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Bloomfield Collieries Pty Limited
17-Jan-2018

Environmental Assessment

Bloomfield Colliery - Life of Mine Extension, Modification 4

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Client: Bloomfield Collieries Pty Limited

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Prepared by

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Glossary of Terms

Term	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, songlines, places) cultural practices and traditions associated with past and present day Aboriginal communities.
Anticline	Upwards-arched fold in the rock strata where the beds dip outwards in two or more directions from the crest.
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding quantities of water.
Archaeological site	A site with material evidence of past Aboriginal or non-Aboriginal activity in which evidence of past activity is preserved.
Archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
Assessment Background Level	The Assessment Background Level (ABL), as defined by the NSW Industrial Noise Policy 2000, is a measure of the background level for noise, representing discrete assessment periods (i.e. day, evening or night) for each day. It is determined by calculating the 10th percentile (lowest 10%) background noise level over a 90 minute period (L_{A90}).
Background noise level	The NSW Industrial Noise Policy 2000 defines the background noise level as the ambient sound-pressure noise level in the absence of the sound under investigation exceeded for 90% of the measurement period. Normally equated to the average minimum A-weighted sound pressure level.
Bed	Stratum of coal or other sedimentary deposit.
Blast	A controlled explosion which is used to loosen the substance being mined.
Bloomfield	Bloomfield Collieries Pty Ltd – Consent Holder
Bore	A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring.
Borehole	A hole produced in the ground by drilling for the investigation and assessment of soil and rock profiles.
Catchment	The area from which a surface watercourse or a groundwater system derives its water.
Carbon dioxide equivalents (CO_{2e})	Carbon dioxide equivalents. Used as a standard measurement of the level of effect of various gases on the atmosphere, particularly greenhouse gases.
Clearing	The removal of vegetation or other obstacles at or above ground level.
Coal Handling and Preparation Plant	Treatment by screening coal into various sizes to meet a purchasers requirements and treatment by one or more processes to reduce the amount of waste (ash) present in the coal.
Coking coal	Coal suitable for the manufacture of coke.
Conveyor	A means of transporting coal. It consists of a belt being driven by a motor drum system over a structure roller assembly.
Cover	The overburden above the coal resource.
Critical habitat	A critical habitat as defined under the *Threatened Species Conservation Act 1995* (repealed) includes, the whole or any part or parts of the area or areas of land comprising the habitat of an endangered species, population or ecological community or critically endangered species or ecological community, that is critical to the survival of the species, population or ecological community.
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
Cut	Mechanically slice a coal seam to extract the coal resource.
Decibel	A scale unit used in the comparison of powers and levels of sound energy. Used for measuring noise.
Discharge	A release of water from a particular source.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.

Term	Definition
Earthworks	Operations involved in loosening, excavating, placing, shaping and compacting soil or rock.
Ecology	The study of the relationship between living things and the environment.
Ecologically sustainable development	As defined by the *Protection of the Environment Administration Act 1991*, requires the effective integration of economic and environmental considerations in decision making processes including: The precautionary principle. Inter-generational equity. Conservation of biological diversity and ecological integrity. Improved valuation, pricing and incentive mechanisms (includes polluter pays, full life cycle costs, cost effective pursuit of environmental goals).
Ecosystem	As defined in the *Environment Protection and Biodiversity Conservation Act 1999*, an ecosystem is a ‘dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.’
Emission	The discharge of a substance into the environment.
Endangered Ecological Community	An ecological community identified by the *Threatened Species Conservation Act 1995* that is facing a very high risk of extinction in New South Wales in the near future, as determined in accordance with criteria prescribed by the regulations, and is not eligible to be listed as a critically endangered ecological community.
Environmental Management Plan	A plan used to manage environmental impacts during each phase of project development. It is a synthesis of proposed mitigation, management and monitoring actions, set to a timeline with defined responsibilities and follow up actions.
Environmental management system (EMS)	A quality system that enables an organisation to identify, monitor and control its environmental aspects. An EMS is part of an overall management system, which includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.
Environment	As defined within the *Environmental Planning & Assessment Act, 1979*, all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings.
Environmental Protection Licence (EPL)	Environment Protection Licence. EPLs are issued by Environment Protection Authority under the *Protection of the Environment Operations Act 1997*. EPLs with respect to scheduled development work or scheduled activities or non-scheduled activities may regulate all forms of pollution (including water pollution) resulting from that work or those activities. EPLs authorising or controlling an activity carried on at any premises may also regulate pollution resulting from any other activity carried on at the premises to which the licence applies.
Extraction height	The heights at which the seam is extracted.
Exploration	The work done to prove or establish the extent of the coal resource.
Greenhouse gases	Gases with the potential to cause climate change (e.g. methane, carbon dioxide and others listed in the *National Greenhouse and Energy Reporting Act 2007*). Expressed in terms of carbon dioxide equivalent.
Groundwater	Water located within an aquifer; that is, held in the rocks and soil beneath the earth’s surface.
Habitat	The place where a species, population or ecological community lives (whether permanently, periodically or occasionally).
Hydrocarbon	Any organic compound — gaseous, liquid or solid — consisting only of carbon and hydrogen.
Hydrogeology	The study of subsurface water in its geological context.
Hydrology	The study of rainfall and surface water runoff processes.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.

