



BENGALLA MINE

DEVELOPMENT CONSENT MODIFICATION
Statement of Environmental Effects

for

Bengalla Mining Company Pty Limited

August 2015

Hansen Bailey

ENVIRONMENTAL CONSULTANTS

BENGALLA MINE

DEVELOPMENT CONSENT MODIFICATION
STATEMENT OF ENVIRONMENTAL EFFECTS

Prepared by:

HANSEN BAILEY
6 / 127 – 129 John Street
SINGLETON NSW 2330

August 2015

For:

BENGALLA MINING COMPANY PTY LIMITED
LMB 5
MUSWELLBROOK NSW 2333

EXECUTIVE SUMMARY

OVERVIEW

Bengalla Mining Company Pty Limited operates the Bengalla Mine in the Upper Hunter Valley of New South Wales. Bengalla Mine is situated approximately 130 kilometres north-west of Newcastle and 4 kilometres west of the township of Muswellbrook.

On 3 March 2015, BMC was granted Development Consent (State Significant Development (SSD) 5170) by the Secretary of Department of Planning and Environment. This consent authorised the continued operations at a production rate of up to 15 Million tonnes per annum of Run of Mine coal until 2039. The application for development consent was supported by the *'Continuation of Bengalla Mine Environmental Impact Statement'* (Hansen Bailey, 2013).

MODIFICATION DESCRIPTION

Bengalla Mining Company Pty Limited is seeking approval from the NSW Minister for Planning or their delegate for a modification to its State Significant Development SSD-5170. This Modification is sought under section 96(2) of the *Environmental Planning and Assessment Act 1979* for the following:

- Alterations to various water management infrastructure components including:
    - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
    - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme staged discharge release point;
    - Construction of clean water diversion levees in locations other than those already approved; and
    - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional locations for the siting of the Explosives Storage Facility; and
- The placement of fill from the excavation of Clean Water Dam 1 adjacent to it.

REGULATORY FRAMEWORK

On 3 March 2015, the Secretary for Department of Planning and Environment as delegate of the Minister for Planning granted Bengalla Mining Company Pty Limited SSD-5170 for the Bengalla Continuation Project under section 89E of the *Environmental Planning and Assessment Act 1979.* Section 96 of the *Environmental Planning and Assessment Act 1979* allows for a Development Consent to be modified by the authority to which the original application was made. This Modification application is made pursuant to section 96(2) of the *Environmental Planning and Assessment Act 1979.*

The prerequisite to a Modification under section 96(2) is that the consent authority is satisfied that the proposed development (including the Modification and any previous modifications) is '*substantially the same development*' as the originally approved development.

RISK ASSESSMENT

A risk assessment was completed to identify potential environmental and socio-economic issues associated with the Modification. The primary purpose of the risk assessment process was to prioritise and focus the required environmental and socio-economic impact studies required for the Statement of Environmental Effects.

Each of the potential environmental issues was ranked in accordance with the Rio Tinto Coal Australia - Health, Safety, Environment and Quality Risk Classification Matrix as being of low, moderate, high or critical risk dependent upon the probability of the impact occurring and the potential consequences should the impact materialise.

Due to the minor nature of the Modification no environmental aspects provided a critical or high risk. Ecology and surface water impacts were determined to be of moderate risk with all remaining environmental issues deemed to be low risk.

IMPACTS, MANAGEMENT AND MITIGATION

To determine the potential environmental impacts of the Modification, an assessment was undertaken in relation to ecology, surface water, air quality, acoustics, Aboriginal archaeology, visual intrusion, hazards and non-Aboriginal heritage. The impact assessments undertaken for the environmental issues outlined above have confirmed that the impacts of the mining operation will generally be consistent or will result in a better environmental outcome compared to those currently approved.

This Modification will result in an increase of approximately 9.1 hectares to the previously identified Disturbance Boundary however this impact has been determined to not represent a significant impact on communities, species or populations listed under the *Threatened Species Conservation Act 1995* or *Environment Protection and Biodiversity Conservation Act 1999*.

The results from the site water balance modelling completed for the Modification has confirmed that the mine water management system can continue to be operated in accordance with the mine's existing Environment Protection Licence 6538. No uncontrolled discharges of mine affected water have been predicted to occur over the life of Bengalla as a consequence of this Modification. Controlled discharges will continue to occur in accordance with the Hunter River Salinity Trading Scheme with no discharges predicted to occur under median (50th percentile) conditions. The median annual raw water requirement from an external source is predicted to be between 1,1440 and 1,530 Mega litres per annum as a consequence of this Modification.

This Modification will not result in any additional air quality or acoustic impacts above existing State Significant Development 5170 criterion at private receptors. In addition, assessments have identified that this Modification will not result in any significant impacts to Aboriginal archaeology, visual, non-Aboriginal heritage items or provide an increased risk associated with the transportation or storage of hazards materials.

Given the relatively small scale and nature of this Modification, Bengalla Mining Company Pty Limited will be capable of conducting the activities proposed under this Modification in accordance with the conditions of State Significant Development 5170 and the management plans implemented under this approval. The Bengalla Mining Operations Plan will be updated in consultation with the relevant agencies to incorporate the Modification, if approved.

Further to the conditions of State Significant Development 5170, Bengalla Mining Company Pty Limited notes its ongoing commitment to existing management and mitigation measures, as stated in this Statement of Environmental Effects, to ensure that the Modification's environmental impacts are minimised.

ENVIRONMENTAL ASSESSMENT STATEMENT

Submission of Statement of Environmental Effects

Under section 96(2) of the *Environmental Planning and Assessment Act 1979*

Modification SEE Prepared by	
Name:	James Bailey
Qualifications:	B. Natural Resources, MBA
Address:	Hansen Bailey Pty Limited PO Box 473 SINGLETON NSW 2330
In Respect Of:	Bengalla Mine SSD-5170 Modification SEE
Applicant Name:	Bengalla Mining Company Pty Limited
Applicant Address:	LMB 5 MUSWELLBROOK NSW 2333
Proposed modification sought:	Modification to SSD-5170 for activities described in Section 3 of this SEE.
Environmental Assessment:	An SEE for these Modifications is attached.
Certification:	I certify that I have prepared the contents of this SEE, and to the best of my knowledge: • It is in accordance with section 96(2) of the *Environmental Planning and Assessment Act 1979*; • Meets the form and content of Part 1 Clauses 2(4) of Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*; • It contains all available information that is relevant to the environmental assessment of the activity to which this Modification SEE relates; and • The information contained in this Modification SEE is neither false nor misleading.
Signature:	
Name:	James Bailey Director
Date:	12 August 2015

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1 OVERVIEW

This section provides an introduction to the Bengalla Continuation of Mining Project, introduces the proponent and outlines the purpose and structure of this Statement of Environmental Effects (SEE).

1.1 BACKGROUND

Bengalla Mining Company Pty Limited (BMC) operates the Bengalla Mine (Bengalla) in the Upper Hunter Valley of NSW. Bengalla is situated approximately 130 kilometres (km) north-west of Newcastle and 4 km west of the township of Muswellbrook (see Figure 1). It is generally bounded by Wybong Road to the north, Roxburgh Road to the west, Overton Road to the east and the Bengalla Link Road and Muswellbrook-Ulan Rail Line to the south.

BMC was granted Mining Lease 1397 in 1996 and mining operations subsequently commenced in 1998 with approval enabling operations to continue until 2017. In 2013, as part of its ongoing commitment to future operations at Bengalla and long term investment in the Upper Hunter region, BMC sought a new Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to enable continued mining operations at Bengalla.

On 3 March 2015, BMC was granted Development Consent (State Significant Development (SSD) 5170) by the Secretary of the Department of Planning and Environment (DP&E). This consent authorised the continued operations at up to 15 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal until 2039. The application for development consent was supported by the *'Continuation of Bengalla Mine Environmental Impact Statement'* (Bengalla EIS) (Hansen Bailey, 2013).

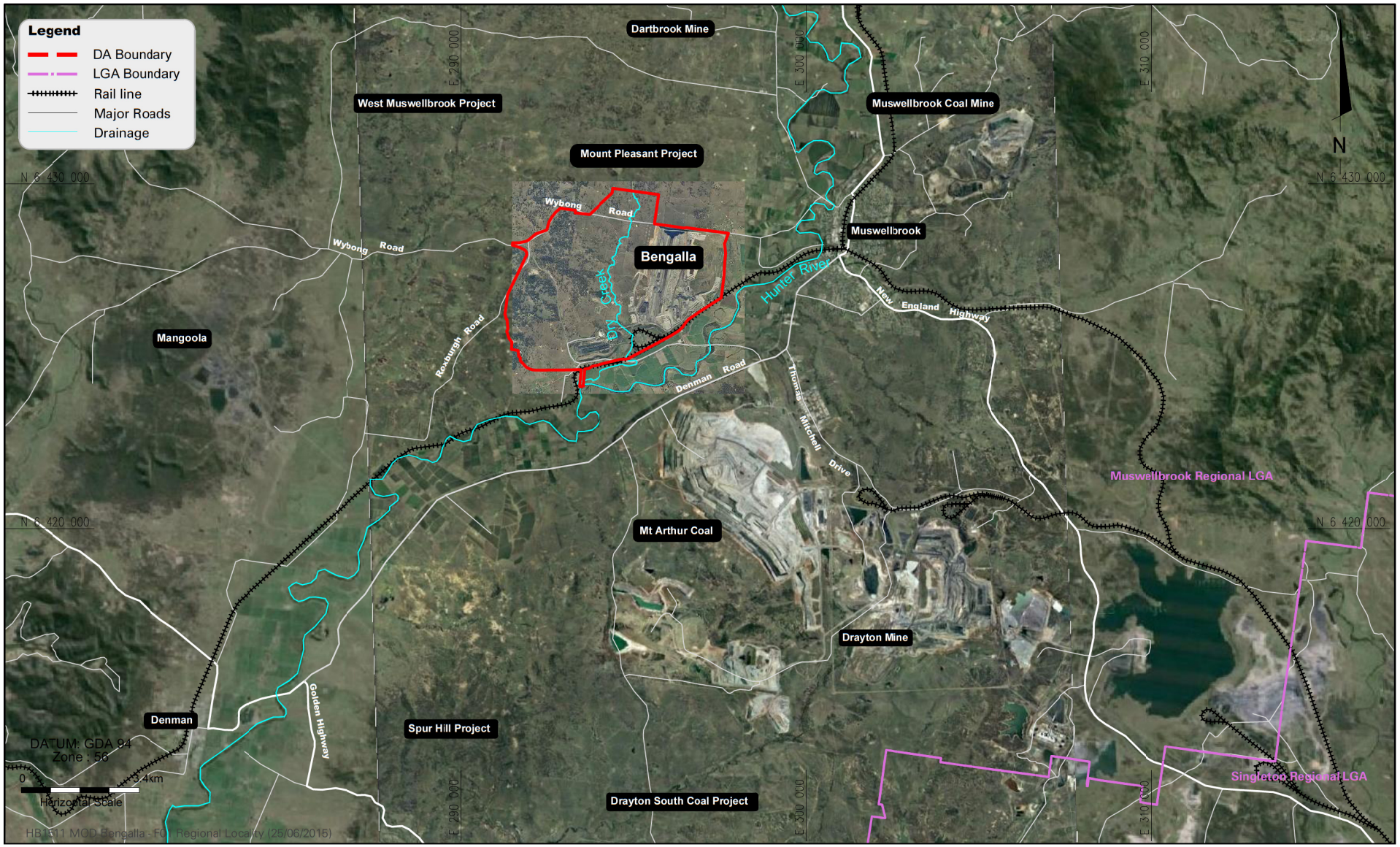
On 27 May 2015 BMC was granted *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval 2012/6378 from the Department of the Environment (DoE). A summary of Bengalla's approvals history is provided in Section 2.

1.2 DOCUMENT PURPOSE

This Statement of Environmental Effects (Modification SEE) has been prepared to support an application for the Modification of SSD-5170 under section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (the Modification). The Modification is being sought to facilitate:

- Alterations to various water management infrastructure components including:
    - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
    - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme (HRSTS) staged discharge release point;
    - Construction of clean water diversion levees in locations other than those already approved; and
    - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional locations for the siting of the Explosives Storage Facility; and
- The placement of fill from the excavation of Clean Water Dam 1 (CW1) adjacent to it.

A detailed Modification Description is provided in Section 3.



BENGALLA MINE

Regional Locality

FIGURE 1

1.3 PROPONENT

The proponent for the Modification is BMC which is owned by the Bengalla Joint Venture (BJV). The BJV comprises:

- CNA Bengalla Investments Pty Limited (a subsidiary of Coal & Allied Industries Limited, a Rio Tinto Group company) 40%;
- Wesfarmers Bengalla Limited (a wholly owned subsidiary of Wesfarmers Limited) 40%;
- Taipower Bengalla Pty Limited (a wholly owned subsidiary of Taiwan Power Company) 10%; and
- Mitsui Bengalla Investment Pty Limited (a wholly owned subsidiary of Mitsui Coal Holdings Pty Limited) 10%.

The contact details for BMC are:

Bengalla Mining Company Pty Limited

LMB 5

MUSWELLBROOK NSW 2333

Phone: 02 6542 9500

Fax: 02 6542 9599

Website: http://www.riotintocoalaustralia.com.au/

1.4 DOCUMENT STRUCTURE

This Modification SEE is structured as follows:

- Section 2 provides a description of the approved operations at Bengalla Mine;
- Section 3 provides a description of the Modification for which approval is sought;
- Section 4 describes the regulatory framework relevant to the Modification;
- Section 5 presents a high level risk assessment completed for the Modification;
- Section 6 assesses environmental impacts and outlines management and mitigation measures proposed in respect of the Modification;
- Section 7 presents BMC's Statement of Commitments related to the Modification; and
- Sections 8 and Section 9 lists the abbreviations and references used in this SEE.

2 APPROVED OPERATIONS

This section includes a description of the approved operations at Bengalla.

2.1 PLANNING APPROVAL FRAMEWORK

2.1.1 NSW Environmental Planning and Assessment Act 1979

State Significant Development 5170

In September 2013, the Bengalla EIS (Hansen Bailey, 2013) was prepared to support an Application for Development to enable continued mining operations at Bengalla. Subsequently, on 3 March 2015 the Secretary of the DP&E granted SSD-5170 which permits the following activities at Bengalla:

- Open cut mining west at a rate of up to 15 Mtpa ROM coal for 24 years to a total of 316 Mt;
- Continued use of the existing dragline, truck fleet and excavator fleet (with progressive replacement or substitution with equivalent);
- An out of mining area overburden emplacement area (OEA) to the west of Dry Creek, which may be utilised for excess overburden material until it is intercepted by mining;
- Continued use, extension or relocation to existing and new infrastructure, including administration and parking facilities, in-mining area facilities (including dragline shut down and erection pad), helipad, tyre laydown area, explosives and reload storage facility, core shed workshop, roads, reject bin, ROM hopper, stockpiles, conveyors, water management infrastructure, bioremediation area, supporting power infrastructure, rail and rail loading infrastructure and ancillary infrastructure;
- Construction and use of various items of new infrastructure (including radio tower, extensions to the MIA, additional raw coal stockpile and upgrade to the ROM coal stockpile (along with associated conveyor network) generally as shown on the infrastructure plans and construction of the Mount Pleasant Staged Discharge Dam and associated water reticulation infrastructure;
- Processing, handling and transportation of coal via the (upgraded) Coal Handling and Preparation Plant (CHPP) and rail loop for export and domestic sale;
- Continued rejects and tailings co-disposal in the Main OEA and in the temporary in-mining area reject emplacement;
- Relocation of a 6 km section of Bengalla Link Road at approximately Year 15 near the existing mine access road to facilitate coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent alignment of Dry Creek through rehabilitation areas when emplacement areas are suitably advanced;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the Staged Discharge Dam and Raw Water Dam); and
- A workforce of up to 900 full time equivalent personnel (plus contractors) at peak production.

The approved operations layout is presented in Figure 2.

Mining operations approved under SSD-5170 occur within a number of mining authorities held by BMC, the status of which is shown in Table 1. BMC holds all of the other ancillary licences and approvals which enables BMC to conduct its mining and associated activities at Bengalla Mine. These are summarised in Table 1.

2.1.2 Environment Protection and Biodiversity Conservation Act 1999

EPBC Approval 2012/6378

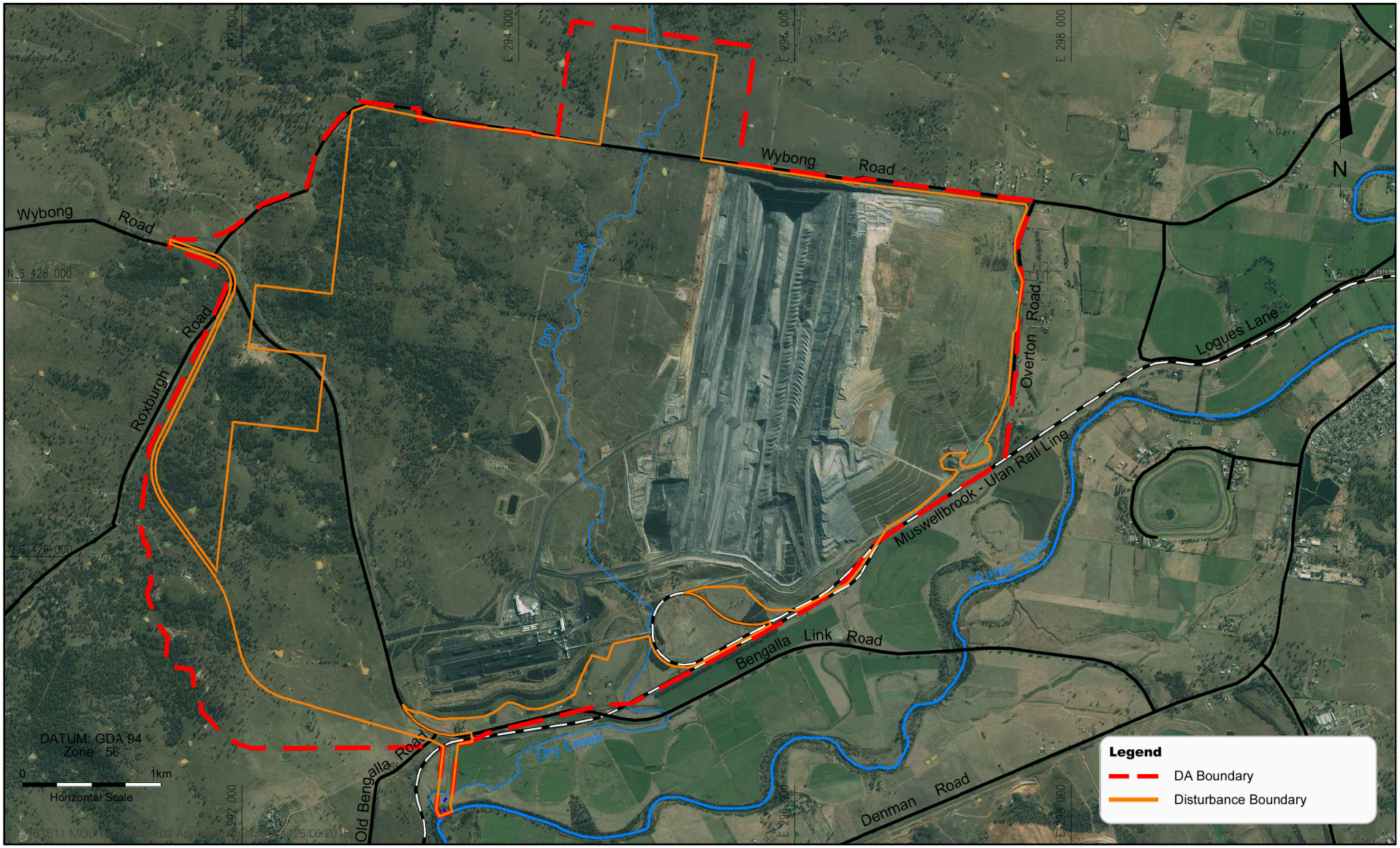
On 27 May 2015 BMC was granted EPBC Approval 2012/6378 from the Acting Assistant Secretary of DoE. EPBC Approval 2012/6378 has effect until 31 December 2050.

Table 1
Licences and Approvals

Approval	Description	Duration	Authority
SSD-5170	State Significant Development Consent	03/03/15 – 28/02/39	DP&E
EPBC 2012/6378	EPBC Approval	27/05/15 – 31/12/2050	DoE
DA 211/93	Development Consent	07/08/95 – 07/08/17	DP&E
DA 211/93 (Modification 1)	Development Consent	09/11/06 – 07/08/17	DP&E
DA 211/93 (Modification 2)	Development Consent	06/12/07 – 07/08/17	DP&E
DA 211/93 (Modification 3)	Development Consent	22/07/08 – 07/08/17	DP&E
DA 211/93 (Modification 4)	Development Consent	07/11/11 – 07/08/17	DP&E
DA 211/93 (Modification 5)	Development Consent	11/07/14 – 07/08/17	DP&E
DA 273/2006	Development Consent Explosives facility	06/09/06 – Perpetuity	MSC
Mining Lease 1397	Mining Lease	27/06/96 – 27/06/17	DTIRIS – DRE
Mining Lease 1450	Mining Lease	11/06/99 – 11/06/20	DTIRIS – DRE
Mining Lease 1469	Mining Lease	05/06/00 – 05/06/21	DTIRIS – DRE
Mining Lease 1592	Mining Lease	19/04/07 – 19/04/28	DTIRIS – DRE
MLA 493	Authorisation 102 Surface Lease	In process for ML	DTIRIS – DRE
MLA 494	Authorisation 438 and AL13	In process for ML	DTIRIS – DRE
Mining Lease 1645 (Part Transfer)	Mining Purposes Lease	In process for ML Part Transfer	DTIRIS – DRE
AL 13	Assessment Lease	20/12/06 – 19/12/11*	DTIRIS – DRE
A 438 (part)	Exploration Licence	18/08/09 – 07/05/14**	DTIRIS – DRE
EPL 6538	Environmental Protection Licence	11 September (anniversary)	NSW Office of Environment and Heritage (OEH)
Bengalla Mining Operations Plan	MOP (2015 – 2021)	01/01/15 – 31/12/21	DTIRIS – DRE

** Application lodged for mining lease and pending.*

*** Application lodged for surface purposes lease and pending*



BENGALLA MINE

Approved Operations

FIGURE 2

2.2 PLANNING APPROVAL HISTORY

2.2.1 Original Approval

On 7 August 1995, BMC was granted development consent DA 211/93, which allowed for the "*Construction and operation of a surface coal mine, coal preparation plant, rail loop, loading facilities and associated facilities".* DA 211/93 authorised the following:

- Extraction of coal within the 21 year coal extraction limit until 2017;
- Maximum ROM coal production of 8.7 Mtpa;
- Maximum reserve of 147 Mt of ROM coal;
- Coal mining using dragline, excavator / shovel mining methods and a truck fleet;
- Open cut strip mining progressing from east to west;
- OEA to a maximum height of Reduced Level (RL) 240 m AHD;
- Construction workforce of approximately 510 employees;
- Permanent workforce of approximately 300 employees; and
- Construction and operation of the CHPP and associated facilities, rail loop and loading facilities, bathhouse and administration buildings and other coal mining related facilities.

The original DA 211/93 was supported by the Bengalla 1993 EIS. DA 211/93 has not yet been surrendered.

Since original approval there have been four modifications to DA 211/93 as described below.

2.2.2 Modification 1

DA 211/93 (Modification 1) was granted on 9 November 2006 providing approval for the following:

- Increase in the maximum height of the final landform height from RL 240 m to RL 270 m;
- Increase in the maximum allowable annual production 10.7 Mtpa of ROM coal; and
- Various Infrastructure upgrades and relocations to facilitate increased production.

2.2.3 Modification 2

DA 211/93 (Modification 2) was granted on 6 December 2007 providing approval for the following:

- Extending open cut coal mining operations into the 'Wantana Extension'; and
- Minor infrastructure extensions and relocations.

2.2.4 Modification 3

DA 211/93 (Modification 3) was granted on 22 July 2008 providing approval for the following:

- Construction of the Bengalla Link Road Stage 2 on an alternative alignment to that originally approved; and
- Deferral of the relocation of the ROM hopper and associated facilities from their existing location to a site adjacent to the CHPP.

2.2.5 Modification 4

DA 211/93 (Modification 4) was granted on 7 October 2011 providing approval for the following:

- Acceleration of mining operations in the Wantana Extension; and
- Implementation of the southern overburden emplacement area.

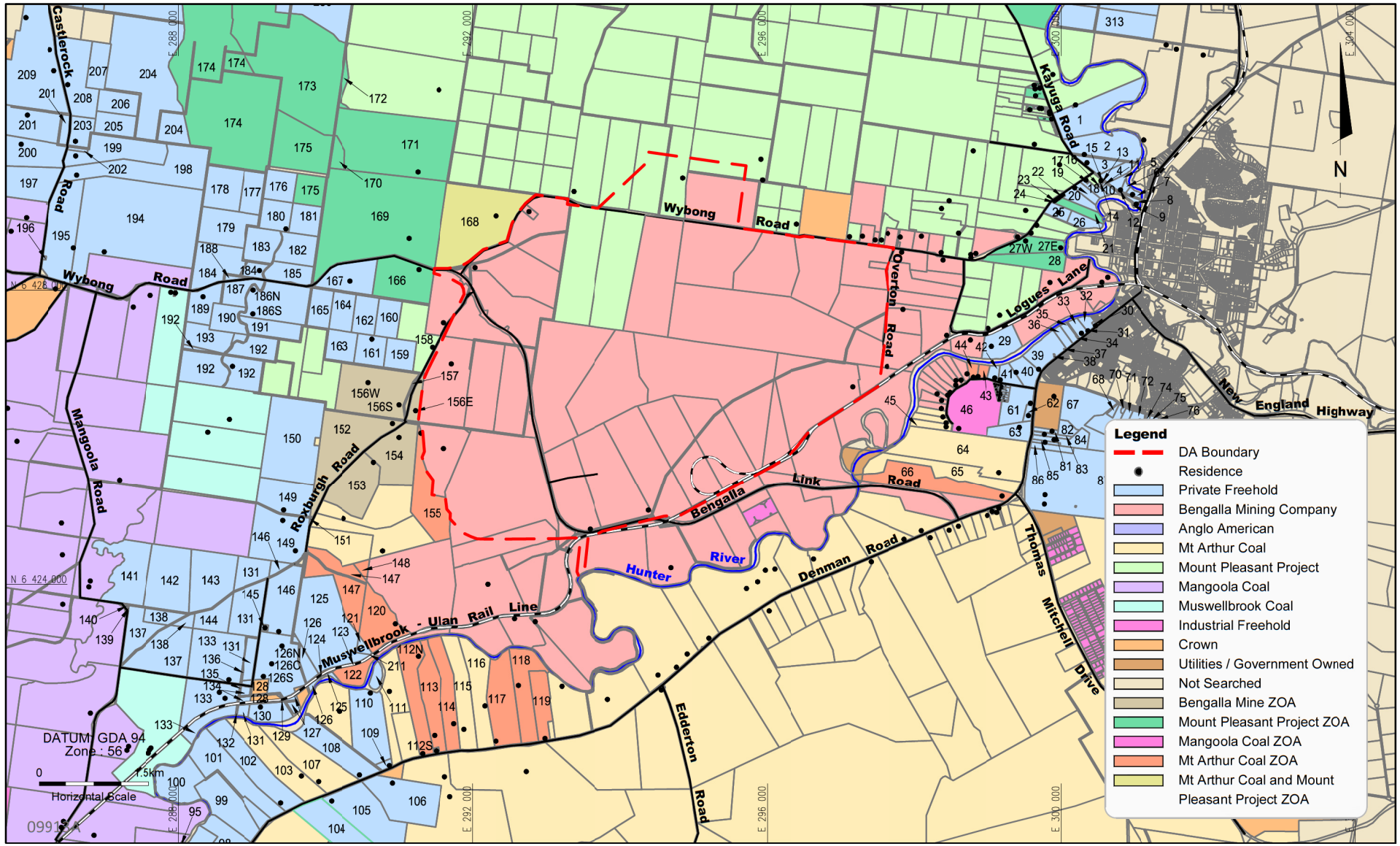
2.2.6 Modification 5

DA 211/93 (Modification 5) was granted on 11 July 2014 providing approval for geotechnical drilling activities associated with the future construction of various water management infrastructure items.

2.3 LAND OWNERSHIP

The ownership of land within and surrounding the DA Boundary with respect to the Modification is shown in Figure 3.

The land to which this Modification applies is owned wholly by BMC and the BJV, along with Coal & Allied (held for the Mount Pleasant Project). Coal & Allied supports this Modification Application. The land to the south of Bengalla is held by Hunter Valley Energy Coal for the Mt Arthur Coal Mine. A revised schedule of lands associated with the Modification is provided in Appendix A.



BENGALLA MINE

Landownership

FIGURE 3

3 MODIFICATION DESCRIPTION

This section provides a detailed description of the Modification. It also includes a discussion on the need for the Modification along with the alternatives considered.

3.1 MODIFICATION OVERVIEW

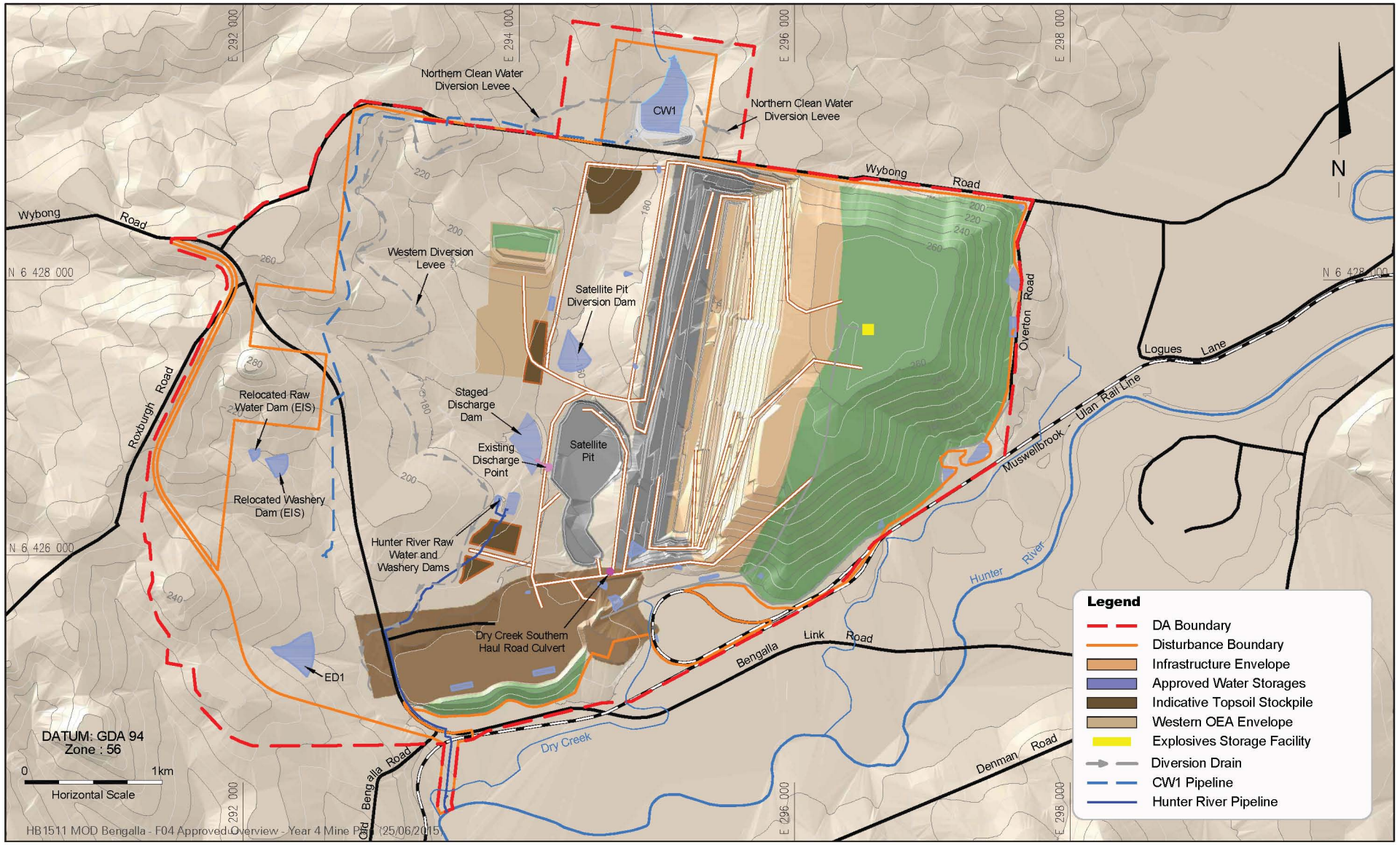
BMC is seeking approval from the NSW Minister for Planning or their delegate for a Modification to SSD-5170. This Modification is sought under section 96(2) of the EP&A Act for the following:

- Alterations to various water management infrastructure components including:
    - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
    - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme (HRSTS) staged discharge release point;
    - Construction of clean water diversion levees in locations other than those already approved; and
    - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional locations for the siting of the Explosives Storage Facility; and
- The placement of fill from the excavation of CW1 adjacent to it.

A comparison between the approved operations and the Modification elements described above is presented on Figure 4 and Figure 5 respectively. A detailed description of each element of the Modification is provided below.

This Modification will result in the construction of diversion levees associated with CW1 outside of the currently approved Disturbance Boundary as illustrated on Figure 5. It is noted that clean water diversion structures were contemplated to occur outside of the Disturbance Boundary in Section 1.2 of the Bengalla EIS (Hansen Bailey, 2013):

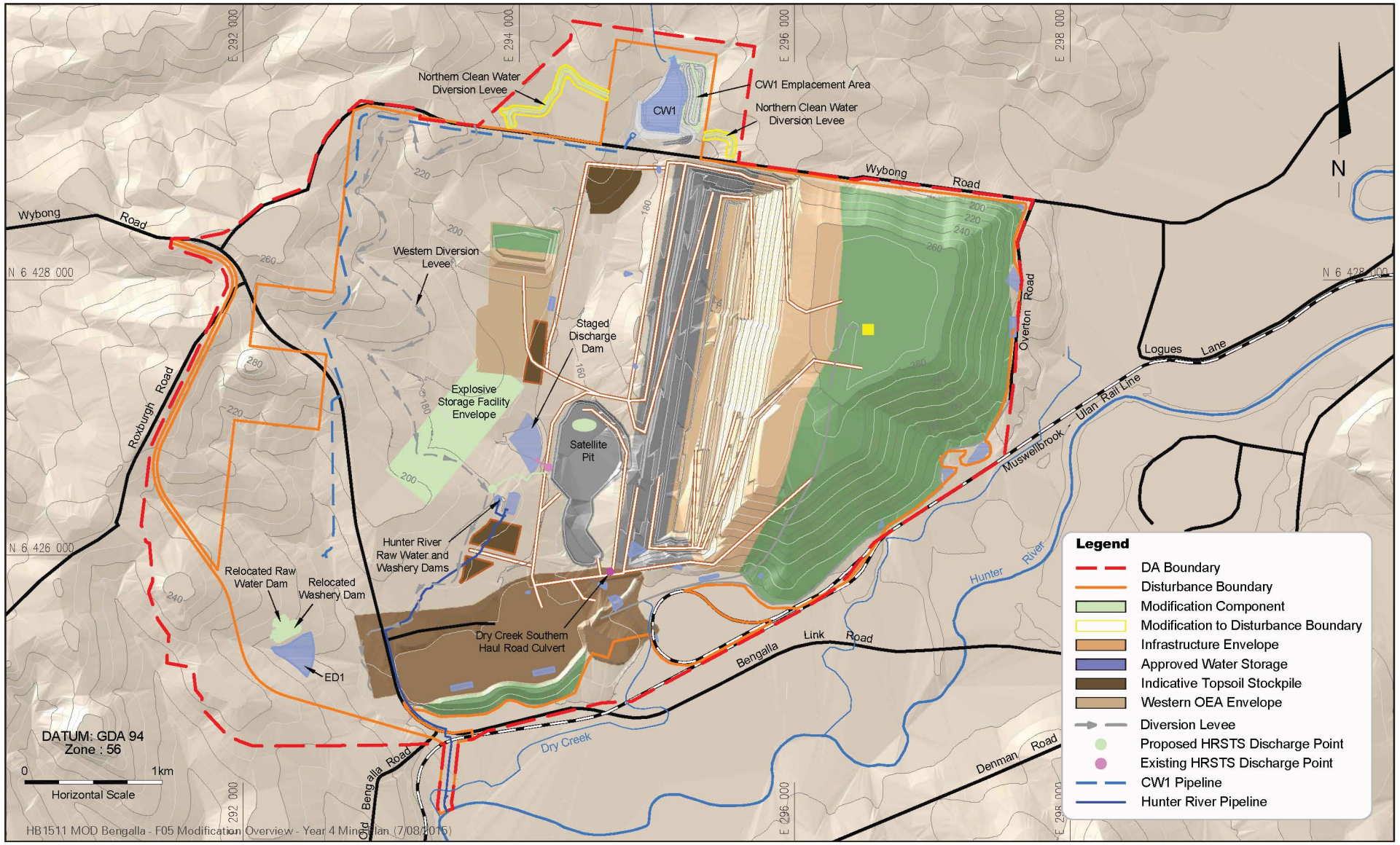
> *"The Project will generally be undertaken within the Disturbance Boundary as illustrated on Figure 3. Minor additional disturbance associated with ancillary works including the Dry Creek pipeline and associated power supply, fencing, firebreaks, water diversion structures, minor contour banks, tracks along pipelines, powerlines, topsoil storage areas, temporary construction areas and sediment control structures will also be required. Any additional disturbance located outside the Disturbance Boundary (but within the Project Boundary) will be subject to the relevant BMC approvals including the completion of a Ground Disturbance Permit (GDP) as discussed in Section 3.13."*



BENGALLA MINE

Approved Overview - Year 4 Mine Plan

FIGURE 4



BENGALLA MINE

Modification Overview - Year 4 Mine Plan

FIGURE 5

3.2 WATER MANAGEMENT INFRASTRUCTURE ALTERATIONS

3.2.1 Utilisation of the Satellite Pit

Approved Operations

Dry Creek commences north of Wybong Road within the Mount Pleasant Project Mining Lease (ML) 1645 and flows from north to south to its confluence with the Hunter River approximately 1 km south of Bengalla (see Figure 1). Dry Creek is an ephemeral gully line only flowing following prolonged heavy rainfall.

As mining activities at Bengalla progress to the west, Dry Creek will be intercepted by mining. As such, the construction of a clean water catchment dam known as CW1 north of Wybong Road is planned to commence in 2015 (see Figure 4). CW1 will provide for the catchment of water upstream of its location and will be designed to contain a 1 in 200 year Average Recurrence Interval (ARI), 72 hour storm rainfall event passing under Wybong Road and onto BMC land.

Associated with the construction of CW1, and as described in the Bengalla EIS, two clean water diversion levees north of Wybong Road referred to as the Northern Clean Water Diversion Levees (see Figure 4) will be constructed to divert clean water into CW1.

Further described in the Bengalla EIS, BMC will develop a Satellite Pit ahead of the primary operations as shown on Figure 4. It is anticipated that mining operations within the Satellite Pit will commence in 2016 and it will take approximately 6 months to complete coal extraction.

To minimise the catchment of clean water from the area between CW1 and the Satellite Pit a clean water catchment dam known as the Satellite Pit Diversion Dam was proposed immediately upstream of the Satellite Pit. All clean water captured in the Satellite Pit Diversion Dam would then be pumped and released into an undisturbed portion of Dry Creek south of the Satellite Pit where water flows then on its natural alignment to the Hunter River.

To further reduce the amount of clean water catchment entering the Satellite Pit Diversion Dam a clean water diversion levee was proposed west of the existing Dry Creek location south of Wybong Road (Western Diversion Levee) (see Figure 4). The Western Diversion Levee will ensure that clean water from a catchment area of approximately 310 ha is diverted around active mining disturbance to a location south of the existing Mine Access Road and then onto the natural alignment of Dry Creek to the Hunter River.

Modification

Mining activities are described in the Bengalla EIS west of the Dry Creek. Those mining activities include but not limited to topsoil stockpiles, haul roads and maintenance areas (see Figure 4). The mining activities will result in significant areas of disturbance which require management including water runoff.

Following the completion of coal extraction within the Satellite Pit, this Modification seeks to enable the Satellite Pit to be commissioned for use as a water catchment dam, referred as the Satellite Dam (see Figure 5). This utilisation of the Satellite Dam as a water catchment dam will be necessary to prevent discharge of sediment and mine affected water into the Hunter River. The catchment east of the Western Diversion Levee and south of CW1 (active mining operations area) includes areas of disturbance reporting to the Satellite Dam. The Satellite Dam water will be utilised within the existing mine water management system. This will result in alterations to the Bengalla site water balance which is discussed in Section 6.2.

It is anticipated that the Satellite Dam will remain in use until around 2019 or until such time as it is intercepted by mining operations where the mine will capture any residual catchment.

Prior to the commencement of mining in the Satellite Pit the existing Dry Creek culvert located under the Southern Haul Road will be closed to facilitate mining operations (see Figure 5). Closure of this culvert will result in a closed catchment with all surface water runoff south of CW1 and east of the Western Diversion Levee to the active mining area captured in the mine water management system.

Prior to the closing of the culvert under the Southern Haul Road, BMC's existing Environment Protection Licence (EPL) 6538 HRSTS discharge location will be relocated. An indicative location has been identified where discharge water will be pumped from the existing Staged Discharge Dam via a pipeline to a release point within the Western Diversion Levee (see Figure 5).

3.2.2 Construction of Clean Water Diversion Levees

Approved Operations

The Bengalla EIS identified that diversion levees would be required to be constructed north of Wybong Road to divert clean water into CW1 from the east and west to isolate the catchment area to the south (see Figure 4). Further it was noted that clean water runoff will be collected in surface channels and diverted away from the mining area into their natural flow or will enter the water management system.

Modification

As part of detailed design work completed to enable to the establishment of the Dry Creek Diversion and Interim Management System, BMC has identified the required locations for the construction of two diversion levees north of Wybong Road (collectively referred to as the Northern Clean Water Diversion Levees) to divert clean water into CW1.

These Northern Clean Water Diversion Levees are located partially outside the Disturbance Boundary and will require a minor increase of 9.1 ha to this area. As such this Modification is seeking approval for the construction of the components of the Northern Clean Water Diversion Levees located outside the Disturbance Boundary as identified on Figure 5.

The construction of the diversion levee on the western side of CW1 is partially located within the approved footprint associated with the Mount Pleasant Project Infrastructure Envelope. Modification interactions with the Mount Pleasant Project are discussed in Section 3.8.

3.2.3 Relocation of the Future Hunter River Dam and Washery Dam

Approved Operations

The relocation of the Hunter River Dam and Washery Dam will be required around 2019 to facilitate the progression of mining operations. The Bengalla EIS provided for the Hunter River and Washery Dam to be situated in the central west portion of the Disturbance Boundary (see Figure 4).

Modification

This Modification seeks to revise the relocated positions for the Hunter River and Washery Dam to an appropriate location within the Disturbance Boundary near the approved future relocated Staged Discharge Dam (see Figure 5).

3.3 RELOCATION OF THE EXPLOSIVES STORAGE FACILITY

Approved Operations

The Bengalla EIS provided for the relocated explosive storage facility to be situated in a fully bunded position (not yet constructed) on the existing OEA (see Figure 4).

Modification

This Modification seeks approval to provide additional positions for the construction of the explosive storage facility in an identified envelope of land positioned wholly within the Disturbance Boundary (see Figure 5). The alternate location will be constructed in accordance with *AS 2187:1998 Explosives - Storage, Transport and Use* – Storage and relevant NSW Occupational Health and Safety (OH&S) regulations.

The explosive facility, in either position, will still require the construction of an all-weather access road suitable for heavy vehicles.

3.4 CW1 EMPLACEMENT AREA

Approved Operations

BMC currently has approval for excavated material associated with the construction of CW1 to be transported across Wybong Road for emplacement within, either, the Main OEA or in the western out of pit emplacement area (Western OEA).

Modification

To minimise the footprint of CW1, the removal of approximately 412,000 bank cubic meters (bcm) of material from within the current footprint is required. This Modification is seeking approval to, in addition to those options already approved, emplace this excavated material adjacent to CW1 (CW1 Emplacement Area). An indicative emplacement area for this material is indicated on Figure 6.

The CW1 Emplacement Area will be developed as a free draining landform with a maximum slope batter of 2H:1V. Temporary erosion and sediment control measures will be established and remain in place until the materials are relocated.

The CW1 Emplacement Area will be positioned on BMC owned land within the already approved Disturbance Boundary. BMC has lodged a part transfer application of ML 1645 with the Division of Resources and Energy (DRE) to accommodate the construction of CW1, associated infrastructure and the CW1 Emplacement Area.

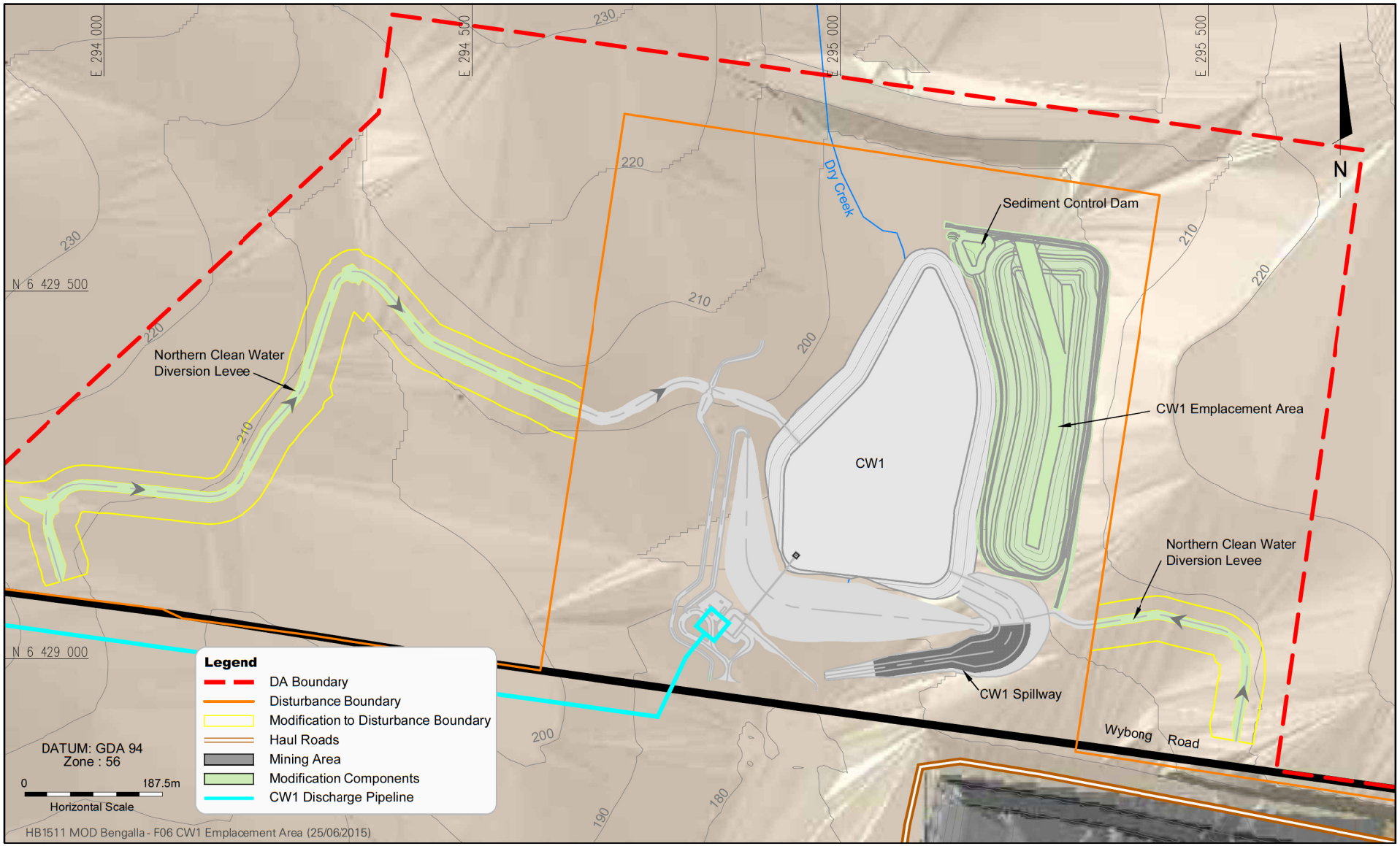
3.5 EQUIPMENT FLEET

No additional equipment fleet above those modelled in the Bengalla EIS are required for this Modification. Actual makes and models of equipment required may vary, however operations will be undertaken to ensure that noise levels meet those modelled in the Bengalla EIS.

3.6 CONSTRUCTION

Consistent with the Bengalla EIS, to facilitate the progression of mining operations it is anticipated that construction activities associated with CW1 will commence in 2015 and take approximately 12 months to complete.

Other Modification elements will be constructed as required to facilitate mining operations. All construction activities will be conducted consistent with SSD-5170 between the hours of 7 am to 6 pm, Monday to Friday and 8 am to 1 pm on Saturdays. No construction works will occur on Sundays or Public Holidays.



BENGALLA MINE

CW1 Emplacement Area

FIGURE 6

3.7 COMPARISON OF THE APPROVED OPERATIONS TO THE MODIFICATION

Table 2 provides a summary of key Modification components and comparison with the approved Bengalla.

Table 2
Key Modification Components and Comparison with Approved Bengalla

Component	Bengalla Existing (Approved)	Modification
Planning Approval & Supporting Documents	• Development Consent SSD-5170	• Modification to Development Consent o This SEE
Life of Mine	28 February 2039	No change
Mining Method	Open Cut - dragline, truck and excavator (machinery will be progressively upgraded)	No change
Production	Up to 15.0 Mtpa ROM coal	No change
Operational Hours	Mining operations and coal processing 24 hours per day, seven days per week	No change
Workforce	Up to 900 full time personnel (plus contractors)	No change
Disturbance Boundary	See Figure 4	Increase by 9.1 ha to construct CW1 clean water diversion levees which represents a minor 0.1% increase in total disturbance (see Figure 5).
Explosives Storage Facility	See Figure 4	Additional locations within the Explosives Storage Facility Envelope (see Figure 5).
Water Management	Water Management System comprised generally of: • Mine water dams and clean water dams (including relocations as required) • CW1 north of Wybong Road and associated Infrastructure • Diversion of Dry Creek (temporary via pipeline, longer term reinstated through OEA) • HRSTS Staged Discharge Dam and release point • Hunter River intake • Minor disturbance associated with ancillary works including the Dry Creek pipeline and associated power supply, water diversion structures, minor contour banks, tracks along pipelines and sediment control structures	Amendments to the approved Water Management System comprised generally of: • Utilisation of the Satellite Pit as a water catch dam; • Relocation of the HRSTS Staged Discharge Dam release point; • Construction of northern clean water diversion levees in an alternate location; and • Relocation of future Hunter River Dam and Washer Dam.
Landform	• Maximum 270 m RL development of the Main OEA • Emplacement of excavated material from CW1 in the Main OEA or WOEA	• No change • Placement of excavated material from CW1 to the CW1 Emplacement Area

3.8 INTERACTION WITH THE MOUNT PLEASANT PROJECT

The Mount Pleasant Project is wholly owned by Coal & Allied Operations Pty Ltd and is located immediately north of Bengalla. The Mount Pleasant Project holds DA 92/97 (as modified) which is supported by the *Mount Pleasant Mine Environmental Impact Statement* (MTP EIS) (ERM Mitchell McCotter 1997) and *Mount Pleasant Project Modification Environmental Assessment Report* (MTP EA) (EMGA Mitchell McLennan 2010).

The construction of the western portion of the Northern Clean Water Diversion Levee will be located partially within the approved Mount Pleasant Infrastructure Area Envelope. An agreement with Coal & Allied Operations Pty Ltd and BMC is in place which facilitates proposed activities at each operation.

In addition, should the Mount Pleasant Project commence Coal & Allied have indicated that excavated material from the CW1 Emplacement Area may be utilised for activities associated with that project. Coal & Allied would seek any required approvals separately for the use of this material.

3.9 MODIFICATION NEED

BMC have identified that environmental and economic benefits can be realised through the implementation of this Modification.

This Modification will result in an improved environmental outcome associated with the construction of the CW1 Emplacement Area. Without the Modification excess material associated with the construction of CW1 will be transported south, across Wybong Road, for emplacement within the Western OEA and/or Main OEA. This Modification will result in improved air quality and noise emissions regarding transporting CW1 materials.

Following the construction of the infrastructure components identified on Figure 4 (i.e. the Western OEA, various topsoil stockpiles, haul roads and Satellite Pit) the catchment of water south of CW1 and east of the Western Diversion Levee will be required to prevent mine affected water leaving the site. BMC have identified that that the Satellite Pit Diversion Dam (see Figure 4) will therefore not be utilised for the sole capture and release of clean water.

This Modification will result in the utilisation of the Satellite Pit as a water catchment dam necessary to prevent discharge of sediment and mine affected water into the Hunter River. The utilisation of the Satellite Pit as a water catchment dam will also negate the need for the construction of the former Satellite Pit Diversion Dam.

The additional alternative associated with the relocation of the Explosives Storage Facility to the envelope proposed for this Modification will provide BMC with improved access efficiencies whilst not impacting on the safety of employees or the community.

4 REGULATORY FRAMEWORK

This section briefly describes the regulatory framework under which Bengalla Mine is approved to operate as relevant to the Modification. It discusses the ability of the Minister for Planning and Infrastructure to modify SSD-5170 under section 96(2) of the EP&A Act and the approvals process.

4.1 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

4.1.1 Existing Development Consent

On 3 March 2015, the Secretary for the DP&E as delegate of the Minister for Planning granted SSD-5170 for the Bengalla Continuation Project under section 89E of the EP&A Act. The supporting document for SSD-5170 is the Bengalla EIS (Hansen Bailey, 2013).

4.1.2 Power to Modify

Section 96 of the EP&A Act allows for a Development Consent to be modified by the authority to which the original application was made. In this instance the Minister for Planning. Section 96(2) (a) of the EP&A Act states:

> *96 (2) "A consent authority may, on application being made by the applicant or any other person entitled to act on a consent granted by the consent authority and subject to and in accordance with the regulations, modify the consent if:*
>
> > *(a) It is satisfied that the development to which the consent as modified relates is substantially the same as the development for which consent was originally granted and before that consent was originally granted was modified (if at all)".*

Under Section 96(2) the consent authority must be satisfied that what is proposed is no more than to "modify" (i.e. alter without radical transformation) the proposed development (including the Modification and any previous modifications) such that it remains '*substantially the same development*' as the originally approved development.

Bengalla as Originally Approved

BMC was granted SSD-5170 under the EP&A Act for the '*Bengalla Continuation Project*' on 3 March 2015. Bengalla as originally approved in SSD-5170 had the following features:

- Open cut mining west at a rate of up to 15 Mtpa ROM coal for 24 years to a total of 316 Mt;
- Continued use of the existing dragline, truck fleet and excavator fleet (with progressive replacement or substitution with equivalent);
- An out of mining area OEA to the west of Dry Creek, which may be utilised for excess overburden material until it is intercepted by mining;
- Continued use, extension or relocation to existing and new infrastructure, including administration and parking facilities, in-mining area facilities (including dragline shut down and erection pad), helipad, tyre laydown area, explosives and reload storage facility, core shed workshop, roads, reject bin, ROM hopper, stockpiles, conveyors, water management infrastructure, bioremediation area, supporting power infrastructure, rail and rail loading infrastructure and ancillary infrastructure;
- Construction and use of various items of new infrastructure (including radio tower, extensions to the MIA, additional raw coal stockpile and upgrade to the ROM coal stockpile (along with associated conveyor network) generally as shown on the infrastructure plans and construction of the Mount Pleasant Staged Discharge Dam and associated water reticulation infrastructure;
- Processing, handling and transportation of coal via the (upgraded) CHPP and rail loop for export and domestic sale;
- Continued rejects and tailings co-disposal in the Main OEA and in the temporary in-mining area reject emplacement;

- Relocation of a 6 km section of Bengalla Link Road at approximately Year 15 near the existing mine access road to facilitate coal extraction;
- The diversion of Dry Creek via dams and pipe work with a later permanent alignment of Dry Creek through rehabilitation areas when emplacement areas are suitably advanced;
- Relocation of water storage infrastructure as mining progresses through existing dams (including the Staged Discharge Dam and raw water dam); and
- A workforce of up to 900 full time equivalent personnel (plus contractors) at peak production.

Bengalla as Modified

If this Modification is approved, Bengalla as modified will have the following features as compared to the originally approved development:

- Alterations to various water management infrastructure components including:
    - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
    - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme (HRSTS) staged discharge release point;
    - Construction of clean water diversion levees in locations other than those already approved; and
    - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional locations for the siting of the Explosives Storage Facility; and
- The placement of fill from the excavation of CW1 adjacent to it.

Substantially the Same Development

The proposed repositioning of various water and other infrastructure elements approved under SSD-5170 are very minor in nature and will not result in any substantive changes to the development.

The alterations to the development will not have a significant impact on the *Threatened Species Conservation Act 1995* (TSC Act) or EPBC Act listed flora or fauna species.

The Modification will not result in any change to the core elements of SSD-5170 such as:

- Total coal production rates or duration of mining;
- Existing method of mining or destination of ROM and product coal;
- The character of the currently approved infrastructure components; and
- Existing manning levels or operational hours.

Mining operations will occur within the existing Mining Leases, and those currently being sought to facilitate SSD-5170, utilising the approved open-cut coal mining methods and similar equipment fleet to that proposed in the Bengalla EIS. Additional discussion comparing the approved operations with the Modification is provided in Section 3 and summarised in Table 2.

Limited environmental impacts have been predicted as a result of the Modification as discussed further in Section 6 of this SEE.

It is concluded that it is open to the Minister to be satisfied that the modified development will be substantially the same as the development for which SSD-5170 was originally granted. It is therefore available for the Minister (or his delegate) to determine the application for Modification to the Development Consent as sought.

4.1.3 Need for a Statement of Environmental Effects

Clause 115 of the *Environmental Planning and Assessment Regulation 2000* NSW (EP&A Regs) sets out the information which is required to accompany any application for modification of a development consent. That information is set out Table 3 below.

Table 3
Statement of Environmental Effects Requirements

Clause of Regulation	Information Required	Where it is provided in this SEE
115(1) An application for modification of a development consent under section 96 (1), (1A) or (2) or 96AA (1) of the Act must contain the following information:		
(a)	the name and address of the applicant,	Section 1.3
(b)	a description of the development to be carried out under the consent (as previously modified),	Section 2.1
(c)	the address, and formal particulars of title, of the land on which the development is to be carried out,	Appendix A
(d)	a description of the proposed modification to the development consent,	Section 3.0
(e)	a statement that indicates either: (i) that the modification is merely intended to correct a minor error, misdescription or miscalculation, or	N/A
	(ii) that the modification is intended to have some other effect, as specified in the statement	Section 4.1.2
(f)	a description of the expected impacts of the modification,	Section 6.0
(g)	an undertaking to the effect that the development (as to be modified) will remain substantially the same as the development that was originally approved,	Section 4.1.2
(h)	if the applicant is not the owner of the land, a statement signed by the owner of the land to the effect that the owner consents to the making of the application (except where the application for the consent the subject of the modification was made, or could have been made, without the consent of the owner),	Landowner consent not required
(i)	a statement as to whether the application is being made to the Court (under section 96) or to the consent authority (under section 96AA), and, if the consent authority so requires, must be in the form approved by that authority.	Section 4.1.2

4.1.4 Matters for Consideration in Determining Modification Application

Section 96(3) of the EP&A Act provides:

> *(b) "In determining an application for modification of a consent under this section, the consent authority must take into consideration such of the matters referred to in section 79C (1) as are of relevance to the development the subject of the application."*

The matters referred to in section 79C (1) relevant to the application for Modification to SSD-5170 are:

- The provisions of any environmental planning instrument that applies to the land the subject of the Modification being:
    - *Muswellbrook Local Environmental Plan* (LEP) 2009 (Muswellbrook LEP);
    - *Hunter Regional Environmental Plan* (REP) 1989 (Hunter REP); and
    - SEPP Mining.
- Any Development Control Plan;
- Any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F;
- The regulations that apply to the land to which the development application relates;
- The likely impacts of the development including environmental impacts on both the natural and built environments, and social environmental impacts on the locality;
- The suitability of the site for the development;
- Any submissions made in accordance with the EP&A Act or the regulations; and
- The public interest.

4.2 RELEVANT PLANNING INSTRUMENTS

4.2.1 Muswellbrook LEP (2009)

All of the elements of the Modification are located entirely within the Muswellbrook LGA on land zoned as "RU1 Primary Production" and as "E3 Environmental Management" under the Muswellbrook Local Environment Plan 2009 (Muswellbrook LEP).

The land use table in the Muswellbrook LEP states that mining is prohibited within Zone E3. However, the permissibility of mining developments is also governed by the Mining SEPP. Clause 7(1) of the Mining SEPP provides:

> *"7 Development permissible with consent*
>
> *(1) Mining*
> *Development for any of the following purposes may be carried out only with development consent: …*
>
> *(b) mining carried out:*
>
> *(i) on land where development for the purposes of agriculture or industry may be carried out (with or without development consent), or*
>
> *(ii) on land that is, immediately before the commencement of this clause, the subject of a mining lease under the Mining Act 1992 or a mining licence under the Offshore Minerals Act 1999."*

The Muswellbrook LEP provides that development for the purposes of '*extensive agriculture'* is permissible within zone E3. By virtue of clause 7(1)(b)(i) of the Mining SEPP, mining is also permissible within zone E3. This is inconsistent with the land use table in the Muswellbrook LEP. Clause 5 of the Mining SEPP states that where there is an inconsistency between the SEPP and another Environmental Planning Instrument (EPI), the SEPP will prevail to the extent of the inconsistency. Therefore, the Mining SEPP overrides the Muswellbrook LEP, resulting in mining being permissible in Zone E3 with Development Consent.

4.2.2 Hunter Regional Environment Plan 1989

The *Hunter Regional Environmental Plan 1989 (Heritage)* (Hunter REP) aims to conserve the environmental heritage of the Hunter Region. Items of state, regional and local heritage significance are listed under schedules 1, 2 and 3 of the Hunter REP. None of these heritage items are located in proximity to any element of the Modification.

The Hunter REP applies to the land within the DA Boundary and provides objectives to ensure balanced development within the Hunter Region. Clause 39 of the Hunter REP pertains to Mineral Resources and Extractive Industries within the Hunter Region and outlines clear objectives for coal mining in the Hunter with the primary objective to ensure mining is conducted where adverse impacts on the environment and community are minimised.

Clause 48 of the Hunter REP describes policies and objectives for pollution control in the Hunter Region. This includes ensuring adverse impacts associated with potential air quality, noise and water impacts of mining are minimised on the environment and community.

This SEE addresses the above objectives and concludes that the Modification of SSD-5170 will continue to meet the objectives of the Hunter REP.

4.2.3 SEPP (Mining, Petroleum Production and Extractive Industries) 2007

Under clause 7 of *State Environmental Planning Policy Mining, Petroleum Production and Extractive Industries) 2007* (SEPP Mining) the proposed development modification is permissible with consent under the EP&A Act.

The matters for consideration in development applications (and modifications) are set out in Part 3.

4.2.4 SEPP 33 - Hazardous & Offensive Development

SEPP 33 (Hazardous & Offensive Development) (SEPP 33) prescribes matters for consideration by the consent authority in determining a development application for development that is a potentially hazardous or offensive industry. This Modification will result in the approval of an alternative locations for the Explosives Storage Facility which was approved to be constructed in SSD-5170.

Clause 12 of SEPP 33 requires a preliminary hazard analysis to be prepared in accordance with current circulars or guidelines. A preliminary hazard analysis completed for the Modification is discussed in Section 6.7.

Clause 13 of SEPP 33 requires the consent authority to consider the following:

> *"(a) current circulars or guidelines published by the Department of Planning relating to hazardous or offensive development and*
>
> *(b) whether any public authority should be consulted concerning any environmental and land use safety requirements with which the development should comply and*
>
> *(c) in the case of development for the purpose of a potentially hazardous industry – a preliminary hazard analysis prepared by or on behalf of the applicant and*
>
> *(d) any feasible alternatives to the carrying out of the development and the reasons for choosing the development the subject of the application (including any feasible alternatives*

for the location of the development and the reasons for choosing the location the subject of the application) and

(e) any likely future use of the land surrounding the development."

4.2.5 Gateway Process

Clause 119A of the EP&A Regs requires that a modification application that relates to "mining or petroleum development" on certain land is required to be accompanied by either a Gateway Certificate or a Site Verification Certificate.

The term "mining or petroleum development" is defined in clause 17A of SEPP Mining. The definition excludes:

(1) development for which a mining lease is not required to be issued to enable the development to be carried out; and

(2) "development carried out on land that is outside the mining area of a proposed mining lease".

None of the elements of the development proposed by this Modification are within the definition of "mining or petroleum development" because of either or both of the above exclusions. Accordingly, neither a Site Verification Certificate or a Gateway Certificate is required to accompany this application.

4.3 OTHER APPROVALS UNDER OTHER NSW LEGISLATION

4.3.1 Protection of the Environment Operations Act 1997

Section 48 of the *Protection of the Environment Operations Act 1997* (POEO Act) provides that an EPL is required in respect of premises at which any "… s*cheduled activity is carried on* …". BMC holds EPL 6538 in respect to its currently approved mining operations for DA 211/93 (as modified) and is currently seeking a variation to EPL 6538 relevant to SSD-5170.

The POEO Act provides for licensing of pollution by the NSW Environment Protection Authority (EPA) which administers the POEO Act. Should the Minister for Planning consider it appropriate to grant approval for this Modification, a variation to the EPL 6538 will be sought under the POEO Act prior to the relocation of the HRSTS staged discharge location.

4.3.2 Mining Act 1992

Applications for mining leases have been lodged in respect of all areas where mining or section 6 mining purposes (which require mining leases) are proposed.

This application does not relate to any new mining or changes to mining operations.

4.3.3 Native Vegetation Act 2003

Section 89J of the EP&A Act lists the approvals that are not required for approved developments under Division 4.1 of Part 4. Section 89J provides that an authorisation under section 12 of the Native Vegetation Act is "*… not required for State significant development that is authorised by a development consent …*".

4.3.4 National Parks and Wildlife Act 1974

Relevantly section 89J provides that an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the *National Parks and Wildlife Act 1974* (NPW Act) is not required for any SSD that has been granted Development Consent. Therefore, an AHIP will not be required in connection with the activities authorised by the development consent if this Modification is approved.

Aboriginal archaeological surveys completed for the Modification have determined that one previously identified and two new Aboriginal artefacts will be impacted.

Aboriginal heritage is to be managed in accordance with the conditions stipulated as part of SSD-5170. SSD-5170 Schedule 3, Condition 31 requires the preparation and implementation of an Aboriginal Archaeological and Cultural Heritage Management Plan (ACHMP) to manage all Aboriginal Heritage items within the DA Boundary. All Aboriginal artefacts predicted to be impacted by the Modification will be managed in accordance with the approved ACHMP (BMC, 2015).

4.3.5 Water Management Act 2000 and Water Act 1912

The licensing and approvals provisions of the *Water Management Act 2000* (WM Act) apply (in general terms) to water sources that are subject to a Water Sharing Plan (WSP). Parts 2 and 5 of the *Water Act 1912* continue to apply to water sources that are not subject to a WSP.

No water sources regulated under the Water Act 1912 will be affected by the proposed activities.

The Modification will not result in an increase of the maximum approved water take from water sources regulated under the WM Act and therefore no additional water access licences will be required. BMC will continue to hold all relevant licences, share component and allocation required to comply with the WM Act and Water Act at all times water is taken, whether during or after the life of the Project.

4.3.6 Dams Safety Act 1978

The *Dams Safety Act 1978* (Dams Safety Act) requires the NSW Dams Safety Committee (DSC) to "*formulate measures to ensure the safety of dams*" and to "*maintain a surveillance of prescribed dams*". A "prescribed dam" is any dam listed under Schedule 1 of the Dams Safety Act.

BMC's existing Staged Discharge Dam is listed as a Prescribed Dam under the Dams Safety Act. In addition, it is anticipated that CW1 (to be constructed) will also be listed as a Prescribed Dam following final confirmation with the DSC.

All prescribed dams at Bengalla will be operated under a safety management system which complies with the requirements of the DSC.

The Modification will not result in the construction of any other dams that will require regulation under the Dams Safety Act by the DSC.

4.4 COMMONWEALTH LEGISLATION

4.4.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

If a proposed action is likely to have a significant effect on one or more '*Matters of National Environmental Significance'* (MNES), the action is deemed to be a '*controlled action'*. The approval of the Commonwealth Minister for the Environment must be obtained before a controlled action can be carried out.

The Project was referred to the Minister for the Environment on 30 April 2012 and was subsequently determined to be a controlled action on 7 June 2012 as it was considered that it was likely to have a significant effect on "*Listed threatened species and communities"* (sections 18 & 18A). On 24 September 2013, BMC was further notified by the Minister for the Environment that the additional controlling provisions in accordance with section 24D and 24E associated with significant impacts to a water resource would also apply to Bengalla.

On 27 May 2015, BMC was granted EPBC Act Approval 2012/6378 for the proposed action to:

> *(c) "To continue open cut coal mining operations at the Bengalla Mine, approximately 4 km west of Muswellbrook in the Upper Hunter Valley, NSW for a further 24 years (See EPBC Act Referral 2012/6378), including the variation to the action as approved on 18 January 2013 to realign the southern section of the project boundary and expand a portion of the disturbance boundary".*

This Modification will result in the disturbance of up to an additional 9.1 ha of vegetation located outside the Disturbance Boundary. Of this area 6.1 ha contains vegetation communities conforming to the Box Gum Woodland and Derived Native Grassland community listed as Critically Endangered Ecological Community (CEEC) under the EPBC Act.

The Ecological Assessment completed for this SEE (see Section 6.1) has determined that due to the degraded nature of the CEEC to be disturbed and the relatively small area of disturbance proposed, providing that the management and mitigation measures described in this SEE are carefully implemented, this Modification will not result in a significant impact to EPBC listed communities.

This Modification has also considered the potential impacts on water resources in relation to the Federal Guidelines: *Matters of National Environmental Significance Significant Impact Guidelines 1.1* and the *Significant Impact Guidelines 1.3; Coal seam gas and large coal mining developments – impacts on water resources* (EPBC Water Guidelines). Section 1.1.2 of the EPBC Water Guidelines state:

> *"The core purpose of these guidelines is to assist any person who proposes to take an action which involves a … large coal mining development to decide whether the action has or is likely to have a significant impact on a water resource."*

A *"large coal mining development"* is defined under the EPBC Act (section 528) as:

> *"any coal mining activity that has, or is likely to have, a significant impact on water resources (including any impacts of associated salt production and/or salinity):*
>
> *(a) in its own right; or*
>
> *(b) when considered with other developments, whether past, present or reasonably foreseeable developments."*

The following extracts from the EPBC Water Guidelines are also relevant to the Modification:

> *"3.6 An expansion or modification to existing facilities may be within the definition of'… 'large coal mining development' if the expansion or modification involves extractive … coal mining activities which are likely to have a significant impact on a water resource."*

And

> *"4.2.1 If a referral for a proposed expansion or modification to a project does not involve extraction of … coal, then it will not be within the definition of … 'large coal mining development', and the water trigger will not apply …."*

And

> *"3.4. Extraction of CSG or coal*
>
> *The definitions of '… 'large coal mining development' relate to impacts on a water resource of activities that form part of the process of extracting coal …. The development of associated infrastructure that is not part of the extraction process is not included in the definitions of … large coal mining development.*
>
> *Extraction of … coal must form part of the activity and not merely be associated with it. Where referred along with new or modified extraction of … coal, the following activities will form part of the extractive process:*
>
> - *water supply for use in the extraction of … coal*
> - *management of water generated as a result of extraction of … coal, such as holding dams or water treatment facilities*
> - *management of waste generated as a result of extraction of … coal, such as spoil heaps.*

However, these activities will not independently be … coal mining development where there is no new or modified extraction of … coal…."

"3.5. Associated infrastructure

The development of associated infrastructure that is not part of the extraction process is not included in the definitions of'… 'large coal mining development'. This may include:

- *transport infrastructure, such as pipelines, road or rail infrastructure*
- *office/housing and amenity construction*
- *environment protection, monitoring and associated land management activities…*"

The activities, the subject of this Modification, do not include an extraction of coal. They relate purely to "*associated infrastructure that is not part of the extraction process*" (the extraction process itself was all assessed and approved under EPBC 2012/6378).

The area to be cleared in association with the Modification activities has been assessed as not having a significant impact on any MNES.

It has been determined the Modification will not constitute a '*controlled action'* for any impacts to MNES and there is no need to refer the Action under Section 68 of the EPBC Act to the Federal Minister for the Environment for an approval under Part 9 of the EPBC Act.

5 RISK ASSESSMENT

A risk assessment was completed to identify potential environmental and socio-economic issues associated with the Modification. The primary purpose of the risk assessment process was to prioritise and focus the required environmental and socio-economic impact studies required for the SEE.

Each of the potential environmental issues was ranked in accordance with the RTCA HSEQ Risk Classification Matrix (see Appendix B) as being of low, moderate, significant, high or critical risk. The risk rating allocated to an impact is dependent upon the probability of the impact occurring and the potential consequences should the impact materialise.

Each of the environmental and social-economic issues has been assessed and where appropriate, management and mitigation options developed.

Due to the minor nature of the Modification no environmental aspects provided a critical or high risk. Ecology and surface water impacts were determined to be of moderate risk with all remaining environmental issues deemed to be low risk. Table 4 summarises findings from the risk assessment.

Table 4
Environmental and Socio-Economic Risk Rating

Critical	High	Moderate	Low
None	None	Ecology	Air Quality
		Surface Water	Acoustics
			Aboriginal Archaeology
			Visual
			Hazard Analysis
			Non-Aboriginal Heritage

6 IMPACTS, MANAGEMENT AND MITIGATION

The potential environmental impacts of the Modification has been assessed as part of this SEE. The findings of this assessment as well as a description of the measures that will be implemented to manage and mitigate potential impacts are presented below.

6.1 ECOLOGY

6.1.1 Impact Assessment

An Ecological Assessment was completed by Cumberland Ecology for this Modification and is presented in Appendix C. Specifically the Ecological Assessment focused on the following objectives:

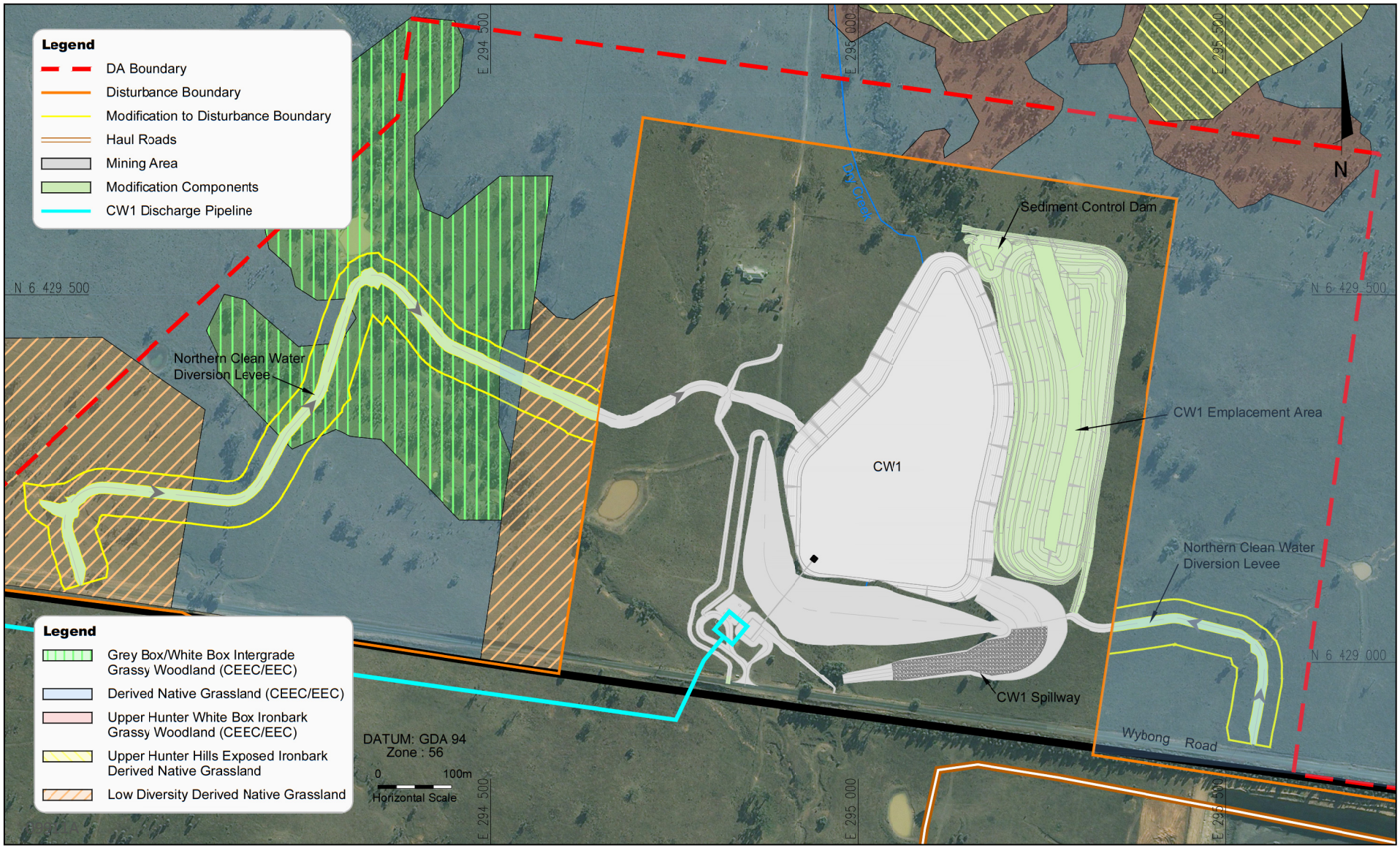
- Describe and map vegetation communities within the Modification to Disturbance Boundary area, identifying threatened ecological communities (TECs) listed under the NSW TSC Act and/or the Commonwealth EPBC Act;
- Assess the likelihood as to whether threatened flora and fauna species could occur within the Modification to Disturbance Boundary area;
- Describe the types and extent of potential impacts arising from this Modification; and
- Describe any avoidance and mitigation measures proposed to manage impacts on threatened species and areas of high conservation value.

The original character of the land within the Modification to Disturbance Boundary area has been greatly altered as a result of historical and current land uses. Prior to European settlement, the vegetation in the Modification to Disturbance Boundary area and surrounds would have been dominated by open grassy forest and woodland communities. Following European settlement, the majority of the forest and woodland in the area was cleared to provide grasslands for livestock. The resultant mosaic of grassland and modified woodland patches in the Modification to Disturbance Boundary area is typical of the Muswellbrook locality and has been influenced by a long history of agricultural land use. Vegetation communities present within and adjacent to the Modification to Disturbance Boundary area is provided on Figure 7.

The majority of the vegetation species recorded within the Modification to Disturbance Boundary area consist of ground layer species. The dominant plant families in the canopy and shrub layer are *Myrtaceae* and *Chenopodiaceae*, represented mostly by the genera of *Eucalyptus* and *Maireana.*

The Modification to Disturbance Boundary area is not considered to support a high diversity of fauna species, mostly due to the simplified and highly modified habitat present. The majority of the species known to occur in the surrounding areas have been recorded from the more intact areas of forest and woodland in locations outside the Modification to Disturbance Boundary area. A large proportion of recorded species are represented by birds and microchiropteran bats, which are highly mobile species. Reptiles, arboreal mammals and terrestrial mammals, which are less mobile, are not as well represented.

The native and semi-cleared vegetation within the Modification to Disturbance Boundary area provides limited habitat for native flora and fauna; including some species that are listed as threatened or migratory under the TSC Act and/or EPBC Act. However, no threatened flora or fauna species have been recorded within the Modification to Disturbance Boundary area.



BENGALLA MINE

Vegetation Communities

FIGURE 7

The Modification to Disturbance Boundary area is a total of 9.07 ha in size, comprising 6.1 ha of native vegetation and 2.97 ha of Low Diversity Derived Native Grassland/Exotic Pasture. Table 5 lists the vegetation communities occurring within the Modification to Disturbance Boundary area.

The Modification to Disturbance Boundary area contains a total of 6.1 ha of vegetation which conforms to the Grey Box/White Box Intergrade Grassy Woodland and Derived Native Grassland (Box Gum Woodland and Derived Native Grassland), listed as an EEC and CEEC under both the TSC Act and EPBC Act respectively. The Modification will result in the disturbance of up to 2.79 ha of Box Gum Woodland habitat and 3.31 ha of Derived Native Grassland habitat within the Modification to Disturbance area.

Of the vegetation to be impacted, 5.56 ha will be a temporary impacted and will be regenerated back to its original condition following completion of rehabilitation for this Modification. Permanent vegetation loss as a result of the Modification (the Northern Clean Water Diversion Levee) consists of 1.24 ha of Box Gum Woodland and Derived Native Grassland along with 2.28 ha of Low Diversity Derived Native Grassland/Exotic Pasture. Table 5 shows the total disturbed vegetation, temporarily disturbed vegetation and the area of vegetation that will be permanently removed within the Modification to Disturbance Boundary area.

The woodland remnants occurring within the Modification to Disturbance Boundary area are fragmented from other more intact patches of woodland and forest. The condition and nature of the woodland habitats have been greatly altered by existing and historical land uses. The Modification will result in the direct loss of 1.24 ha of Box Gum Woodland and Derived Native Grassland. The extent of the community to be removed exists in a modified form within a fragmented landscape between existing mining approvals. This Modification is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland. A complete assessment of significance against TSC Act and EPBC Act requirements is presented in Appendix C.

Table 5
Vegetation Communities Present within the Modification to Disturbance Boundary Area

Vegetation Community	TSC Act Status	EPBC Act Status	Permanently Removed (Levee) (ha)	Temporarily Disturbed (Buffer) (ha)	Modification to Disturbance Boundary Area (ha)
Grey Box/White Box Intergrade Grassy Woodland (Box Gum Woodland)	EEC	CEEC	0.59	2.2	2.79
Derived Native Grassland (Box Gum Woodland)	EEC	CEEC	0.65	2.66	3.31
Low Diversity Derived Native Grassland/Exotic Pasture	-	-	2.28	0.69	2.97
Total			3.52	5.56	9.07

6.1.2 Mitigation and Management

In order to further ensure impacts are minimised the following general mitigation measures will be implemented for the Modification to avoid significant disturbance to native vegetation and fauna habitat, as follows:

- Impacts to mature trees will be avoided where possible;
- To avoid unnecessary removal or damage to Box Gum Woodland and Derived Native Grassland the clearing area will be clearly demarcated and sign posted where appropriate;
- Following completion of works, the vegetation communities not directly associated with the levee will be rehabilitated back to their previous condition using locally endemic groundcover species from the Box Gum Woodland and Derived Native Grassland community and fenced to prevent cattle entering until the vegetation communities recover;
- Pre-clearance and clearance surveys will be conducted in accordance with the Biodiversity Management Plan;
- All disturbance will be rehabilitated in accordance with the BMC Rehabilitation Management Plan and Ground Disturbance Permit requirements; and
- The above measures will be communicated to all contractors and ensure that they are observed.

6.2 SURFACE WATER

6.2.1 Impact Assessment

A Surface Water Assessment was completed by WRM Water & Environment for the Modification and is presented in Appendix D. Specifically the Surface Water Assessment identified the impacts as a result of the Modification on the Bengalla water management system and in particular the potential impacts to local surface hydrology.

BMC's water management system provides an effective and pro-active management tool to ensure best-practice management of all water on site. Surface water management at Bengalla is based on the following key principles:

- Minimise use of fresh water from external sources (Bengalla has a current allocation from the Hunter River);
- Diversion of clean surface water runoff away from areas disturbed by mining activities where possible;
- Collection of surface water runoff from areas disturbed by mining activities in catch drains and direction of this to sediment traps;
- Collection of runoff from industrial areas in catch drains and direction, via an oil and grease separator, to the Bengalla Waste Water Treatment Plant (WWTP) for treatment and return to storage dams for reuse as mine water supply;
- Transfer of open cut pit water to storage dams for reuse as mine water supply; and
- Minimal discharge of surplus mine water off-site (i.e. promote recycling of captured water).

The water balance modelling completed for the Bengalla EIS Surface Water Impact Assessment (WRM, 2013) was the basis adopted for the Modification assessment. The computer based OPSIM model has been used to simulate and assess the dynamics of the site water balance at Bengalla Mine (incorporating this Modification) under varying climatic sequences across five representative mine stages previously utilised for the Bengalla EIS. The model simulates the operations of all major components of the proposed water management system on a daily basis using different historical sequences of recorded rainfall data. The inflows and outflows for the water management system are outlined in Table 6.

Table 6
Simulated Inflows and Outflows for the Water Management System

Inflows	Outflows
Direct rainfall onto water surface of storage	Evaporation from water surface of storages
Catchment Runoff	Water demands (CHPP, dust suppression, vehicle wash down)
Groundwater Inflows	Overflows from storages
Raw water extracted from the Hunter River	Controlled releases under the HRSTS
	Clean water pumped from clean water dams

Rainfall data records for the region commencing in 1893 were divided into 93 different climatic sequences, referred to as "realisations". Each realisation represents a different 24 year sequential period within the historical rainfall data. The first realisation consists of rainfall data from 1893 to 1916. The second realisation is based on data from 1894 to 1917, with every subsequent realisation being offset by one year. The OPSIM model performed a simulation for each of the 93 realisations, with each simulation reflecting the Project life. This approach provides the widest possible range of climate scenarios covering the full range of climatic conditions represented in the historical rainfall record.

The water balance modelling provides an assessment of surface water impacts under the full range of wet and dry conditions that have historically been experienced in the region. The model results are presented as a statistical summary of the results from different realisations, represented as percentiles. For example, the 50th percentile value represents the median of all realisations. The 10th percentile value represents the result that is exceeded in 90 percent of the model realisations.

Five different stages of the Project life were considered in the modelling (Years 1 (existing), 4, 8, 15 and 24). Although the catchment areas will continually change as mining progresses, these modelled years will provide a good representation of conditions over the 24 year Project life. The surface water runoff volumes used in the water balance model were estimated using the Australian Water Balance Model (Boughton, 1993).

The results of the site water balance modelling show that the mine water management system can be operated in accordance with BMCs existing EPL 6538 conditions. The model results indicate that there is:

- No uncontrolled release of mine affected water from the existing Staged Discharge Dam or Bengalla Discharge Dam over the Project life;
- No uncontrolled releases of mine affected water from Wantana West Dam during Years 1 to 3 prior to it being converted to a sediment dam. and
- Less than a 1% annual risk of discharge from the East and West Facilities Dam;

There is one modelled discharge from the East and West Facilities Dam, which is associated with the extreme flood event that occurred between 24 and 29 February 1955, where over 250 mm of rainfall fell over a 72 hour period. This event exceeded the 100 year ARI rainfall intensity for a 72 hour storm duration in the vicinity of the Project.

Controlled offsite discharges refers to water discharged under the HRSTS directly from the Staged Discharge Dam/Bengalla Relocated Discharge Dam to Dry Creek. The results from the assessment indicate the following:

- The 50th percentile annual discharge shows that no discharges are required under the HRSTS;
- The 90th percentile annual discharge shows that up to approximately 750 ML/a are discharged under the HRSTS;
- The 99th percentile annual discharge shows that up to approximately 1,550 ML/a are discharged under the HRSTS; and
- There is risk of potential discharge in Year 8 of Project life, likely associated with the large increase in catchment area reporting to the mine water system.

Appendix D presents the total annual modelled demand for water from an external source over the Project period. A summary of these results indicates the following:

- There is an increase in raw water requirement in Year 4 of the Project life likely due to the increase in CHPP throughput and increased haul road dust suppression requirements;
- The median (50th percentile) raw water requirement from an external source is between 1,140 and 1,530 ML/a during Years 5 to 24; and
- The 99th percentile raw water requirement from an external source is between 1,770 and 1,920 ML/a during Years 5 to 24.

The raw water source for the site demands is via an existing allocation from the Hunter Regulated River Water Source, which is pumped to the Raw Water Dam for use when required. Raw water is used as a last priority to meet site demands, with the exception of the vehicle wash demand which ranges between 97 and 132 ML/a.

The median (50th percentile) inventories of Main Pit and Satellite Pit show that the pits are generally maintained dry with no long term build up. The 90th percentile inventory in Main Pit and the Satellite Pit reaches 240 ML and 450 ML respectively.

BMC hold WALs with sufficient share component totalling 6,017 units (comprising 1,455 high security units and 4,562 general security units) to account for the maximum predicted take for the life of Bengalla based on predicted demands from the Hunter Regulated River Water Source (Management Zone 1A). BMC maintains exclusive rights for the dedicated use of at least 2,534 units (comprising 1,449 high security units and 1,085 general security units) under these WALs. The remaining units of the WALs (comprising 2,702 units) are currently subject to use by licensees of BMC owned land for agricultural purposes.

6.2.2 Mitigation and Management

Following approval of this Modification BMC will update the existing Water Management Plan (WMP) (BMC, 2015) to include the commitments in this SEE to the satisfaction of the relevant regulators. The revised water management system described in Section 6.2.1 and assessed in the water balance model will be included in the revised WMP.

BMC will ensure that appropriate erosion and sediment control measures as described in the WMP are in place to facilitate the Modification. Surface runoff water from any disturbed areas is considered dirty water and is separated from clean area runoff and will be managed in the mine water management system.

Erosion and sediment control devices will be designed and constructed according to the guidelines *Managing Urban Stormwater: Soils and Construction* (NSW Department of Housing, 1998), as well as recommendations from the *Draft Guidelines for Establishing Stable Drainage Lines on Rehabilitated Minesites* (Department of Land and Water Conservation, 1999).

BMC will hold all relevant licences, share component and allocation required to comply with the WM Act and Water Act at all times water is taken, whether during or after the life of the Project.

6.3 AIR QUALITY

6.3.1 Impact Assessment

An Air Quality Assessment was completed by Todoroski Air Sciences for the Modification and is presented in Appendix E. Specifically the Air Quality Assessment provided a qualitative assessment of the potential change in air quality associated with the Modification. The Air Quality Assessment primarily focused on the activity associated with the development and placement of excavated material from the CW1 adjacent to the dam, all other features associated with this Modification are by comparison unlikely to generate a significant amount of dust emissions and therefore were not subject of the assessment.

SSD-5170 provides that the excavated material removed would be transported using appropriate mining equipment across Wybong Road for emplacement within either the main overburden emplacement area (Main OEA) or in the western out of pit emplacement area (Western OEA). Further, any material emplaced within the Western OEA would later be required to be rehandled as operations progress west to the Main OEA. A comparison of the estimated total dust emissions for the approved activity associated with the construction of CW1 and emplacement of CW1 materials is summarised in Table 7.

The results in Table 7 indicate that the estimated change in potential dust emissions associated with the emplacement of excavated material immediately adjacent to the CW1 would see a decrease in dust emissions from the development. A detailed emissions inventory is provided in Appendix E.

By emplacing the excavated material adjacent to the CW1, the required haulage distance will be reduced significantly when compared to the distance required for transporting material to the Western OEA or Main OEA and therefore the amount of dust generated will be significantly lower.

A comparison of the amount of estimated dust emissions for the Modification with the estimated emissions presented in the Bengalla EIS (Year 1) *Air Quality and Greenhouse Gas Impact Assessment* (Todoroski Air Sciences, 2013), indicates that the quantity of dust will equate to approximately 1.3 % of the total dust generated by the entire operation. The placement of materials within the CW1 Emplacement Area will result in a 16 % reduction in air quality emissions when compared to the approved CW1 construction program through reduced haulage distances. This translates to a reduction of 0.3 % of the total emissions. This change is considered minor and is unlikely to be discernible relative to the existing contribution from the site.

This Modification will result in a minor improvement in air quality compared to approved operations. As a result, this Modification is unlikely to cause any discernible negative impact at any surrounding sensitive receptor locations. Further it is anticipated that the dust emissions resulting from the activities to be conducted as part of the Modification will remain within air quality emissions criteria presented in SSD-5170.

Table 7
Comparison of Estimated TSP Emissions (kg/year)

CW1 Construction Activity	Approved Operations	Modification	% Change
Stripping topsoil material	1,339	1,339	-
Excavator loading topsoil material to haul truck	69	69	-
Hauling topsoil material to stockpile area	1,000	246	-75%
Emplacing topsoil at stockpile area	69	69	-
Excavator loading excavated material to haul truck	1,216	1,216	-
Hauling excavated material to overburden emplacement area	17,711	4,350	-75%
Emplacing excavated material at overburden emplacement area	1,216	1,216	-
Dozer activity	8,368	8,368	-
Wind erosion from active exposed areas	56,249	56,249	-
Total TSP emissions (kg/year)	87,236	73,120	-16%

6.3.2 Mitigation and Management

Existing BMC dust management techniques consistent with Bengalla Air Quality and Greenhouse Gas Management Plan will be applied to the Modification including but not limited to:

- Job-site induction;
- Completion of relevant internal BMC documentation including; Risk Assessments and Ground Disturbance Permit;
- To ensure dust emissions from the development of CW1 are minimised where possible, appropriate operational and physical dust mitigation measures should be implemented such as maintaining sufficient levels of moisture on the surface of trafficked surfaces and limiting vehicle speeds.
- A water cart (or similar) will wet down the relevant area when required;
- Site access points and access tracks will be situated away from residential receivers and where reasonable and feasible; and
- Rehabilitation will commence as soon as practicable following completion of the CW1 Emplacement Area.

6.4 ACOUSTICS

6.4.1 Impact Assessment

An Acoustic Assessment was completed by Bridges Acoustics for the Modification and is presented in Appendix F. Specifically the Acoustic Assessment provided a qualitative assessment of the potential change in construction and operational noise associated with the Modification in comparison to those presented in the Bengalla EIS Acoustic Impact Assessment (Bridges Acoustics, 2013).

This assessment indicates the Modification would produce a minor and insignificant change to short term construction noise levels at all receptors, with no appreciable change to operational noise levels or to other acoustic issues such as low frequency noise or sleep disturbance.

The Modification construction and operational noise levels are expected to remain similar to and consistent with the noise levels reported in the Bengalla EIS. Based on the results of this assessment, the Modification is unlikely to have a significant effect on noise levels and impacts are anticipated to remain within criteria presented in SSD-5170.

6.4.2 Mitigation and Management

Existing BMC noise management techniques consistent with Bengalla Noise Management Plan will be applied to the Modification including but not limited to:

- Job-site induction;
- The Modification construction works audible to sensitive receptors will only occur between the hours of 7:00 am to 6 pm on Monday to Friday and 8 am to 1 pm on Saturdays. No construction works will occur on Sundays or Public Holidays;
- All equipment used on site will be maintained in good working order;
- Pre-start inspections will be made on all equipment;
- The use of exhaust brakes will be eliminated, where practical; and
- Where practical, machines will be switched off when not being used, rather than left idling for prolonged periods.

6.5 ABORIGINAL ARCHAEOLOGY

6.5.1 Impact Assessment

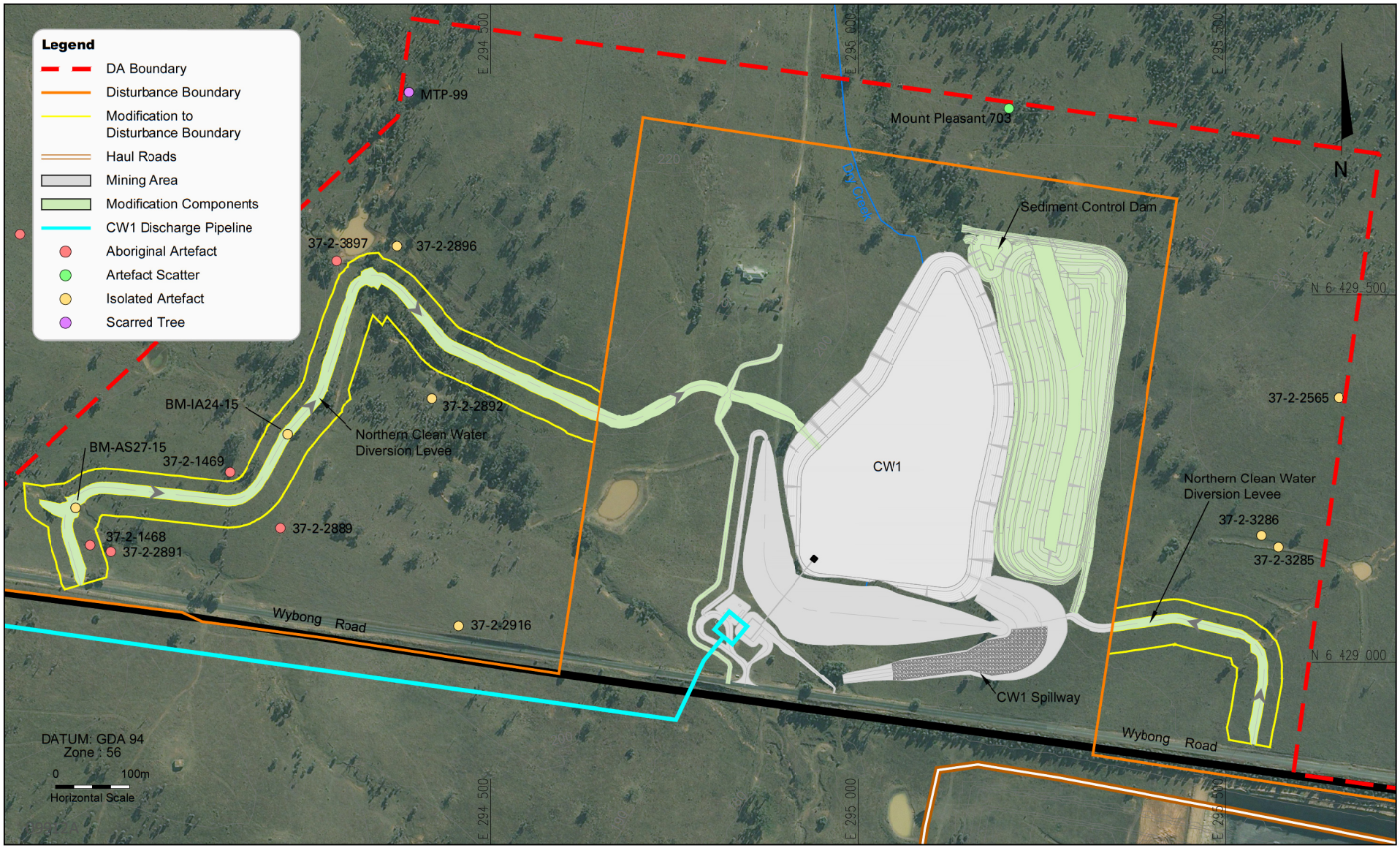
An Aboriginal Archaeology Due Diligence Assessment was completed by AECOM for the Modification and is presented in Appendix G. The Aboriginal Archaeology Due Diligence Assessment focused on the additional area outside the Disturbance Boundary delineated in SSD-5170. All previously identified sites within the SSD-5170 Disturbance Boundary will be managed in Accordance with the approved Bengalla ACHMP (BMC, 2015).

Information regarding the known and potential Aboriginal archaeological resource of the area was obtained from:

- A review of the landscape context of the DA Boundary and surrounds;
- A review of existing Aboriginal Heritage Information Management System (AHIMS) data for all land within the DA Boundary obtained from OEH on 5 June 2015 (AHIMS ID #176180);
- A review of Bengalla Mine Aboriginal sites data held by AECOM as resulting from the completion of the Bengalla EIS *Aboriginal Archaeological and Cultural Heritage Impact Assessment* (AECOM 2013a);
- A review of the findings of past Aboriginal archaeological investigations for Bengalla Mine and adjacent operations; and
- A site inspection of the Modification area by a combined field team consisting of AECOM archaeologists and representatives from the Aboriginal community.

A review of existing AHIMS data sites indicates that one site is located directly within the Modification to Disturbance Boundary – open artefact site A7-A8 (AHIMS#37-2-1468) (see Figure 8). In addition, the search indicated that four sites are located within 50 m of the Modification to Disturbance Boundary including open artefact sites AHIMS#37-2-1469, 37-2-2891, 37-2-2896, and 37-2-2897.

The site inspection identified a further two sites located within the Modification to Disturbance Boundary that would be impacted as a result of the Modification consisting of artefact scatter BM-AS27-15 and isolated artefact site BM-IA24-15 (see Figure 8).



BENGALLA MINE

Aboriginal Cultural Heritage Sites

FIGURE 8

6.5.2 Mitigation and Management

Impacts as a result of the Modification will be managed in accordance with the existing Bengalla ACHMP. In addition the following specific mitigation measures for the Modification will be implemented:

- AHIMS sites 37-2-1469, 37-2-2891, 37-2-2896, and 37-2-2897 will be temporarily fenced and appropriately signposted during construction of the Northern Clean Water Diversion Levees. A suitable buffer where reasonable and feasible will be established as part of the temporary fencing to exclude the sites from potential impact;
- Impacts to previously recorded AHIMS site 37-2-1468 (A7-A8) and newly recorded Aboriginal sites BM-AS27-15 and BM-IA24-15 will be salvaged in accordance with BMC's existing ACHMP following approval of the Modification; and
- AHIMS site cards for Aboriginal sites BM-AS27-15 and BM-IA24-15 will be submitted to the AHIMS register.

6.6 VISUAL ASSESSMENT

6.6.1 Impact Assessment

Consideration of visual impacts associated with the Modification was provided in relation to the existing surrounding visual landscape and those activities approved in SSD-5170. The Visual Impact Assessment (JVP Planning and Design, 2013) undertaken for the Bengalla EIS characterised the local visual landscape within the vicinity of Bengalla as being that of a rural setting dominated by mining activities along with agricultural activities associated with the Hunter River Floodplain.