Term	Definition
Interburden	The rock between two geological features.
Intrusive noise	Intrusive noise, as defined in the NSW Industrial Noise Policy, refers to noise that intrudes above the background level by more than five decibels.
Key threatening process	As defined under the *Threatened Species Conservation Act 1994*, a key threatening process is any listed process under the Act that adversely affects threatened species, populations or ecological communities, or that could cause species, populations or ecological communities that are not threatened to become threatened.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.
Overburden	The geological units and material above the coal seam to be mined.
Pollutant	Any matter that is not naturally present in the environment.
Product coal	Coal that has been processed within the processing plant to remove unwanted waste rock and prepared to customers specifications.
Project Area	The area of land within the mining lease boundary (CCL 761 and ML 1738) which includes the current and proposed extraction areas, the unshaped overburden dump areas, the workshop and the internal roads connecting the open cut pits to the ROM coal stockpile, the CHPP and the workshop.
Rating Background Level (RBL)	The RBL, as defined in the NSW Industrial Noise Policy, is the overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hr period used for the assessment background level).
Rehabilitation	The return of disturbed land to a stable, productive and self-sustaining condition, after taking into account beneficial uses of the site and surrounding land.
Revegetation	Direct seeding or planting (generally with native species) within an area in order to re-establish vegetation that was previously removed from that area.
Run-off	The portion of water that drains away as surface flow.
Run of mine	Raw coal production that contains coal and rock.
Seam	Layer or bed of coal.
Sensitive receiver	A location where a person works or resides, including residential, hospitals, hotels, shopping centres, play grounds, recreational centres or similar.
Stockpile	Stored materials such as product coal, soil, sand, gravel and spoil/waste.
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape.
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent).

Acronyms / Abbreviations

Acronym	Term/ Definition
ABS	Australian Bureau of Statistics
ACHMP	Aboriginal Cultural Heritage Management Plan
AEMR	Annual Environmental Management Report
AHIMS	Aboriginal Heritage Information Management System
CCC	Community Consultative Committee
CHPP	Coal Handling & Preparation Plant
CCL	Consolidated Coal Lease
CCWSS	Cessnock City Wide Settlement Strategy
CO	Carbon monoxide
CO_2	Carbon dioxide
DA	Development Application
dB(A)	Decibels using the A-weighted scale measured according to the frequencies perceptible to the human ear.
DoE	Department of Environment (Cth)
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries
DRG	DP&E – Division of Resources and Geosciences (formerly known as Department of Resources and Energy)
EA	Environmental Assessment
EARs	Environmental Assessment Requirements (issued by the Secretary of the Department of Planning and Environment)
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EMS	Environmental Management Systems
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	Environment Protection Licence
ESAP	Energy Savings Action Plan
FBA	Framework for Biodiversity Assessment
g/m^2	grams per square metre
GHG	Greenhouse gas
Ha	Hectare/s
HVAS	High Volume Air Samplers
INP	Industrial Noise Policy
KMA	Koala Management Plan
LEP	Local Environment Plan