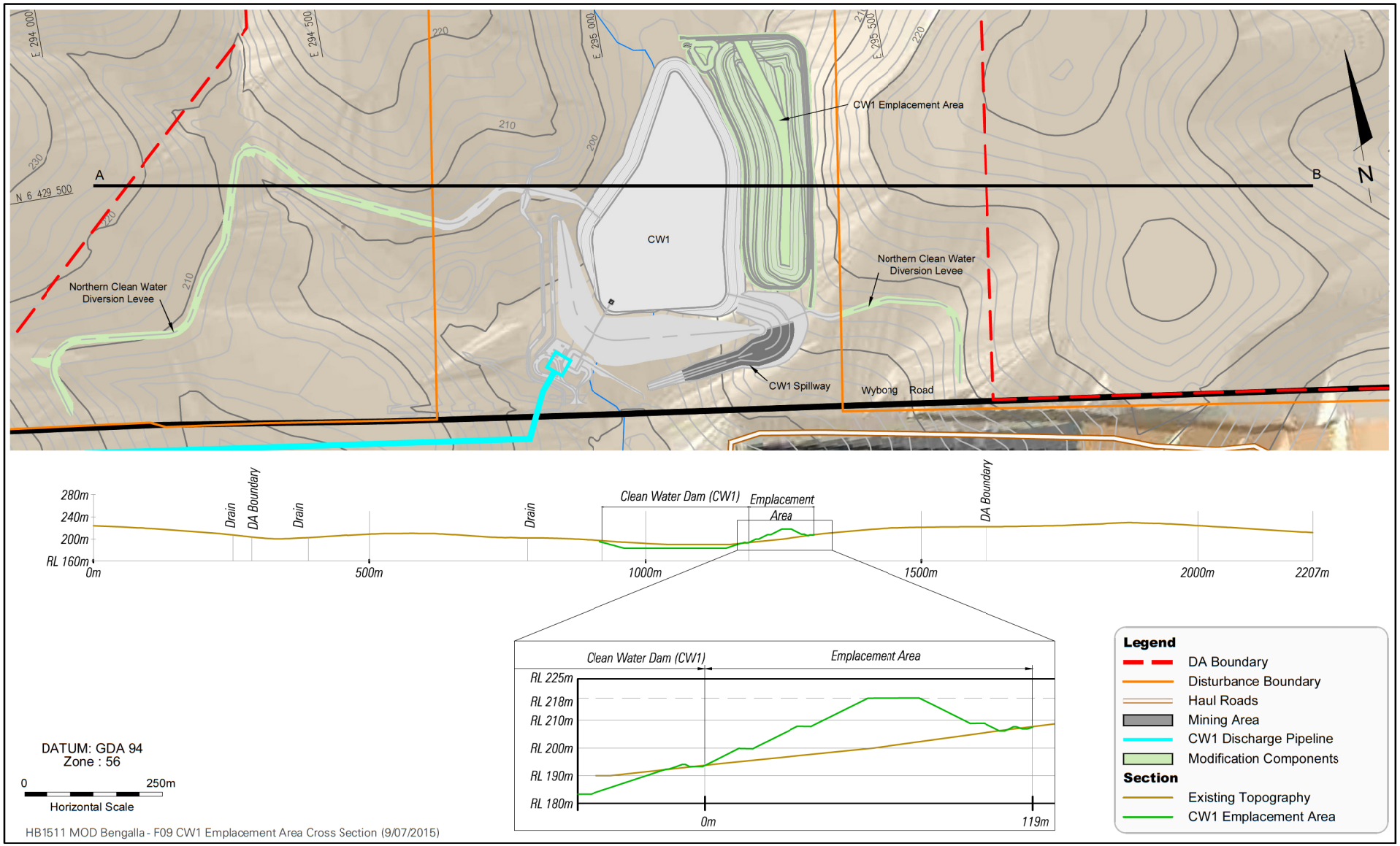
The CW1 Emplacement Area is located immediately north of Wybong Road and has been determined to represent the only change to the visual character when the Modification is compared to Bengalla's approved operations. Figure 9 presents a cross section associated with the CW1 Emplacement Area and indicates that the maximum height will be approximately RL 218 m. This maximum height is approximately 18 m higher than the natural topography in its centre and does not represent a dominant landform when compared to the local visual landscape.

The CW1 Emplacement Area sits adjacent to Dry Creek in a natural basin providing shielding from the majority of public vantage locations. The natural topography surrounding the CW1 Emplacement Area combined with the well-established Main OEA associated with BMC's approved operations (up to RL 270 m) will result in views of CW1 Emplacement Area limited to those experienced from Wybong Road. Views from Wybong Road of the CW1 Emplacement Area will be possible however will only be experienced for a limited time.

The construction of the approved CW1 embankment will be located immediately adjacent to the CW1 Emplacement Area. Due to its proximity and positioning being further south this will assist in reducing visual impacts from Wybong Road.

6.6.2 Mitigation and Management

In order to further mitigate the minimal impacts arising from the construction of the CW1 Emplacement Area BMC will commence rehabilitation as soon as practicable.



HB1511 MOD Bengalla - F09 CW1 Emplacement Area Cross Section (9/07/2015)

BENGALLA MINE

CW1 Emplacement Area
Cross Section

FIGURE 9

6.7 HAZARD ANALYSIS

6.7.1 Impact Assessment

A review of the *Preliminary Hazard Analysis* (Hansen Bailey, 2013) developed for the Bengalla EIS was completed for the Modification. This qualitative review aimed to identify any potential changes arising from the Modification to previously identified hazards and develop possible management and control procedures as specified in the relevant legislation. The inclusion of the Explosives Storage Facility Envelope is the only hazardous activity proposed by the Modification and is discussed further below.

The *Preliminary Hazard Analysis* (Hansen Bailey, 2013) was undertaken in accordance with *SEPP 33 – Hazardous and Offensive Development Application Guidelines* (DUAP, 1994). The *Hazardous Industry Planning Advisory Papers* (HIPAPs) developed under SEPP 33 were also considered throughout the assessment. HIPAPs of particular relevance to the Modification included the:

- 'Hazardous Industry Planning Advisory Paper No 3 – Risk Assessment' (DOP 2011a);
- 'Hazardous Industry Planning Advisory Paper No 4 – Risk Criteria for Land Use Planning' (DOP, 2011b); and
- 'Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis' (DOP, 2011c).

The key hazardous materials relevant for review include explosives, hydrocarbons and other hazardous chemicals. The key hazardous chemicals are predicted to include, however are not limited to, fuels such as diesel and petrol, degreaser, kerosene, oils, greases and explosives. The key potential hazards associated with explosives include onsite storage location, proximity to fuel and workshop and possible explosions as a result of mixed materials. The Modification will continue to require the use of explosives and other related materials to support ongoing mining operations.

As noted in Section 3.3, the Modification will involve the possible relocation of an explosives storage facility from its currently approved location on the Main OEA to the Explosives Storage Facility Envelope in approximately 2016 (see Figure 5). The Explosives Storage Facility Envelope is situated in the central portion of the Disturbance Boundary and is approximately 1 km from its existing position. The Explosives Storage Facility Envelope will provide more efficient and safe access by light and heavy vehicles by not having to traverse the active open cut mining area and Main OEA. The Modification will not require any other changes to the approved storage capacity, type or use of explosives. All other Modification components are not considered hazardous.

Potential hazards to the surrounding environment during the transport, storage and use of explosives at Bengalla will continue to be managed in accordance with the *AS 2187.1 – 1998: Explosives – Storage, Transport and Use – Storage*, the *Australian Explosives Industry and Safety Group Code of Practice – Precursors for Explosives* (AEISG, 1999) and the relevant BMC management plans and procedures.

BMC currently holds two licences to store explosives and associated materials, issued under the OH&S Act, 07-100151-001 and XSTR100151 for the existing Bengalla explosive precursor storage facility and Explosives Storage Facility. BMC will ensure the relocated Explosives Storage Facility is secure and the products stored at these facilities will continue to be stored and handled in accordance with '*AS2187.2-2006 – Explosives – Storage, Transport and Use, Part 2: Use of Explosives*'.

BMC holds an 'Acknowledgement of Notification of Dangerous Goods on Premises' 35/033746 for the diesel currently stored on site.

6.7.2 Mitigation and Management

The Modification is not considered hazardous or offensive and no offsite impacts are predicted as a result of the revised positioning of the Explosives Storage Facility. Management procedures will be implemented to ensure that all potential hazards are minimised and their likelihood of occurrence decreased by ensuring compliance with relevant legislation, regulations and guidelines. All storage facilities at BMC will continue to satisfy the following requirements:

- Facilities will be designed, constructed, inspected and maintained in accordance with the requirements of the Dangerous Goods Act and the relevant Australian Standards;
- Explosives will continue to be transported and utilised in accordance with site procedures and the requirements of AS*/NZS 2187 – 1998: Explosives – Storage, Transport and Use* (Standards Australia, 1998), the *Explosive Act 2003*, the *Explosive Regulations 2005*, the *Coal Mines Health and Safety Act 2002* (CMH&S), the *CMH&S Regulations 2006* and other relevant codes;
- All facilities will be secure;
- Designs will ensure easy access for fire fighting should a fire occur; and
- All substances shall be stored in the areas or facilities provided.

6.8 NON-ABORIGINAL HERITAGE

6.8.1 Impact Assessment

An analysis of the Non-Aboriginal Heritage items previously identified in the Bengalla EIS *Historic Heritage Impact Assessment* (AECOM, 2013b) was completed for the Modification. A total of four previously recorded Historic Heritage Sites was identified within 1 km of the Modification components.

6.8.2 Mitigation and Management

None of the previously recorded sites will be impacted by the Modification and as a result no additional mitigation measures are proposed.

7 STATEMENT OF COMMITMENTS

This section provides a summary of the environmental mitigation measures arising from the Modification.

7.1 SUMMARY OF MITIGATION MEASURES

Further to the conditions of SSD-5170, the statement of commitments in Table 8 summarises the key management and mitigation measures proposed in this SEE.

The aim of the statement of commitments is to ensure that the Modification's environmental and social impacts are minimised by implementing the appropriate management, monitoring and mitigation strategies.

Table 8
Statement of Commitments

Ref	Description	Section(s)
1.	All construction activities potentially audible at sensitive receivers will be conducted between the hours of 7 am to 6 pm, Monday to Friday and 8 am to 1 pm on Saturdays. No construction works will occur on Sundays or Public Holidays.	3.6
2.	Disturbance associated with the construction of the Northern Clean Water Diversion Levees will be contained to the area as shown on Figure 7. Disturbance areas will be clearly demarcated and sign posted, where appropriate.	6.1.1
3.	Impacts to mature trees associated with the construction of the Northern Clean Water Diversion Levees will be avoided where possible which will be identified during the completion of pre-clearance and clearance surveys in accordance with the Biodiversity Management Plan or its latest version.	6.1.2
4.	Following completion of the Northern Clean Water Diversion Levees, the vegetation communities will be rehabilitated back to its previous condition using locally endemic groundcover species from the Box Gum Woodland and Derived Native Grassland community.	6.1.2
5.	To ensure dust emissions from the development of the CW1 Emplacement Area are minimised where possible, appropriate operational and physical dust mitigation measures will be implemented such as maintaining sufficient levels of moisture on the surface of trafficked surfaces and limiting vehicle speeds.	6.3.2
6.	Rehabilitation will commence as soon as practicable following completion of the CW1 Emplacement Area.	6.1.2 and 6.3.2
7.	AHIMS sites 37-2-1469, 37-2-2891, 37-2-2896, and 37-2-2897 will be temporarily fenced and signposted as appropriate during construction of the Northern Clean Water Diversion Levees.	6.5.2
8.	Impacts to previously recorded AHIMS site A7-A8 (#37-2-1468) and newly recorded Aboriginal sites BM-AS27-15 and BM-IA24-15 will be salvaged in accordance with BMC's existing ACHMP following approval of the Modification.	6.5.2
9.	AHIMS site cards for Aboriginal sites BM-AS27-15 and BM-IA24-15 will be submitted to the AHIMS register.	6.5.2
10.	BMC will update (at least) the SSD-5170 required Water Management Plan and Aboriginal Archaeology and Cultural Heritage Management Plan following approval of the Modification.	6.2.2 and 6.5.2

8 ABBREVIATIONS

Abbreviation	Description
ACHMP	Aboriginal Cultural Heritage Management Plan
ARI	Average Recurrence Interval
AHIP	Aboriginal Heritage Impact Permit
BMC	Bengalla Mining Company Pty Limited
Bengalla 2008 EA	Bengalla Mine Development Consent Modification Environmental Assessment (Hansen Bailey, 2008)
Bengalla 2010 EA	Bengalla Mine Development Consent Modification Environmental Assessment (Hansen Bailey, 2010)
Bengalla 2006 SEE	Bengalla Mining Company Modifications to Mining Operations Statement of Environmental Effects (Hansen Bailey, 2006)
Bengalla 1993 EIS	Environmental Impact Statement for the Bengalla Coal Mine (Envirosciences, 1993)
Bengalla 2013 EIS	Continuation of Bengalla Mine Environmental Impact Statement (Hansen Bailey, 2013)
BCMP	Bengalla Continuation of mining Project as described in the Bengalla 2013 EIS
BJV	Bengalla Joint Venture
CEEC	Critically Endangered Ecological Community
CHPP	Coal Handling and Preparation Plant
DA	Development Application
DBH	Diameter at Base Height
DP&E	NSW Department of Planning and Environment
DoE	Department of the Environment
DRE	Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy
EA	Environmental Assessment
EEC	Endangered Ecological Community
EMP	Environmental Monitoring Program
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
ha	Hectare
Hansen Bailey	Hansen Bailey Environmental Consultants
LGA	Local Government Area
Mining Act	*Mining Act 1992*
ML	Mining Lease

Abbreviation	Description
WM Act	*Water Management Act 2000*
MNES	Matters of National Environmental Significance
MOP	Mining Operations Plan
Mtpa	Million tonnes per annum
Muswellbrook LEP	Muswellbrook Local Environment Plan 2009
NOW	NSW Office of Water
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
NV Act	*Native Vegetation Act* 2003
OEA	Overburden Emplacement Area
OEH	Office of Environment and Heritage
POEO Act	*Protection of the Environment Operations Act 1997*
ROM	Run of Mine
RL	Reduced Level
SEE	Statement of Environmental Effects
TSC Act	*Threatened Species Conservation Act 1995*
WAL	Water Access Licence
Water Act	*Water Act 1912*
WSP	Water Sharing Plan

9 REFERENCES

- AECOM (2013a), *Aboriginal Archaeological and Cultural Heritage Impact Assessment.* Prepared for the Continuation of Bengalla Mine Environmental Impact Statement 2013.
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Appendix A

Schedule of Land

Appendix A – Schedule of Land to which this SEE applies

Lot	DP	Owner
9	39345	Bengalla Mining Company Limited
1	189134	Bengalla Mining Company Limited
1	236668	Bengalla Mining Company Limited
3	236668	Bengalla Mining Company Limited
6	236668	Bengalla Mining Company Limited
7	236668	Bengalla Mining Company Limited
10	236668	Bengalla Mining Company Limited
112	551930	Bengalla Mining Company Limited
110	556761	Bengalla Mining Company Limited
111	556761	Bengalla Mining Company Limited
2	561117	Bengalla Mining Company Limited
19	563495	Bengalla Mining Company Limited
1	570070	Bengalla Mining Company Limited
2	570070	Bengalla Mining Company Limited
91	620639	Bengalla Mining Company Limited
71	626353	Bengalla Mining Company Limited
72	626353	Bengalla Mining Company Limited
20	706045	Bengalla Mining Company Limited
505	711996	Bengalla Mining Company Limited
1	718834	Bengalla Mining Company Limited
1	735667	Bengalla Mining Company Limited
2	735667	Bengalla Mining Company Limited
21	776758	Bengalla Mining Company Limited
22	776758	Bengalla Mining Company Limited
41	792447	Bengalla Mining Company Limited
43	792447	Bengalla Mining Company Limited
5	801249	Bengalla Mining Company Limited
8	821183	Bengalla Mining Company Limited
20	1072668	Bengalla Mining Company Limited
22	1072668	Bengalla Mining Company Limited
24	1072668	Bengalla Mining Company Limited
25	1072668	Bengalla Mining Company Limited
26	1072668	Bengalla Mining Company Limited
27	1072668	Bengalla Mining Company Limited
100	1148907	Bengalla Mining Company Limited
101	1148907	Bengalla Mining Company Limited
102	1148907	Bengalla Mining Company Limited
103	1148907	Bengalla Mining Company Limited

Lot	DP	Owner
104	1148907	Bengalla Mining Company Limited
105	1148907	Bengalla Mining Company Limited
106	1148907	Bengalla Mining Company Limited
274	750926	Coal & Allied Operations Pty Limited
4	801249	Coal & Allied Operations Pty Limited
6	821183	Coal & Allied Operations Pty Limited
2*	801249	Coal & Allied Operations Pty Limited
10	1184928	Coal & Allied Operations Pty Limited
11	1184928	Bengalla Mining Company Limited
3	998477	Coal & Allied Operations Pty Limited
Sections of various Council roads		
Sections of Crown roads		
Sections of Muswellbrook-Ulan Rail Line		

*Associated with Bengalla Development Consent Modification SEE (August 2015)

Appendix B

RTCA HSEQ Environmental Risk Assessment Matrix

Risk Assessment Tools

HSEQ Matrix for Determining Level of Risk

Likelihood	Consequence				
	1 – Minor	**2 - Medium**	**3 - Serious**	**4 - Major**	**5 - Catastrophic**
A – Almost Certain	Moderate	High	Critical	Critical	Critical
B - Likely	Moderate	High	High	Critical	Critical
C - Possible	Low	Moderate	High	Critical	Critical
D – Unlikely	Low	Low	Moderate	High	Critical
E - Rare	Low	Low	Moderate	High	High

Likelihood Classification Used for the HSEQ Risk Framework

Likelihood	Likelihood Description	Frequency	Substance Exposure
Almost Certain	Recurring event during the life-time of an operation / project	Occurs more than twice per year	Frequent (daily) exposure at > 10 x OEL
Likely	Event that may occur frequently during the life-time of an operation / project	Typically occurs once or twice per year	Frequent (daily) exposure at > OEL
Possible	Event that may occur during the life-time of an operation / project	Typically occurs in 1-10 years	Frequent (daily) exposure at > 50% of OEL Infrequent exposure at > OEL
Unlikely	Event that is unlikely to occur during the life-time of an operation / project	Typically occurs in 10-100 years	Frequent (daily) exposure at > 10% of OEL Infrequent exposure at > 50% of OEL
Rare	Event that is very unlikely to occur during the life-time of an operation / project	Greater than 100 year event	Frequent (daily) exposure at < 10% of OEL Infrequent exposure at > 10% of OEL

Appendix C

Ecological Assessment

BENGALLA MINE - SECTION 96(2) MODIFICATION TO SSD-5170

Ecological Assessment

For:

Hansen Bailey

June 2015

Final

PO Box 2474

Carlingford Court 2118

Report No. 14081RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Version	Date Issued	Amended by	Details
001	12/06/2015	LH	Draft
002	24/06/2015	LH	Final

Approved by: David Robertson

Position: Director

Signed:

Date: *24 June, 2015*

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Glossary of Terms

Disturbance Boundary	The extent of Bengalla Mine that has been approved for development through various applications for development consent (see **Figure 1.1**)
BMC	Bengalla Mining Company Pty Limited
Buffer	Buffer area in the Modification used for construction services (see **Figure 3.1**)
CEEC	Critically Endangered Ecological Community
CW1	Clean Water Dam 1
DA	Development Application
DoE	Commonwealth Department of the Environment
EEC	Endangered Ecological Community
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDE	Groundwater Dependent Ecosystem
KTP	Key Threatening Process
LGA	Local Government Area
Levee	Vegetation to be permanently removed to facilitate levee installation (see **Figure 3.1**)
Locality	Defined as a 20km radius of the Modification to Disturbance Boundary
MNES	Matters of National Environmental Significance
the Modification	Proposed modification to SSD-5170 under Section 96(2) the EP&A Act
Modification to Disturbance Boundary	The portion of the Modification occurring outside the previously delineated Disturbance Boundary (see **Figure 1.1** and **Figure 1.2**). This area will be directly impacted by the Project and includes the diversion drains associated with CW1.
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
the Project	The portion of the Modification that occurs within the Modification to Disturbance Boundary.
SEE	Statement of Environmental Effects
SSD	State Significant Development
TEC	'Threatened Ecological Community' as listed under the TSC Act and/or EPBC Act
TSC Act	NSW *Threatened Species Conservation Act 1995*

Chapter 1

Introduction

Cumberland Ecology was commissioned by Hansen Bailey on behalf of Bengalla Mining Company Pty Limited (BMC) to prepare an Ecological Assessment for a modification to the Bengalla Continuation of Mining Project (the 'Modification'). This report will form part of the Statement of Environmental Effects (SEE) being prepared by Hansen Bailey to support an application for modification to SSD-5170 under Section 96(2) the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Modification includes on-ground components both within and outside of the previously delineated Project and Disturbance Boundaries for Bengalla Mine (see **Figure 1.1**). The subject of this Ecological Assessment includes the portion of the Modification occurring outside the previously delineated Disturbance Boundary (the 'Modification to Disturbance Boundary') (see **Figure 1.2**). The portion of the Modification that occurs within the Modification to Disturbance Boundary is hereafter referred to as the 'Project'.

1.1 Purpose

This report will consider all of the impacts of the Modification; however the main focus of the assessment is to assess the additional impacts of the Project on biodiversity values outside the previously delineated Disturbance Boundary. Biodiversity values include threatened species, populations and ecological communities protected under State and Commonwealth legislation. The main objective of this report is to determine whether the Project is likely to significantly affect threatened biodiversity values within the Modification to Disturbance Boundary and how the Modification plans to mitigate those impacts.

Specifically, the objectives of this Ecological Assessment are to:

- Describe and map vegetation communities of the Modification to Disturbance Boundary, identifying threatened ecological communities (TECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Assess the likelihood as to whether threatened flora and fauna species could occur within the Modification to Disturbance Boundary;
- Describe the types and extent of potential impacts arising from the Project; and

- Describe any avoidance and mitigation measures proposed to manage impacts on threatened species and areas of high conservation value.

1.2 Modification Description

BMC are seeking modification to SSD-5170 under Section 96(2) the EP&A Act. The Modification includes the following:

- Alterations to various water management infrastructure components including:
  - Utilisation of the Satellite Pit as a catchment dam;
  - Construction of clean water diversion levees;
  - Relocation of the Staged Discharge Dam release point; and
  - Revised location for the future relocated Hunter River and Washery Dam.
- Relocation of the existing Explosives Storage Facility; and
- Placement of fill from the excavation of the Clean Water Dam 1 (CW1) immediately east of CW1.

The conceptual layout of the Modification is shown in **Figure 1.1**. A detailed description of each component of the Modification is provided within the SEE.

1.3 Modification to Disturbance Boundary

1.3.1 Existing Mine

BMC operates the Bengalla Mine in the Upper Hunter Valley of NSW. Bengalla Mine is an open cut operation where mining advances generally to the west. BMC was granted Development Consent (Development Application (DA) 211/93) in August 1995 for the development and operation of Bengalla Mine. Bengalla Mine was approved to operate for a 21 year period from 1996 (i.e. until 2017).

In 2013, BMC lodged an application for State Significant Development (SSD) Consent (SSD-5170) under Division 4.1 of Part 4 of the EP&A Act for the continuation of mining operations at Bengalla Mine. The development includes the extension of existing operations for a further 24 years in a westerly direction. BMC was granted Development Consent in March 2015 for SSD-5170.

1.3.2 Location

The existing Bengalla Mine is located approximately 4 km west of Muswellbrook in the Upper Hunter Valley, NSW. Bengalla Mine is generally bounded by Wybong Road to the north, Roxburgh Road to the west, Overton Road to the east, and the Muswellbrook-Ulan Rail Line

to the south. Bengalla mine is wholly contained within the Muswellbrook Local Government Area (LGA).

1.3.3 Description of the Environment

i. Bioregional Context

The Project is located in the Hunter subregion of the Sydney Basin Bioregion, a large and complex area that extends from Batemans Bay in the south to Nelson Bay in the north and includes parts of the Blue Mountains. The Hunter subregion is principally located in the Hunter Valley and incorporates all of the Hunter River Catchment.

ii. Topography, Geology and Soils

The Hunter subregion is characterised by rolling hills and wide valleys, with a meandering river system (the Hunter River) on a wide floodplain. River terraces are evident, the highest with silicified gravels. Streams can be brackish or saline at low flow, and numerous small swamps are present in the upper catchment, and extensive estuarine swamps occur near the coast behind the coastal barrier of beach and dunes (Morgan, 2001).

The Project is located to the north west of the Hunter Coalfields. The stratigraphical sequence across the site is comprised of overburden and interburden layers of lithic sandstone, interbedded with siltstone, tuffaceous claystone and mudstone (Hansen Bailey, 2007b).

The soils in the Hunter subregion comprise a variety of harsh texture contrast soils on slopes and deep sandy loam alluvium on the valley floors. There are a small number of source bordering dunes on southern tributaries of the Hunter River. Deep sands with podsol profiles occur in dunes on the coastal barrier, and saline, organic muds are present in the Hunter River estuary. Soil salinity is common on some bedrocks in the upper catchment (Morgan, 2001).

iii. Water Catchments, Drainage and Aquifers

a. Hunter River

The Project lies within the catchment of the Hunter River, which is a sizable watercourse that flows in a south westerly direction approximately one kilometre south of Bengalla Mine. The Hunter River is regulated, meaning its flow regime is modified by upstream dams. Glenbawn Dam is located upstream of the Project and has the largest water storage capacity in the catchment. Regulation and water extraction from the Hunter River has resulted in alteration of natural geomorphology characterised by old alluvial or floodplain terraces and disrupted flow regimes (Brierley *et al.*, 2005; Fryirs *et al.*, 2009).

b. Dry Creek

Within the previously delineated Disturbance Boundary, surface water is naturally directed southwards to the Hunter River. The main ephemeral waterway within the previously delineated Disturbance Boundary is Dry Creek, which flows from north east to south west

and enters the Hunter River south of Bengalla Mine (**Figure 1.2**). The banks are highly eroded and the channel varies in width across the distribution in the previously delineated Disturbance Boundary. Current onsite environmental monitoring indicates that the water course is reported to flow only following heavy rain events for short periods of time. The shallow floodplain of Dry Creek is mostly bare of vegetation, or contains scattered large mature trees with exotic understorey.

A number of small tributaries in the previously delineated Disturbance Boundary drain into Dry Creek from west to east. These drainage lines are intersected with farm dams at intervals and remain dry for most of the year except in times of high rainfall. Vegetation is slightly more intact than that associated with Dry Creek and a more substantial canopy of *Angophora floribunda* (Rough-barked Apple) is commonly present, and a grassy understorey exists in parts. However, this drainage line is also highly eroded, exposing large areas of bare earth.

c. Hunter Valley Alluvium

The major aquifer system in the subregion is known as the Hunter Valley Alluvium, which extends in a continuous strip from the mouth of the Hunter River at Newcastle to just upstream of Scone (Australian Government, 2009b). The aquifer consists of sand and gravel lenses in unconsolidated alluvial deposits and is restricted to long, sinuous and relatively narrow strips along the Hunter River and its major tributaries (Australian Government, 2009a).

iv. Land Use

The main non-residential land uses in the Muswellbrook LGA include various agricultural enterprises, industry and mining. Other land uses include thoroughbred breeding and training. Approximately 42% of the LGA is represented by National Parks and Nature Reserves and includes Wollemi National Park, Goulburn River National Park and Manobalai Nature Reserve (MSC Environmental Services Department, 2011). The nearest conservation area to the Modification to Disturbance Boundary is Manobalai Nature Reserve, located more than 30 km to the north-west.

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- Modification to Disturbance Boundary
- Disturbance Boundary
- Modification Area
- Roads
- Watercourse

Grid North

Image Source:
BMC 2012

Data Source:
© Copyright Commonwealth of Australia
(Geoscience Australia) 2006

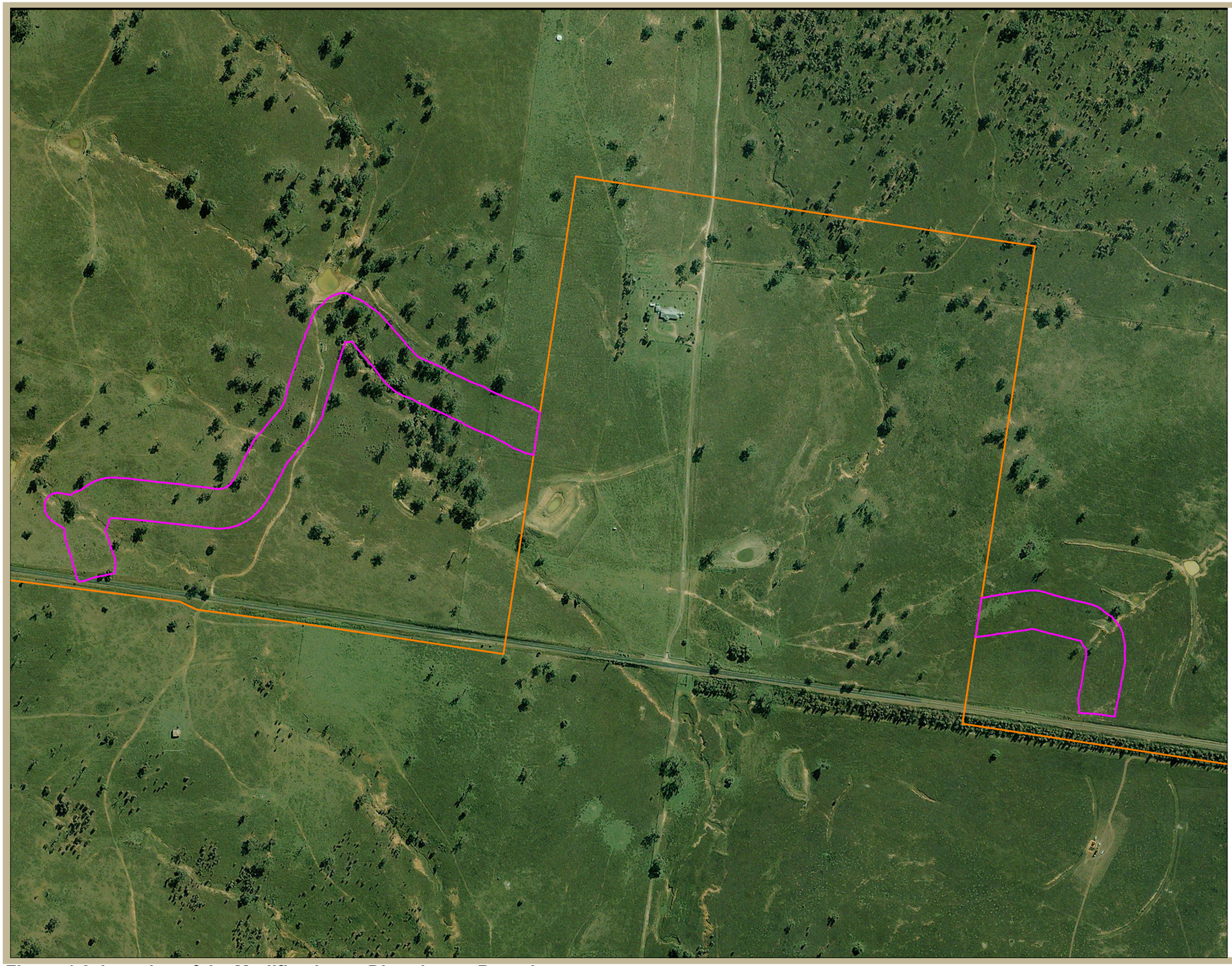
CUMBERLAND ECOLOGY

250 0 250 500 750 1000m

I:\...\14081\Figures\RP1_Mod Report\20150622\Figure 1.1. Conceptual Layout

Figure 1.1. Conceptual layout of the Modification

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Modification to Disturbance Boundary
- Disturbance Boundary

Grid North

Image Source:
BMC 2012

CUMBERLAND ECOLOGY

100 0 100 200 300 400m

I:\...\14081\Figures\RP1_Mod Report\20150622\Figure 1.2. Modification to Disturbance Boundary.mxd

Figure 1.2. Location of the Modification to Disturbance Boundary

Chapter 2

Methodology

2.1 Database Analysis

Database analysis was conducted for the locality using both the NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database (OEH, 2015) and the Commonwealth Department of the Environment (DoE) Protected Matters Search Tool (DoE, 2015a). The locality is defined as the area within a 20 km radius of the centre of the Modification to Disturbance Boundary. The Atlas of NSW Wildlife Database search facility was used to generate records of threatened flora and fauna species and populations listed under the TSC Act within the locality of the Modification to Disturbance Boundary. The abundance, distribution and age of records generated within the search areas provided supplementary information for the assessment of likelihood of occurrence of those threatened species within the Modification to Disturbance Boundary. The Protected Matters Search Tool generated a list of potentially occurring Matters of National Environmental Significance listed under the EPBC Act within the locality of the Modification to Disturbance Boundary.

2.2 Literature Review

A literature review was completed to identify the key ecological attributes and issues of the Modification to Disturbance Boundary and its surrounds. This information was used to assist in the preparation of this Ecological Assessment, in conjunction with the results of the database analysis.

The biodiversity values of the Modification to Disturbance Boundary and its surrounds is generally well known as a result of numerous ecological studies for coal projects in the locality, including the Mount Pleasant Project (ERM Mitchell McCotter, 1997; Cumberland Ecology, 2010b), Mt Arthur Coal (Dames & Moore, 2000; Umwelt (Australia) Pty Limited, 2006; Umwelt (Australia) Pty Limited, 2007; Cumberland Ecology, 2009), Muswellbrook Coal (HLA-Envirosciences, 2002), Drayton Mine (Hansen Bailey, 2007a; Hansen Bailey, 2009), Drayton South (Cumberland Ecology, 2012) and Bayswater B Power Station (Resource Planning Pty Limited, 1993; Eco Logical Australia Pty Ltd, 2009).

Bengalla Mine has been subject to a number of ecological investigations, including those prepared for the original DA 211/93 (Envirosciences Pty Ltd, 1993) and for various modifications to the original development consent (Hansen Consulting, 2006; Cumberland Ecology, 2007; Hansen Bailey, 2007b; Cumberland Ecology, 2010a). Most recently, detailed

ecological studies were conducted for the continuation of mining operations project at Bengalla Mine by Cumberland Ecology (2013).

This Ecological Assessment primarily utilised the data presented in the Ecological Impact Assessment prepared by Cumberland Ecology (2013) for Bengalla Mine as well as data presented in the Ecological Assessment prepared by Cumberland Ecology (2010b) for the Mount Pleasant Project.

2.3 Aerial Photograph Interpretation

Aerial photographs of the Modification to Disturbance Boundary and surrounds were obtained and detailed analysis was undertaken, in conjunction with interpretation of background information and existing knowledge of the locality and Modification to Disturbance Boundary.

2.4 Limitations

The Modification to Disturbance Boundary, immediate surrounds and broader locality have been surveyed numerous times over many years for various projects, including Mt Arthur Coal Mine, Mount Pleasant, Drayton Mine and Drayton South. As a result, detailed baseline vegetation and fauna data (including threatened species known and expected to occur within the locality) exists and are well documented on a spatial and temporal scale.

Extensive detailed field surveys have been undertaken within both Bengalla Mine and Mount Pleasant Project areas. When combined, the data from these surveys provides a database that is sufficiently comprehensive to support this Ecological Assessment. The field surveys have produced reliable information regarding flora and fauna species occurrences within the Modification to Disturbance Boundary, and immediate surrounds, and are considered to be adequate to support the assessment of the impacts of the Modification.

Additionally, a precautionary approach was used to assess threatened species impacts. Presence of suitable habitat was considered when assessing the potential occurrence of a given threatened species; where potential habitat was present and the species was known to occur at other locations in the locality, it was assumed that the species had potential to occur and were thus assessed accordingly.

Chapter 3

Results

3.1 Overview

The original character of the land within the Modification has been greatly altered as a result of historical and current land uses. Prior to European settlement, the vegetation in the Modification and surrounds would have been dominated by open grassy forest and woodland communities. Following European settlement, the majority of the forest and woodland in the Modification and surrounds was cleared to provide grasslands for livestock. In 1999, mining associated with the approved Bengalla Mine commenced and is currently ongoing. Although approved, the Mount Pleasant Project is not currently operational.

In the current landscape, a high proportion of the Modification is now dominated by native perennial grassland of variable diversity and floristic composition, with scattered patches of modified woodland. The resultant mosaic of grassland and modified woodland patches in the Modification to Disturbance Boundary is typical of the Muswellbrook locality and has been influenced by a long history of agricultural land use.

3.2 Vegetation Communities

The vegetation within the Modification consists of a mosaic of grasslands that were derived when the woody component (i.e. canopy trees and tall shrubs) of the original woodland community were first cleared, leaving behind predominantly native understorey. These grasslands are referred to as Derived Native Grassland in this report and are distinct from naturally occurring grasslands.

Within the Modification, six vegetation communities have been recorded that are spread across the Modification to Disturbance Boundary and previously delineated Disturbance Boundary. For the purposes of this report, only the vegetation communities within the Modification to Disturbance Boundary have been assessed. Further information on the vegetation communities within the previously delineated Disturbance Boundary can be found in the Bengalla Continuation of Mining Environmental Impact Assessment (Cumberland Ecology, 2013).

Three locally defined vegetation communities have been recorded within the Modification to Disturbance Boundary. Two of these communities conform to Box Gum Woodland and Derived Native Grassland, a TEC listed under both the TSC Act and EPBC Act. **Table 3.1** lists the vegetation communities occurring within the Modification to Disturbance Boundary.

The distribution of these communities within these areas is shown in **Figure 3.1**. General descriptions of the vegetation communities known from the Modification to Disturbance Boundary are provided below.

One potential groundwater dependent ecosystem (GDE), Hunter Floodplain Red Gum Woodland, has been identified within the previously delineated Disturbance Boundary for Bengalla Mine. No area of this community occurs within the Modification to Disturbance Boundary and none of the vegetation in this area is considered to comprise a GDE.

Table 3.1 Vegetation communities within the Modification to Disturbance Boundary

Vegetation Community	TSC Act Status	EPBC Act Status	Modification to Disturbance Boundary (ha)^
Grey Box/White Box Intergrade Grassy Woodland (Box Gum Woodland)	EEC	CEEC	2.79
Derived Native Grassland (Box Gum Woodland)	EEC	CEEC	3.31
Low Diversity Derived Native Grassland/Exotic Pasture	-	-	2.97
Total[+]			**9.07**

TSC Act / EPBC Act Status: EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community

^ *Area calculations are approximate*

3.2.1 Grey Box / White Box Intergrade Grassy Woodland

TSC Act Status: EEC (White Box - Yellow Box - Blakely's Red Gum Woodland)

EPBC Act Status: CEEC (White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland)

Grey Box/White Box Intergrade Grassy Woodland typically occurs as mid to tall grassy woodland on clay soils derived from Permian, Carboniferous or Quaternary geology. It is concentrated in the north of the Hunter region where rainfall is relatively low, on undulating slopes and hills that surround the floodplains along the Hunter River.

Within the Modification to Disturbance Boundary, this community occurs as regenerating woodland, consisting predominately of *Eucalyptus crebra* (Narrow-leaved Ironbark), with a small number of *Angophora floribunda* (Rough-barked Apple) occurring adjacent to a creek bed. The canopy consists of scattered mature trees, around which in most areas dense regrowth is occurring, consisting of *Eucalyptus crebra* juveniles of a shrub to small tree size. Scattered shrubs are also present and consist of the native species *Maireana microphylla*

(Small-leaf Bluebush), and the noxious weed species *Lycium ferocissimum* (African Boxthorn).

The open grassy understorey contains a ground layer of native herbs, forbs and grasses, with exotic weed species present and common in most areas (**Photograph 3.1** The groundcover is dominated by the native grass *Aristida ramosa* (Threeawn Wiregrass), in most areas, and other commonly occurring species include *Microlaena stipoides* (Weeping Grass), *Panicum effusum* (Hairy Panic), *Bothriochloa decipiens* var. *decipiens* (Pitted Bluegrass), and *Chloris ventricosa* (Windmill Grass). The grass *Austrostipa verticillata* (Slender Bamboo Grass) is also common in the community, and dominant in areas adjacent to the creek bed. ,Common native forbs present include *Dichondra repens* (Kidney Weed), *Solanum cinereum* (Narrawa Burr), and, *Sida corrugata* (Corrugated Sida), with others such as *Calotis lappulacea* (Yellow Burr-daisy), *Desmodium varians* (Variable Tick-trefoil), and *Einadia trigonos* (Fishweed) occurring less frequently.

Forbs of exotic weed species present in large numbers throughout the community include *Anagallis arvensis* (Scarlet Pimpernel), and the Weed of National Significance, *Senecio madagascariensis* (Fireweed). Less common species include *Marrubium vulgare* (White Horehound), *Modiola caroliniana* (Redflower Mallow), and *Stachys arvensis* (Staggerweed). Common exotic grasses include the species *Cynodon dactylon* (Couch), and *Lolium perenne* (Ryegrass).

Photograph 3.1 **Grey Box/White Box Intergrade Grassy Woodland within the Modifcation Disturbance Area**

3.2.2 Derived Native Grassland (Box Gum Woodland)

TSC Act Status: EEC (White Box - Yellow Box - Blakely's Red Gum Woodland)

EPBC Act Status: CEEC (White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland)

This community is a native grassland that has been derived from the previous clearing of canopy trees of Upper Hunter White Box - Ironbark Grassy Woodland and Grey Box / White Box Intergrade Grassy Woodland and is characterised by an assemblage of understorey species representative of the understorey that typifies the woodland community (**Photograph 3.2**). Within the Disturbance Modification Area, this community occurs in areas that have not recently been heavily impacted by grazing.

To be considered as conforming to Box Gum Woodland, these grasslands support over 12 native non-grass species and at least one grazing-sensitive species within a 0.1 ha area. Examples of grazing-sensitive species include *Calotis lappulacea* (Yellow Burr-daisy) or *Cheilanthes sieberi* (Poison Rock Fern) and various lilies, daisies, pea plants and orchids. The dominant groundcover in this derived native grassland unit is typically a native grass species. Derived Native Grassland (Box Gum Woodland) is typically grassland of moderate to good condition that has some potential for assisted natural woodland regeneration if livestock grazing and other land disturbances were removed.

The occurrence of the community within the Disturbance Modification Area is dominated by the native grasses *Aristida ramosa* (Purple Wiregrass), and *Chloris ventricosa* (Tall Chloris). Native forbs recorded include the species *Phyllanthus virgatus*, *Chrysocephalum apiculatum* (Common Everlasting), *Wahlenbergia communis* (Tufted Bluebell), and *Lagenophora stipitata* (Blue Bottle-daisy). The native shrub *Maireana microphylla* is present, and a small patch of regrowth *Casuarina glauca* (Swamp Oak) juveniles is present in a single area within a paddock.

Exotic weed species recorded include the shrubs *Gomphocarpus fruticosus* (Cottonbush), *Opuntia stricta* (Prickly Pear), *Lycium ferocissimum* (African Boxthorn), and forbs such as *Sida rhombifolia* (Paddy's Lucerne), *Cirsium vulgare* (Spear Thistle), and *Senecio madagascariensis* (Fireweed).

Photograph 3.2 **Derived Native Grassland (Box Gum Woodland) in eastern section of the Modification to Disturbance Boundary**

3.2.3 Low Diversity Derived Native Grassland / Exotic Pasture

TSC Act Status: Not listed

EPBC Act Status: Not listed

Low Diversity Derived Native Grassland / Exotic Pasture comprises areas that have been intensively ploughed for cultivation; pasture-improvement; or have been subject to prolonged grazing by dairy cattle in the past. These areas have typically suffered from a moderate to high level of soil disturbance (**Photograph 3.3**).

Scattered trees are present in the community within the Disturbance Modification Area of the *Eucalyptus albens* (White Box) *Eucalyptus moluccana* (Grey Box) intergrade, and *Eucalyptus crebra*. Regrowth individuals of a shrub to small-tree size are present in association with trees in some areas, predominately of the species *Eucalyptus crebra*. The native shrubs *Bursaria spinosa* (Blackthorn) and *Maireana microphylla* are present in some areas. The exotic shrubs *Lycium ferocissimum*, *Gomphocarpus fruticosus*, and *Opuntia stricta*

The ground layer of the more disturbed areas within the Disturbance Modification Area is dominated by exotic grass species such as *Cynodon dactylon* (Couch Grass) and *Paspalum dilatatum*, which commonly occur with *Sida rhombifolia* (Paddys Lucerne) and *Medicago* spp. (Medics). Concentrations of weed species were locally dominant, particularly *Galenia pubescens* (Galenia), and *Plantago lanceolata* (Lamb's Tongues).

The less disturbed areas are dominated by one or two hardy native grasses such as *Aristida ramosa* (Purple Wiregrass) and *Dichanthium sericeum* (Queensland Bluegrass), but lack grazing sensitive native herbs like *Calotis lappulacea* (Common Everlasting). Native forbs recorded include *Linum marginale* (Native Flax), *Asperula conferta* (Common Woodruff), and *Geranium solanderi* (Native Geranium).

Low Diversity Derived Native Grassland / Exotic Pasture are typically of significantly poorer condition and would not naturally regenerate to woodland without active rehabilitation measures. These areas are not listed TECs under the EPBC Act and TSC Act.

Photograph 3.3 **Low Diversity Derived Native Grassland in the Modification to Disturbance Boundary**

3.3 Flora Species

3.3.1 General Species

The vegetation within the Modification to Disturbance Boundary supports vegetation containing a relatively low diversity of native species, due mostly to widespread degradation caused by past land clearance and grazing. The majority of the species recorded are ground layer species. The dominant plant families in the canopy and shrub layer are Myrtaceae and Chenopodiaceae, represented mostly by the genera of *Eucalyptus* and *Maireana*.

3.3.2 Threatened Species

No threatened flora species have previously been recorded within the Modification to Disturbance Boundary.

A number of threatened flora species have been recorded from the locality, or have been predicted to occur. **Appendix A** analyses the likelihood of occurrence within the Modification to Disturbance Boundary for each threatened flora species recorded or predicted to occur within the locality. **Table 3.2** lists the threatened flora species considered to potentially occur within the Modification to Disturbance Boundary. Of these species, only *Cymbidium canaliculatum* (Tiger Orchid) has been recorded within the previously delineated Disturbance Boundary of Bengalla Mine.

Table 3.2 Threatened flora species potentially occurring within the Modification to Disturbance Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	EP	-
Diuris tricolor	Pine Donkey Orchid	V	-
*Prasophyllum sp. Wybong / Prasophyllum petilum**	Tarengo Leek Orchid	E	CE/E*
Thesium australe	Austral Toadflax	V	V

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered

** Taxonomic changes have combined Prasophyllum sp. Wybong and Prasophyllum petilum; however they are still listed under two status levels under the EPBC Act*

i. Cymbidium canaliculatum population in the Hunter Catchment

Cymbidium canaliculatum (Tiger Orchid) is an epiphytic orchid which grows in the hollows and forks of eucalypts and wattles, usually occurring singly or as a single clump, typically between two and six metres above the ground (OEH, 2013c). Within the Hunter catchment, *Cymbidium canaliculatum* (Tiger Orchid) is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands and has also been found less commonly on *Eucalyptus dawsonii* (Slaty Gum), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus moluccana* (Grey Box), *Angophora floribunda* (Rough-barked Apple), *Acacia salicina* (Cooba) and on some other species, including dead stags (OEH, 2013c). This species has a scattered distribution across northern and eastern Australia and is restricted in NSW to the north-eastern quarter of the state (OEH, 2013c). A disjunct population of the species occurs in the Hunter Valley at the south-eastern distributional limit of the species' range (OEH, 2013c).

This species has not previously been recorded within the Modification to Disturbance Boundary; however records exist within the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and scattered trees occurring within the Modification to Disturbance Boundary.

ii. Diuris tricolor

Diuris tricolor (Pine Donkey Orchid) is a terrestrial orchid growing to 20–40 cm high (Botanic Gardens Trust, 2015). This species grows in sclerophyll forest among grass, often with native Callitris species and is found in sandy soils, either on flats or small rises (OEH, 2014e). Associated species include *Callitris glaucophylla* (White Cypress Pine), *Eucalyptus populnea* (Poplar Box), *Eucalyptus intertexta* (Gum Coolibah), Ironbark and Acacia shrubland (OEH, 2014e). The understorey is often grassy with herbaceous plants such as Bulbine species (OEH, 2014e). *Diuris tricolor* (Pine Donkey Orchid) is sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the north of NSW.

This species has not previously been recorded within the Modification to Disturbance Boundary or the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and derived native grassland within the Modification to Disturbance Boundary.

iii. Prasophyllum sp. Wybong / Prasophyllum petilum

Prasophyllum sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) is a terrestrial orchid that grows to approximately 30 cm high (DoE, 2015b). It grows in; open sites within Natural Temperate Grassland at the Boorowa and Delegate sites; grassy woodland in association with River Tussock *Poa labillardierei*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. at Captains Flat; and grassy ground layer dominated by Kangaroo Grass under Box-Gum Woodland at Ilford (OEH, 2013d). Natural populations are known from a total of five sites, including Boorowa, Captains Flat, Ilford and Delegate in NSW and Hall in the Australian Capital Territory (OEH, 2013d).

This species has not previously been recorded within the Modification to Disturbance Boundary or the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and derived native grassland within the Modification to Disturbance Boundary.

iv. Thesium australe

Thesium australe (Austral Toadflax) is a small, straggling herb to 40 cm tall and is semi-parasitic on roots of a range of grass species (OEH, 2013a). This species occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast and is often found in association with *Themeda australis* (Kangaroo Grass) (OEH, 2013a). Within NSW, *Thesium australe* (Austral Toadflax) is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands (OEH, 2013a).

This species has not previously been recorded within the Modification to Disturbance Boundary or the previously delineated Disturbance Boundary. This species has the potential to occur within woodland and derived native grassland within the Modification to Disturbance Boundary.

3.4 Fauna Habitat

Extensive historical vegetation clearing has converted much of the Modification to Disturbance Boundary to grassland with varying degrees of native plant species diversity. Such vegetation supports a much lower diversity of native fauna than the treed landscapes. Agricultural land uses have simplified and/or removed the majority of ground habitat features such as logs and rocks. The resultant landscape has simplified and fragmented habitats typical of many rural areas that support a subset of the pre-European fauna. The integrity of habitats is further challenged by the abundance of feral animals such as foxes and rabbits, which prey upon or compete with native fauna.

Despite the modified nature, the Modification to Disturbance Boundary still offers some broad habitat features for native fauna including:

- Regenerating woodland and scattered paddock trees that may facilitate dispersal for woodland birds;
- Limited understorey vegetation and ground cover, leaf litter and fallen timber for small terrestrial fauna species;
- Limited tree hollows suitable as shelter and breeding habitat for a range of hollow-dependant fauna; and
- Blossom-producing trees suitable as forage habitat for a range of nectarivores.

3.5 Fauna Species

3.5.1 General Species

The Modification to Disturbance Boundary is not considered to support a high diversity of fauna species, mostly due to the simplified and highly modified habitat present. The majority of the species known from the surrounding areas have been recorded from the more intact areas of forest and woodland. A large proportion of recorded species are represented by birds and microchiropteran bats, which are highly mobile species. Reptiles, arboreal mammals and terrestrial mammals, which are less mobile, are not as well represented. A number of feral animals have also been recorded including foxes (*Vulpes vulpes*) and rabbits (*Oryctolagus cuniculus*).

3.5.2 Threatened Species

No threatened fauna species have previously been recorded within the Modification to Disturbance Boundary.

A number of threatened fauna species have been recorded from the locality, or have been predicted to occur. **Appendix B** analyses the likelihood of occurrence within the Modification to Disturbance Boundary for each threatened fauna species recorded or predicted to occur within the locality. **Table 3.4** lists the threatened fauna species considered likely to occur, or considered possible to occur within the Modification to

Disturbance Boundary. The fragmented nature of the habitat within the Modification to Disturbance Boundary and the distance to larger, more intact patches of woodland habitat, including rocky habitat, has resulted in fewer species being considered likely to occur than within the previously delineated Disturbance Boundary. Species considered likely to occur within the Modification to Disturbance Boundary are assessed further in this report.

Table 3.3 Threatened fauna species potentially occurring within the Modification to Disturbance Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
LIKELY			
Birds			
Chthonicola sagittata	Speckled Warbler	V	-
Circus assimilis	Spotted Harrier	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Apus pacificus	Fork-tailed Swift	-	M
Hirundapus caudacutus	White-throated Needletail	-	M
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-
Merops ornatus	Rainbow Bee-eater	-	M
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-
Ninox connivens	Barking Owl	V	-
Mammals			
Petaurus norfolcensis	Squirrel Glider	V	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
POSSIBLE			
Birds			
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	M
Stagonopleura guttata	Diamond Firetail	V	-
Anthochaera phrygia	Regent Honeyeater	CE	E
Grantiella picta	Painted Honeyeater	V	-

Table 3.3 Threatened fauna species potentially occurring within the Modification to Disturbance Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Daphoenositta chrysoptera	Varied Sittella	V	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Lathamus discolor	Swift Parrot	E	E
Tyto novaehollandiae	Masked Owl	V	-
Mammals			
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	E
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Myotis macropus	Large-footed Myotis	V	-
Nyctophilus corbeni	Corben's Long-eared Bat	V	V
Vespadelus troughtoni	Eastern Cave Bat	V	-

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory

i. Speckled Warbler

The Speckled Warbler (*Chthonicola sagittata*) inhabits a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies (OEH, 2012c). Typical habitat for this species would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy (OEH, 2012c). This species forages on the ground and in the understorey for arthropods and seeds (NSW Scientific Committee, 2001b). Preferred areas of foraging habitat contain a combination of open grassy patches, leaf litter and shrub cover (NSW Scientific Committee, 2001b). Nests of this species are built using dry grass and strips of bark and are located in a slight hollow in the ground or at the base of a low dense plant, such as grass tussocks, often among fallen branches and other litter (OEH, 2012c) (NSW Scientific Committee, 2001b). The Speckled Warbler occurs from south-eastern Queensland, through central and eastern NSW to Victoria (NSW Scientific Committee, 2001b). In NSW, the Speckled Warbler occurs on the slopes west of the Great Dividing Range, with populations also occurring in drier coastal areas such as the Cumberland Plain, Western Sydney and the Hunter and Snowy River valleys (NSW Scientific Committee, 2001b).

The Speckled Warbler has been recorded in the previously delineated Disturbance Boundary. Speckled Warblers were consistently detected in regenerating woodland at four locations, suggesting the species lives in discrete and stable social groups throughout winter

(Gardner, 2004). This species has also been consistently recorded in woodland and open forests in and near the Mt Arthur Coal Mine lease (Cumberland Ecology, 2009) in Central Hunter Bulloak Forest Regeneration. It has also been recorded in the adjoining Mount Pleasant Project area (Cumberland Ecology, 2010b). There are 90 records of the species within the locality of the Modification to Disturbance Boundary.

ii. Spotted Harrier

The Spotted Harrier (*Circus assimilis*) inhabits grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe (NSW Scientific Committee, 2010). It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (NSW Scientific Committee, 2010). The diet of the Spotted Harrier includes terrestrial mammals, such as bandicoots, bettongs and rodents, birds and reptiles, occasionally large insects and rarely carrion (NSW Scientific Committee, 2010). Nests are located in trees and built from sticks (OEH, 2012d). The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and individuals disperse widely in NSW (NSW Scientific Committee, 2010).

It is expected that this species would forage across woodland and grassland communities within the Modification to Disturbance Boundary as part of a much larger foraging range. There are 12 records of the species within the locality of the Modification to Disturbance Boundary.

iii. Little Eagle

The Little Eagle (*Hieraaetus morphnoides*) inhabits open eucalypt forest, woodland or open woodland, she-oak woodlands, acacia woodlands, and riparian woodland within interior NSW, which have an abundance of prey (NSW Scientific Committee, 2011b). It feeds on birds, reptiles and mammals, occasionally consuming large insects and carrion. Nests are built using large sticks in tall living trees within remnant patches of vegetation (NSW Scientific Committee, 2011b). The Little Eagle is distributed throughout the mainland of Australia, except for the most densely forested parts of the Dividing Range escarpment (NSW Scientific Committee, 2011b).

It is expected that this species would forage across woodland and grassland communities within the Modification to Disturbance Boundary as part of a much larger foraging range. There are six records of the species within the locality of the Modification to Disturbance Boundary.

iv. Fork-tailed Swift

The Fork-tailed Swift (*Apus pacificus*) is a migrant to Australia in the non-breeding season (DoE, 2014a). This species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher, mostly over inland plains but sometimes above foothills or in coastal areas (DoE, 2014a). Foraging occurs anywhere from 1 m to 300 m above the ground, with the known diet comprising small bees, wasps, termites and moths

(DoE, 2014a). This species breeds in Siberia (DoE, 2014a). In NSW, the Fork-tailed Swift is recorded in all regions, with many records occurring east of the Great Divide (DoE, 2014a).

This species was not recorded during surveys, however, there is potential for this species to fly over the Modification to Disturbance Boundary. This species is expected to forage aerially above the Modification to Disturbance Boundary. There are no records of the species within the locality of the Modification to Disturbance Boundary.

v. White-throated Needletail

The White-throated Needletail (*Hirundapus caudacutus*) is a migrant to Australia in the non-breeding season (DoE, 2014b). This species is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground, occurring above a wide range of habitats (DoE, 2014b). The diet of this species includes a wide variety of insects including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers (DoE, 2014b). This species breeds in Asia (DoE, 2014b). The White-throated Needletail is widespread in eastern and south-eastern Australia, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains (DoE, 2014b).

This species was not recorded during surveys, however, there is potential for this species to fly over the Modification to Disturbance Boundary. This species is expected to forage aerially above the Modification to Disturbance Boundary. There are four records of the species within the locality of the Modification to Disturbance Boundary.

vi. Brown Treecreeper (eastern subspecies)

The Brown Treecreeper (*Climacteris picumnus victoriae*) inhabits eucalypt woodlands (including box-gum woodland) and dry open forest (OEH, 2012a). The woodlands and forests are usually dominated by stringybarks or other rough-barked eucalypts, typically with an open grassy understorey and sometimes with one or more shrub species (OEH, 2012a). This species forages on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae (NSW Scientific Committee, 2004). Fallen timber is considered to be an important habitat component for foraging (OEH, 2012a). The Brown Treecreeper nests in hollows in standing dead or live trees and tree stumps are essential for nesting (OEH, 2012a). The Brown Treecreeper occurs through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys (NSW Scientific Committee, 2004).

The Brown Treecreeper has been recorded within the previously delineated Disturbance Boundary in woodland habitat. It is expected that this species would forage within the grassy woodland of the Modification to Disturbance Boundary. The scattered paddock trees are likely to facilitate some dispersal for the species into adjoining woodland areas outside the Modification to Disturbance Boundary. There are 63 records of the species within the locality of the Modification to Disturbance Boundary.

vii. Black-chinned Honeyeater (eastern subspecies)

The Black-chinned Honeyeater (*Melithreptus gularis gularis*) inhabits woodlands containing box-ironbark associations and *Eucalyptus camaldulensis* (River Red Gum) within NSW (NSW Scientific Committee, 2001a) and some open forests (OEH, 2014b). Commonly associated species include *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus albens* (White Box), *Eucalyptus microcarpa* (Grey Box), *Eucalyptus melliodora* (Yellow Box), *Eucalyptus blakelyi* (Blakely's Red Gum) and *Eucalyptus tereticornis* (Forest Red Gum) (OEH, 2014b). This species feeds on arthropods, nectar and lerp from eucalypt foliage and bark (OEH, 2014b). Nesting occurs in crowns of tall eucalyptus, often box or ironbark trees, usually in the uppermost lateral branches, concealed by foliage (OEH, 2014b). Within NSW, this species is widespread with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina (OEH, 2014b).

The Black-chinned Honeyeater was recorded in woodland in the north western corner of the previously delineated Disturbance Boundary. It has also been recorded in the adjoining Mount Pleasant lease area (Cumberland Ecology, 2010b). There are two records of the species within the locality of the Modification to Disturbance Boundary.

viii. Rainbow Bee-eater

The Rainbow Bee-eater (*Merops ornatus*) occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation, often in proximity to permanent water (DoE, 2014c). This species feeds mainly on insects, such as bees and wasps, and on occasion will take earthworms, spiders and tadpoles (DoE, 2014c). Nests of this species are located in long burrows or tunnels that are excavated in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces (DoE, 2014c). The Rainbow Bee-eater occurs across much of mainland Australia (DoE, 2014c).

It is expected that this species would forage across grassy woodland and derived native grassland within the Modification to Disturbance Boundary. There are 23 records of the species within the locality of the Modification to Disturbance Boundary.

ix. Grey-crowned Babbler (eastern subspecies)

The Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) inhabits box-gum woodlands on the slopes and box-Cypress Pine and open box woodlands on alluvial plains (OEH, 2012b). Woodlands typically have regenerating trees, tall shrubs and an intact ground cover of grass and forbs (NSW Scientific Committee, 2011a). The Grey-crowned Babbler feeds on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses (OEH, 2012b). Nests are built from sticks and are usually located in shrubs or sapling eucalypts, however they occasionally build nests in the outermost leaves of low branches of large eucalypts (OEH, 2012b). In NSW, this species occurs on the western slopes and plains and isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (NSW Scientific Committee, 2011a).

The Grey-crowned Babbler has been recorded within the previously delineated Disturbance Boundary at multiple locations. The species has also been recorded from surveys of the Mt Arthur Coal Mine lease where it tends to occur along Saddlers Creek and its tributaries (Cumberland Ecology, 2009). It has also been recorded in the adjoining Mount Pleasant Project area (Cumberland Ecology, 2010b). There are 65 records of the species within the locality of the Modification to Disturbance Boundary.

x. Barking Owl

The Barking Owl (*Ninox connivens*) inhabits forests and woodlands of tropical, temperate and semi-arid zones that are typically dominated by eucalypts, often red gum species (NSW NPWS, 2003). It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas (OEH, 2014a). The diet of this species preferentially includes small arboreal mammals such as the Squirrel Glider and Common Ringtail Possum; however they are also known to feed on birds, invertebrates and terrestrial mammals such as rodents and rabbits (OEH, 2014a). This species roosts in or under dense foliage in large trees including rainforest species of streamside gallery forests, *Casuarina cunninghamiana* (River Oak), other *Casuarina* and *Allocasuarina* species, *Eucalypt*, *Angophora* or *Acacia* species (NSW NPWS, 2003). For breeding, this species required hollows in large eucalypts or paperbarks, usually near watercourses or wetlands (NSW NPWS, 2003). In NSW, the occurrence of the Barking Owl is widespread on the coastal plain and foothills and the inland slopes and plains (NSW NPWS, 2003).

It is expected that this species would forage across grassy woodland within the Modification to Disturbance Boundary as part of a much larger foraging range. There are four records of the species within the locality of the Modification to Disturbance Boundary.

xi. Squirrel Glider

The Squirrel Glider (*Petaurus norfolcensis*) inhabits mature or old-growth box / box-ironbark woodland, *Eucalyptus camaldulensis* (River Red Gum) forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heathy understorey in coastal areas (OEH, 2014f). It prefers mixed species stands with a shrub or *Acacia* midstorey (OEH, 2014f). This species feeds on nectar, pollen, plant exudates (e.g. wattle and eucalypt sap), invertebrates, and honeydew (sugary exudate from insects), and rarely small vertebrates such as nestling birds (NSW Scientific Commitee, 2008). The presence of large trees with abundant hollows are critical elements for nesting habitat (NSW Scientific Commitee, 2008). Den and nest sites are in hollows, preferably with a large cavity that can house multiple gliders in a large nest, yet with a small entrance that protects the group from predators (NSW Scientific Commitee, 2008). The Squirrel Glider is distributed from north Queensland to western Victoria, with a few records in extreme south-east South Australia where it may still persist (NSW Scientific Commitee, 2008).

The Squirrel Glider has been recorded within the previously delineated Disturbance Boundary. It has been recorded from surveys of the Mt Arthur Coal Mine lease area (Cumberland Ecology, 2009), Drayton Mine lease area (Hansen Bailey, 2007a) and the Mount Pleasant Project area (Cumberland Ecology, 2010b). There are 13 records of this species within the locality of the previously delineated Disturbance Boundary.

xii. Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) inhabits a range of habitats including wet and dry sclerophyll forest, open woodland, *Acacia* shrubland, mallee, grasslands and deserts (Churchill, 2009). The species typically forages above the canopy and lower over open vegetation and along forest edges (Churchill, 2009). Their diet predominantly consists of beetles, but grasshoppers, crickets, leafhoppers, shield bugs, wasps and some flying ants are also consumed (Churchill, 2009). This species is known to roost in tree hollows and buildings, and in treeless areas they are known to utilise mammal burrows (OEH, 2014g). The Yellow-bellied Sheathtail-bat occurs across northern and eastern Australia (OEH, 2014g).

The Yellow-bellied Sheathtail-bat was recorded within the previously delineated Disturbance Boundary. It has also been recorded from surveys of the Mt Arthur Coal Mine lease area (Cumberland Ecology, 2009), Drayton Mine lease area (Hansen Bailey, 2007a) and the Mount Pleasant Project area (Cumberland Ecology, 2010b). There are six records of the species within the locality of the Modification to Disturbance Boundary.

xiii. Eastern Freetail-bat

The Eastern Freetail-bat (*Mormopterus norfolkensis*) occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range (OEH, 2014c). This species roosts mainly in tree hollows, but will also roost under bark or in man-made structures (OEH, 2014c). The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW (OEH, 2014c).

Available habitat within the Modification to Disturbance Boundary includes woody vegetation for foraging and hollow-bearing trees for roosting. There are 15 records of the species within the locality of the Modification to Disturbance Boundary.

xiv. Greater Broad-nosed Bat

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) inhabits a variety of habitats including moist gullies in mature coastal forest, rainforest, open woodland, Melaleuca swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree-lines creeks in open areas (Churchill, 2009). Foraging occurs at the edge of isolated trees and forest remnants (Churchill, 2009). Their diet consists mainly of beetles with moths, ants and large flies consumed occasionally (Churchill, 2009). This species roosts in tree hollows, cracks and fissures in trucks and dead branches, under exfoliating bark, as well as the roofs of old buildings (Churchill, 2009). The Greater Broad-nosed Bat occurs mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland, extending to the coast over much of its range (OEH, 2014d).

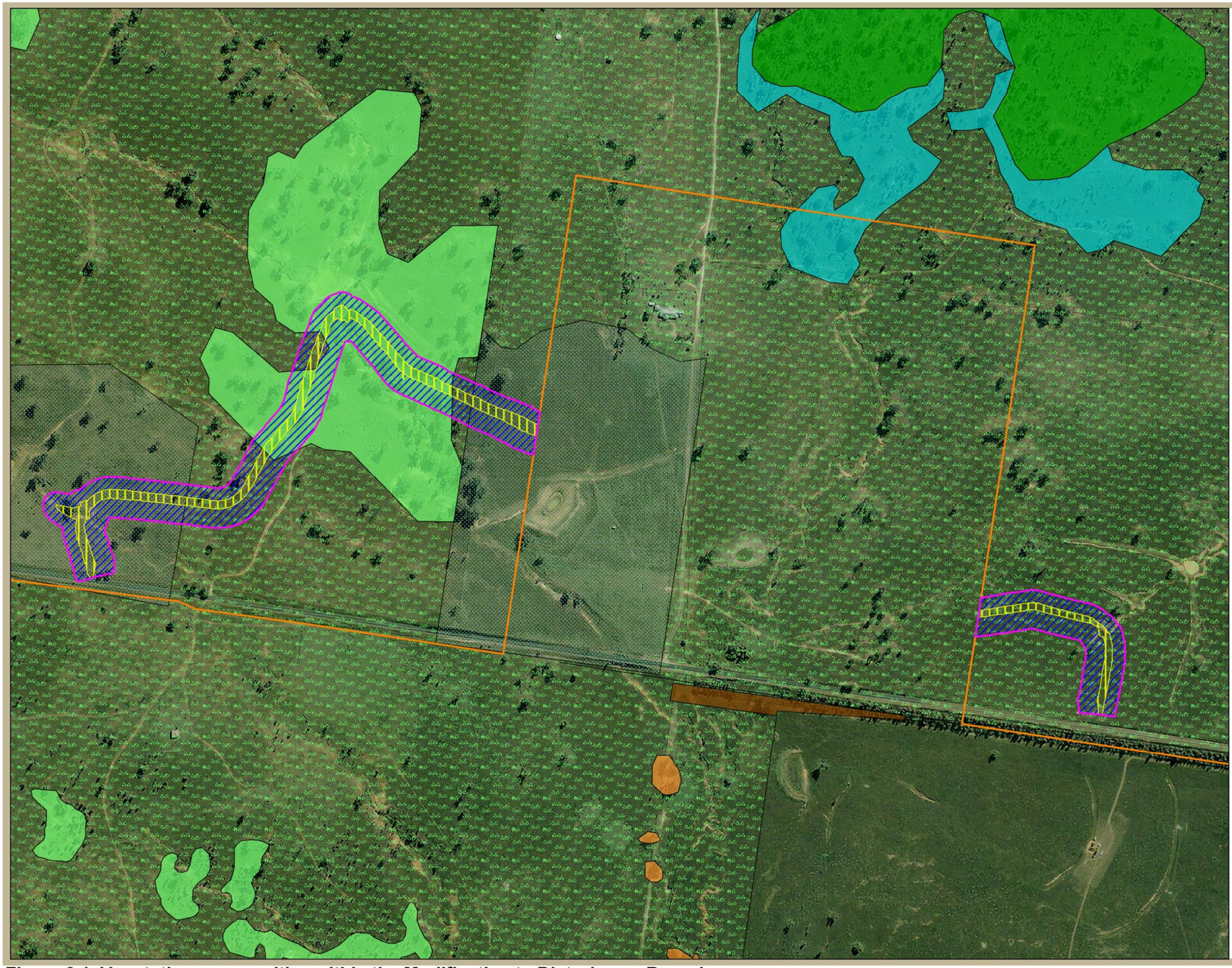
Available habitat within the Modification to Disturbance Boundary includes woody vegetation for foraging and hollow-bearing trees for roosting. There are five records of the species within the locality of the Modification to Disturbance Boundary.

xv. Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops (OEH, 2013b). The primary food source is blossom from eucalypts (genera *Eucalyptus*, *Corymbia* and *Angophora*), melaleucas and banksias, and in some areas it also utilises a wide range of rainforest fruits (DoE, 2014d). As none of the vegetation communities used by this species produces continuous foraging resources throughout the year, it has adopted complex migration traits in response to ephemeral and patchy food resources (DoE, 2014d). Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy (OEH, 2013b). The Grey-headed Flying-fox is generally found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria (OEH, 2013b).

The woody vegetation within the Modification to Disturbance Boundary contains eucalypts that may potentially be utilised as foraging habitat. There are five records of the species within the locality of the Modification to Disturbance Boundary.

Coordinate System: MGA Zone 56 (GDA 94)



Legend

- Modification to Disturbance Boundary
- Disturbance Boundary
- Levee
- Buffer

Vegetation Community

- Upper Hunter White Box –Ironbark Grassy Woodland (EPBC CEEC; TSC EEC)
- Grey Box/White Box Intergrade Grassy Woodland (EPBC CEEC; TSC EEC)
- Derived Native Grassland (EPBC CEEC; TSC EEC)
- Hunter Floodplain Red Gum Woodland Complex (TSC Act EEC)
- Upper Hunter Hills Exposed Ironbark Woodland
- Low Diversity Derived Native Grassland/ Exotic Pasture
- Tree and Shrub Plantation

N
Grid North

Image Source:
BMC 2012

CUMBERLAND ECOLOGY

I:\...\14081\Figures\RP1_Mod Report\20150622\Figure 3.1. Vegetation_Modification

Figure 3.1. Vegetation communities within the Modification to Disturbance Boundary

100 0 100 200 300 400m

Chapter 4

Impact Assessment

This chapter considers the ecological impacts of the Project on the biodiversity values within the Modification to Disturbance Boundary and surrounds. The ecological impacts of the Project are largely related to the direct disturbance of vegetation and associated habitat loss, represented by the removal of native and semi-cleared vegetation. Potential indirect impacts of the Project are also discussed.

4.1 Direct Impacts

4.1.1 Vegetation Removal

The Modification to Disturbance Boundary is 9.07 ha in size, comprising 6.1 ha of native vegetation and 2.97 ha of non-native vegetation.

Table 4.1 provides a summary of the areas of each vegetation community within the Modification to Disturbance Boundary and **Figure 3.1** shows their distribution. One TEC, Box Gum Woodland and Derived Native Grassland, occurs within the Modification to Disturbance Boundary. Impacts to this TEC are discussed within ***Section 4.3***.

Table 4.1 Vegetation communities to be removed

Vegetation Community	TSC Act Status	EPBC Act Status	Modification to Disturbance Boundary (ha)^
Upper Hunter White Box –Ironbark Grassy Woodland	EEC	CEEC	
Grey Box/White Box Intergrade Grassy Woodland	EEC	CEEC	2.79
Derived Native Grassland (Box Gum Woodland)	EEC	CEEC	3.31
Hunter Floodplain Red Gum Woodland Complex	EEC		
Upper Hunter Hills Exposed Ironbark Derived Native Grassland			
Low Diversity Derived Native Grassland/Exotic Pasture	-	-	2.97
Total[+]			**9.07**

TSC Act / EPBC Act Status: EEC = Endangered Ecological Community, CEEC = Critically Endangered Ecological Community

[+] *In some cases totals may not equal the appropriate total number due to rounding*

[^] *Area calculations are approximate*

4.1.2 Habitat Removal

The Project will result in the removal of 2.79 ha of woodland habitat and 6.28 ha of grassland habitat within the Modification to Disturbance Boundary. The native and semi-cleared vegetation within the Modification to Disturbance Boundary provides some limited habitat for native flora and fauna; including some species that are listed as threatened or migratory under the TSC Act and/or EPBC Act.

However, of the 9.07 ha of vegetation to be removed, 5.56 ha will be a temporary impact and will be regenerated back to its original condition following completion of the Project. As such, the permanent vegetation loss as a result of the project (the levee) will be 0.59 ha of woodland and 2.93 ha of grassland. **Table 4.2** shows the total disturbed vegetation, temporarily disturbed vegetation and the area of vegetation that will be permanently removed within the Modification to Disturbance Boundary. These areas are shown as the levee and buffer areas in **Figure 3.1**. Mitigation recommendations for the regeneration of the impacted areas are discussed in ***Section 5.1***.

Table 4.2 Temporarily disturbed and permanently removed vegetation within the Modification to Disturbance Boundary

Vegetation Community	TSC Act Status	EPBC Act Status	Permanently removed (Levee) (ha)	Temporarily disturbed (Buffer) (ha)	Total Disturbed Area (ha)
Grey Box/White Box Intergrade Grassy Woodland	EEC	CEEC	0.59	2.2	2.79
Derived Native Grassland	EEC	CEEC	0.65	2.66	3.31
Low Diversity Derived Native Grassland/Exotic Pasture			2.28	0.69	2.97
Total			**3.52**	**5.56**	**9.07**

The woodland remnants occurring within the Modification to Disturbance Boundary are fragmented from other more intact patches of woodland and forest. The condition and nature of the woodland habitats have been greatly altered by existing and historical land uses. The long-term loss of 0.59 ha of woodland habitat within the Modification to Disturbance Boundary is not considered a significant loss of woodland habitat.

The loss of grassland areas is not considered to comprise an important impact in terms of flora and fauna habitat for the large majority of potentially occurring species. None of the threatened fauna species that are considered to have the potential to occur within the

Modification to Disturbance Boundary are likely to rely on such grassland habitats for their survival.

4.2 Indirect Impacts

The Project has the potential to indirectly impact remaining vegetation and habitats. These impacts include:

- Habitat fragmentation - affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches. The works associated with the Project include the construction and operation of diversion levees that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion. Movement of the flora and fauna species likely to occur in the areas surrounding the Modification to Disturbance Boundary is not considered to be significantly impacted by the Project.

- Edge effects – affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer, 2006). The potential for edge effects is considered minimal given the already fragmented nature of the habitat within the Modification to Disturbance Boundary.

- Alteration to hydrological regimes – affects biodiversity through modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns and through the construction of hard surfaces. The Project includes the modification of an existing drainage line, which is not considered to result in the significant loss of flora and fauna habitats within proximity to the Modification to Disturbance Boundary.

- Increased sedimentation and erosion – affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients. Without the implementation of appropriate mitigation measures, the Project may increase sedimentation and erosion impacts on downstream environments.

4.3 Impacts to Threatened Ecological Communities

One TEC, Box Gum Woodland and Derived Native Grassland, will be directly impacted within the Modification to Disturbance Boundary. A discussion of the impacts to this TEC is provided below.

i. Significance of the Community

Box Gum Woodland and Derived Native Grassland is listed as an EEC under the TSC Act as it is likely to become extinct in NSW unless the circumstances and factors threatening its survival or evolutionary development cease to operate (NSW Scientific Committee, 2002).

Box Gum Woodland and Derived Native Grassland is listed as a CEEC under the EPBC Act due to its very severe decline in geographic distribution and due to its integrity being very severely reduced across most of its geographic range (Threatened Species Scientific Committee, 2006). It was once a geographically wide-spread community spanning three different states and covering an estimated pre-European area of several million hectares. Approximately 10% of its pre-European extent is estimated to remain today; the decline is primarily attributed to the community being situated largely on fertile, arable land in prime agricultural areas (DECCW (NSW), 2010).

ii. Impacts

The following communities within the Modification to Disturbance Boundary conform to the TSC Act and EPBC Act listed Box Gum Woodland and Derived Native Grassland:

- Grey Box/White Box Intergrade Grassy Woodland; and
- Derived Native Grassland (Box Gum Woodland).

Table 4.1 and **Table 4.2** shows the breakdown of each component of this community within the Modification to Disturbance Boundary. A total of 6.1 ha of this community will be disturbed including 1.55 ha being permanently removed, including 0.59 ha of woodland form and 0.65 ha of grassland form. Within the Modification to Disturbance Boundary, this community has been previously impacted by clearing and ongoing agricultural land uses and currently exists in a modified form of the original community. Within the woodland form of the community in the Modification to Disturbance Boundary, the Project may require the removal of some mature trees.

As a result of the Project, there will be interfaces between the Modification to Disturbance Boundary and the remaining areas of Box Gum Woodland and Derived Native Grassland. Clearing of vegetation at these interfaces will increase edge effects on the retained portion of Box Gum Woodland and Derived Native Grassland and as a result, the community may be impacted by indirect impacts such as weed invasion and soil erosion.

The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C** (TSC Act listed community) and **Appendix D** (EPBC Act listed community). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to Box Gum Woodland and Derived Native Grassland. Assuming that the recommended mitigation measures are implemented, these assessments determined that the Project is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland.

4.4 Impacts to Flora Species

The Project has the potential to result in a number of direct and indirect impacts to flora species within the Modification to Disturbance Boundary and immediate surrounds. In addition to the direct removal of habitat within the Modification to Disturbance Boundary, potential indirect impacts to flora species include:

- Weed invasion;
- Run-off, erosion and sedimentation; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of mitigation measures are proposed to minimise these impacts. These are discussed further in **Chapter 5**.

No threatened flora species listed under the TSC Act or EPBC Act have been recorded within the Modification to Disturbance Boundary. Four species are considered to have the potential to occur. The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C** (TSC Act listed species) and **Appendix D** (EPBC Act listed species). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to habitat for these species. Assuming that the recommended mitigation measures are implemented, these assessments determined that the Project is not considered to result in a significant impact to the potentially occurring threatened flora species.

4.5 Impacts to Fauna Species

The proposed development has the potential to result in a number of direct and indirect impacts to fauna species within the Modification to Disturbance Boundary and immediate surrounds. In addition to the direct removal of habitat within the Modification to Disturbance Boundary, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the Project;
- Runoff, erosion and sedimentation;
- Increased pollution;
- Hydrological changes resulting in altered fauna habitats; and
- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

No threatened fauna species listed under the TSC Act or EPBC Act have been recorded within the Modification to Disturbance Boundary. A total of 15 species are considered likely to occur. These species are highly mobile and are considered to utilise the Modification to Disturbance Boundary as part of larger foraging ranges. The habitat to be removed within the Modification to Disturbance Boundary exists in a fragmented landscape.

The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C** (TSC Act listed species) and **Appendix D** (EPBC Act listed species). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to habitat for these species. Assuming that

the recommended mitigation measures are implemented, these assessments determined that the Project is not considered to result in a significant impact to the potentially occurring threatened fauna species.

Chapter 5

Mitigation Measures

A number of mitigation measures are recommended for the Project. These measures should be implemented to minimise impacts to biodiversity values in adjoining habitats.

5.1 Vegetation Protection and Rehabilitation

Mature trees within the buffer area (see **Figure 3.1**) will be avoided where possible and safe to do so to minimise the impacts on the vegetation communities outside of the levees.

To avoid unnecessary removal or damage to Box Gum Woodland and Derived Native Grassland the clearing area should be clearly demarcated and signed, where appropriate, to ensure no vegetation beyond these boundaries is removed. Clearing works and equipment should be excluded from areas outside the Modification to Disturbance Boundaries. Site inductions are to be given to ensure all site workers and visitors are aware of any no-access areas.

Following completion of works, the vegetation communities in the buffer area (see **Figure 3.1**) will be rehabilitated back to its previous condition. This will be achieved by returning the topsoil back to the vegetation communities then the Modification to Disturbance Boundary will be fenced to prevent cattle entering the Modification to Disturbance Boundary whilst the vegetation communities recover. Weed management protocols will be implemented in order to control any establishment or infestation of weeds.

5.2 Erosion, Sedimentation and Pollution Control

Potential impacts to flora and fauna occurring in the construction and operational phases that can be managed include: run-off, sedimentation, erosion and pollution. As the Modification to Disturbance Boundary is located within an existing drainage line and Box Gum Woodland and Derived Native Grassland, precautions need to be taken to minimise impacts to these areas.

To reduce sedimentation on the construction site, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences (or equivalent) should be established around the perimeter of the development area to prevent the impacts of sedimentation on the adjoining vegetation. It is also recommended that, where possible, the diversion levees are

revegetated with locally endemic groundcover species from the Box Gum Woodland and Derived Native Grassland community.

During development, precautions should be taken to ensure that no pollution escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

5.3 Pre-clearance Assessments and Clearance Supervision

Removal of mature trees will be minimised where possible; however, it is likely that some trees will be required to be removed to faciliate the Project. It is recommended that during the clearance phase of the Project that pre-clearance assessments and clearance supervsion of trees is conducted.

Pre-clearance assessments are to be undertaken by a suitably qualified ecologist to identify any trees, which require to be removed, that may support native fauna. Pre-clearing assessments will include the demarcation of key habitat features as hollow-bearing trees and fallen logs.

To minimise impacts to native fauna species, clearing should be undertaken in the following two-stage process under the supervision of a suitably qualified ecologist:

- The initial phase of clearing will involve clearing around identified habitat features and leaving the features overnight;
- The second stage will involve clearing of the habitat features left overnight followed by an inspection;

If possible, trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollows and move on. An ecologist should investigate all hollows for the presence of fauna following felling of the tree.

An ecologist should be present during clearing operations to rescue any animals injured during the clearance. Provisions will be made to protect any native fauna during clearing operations by the following means:

- All persons working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured should be assisted to move to the adjacent bushland; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized).

Chapter 6

Conclusion

Despite the impacts of previous disturbance and its location within a fragmented landscape, the Project will require the clearing of native vegetation that forms suitable habitat for some threatened flora and fauna species. Past and current use of the Modification has entailed clearing and modification of the majority of pre-existing native vegetation.

Within the Modification to Disturbance Boundary, 9.07 ha of native and non-native vegetation will be disturbed consisting of approximately 6.1 ha of Box Gum Woodland and Derived Native Grassland and 2.28 ha of Low Diversity Derived Native Grassland/Exotic Pasture will be disturbed for the Project. However, only 1.24 ha of Box Gum Woodland and Derived Native Grassland (0.59 ha of woodland form and 0.65 ha of grassland form) will be permanently removed with the rest of the vegetation rehabilitated back to its previous condition prior to completion of the Project.

The Box Gum Woodland and Derived Native Grassland occurring within the Modification to Disturbance Boundary is listed as an EEC under the TSC Act and a CEEC under the EPBC Act. Within the Modification to Disturbance Boundary this community exists in a modified form. No threatened flora or fauna species have been recorded within the Modification to Disturbance Boundary; however a number of species have been recorded within the locality and have the potential to occur. None of these species are considered to rely upon the habitats to be cleared for the Project.

A number of mitigation measures have been recommended for the Project, including vegetation protection measures and vegetation community rehabilitation; erosion, sedimentation and pollution control; and pre-clearance assessments and clearance supervision.

The direct and indirect impacts of the Project on TSC Act and EPBC Act communities, species and populations have been assessed. Assuming all recommended mitigation measures are implemented, no significant impact to these entities is predicted to occur as a result of the Project.

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Appendix A

Threatened Flora Likelihood of Occurrence

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Apocynaceae	*Cynanchum elegans*	White-flowered Wax Plant	Predicted	E	E	Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; *Leptospermum laevigatum – Banksia integrifolia subsp. integrifolia* coastal scrub; *Eucalyptus tereticornis* aligned open forest and woodland; *Corymbia maculata* aligned open forest and woodland; and *Melaleuca armillaris* scrub to open scrub. Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. Has been recorded as far west as Merriwa in the Upper Hunter River valley.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Apocynaceae	*Tylophora linearis*		Predicted	V	E	Occurs in dry scrub and open forest and has been recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa*, *Eucalyptus sideroxylon*, *Eucalyptus albens*, *Callitris endlicheri*, *Callitris glaucophylla* and *Allocasuarina luehmannii*.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.
Asteraceae	*Ozothamnus tesselatus*		2	V	V	Grows in eucalypt woodland. Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Brassicaceae	*Lepidium hyssopifolium*	Aromatic Peppercress	2	E	E	Occurs in a variety of habitats including woodland with a grassy understorey and grassland. In NSW, there is a small population near Bathurst, one population at Bungendore, and one near Crookwell.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.
Fabaceae (Mimosoideae)	*Acacia pendula* - endangered population	Weeping Myall Population in the Hunter Catchment	57	EP		Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations. This Hunter population is known to occur naturally as far east as Warkworth, and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong.	UNLIKELY. Limited habitat present within the Modification to Disturbance Boundary. Not recorded during surveys.
Geraniaceae	*Pelargonium sp. (G.W. Carr 10345 (syn. Pelargonium sp. striatellum)*		Predicted	E	E	Has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Lamiaceae	*Prostanthera cryptandroides subsp. cryptandroides*	Wollemi Mint-bush	51	V	V	Associated communities include: Narrabeen Rocky Heath, Narrabeen Acacia Woodland, Narrabeen Exposed Woodland; Open Heath of *Calytrix tetragona*, *Leptospermum parviflorum* and *Isopogon dawsonii*; and Open Scrubland of *Eucalyptus dwyeri*, *Baeckea densifolia*, *Dillwynia floribunda*, *Aotus ericoides* and *Hemigenia cunefolia*. Distributed between Lithgow and Sandy Hollow	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						on the NSW central west slopes, central tablelands and western parts of the central coast botanical regions.	
Malvaceae	*Androclava procumbens*		Predicted	V	V	Recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and *Callitris* area. Mainly confined to the Dubbo-Mendooran-Gilgandra region.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Malvaceae	*Commersonia rosea (syn. Androcalva rosea)*		1	E	E	Occurs on skeletal sandy soils in scrub or heath vegetation with occasional emergents of *Eucalyptus crebra*, *Callitris endlicheri* or *Eucalyptus caleyi* subsp. *caleyi*.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Malvaceae	*Lasiopetalum longistamineum*		2	V	V	Known to occur in grassy woodlands and dry (sclerophyll) forests and rainforests on rich alluvial deposits. Occurs in the Mt Dangar - Gungal area within Merriwa and Muswellbrook Local Government Areas.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Moraceae	*Streblus pendulinus*	Siah's Backbone	Predicted		E	Grows in well developed rainforest, gallery forest and drier, more seasonal rainforest. Occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Myrtaceae	*Eucalyptus camaldulensis* - endangered population	River Red Gum Population in the Hunter Catchment	553	EP		May occur with *Eucalyptus tereticornis*, *Eucalyptus melliodora*, *Casuarina cunninghamiana subsp. cunninghamiana* and *Angophora floribunda* on major floodplains. The Hunter population occurs from the west at	UNLIKELY. Limited habitat present within the Modification to Disturbance Boundary.

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens local government area	Not recorded during surveys.
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum	2	V	V	Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils. Found only on the north coast of NSW and in separate districts: near Casino, and farther south, from Taree to Broke, west of Maitland.	UNLIKELY. Limited habitat present within the Modification to Disturbance Boundary. Not recorded during surveys.
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	2	V	V	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range.	UNLIKELY. Modification to Disturbance Boundary outside the natural range of the species.
Orchidaceae	*Cryptostylis hunteriana*	Leafless Tongue-orchid	Predicted	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range.
Orchidaceae	*Cymbidium canaliculatum* -	*Cymbidium canaliculatum*	56	EP		Within the Hunter Catchment, it is most commonly found in *Eucalyptus albens* (White Box) dominated woodlands	POTENTIAL. Suitable habitat within woodland

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
	endangered population	population in the Hunter Catchment				(including those dominated by the intergrade *E. albens-moluccana*). The Hunter population is known to occur naturally as far south as Weston and Pokolbin in the Lower Hunter, which represents its south-eastern geographic limit, but appears to be more centred in the Upper Hunter, predominantly north of Singleton.	and scattered trees. Recorded at three locations within the Disturbance Boundary. Also recorded within the Mt Arthur Coal lease area and the Drayton South Mine Lease. Not recorded during surveys.
Orchidaceae	*Diuris tricolor* / *Diuris tricolor* - endangered population	Pine Donkey Orchid / Pine Donkey Orchid in the Muswellbrook local government area	643	V / EP		Found in sclerophyll woodland and derived grassland on flats or small rises, on a range of substrates including sandy or loamy soils. The population of Diuris tricolor in the Muswellbrook LGA is at the eastern limit of the geographic range of the species and all other populations of the species are located west of the Great Dividing Range.	POTENTIAL. Suitable habitat present within the Modification to Disturbance Boundary. Recorded within the Mt Arthur Coal lease area and the Drayton South Mine Lease.
Orchidaceae	*Prasophyllum* sp. Wybong / *Prasophyllum petilum*^	Tarengo Leek Orchid	75	E	CE/E^	Grows in open sites within Natural Temperate Grassland. Also grows in grassy woodland in association with River Tussock *Poa labillardierei*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. and within the grassy ground layer dominated by Kangaroo Grass under Box-Gum Woodland. Natural populations are known from a total of four sites in NSW, including	POTENTIAL. Some suitable habitat present within the Modification to Disturbance Boundary. However the Modification to Disturbance Boundary is outside of the known

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Boorowa, Captains Flat, Ilford and Delegate.	populations.
Orchidaceae	*Pterostylis gibbosa*	Illawarra Greenhood	Predicted	E	E	Known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Hunter region, the species grows in open woodland dominated by *Eucalyptus crebra*, *E. tereticornis* and *Callitris endlicheri*. Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	UNLIKELY. Some suitable habitat present; however the Modification to Disturbance Boundary is outside of the known range within the Hunter Valley.
Rhamnaceae	*Pomaderris queenslandica*	Scant Pomaderris	36	E		Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. It is only known from a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolatai, and also from several locations on the NSW north coast.	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Rhamnaceae	*Pomaderris reperta*	Denman Pomaderris	115	CE	CE	Occupies woodland in association with *Eucalyptus crebra*, *E. blakelyi*, *Notelaea microcarpa* and *Allocasuarina littoralis*. Associated soil is a sandy loam on sandstone or conglomerate. Recorded from a small number of sites along a single ridgeline near Denman in the Upper Hunter Valley	UNLIKELY. No suitable habitat available within the Modification to Disturbance Boundary.
Santalaceae	*Thesium australe*	Austral Toadflax	Predicted	V	V	Occurs in grassland or grassy woodland. Often found in damp sites in association with *Themeda australis*. Austral	POTENTIAL. Suitable habitat present. The

Table 6.1 Likelihood of occurrence of threatened flora species

Family	Scientific Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands.	species is only known from two localised populations detected elsewhere in the Muswellbrook LGA.
Scrophulariaceae	*Euphrasia arguta*		Predicted	CE	CE	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. It was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years.	UNLIKELY. Modification to Disturbance Boundary is outside the natural range of the species.

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, EP = Endangered population, CE = Critically Endangered

**Data obtained from the Atlas of NSW Wildlife (OEH, 2015) and Protected Matters Search Tool (DoE, 2015a)*

^ Taxonomic changes have combined Prasophyllum sp. Wybong and Prasophyllum petilum; however they are still listed under two status levels under the EPBC Act

Appendix B

Threatened Fauna Likelihood of Occurrence

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Amphibians							
Hylidae	*Litoria booroolongensis*	Booroolong Frog	Predicted	E	E	Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Birds							
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	90	V	-	Inhabits a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.	LIKELY. Recorded during surveys within the Disturbance Boundary.
Accipitridae	*Circus assimilis*	Spotted Harrier	12	V	-	Inhabits grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	LIKELY. Suitable habitat present and likely to hunt over grassland areas within the Modification to Disturbance Boundary on occasion.
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	3	-	M	Inhabits coastal habitats, particularly those close to the sea-shore, and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Its habitat is characterised by the presence of large areas of open water including larger rivers, swamps, lakes and the sea, and have been recorded flying over a variety of terrestrial habitats.	POTENITAL. May occasionally fly over the Modification Area.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	6	V	-	Inhabits open eucalypt forest, woodland or open woodland, she-oak woodlands, acacia woodlands, and riparian woodland, which have an abundance of prey.	LIKELY. Suitable habitat is present in the Modification to Disturbance Boundary. Has been recorded hunting among scattered paddock trees on a nearby property in 2011.
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	1	V	-	Inhabits coastal and subcoastal eucalypt-dominated open forests and woodlands, and inland riparian woodland.	UNLIKELY. Some suitable habitat present in the Modification to Disturbance Boundary, but few recent records in the locality.
Accipitridae	*Pandion cristatus*	Eastern Osprey		V	M	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary. No records in the locality.
Apodidae	*Apus pacificus*	Fork-tailed Swift	Predicted	-	M	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. The species mostly occurs over inland plains but sometimes above foothills or in coastal areas. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including	LIKELY. Likely to occasionally fly over but not likely to visit.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They probably roost aerially, but are occasionally observed to land.	
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	4	-	M	This species is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground, occurring above a wide range of habitats.	LIKELY. Recorded in Mt Arthur Coal lease area in 2006/7 and frequently recorded during 2006 surveys within the Drayton Mine lease area. Likely to fly over from time to time.
Ardeidae	*Ardea ibis*	Cattle Egret	1	-	M	Inhabits tropical and temperate grasslands, wooded lands and terrestrial wetlands and often forages away from water on low lying grasslands, improved pastures and croplands. Within Australia the principal breeding sites of the Cattle Egret are along the central east coast from Newcastle to Bundaberg.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary.
Ardeidae	*Ardea modesta*	Eastern Great Egret	Predicted	-	M	Occur a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary.
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	Predicted	E	E	Permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.).	UNLIKELY. No suitable habitat is present in the Modification to Disturbance

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							Boundary.
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-cockatoo	30	V	-	Lives in coastal woodlands and drier forest areas, open inland woodlands or timbered watercourses where sheoaks, its main food trees, are common.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	1	E	-	Associated with tropical and warm temperate terrestrial wetlands, estuarine and littoral habitats, and occasionally woodlands and grasslands, floodplains. Forages in fresh or saline waters up to 0.5m deep, mainly in open fresh waters, extensive sheets of shallow water over grasslands or sedgeland, mangroves, mudflats, shallow swamps with short emergent vegetation and permanent billabongs and pools on floodplains.	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	63	V	-	Inhabits eucalypt woodlands (including box-gum woodland) and dry open forest. The woodlands and forests are usually dominated by stringybarks or other rough-barked eucalypts, typically with an open grassy understorey and sometimes with one or more shrub species.	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	14	V	-	Inhabits eucalypt woodlands, forests and mallee where there is a grassy understorey.	POTENTIAL. Recorded in the Mt Arthur Coal lease area in 2000 and in the Drayton Mine lease area in

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							2006. Suitable habitat present in the Modification to Disturbance Boundary. The species was recorded in a nearby property in 2011.
Falconidae	*Falco subniger*	Black Falcon	3	V	-	Inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees and usually associated with streams or wetlands.	UNLIKELY. Limited suitable habitat present in the Modification to Disturbance Boundary and few recent records in the locality.
Laridae	*Hydroprogne caspia*	Caspian Tern	1	-	M	Mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks.	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	Predicted	CE	E	Inhabits eucalypt open forests and woodlands, particularly box-ironbark vegetation as well as River Oak gallery forest. Feeds on the nectar of eucalypts and key species include *Eucalyptus sideroxylon*, *Eucalyptus albens* and *Eucalyptus melliodora* as well as the mistletoe *Amyema cambagei* which grows on *Casuarina cunninghamiana*.	POTENTIAL. No records exist for the locality but there is some limited suitable foraging habitat present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							May visit in times of food shortage.
Meliphagidae	*Grantiella picta*	Painted Honeyeater	1	V	-	Inhabits Boree, Brigalow and box-gum woodlands and box-ironbark forests. The species feeds on the fruits of mistletoes, particularly those in the Amyema genus, growing on woodland eucalypts and acacias.	POTENTIAL. Some suitable habitat in the Modification to Disturbance Boundary but is rare in the locality.
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	2	V	-	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (E. *albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*) and Forest Red Gum (*E. tereticornis*).	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Meropidae	*Merops ornatus*	Rainbow Bee-eater	23	-	M	Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation, often in proximity to permanent water.	LIKELY. Recorded in Mt Arthur Coal lease area in 2006/7 and during 2006 surveys within the Drayton Mine lease area. Likely to fly over from time to time.
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	Predicted	-	M	Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	
Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher	Predicted	-	M	Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Widespread on and east of the Great Divide and sparsely scattered on the western slopes in NSW, with very occasional records on the western plains.	UNLIKELY. No suitable habitat is present in the Modification to Disturbance Boundary.
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	15	V	-	Inhabits eucalypt forests and woodlands, especially where rough-barked species and mature smooth-barked gums with dead branches are present, as well as mallee and Acacia woodland.	POTENTIAL. Suitable habitat present and known to occur in the locality.
Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	21	V	-	Inhabits lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	POTENTIAL. Recorded in the Mt Arthur Coal lease area in 2000. Suitable habitat present in the Modification to Disturbance Boundary.
Petroicidae	*Petroica boodang*	Scarlet Robin	3	V	-	Inhabits dry eucalypt forests and woodlands, usually in areas where the understorey is open and grassy with few scattered shrubs.	UNLIKELY. Limited suitable habitat present within the Modification to Disturbance Boundary.
Petroicidae	*Petroica phoenicea*	Flame Robin	1	V	-	Inhabits upland tall moist eucalypt forests and woodlands,	UNLIKELY. Limited

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						often on ridges and slopes during breeding season and migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).	suitable habitat present within the Modification to Disturbance Boundary.
Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	65	V	-	Open woodlands dominated by mature eucalypts with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. This species avoids very wet areas.	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	7	V	-	Mainly inhabit dry, open sclerophyll forests and woodlands, usually dominated by tall eucalypts, especially box–ironbark species including White Box and Yellow Box, where they forage in the canopy of flowering trees.	POTENTIAL. Suitable habitat present and known to occur in the locality. One sighting from 2005 was recorded just off Edderton Road near the Denman Road intersection.
Psittacidae	*Lathamus discolor*	Swift Parrot	Predicted	E	E	Migrates from its Tasmanian breeding grounds to overwinter in the box-ironbark forests and woodlands of Victoria, NSW and southern Queensland. They occur in areas where eucalypts are flowering profusely or where there are abundant lerp infestations. Favoured feed trees include *Eucalyptus robusta*, *Corymbia maculata*, *Corymbia gummifera*, *Eucalyptus sideroxylon* and *Eucalyptus albens*.	POTENTIAL. Suitable foraging habitat present in the Modification to Disturbance Boundary. May visit in times of food shortage. A pair was recorded foraging in a

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
							paddock tree on a nearby property in 2011.
Psittacidae	*Neophema pulchella*	Turquoise Parrot	4	V	-	Inhabits eucalypt and cypress-pine open forests and woodlands, particularly box or box-ironbark woodlands, often in undulating or rugged country.	UNLIKELY. Limited suitable habitat within the Modification to Disturbance Boundary.
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	Predicted		M	Mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as *Eucalyptus microcorys*, *Eucalyptus cypellocarpa*, *Eucalyptus radiata*, *Eucalyptus regnans*, *Eucalyptus delegatensis*, *Eucalyptus pilularis* or *Eucalyptus resinifera*, usually with a dense shrubby understorey often including ferns.	UNLIKELY. Limited suitable habitat within the Modification to Disturbance Boundary.
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	Predicted	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Roosts during the day in dense vegetation. Forages nocturnally on mud-flats and in shallow water.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe	Predicted	-	M	Usually inhabits open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						humans or human activity.	
Strigidae	*Ninox connivens*	Barking Owl	4	V	-	Inhabits forests and woodlands of tropical, temperate and semi arid zones that are typically dominated by eucalypts, often red gum species. Roosts in or under dense foliage in large trees including rainforest species of streamside gallery forests, Casuarina cunninghamiana, other Casuarina and Allocasuarina species, Eucalypt, Angophora or Acacia species. For breeding, this species required hollows in large eucalypts or paperbarks, usually near watercourses or wetlands.	LIKELY. Has been recorded on a nearby property during surveys in 2000. Suitable foraging habitat present in the Modification to Disturbance Boundary.
Strigidae	*Ninox strenua*	Powerful Owl	2	V	-	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Roosting occurs in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines. This species nests in old hollow eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines.	UNLIKELY. Limited suitable habitat within the Modification to Disturbance Boundary.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	6	V	-	Inhabits dry eucalypt forests of the tablelands, western slopes and the undulating wet-dry forests of the coast. Optimal habitat includes an open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. This species nests in old hollow eucalypts, live or dead but commonly live, in a variety of topographic positions from gully to upper slope.	POTENTIAL. Limited suitable habitat present in the Modification to Disturbance Boundary.