Acronym	Term/ Definition
LGA	Local Government Area
ML	Mining Lease
MOP	Mining Operations Plan
$\mu g/m^3$	microgram per cubic meter
MIC	Maximum Instantaneous Charge
Mining SEPP	*State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
ML	Mining Lease
MLA	Mine Lease Area
Mtpa	Million tonnes per annum
N_20	Nitrous oxide
NES	Matters of National environmental significance (from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*).
NMP	
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PEA	Preliminary Environmental Assessment
POEO Act	*Protection of the Environment Operations Act 1997*(NSW)
PM	Particulate matter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter.
PM_{10}	Particulate matter less than 10 microns in diameter.
RBL	Rating Background Level
RMP	Rehabilitation Management Plan
RMS	Roads and Maritime Authority
ROM	Run-of-mine. Coal delivered from the mine that reports to the coal preparation plant. This is raw material for the coal preparation plant and can consist of coal, rocks, middlings, minerals and contamination.
SEPP	State Environmental Planning Policy
TAPM	The Air Pollution Model
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TSC Act	*Threatened Species Conservation Act 1995* (NSW) (now referred to as *Biodiversity Conservation Act 2016* (NSW)).
TSP	Total Suspended Particulate

Declaration

Author of the Environmental Impact Statement

Name	Simon Murphy
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	Master of Social Science (Environment and Planning)

Author of the Environmental Impact Statement

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Address	Level 21, 420 George Street, SYDNEY NSW 2000
Qualification	Bachelor of Arts (Geography and Economics)
	Master of Urban and Regional Planning

Address of the Land to which this EIS Applies

The land subject to this EIS is located north of John Renshaw Drive, Buttai and east of Buchanan Road, Buchanan, in NSW.

Description of the Project to which this EIS Applies

This EIS examines the works that would be required for the Project. The key Project elements include:

- The extension of the existing open cut mining operation for an additional nine years (i.e. until 31 December 2030) beyond the life of the existing consent;
- Continuation of mining within approved extraction areas at existing production limits of up to 1.3 Mtpa of ROM coal; and
- Modification of the previously approved final landform, moving the final void approximately 200 metres to the west.

Assessment of the Environmental Impact of the Project

An assessment of the environmental impact of the Project is contained in this Environmental Impact Statement.

Declaration

Pursuant to clause 6(f), Part 3, Schedule 2 of the Environmental Planning and Assessment Regulation 2000,
I declare that this Environmental Impact Statement:

a. Has been prepared in accordance with the requirements of the Environmental Planning and Assessment Act 1979 and the Environmental Planning and Assessment Regulation 2000;

b. Contains all available information that is relevant to the environmental assessment of the Project to which this Environmental Impact Statement relates; and

c. Contains information that is neither false nor misleading.

Simon Murphy
17 January 2018

Catherine Brady
17 January 2018

Executive Summary

Introduction

The Bloomfield Colliery (the Colliery) is an existing open cut mining operation located approximately 20 kilometres north-west of Newcastle. The Colliery is operated by Bloomfield Collieries Pty Limited (Bloomfield), part of the Bloomfield Group of companies. The Colliery currently operates in accordance with Project Approval 07_0087 issued under Part 3A (repealed) of the *Environmental Planning and Assessment Act 1979,* with approved production levels of 1.3 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal. Mining operations under the existing approval may take place until 31 December 2021.

Based on current annual mining rates and an estimate of remaining coal reserves inside the approved extraction area, mining is expected to extend beyond 2021. Bloomfield is therefore seeking a modification to the Project Approval to allow for the continuation of mining within Consolidated Coal Lease (CCL) 761 and Mining Lease (ML) 1738 beyond the life of its current consent.

The Project would allow the Colliery to continue its open cut mining operations and use existing mine infrastructure to process up to 1.3Mtpa of ROM coal until 31 December 2030. The Project also includes a modification of the previously approved final landform by moving the final void approximately 200m to the west.

The current operations at the Colliery include various mining items and activities that have previously been approved as part of the Abel Project Approval (MP 05_0136) for the Abel Underground Mine, granted by the Minister for Planning to Donaldson Coal Pty Limited on 7 June 2007. These infrastructure items and activities include:

- Coal Handling and Preparation Plant (CHPP) and associated water management;
- Rail loading facility; and
- Coarse reject and tailings disposal and coal handling.

These infrastructure items and activities do not form part of this application, but have been considered as part of the assessment of potential cumulative impacts. While the Abel Underground Mine is currently in care and maintenance, Bloomfield would continue to operate these facilities in accordance with the relevant Abel Project Approval conditions of consent. The Project would synchronise the approval timeframe of Project Approval 07_0087 to coincide with the Abel Project Approval consent limit of 31 December 2030. This would allow common infrastructure to be used by both mines until completion.

Project Need and Benefits

Under the current Project Approval (MP_07_0087) Schedule 2 Condition 5, mining operations may take place on the site until 31 December 2021. However, mining is now predicted to extend beyond 2021 for the following reasons:

- The originally predicted ROM coal production levels of 1.3 Mtpa have been lower than anticipated over the life of the project to-date;
- Changes to the mine fleet have allowed extraction of seams that were not previously considered to be a recoverable resource as part of the *Bloomfield Colliery Completion of Mining and Rehabilitation: Part 3A Environmental Assessment* (2008 EA) prepared by Business Environment Pty Ltd. This has increased the amount of recoverable resource at the Mine and therefore the time required for extraction; and
- Further exploration has been undertaken which has identified other previously unrecoverable resources that the new fleet can now access.

As a result of these factors, Bloomfield has identified up to 13 million tonnes of ROM coal remaining inside the approval area. Approval of the Project would therefore enable Bloomfield to extract the identified resource of saleable coal until 31 December 2030.

The Project would see the existing economic and social benefits of the Colliery operations continue over the life of the extended Project Approval. The Project would prolong the life of the Colliery and provide ongoing direct employment for the existing 93 personnel at the Colliery for an additional nine years beyond the life of the current approval. A number of indirect jobs are also supported through the use of contractors for a variety of services.

Project Description

The Proponent is seeking a modification to the Project Approval MP 07_0087 to extend the life of mining at the Colliery until 31 December 2030. This modification would align the Bloomfield mining operations consent limit to coincide with the Abel Underground Mine consent limit.

Existing mining methods would continue to be employed as part of the Project to extract up to 1.3 Mtpa of ROM coal from within the existing approved extraction area. Changes to the mine fleet have allowed extraction of seams that were not previously considered to be a recoverable resource in the 2008 EA. In addition, further exploration has identified other previously unrecoverable resources that the new fleet can now access. This modification therefore proposes a revised mine plan which includes extraction of deeper coal seams than originally approved.

The revised mine plan proposed as part of this Project would result in a modification of the previously approved final landform by moving the final void approximately 200m to the west.

Alternatives

The feasibility of alternatives to the Project was considered, including alternative mine plans and final landforms, mine scheduling, transport methods, and rehabilitation and final land use.

Alternative mine plans considered including the ‘do nothing’ option which would retain the existing approved final landform, the ‘no final void’ option, the ‘large void plan’ and the ‘flat area plan’ The proposed mine plan was selected as it is the most efficient method of mining the last remaining economically viable coal seams on the site. The resulting final landform offers the best shape and slope for post mining commercial utilisation and there would be no highwalls remaining within the final void (as opposed to the currently approved 2008 EA final landform).

This Project aims to extract up to a maximum of 1.3 Mtpa ROM coal up until 31 December 2030. This rate is the same or similar to historical operations. More rapid extraction could be undertaken to remove more material per year, thereby completing mining on the site over a shorter timeframe. Bloomfield, however, blends coal from both the Bloomfield operations and Rix’s Creek Mine (located near Singleton) to meet market specifications. The scheduling of coals to be mined from the various locations in the Bloomfield mine plan is designed to provide flexibility to meet changes in coal quality from Rix’s Creek and/or changes in market requirements.

An alternative to this current transport method would be to provide an in-pit crushing system feeding a conveyor that transports coal to the ROM coal stockpile pad at the CHPP. However this would require Bloomfield to maintain a central extraction point, which is not possible as flexibility is required in extraction areas due to the multi-seam environment and varying coal quality requirements.