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Tytonidae	*Tyto tenebricosa*	Sooty Owl	1	V	-	Roost in large tree hollows, caves and in dense foliage during daylight hours. Rarely seen or heard they can be found in areas with deep gullies in moist forests, where smooth-barked gum trees, tree ferns and wet forest under-storey are present.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Mammals							
Dasyuridae	*Dasyurus maculatus maculatus*	Spotted-tailed Quoll	19	V	E	Inhabits a wide range of forest habitat types, although all appear to be characterised by relatively high (>600 mm/year) and predictable seasonal rainfall. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	POTENTIAL. Suitable habitat present in the Modification to Disturbance Boundary and known to occur in the locality.
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	1	V	-	Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	6	V	-	Inhabits a range of habitats including wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and deserts. This species is known to roost in tree hollows and buildings, and in treeless areas they are known to utilise mammal burrows.	LIKELY. Suitable habitat present within the Modification to Disturbance Boundary. Recorded during surveys within the Disturbance Boundary.
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	1	E	V	Inhabits rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and	UNLIKELY. No suitable habitat is present in the

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						ledges, often facing north. A range of vegetation types are associated with the habitat of this species, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	Modification to Disturbance Boundary.
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	15	V	-	Inhabits dry and wet sclerophyll forests, coastal woodland. Roosts in tree hollows and buildings. Have been found roosting under the bark of trees.	LIKELY. Recorded in the Mt Arthur Coal lease area in 2006, Drayton Mine lease area in 2006 and Mount Pleasant Coal lease area in 2009. Suitable habitat present in the Modification to Disturbance Boundary.
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	Predicted	-	V	Inhabits open heathland, open woodland with a heathland understorey and vegetated sand dunes with peak abundances during the early to mid stages of vegetation succession three to five years after fire.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Petauridae	*Petaurus australis*	Yellow-bellied Glider	1	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Den, often in family groups, in hollows of large trees.	UNLIKELY. No suitable habitat present in the Modification to Disturbance Boundary.
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	13	V	-	Inhabits mature or old-growth box / box-ironbark woodland, Eucalyptus camaldulensis forest west of the Great Dividing	LIKELY. Recorded during surveys of the Disturbance

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						Range and Blackbutt-Bloodwood forest with heathy understorey in coastal areas. The presence of large trees with abundant hollows are critical elements for nesting habitat.	Boundary. Also known from the Mount Pleasant, Mt Arthur and Drayton Mine lease areas.
Phascolarctidae	*Phascolarctos cinereus*	Koala	6	V	V	Widespread in sclerophyll forest and woodlands. Requires relatively large home ranges. . Eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	UNLIKELY. Limited woodland habitat and connected tree canopy available; although individuals are known to travel across open landscapes. The Modification to Disturbance Boundary does not support core habitat.
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	5	V	V	Inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. The primary food source is blossom from eucalypts (genera Eucalyptus, Corymbia and Angophora), melaleucas and banksias.	LIKELY. Recorded in the Mount Pleasant lease area in 2009 and the Drayton Mine lease area in 2006. Suitable habitat present in the Modification to Disturbance Boundary and may occasionally fly over.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	14	V	V	Inhabits a range of vegetation types including dry and wet sclerophyll forest, *Callitris glaucophylla* dominated forest; tall	POTENTIAL. Suitable foraging habitat present in

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						open eucalypt forest with a rainforest sub-canopy; sub-alpine woodland; and sandstone outcrop country. The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging.	the Modification to Disturbance Boundary and known from the locality. Was recorded during surveys of a nearby property in 2006.
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	3	V	-	Inhabits wet sclerophyll and coastal mallee, preferring tall and wet forests where trees are more than 20m in height and the understorey is dense. Typically roosts in tree hollows, however there are a few records in caves and old buildings..	POTENTIAL. Recorded in the Mount Pleasant lease area in 2009. Limited suitable habitat present in the Modification to Disturbance Boundary.
Vespertilionidae	*Miniopterus australis*	Little Bentwing-bat	3	V	-	Inhabits well timbered areas including rainforest, vine thicket, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. A cave-dwelling species with roosting occurring in caves, abandoned mines, tunnels, stormwater drains and occasionally buildings.	UNLIKELY. Sub-optimal habitat exists in the Modification to Disturbance Boundary and the species is rare for the locality.
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	25	V	-	Inhabits a variety of habitats including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, melaleuca forests and open grasslands. Caves are the primary roosting habitat, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures.	POTENTIAL. Suitable foraging habitat present in the Modification to Disturbance Boundary and known from the Disturbance Boundary

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
Vespertilionidae	*Myotis macropus*	Large-footed Myotis	10	V	-	Known from a range of habitats close to water from lakes, small creeks to large lakes and mangrove lined estuaries.	POTENTIAL. Suitable foraging habitat present in the Modification to Disturbance Boundary and known from the Disturbance Boundary.
Vespertilionidae	*Nyctophilus corbeni*	Corben's Long-eared Bat	1	V	V	Inhabits a wide variety of vegetation types including *Eucalyptus camaldulensis*, *Eucalyptus largiflorens*, *Allocasuarina*, *Casuarina cristata*, mallee, open woodlands and savannahs. Roosting occurs in hollow-bearing trees where hollows and is also known to roost in tree crevices and under loose bark.	POTENTIAL. Has been recorded on a nearby property during surveys in 2000. Suitable foraging habitat present in the Modification to Disturbance Boundary.
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	5	V	-	Inhabits a variety of habitats including moist gullies in mature coastal forest, rainforest, open woodland, Melaleuca swamp woodland, wet and dry sclerophyll forests, cleared paddocks with remnant trees and tree-lines creeks in open areas. Roosts in tree hollows, cracks and fissures in trucks and dead branches, under exfoliating bark, as well as the roofs of old buildings.	LIKELY. Recorded in the Mount Pleasant lease area in 2009, and in the Mt Arthur and Drayton Mine lease areas in 2006. Suitable habitat present in the Modification to Disturbance Boundary.
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	13	V	-	Inhabits tropical mixed woodland, wet and dry sclerophyll forest located in close proximity to sandstone or volcanic	POTENTIAL. Suitable foraging habitat present in

Table 6.2 Likelihood of Occurrence of Threatened Fauna Species

Family	Species Name	Common Name	Locality Count^	TSC Act Status	EPBC Act Status	Habitat Requirements	Likelihood of Occurrence
						escarpments. Roosting can take place in sandstone overhang caves, boulder piles, mines and occasionally in buildings. Maternity colonies have been observed in shallow sandstone caves.	the Modification to Disturbance Boundary and known from the Disturbance Boundary.
Reptiles							
Pygopodidae	*Aprasia parapulchella*	Pink-tailed Legless Lizard	Predicted	V	V	Occurs in primary and secondary grassland, grassy woodland and woodland communities including mallee, and box-ironbark forest.	UNLIKELY. Some suitable habitat present within the Modification to Disturbance Boundary; however no records in the locality.

TSC Act / EPBC Act Status: V = Vulnerable, E = Endangered, EP = Endangered population, CE = Critically Endangered

**Data obtained from the Atlas of NSW Wildlife (OEH, 2015) and Protected Matters Search Tool (DoE, 2015a)*

Appendix C

Assessment of Significance (NSW)

C.1 Introduction

This appendix contains formal Assessments of Significance according to Section 5A of the EP&A Act. The Assessments of Significance provide a means by which to gauge the significance of predicted impacts to threatened species, populations and ecological communities listed under the TSC Act. They have been prepared to help examine the magnitude of impacts to local occurrences of threatened biota.

Both direct and indirect impacts are taken into account within these assessments. Direct impacts have been quantified within the assessments and are represented by the Project Disturbance Boundary. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of species, such impacts cannot be mapped or accurately calculated in advance.

Each Assessment of Significance is a series of questions (shown as italicised text below) for which a response has been supplied beneath in plain text. The assessments have been prepared without considering the ameliorative and compensatory measures proposed for the Project as instructed under the *Threatened Species Assessment Guidelines* (DECC (NSW), 2007):

> *"Proposed measures that mitigate, improve or compensate for the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been used successfully for that species in a similar situation".*

However, it is noted that the Project a number of mitigation measures are proposed to minimise impacts to biodiversity values. The ultimate conclusions to this Ecological Assessment take such measures into consideration when assessing the long term implications for threatened species, populations and communities.

C.2 Box Gum Woodland and Derived Native Grassland

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The Project will disturb 6.1 ha of Box Gum Woodland and Derived Native Grassland but of this only 1.24 ha will be permanently removed formed of 0.59 ha of woodland form and 0.65 ha of grassland form within the Modification to Disturbance Boundary. This community has previously been substantially cleared and or modified within the Modification to Disturbance Boundary and surrounds. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to Disturbance Boundary. Removal of vegetation within these narrow corridors is not considered to place the local occurrence at risk of extinction. Areas of this community will remain outside of the Modification to Disturbance Boundary and Disturbance Boundary.

Within the Modification to Disturbance Boundary, a substantial change will occur to the species composition of Box Gum Woodland and Derived Native Grassland, as it will be entirely removed. The remaining extent of this community has the potential to be indirectly impacted by the Project. These changes are expected to be localised and overall are not considered to cause a substantial change in species composition such that the local occurrence of the community is likely to be placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

A total of 6.1 ha of Box Gum Woodland and Derived Native Grassland will be disturbed within the Modification to Disturbance Boundary, with 1.24 ha permanently removed and 4.86 ha rehabilitated following completion of the Project.

The Project is not considered to significantly increase fragmentation of Box Gum Woodland and Derived Native Grassland within the immediate vicinity of the Modification to Disturbance Boundary. The treed vegetation within the Modification to Disturbance

Boundary has previously been cleared and/or modified through agricultural practices. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to Disturbance Boundary. It is anticipated that dispersal of flora species between the remaining patches will continue.

The patch of Box Gum Woodland and Derived Native Grassland occurs within a fragmented landscape between existing approved mining projects. The patch of Box Gum Woodland and Derived Native Grassland has been modified through previous and current land uses. As such, is not considered to be important for the long-term survival of the community in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for Box Gum Woodland and Derived Native Grassland has been identified by OEH.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The *National Recovery Plan for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (DECCW, 2011) has an overall aim to promote the recovery and prevent the extinction of Box Gum Woodland and Derived Native Grassland. The direct removal of 1.24 ha of Box Gum Woodland and Derived Native Grassland is an action that is not consistent with the recovery plan. However, the local extent of the community is not considered to be placed at risk of extinction as a result of the Project.

No threat abatement plans are relevant to Box Gum Woodland and Derived Native Grassland within the Modification to Disturbance Boundary.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The following key threatening processes (KTPs) are relevant to Box Gum Woodland and Derived Native Grassland and have the potential to be exacerbated by the Project:

- 'Clearing of native vegetation' as this reduces the area habitat available for this community; and
- 'Invasion of native plant communities by exotic perennial grasses' that readily invade disturbed sites and communities as they can dominate and suppress native flora species.

The primary KTP relevant to the Project is the clearing of native vegetation, as 1.24 ha of Box Gum Woodland and Derived Native Grassland will be removed within the Modification to Disturbance Boundary. The Project is not considered to exacerbate the KTP of invasion by exotic perennial grasses further than current conditions.

Conclusion

The Project will result in the direct loss of 1.24 ha of Box Gum Woodland and Derived Native Grassland. The extent of the community to be removed exists in a modified form within a fragmented landscape between existing mining approvals. The Project is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland.

C.3 Flora Species

The following Assessment of Significance has been provided to assess impacts of the Project on the following potentially occurring threatened flora species:

- *Cymbidium canaliculatum* population in the Hunter Catchment;
- *Diuris tricolor* (Pine Donkey Orchid);
- *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid); and
- *Thesium australe* (Austral Toadflax).

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No individuals of *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) and *Thesium australe* (Austral Toadflax) have been recorded within the Modification to Disturbance Boundary or adjoining Bengalla Mine Approved Operations Area or Mount Pleasant Project area. The direct impact of the Project is the removal of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland. Given that these species have not been recorded within the Modification to Disturbance Boundary it is not considered that the Project will result in the extinction of a local population of these species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No individuals of *Cymbidium canaliculatum* (Tiger Orchid) have been recorded within the Modification to Disturbance Boundary. Individuals of this population have previously been recorded at scattered locations within Bengalla Mine Approved Operations Area and Mount Pleasant Project area. The direct impact of the Project is the removal of 0.59 ha of potential habitat in the form of grassy woodland and some scattered trees. Given that this species has not been recorded within the Modification to Disturbance Boundary it is not considered that the Project will result in the extinction of a local population of the species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

A total of 1.24 ha of native grassy woodland and derived native grassland will be lost within the Modification to Disturbance Boundary, including 0.59 ha of woodland form and 0.65 ha of grassland form. This are of native vegetation provides potential habitat for the assessed flora species.

The Project is not considered to significantly increase fragmentation within the area surrounding the Modification to Disturbance Boundary. The majority of this land has historically been modified through agricultural practices and it occurs between existing approved mines.

Given that no individuals of the assessed species have been recorded within the Modification to Disturbance Boundary, the habitat present is not considered to be important for the long-term survival of the species.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for the assessed species has been identified by OEH.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Draft NSW and National Recovery Plan for the Tarengo Leek Orchid (Prasophyllum petilum) (NSW NPWS, 2000) has an overall aim to maintain or enhance the populations of the

species at the known sites by controlling threatening processes and improving conditions for growth and recruitment. The removal of potential habitat within an area where the species is not known is not considered to be inconsistent with this aim.

No recovery plans have been prepared for *Cymbidium canaliculatum* population in the Hunter Catchment, *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum petilum* (Tarengo Leek Orchid) and *Thesium australe* (Austral Toadflax).

No threat abatement plans are relevant to the assessed flora species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The following KTPs are relevant to the assessed flora species and have the potential to be exacerbated by the Project:

- 'Clearing of native vegetation' as this reduces the area habitat available for these species; and
- 'Invasion of native plant communities by exotic perennial grasses' that readily invade disturbed sites and communities as they can dominate and suppress native flora species.

The primary KTP relevant to the Project is the loss of 1.24 ha of native grassy woodland and derived native grassland within the Modification to Disturbance Boundary that comprises potential habitat for the assessed species. The Project is not considered to exacerbate the KTP of invasion by exotic perennial grasses further than current conditions.

Conclusion

No individuals of *Cymbidium canaliculatum* (Tiger Orchid), *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) and *Thesium australe* (Austral Toadflax) have been recorded within the Modification to Disturbance Boundary. The Project will remove potential habitat for these species in the form of grassy woodland and derived native grassland. The removal of this potential habitat is not considered to result in a significant impact to the assessed flora species.

C.4 Fauna Species

The following Assessment of Significance has been provided to assess impacts of the Project on the following potentially occurring threatened fauna species:

- Speckled Warbler (*Chthonicola sagittata*);
- Spotted Harrier (*Circus assimilis*);
- Little Eagle (*Hieraaetus morphnoides*);

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- Barking Owl (*Ninox connivens*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern Freetail-bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*); and
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No individuals of the assessed threatened fauna species have been recorded within the Modification to Disturbance Boundary. The direct impact of the Project is the loss of 0.59 ha of grassy woodland, 0.65 ha of derived native grassland and 2.28 ha of low diversity native grassland/exotic pasture. Given that these species have not been recorded within the Modification to Disturbance Boundary it is not considered that the Project will result in the extinction of a local population of these species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

A breakdown of the areas of impact to each of these species is shown below.

Scientific Name	Common Name	Preferred Habitat^	Habitat within Modification to Disturbance Boundary (ha)
Chthonicola sagittata	Speckled Warbler	W	1.0
Circus assimilis	Spotted Harrier	W, G, G/P	3.1
Hieraaetus morphnoides	Little Eagle	W, G, G/P	3.1
Apus pacificus	Fork-tailed Swift	W	1.0
Hirundapus caudacutus	White-throated Needletail	W	1.0
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	W	1.0
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	W	1.0
Merops ornatus	Rainbow Bee-eater	W, G	2.0
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	W	1.0
Ninox connivens	Barking Owl	W	1.0
Mammals			
Petaurus norfolcensis	Squirrel Glider	W	1.0
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	W	1.0
Mormopterus norfolkensis	Eastern Freetail-bat	W	1.0
Scoteanax rueppellii	Greater Broad-nosed Bat	W	1.0
Pteropus poliocephalus	Grey-headed Flying-fox	W	1.0

^ Preferred habitat: W = woodland, G = derived native grassland; G/P = low diversity grassland/exotic pasture

The Project is not considered to significantly increase fragmentation of the available habitat within the immediate vicinity of the Modification to Disturbance Boundary. The treed vegetation within the Modification to Disturbance Boundary has previously been cleared and/or modified through agricultural practices. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to Disturbance Boundary. It is anticipated that dispersal of fauna species between the remaining patches will continue, for the assessed species as they are highly mobile.

The fauna habitat within the Modification to Disturbance Boundary occurs within a fragmented landscape between existing approved mining projects. The patch of habitat has been modified through previous and current land uses. No threatened fauna species have

been recorded within the Modification to Disturbance Boundary. As such, is not considered to be important for the long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for the assessed species has been identified by OEH.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Given that none of the assessed threatened fauna species have been recorded within the Modification to Disturbance Boundary, and the small amount of habitat available to these species, the Project is expected to be consistent with the objectives or actions of recovery plans or draft recovery plans for the following species:

- Barking Owl (draft); and
- Grey-headed Flying-fox (draft National Recovery Plan).

The Project is also expected to be consistent with any threat abatement plans.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The following KTPs are relevant to these species within the Modification to Disturbance Boundary:

- 'Clearing of native vegetation' as this reduces the area of forage and nesting habitat available for the species;
- 'Loss of hollow-bearing trees' as this reduces the abundance of nesting habitat for some species;
- 'Removal of dead wood and dead trees' as this reduces the abundance of important ground foraging and nesting habitat;
- 'Invasion of native plant communities by exotic perennial grasses' as this results in the loss of key food plants and habitat and encourages flock-foraging species;

The primary KTP relevant to the Project is the loss of 0.59 ha of grassy woodland, 0.65 ha of derived native grassland and 2.28 ha of low diversity native grassland/exotic pasture within the Modification to Disturbance Boundary that comprises potential habitat for the assessed species.

Conclusion

No individuals of the assessed threatened fauna species have been recorded within the Modification to Disturbance Boundary. The Project will remove potential habitat for these species in the form of grassy woodland, derived native grassland and low diversity grassland/exotic pasture. It is likely that the species assessed forage in the Modification to Disturbance Boundary on occasion as part of their larger home ranges. Accordingly no significant impacts are predicted to occur to these species as a result of the Project.

Appendix D

Assessment of Significance (Commonwealth)

D.1 Introduction

This appendix contains assessments of significance according to the Matters of National Environmental Significance (MNES) *Significant Impact Guidelines 1.1* (DoE, 2013). They are intended to assist in determining whether the impacts of the Project on any MNES are likely to be significant. They provide a means by which to gauge the significance of predicted impacts to threatened species, populations and ecological communities and have been prepared to examine the magnitude of impacts to threatened biota.

Both direct and indirect impacts are taken into account within these assessments. Direct impacts have been quantified within the assessments and are represented by the Modification to Disturbance Boundary. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of MNES, such impacts cannot be mapped or accurately calculated in advance.

Each assessment of significance reproduces the significant impact criteria in italicised text, beneath which a response is supplied in plain text. The responses have been prepared under the scenario that no mitigation or compensatory measures are applied. That is, to determine the significance of impacts, the assessments of significance consider the impacts without amelioration.

The Project does however include substantial mitigation and offset measures. The ultimate conclusions to this Ecological Assessment take such measures into consideration when assessing the long term implications for MNES.

D.2 Box Gum Woodland and Derived Native Grassland

Assessment of Significance

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

reduce the extent of an ecological community

A total of 6.1 ha of Box Gum Woodland and Derived Native Grassland will be disturbed within the Modification to Disturbance Boundary. Of the 6.1 ha disturbed, 1.24 ha will be permanently lost including 0.59 ha of woodland form and 0.65 ha of grassland form with the remaining 4.86 ha rehabilitated back to its previous condition upon completion of the Project.

fragment or increase fragmentation of an ecological community

The Project is not considered to significantly increase fragmentation of Box Gum Woodland and Derived Native Grassland within the immediate vicinity of the Modification to Disturbance Boundary. The treed vegetation within the Modification to Disturbance Boundary has previously been cleared and/or modified through agricultural practices. The works associated with the Project include the construction and operation of diversion drains that are 6-15 m wide in the eastern portion and 20-65 m wide in the western portion of the Modification to

Disturbance Boundary. It is anticipated that dispersal of flora species between the remaining patches will continue.

adversely affect habitat critical to the survival of an ecological community

The patch of Box Gum Woodland and Derived Native Grassland occurs within a fragmented landscape between existing approved mining projects. The patch of Box Gum Woodland and Derived Native Grassland has been modified through previous and current land uses. As such, is not considered to be critical to the survival of the community in the locality.

modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

Within the Modification to Disturbance Boundary, the extent of Box Gum Woodland and Derived Native Grassland will be entirely removed. The portions of this community occurring at this interface have the potential to be indirectly impact. The Project includes the construction and operation of diversion levees. These leveeswill be located with the existing flow path within the Modification to Disturbance Boundary. Surface water will continue to be accessed by the community.

cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species

Within the Modification to Disturbance Boundary, a change will occur to the species composition of Box Gum Woodland and Derived Native Grassland, as it will be entirely removed. There is potential for changes to species composition at the interface between the Modification to Disturbance Boundary and adjoining land. These changes are expected to be localised and overall are not considered to cause a substantial change in species composition.

cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- assisting invasive species, that are harmful to the listed ecological community, to become established, or

- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

Box Gum Woodland and Derived Native Grassland has previously been substantially cleared and or modified within the Modification to Disturbance Boundary and surrounds. Invasive flora species are known to occur within this community, however the Project is not considered to exacerbate this threat further than current conditions.

The Project will not result in the regular mobilisation of chemicals that kill or inhibit the growth of plant species into Box Gum Woodland and Derived Native Grassland.

interfere with the recovery of an ecological community.

The Project will remove approximately 1.24 ha of Box Gum Woodland and Derived Native Grassland, including 0.59 ha of woodland form and 0.65 ha of grassland form. Box Gum Woodland and Derived Native Grassland has previously been substantially cleared and or modified within the Modification to Disturbance Boundary and surrounds. The Project is not considered to interfere with the recovery of this community.

Conclusion

The Project will result in the direct loss of 1.24 ha of Box Gum Woodland and Derived Native Grassland. The extent of the community to be removed exists in a modified form within a fragmented landscape between existing mining approvals. The Project is not considered to result in a significant impact to Box Gum Woodland and Derived Native Grassland.

D.3 Flora Species

D.3.1 Prasophyllum *sp. Wybong / Prasophyllum petilum (Tarengo Leek Orchid)*

Assessment of Significance

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of a population

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary.

reduce the area of occupancy of the species

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. The direct impact to this species is the removal of potential habitat in the form of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland.

fragment an existing population into two or more populations

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. As such the Project is not considered to result in the fragmentation of an existing population.

adversely affect habitat critical to the survival of a species

The direct impact to this species is the removal of potential habitat in the form of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland. However no individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have

been recorded within the Modification to Disturbance Boundary. The Modification to Disturbance Boundary is not considered critical to the survival of the species.

disrupt the breeding cycle of a population

No individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. As such the Project is not considered to result in the fragmentation of an existing population. Therefore the action will not disrupt the life cycle of a local population.

modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The direct impact to this species is the removal of potential habitat in the form of 1.24 ha of potential habitat in the form of grassy woodland and derived native grassland. However no individuals of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) have been recorded within the Modification to Disturbance Boundary. The Modification to Disturbance Boundary is not considered to result in the decline of the species.

result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The action will generate indirect impacts associated within the construction and operation of the Project. The Modification to Disturbance Boundary occurs within a highly fragmented landscape which is currently impacted by weeds and feral animals. As such, it is considered unlikely that the Project will result in invasive species becoming further established within the potential habitat for this species.

introduce disease that may cause the species to decline, or

The Project is considered unlikely to introduce disease that may cause a population of *Prasophyllum* sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) to decline.

interfere with the recovery of the species.

Prasophyllum sp. Wybong / *Prasophyllum petilum* (Tarengo Leek Orchid) has not been recorded within the Modification to Disturbance Boundary and therefore no known populations will be affected. The Project will remove 1.24 ha of potential habitat in the form of grassland and grassy woodland vegetation. The Project is not expected to interfere with the recovery of this species.

Conclusion

Given that no individuals of this species have been recorded within the Modification to Disturbance Boundary and the small amount of potential habitat removed, the Project is not considered to result in a significant impact to this species.

D.3.2 Thesium australe (Austral Toadflax)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of an important population of a species

The species has not been recorded within the Modification to Disturbance Boundary. It is therefore considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax), further to this, it is also considered unlikely that the proposed action will lead to a long-term decrease in the size of an important population of the species. The amount of suitable potential habitat for the species within the Project Disturbance Boundary represents a small portion of the available habitat within the locality.

reduce the area of occupancy of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax) it is also considered unlikely that the action will reduce the area of occupancy of an important population. The Project will remove 1.24 ha potential habitat in the form of grassland and grassy woodland vegetation.

fragment an existing important population into two or more populations

As it is considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax) it is also considered unlikely that the action will fragment an existing important population into two or more populations. The action is not considered to significantly increase fragmentation within the immediate surrounds of the Modification to Disturbance Boundary. The majority of the Modification to Disturbance Boundary has previously been modified through agricultural practices.

adversely affect habitat critical to the survival of a species?

Thesium australe (Austral Toadflax) has not been recorded from within the Modification to Disturbance Boundary and therefore the potential habitat to be removed is not considered to be critical to its survival. Extensive areas of similar habitat occurs within the locality, however there are no records held within the Atlas of NSW Wildlife of this species within this area.

disrupt the breeding cycle of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of *Thesium australe* (Austral Toadflax) it is also considered unlikely that the action will disrupt the life cycle of an important population. Extensive areas of similar habitat occur within the locality, however there are no records held within the Atlas of NSW Wildlife of this species within this area.

modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

No individuals of *Thesium australe* (Austral Toadflax) were recorded within the Modification to Disturbance Boundary. The Project will remove potential habitat in the form of grassland and grassy woodland vegetation. Potential indirect impacts resulting from the Project may also impact the potential habitat within the adjoining areas. The potential changes to habitat are expected to be localised and overall are not considered to cause a substantial change in potential habitat.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action will generate indirect impacts associated within the construction and operation of the Project. The Modification to Disturbance Boundary occurs within a highly fragmented landscape which is currently impacted by weeds and feral animals. As such, it is considered unlikely that the Project will result in invasive species becoming further established within the potential habitat for this species.

introduce disease that may cause the species to decline

The Project is considered unlikely to introduce disease that may cause the local population of *Thesium australe* (Austral Toadflax) to decline as no local population of *Thesium australe* (Austral Toadflax) was identified within the Modification to Disturbance Boundary or its surrounds.

interfere substantially with the recovery of the species

Thesium australe (Austral Toadflax) has not been recorded within the Modification to Disturbance Boundary and therefore no known populations will be affected. The Project will remove 1.24 ha of potential habitat in the form of grassland and grassy woodland vegetation. The Project is not expected to interfere substantially with the recovery of this species.

Conclusion

Given that no individuals of this species have been recorded within the Modification to Disturbance Boundary and the small amount of potential habitat removed, the Project is not considered to result in a significant impact to this species.

D.4 Fauna Species

D.4.1 Grey-headed Flying-fox

Assessment of Significance

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

lead to a long-term decrease in the size of an important population of a species

The species has not been recorded within the Modification to Disturbance Boundary. The Modification to Disturbance Boundary is not considered to support an important population of the Grey-headed Flying-fox. It is also considered unlikely that the action will lead to a long-term decrease in the size of an important population of the species. The amount of suitable potential habitat for the species within the Modification to Disturbance Boundary represents a small portion of the available habitat within the locality.

reduce the area of occupancy of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of the Grey-headed Flying-fox it is also considered unlikely that the action will reduce the area of occupancy of an important population. The Project will directly impact approximately 0.59 ha of suitable potential foraging habitat for the species.

fragment an existing important population into two or more populations

As it is considered that the Modification to Disturbance Boundary does not support an important population of the Grey-headed Flying-fox it is also considered unlikely that the action will fragment an existing important population into two or more populations. The action is not considered to significantly increase fragmentation within the Modification to Disturbance Boundary for the species, which is highly mobile. The majority of the Modification to Disturbance Boundary has previously been modified through agricultural practices.

adversely affect habitat critical to the survival of a species

The Grey-headed Flying-fox has not been recorded from within the Modification to Disturbance Boundary. The closest known Grey-headed Flying-fox camp is in Singleton. The species typically travels 20 km to forage from roost sites and it is likely that individuals will fly over and potentially forage in the Modification to Disturbance Boundary and elsewhere in the locality as part of their extensive home range. The 0.59 ha of habitat within the Modification to Disturbance Boundary is not considered critical to the survival of the species.

disrupt the breeding cycle of an important population

As it is considered that the Modification to Disturbance Boundary does not support an important population of the Grey-headed Flying-fox it is also considered unlikely that the action will disrupt the breeding cycle of an important population. The closest known Grey-headed Flying-fox camp is in Singleton.

modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Project will directly impact approximately 0.59 ha of suitable potential habitat for the species. The species typically travels 20 km to forage from roost sites. The loss of a small amount of foraging habitat within the Modification to Disturbance Boundary is not considered to result in a decline of the species.

result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The action will generate indirect impacts associated within the construction and operation of the Project. Feral species known from the Modification to Disturbance Boundary and immediate surrounds are not considered a threat to the Grey-headed Flying-fox.

introduce disease that may cause the species to decline

The Project is considered unlikely to introduce disease that may cause a potentially occurring population of the Grey-headed Flying-fox to decline.

interfere substantially with the recovery of the species

The Grey-headed Flying-fox has not been recorded within the Modification to Disturbance Boundary. The Project will directly impact approximately 0.59 ha of suitable potential habitat for the species. Extensive areas of similar habitat also occur within the locality. Accordingly the Project is not expected to interfere with the recovery of this species.

Conclusion

The Project is expected to directly impact on approximately 0.59 ha of suitable potential habitat for the Grey-headed Flying-fox. Known camps exist elsewhere in the region and based on a lack of records, the Modification to Disturbance Boundary does not support a local population. It is likely that the species forages in the Modification to Disturbance Boundary on occasion as part of a much larger home range. Accordingly no significant impacts are predicted to occur to this species as a result of the Project.

D.4.2 Migratory Species

The following Assessment of Significance has been prepared as a composite test for migratory species listed under the EPBC Act that are likely to occur within the Modification to Disturbance Boundary. These include the following:

- Fork-tailed Swift;
- White-throated Needletail; and
- Rainbow Bee-eater.

Assessment of Significance

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

substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species

The area of habitat within the Modification to Disturbance Boundary to be impacted by the Project is not considered important habitat for these migratory species and it represents a

relatively small area of suitable habitat within a regional context. As such, the action will not substantially modify, destroy or isolate an area of important habitat for these species.

> *result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or*

The area of habitat within the Modification to Disturbance Boundary to be impacted by the Project is not considered important habitat for these migratory species. Feral species known from the Modification to Disturbance Boundary and immediate surrounds are not considered a threat to the assessed species.

> *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.*

The action will not seriously disrupt the lifecycle of an ecologically significant proportion of these species. A relatively small amount of suitable habitat will be directly impacted by the Project, however this is a small area in the broader scale of the species' range, and significant areas of suitable foraging and breeding habitat will continue to exist within the locality.

Conclusion

The habitat occurring within the Modification to Disturbance Boundary is not considered important for the known and potentially occurring migratory species. The area of suitable habitat is considered small compared to the amount of suitable habitat within the species' range, thus no significant impact is predicted to occur to these species as a result of the Project.

Appendix D

Surface Water Assessment

Bengalla Modification

Surface Water Impact Assessment

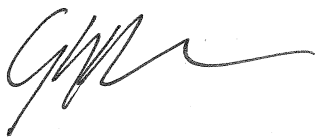
Hansen Bailey Pty Ltd

0643-07-C2, 11 August 2015

Report Title	Bengalla Modification Surface Water Impact Assessment
Client	Hansen Bailey Pty Ltd
Report Number	0643-07-C2

Revision Number	Report Date	Report Author	Reviewer
0	25 June 2015	TB	GR
1	1 July 2015	GR	Hansen Bailey
2	11 July 2015	GR	Hansen Bailey

For and on behalf of WRM Water & Environment Pty Ltd
Level 9, 135 Wickham Tce, Spring Hill
PO Box 10703 Brisbane Adelaide St Qld 4000
Tel 07 3225 0200



Greg Roads
Director

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1 Introduction

Bengalla Mining Company Pty Limited (BMC) received development consent SSD-5170 (DA 5170) on 3 March 2015 under Part 4 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) for the continuation of Bengalla Mine for a further 24 years producing up to 15 Mtpa ROM coal.

BMC is now seeking approval from the NSW Minister for Planning or their delegate for a modification to SSD-5170. The modification is sought under section 96(2) of the EP&A Act for the following:

- Alterations to various water management infrastructure components including:
  - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
  - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme (HRSTS) staged discharge release point;
  - Construction of clean water diversion levees in locations other than those already approved; and
  - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional (possible alternative) location for the siting of the Explosives Storage Facility; and
- The placement of fill from the excavation of CW1 immediately adjacent to it.

A comparison between the approved operations and the Modification elements described above is presented on Figure 1.1 and Figure 1.2 respectively.

This report, prepared by WRM Water & Environment Pty Ltd, presents the methodology and results of surface water investigations undertaken to assess the impacts of the water management infrastructure alterations on the Bengalla water management system and in particular the potential impacts of the Modification on local surface hydrology. The Bengalla water management system is described in detail in the Bengalla Water Management Plan (BMC, 2015).

This report includes a further six sections:

- Section 2 describes the existing water management strategy and the proposed water management system at Bengalla Mine including the proposed modifications;
- Section 3 describes the water balance model developed to assess the effectiveness of the water management system. The operating rules of the various water management storages including the sources of water and demands from the system have also been outlined.
- Section 4 outlines the water balance modelling results to assess the performance of the water management system in:
  - meeting the water management conditions of the Environmental Protection License (EPL);
  - meeting the mine water release conditions of the Hunter River Salinity Trading Scheme (HRSTS) rules;
  - whether sufficient external water licenses are available to meet the site water demands; and
  - assessing the health of the overall water management system.
- Section 5 summarises the findings of the assessment;
- Section 6 provides a list of references.

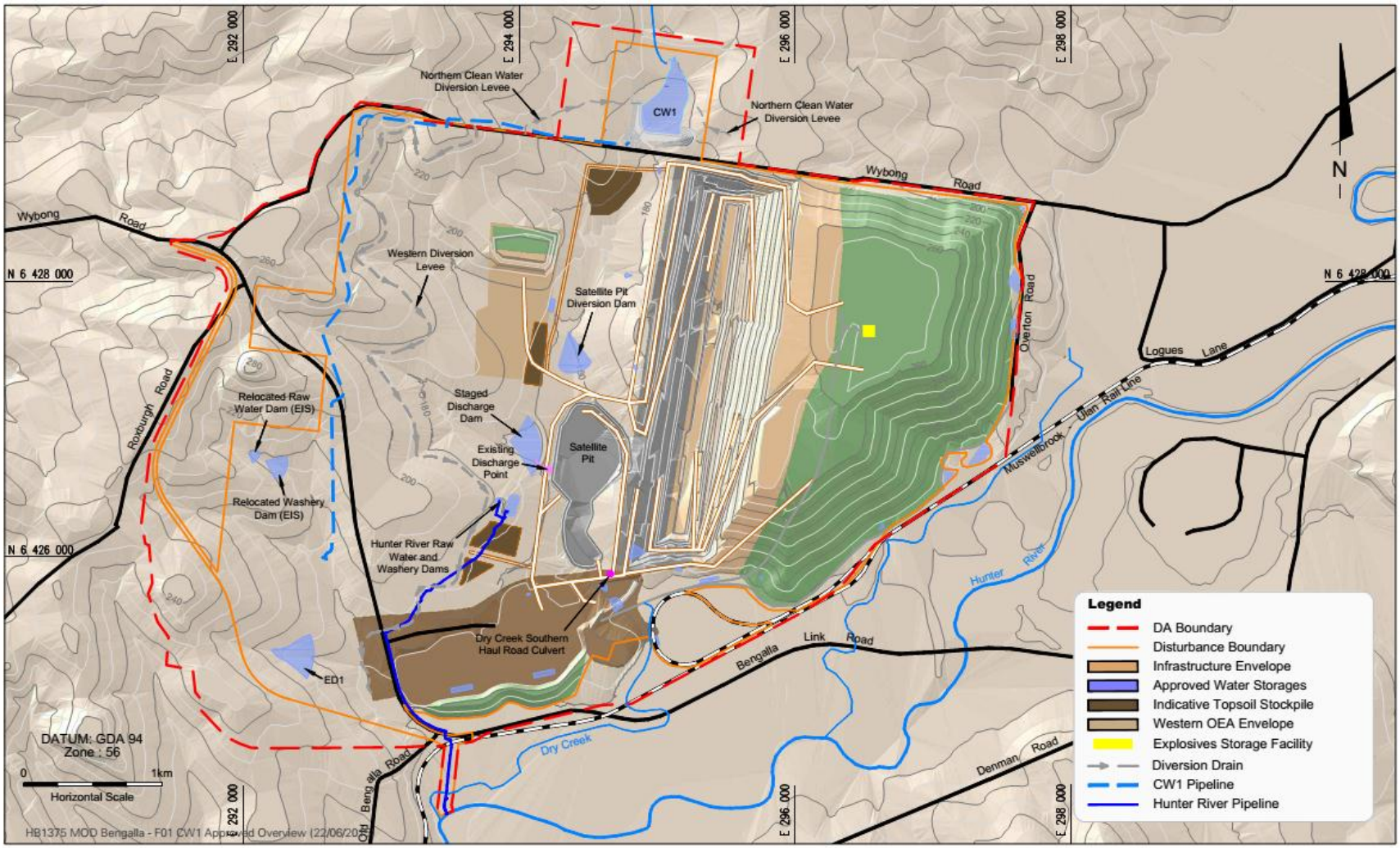

Figure 1.1 - Bengalla Mine Approved Year 4 Mine Plan

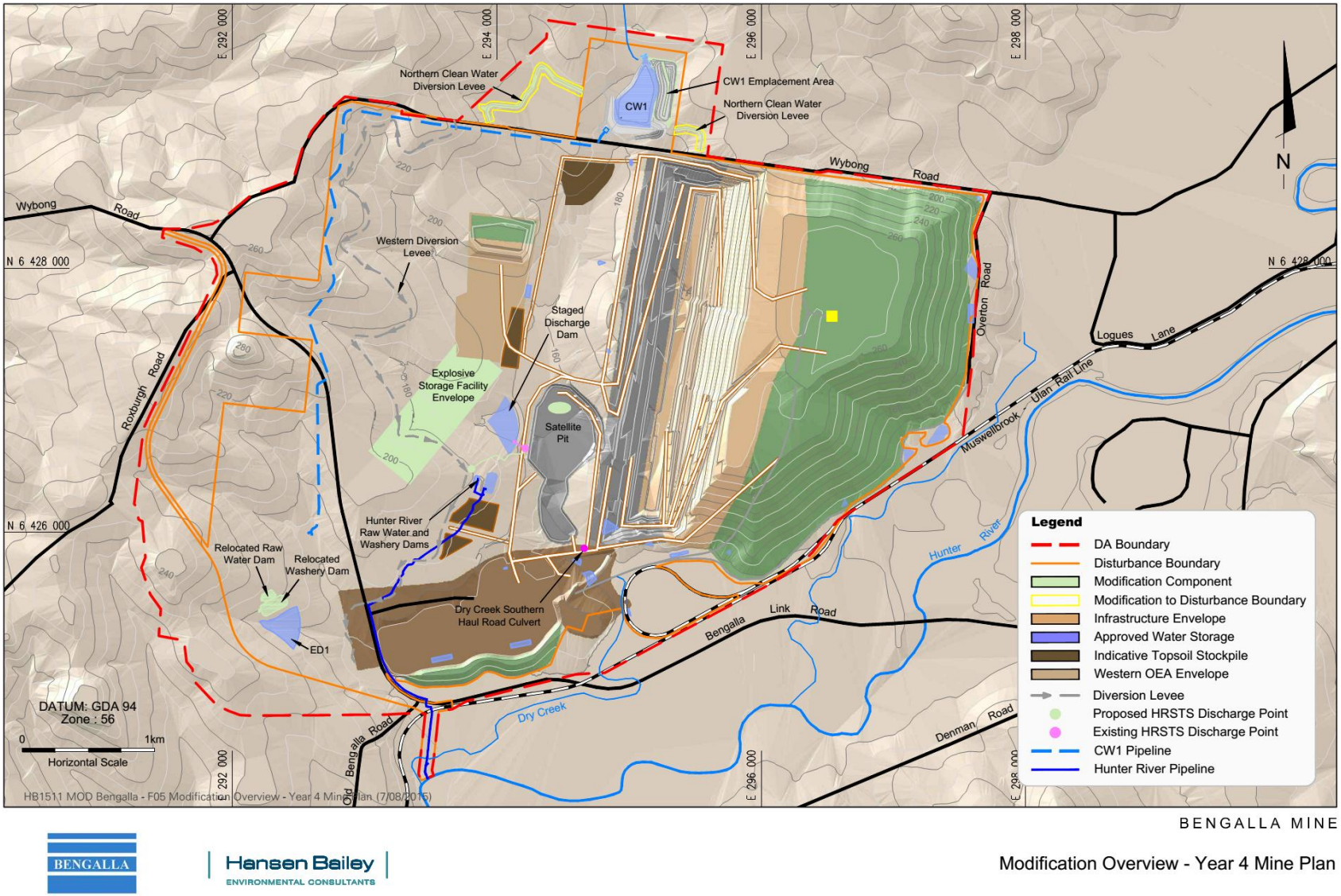

Figure 1.2 - Bengalla Mine Proposed Year 4 Mine Plan including modification elements

2 Water management

2.1 EXISTING WATER MANAGEMENT STRATEGY

The existing Bengalla water management system is operated in accordance with the Bengalla Water Management Plan (BMC, 2015) and the environmental management system (EMS) procedures. BMC's water management system provides an effective and pro-active management tool to ensure best-practice management of all water on site. Surface water management at Bengalla is based on the following key principles:

- minimise use of fresh water from external sources (Bengalla has a current allocation from the Hunter River);
- diversion of clean surface water runoff away from areas disturbed by mining activities;
- collection of surface water runoff from areas disturbed by mining activities in catch drains and direction to sediment traps and settling dams for control of suspended sediment prior to release from site or reuse via the mine water management system;
- collection of runoff from industrial areas in catch drains and direction, via an oil and grease separator, to the Bengalla Waste Water Treatment Plant (WWTP) for treatment and return to storage dams for reuse as mine water supply;
- transfer of open cut pit water to storage dams for reuse as mine water supply; and
- minimal discharge of surplus mine water off-site (i.e. promote recycling of captured water).

2.2 EXISTING WATER MANAGEMENT SYSTEM

The Bengalla water management system includes various water storages for mine water and sedimentation dams for settling of suspended sediment prior to release off site or reuse via the mine water management system as shown in Figure 1.1 and Figure 1.2. The main components of the existing water-related infrastructure include:

- The Washery Dam which supplies process water to the coal handling and preparation plant (CHPP) and truck fill stations. The Washery Dam is also used as a transfer dam, receiving excess mine water which is then pumped to the Staged Discharge Dam.
- The Staged Discharge Dam is the licensed release point for saline water when required in accordance with the HRSTS.
- Water supply infrastructure including the Hunter River intake and pipeline and the Raw Water Dam, which acts as a storage dam for Hunter River water pumped to site.
- The East and West Facilities dams, which capture CHPP return water and runoff from the industrial area.
- The Bengalla WWTP, which treats sewage effluent and directs it into the process water circuit for reuse.
- The Wantana West Dam and Endwall Dam which act as temporary transfer dams receiving pit dewatering for supply to the Washery Dam.
- Sediment traps, drainage channels and sediment dams to collect and treat runoff from spoil and hardstand areas.

- Clean water drains to divert runoff from natural catchments around areas disturbed by mining/infrastructure.

2.3 APPROVED OPERATIONS

To facilitate Bengalla's ongoing operations a number of changes to the original mines water management system were required including:

- Increased water demands associated with increased production rates (when required), including CHPP water use, stockpile and haul road dust suppression and vehicle washdown.
- A potential extension of the existing infrastructure and stockpile areas and associated additional runoff capture capacity to ensure no uncontrolled overflows from the mine water system.
- Mining operations continuing west through existing facilities including the Staged Discharge Dam, Washery Dam and Raw Water Dam. All storages are approved to be relocated at the appropriate time in a location generally west of their current position. The relocated dams will have a similar size and function to the existing dams.
- Mining through Dry Creek, water from which it is proposed to be captured north of Wybong Road in a clean water dam (CW1) and pumped south around the mining operations and released into the Dry Creek tributary west of the Bengalla Link Road. Once mining has progressed sufficiently, Dry Creek will be reinstated through reshaped overburden and CW1 decommissioned.
- Construction of various water management diversion drains and levees along with sediment dams and associated drainage as required.

Further details of the continuation project are given in the Bengalla Continuation EIS (Hansen Bailey, 2013).

2.4 PROPOSED WATER MANAGEMENT SYSTEM

Figure 2.1 to Figure 2.5 show the proposed mine stage plan layouts for Years 1, 4, 8, 15 and 24 incorporating the Modification changes. An overview of progressive development of the water management system is provided below:

- Year 1: Construction of the CW1 and Bengalla East Sediment Dam (completed). Main Pit has advanced so that dewatering is directed to Wantana West Dam only. Endwall Dam is no longer a pit water transfer dam, and now acts as a sediment dam for rehabilitated overburden runoff. Overburden emplacement has commenced at the Western OEA and runoff is collected via the Western OEA Sediment Dam B.
- Year 4: The Satellite Pit is active and dewaters with the Main Pit to Washery Dam (no longer to the Wantana West Dam). The Wantana West Dam now acts as a sediment dam for rehabilitated overburden runoff. The Bengalla Relocated Discharge Dam is being constructed and will be used once the Staged Discharge Mine Dam has been mine through. The additional storages have been constructed to capture the increased infrastructure and stockpile catchment areas (called Additional Facilities Dam and Additional ROM Dam). CW1 is operational on Dry Creek north of Wybong Road with clean water diverted to the discharge point. The infrastructure area has been upgraded, including an additional stockpile capacity.
- Year 8: Satellite Pit has been mined through. The Western OEA is being mined through and runoff is collected via the Western OEA Sediment Dam A. Main Pit has progressed, mining out the Staged Discharge Dam and requiring relocation of the Washery Dam.