A range of final land uses for the Colliery have previously been considered by Bloomfield and the landowner. Consideration of alternative final land uses beyond the life of mining included residential, industrial, open forest / bushland or undulating grazing land / rural landscape. The Colliery is located at the confluence of several local government boundaries. The wider area incorporating the Colliery is identified in strategic land use planning documents for Newcastle, Maitland and Cessnock councils for further investigations for such uses. An indicative final land use plan has been prepared which includes the future use of the Colliery site for a combination of pasture and trees over pasture with any future higher use being subject to separate assessment and approvals in the future.

Statutory Context

The Colliery currently operates under Project Approval MP 07_0087, issued under Part 3A (repealed) of the EP&A Act. As it was for the purpose of coal mining, the original development was classified as a Major Project under the *State Environmental Planning Policy (Major Projects) 2005* which triggered the former Part 3A approval pathway.

While Part 3A of the EP&A Act was repealed in 2011, transitional arrangements set out in Schedule 6A of the EP&A Act provide that Part 3A continues to apply to approved Part 3A projects, and that section 75W of the EP&A Act continues to apply for the purpose of modifications to Project Approvals. The current Project would therefore be undertaken as a modification to the existing Project Approval (MP 07_0087) under section 75W of the EP&A Act. The approval authority is the Minister for Planning.

It is noted that legislative amendments to the EP&A Act are currently being considered, as set out in the draft *Environmental Planning and Assessment Amendment Bill 2017*. One of the proposed amendments is the removal of transitional arrangements for Part 3A projects. If these proposed amendments are enacted, future modifications to the Project Approval MP 07_0087 would be assessed under section 96 of the EP&A Act.

State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) is the principal environmental planning instrument that governs the carrying out of the Project. Clause 7 of the Mining SEPP identifies development which can be carried out only with development consent. The Project is permissible with consent under clause 7 of the Mining SEPP.

The *Cessnock Local Environmental Plan 2011* (Cessnock LEP 2011) applies to the Project Area. The mining area subject to this modification is zoned RU2 Rural Landscape. Mining is not listed as prohibited development in this zone, and is therefore considered permissible with consent. The existing mine rail loop and tailings emplacement area cross the local government area (LGA) boundary and also lie partly within the Maitland LGA. Under the *Maitland Local Environmental Plan 2011* (Maitland LEP 2011) these areas are zoned RU2 Rural Landscape. Open cut mining is permitted with consent within this zone. However, it is noted that the Mining SEPP prevails over the LEPs, and therefore the Project is permissible with consent under the provisions of the Mining SEPP.

This EA supports the application for modification of the Project Approval made by Bloomfield, and has been prepared in accordance with the requirements of the EP&A Act and its Regulation and in accordance with the Environmental Assessment Requirements (EARs) for the Project (issued by the DP&E on the 16 November 2015 and subsequently revised on 22 March 2017).

Environmental Impact Assessment

Biodiversity

A Biodiversity Assessment Report (BAR) was prepared to assess the potential impact of additional clearing proposed as part of the Project and to undertake a gap analysis of previous ecological assessments undertaken within the Project Area.

The 2008 EA included an assessment of potential impacts to flora and fauna, including threatened species, populations and ecological communities. An additional disturbance area was approved to be cleared as part of the MOD 1 modification to the Project Approval to allow for relocation of a powerline corridor and associated infrastructure. The MOD 1 assessment covered 6.12 ha of vegetation which is proposed to be cleared as part of the current Project to allow for further extraction of coal resources. This area is hereafter referred to as the 'MOD1 Study Area'.

A gap analysis undertaken by EMM Consulting identified that the previous ecology impact assessment undertaken for MOD 1 (Hunter Eco, 2010) did not address the matters of NES listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1979* (EPBC Act). EMM Consulting therefore undertook an assessment of the potential impact of vegetation clearance within the MOD1 Study Area on matters of NES listed under the EPBC Act.

An additional 3.5 ha of previously rehabilitated landform (including 0.34 ha of native vegetation) would be cleared as part of the Project for the proposed widening of a haul road and upgrade of a watercourse. This area is hereafter referred to as the 'Haul Road Study Area'. The BAR included an assessment of likely biodiversity impacts of the Project on the Haul Road Study Area.

MOD1 Study Area

A single vegetation type was identified within the ecological MOD1 Study Area – the *Spotted Gum – Broad leaved Mahogany – Red Ironbark shrubby open forest*. This community does not meet the listing of the Critically Endangered Ecological Community (CEEC) Central Hunter Valley eucalypt forest and woodland (CHVEFW) due to the frequent occurrence of contraindicative canopy species, including Red Ironbark and Forest Oak.