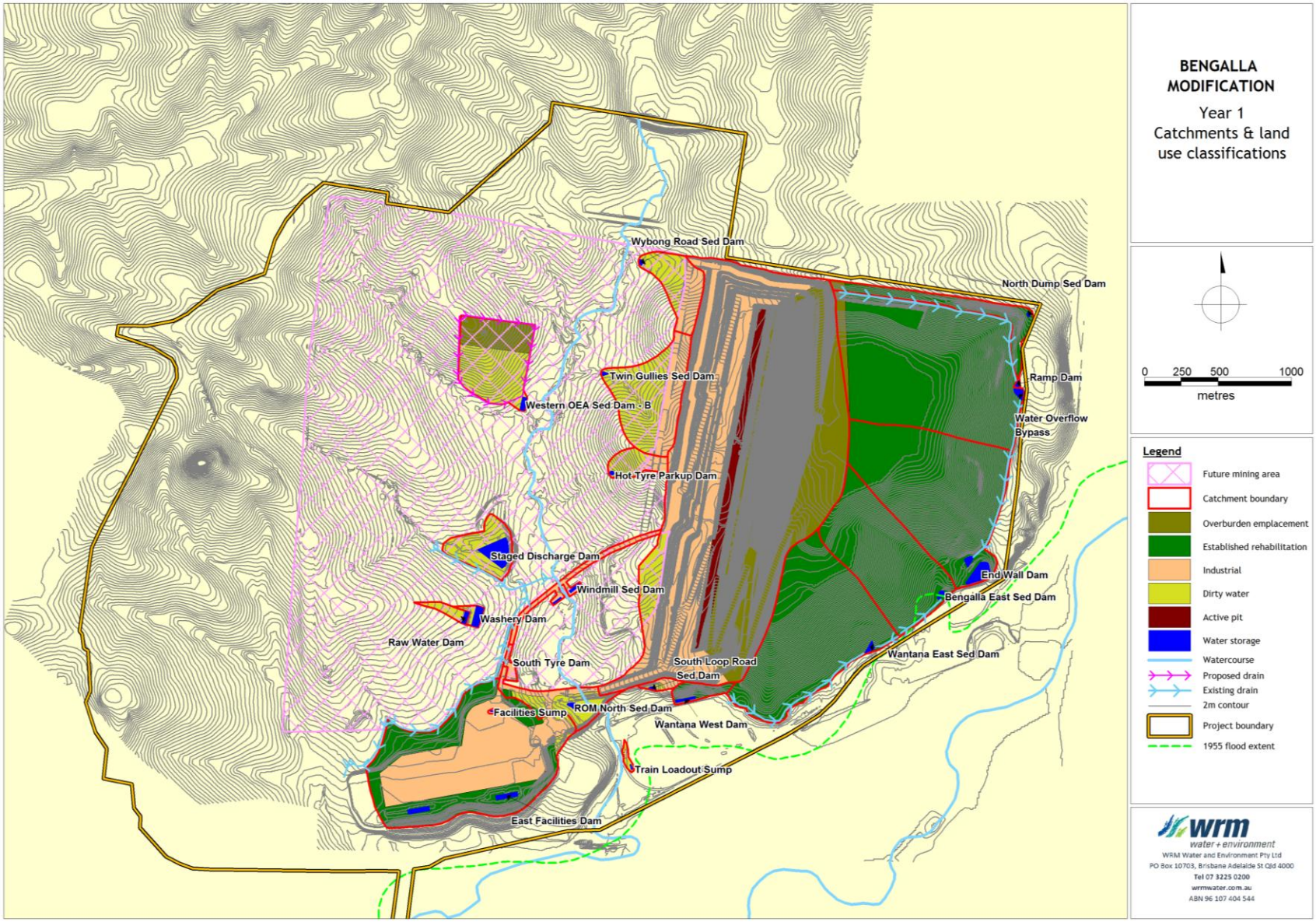

Figure 2.1 - Bengalla Catchments & Land Use Classifications - Year 1

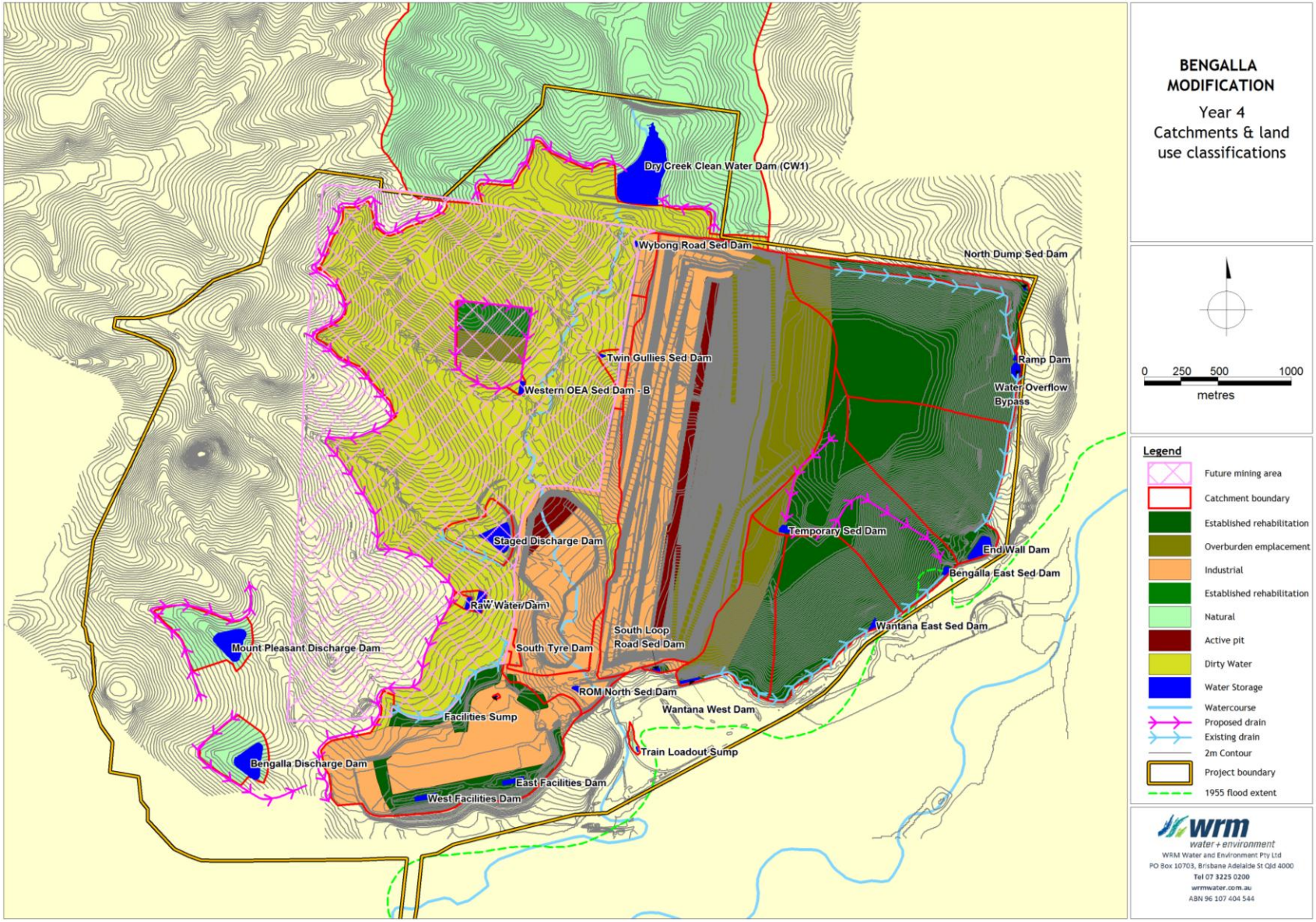

Figure 2.2 - Bengalla Catchments & Land Use Classifications - Year 4

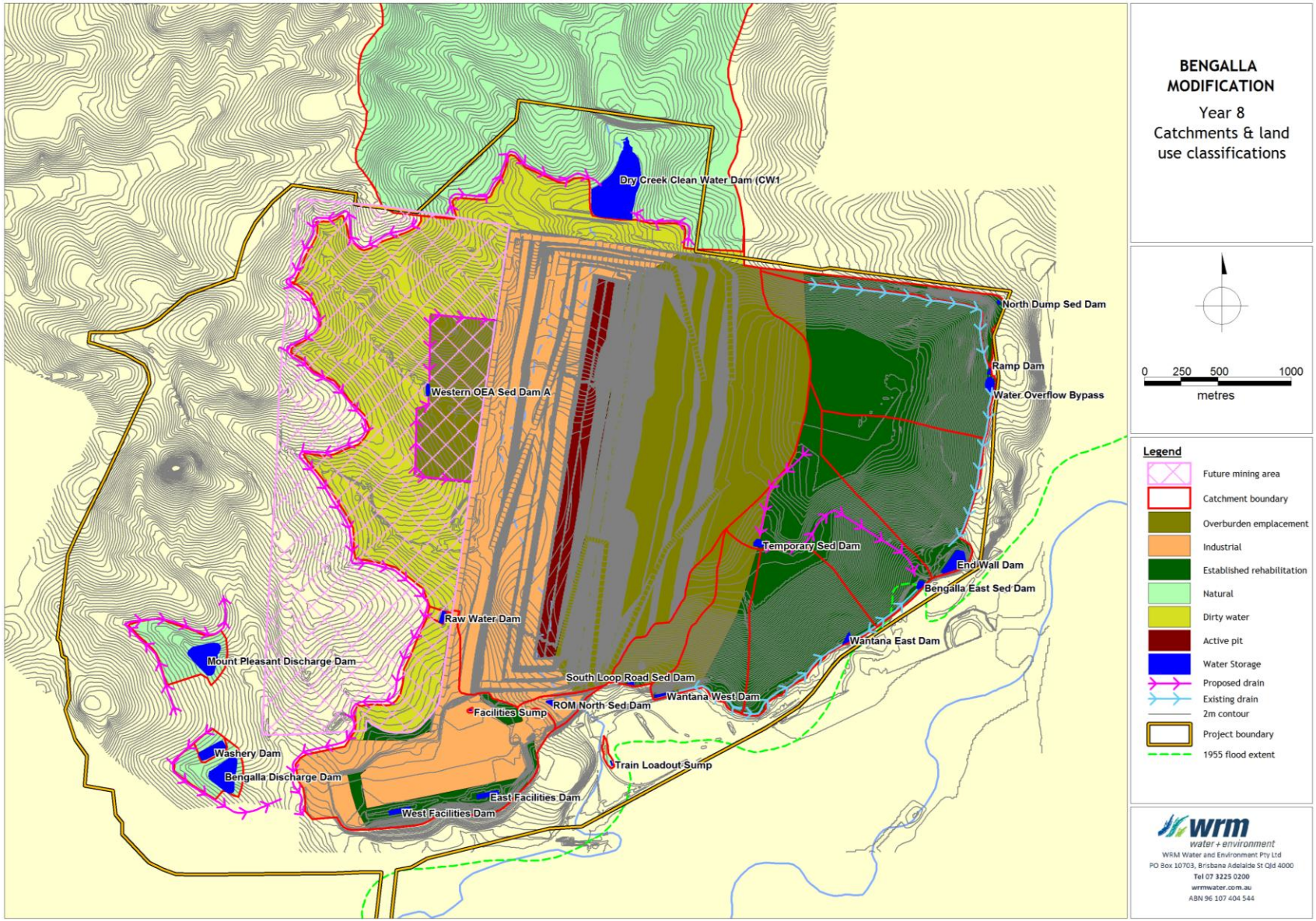

Figure 2.3 - Bengalla Catchments & Land Use Classifications - Year 8

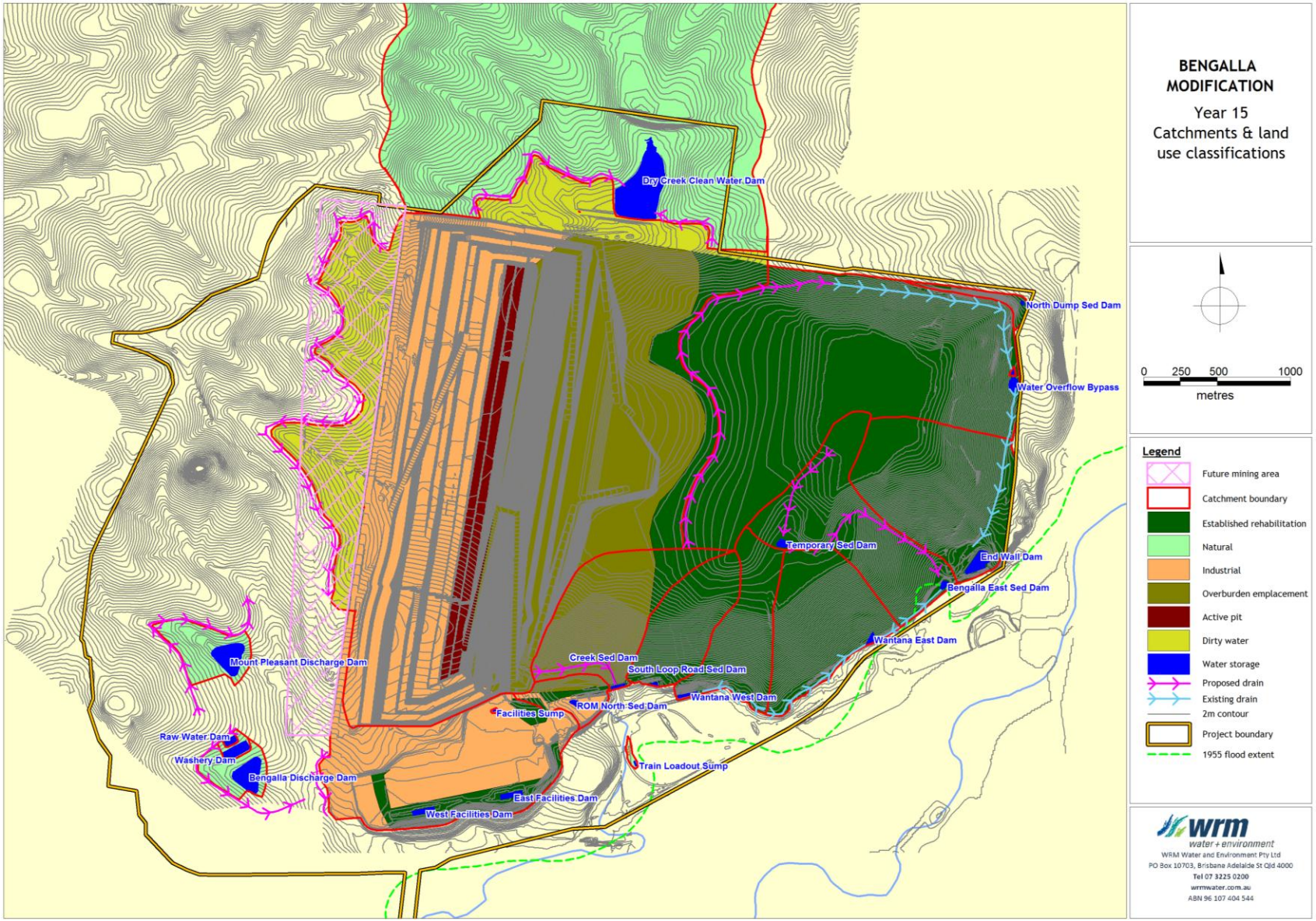

Figure 2.4 - Bengalla Catchments & Land Use Classifications - Year 15

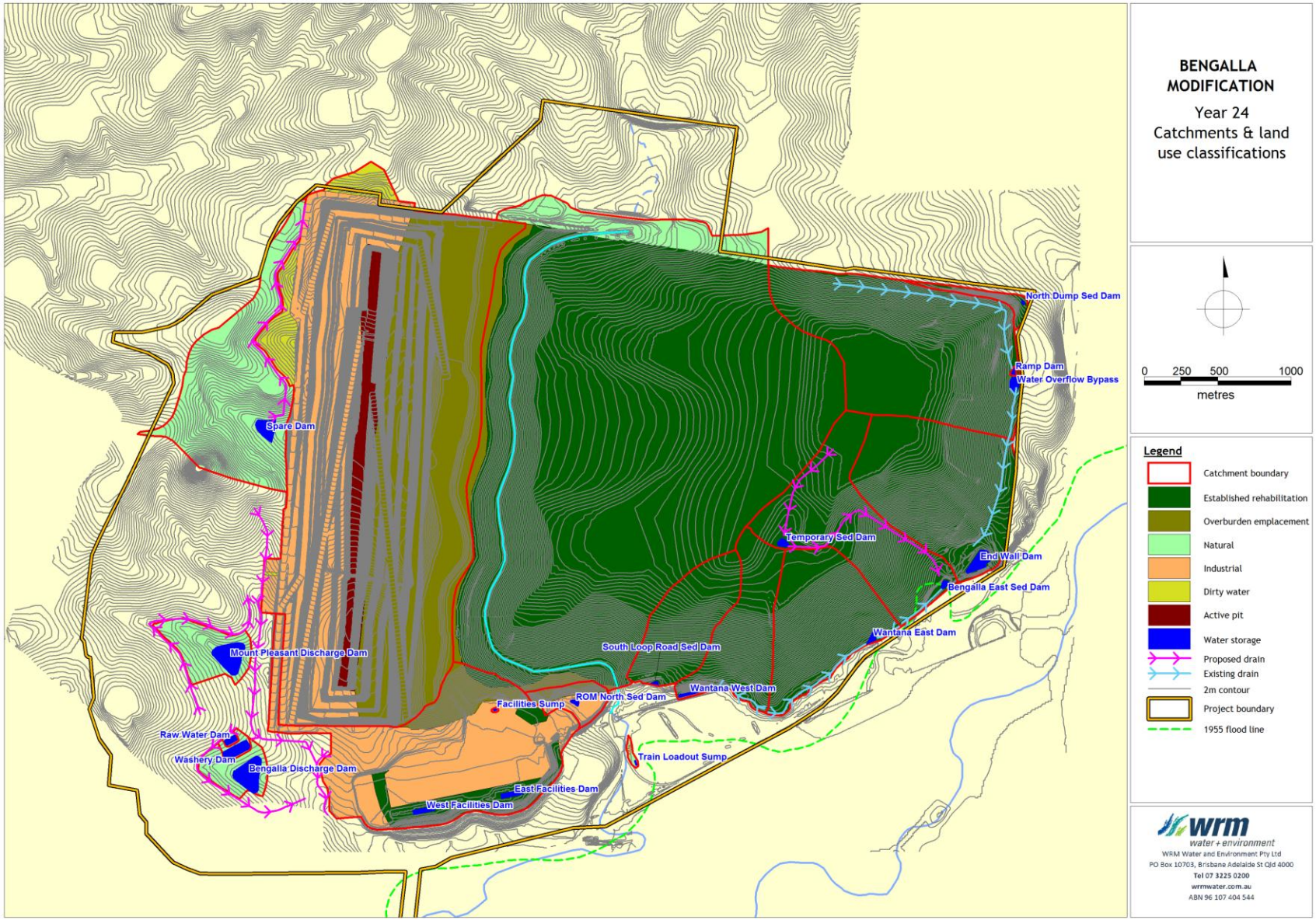

Figure 2.5 - Bengalla Catchments & Land Use Classifications - Year 24

- Year 15: Main Pit has progressed requiring relocation of the Raw Water Dam. The southern end of the Dry Creek relocation has commenced, including a temporary sediment dam (Creek Sediment Dam) to capture the runoff before rehabilitation occurs. The Western OEA has been mined through.
- Year 24: The Dry Creek relocation has been completed and the CW1 and the Creek Sediment Dam are removed. The area to the east of the relocated Dry Creek is now completely rehabilitated. The Spare Dam collects clean water from the west of the pit highwall, which is dewatered to Dry Creek.

The indicative water management system described above will continue to evolve as the mine develops. It is noted that the final timing and positions of relevant infrastructure required for water management system may be subject to change.

2.5 WATER MANAGEMENT STRUCTURES

Table 2.1 shows summary details of the capacity and classification of the existing and proposed storages at Bengalla Mine. The locations of the storages are shown on Figure 2.1 to Figure 2.5. Table 2.2 summarises the period of operation of the existing and proposed storages. All dams have been designed to meet the requirements of SSD-5170. The following dams at Bengalla are prescribed under the Dam Safety Act 1978 (DS Act):

- Staged Discharge Dam; and
- CW1 (pending final confirmation).

Under the DS Act, the NSW Dam Safety Committee requires prescribed dam owners to arrange for:

- proper operation and maintenance of their dams using trained personnel;
- regular dam surveillance using trained personnel;
- appropriate emergency planning and security precautions for their dams;
- ongoing assessment of their dam's behaviour by experienced personnel and regular review of their dam's compliance with current DSC requirements; and
- actions, in response to these assessments to ensure that their dams are maintained in a safe condition.

All prescribed dams at Bengalla will be operated under a safety management system which complies with the requirements of the DSC.

Note that the Additional Facilities Dam and the Additional ROM Dam will only be required should the product stockpile and infrastructure area be extended. It has been assumed that the the product stockpile and infrastructure area will be extended prior to year 4 and the additional storage capacity will be constructed prior to this. For the purpose of the assessment, it has been assumed that the Additional Facilities Dam capacity is incorporated into the East and West Facilities dams and the Additional ROM Dam capacity is incorporated into the existing ROM dam.

Table 2.1 - Bengalla Water Management Structures - Description

Dam	Capacity (ML)	Purpose	Comments
Raw Water Dam^	5.0	Clean Water	Storage dam for Hunter River water, supplies Water Treatment Plant and fire suppression system
Relocated Raw Water Dam*	5.0	Clean Water	
Washery Dam^	25.0	Mine Water	Supply dam for the CHPP and dust suppression water for the water truck fill point and facilities
Relocated Washery Dam*	25.0	Mine Water	
End Wall Dam	80.0	Mine Water/Sediment Dam	Will eventually act solely as sediment dam, accepting rehabilitated overburden runoff
Ramp Dam	16.0	Mine Water	Accepts mine water from the pit and runoff from the pit and spoil area
East Facilities Dam	24.0	Mine Water	Accepts runoff from the CHPP stockpile and main infrastructure area and process water from dewatering of coal reject material
West Facilities Dam	24.0	Mine Water	Accepts runoff from the Western CHPP stockpile area
Additional Facilities Dam**	110.0	Mine water	Additional storage to be constructed should the product stockpile and main infrastructure area be extended
Staged Discharge Dam	280.0	Mine Water	Staging capacity for wet weather conditions.
Bengalla Relocated Discharge Dam^	300.0	Mine water	Licensed release point for saline water under the HRSTS.
Train Loadout Sump	0.5	Sediment Dam	Accepts runoff from the train load out facility
Facilities Sump	0.5	Mine Water	Accepts truck wash down and workshop apron wastewater
Windmill Sedimentation Dams	3.0	Sediment Dam	Accepts runoff from the main haul road adjacent to Dry Creek
Wybong Road Sedimentation Dam	0.4	Sediment Dam	Accepts runoff from pit area, adjacent to Dry Creek
Twin Gullies Sedimentation Dam	32.0	Sediment Dam	Accepts runoff from pit area, adjacent to Dry Creek
North Dump Sedimentation Dam	0.5	Sediment Dam	Accepts runoff from small section of the northern dump
Water Overflow Bypass	10.0	Mine Water	Accepts haul road runoff and runoff from Eastern Overburden Area prior to discharge offsite
Hot Tyre Parkup Dam	0.2	Mine Water	Captures runoff from disturbed areas at Hot Tyre Park up area.
South Loop Road Sedimentation	0.5	Sediment Dam	Captures runoff from disturbed areas associated with Mount Arthur Pit

Dam	Capacity (ML)	Purpose	Comments
Dam			
ROM North & South Sedimentation Dam	1	Sediment Dam	Captures runoff from the ROM visual bund and ROM haul road
Additional ROM Dam**	50	Mine water	Additional storage to be constructed should the main infrastructure area and ROM area be extended.
Wantana West Dam	16**	Mine Water /Sediment Dam	Captures runoff from disturbed areas associated with Wantana Extension and water pumped from the pit up to Year 3. From Year 4 onwards, acts solely as sediment control.
East Wantana Sedimentation Dam	5	Mine Water	Captures runoff from disturbed areas associated with Wantana Extension
Bengalla East Sedimentation Dam*	43**	Sediment Dam	Captures runoff from disturbed areas
Western OEA Sedimentation Dam A*	26**	Sediment Dam	Captures runoff from Western OEA
Western OEA Sedimentation Dam B*	17**	Sediment Dam	Captures runoff from Western OEA
Dry Creek Clean Water Dam (CW1)*	900	Clean water	Captures clean water from upstream Dry Creek catchment
Creek Sedimentation Dam*	36**	Sediment Dam	Captures runoff from disturbed areas during rehabilitation of southern end of Dry Creek
Spare Dam*	100**	Clean water	Captures clean water from upstream catchment

* Dams to be constructed
^ to be relocated as part of Continuation
** Nominal. To be confirmed as part of detailed design.

Table 2.2 - Bengalla Water Management Structures - Period of Operation

Dam	Representative Mine Stage of Continuation				
	Yr1	Yr 4	Yr 8	Yr 15	Yr 24
Raw Water Dam	X	X			
Relocated Raw Water Dam			X	X	X
Washery Dam	X	X			
Relocated Washery Dam			X	X	X
End Wall Dam	X	X	X	X	X
Ramp Dam	X	X	X	X	X
East Facilities Dam	X	X	X	X	X
West Facilities Dam	X	X	X	X	X
Additional Facilities Dam*	X	X	X	X	X
Staged Discharge Dam	X	X			
Bengalla Relocated Discharge Dam		X	X	X	X
Train Loadout Sump	X	X	X	X	X
Facilities Sump	X	X	X	X	X
Windmill Sedimentation Dams	X				
Wybong Road Sedimentation Dam	X	X			
Twin Gullies Sedimentation Dam	X	X			
North Dump Sedimentation Dam	X	X	X	X	X
Water Overflow Bypass	X	X	X	X	X
Hot Tyre Parkup Dam	X				
South Loop Road Sedimentation Dam	X	X	X	X	X
ROM North Sedimentation Dam	X	X	X	X	X
Additional ROM Sedimentation Dam*	X	X	X	X	X
Wantana West Dam	X	X	X	X	X
East Wantana Sedimentation Dam	X	X	X	X	X
Bengalla East Sedimentation Dam	X	X	X	X	X
Western OEA Sedimentation Dam A^			X		
Western OEA Sedimentation Dam B^	X	X			
Dry Creek Clean Water Dam (CW1)	X	X	X	X	
Spare Dam					X
Creek Sedimentation Dam				X	

* for modelling, Additional Facilities Dam capacity was assumed to be captured in existing East and West Facilities Dams and the Additional ROM Dam capacity was assumed to be captured in the existing ROM Dam.
^Only required should the Western OEA be constructed

3 Mine water balance

3.1 OVERVIEW

The computer based OPSIM model has been used to simulate and assess the dynamics of the site water balance at Bengalla Mine (incorporating the proposed changes) under varying climatic sequences. Modelling has been undertaken using the 5 representative mine stages for the project as shown in Figure 2.1 to Figure 2.5. The model simulates the operations of all major components of the proposed water management system on a daily basis using different historical sequences of recorded rainfall data. The simulated inflows and outflows included in the model are given in Table 3.1.

Table 3.1 - Simulated inflows and outflows to the mine water management system

Inflows	Outflows
Direct rainfall on water surface of storages	Evaporation from water surface of storages
Catchment runoff	Site water usage (CHPP, haul road and stockpile dust suppression, vehicle wash)
Groundwater inflows	Controlled discharges (under the HRSTS)
Raw water supply from Hunter River	Offsite spills from storages

3.2 SIMULATION METHODOLOGY

The water balance model was run as a dynamic forecast simulation model.

The 24 year Project life was modelled using historical climatic data from the SILO Data Drill service (Jeffrey et al. 2001). The dynamic configuration allows the simulation to change over the modelled Project life, reflecting changes in the water management system over time.

The forecast water balance results are generated by running multiple climate sequences through the model and taking a statistical representation of the results for the different climate cases modelled. These results more accurately reflect the actual performance of the system because they take into account the dynamic nature of the mine staging, groundwater inflows, and CHPP throughputs. In these runs the model configuration changes over time, to reflect the changes due to mine development.

The forecast water balance model has been run on a daily time-step for a 24 year period, corresponding to the period of operation of the project. The model was run for multiple climate sequences, each referred to as a "realisation". Each realisation is based on a 24 year sequence extracted from the historical rainfall data. The first of 93 realisations is based on rainfall data from 1893 to 1916. The second is based on data from 1894 to 1917, and so on. This approach provides the widest possible range of climate scenarios covering the full range of climatic conditions represented in the historical rainfall record.

The model configuration changes over the 24 year project life, reflecting changes in the water management system over time. The different stages of the mine life are linked in the model to reflect variations over time such as catchments, ROM coal production and groundwater inflows. Five different representative stages of mine life were modelled (Years 1 (existing), 4, 8, 15 and 24). Although the catchment areas will continuously change as mining under the proposal progresses, the adopted approach of modelling discrete stages will provide a reasonable representation of conditions over the 24 year period.

The operational rules and physical layout for each representative stage of mine progression are applied to a range of years given in Table 3.2. The operational rules at

each modelled stage are provided in Section 3.3.1. Although the catchment areas are expected to continuously change over the life of the Project, the simplification is expected to reasonably represent conditions over the 24 year period.

Table 3.2 - Application of representative mine stage to full mine life

Representative Mine Stage	Applied Range of Mine Life	Period (years)
Year 1	Year 1 - Year 3	3
Year 4	Year 4 - Year 7	4
Year 8	Year 8 - Year 14	7
Year 15	Year 15 - Year 23	9
Year 24	Year 24	1

3.3 MODEL CONFIGURATION

3.3.1 Model schematic

Figure 3.1 to Figure 3.5 shows the indicative water management system schematics at each of the representative mine stages.

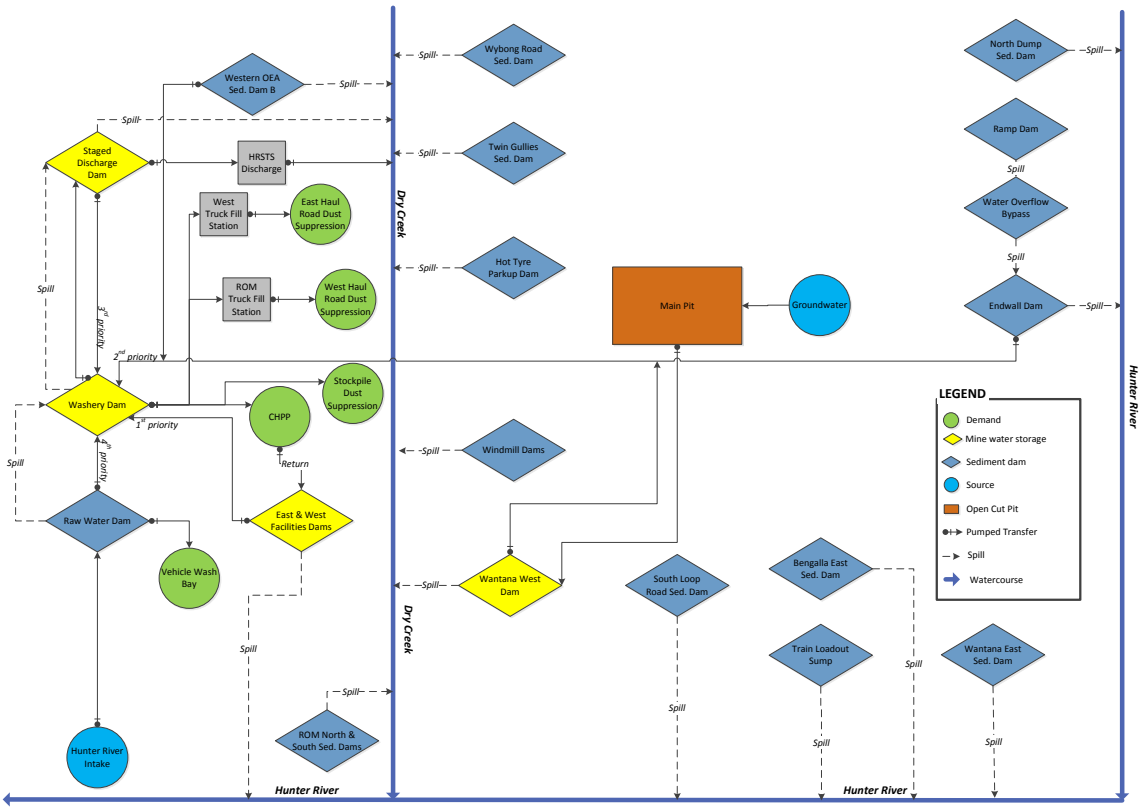

Figure 3.1 - Bengalla Water Management System Schematic - Year 1

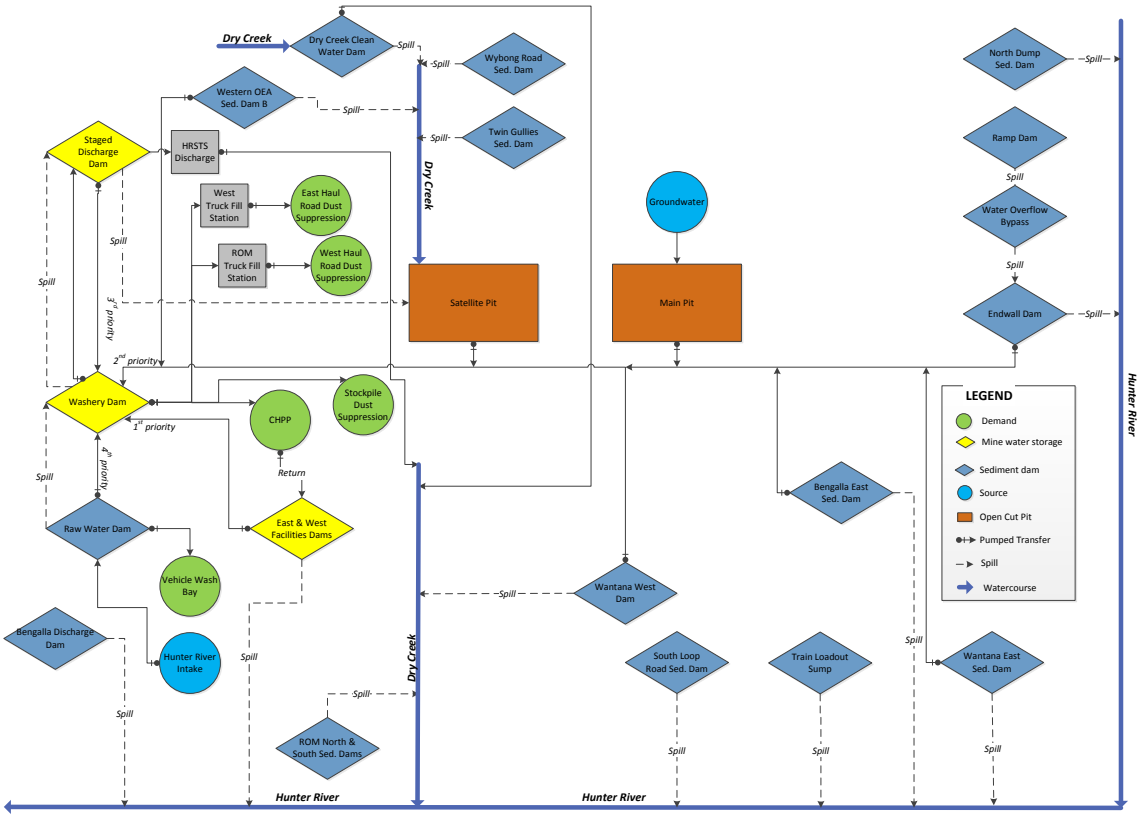

Figure 3.2 - Bengalla Water Management System Schematic - Year 4

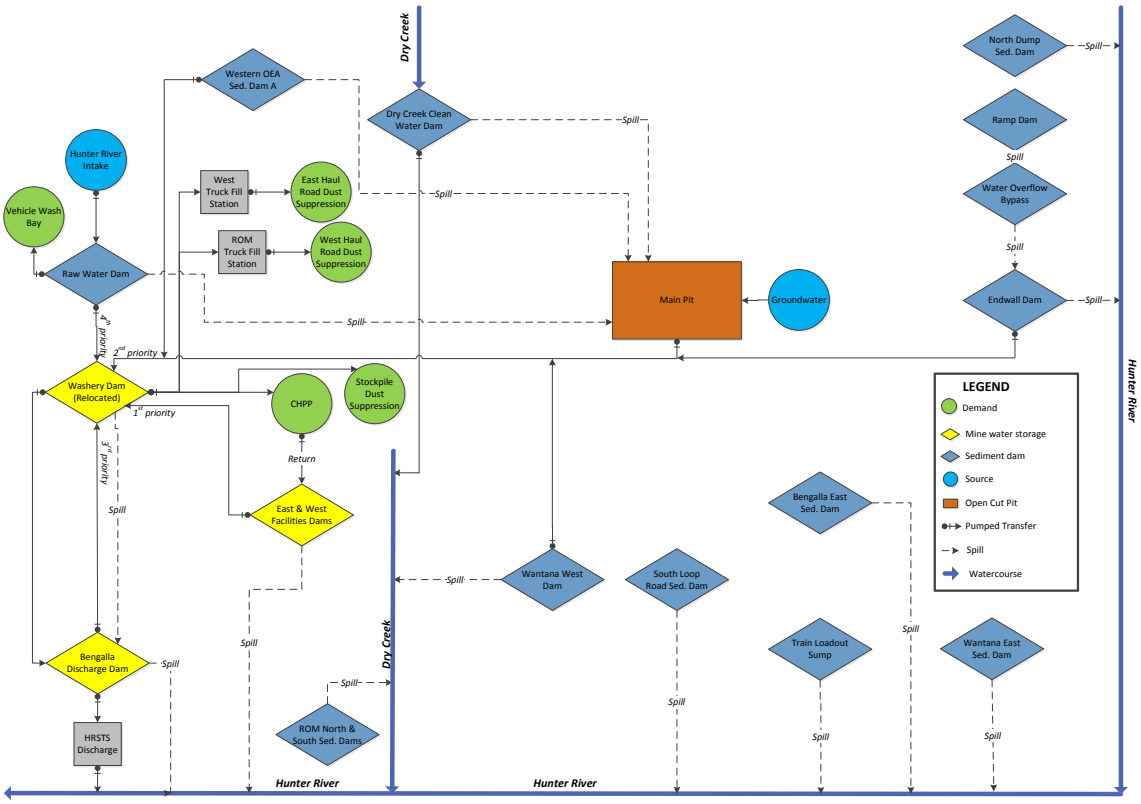

Figure 3.3 - Bengalla Water Management System Schematic - Year 8

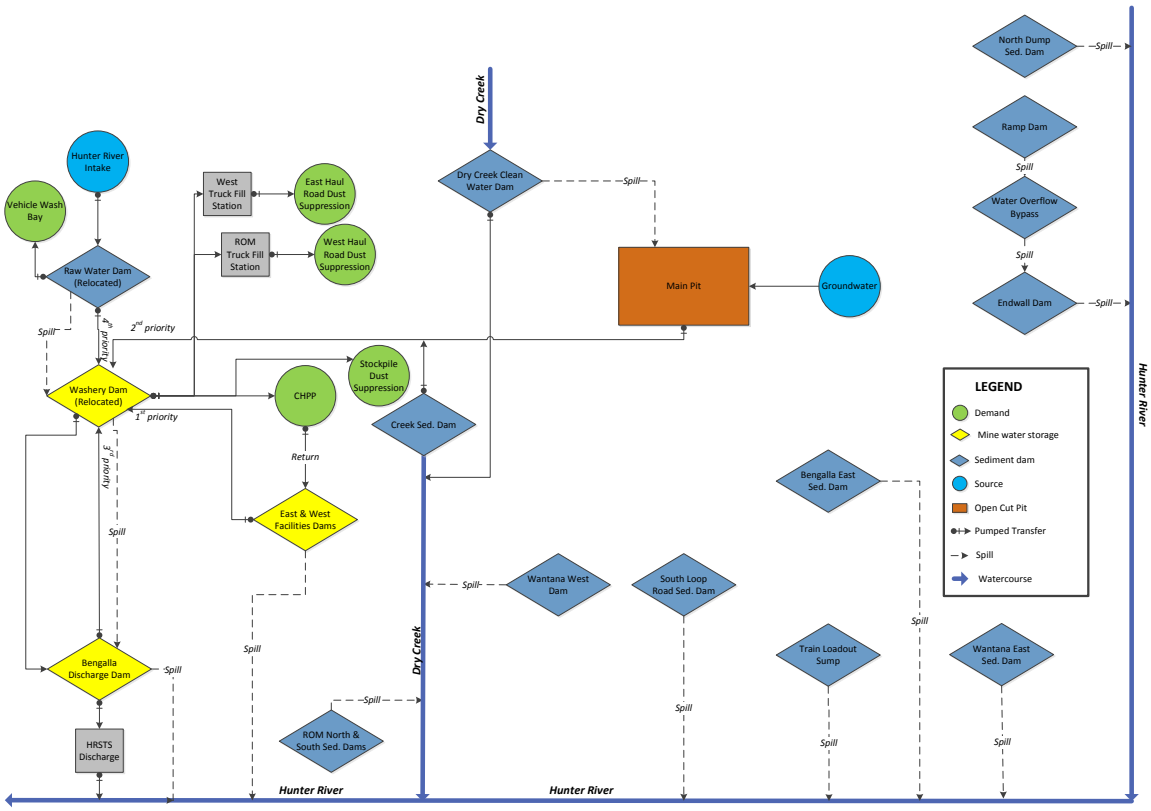

Figure 3.4 - Bengalla Water Management System Schematic - Year 15

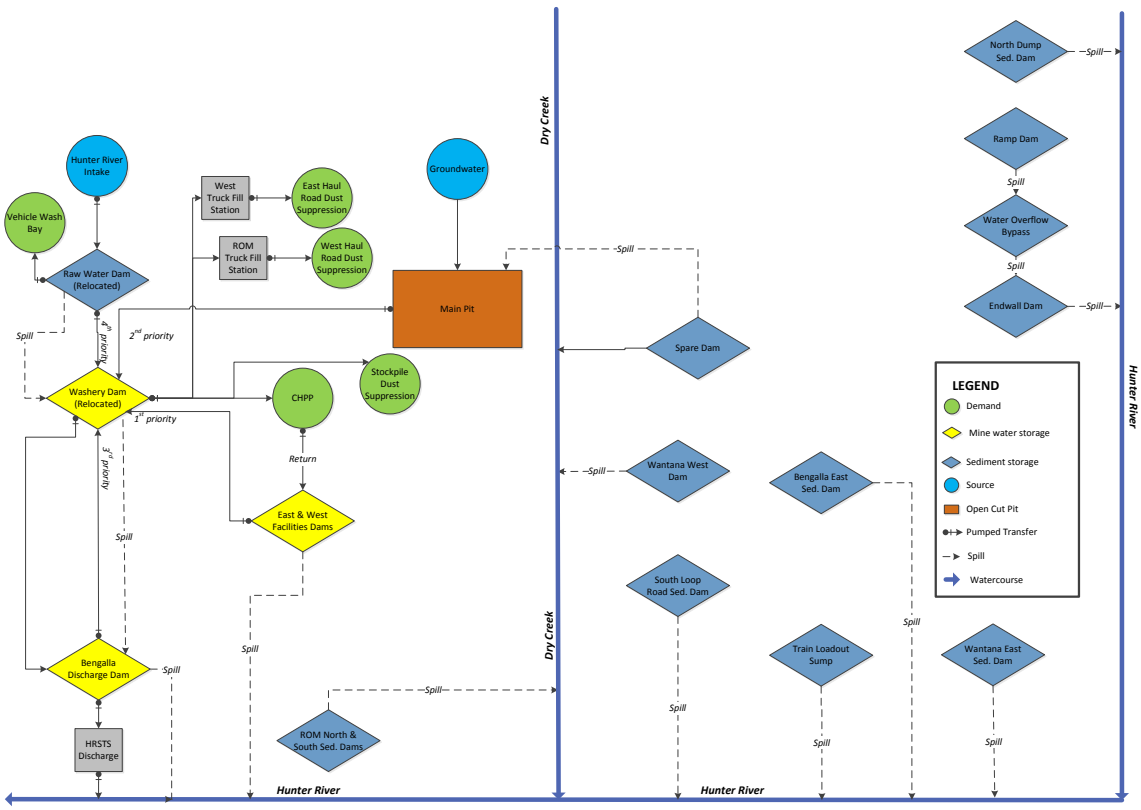

Figure 3.5 - Bengalla Water Management System Schematic - Year 24

3.3.2 Operational rules

Table 3.3 shows the adopted operating rules for the OPSIM water balance simulation.

Table 3.3 – Water balance model operational rules

Item	Node Name	Operational Rules
1.0	**Raw water supply**	• Supplies to the Raw Water Dam as required at a maximum yearly allocation of 1,449 ML/a. • Maximum daily rate of 9.5 ML/d.
1.1	Hunter River supply scheme	
2.0	**Water Demands**	• Supplied from the Washery Dam at the net rates presented in Table 3.8.
2.1	CHPP	
2.2	Haul Road Dust Suppression – East	• Supplied from the Washery Dam via the West Truck Fill Station at the rates presented in Section 3.5. • 100% loss assumed.
2.3	Haul Road Dust Suppression - West	• Supplied from the Washery dam via the ROM Truck Fill Station at the rates presented in Section 3.5. • 100% loss assumed.
2.4	Vehicle Washdown	• Supplied from the Raw Water Dam at the rates presented in Section 3.5. • 100% loss assumed.
3.0	**Operational Pits**	• Receives groundwater inflows at the rates provided in Section 3.4.

	Main Pit	• Continuous dewatering at the following rates:
		  ○ Pit volume <100ML: 100L/s
		  ○ Pit volume 100 - 200ML: 200L/s
		  ○ Pit volume >300ML: 300L/s

	Satellite Pit	• Continuous dewatering to Washery Dam as required at a maximum rates of 200 L/s.
4.0	**Water Storages**	• Primary mine water storage for site operations.

4.1	Washery Dam/Relocated Washery Dam
	
	Mine Stages 1, 4, 8, 15, 24
		• Supplies to the following locations as required:
		  ○ CHPP
		  ○ West Haul Road Dust Suppression via ROM Truck Fill Station
		• Maintained at 10 ML from the following sources in order of priority:
		  ○ East & West Facilities Dams
		  ○ Mining pits
		  ○ Wantana West Dams (Year 1 to 3 only)

Item	Node Name	Operational Rules
		○ Endwall Dam (Year 1 to 3 only) ○ Staged Discharge Dam ○ Sediment dams ○ Raw Water Dam • Pump transfers to the Staged Discharge Dam when >80% capacity (20 ML). • Storage overflows to Staged Discharge Dam.
4.2	Staged Discharge Dam/ Relocated Bengalla Discharge Dam *Mine Stages 1, 4, 8, 15, 24*	• Receives pumped transfers from the Washery Dam. • Controlled releases to Dry Creek via HRSTS under the following conditions: ○ >70% capacity (200 ML). ○ Refer Section 3.6.2. • Receives spills from Washery Dam. • Storage overflows to Dry Creek/Hunter River.
4.3	Endwall Dam *Mine Stages 1, 4, 8, 15, 24*	• Pump transfer to Washery Dam when possible. • Storage overflows to Hunter River.
4.4	Ramp Dam (Mine Stages 1, 4, 8, 15, 24)	• Storage overflows to Water Overflow Bypass.
4.5	East & West Facilities Dams (incl. Additional Storage) *Mine Stages 1, 4, 8, 15, 24*	• Receive return from CHPP. • Pump transfer to Washery Dam to maintain below 20%. • Storage overflows to Hunter River.
4.6	ROM North & South Sediment Dams (incl. Additional ROM Storage) *Mine Stages 1, 4, 8, 15, 24*	• Storage overflows to Dry Creek.
4.7	Facilities Sump *Mine Stages 1, 4, 8, 15, 24*	• Supplies to Vehicle Washdown. • Maintained at 0.5 ML from the Washery Dam. • Storage overflows to East & West Facilities Dams.
4.8	Wybong Road Sediment Dam *Mine Stages 1, 4*	• Storage overflows to Dry Creek.
4.9	Twin Gullies Sediment Dam *Mine Stages 1, 4*	• Storage overflows to Dry Creek.

Item	Node Name	Operational Rules
4.10	Hot Tyre Parkup Dam *Mine Stages 1*	• Storage overflows to Dry Creek.
4.11	South Loop Road Sediment Dam *Mine Stages 1, 4, 8, 15, 24*	• Storage overflows to Dry Creek.
4.12	Train Loadout Sump *Mine Stages 1, 4, 8, 15, 24*	• Storage overflows to Dry Creek.
4.13	Wantana West Sediment Dam *Mine Stages 1, 4, 8, 15, 24*	• Pump transfer to Washery Dam to maintain empty, until rehabilitated. • Storage overflows to Dry Creek.
4.14	Wantana East Sediment Dam *Mine Stages 1, 4, 8, 15, 24*	• Pump transfer to Washery Dam to maintain empty, until rehabilitated. • Storage overflows to Hunter River.
4.15	North Dump Sediment Dam *Mine Stages 1, 4, 8, 15, 24*	• Storage overflows to Hunter River.
4.16	Western OEA Sediment Dam *Mine Stages 1, 4, 8*	• Pump transfer to Washery Dam to maintain empty, until rehabilitated. • Storage overflows to Dry Creek.
4.17	Bengalla East Sediment Dam *Mine Stages 1, 4, 8, 15, 24*	• Pump transfer to Washery Dam to maintain empty, until rehabilitated. • Storage overflows to Hunter River.
4.18	Dry Creek Clean Water Dam	• Pumped transfer to Dry Creek to maintain empty. • Storage overflows to Dry Creek (yr 1), Satellite Pit (yr 4) and Main Pit (yr 8,15).
4.19	Raw Water Dam/Relocated Raw Water Dam *Mine Stages 1, 4, 8, 15, 24*	• Storage maintained at 5 ML from the Hunter River intake at a maximum rate of 9.5 ML/d. • Supplies to Washery Dam as required. • Storage overflows to Washery Dam.
4.20	Windmill Dams *Mine Stage 1*	• Storage overflows to Dry Creek.
4.21	Water Overflow Bypass *Mine Stages 1, 4, 8, 15, 24*	• Storage overflows to Endwall Dam.

Item	Node Name	Operational Rules
4.22	Creek Sediment Dam *Mine Stage 15*	• Pump transfer to Washery Dam to maintain empty. • Storage overflows to Dry Creek.
4.23	Spare Dam *Mine Stage 24*	• Pumped transfer to Dry Creek to maintain empty. • Storage overflows to Main Pit

6.0	Receiving Waters	• Receives controlled discharges from Staged Discharge Dam under HRSTS.
		• Receives storage overflows from the following locations:
		  ○ Wybong Road Sediment Dam
		  ○ Twin Gullies Sediment Dam
		  ○ Hot Tyre Parkup Dam
		  ○ Windmill Dams
		  ○ Wantana West Dam
		  ○ ROM North and South Sediment Dams
		  ○ South Loop Road Sediment Dam
		  ○ Train Loadout Sump
		  ○ Creek Sediment Dam

6.1	Dry Creek	

6.2	Hunter River	• Supplies to Raw Water Dam via Hunter River intake.
		• Receives storage overflows from the following locations:
		  ○ North Dump Sediment Dam
		  ○ Ramp Dam
		  ○ Endwall Dam
		  ○ Water Overflow Bypass Dam
		  ○ Wantana East Sediment Dam
		  ○ East & West Facilities Dams
		  ○ Bengalla East Sediment Dam

3.3.4 Starting inventories

Table 3.4 shows the storage inventories adopted as initial conditions in the water balance model.

Table 3.4 - Inventories at model commencement

Storage	Starting Inventory (ML)
Washery Dam	20 ML
Staged Discharge Dam	38 ML
Endwall Dam	6 ML
East & West Facilities Dam	5 ML

3.4 WATER SOURCES

3.4.1 Groundwater inflows

Adopted groundwater inflows are shown in Table 3.5 (AGE, 2012). The inflows have been corrected for evaporation so that they reflect the 'pumpable' seepage inflows from groundwater to the open cut pit(s), and averaged over the modelled period of the mine stage. The volume of 'pumpable' inflows is the total volume of seepage minus losses due to evaporation. The volume of pumpable inflows will be zero where the evaporation rate exceeds the seepage rate.

Table 3.5 - Groundwater Inflows to Open Cut Pit (AGE, 2012)

Mine Stage	'Pumpable' Groundwater Inflows	
	ML/d	ML/a
Year 1	0.544	199
Year 4	0.038	14
Year 8	0	0
Year 15	0.008	3
Year 24	0	0

3.4.2 Catchment runoff

3.4.2.1 Catchment and land use classifications

The changes in the physical layout are represented in the mine stage plans given in Figure 2.1 to Figure 2.5 for Years 1, 4, 8, 15 and 24 respectively. Table 3.6 shows a summary of the catchment areas reporting to each storage, and further detail is provided in Appendix A, where catchment areas are separated by the different land use types.

Table 3.6 – Storage catchment areas

Storage	Year 1	Year 4	Year 8	Year 15	Year 24
Bengalla Discharge Dam		14.7	14.7	11.6	11.6
Bengalla East Sed Dam	48.5	75.7	75.7	73.1	73.2
Creek Sed Dam				62.4	
Dry Creek Clean Water Dam	631.3	631.3	631.3	630.9	603.7
East & West Facilities Dam	89.2	109.0	134.1	116.0	132.1
End Wall Dam	76.8	76.8	76.8	87.2	87.5
Hot Tyre Parkup Dam	5.9				
Facilities Sump		0.1	0.1	0.1	0.1
Main Pit	285.2	307.8	838.8	759.0	467.5
Mount Pleasant Discharge Dam		18.0	18.0	18.0	18.0
North Dump Sed Dam	13.5	14.8	14.8	4.8	4.8
Ramp Dam	3.8	8.6		0.2	0.2
Raw Water Dam	2.0	1.0	0.9	0.7	0.7
ROM North Sed Dam	12.1	14.2	5.9	13.4	9.9
Satellite Pit		522.9			
South Loop Road Sed Dam	1.7	1.6	24.0	38.2	38.2
South Tyre Dam	1.2	1.2			
Spare Dam					83.8
Staged Discharge Dam	12.0	12.0			
Train Loadout Sump	0.8	0.8	0.8	0.8	0.8
Twin Gullies Sed Dam	29.2	7.9			
Wantana East Sed Dam	71.8	59.4	59.4	59.4	59.4
Wantana West Dam	3.9	40.8	40.8	42.1	
Washery Dam	1.5	1.5	14.7	1,917.9	2.5
Water Overflow Bypass	99.3	105.1	113.7	3,824.2	1,594.0
Western OEA Sed Dam B	25.8				
Windmill Sed Dams	5.2	25.8			
Wybong Rd Sed Dam	13.1	5.4			
Total	**802.5**	**2,056.4**	**2,064.5**	**7,660.0**	**3,188.0**

3.4.2.2 AWBM rainfall runoff parameters

The OPSIM model uses the Australian Water Balance Model (AWBM) (Boughton WC, 1993) model to estimate runoff from rainfall. The AWBM is a saturated overland flow model which allows for variable source areas of surface runoff.