No EPBC listed threatened fauna species or migratory fauna species were recorded during the field surveys. Potential habitat for a number of EPBC listed threatened species, including the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox and migratory species Satin Flycatcher and Rufous Fantail was identified within the MOD1 Study Area. Significant impact assessments were prepared for these EPBC listed species.

Potential habitat for these species was found to be of poor value, primarily due to its condition, fragmented nature, existing threats and location next to an existing operating open cut mine. The habitat is unlikely to support important populations of matters of NES or be critical to the survival of a population or the species. Assessments of significance undertaken for these EPBC listed species concluded that it is unlikely that significant impacts to matters of NES would occur as a result of the Project.

Nonetheless, a precautionary assessment approach has been adopted, and the Regent Honeyeater and Swift Parrot have been assumed to occasionally forage within the ecological study area. Accordingly, measures were recommended to mitigate potential impacts of the Project on potential habitat for the Regent Honeyeater and Swift Parrot.

Haul Road Study Area

The Haul Road Study Area supports 0.34 ha of native vegetation, occurring as small patches. Two Plant Community Types (PCTs) were identified within the Haul Road Study Area, including PCT 1590 – *Spotted Gum – Broad leaved Mahogany – Red Ironbark shrubby open forest* (0.05 ha) and PCT 1592 – *Spotted Gum – Red Ironbark – Grey Gum – grass open forest of the Lower Hunter* (0.29 ha). These PCTs represent the Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion, which is an Endangered Ecological Community listed under the *Biodiversity Conservation Act 2016* (BC Act). These PCTs were assessed as being in moderate / good condition.

No threatened flora or fauna species listed under the BC Act or EPBC Act were recorded during the targeted surveys. Potential seasonal foraging habitat for a number of EPBC listed threatened species, including the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox was identified, however the Haul Road Study Area does not provide habitat for an ecologically significant proportion of these species.

The residual impacts of the proposed removal of 0.34 ha of native vegetation would be offset through the purchase of 10 ecosystem credits and a Biodiversity Offset Strategy was prepared. The Colliery has established clearing practices in place as part of its Environment Management System (EMS) and these would continue to be implemented during the Project. Additional mitigation measures recommended to minimise potential impacts of the Project would also be implemented.

Noise, Vibration and Blasting

A Noise and Vibration Impact Assessment (NVIA) was prepared for the Project by SLR Global Environmental Solutions (2017) to assess the potential noise, vibration and blasting impacts associated with the Project.

Predicted noise levels show that generally Project operations have the potential to exceed the relevant Project Specific Noise Levels (PSNLs) and Project Approval noise limits under prevailing noise enhancing weather conditions. However, during reduced night-time operations noise levels were generally predicted to meet the relevant PSNLs and Project Approval noise limits under prevailing noise enhancing weather conditions. The predicted maximum night-time noise levels meet the sleep disturbance criteria and therefore are not likely to cause sleep disturbance at assessed residential locations.

The cumulative impact of mining in the area surrounding the Project, including the Abel Underground Mine, is predicted to comply with the relevant amenity criteria at relevant receiver locations or on more than 25 percent of, any privately owned land, with the exception of Lot 30/DP1113350 (vacant land owned by JD Hestlow within the mining lease).

Calculations were conducted using blast emission site laws to determine the Maximum Instantaneous Charge (MIC) for blasting. Predicted airblast and ground vibration levels would comply with the relevant criteria at the nearest sensitive receivers. Bloomfield utilises independent technical advice with regards to initiation techniques and timing as well as blast hole loading profiles to control the airblast and ground vibration impacts from mine blasting.

Bloomfield would continue to implement noise and blasting management measures currently utilised at the Colliery to minimise the noise and vibration impacts to surrounding receivers. The Noise Monitoring Plan and Blasting Monitoring Program would continue to be implemented for the duration of the Project and would be updated to reflect the Project as required.

Air Quality

An Air Quality Impact Assessment (AQIA) was prepared for the Project by Todoroski Air Sciences to predict the potential air quality impacts on receivers in the vicinity of the Project and to recommend measures to mitigate the impacts.