The AWBM uses a group of connected conceptual storages (three surface water storages and one ground water storage) to represent a catchment. Water in the conceptual storages is replenished by rainfall and is reduced by evaporation. Simulated surface runoff occurs when the storages fill and overflow.

The model uses daily rainfalls and estimates of catchment evapotranspiration to calculate daily values of runoff using a daily water balance of soil moisture. The model has a baseflow component which simulates the recharge and discharge of a shallow subsurface store. Runoff depth calculated by the AWBM model is converted into runoff volume by multiplying the contributing catchment area.

The model parameters define the storage depths (C1, C2 and C3), the proportion of the catchment draining to each of the storages (A1, A2 and A3), and the rate of flux between them (Kb and BFI) (Boughton, 2003). Catchments across the site have been characterised into land use types, adopted from previous surface water investigations (PB, 2009) including:

- Natural / dirty water;
- rehabilitated spoil;
- industrial;
- open cut pit; and
- active spoil.

The model parameters are shown in Table 3.7.

Table 3.7 - Adopted Rainfall-Runoff Parameters - AWBM Model

Parameter	Natural / dirtywater	Rehabilitated Spoil	Industrial	Open Cut Pit	Active Spoil
A1	0.134	0.134	0.134	0.2	0.136
A2	0.433	0.433	0.433	0.6	0.27
A3	0.433	0.433	0.433	0.2	0.594
C1	5.7	5.7	2.6	5	50
C2	57.8	57.8	26.7	70	100
C3	115.7	115.7	53.3	90	500
C_{avg}	76	76	35	61	331
K_b	0.993	0.933	1	1	1
BFI	0.39	0.39	0	0	0.103
Long-term Volumetric Runoff Coefficient	12.4%	12.4%	21.8%	15.7%	2.7%

3.5 WATER DEMANDS

3.5.1 Coal handling & preparation plant

Table 3.8 shows the net CHPP demand for the project based on production profile provided. The project has a maximum ROM throughput of 15 Mtpa modelled from Year 4. The net CHPP demand is based on the average plant usage of 77.6 L/ROM tonne (wet) which is based on recorded net water use during the 2011 calendar year.

Table 3.8 - Net CHPP Water Loss

Mine Stage	CHPP Throughput (Mtpa)	Net CHPP Demand (ML/a)
1	10.7	830
4, 8, 15, 24	15.0	1,164

3.5.2 Stockpile dust suppression

Stockpile dust suppression rates have been provided by BMC based on existing usage rates. A proposed expansion to the stockpile area in Year 4 will increase dust suppression requirements. Adopted stockpile dust suppression requirements are as follows:

- Existing & Year 1: 115 ML/a
- Year 4 – Year 24: 150 ML/a

3.5.3 Haul road dust suppression

Table 3.9 shows the average dust suppression water requirements for the project. The estimates of haul road lengths were based on the mine plans and an assumed watered width of 25 m. Dust suppression rates were based on a dry day haul road watering rate of 3.1 mm/d. This rate is 66% higher than the average recorded rate over the period 2007 to 2011 to account for the increase in the control rate to 85% for haul road dust suppression to ensure consistency with BMC's existing Air Quality Management Plan and Pollution Reduction Program requirements (J Martin 2012, pers. comm., 15 October).

Table 3.9 - Estimated Haul Road Dust Suppression Requirements

Mining Stage	Dust Suppression Area (ha)	85% Control	
		Maximum Daily Dust Suppression (kL/d)*	Yearly Average Dust Suppression (ML/a)**
Year 1	42.0	1,319	408
Year 4	47.1	1,478	457
Year 8	45.0	1,414	437
Year 15	54.3	1,706	527
Year 24	52.5	1,648	509

* For a non-rainfall (0 mm) day.
** Based on long-term average including rainfall days.

3.5.4 Vehicle wash down

It is assumed that vehicle wash down is proportional to throughput, and will be adjusted accordingly for the water balance modelling for the Project. The demand rate is based on the 2008 vehicle wash usage.

3.5.5 Demand summary

Table 3.10 presents a summary of the site demands.

Table 3.10 - Summary of the Project Site Demands - Net Usage

Mining Stage	Site Demands (ML/a)				
	CHPP Net Demand	Stockpile Dust Suppression	Haul Road Dust Suppression	Net Vehicle Washdown	Total Site Demand
Year 1	830	115	408	97	1,450
Year 4	1,164	150	457	132	1,903
Year 8	1,164	150	437	132	1,883
Year 15	1,164	150	527	132	1,973
Year 24	1,164	150	509	132	1,955

3.5.6 Water quality

Water quality as salinity (electrical conductivity) is modelled in the water balance as a catchment salts generation rate. Salts generation rates for the various land use types are based on analysis of the site water dams water quality monitoring as given in the Bengalla Water Management Plan (BMC, 2015). Table 3.11 shows the salts generation rates adopted in the water balance model. Table 3.11 also shows the adopted open cut pit groundwater inflow salt concentration, based on groundwater quality monitoring results.

Table 3.11 - Adopted Water Quality Salts Generation Rates

Land Use	Salt Generation Rate (µS/cm)	Basis
Natural/dirty water	240	Average of Twin Gullies Sedimentation Dam and Wantana Sedimentation Dam (August 2009)
Rehabilitated Spoil	500	Lower envelope of Endwall Dam & Endwall Sedimentation Dam (January 2007 to July 2011)
Industrial	1,700	Average EC of East & West Windmill Dams (January 2007 to July 2011)
Open Cut Pit	5,000	Upper envelope of Endwall Dam & Endwall Sedimentation Dam (January 2010 to July 2011)
Active Spoil	1,000	Average EC of MTA Pit Sedimentation Dam (December 2008 to March 2009)
Groundwater	1,300	Average EC of alluvial aquifer monitoring (May 1999 to June 2011)
Hunter River Intake	550	Average EC of Hunter River at W04 (2006 to 2011)

3.6 CONTROLLED MINE WATER RELEASES

3.6.1 Overview

Wherever possible, saline mine water and treated sewage water are recycled and used for coal processing and dust suppression, to minimise the risk of requiring off-site discharges of surplus mine water.

During periods of high rainfall, excess water from Bengalla can be discharged into the Hunter River under the Hunter River Salinity Trading Scheme (HRSTS) during periods of 'high' or 'flood' flows. The HRSTS was introduced by the NSW Government to reduce salinity levels in the Hunter River and allows controlled water discharges into the Hunter River. Any required discharges of water are managed under the guidelines of the HRSTS (operated under the *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002)* and MERFF. Discharges are conducted strictly in accordance with BMC's Environment Protection Licence (EPL) 6538 administered under the *Protection of the Environment Operations Act 1997* (POEO Act). Bengalla is permitted to discharge no more than 200 ML per day under the HRSTS, in accordance with section L4.1 of EPL 6538 and conditions stipulated in *Managed Envelope of Residual Flood Flows* (MERFF).

All discharges are released from the main Bengalla water storage (Staged Discharge Dam) and additional surface water monitoring is also undertaken during any such discharge event. Discharges at Bengalla have been infrequent since commencement of operations and it is envisaged that discharges will continue to remain infrequent and only be required following prolonged, heavy rainfall.

3.6.2 Hunter River Salinity Trading Scheme

The HRSTS discharges have been modelled as follows:

- Hunter River Streamflow time series – simulated streamflow data was obtained from the NSW Office of Water IQQM model (this model is still under review and not yet signed off for Water Sharing Plan Rules) for the period 1/1/1900 to 30/6/2007.
- Salinity –Recorded salinity data was obtained for the Hunter River at Denman (#210055) from PINEENA, covering the period February 1993 to October 2010. Based on the recorded historical data, a relationship between streamflow and water quality was developed. EC's for high flows only (1,000 – 4,000 ML/d) were plotted against flow rates and a logarithmic trend line fitted to the data, giving salinity as a function of flow rate.
- Using IQQM flows at Denman, Glennies Creek and Singleton – the flow is classified at Denman as low, high or flood on a daily basis (e.g. flow at Denman is only high if high in all sectors).
- The salinity function is then applied to get a Hunter River flow and EC time series at Denman which is used in OPSIM as the reference node.
- In OPSIM, controlled discharges were simulated using an Environmental Transfer (ETN) node with two 'rules' for discharge. Rule 1 limits the volume of discharges based on the flow rates in the Hunter River, as shown in Table 3.12. Rule 2 limits the salt load discharged based on the salinity in the Hunter River, as shown in Table 3.13.

Table 3.12 - HRSTS Rule 1 (Volume Limit Rating)

Hunter River Qref (ML/d)	Site Discharge Qmax (ML/d)	Apply Rule 2	Comment
0	0	x	No site discharges allowed when Hunter River flows are <1,000 ML/d.
999	0	x	
1,000	200	✓	When Hunter River flows are 1,000 -4,000 ML/d, up to 200 ML/d can be discharged from site, with salinty restrictions as per 'Rule 2'.
4,000	200	✓	
> 4,000	200	x	When Hunter River flows are >4,000 ML/d, up to 200 ML/d can be discharged from site, with no salinity restrictions.

Where:

- Q_{ref} is the reference volume [ML/d] (in this case, the Hunter River).
- Q_{max} is the discharge limit [ML/d] for Q_{ref}.

Table 3.13 - HRSTS Rule 2 (TDS Rating)

Method	Cr (µS/cm)	K Value	Comment
K + Cr	0	600	If the EC in the Hunter River is zero, the concentration in the Hunter River can increase by up to 600 µS/cm due to discharges under the HRSTS.
K + Cr	600	0	If the EC in the Hunter River is 600 µS/cm, the concentration in the Hunter River can increase by zero µS/cm due to discharges under the HRSTS.

Where:

- Cr is the concentration at the Reference Node (in this case, the Hunter River).
- K is concentration increase (linearly interpolated between the specified values).
- Limiting transfer concentration is calculated as K+Cr.

For the purposes of the water balance modelling, it has been assumed that a low water inventory trigger of 200 ML is set on the Staged Discharge Dam/Bengalla Relocated Discharge Dam and Main Pit (i.e. no discharges if volume in Staged Discharge Dam + Main Pit < 200ML). For the purposes of the water balance modelling it is assumed that the Washery Dam transfers to the Staged Discharge Dam when it reaches >80% capacity (20 ML).

A sample of the simulated Discharge Dam behaviour is shown in Figure 3.6, including simulated Hunter River flows and salinity (at Denman), Pit and Discharge Dam stored inventories and simulated discharges from the Discharge Dam under the HRSTS.

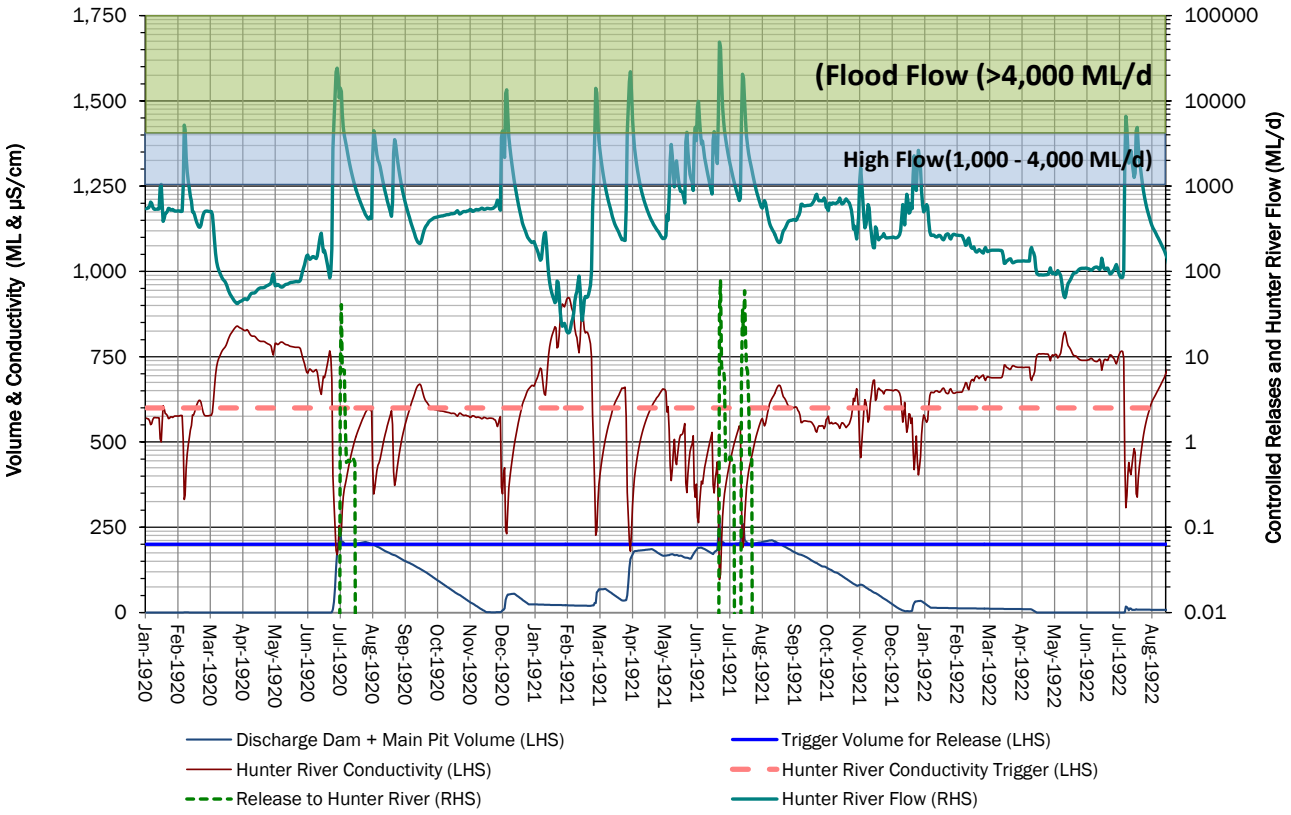

Figure 3.6 - Sample of Simulated Discharge Dam Behaviour

4 Water balance model results

4.1 OVERVIEW

The OPSIM model was used to assess the performance of the proposed water management system against the following:

- meeting the water management conditions of the EPL;
- meeting the mine water release conditions of the HRSTS rules;
- whether sufficient external water licenses are available to meet the site water demands; and
- assessing the health of the overall water management system.

4.2 INTERPRETATION OF RESULTS

The forecast model results indicate the likelihood of the mine water system achieving different levels of performance over the life of the Project. A forecast simulation provides a statistical analysis of the water management system's performance over the 24 year Project life, based on 91 realisations with different climatic sequences. The 50th percentile probability represents the median results, the 10th percentile represent 10% exceedance and the 90th percentile results represent 90% exceedance. There is an 80% chance that the result will fall within the 10th and 90th percentiles and a 98% chance the result will fall between the 1st and 99th percentiles. Importantly, a percentile trace shows the chance of a particular value, and does not represent continuous results from a single model realisation e.g. the 50th percentile trace does not represent the model time series for median climatic conditions.

4.2.1 Uncontrolled Offsite Releases

The results of the site water balance modelling show that the mine water management system can generally be operated in accordance with its EPL conditions. The model results indicate that there is:

- no uncontrolled release of mine affected water from the Staged Discharge Dam or Bengalla Discharge Dam over the Project life;
- no uncontrolled release of mine affected water from Wantana West Dam during Years 1 to 3 prior to it being converted to a sediment dam.
- less than a 1% annual risk of discharge from the East & West Facilities Dam; and

There is one modelled discharge from the East & West Facilities Dam, which is associated with the extreme flood event that occurred between 24 and 29 February 1955, where over 250 mm of rainfall fell over a 72 hour period. This event exceeded the 100 year ARI rainfall intensity for a 72 hour storm duration in the vicinity of the Project.

Uncontrolled offsite releases occur from sedimentation dams, which have been treated for sediment.

4.2.2 Controlled Offsite Discharges under HRSTS

Controlled offsite discharges refers to water discharged under the HRSTS directly from the Staged Discharge Dam/Bengalla Relocated Discharge Dam to Dry Creek. Figure 4.1 shows the total annual water discharges to Dry Creek over the Project period. Review of the results indicates the following:

- The 50th percentile annual discharge shows that no discharges are required under the HRSTS.

- The 90th percentile annual discharge shows that up to approximately 750 ML/a are discharged under the HRSTS.
- The 99th percentile annual discharge shows that up to approximately 1,550 ML/a are discharged under the HRSTS.
- There is a marked increase in potential discharges in Year 8 of Project life, likely associated with the large increase in impervious catchment area reporting to the mine water system. Year 4 has a total 'disturbed' footprint of 531 ha (industrial + overburden + active pit areas), compared to 744 ha in Year 8 (refer Section 3.4.2).

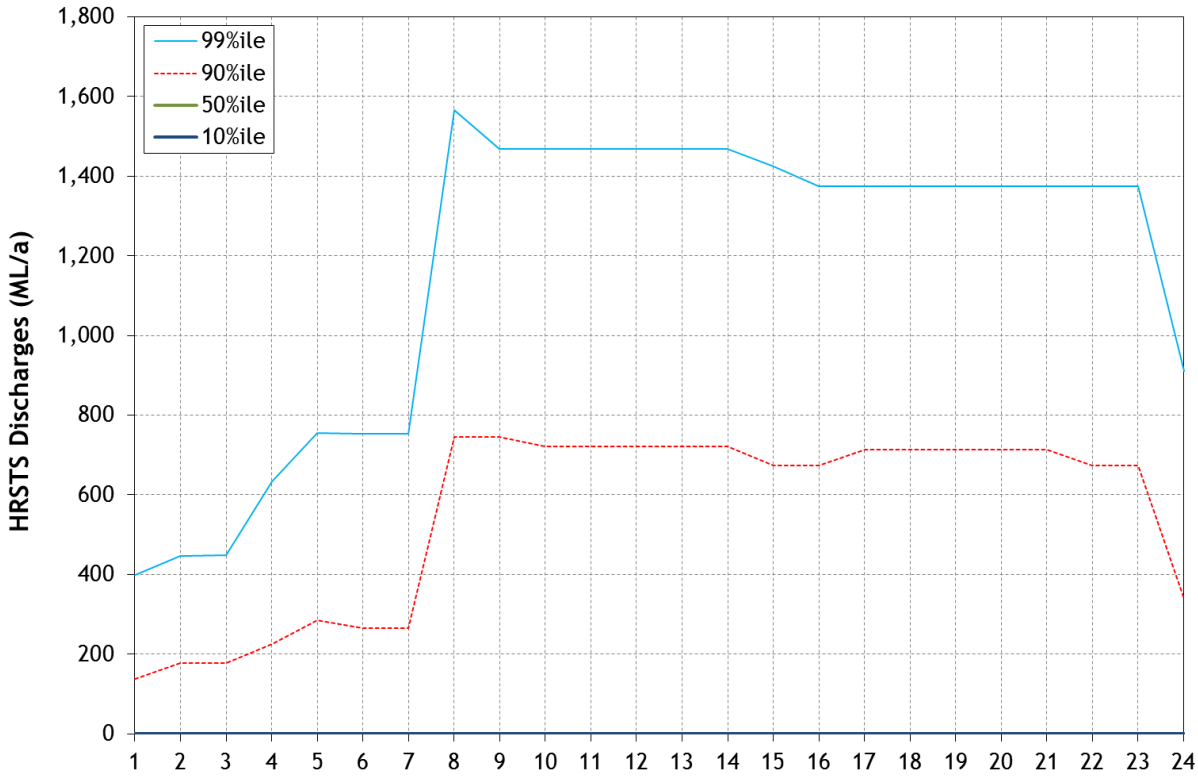

Figure 4.1 - Annual HRSTS Discharges

4.2.3 External Water Supply Requirements

Figure 4.2 shows the total annual modelled demand for water from an external source over the Project period. Review of the results indicates the following:

- There is a marked increase in raw water requirement in Year 4 of the Project life. This is likely due to the increase in CHPP throughput and increased haul road dust suppression requirements.
- The median (50th percentile) raw water requirement from an external source is between 1,140 and 1,530 ML/a during Years 5 to 24; and
- The 99th percentile raw water requirement from an external source is between 1,770 and 1,920 ML/a ML/a during Years 5 to 24.

The raw water source for the site demands is via an existing allocation from the Hunter Regulated River Water Source, which is pumped to the Raw Water Dam when required. Raw water is used as a last priority to meet site demands, with the exception of the vehicle wash demand which ranges between 97 and 132 ML/a.

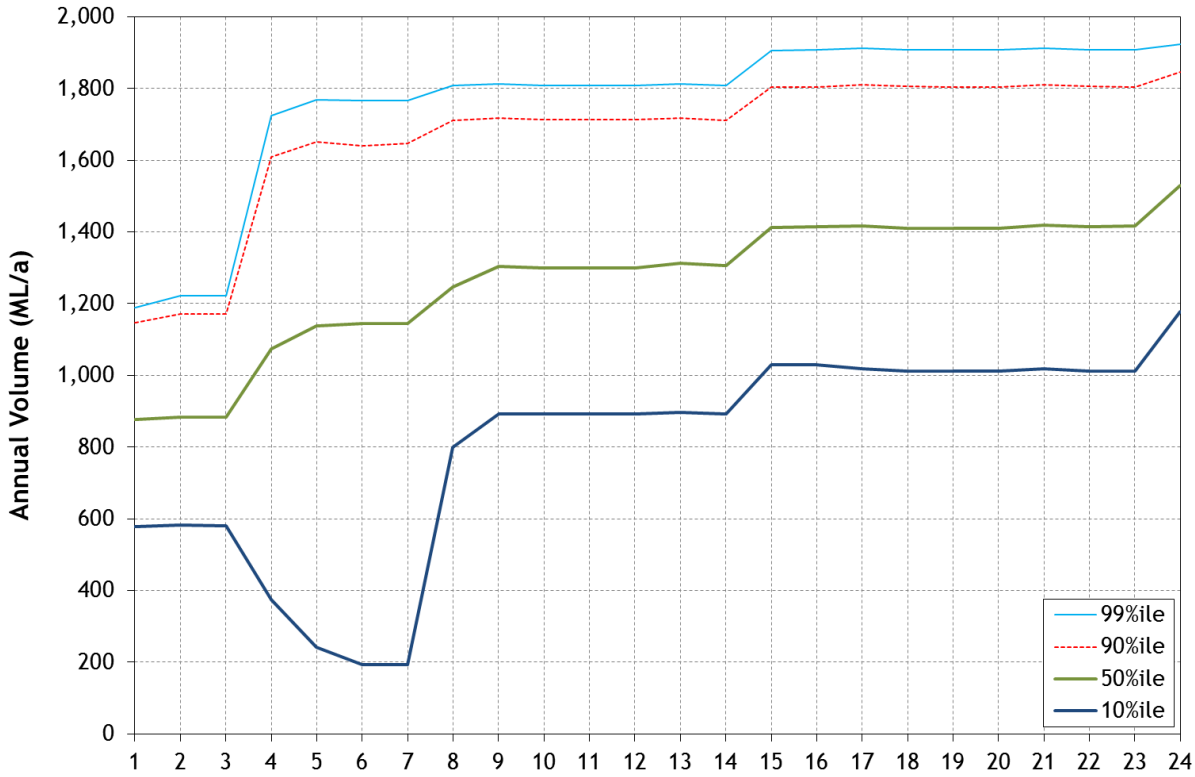

Figure 4.2 - Annual Raw Water Requirements - External Source

BMC hold WALs with sufficient share component totalling 6,017 units (comprising 1,455 high security units and 4,562 general security units) to account for the maximum predicted take for the life of Bengalla based on predicted demands from the Hunter Regulated River Water Source (Management Zone 1A). BMC maintains exclusive rights for the dedicated use of at least 2,534 units (comprising 1,449 high security units and 1,085 general security units) under these WALs. The remaining units of the WALs (comprising 2,702 units) are currently subject to use by licensees of BMC owned land for agricultural purposes.

4.2.4 Health of the water management system

The health of the water management system is reflected in the modelled stored inventory in the open cut pits. The operational rules have been set to ensure that the EPL conditions are met, which means that excess water is stored in-pit until it can be dewatered. The operation of the mine is potentially impacted when there is excess water in the pit. It also suggests that additional out of pit storage is required.

Figure 6.16 and Figure 6.17 show the stored inventory in the Main Pit and Satellite Pit respectively over the Project life. Review of the results indicates the following:

- The median (50th percentile) inventories of Main Pit and Satellite Pit show that the pits are generally maintained dry.
- The 90th percentile inventory in Main Pit reaches 240 ML. This volume generally occurs when the Satellite pit is operational. Excess water will be pumped to the Main pit when and if these wet conditions occur. This has not been explicitly modelled.
- The 90th percentile inventory in Satellite Pit reaches 450 ML (excluding Main Pit water), which would potentially affect mining. There is sufficient flexibility in the mine plan to slow mining in the Satellite Pit if these wet conditions prevail.

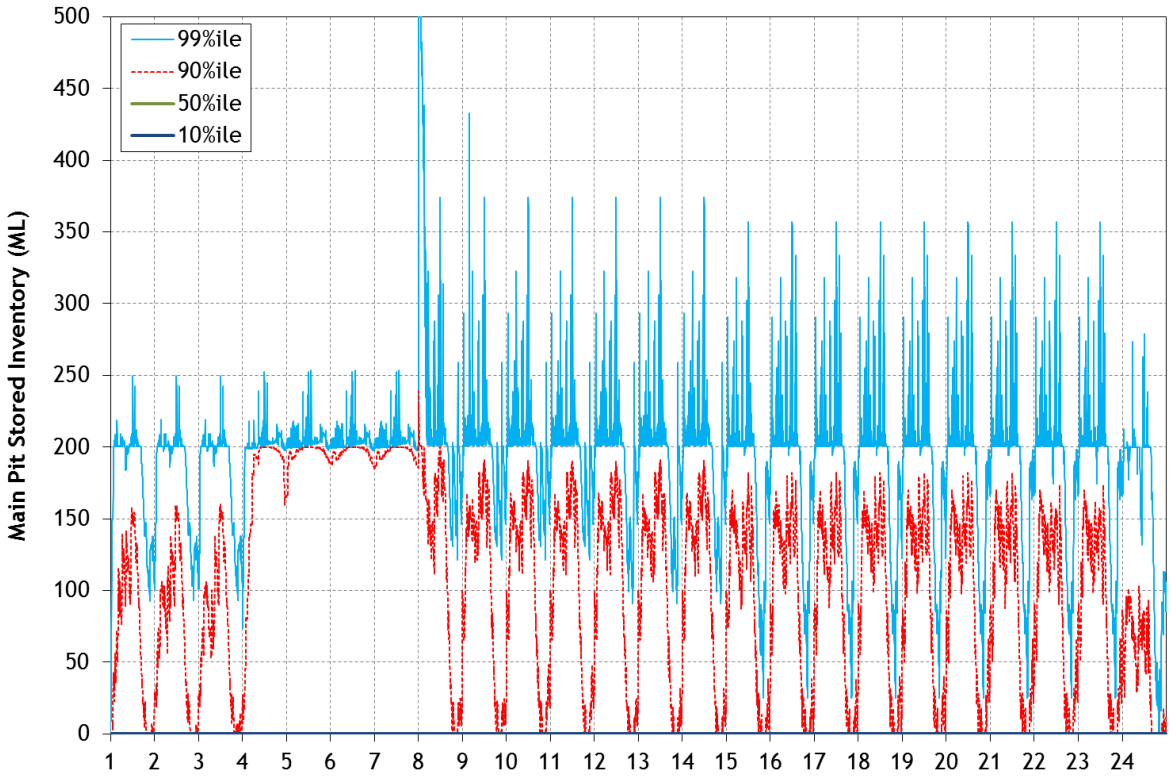

Figure 4.3 - Main Pit Stored Inventory (ML)

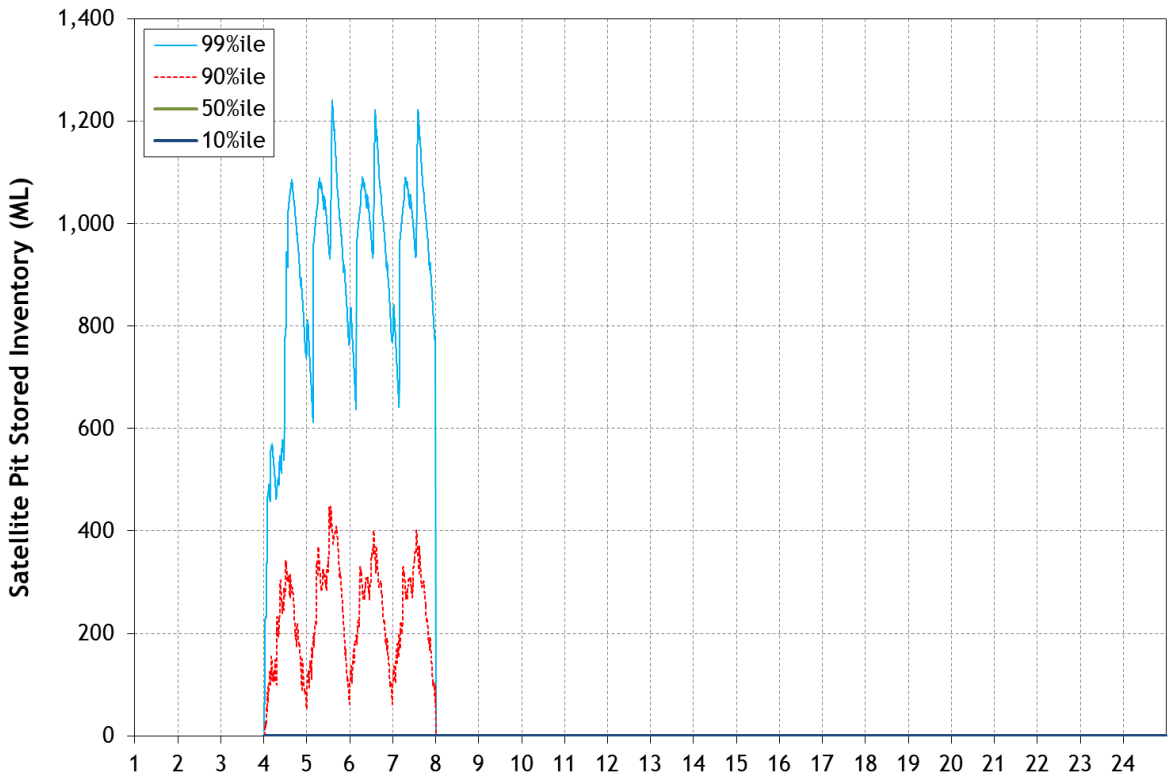

Figure 4.4 - Satellite Pit Stored Inventory (ML)

5 Summary of findings

Water balance modelling has been undertaken to assess the impacts of the proposed water management infrastructure alterations on the Bengalla water management system and in particular the potential impacts of the Modification on local surface hydrology. The results of the mine water balance are summarised below:

- The mine water management system can generally be operated in accordance with its EPL conditions with respect to uncontrolled releases of mine affected water.
    - There is one modelled discharge from the upgraded East & West Facilities Dam (after the existing capacity has been increased). The East and West facilities dam spill is associated with the extreme flood event that occurred between 24 and 29 February 1955, where over 250 mm of rainfall fell over a 72 hour period. This event exceeded the 100 year ARI rainfall intensity for a 72 hour storm duration in the vicinity of the Project.
    - There are no uncontrolled releases from any other mine water dam.
- Controlled releases under the HRSTS will be required if wet conditions prevail. There is a 50% chance of no HRSTS releases, a 10% chance (90th percentile trace) of at least 750 Ml/a of releases and a 1% chance (99th percentile trace) of at least 1,550 ML/a of releases
- External water will be required to meet mine site demand. The median (50th percentile) external water requirement is between 1,140 and 1,530 ML/a during Years 5 to 24 and the 99th percentile raw water requirement from an external source is between 1,770 and 1,920 ML/a during Years 5 to 24. BMC hold sufficient WALs from the Hunter Regulated River Water Source with sufficient share component totalling 6,017 units (comprising 1,455 high security units and 4,562 general security units) to account for the maximum predicted take for the life of the project.
- The overall health of the water management system is reflected in the modelled stored inventory in the open cut pits. The median (50th percentile) inventories of Main Pit and Satellite Pit show that the pits are generally maintained dry with no long term build up. The 90th percentile inventory in Main Pit and the Satellite Pit reaches 240 ML and 450 ML respectively. The Satellite Pit will be used to store excess water when wet conditions prevail. The excess water can generally be managed in Pit when the Satellite Pit has been consumed.

6 References

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BMC, 2015 — *Bengalla Mining Company Pty Limited Water Management Plan.* Report prepared by WRM, Hansen Bailey and AGE dated 20 May 2015.

Boughton WC, 1993 — *A hydrograph based model for estimating the water yield of Ungaged Catchments*, Hydrology and Water Resources Symposium, June 1993, newcastl

Boughton, 2003 — *Calibrations of the AWBM for Use on Ungauged Catchments*, Technical Report 03/15, Cooperative Research Centre for Catchment Hydrology, December 2003.

Hansen Bailey, 2013 — *Continuation of Bengalla Mine Environmental Impact Statement* prepared by Hansen Bailey Environmental Consultants September 2013

Jeffrey et al. 2001 — *Using Spatial interpolation to Construct a Comprehensive Archive of Australian Climate Data, Environmental Modelling & Software, Vol. 16/4, pp. 309-330, 2001*

PB, 2009 — *Existing Surface Water Management Infrastructure Assessment – Bengalla Coal Mine, September 2009*

Appendix A - **Catchments & land use classification**

Table A.1 - Year 1 - catchment and land use classification breakdown (ha)

Storage	Natural/dirty water	Industrial	Rehabilitated Spoil	Overburden	Open Cut Pit	Total
Bengalla East Sed Dam			48.5			**48.5**
East & West Facilities Dam	1.8	47.8	39.6			**89.2**
End Wall Dam			76.8			**76.8**
Hot Tyre Parkup Dam	4.3	1.6				**5.9**
Main Pit	6.9	116.1		135.5	26.7	**285.2**
North Dump Sed Dam			12.9	0.6		**13.5**
Ramp Dam				3.8		**3.8**
Raw Water Dam	2.0					**2.0**
ROM North Sed Dam	7.9	3.5	0.7			**12.1**
South Loop Road Sed Dam	0.7	1.0				**1.7**
South Tyre Dam		1.2				**1.2**
Staged Discharge Dam	12.0					**12.0**
Train Loadout Sump	0.7	0.1				**0.8**
Twin Gullies Sed Dam	19.0	10.2				**29.2**
Wantana East Sed Dam			71.8			**71.8**
Wantana West Dam			3.9			**3.9**
Washery Dam	1.5					**1.5**
Water Overflow Bypass			99.3			**99.3**
Western OEA Sed Dam B	16.1			9.7		**25.8**
Windmill Sed Dams		5.2				**5.2**
Wybong Rd Sed Dam	7.1	6.0				**13.1**
Total	**80.0**	**192.7**	**353.5**	**149.6**	**26.7**	**802.5**

Table A.2 – Year 4 - catchment and land use classification breakdown (ha)

Storage	Natural/dirty water	Industrial	Rehabilitated Spoil	Overburden	Open Cut Pit	Total
Bengalla Discharge Dam	14.7					**14.7**
Bengalla East Sed Dam			69.1	6.6		**75.7**
Dry Creek Clean Water Dam	631.3					**631.3**
East & West Facilities Dams	2.1	73.2	33.7			**109.0**
Endwall Dam			76.8			**76.8**
Facilities Sump		0.1				**0.1**
Main Pit		120.9	1.8	153.4	31.7	**307.8**
Mount Pleasant Discharge Dam	18.0					**18.0**
North Dump Sed Dam			13.5	1.3		**14.8**
Ramp Dam				8.6		**8.6**
Raw Water Dam	1.0					**1.0**
ROM North Sed Dam		13.5	0.7			**14.2**
Satellite Pit	446.8	67.1			9.0	**522.9**
South Loop Road Sed Dam		0.9	0.7			**1.6**
South Tyre Dam		1.2				**1.2**
Staged Discharge Dam	12.0					**12.0**
Train Loadout Sump	0.7	0.1				**0.8**
Twin Gullies Sed Dam	2.2	5.7				**7.9**
Wantana East Sed Dam			59.4			**59.4**
Wantana West Dam			16.3	24.5		**40.8**
Washery Dam	1.5					**1.5**
Water Overflow Bypass			105.1			**105.1**
Western OEA Sed DamB	7.8		9.7	8.3		**25.8**
Wybong Road Sed Dam	0.4	5.0				**5.4**
Total	**1,138.5**	**287.7**	**386.8**	**202.7**	**40.7**	**2,056.4**

Table A.3 - Year 8 - catchment and land use classification breakdown (ha)

Storage	Natural/dirty water	Industrial	Rehabilitated Spoil	Overburden	Open Cut Pit	Total
Bengalla Discharge Dam	14.7					**14.7**
Bengalla East Sed Dam			69.1	6.6		**75.7**
Dry Creek Clean Water Dam	631.3					**631.3**
East & West Facilities Dam	22.9	82.7	28.5			**134.1**
Endwall Dam			76.8			**76.8**
Facilities Sump		0.1				**0.1**
Main Pit	248.0	201.9		333.1	55.8	**838.8**
Mount Pleasant Discharge Dam	18.0					**18.0**
North Dump Sed Dam			13.5	1.3		**14.8**
Raw Water Dam	0.9					**0.9**
ROM North Sed Dam		5.9				**5.9**
South Loop Road Sed Dam			0.7	23.3		**24.0**
Train Loadout Sump	0.7	0.1				**0.8**
Wantana East Sed Dam			59.4			**59.4**
Wantana West Dam			16.3	24.5		**40.8**
Washery Dam	14.7					**14.7**
Water Overflow Bypass			105.1	8.6		**113.7**
Total	**951.2**	**290.7**	**369.4**	**397.4**	**55.8**	**2,064.5**

Table A.4 - Year 15 - catchment and land use classification breakdown (ha)

Storage	Natural/dirty water	Industrial	Rehabilitated Spoil	Overburden	Open Cut Pit	Total
Bengalla Discharge Dam	11.6					**11.6**
Bengalla East Sed Dam			73.1			**73.1**
Creek Sed Dam			9.5	52.9		**62.4**
Dry Creek Clean Water Dam	630.9					**630.9**
East & West Facilities Dam		91.0	25.0			**116.0**
End Wall Dam			87.2			**87.2**
Facilities Sump	0.1					**0.1**
Main Pit	129.0	254.9	33.4	287.3	54.4	**759.0**
Mount Pleasant Discharge Dam	18.0					**18.0**
North Dump Sed Dam			4.8			**4.8**
Ramp Dam			0.2			**0.2**
Raw Water Dam	0.7					**0.7**
ROM North Sed Dam		6.1	2.9	4.4		**13.4**
South Loop Road Sed Dam			38.2			**38.2**
Train Loadout Sump	0.7	0.1				**0.8**
Wantana East Dam			59.4			**59.4**
Wantana West Dam			42.1			**42.1**
Washery Dam	2.5					**1,917.9**
Water Overflow Bypass			255.8			**3,824.2**
Total	**793.5**	**352.1**	**631.6**	**344.6**	**54.4**	**7,660.0**

Table A.5 – Year 24 - catchment and land use classification breakdown (ha)

Storage	Natural/dirty water	Industrial	Rehabilitated Spoil	Overburden	Open Cut Pit	Total
Bengalla Discharge Dam	11.6					**11.6**
Bengalla East Sed Dam			73.2			**73.2**
Dry Creek Relocation	31.1		557.1	15.5		**603.7**
East & West Facilities Dam		91.0	26.7	14.4		**132.1**
End Wall Dam			87.5			**87.5**
Facilities Sump		0.1				**0.1**
Main Pit	20.2	167.9		224.1	55.3	**467.5**
Mount Pleasant Discharge Dam	18.0					**18.0**
North Dump Sed Dam			4.8			**4.8**
Ramp Dam			0.2			**0.2**
Raw Water Dam	0.7					**0.7**
ROM North Sed Dam		5.5		4.4		**9.9**
South Loop Road Sed Dam			38.2			**38.2**
Spare Dam	83.8					**83.8**
Train Loadout Sump	0.7	0.1				**0.8**
Wantana East Dam			59.4			**59.4**
Wantana West Dam			42.1			
Washery Dam	2.5					**2.5**
Water Overflow Bypass			128.6			**1,594.0**
Total	**168.6**	**264.6**	**1,017.8**	**258.4**	**55.3**	**3,188.0**

Appendix E

Air Quality Assessment

TODOROSKI AIR SCIENCES
Suite 2B, 14 Glen Street
Eastwood NSW 2122
Phone: (02) 9874 2123
Fax: (02) 9874 2125
Email: info@airsciences.com.au
Web: www.airsciences.com.au
ACN: 151 202 765 | ABN: 74 955 076 914

23 June 2015

Jason Martin
Senior Environmental Scientist
Hansen Bailey
Via email: jmartin@hansenbailey.com.au

RE: Air Quality Assessment - Bengalla Modification 1

Dear Jason,
Todoroski Air Sciences has assessed the potential for air quality impacts to arise due to the proposed modifications to various water management infrastructure and other infrastructure components associated with the Bengalla Mine.

Overview
Bengalla is located approximately 4km west of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW) and was recently granted approval on 3 March 2015 for the continuation of mining under State Significant Development Consent SSD-5170.

Bengalla Mining Company (BMC) is seeking approval for a modification to SSD-5170 for the following:

- Alterations to various water management infrastructure components including:
  - Utilisation of the Satellite Pit as a catchment dam;
  - Construction of clean water diversion drains;
  - Relocation of the Staged Discharge Dam release point; and
  - Revised location for the future relocated Hunter River and Washery Dam.
- Relocation of the existing Explosives Storage Facility and Reload Facility; and
- Placement of fill from the excavation of the Clean Water Dam 1 (CW1) immediately east of the dam (CW1 Emplacement Strategy).

This letter report provides a qualitative assessment of the potential change in air quality associated with the proposed modifications. The assessment focuses on the activity associated with the development and placement of excavated material from the CW1 immediately to the east of the dam, all other features

associated with this Modification are by comparison unlikely to generate a significant amount of dust emissions and therefore have not been considered further in this assessment. An overview of the proposed modifications are presented in **Figure 1**.

Assessment of potential air quality impacts

For the development of the CW1 dam, SSD-5170 provides that the excavated material removed would be transported using appropriate mining equipment across Wybong Road for emplacement within either the main overburden emplacement area (Main OEA) or in the western out of pit emplacement area (Western OEA). Further, any material emplaced within the Western OEA would later be required to be rehandled as operations progress west.

The modification is seeking approval to emplace this excavated material immediately adjacent to the CW1 (see **Figure 2**).

The development of the CW1 dam would involve the excavation of approximately 412,000 bank cubic meters (bcm) of material with construction proposed to commence in Q3 of 2015 and take approximately 12 months to complete. The construction activities would be conducted between the hours of 7:00am to 6:00pm, Monday to Friday, and 8:00am to 1:00pm on Saturday, with no works occurring on Sunday or Public Holidays.

A comparison of the estimated total dust emissions for the approved activity associated with the construction of CW1 and the CW1 Emplacement Strategy associated with this Modification is summarised in **Table 1**. The results in **Table 1** indicate that the estimated change in potential dust emissions associated with the emplacement of excavated material immediately adjacent to the CW1 would see a decrease of the potential amount of dust emissions from the development. A detailed emissions inventory is provided in **Table 2** and **Table 3**.

Table 1: Comparison of estimated TSP emission rate for the CW1 Construction Activity Modification (kg/year)

CW1 Construction Activity	Approved operations	Modification	% Change
Stripping topsoil material	1,339	1,339	-
Excavator loading topsoil material to haul truck	69	69	-
Hauling topsoil material to stockpile area	1,000	246	-75%
Emplacing topsoil at stockpile area	69	69	-
Excavator loading excavated material to haul truck	1,216	1,216	-
Hauling excavated material to overburden emplacement area	17,711	4,350	-75%
Emplacing excavated material at overburden emplacement area	1,216	1,216	-
Dozer activity	8,368	8,368	-
Wind erosion from active exposed areas	56,249	56,249	-
Total TSP emissions (kg/year)	**87,236**	**73,120**	**-16%**

By emplacing the excavated material immediately adjacent to the CW1, the required haulage distance would be reduced significantly when compared to the distance required for transporting material to the Western OEA or Main OEA and therefore the amount of dust generated would be significantly lower.

A comparison of the amount of estimated dust emissions for the modification with the estimated emissions for the assessed Year 1 in the Air Quality and Greenhouse Gas Impact Assessment for the Continuation of Bengalla (**Todoroski Air Sciences, 2013**), indicates that the quantity of dust would equate to approximately 1.3 per cent of the total dust generated by the entire operation. The implementation of the CW1 Emplacement Strategy will result in a 16 per cent reduction in air quality emissions when compared to the approved

operations. This translates to a reduction of 0.3 per cent in the total emissions. This change is considered minor and is unlikely to be discernible relative to the existing contribution from the site.

To ensure dust emissions from the development of the CW1 are minimised where possible, appropriate operational and physical dust mitigation measures should be implemented such as maintaining sufficient levels of moisture on the surface of trafficked surfaces, limiting vehicle speeds and rehabilitating completed sections as soon as practicable.

Summary and Conclusions

This assessment has examined the likely air quality effects resulting from the proposed placement of excavated material from the CW1 dam to a location immediately to the east of the dam. The assessment estimates that activities associated with the modification would see a potential reduction of approximately 16 per cent in the dust emissions associated with the CW1 Emplacement Strategy through reduced haulage distances.

Overall it can be expected that based on the comparison of estimated dust emissions for the modification with the approved operation, also with the entire mine operations and the ongoing active dust management measures in place, there is unlikely to be a noticeable change in the existing air quality surrounding the site associated with the proposed modifications.

On the basis of the above it can be expected that there would be a small improvement in air quality due to the modification. Therefore it is reasonable to conclude that the proposed modification is unlikely to cause any negative discernible impact at any surrounding sensitive receptor locations relative to the approved operations.

Please feel free to contact us if you need to discuss (or require clarification on) any aspect of this report.

Yours faithfully,

Todoroski Air Sciences

Philip Henschke

Aleks Todoroski

References

Todoroski Air Sciences (2013)

"Air Quality and Greenhouse Gas Impact Assessment Continuation of Bengalla Mine", prepared for Hansen Bailey by Todoroski Air Sciences, July 2013.