As the Project is not seeking changes to the intensity or general extent of mining, or changes in the mining equipment fleet or mining method, the Project is not expected to result in significant changes to the existing level of impact.

Dispersion modelling indicates that dust levels would be below the relevant criterion at the privately-owned receptor locations. The results also indicate that without reactive or predictive mitigation measures, there is some potential for cumulative 24-hour average PM_{10} levels to marginally exceed the EPA impact assessment criteria. However, with the use of the now routine day-to-day reactive and predictive systems at the operations, no unacceptable levels of impact would be expected to arise.

It is noted that the approach taken in the AQIA is conservative, and would overestimate the likely impacts. For example, conservative emission estimation is applied using maximum mining rates, the dispersion modelling does not include the effect of rainfall or in-pit dust retention, and the background levels used mean that existing dust emissions from the Colliery are double counted in the cumulative assessment.

Overall, the potential air quality impacts associated with the Project are not expected to be significantly different from the existing approved operations. Bloomfield would continue to implement air quality management measures currently used at the Colliery to mitigate air quality emissions from its operations, which includes a reactive dust mitigation strategy and forecast management system.

Soils and Water

An assessment of the site's existing soils and surface water environment was undertaken to determine the potential impacts of the Project and to recommend measures to account for these impacts.

The Surface Water Assessment included a review of the existing mine water management system at the Colliery and its integration with neighbouring mine sites as well as the site water balance previously developed by Evans and Peck (2012) for the Abel Underground Mine Environmental Assessment.

Abel Underground Mine is currently in care and maintenance, however the surface water assessment concluded that recent differences in Abel's mine water make, water budget and projections of tailings production (compared to the 2012 projections) are not an impediment to the ongoing operations of Bloomfield through to 2030. Abel's Project Approval includes an allowance for disposal of surplus water to Bloomfield voids in future years and that if Bloomfield is still operational and unable to accept the water, appropriate means are available to dispose of surplus water (if that were to occur) via an reverse osmosis plant if necessary and modifications to the Donaldson Square Pit, which could then be discharged to Four Mile Creek under appropriate conditions.

The Project is not predicted to have significant impacts on water supply or demand, or offsite water quality impacts. The design and operation of the existing water management system allows a high degree of flexibility in and significant capacity to account for variations in climatic conditions and production rates. No further impacts to surface water management, beyond that approved under the current Project Approval are predicted.

The Project includes modification of the previously approved final landform by moving the final void approximately 200m to the west. The amended final landform would result in the following changes to the existing approved design:

- The final eastern slopes of the overburden dump would drain east towards Four Mile Creek. The catchment area draining towards Four Mile Creek would increase by approximately 40 Ha and the catchment area draining to Buttai Creek and its tributaries by approximately 188 Ha, as compared to the currently approved final landform design; and
- The proposed catchment area draining towards the final void would be approximately 52 Ha, a decrease from the 240 Ha under the currently approved final landscape design.

A reduced catchment draining to the final void would have a positive effect on Four Mile Creek and Buttai Creek and its tributaries, as it would result in less water being removed from the catchment in the post-mining phase, and less water draining to the final mining void.

The Abel and Bloomfield operations have a cumulative impact on the local soil and water environment. The sites are operating within their approved limits, and would continue to do so up until the approved limit of mining in 2030. The minor additional impacts related to soil, water quality and surface water as a result of the Project would be addressed through implementation of the recommended mitigation measures.

Groundwater

A Groundwater Impact Assessment was prepared for the Project by AECOM to assess the potential hydrogeological impacts of the Project including potential changes to the site water balance and water management system at the Colliery. The assessment was based on data from a predictive groundwater model for the Colliery developed independently by HydroSimulations.

The modelling included prediction of mine inflows throughout the operational life of the Project. For licencing purposes the maximum inflow predicted by the model across the life of the proposed Project is 561 ML/year in 2020. However the groundwater model is conservative and applies higher recharge across parts of the model domain. The mine inflows have been recalculated reducing recharge to these areas and the resultant mine inflows are within the licence conditions of 500 ML/year.