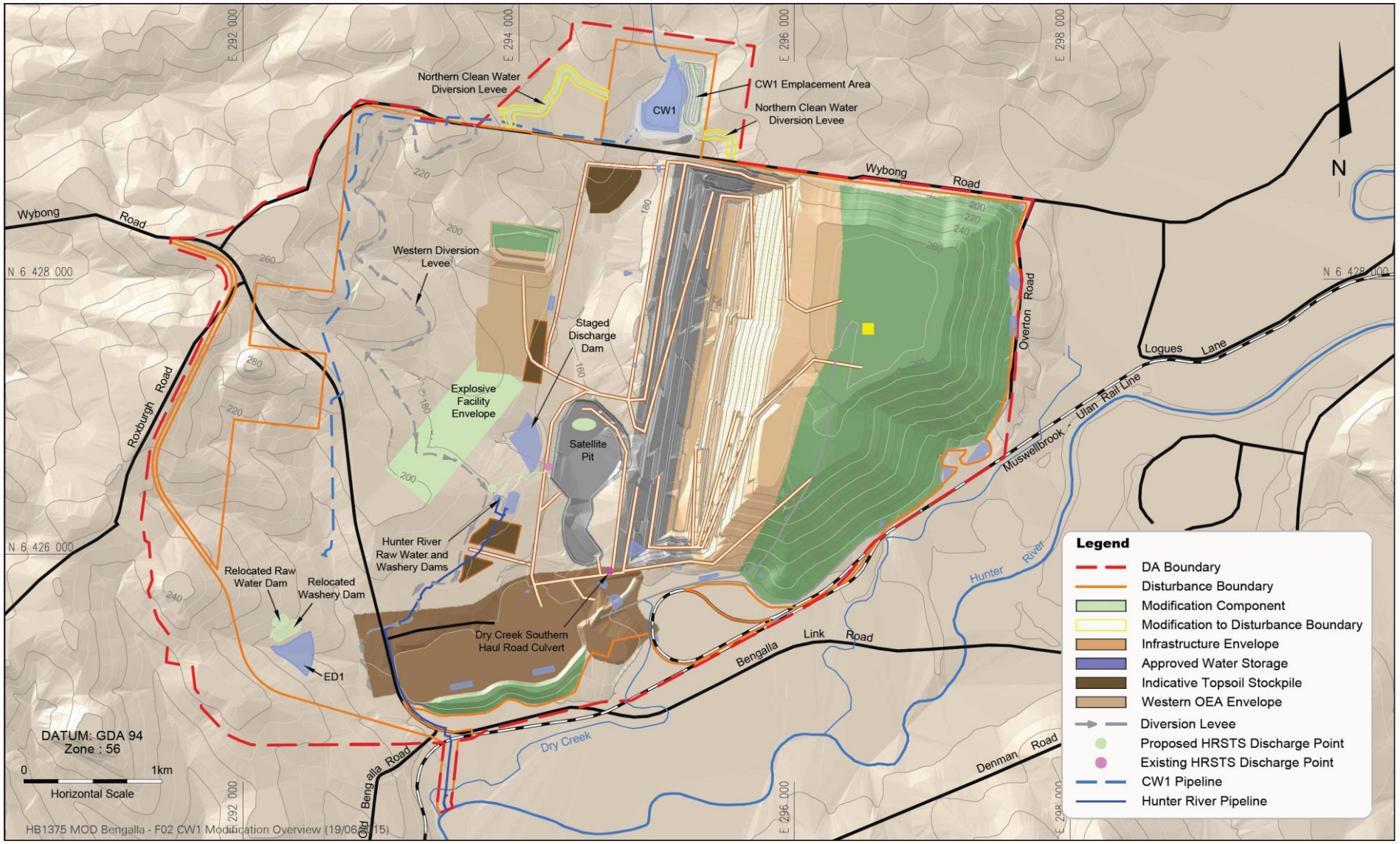


Figure 1: Overview of proposed modifications for Bengalla Mine

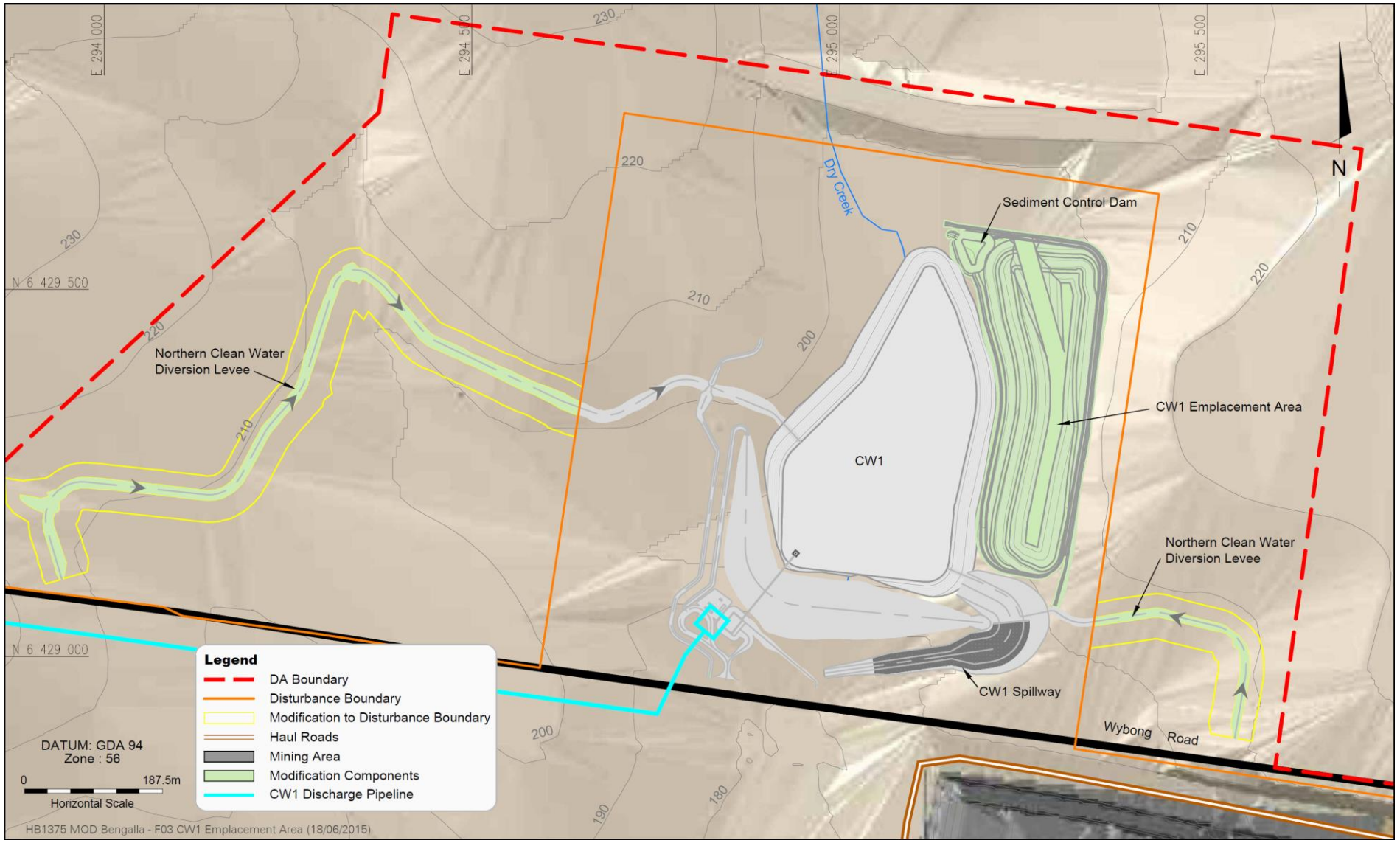


Figure 2: Proposed emplacement strategy for CW1

Table 2: Emissions Inventory for CW1 Construction Activity - Approved Operation

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
Stripping Topsoil (dozer)	1,339	80	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
Excavator loading Topsoil to haul truck	69	51,197	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Hauling to Topsoil dump	1,000	51,197	tonnes/year	0.130	kg/t	180	tonnes/load	5.7	km/return trip	4.1	kg/VKT	2.8	% silt content	296	Ave GMV (tonnes)	85	% Control
Emplacing at Topsoil dump	69	51,197	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Excavator loading OB to haul truck	1,216	906,400	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Hauling to dump	17,711	906,400	tonnes/year	0.130	kg/t	180	tonnes/load	5.7	km/return trip	4.1	kg/VKT	2.8	% silt content	296	Ave GMV (tonnes)	85	% Control
Emplacing at dump	1,216	906,400	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Dozer	8,368	500	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
WE - Overburden emplacement areas	56,249	16.1	ha	3,504	kg/ha/year												
Total TSP emissions (kg/yr)	**87,236**																

Table 3: Emissions Inventory for CW1 Construction Activity - Proposed Modification

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
Stripping Topsoil (dozer)	1,339	80	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
Excavator loading Topsoil to haul truck	69	51,197	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Hauling to Topsoil dump	246	51,197	tonnes/year	0.032	kg/t	180	tonnes/load	1.4	km/return trip	4.1	kg/VKT	2.8	% silt content	296	Ave GMV (tonnes)	85	% Control
Emplacing at Topsoil dump	69	51,197	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Excavator loading OB to haul truck	1,216	906,400	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Hauling to dump	4,350	906,400	tonnes/year	0.032	kg/t	180	tonnes/load	1.4	km/return trip	4.1	kg/VKT	2.8	% silt content	296	Ave GMV (tonnes)	85	% Control
Emplacing at dump	1,216	906,400	tonnes/year	0.00134	kg/t	1.133	average of (WS/2.2)^1.3 in m/s	2	moisture content in %								
Dozer	8,368	500	hours/year	16.7	kg/h	10	silt content in %	2	moisture content in %								
WE - Overburden emplacement areas	56,249	16.1	ha	3,504	kg/ha/year												
Total TSP emissions (kg/yr)	**73,120**																

Appendix F

Acoustics Assessment

ABN: 73 254 053 305

78 Woodglen Close
P.O. Box 61
PATERSON NSW 2421

Phone: 02 4938 5866
Mobile: 0407 38 5866
E-mail: bridgesacoustics@bigpond.com

23 June 2015
Ref: J0130-102-L1

Hansen Bailey Pty Ltd
P.O. Box 473
SINGLETON NSW 2330

Attn: Mr Jason Martin

Dear Jason,

RE: BENGALLA MINE DEVELOPMENT CONSENT MODIFICATION - ACOUSTICS

Bengalla Mining Company Pty Limited (BMC) owns and operates Bengalla Mine (Bengalla) located approximately 4 km south east of Muswellbrook in the Upper Hunter region of NSW. BMC is seeking approval from the NSW Minister for Planning or delegate for a modification to SSD-5170 under section 96(2) of the *Environmental Planning and Assessment Act* (EP&A Act) for the following:

- Alterations to various water management infrastructure components including:
  - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
  - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme (HRSTS) staged discharge release point;
  - Construction of clean water diversion levees in locations other than those already approved; and
  - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional (possible alternative) location for the Explosives Storage Facility; and
- The placement of fill from the excavation of Clean Water Dam 1 (CW1) immediately adjacent to it.

Proposed Modification components are shown in the attached figures. No changes are proposed to other details such as annual production rate, mining area, mining equipment, quantity of overburden handled or workforce limit. This report describes results from an assessment of acoustic issues, including construction and operational noise and vibration, associated with the Modification.

REFERENCES

The following documents are referred to in this assessment:

Hansen Bailey (2013) *Continuation of Bengalla Mine Environmental Impact Statement* (Bengalla EIS) including *Continuation of Bengalla Mine Acoustic Impact Assessment* (Bridges Acoustics, 2013) (Bengalla EIS Appendix H).

Department of Planning (2015) *Project Approval SSD-5170* (Development Consent).

CONSTRUCTION NOISE

The Bengalla EIS determined construction noise levels due to various construction activities relevant to the Modification including:

- Excavation of CW1 using a large earthmoving fleet with an average sound power level of 127 dBA;
- Installation of the CW1 Pipeline from CW1 to the west then south to terminate west of the existing Mine Access Road, using a smaller earthmoving fleet producing an average sound power level of 115 dBA; and
- Excavation of various dams adjacent to the western boundary of the then proposed (now approved) mining area including the Raw Water Dam and Washery Dam. Each dam was assumed to be excavated using an earthmoving fleet producing an average sound power level of 122 dBA.

Each component of the Modification is assessed in the following sections.

Satellite Pit used as a catchment dam

Use of the approved Satellite Pit as a catchment dam is not expected to involve any additional acoustically significant activities as no additional construction work is required and any pumps (if required) to dewater the dam would produce insignificant noise compared to nearby mining activity.

Relocation of the Staged Discharge Dam HRSTS Release Point

The Modification includes relocation of the HRSTS discharge point to an alternative location approximately 400 m west. The discharge point is at least 3 km from any privately owned receptor, therefore any construction noise associated with the pipeline or discharge point would be inaudible at all receptors and insignificant compared to operating noise from adjacent mining activity.

Clean Water Diversion Levees

Construction of Clean Water Diversion Levees is proposed generally east and west of CW1 on the northern side of Wybong Road. The levees would be constructed using a small excavator or similar earthmoving machine, with subsequent shaping using a small grader or similar machine if required. Construction machines would produce a sound power level of less than 115 dBA and would therefore produce a similar or lower sound power level than the nearby CW1 Pipeline construction fleet.

The nearest privately owned receptor is Residence 168 located approximately 1.8 to 2.5 km west of the construction site. A sound power level of 115 dBA is expected to produce a noise level in the range 39 to 42 LAeq,15min which is lower than the construction noise level of 44 LAeq,15min predicted in the EIS at this receptor. No significant change to the construction noise impacts predicted in the EIS is therefore expected.

Revised location for the Hunter River and Washery Dams

The Hunter River Dam and Washery Dam are approved to be relocated to the western side of the Bengalla Link Road to avoid being intercepted by the advancing mining area by approximately Year 8. This Modification includes construction of these dams at alternative locations to those presented in the Bengalla EIS. The Modification proposes to construct these dams adjacent to the future Staged Discharge Dam.

The EIS construction noise assessment included a dam construction fleet producing a sound power level of 122 dBA at the approximate location of the proposed dams. The EIS therefore adequately considered this component of the Modification.

Alternative Location for the Explosives Storage Facility

The Explosives Storage Facility is currently located on the natural surface west of the mining area and is approved to be relocated to the Overburden Emplacement Area (OEA) or within a recently rehabilitated area to avoid the advancing mine. This Modification will result in construction of the Explosives Storage Facility within an envelope west of its current location.

Construction work would require one or two small earthmoving machines to level and grade a suitable area and to spread hardstand gravel, plus a few trucks to transport gravel to the site. Fencing, portable buildings and similar infrastructure would then be installed for each facility. A maximum sound power level of 115 dBA is expected to be produced by construction machines which is similar to the noise produced by one large mining truck operating on the adjacent out-of-pit OEA. Noise associated with construction of the facility is therefore insignificant compared to mining noise.

Placement of Clean Water Dam 1 fill adjacent to the dam

The EIS construction noise assessment included a dam construction fleet producing a sound power level of 127 dBA at the location of the proposed dam and assumed all earth material excavated from the dam would be used to form the wall and spillway. No fill material was assumed to be transported a significant distance from the excavation area.

The Modification includes placement of fill material immediately adjacent to the dam. The Modification therefore proposes some of the fill material be deposited at a slightly higher elevation than was assumed in the EIS noise assessment, which would result in an insignificant noise increase of less than 1 dBA at any receptor. The EIS therefore adequately considered this component of the Modification.

OPERATIONAL NOISE

The Modification has limited potential to affect operational noise levels as all Modification components related to water management infrastructure do not produce audible noise at any receptor. Vehicles intermittently accessing the Explosives Storage Facility would generally include light vehicles and on-road trucks which produce a sound power level of up to 108 dBA and would therefore be at least 7 dBA quieter than heavy mining trucks operating within the mining area. The Modification would therefore produce insignificant noise at all receptors compared to approved mining activity.

OTHER ACOUSTIC ISSUES

The Modification is not expected to affect other acoustic issues including sleep disturbance, road or rail traffic noise, low frequency noise or blasting.

NOISE MANAGEMENT

Construction and operational noise levels are expected to remain similar to and consistent with the noise levels reported in the EIS. Construction noise management measures recommended in the EIS continue to be recommended for the Modification.

CONCLUSION

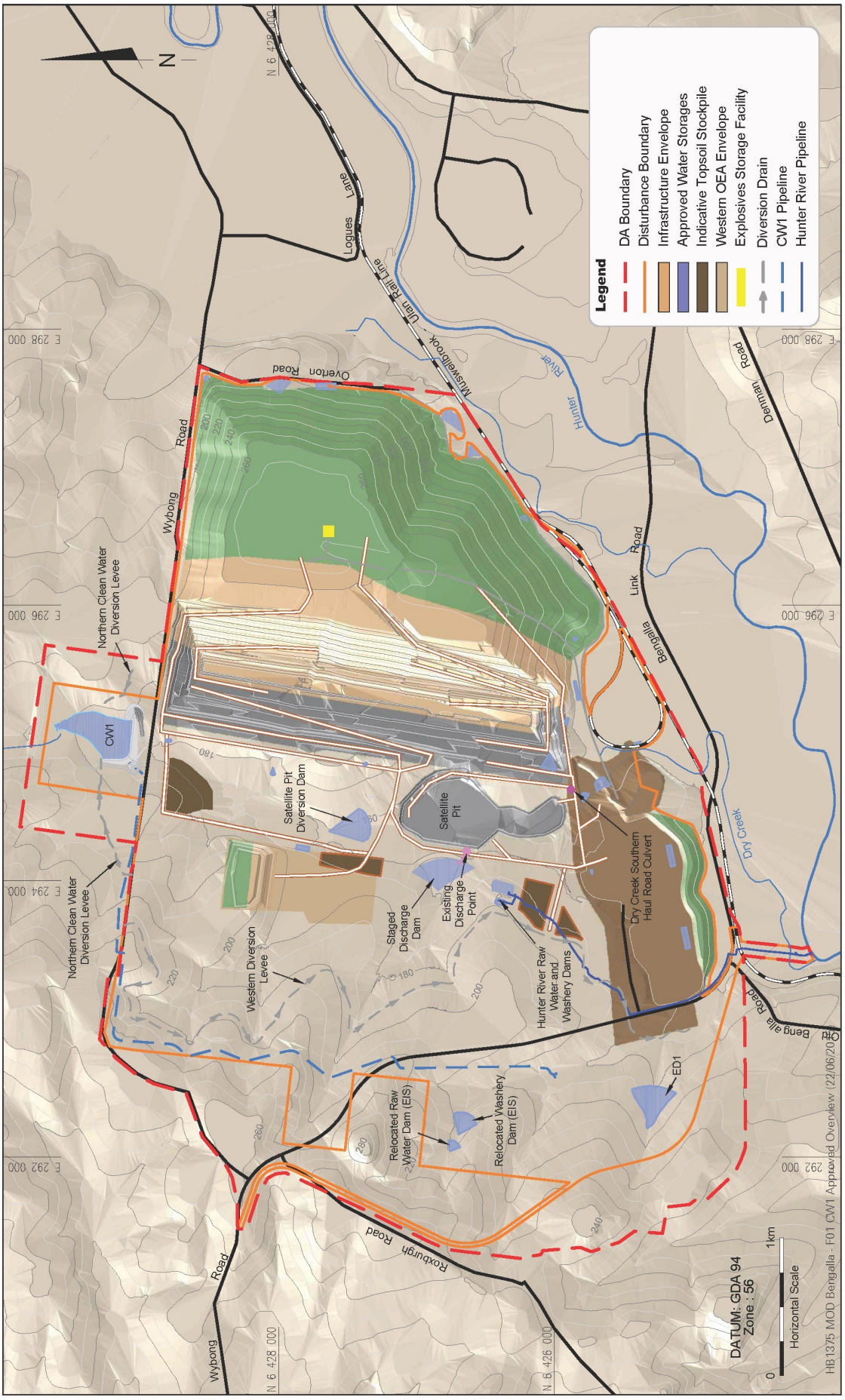
This assessment indicates the Modification would produce a minor and insignificant change to short term construction noise levels at all receptors, with no appreciable change to operational noise levels or to other acoustic issues such as low frequency noise or sleep disturbance.

The current noise management plan should be revised to consider the proposed construction activities and operational noise sources with a focus on any work proposed to be completed during the evening and night, as recommended in the EIS.

Based on the results of this assessment, the Modification is unlikely to have a significant effect on noise levels from the Project and is therefore considered acceptable. We trust this report presents sufficient information regarding acoustic issues associated with the proposed Modification. Please contact the undersigned for any further information or discussion.

Yours faithfully,

MARK BRIDGES BE (Mech) (Hons) MAAS
Principal Consultant



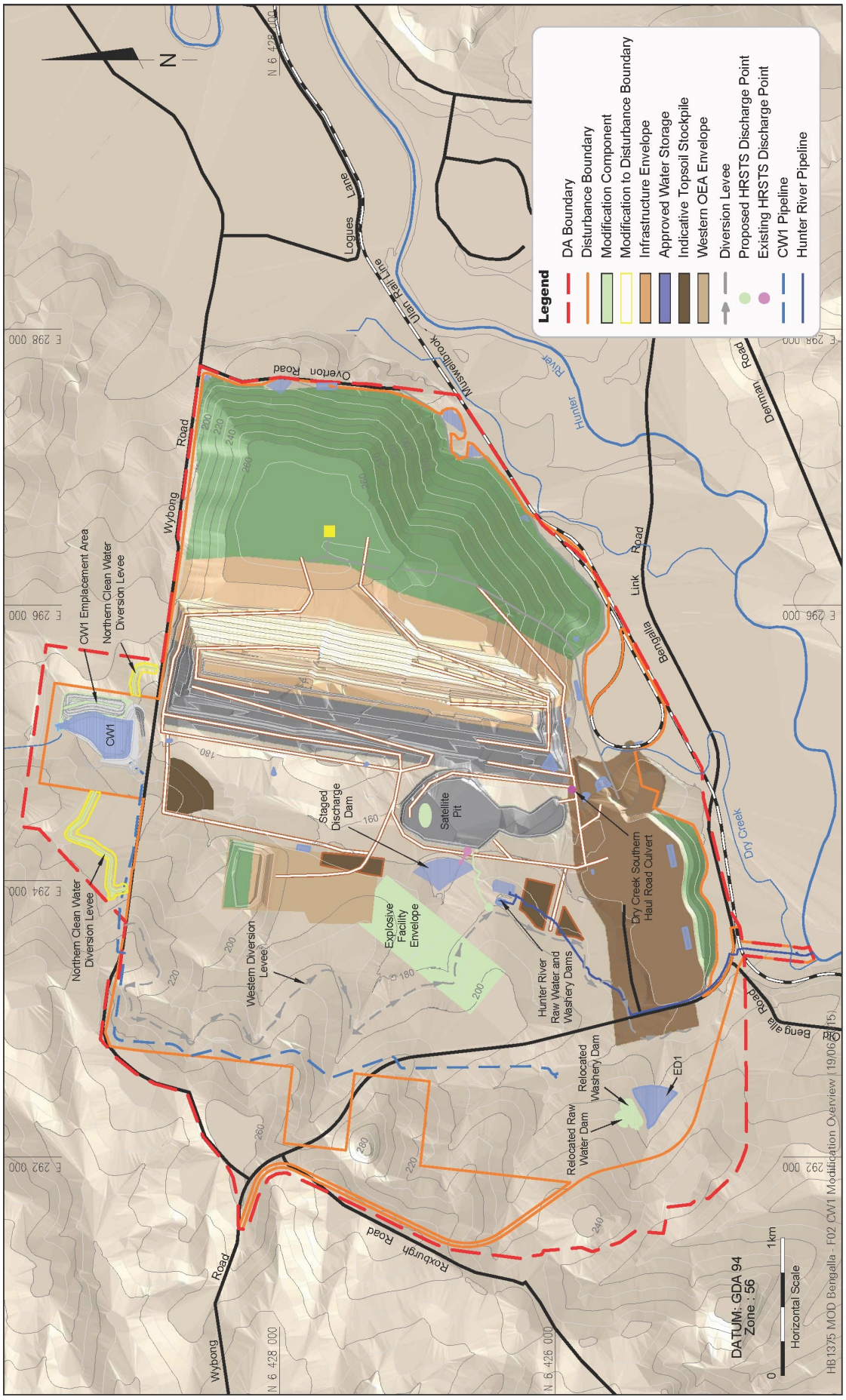
BENGALLA MINE

Approved Overview - Year 4 Mine Plan

FIGURE 1

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

BENGALLA



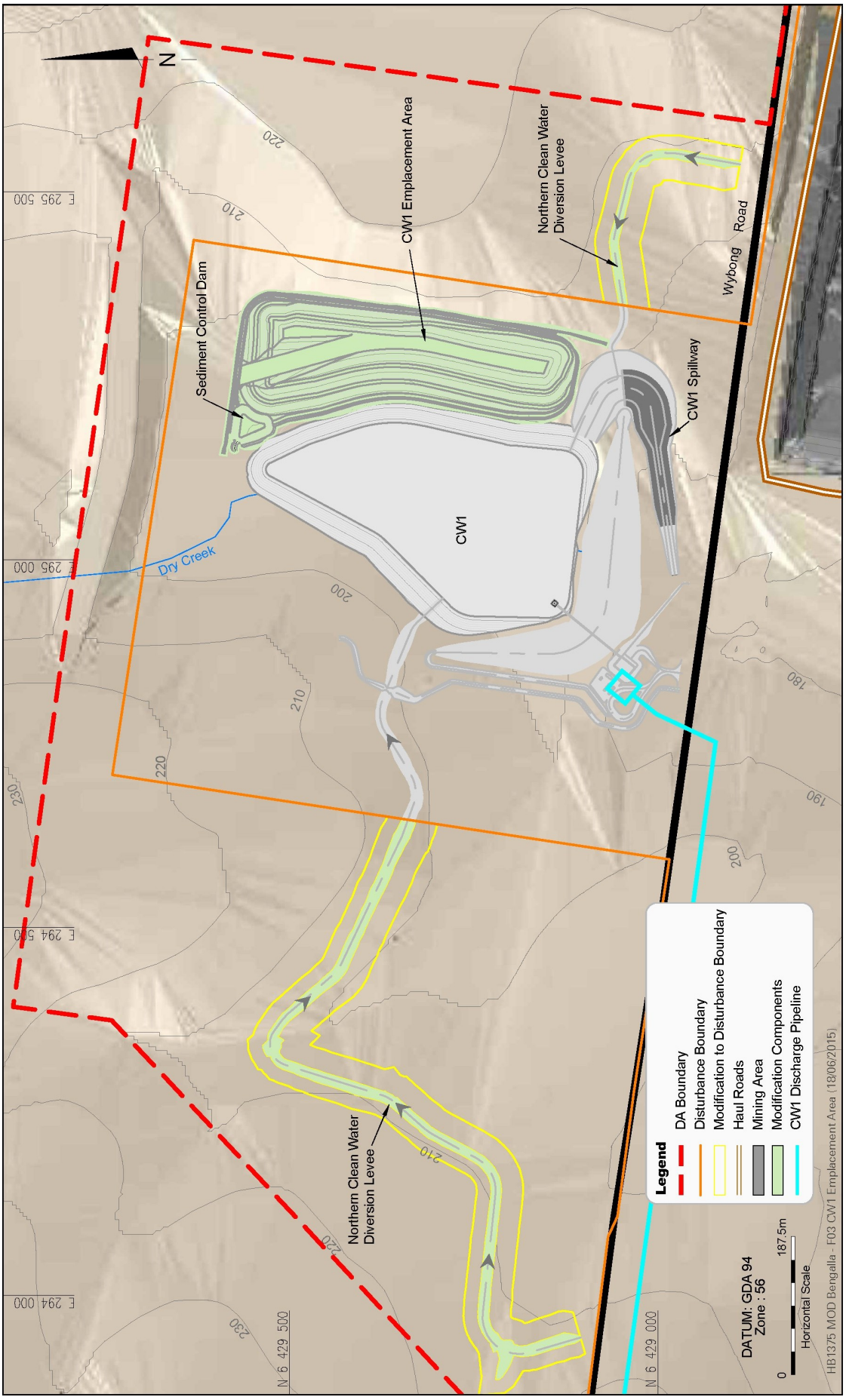
BENGALLA MINE

Modification Overview - Year 4 Mine Plan

FIGURE 2

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

BENGALLA


BENGALLA MINE
CW1 Emplacement Area
FIGURE 3
N
CW1 Emplacement Area
Northern Clean Water Diversion Levee
Wybong Road
Sediment Control Dam
CW1 Spillway
CW1
Dry Creek
Northern Clean Water Diversion Levee
Legend
DA Boundary
Disturbance Boundary
Modification to Disturbance Boundary
Haul Roads
Mining Area
Modification Components
CW1 Discharge Pipeline
DATUM: GDA 94
Zone : 56
0
187.5m
Horizontal Scale
HB1375 MOD Bengalla - F03 CW1 Emplacement Area (18/06/2015)
E 295 500
E 295 000
E 294 500
E 294 000
N 6 429 500
N 6 429 000
Hansen Bailey
ENVIRONMENTAL CONSULTANTS
BENGALLA

Appendix G

Aboriginal Archaeology Assessment

AECOM

25 June 2015

Jason Martin
Hansen Bailey Environmental Consultants
PO Box 473
Singleton, NSW 2330

Fax No: (02) 6575 2001

Dear Jason,

RE: Aboriginal Archaeological Due Diligence Assessment for Bengalla Development Consent Modification

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by Hansen Bailey Environmental Consultants (Hansen Bailey), on behalf of Bengalla Mining Company (BMC), to undertake an Aboriginal archaeological due diligence assessment of land required to facilitate the construction of clean water diversion levees (Project area).

BMC is seeking approval from the NSW Minister for Planning or their delegate for a modification to SSD-5170. The modification is sought under section 96(2) of the *Environmental Planning and Assessment Act* (EP&A Act) for the following:

- Alterations to various water management infrastructure components including:
    - Utilisation of the Satellite Pit as a temporary dirty water catchment dam;
    - Relocation of the Staged Discharge Dam Hunter River Salinity Trading Scheme (HRSTS) staged discharge release point;
    - Construction of clean water diversion levees in locations other than those already approved; and
    - Revised locations for the proposed relocation of the Hunter River and Washery Dams.
- Additional (possible alternative) location for the siting of the Explosives Storage Facility; and
- The placement of fill from the excavation of CW1 immediately adjacent to it.

The required levees are the subject of this assessment and are located partly outside of the previously delineated Disturbance Boundary (Figure 1). They are associated with construction of Clean Water Dam 1 (CW1), which will be constructed as part of the approved Bengalla Continuation of Mining Project (SSD-5170).

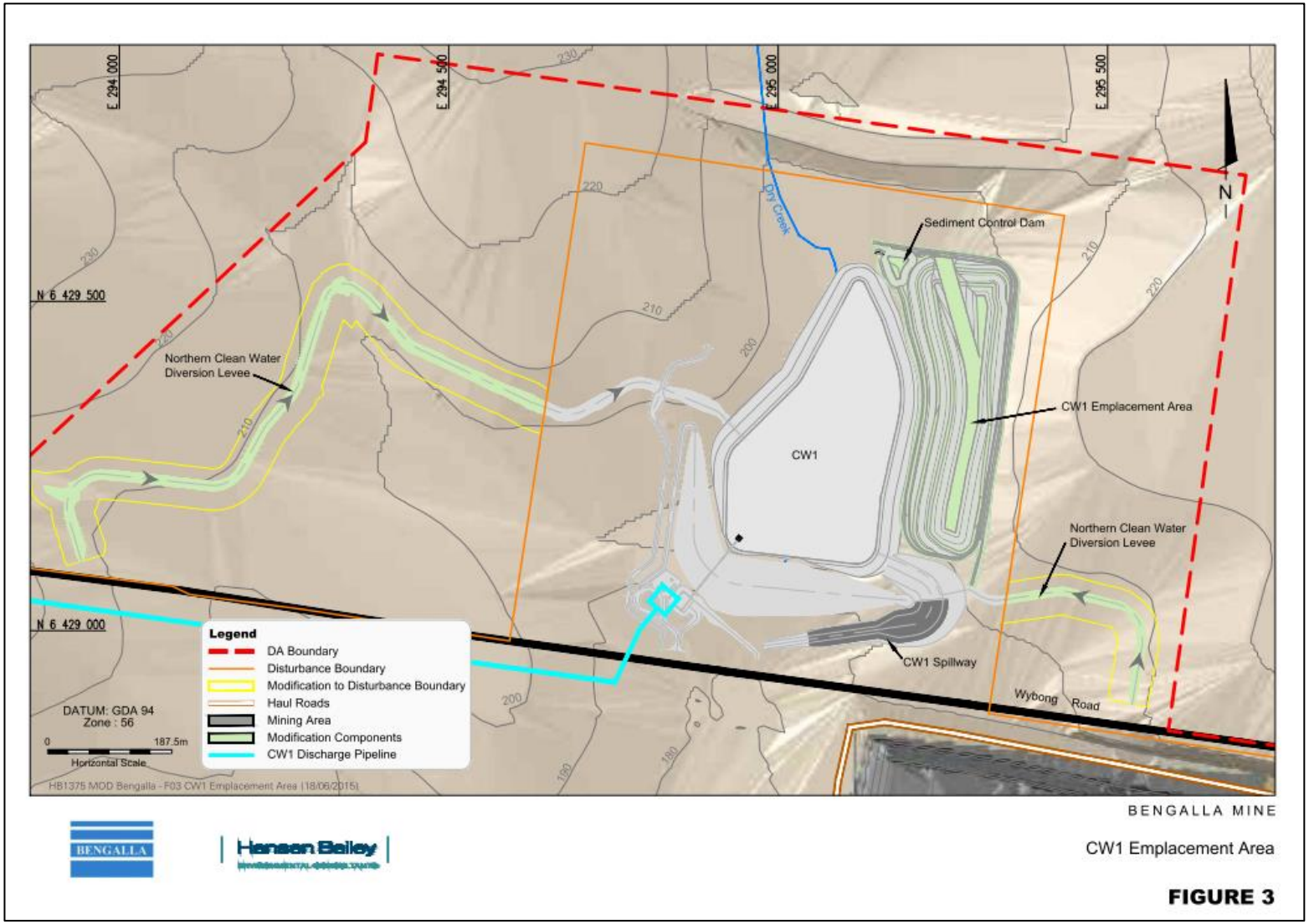


Figure 1: CW1 Emplacement Strategy

2.0 Relevant Legislation and Approved Aboriginal Heritage Management Plans

The *National Parks and Wildlife Act 1974* (NPW Act), administered by OEH, is the primary legislation for the protection of Aboriginal cultural heritage in NSW. The NPW Act gives the Director General of OEH responsibility for the proper care, preservation and protection of 'Aboriginal objects' and 'Aboriginal places', defined under the Act as follows:

- an *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains).
- an *Aboriginal place* is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them. The NPW Act includes a 'strict liability offence' for harm to Aboriginal objects and places. A 'strict liability offence' does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the 'strict liability offence' include the carrying out of certain 'low impact activities', prescribed in Clause 80B of the *National Parks and Wildlife Regulation 2009* (NPW Regulation), and the demonstration of due diligence.

With the exception of projects approved under Division 4.1 of Part 4 (formerly Part 3A) of the EP&A Act (Section 89J(d)) where there is an approved Aboriginal Cultural Heritage Management Plan (ACHMP), an Aboriginal Heritage Impact Permit (AHIP) is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened.

In relation to this Project, Aboriginal sites within the approved Bengalla Mine Development Consent boundary are currently managed under the *Bengalla Mine Aboriginal Cultural Heritage Management Plan* (Bengalla Mine ACHMP 2015). It is, however, noted that the Modification land assessed for this due diligence is located outside of previously delineated Disturbance Boundary and as such, will not be covered by the Bengalla Mine ACHMP until the Modification is approved.

3.0 Proposed Activity

The Modification requires the construction of two diversion levees north of Wybong Road to divert clean water into CW1. These minor levees are located partially outside the previously delineated Disturbance Boundary and will require a minor increase of approximately 9.1 ha (0.1% increase) to the total Disturbance Boundary.

All other components subject to the Modification are located within the Disturbance Boundary and as a result will be managed in accordance with the approved Bengalla Mine ACHMP.

4.0 Data Sources

Information regarding the known and potential Aboriginal archaeological resource of the Project area was obtained from:

- A review of the landscape context of the Project area and surrounds;
- A review of existing Aboriginal Heritage Information Management System (AHIMS) data for all land within the Project area obtained from OEH on 5 June 2015 (AHIMS ID #176180);
- A review of Bengalla Mine Aboriginal sites data held by AECOM as resulting from the completion of the *Bengalla Continuation of Mining Project Aboriginal Archaeological and Cultural Heritage Impact Assessment* (AECOM 2013);
- A review of the findings of past Aboriginal archaeological investigations for Bengalla Mine and adjacent mine complexes; and
- A site inspection of the Project area on 16 June 2015 by a combined field team if AECOM archaeologists Geordie Oakes and Darran Jordan, and Aboriginal community members.

- **Environmental Elements**

Environmental variables such as topography, geology, hydrology and vegetation will have played a critical role in influencing how people moved within and utilised the landscape. Accordingly, any attempt to predict or interpret the character and distribution of Aboriginal sites must take such environmental factors into account.

Key observations from the background review of the landscape context of the Project area are presented in Table 1.

Table 1 Environmental Elements relevant to the Project area

Environmental Element	Description
Topography	The topography of the Project area consists of a moderately inclined slope (lower and mid portions). Existing archaeological data indicates that lower slopes are archaeologically sensitive, while mid slopes are not, particularly when moderately sloped.
Hydrology	Dry Creek, a 3rd order creekline, is the principal creek associated with the Project area with its main channel passing to the east. The creek flows in a south-easterly direction beginning north of Bengalla and traversing in a general north-south direction through the Bengalla DA Boundary to the Hunter River. A tributary of Dry Creek is located within the western portion of the Project area. Existing archaeological data indicates that proximity to creeklines is a key variable in the location of Aboriginal archaeological sites, with sites often found within 200 m of creeklines.
Geology	Reference to the Singleton 1:100 000 Geological Mapsheet (SI/56-01) suggests that the surface geology of the Project area consists predominately of geology associated with Triassic Singleton Coal Measures. Lithic material found within with the Singleton Coal Measures includes sandstone, shale, mudstone, conglomerate and coal seams. In addition, a known source of silcrete, commonly utilised in Aboriginal stone tool manufacture, is located 3 km south of the Project area.
Soils	Soils within the Project area have been mapped by Kovac and Lawrie (1991) as belonging to the Roxburgh soil landscape. Roxburgh soils are soils are considered to undergo varying levels of erosion and movement making them, in places, unlikely to contain subsurface archaeological deposit.
Flora & Fauna	Extant vegetation in the Project area has been largely been cleared and predominately consists of grasses in open pasture areas. As a result, Aboriginal scarred trees are not considered likely within the Project area.
Past Disturbance	Known past land use disturbances within the Project area include vegetation clearance and grazing activates. If present, Aboriginal sites within the Project area may have been disturbed by these activities.

5.0 Aboriginal Heritage Information Management System (AHIMS)

A search of the AHIMS database was undertaken on 5 June 2015 (AHIMS ID #176180) (Appendix A) to identify previously recorded sites within an approximate 2 x 2 km area centred on the Project area. A total of 229 previously recorded Aboriginal sites were identified within the search area comprising 223 open artefact sites (i.e., isolated artefacts and artefact scatters) and six scarred trees.

Consideration of the location of previously recorded sites indicates that one site is located directly within the Project area – open artefact site A7-A8 (AHIMS#37-2-1468). In addition, the search indicated that four sites are located within 50 m of the project area including open artefact sites AHIMS#37-2-1469, 37-2-2891, 37-2-2896, and 37-2-2897. Table 2 provides a summary of site types within the search area with their locations shown on Figure 2.

Table 2 Site search results

Site Type	Count	%
Open artefact site (i.e., isolated artefacts and artefact scatters)	223	97.4
Scarred trees	6	2.6
Total	**229**	**100**

6.0 Previous Aboriginal Archaeological Investigations

The Aboriginal archaeology of the Bengalla area and surrounds is well researched, having been the subject of numerous Aboriginal archaeological investigations since the early 1990s (for a detailed review see AECOM, 2013). Major surveys and excavation programs include those undertaken by Rich (1993), White (1998), ERM (2007), ERM (2008), Central Queensland Cultural Heritage Management (2010) and AECOM (2013).

Key observations to be drawn from a review of the findings of these and other investigations undertaken in the area are as follows:

- Artefact scatters and isolated finds - collectively referred to as open artefact sites - are the most common site types within this area.
- Aboriginal stone quarry site B10, comprising tertiary ridge gravels and associated quarrying activities, is mapped within the Bengalla Mine Development Consent boundary.
- Scarred trees may be present within the local area where remanent vegetation remains.
- Stone artefacts can occur within any landform element, both in surface and subsurface contexts.
- Stone artefact distributions tend to vary significantly with landform and stream order, with larger complex deposits occurring on/within low gradient landform elements directly associated with higher order streams such as Dry Creek.
- Recorded stone artefact assemblages consist principally of flake and non-flake debitage (i.e., flakes (complete and broken), flake shatter fragments and flaked pieces), with cores, retouched tools and groundstone implements comparatively poorly represented.
- Silcrete was the dominant raw material for stone artefact manufacture in the Bengalla area.
- Key archaeological implications of historic European land use activities within this area include:
    - The disturbance of pre-existing sites and deposit(s) through both direct and indirect means, resulting in a loss of archaeological integrity;
    - The likely removal of culturally scarred trees; and
    - An increase, in areas affected by erosion, of archaeological site visibility.

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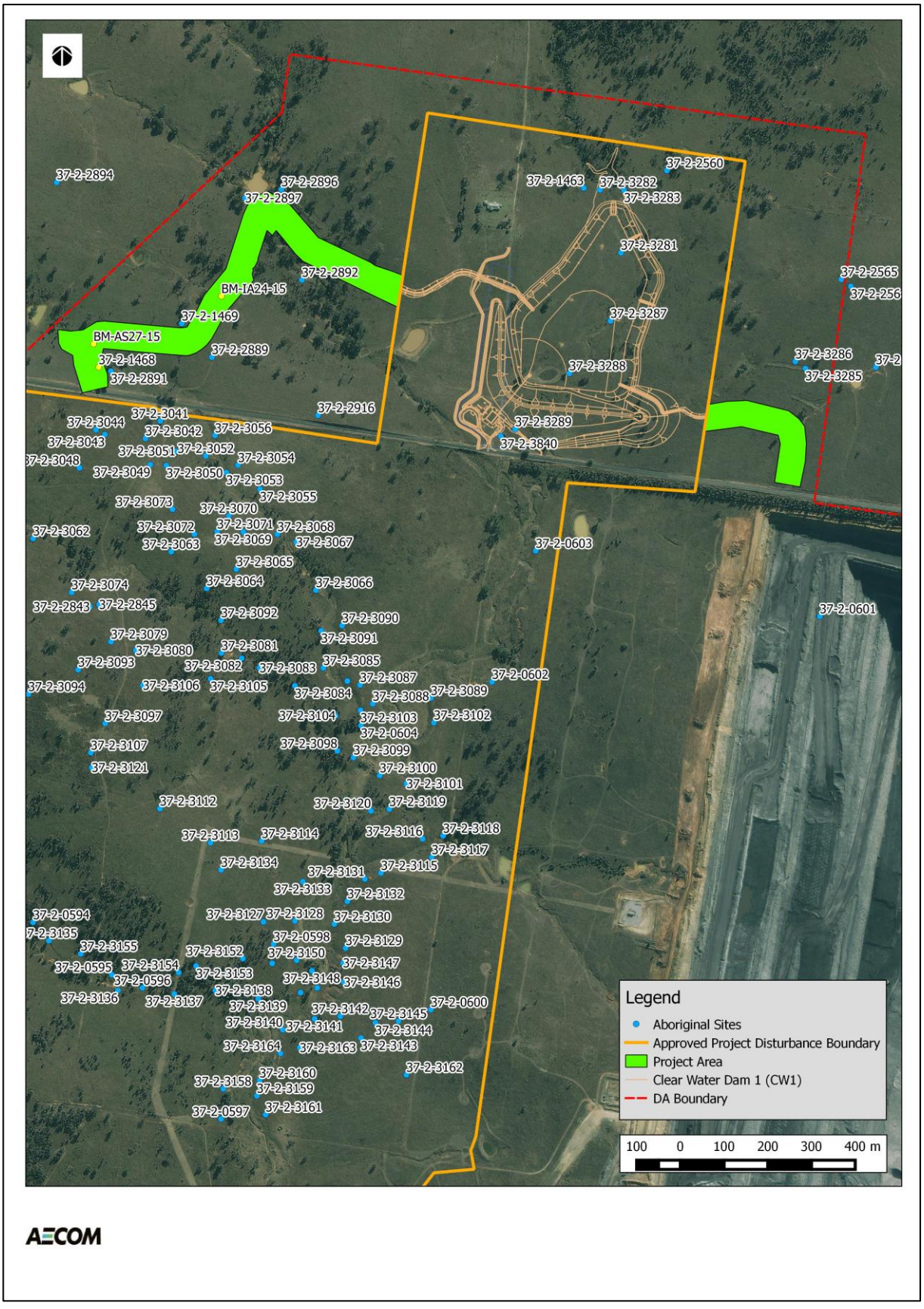

Figure 2: Levees outside approved operations and Aboriginal sites

7.0 Site Inspection

A site inspection of the Project area was completed on 16 June 2015 by a combined field team of AECOM archaeologists Geordie Oakes and Darran Jordan, and Aboriginal community members including Maree Waugh, Georgina Berry and Annie Hickey. The purpose of the inspection was to identify surface evidence of past Aboriginal activity and to assess the levels of archaeological sensitivity. During the inspection notes were taken on the Project area's environmental variables including topography, landform elements and distance to creekline.

Two newly recorded Aboriginal sites were identified within the Project area during the site inspection including artefact scatter BM-AS27-15 and isolated artefact site BM-IA24-15. Site details are provided below.

***Site Name**:* BM-AS27-15

Site type: Artefact scatter

Co-ordinates: 293943mE 6429212mN GDA 94 (Zone 56)

Landform: Lower slope

Site Area: 1m²

Artefacts: 1 x silcrete flake shatter, 1 x tuff complete flake

Disturbance Factors: Erosion, vegetation clearance

Significance: Low (scientific)

Plate 1: BM-AS27-15 (view north)

Plate 2: BM-AS27-15

***Site Name**:* BM-IA24-15

Site type: Isolated artefact

Co-ordinates: 294235mE 6429321mN GDA 94 (Zone 56)

Landform: Lower slope

Site Area: 1m²

Artefacts: 1 x silcrete complete flake

Disturbance Factors: Vehicle track construction, erosion, vegetation clearance

Significance: Low (scientific)

Plate 3: BM-IA24-15 (view west)

Plate 4: BM-IA24-15

8.0 Key Findings and Recommendations

The key findings of this due diligence assessment are as follows:

- With the exception of the levees all other components subject to Modification are located within the currently delineated Disturbance Boundary and as a result will be managed in accordance with the approved Bengalla Mine ACHMP.
- A review of existing AHIMS data sites indicates that one site is located directly within the Project area – open artefact site A7-A8 (AHIMS#37-2-1468). In addition, the search indicated that four sites are located within 50 m of the project area including open artefact sites AHIMS#37-2-1469, 37-2-2891, 37-2-2896, and 37-2-2897. These sites represent potential impact risks.
- Two new sites were identified within the Project area that would be impacted as a result of the construction of the diversion levees - including artefact scatter BM-AS27-15 and isolated artefact site BM-IA24-15.
- A review of the landscape context of the Project area suggests that land associated with the tributary of Dry Creek located within the Project area is archaeologically sensitive.

On the basis of the above findings, the following recommendations are made:

- Impacts to AHIMS sites 37-2-1469, 37-2-2891, 37-2-2896, and 37-2-2897 should be avoided. As a precaution the sites should be temporarily fenced. Temporary fencing may consist of high visibility barrier mesh attached to star pickets. A suitable buffer of 5 to 10 m should be established as part of the temporary fencing to exclude the sites from potential impact.
- Impacts to previously recorded AHIMS site A7-A8 (#37-2-1468) and newly recorded Aboriginal sites BM-AS27-15 and BM-IA24-15 should be salvaged in accordance with the *Bengalla Mine Aboriginal Cultural Heritage Management Plan* (Bengalla Mine ACHMP) modified as required, once Modification to SSD-5170 has been approved.
- AHIMS site cards should be completed for Aboriginal sites BM-AS27-15 and BM-IA24-15 and submitted to the AHIMS register.
- In the event that Aboriginal objects, including possible human skeletal material (remains), are identified during project related activities all works must cease immediately in the area and the procedures identified in the Bengalla Mine ACHMP are to be followed. This will include contacting BMCs Environment Manager and engaging a qualified archaeologist to assess the site.

Yours faithfully,

Geordie Oakes
Archaeologist
geordie.oakes@aecom.com

Direct Dial: +64 2 89340610
Direct Fax: +64 2 89340001

9.0 References

AECOM Australia Pty Ltd. (2013). *Bengalla Continuation of Mining Project Aboriginal Archaeological and Cultural Heritage Impact Assessment*. Sydney: Unpublished report for Hansen Bailey.

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Kovac, M., & Lawrie, J. W. (1991). *Soil Landscapes of the Singleton 1:250 000 Sheet*. Sydney: Soil Conservation Service of NSW.

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10.0 Appendix A (AHIMS Search)

AHIMS Web Services (AWS)

Extensive search - Site list report

Purchase Order/Reference : 60330955 1.1

Client Service ID : 176180

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
37-2-3042	MTP-462	GDA	56	294062	6428996	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3049	MTP-469	GDA	56	294073	6428936	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3090	MTP-510	GDA	56	294512	6428568	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3289	MTP-710	GDA	56	294908	6429017	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-4433	BM-AS 01-12	GDA	56	294901	6428871	Open site	Valid	Artefact : 1		
Contact	Recorders	Mr.Geordie Oakes,AECOM Australia Pty Ltd (previously HLA-Envirosciences)						Permits		
37-2-4434	BM-AS 02-12	GDA	56	294815	6428544	Open site	Valid	Artefact : 1		
Contact	Recorders	Mr.Geordie Oakes,AECOM Australia Pty Ltd (previously HLA-Envirosciences)						Permits		
37-2-0602	B33;	AGD	56	294750	6428250	Open site	Valid	Artefact : -	Open Camp Site	2687,100681,100765
Contact	Recorders	Ms.Laila Haglund						Permits	851	
37-2-0603	B34;	AGD	56	294850	6428550	Open site	Valid	Artefact : -	Open Camp Site	2687,100681,100765
Contact	Recorders	Ms.Laila Haglund						Permits	851	
37-2-0604	B35;	AGD	56	294450	6428150	Open site	Valid	Artefact : -	Open Camp Site	2687,100681,100765
Contact	Recorders	Elizabeth Rich						Permits		
37-2-1469	A33-A34;	AGD	56	294040	6429070	Open site	Valid	Artefact : -	Open Camp Site	4105
Contact	Recorders	Elizabeth Rich,Barry French						Permits	3459	
37-2-2889	MTP-85	GDA	56	294214	6429182	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-2892	MTP-88	GDA	56	294420	6429359	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-2896	MTP-92	GDA	56	294373	6429566	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-2897	MTP-93	GDA	56	294290	6429546	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-2902	MTP-98	GDA	56	294039	6429763	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-2903	MTP-99	GDA	56	294389	6429775	Open site	Valid	Modified Tree (Carved or Scarred) : -		

Report generated by AHIMS Web Service on 05/06/2015 for Geordie Oakes for the following area at Datum :GDA, Zone : 56, Eastings : 294000 - 295000, Northings : 6428255 - 6430255 with a Buffer of 0 meters. Additional Info : Archaeological asssessment. Number of Aboriginal sites and Aboriginal objects found is 58

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3041	MTP-461	GDA	56	294096	6429036	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3050	MTP-470	GDA	56	294110	6428934	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3051	MTP-471	GDA	56	294131	6428967	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3052	MTP-472	GDA	56	294200	6428956	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3053	MTP-473	GDA	56	294247	6428918	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3054	MTP-474	GDA	56	294274	6428935	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3055	MTP-475	GDA	56	294324	6428880	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3056	MTP-476	GDA	56	294221	6429003	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3063	MTP-483	GDA	56	294121	6428737	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3064	MTP-484	GDA	56	294202	6428653	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3065	MTP-485	GDA	56	294270	6428697	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3066	MTP-486	GDA	56	294452	6428649	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3067	MTP-487	GDA	56	294407	6428759	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3068	MTP-488	GDA	56	294364	6428777	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3069	MTP-489	GDA	56	294286	6428782	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		
37-2-3070	MTP-490	GDA	56	294253	6428819	Open site	Valid	Artefact : -		
	Contact	Recorders	Mr.Lennard Roberts					Permits		

Report generated by AHIMS Web Service on 05/06/2015 for Geordie Oakes for the following area at Datum :GDA, Zone : 56, Eastings : 294000 - 295000, Northings : 6428255 - 6430255 with a Buffer of 0 meters. Additional Info : Archaeological asssessment. Number of Aboriginal sites and Aboriginal objects found is 58

AHIMS Web Services (AWS)

Extensive search - Site list report

Purchase Order/Reference : 60330955 1.1

Client Service ID : 176180

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
37-2-3071	MTP-491	GDA	56	294226	6428783	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3072	MTP-492	GDA	56	294174	6428777	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3073	MTP-493	GDA	56	294124	6428834	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3080	MTP-500	GDA	56	294040	6428511	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3081	MTP-501	GDA	56	294236	6428505	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3082	MTP-502	GDA	56	294282	6428493	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3083	MTP-503	GDA	56	294323	6428471	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3084	MTP-504	GDA	56	294404	6428430	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3085	MTP-505	GDA	56	294469	6428471	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3086	MTP-506	GDA	56	294524	6428441	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3087	MTP-507	GDA	56	294553	6428432	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3088	MTP-508	GDA	56	294582	6428389	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3089	MTP-509	GDA	56	294715	6428402	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3091	MTP-511	GDA	56	294464	6428556	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3092	MTP-512	GDA	56	294235	6428580	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-3098	MTP-519	GDA	56	294501	6428281	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		
37-2-2913	MTP-109	GDA	56	294273	6430211	Open site	Valid	Artefact : -		
Contact		Recorders	Mr.Lennard Roberts					Permits		

Report generated by AHIMS Web Service on 05/06/2015 for Geordie Oakes for the following area at Datum :GDA, Zone : 56, Eastings : 294000 - 295000, Northings : 6428255 - 6430255 with a Buffer of 0 meters. Additional Info : Archaeological asssessment. Number of Aboriginal sites and Aboriginal objects found is 58

AHIMS Web Services (AWS)

Extensive search - Site list report

Purchase Order/Reference : 60330955 1.1

Client Service ID : 176180

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
37-2-2914	MTP-110	GDA	56	294212	6430165	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-2916	MTP-113	GDA	56	294457	6429049	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3099	MTP-520	GDA	56	294538	6428266	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3102	MTP-523	GDA	56	294722	6428346	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3103	MTP-524	GDA	56	294554	6428374	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3104	MTP-525	GDA	56	294497	6428362	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3105	MTP-526	GDA	56	294211	6428446	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3106	MTP-527	GDA	56	294056	6428431	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		
37-2-3840	MTP-1262	GDA	56	294875	6429001	Open site	Valid	Artefact : -		
Contact	Recorders	Mr.Lennard Roberts						Permits		

Report generated by AHIMS Web Service on 05/06/2015 for Geordie Oakes for the following area at Datum :GDA, Zone : 56, Eastings : 294000 - 295000, Northings : 6428255 - 6430255 with a Buffer of 0 meters. Additional Info : Archaeological asssessment. Number of Aboriginal sites and Aboriginal objects found is 58