The final void will remain a sink and will have a wide spread effect of lowering water levels in the vicinity of the mine in the long term. A hypothetical monitoring point within the final void is predicted to only recover 15 m after 100 years.

Groundwater drawdown as a result of mining activities are expected to reach a maximum in 2025, at which time mining activities are scheduled to cease in the southern end of the approved extraction area and groundwater levels would start to recover. A drawdown of 100 m is predicted in the surficial aquifer in the Bloomfield approved extraction area and final mine void. Drawdown is generally less than 0.5 m outside the Bloomfield lease area apart from the south-west corner where the 2 m drawdown contour extends outside the lease approximately 600 m beneath Buttai Creek. The predicted drawdowns are not expected to negatively impact GDE's as historical mining in the area has lowered water levels far below the ground surface.

Potential impact to groundwater quality as a result of Bloomfield's current and future operations relate to the risks of contamination from disturbed catchments, mine water, and process water being released off site to natural waterbodies. The Project would not increase or decrease the probability of unplanned discharges or water quality risks from Bloomfield's operations.

Predicted surface water impacts were considered negligible, indicating that Bloomfield mining is having an insignificant effect on stream baseflow. Four Mile Creek is predicted to have been converted to a losing stream around 2011, losing an average baseflow of 0.24kL/day.

A minimal impact assessment has been conducted for the groundwater potentially impacted by the project in accordance with the AIP. All predicted impacts are less than Level 1 minimal impact considerations (as defined in the AIP) and are therefore considered acceptable with appropriate monitoring during operation.

Visual and Rehabilitation

An assessment of the visual environment, including lighting, was undertaken as part of the 2008 EA. This previous assessment identified viewing points around the site with the potential to view operations occurring within the site, in particular residences or other places of public access such as roads or public buildings. The existing visual environment of the Project Area would be similar to that assessed in the 2008 EA as there have been no substantial changes to the Colliery infrastructure or operations since the previous visual assessment was prepared.

The previous assessment of visual impact identified a low visual impact level associated with the Colliery operations. Only one viewing location (Location D – Buttai Valley south of John Renshaw Drive) was considered to have moderate-low visual impact during operations, and it was noted that this would diminish over time as the overburden dump and rehabilitation progresses west out of their line of sight behind Elliots Hill.

The previous assessment also included an assessment of the impact of night lighting. Potential impacts of direct lighting are managed through consultation with residents and attention to the direction of fixed site lighting.

The potential visual impacts of the Project relate primarily to the change in final landform which would see a shift in the final void approximately 200m to the west. This means that views to the overburden emplacement area may change compared to that originally assessed. The visual impacts associated with the proposed overburden emplacement area were assessed through the development of photomontages to illustrate the visual effect from two of the most impacted viewing locations. The photomontages indicate that the visual impact of the Project would be minimal.

Rehabilitation at the Colliery is currently undertaken in accordance with the Rehabilitation Management Plan (RMP) and the Mining Operations Plan (MOP) prepared for the Colliery site. The general rehabilitation, landform and vegetation objectives of the current RMP are based on those detailed in the 2008 EA.

Rehabilitation works generally consist of reshaping of overburden dumps and re-establishment of a vegetative cover. Rehabilitation activities are carried out throughout the year, with the aim of timing vegetation seeding operations in spring and autumn. As reported in the Bloomfield 2016 Annual Environmental Management Reports (AEMR), to date 488 hectares have been rehabilitated within the Project area. The practice of rehabilitation of disturbed areas as soon as practical has minimised the visual impact of the Colliery.

The existing rehabilitation methods and monitoring procedures would continue to be implemented across the Project area, and the RMP would be updated to incorporate the Project.

Social and Economic

An assessment of potential social and economic impacts and benefits associated with the Project was undertaken. An assessment of key social impact elements indicated that the Project would not have an adverse impact on the social fabric of the local community.

Potential impacts and community concerns relating to social amenity were identified via CCC meetings minutes and community hotline data (complaints) for 2009 - 2016. Review of the Bloomfield AEMRs indicates a decline in the number of community complaints received over the last seven years, with only five complaints received in 2015 and 2016. The main concerns related to noise and blasting, with fewer community complaints related to air quality (dust and odour), transport, wild dogs and weeds.

The Project involves the continuation of existing mining activities with the existing workforce and would not require construction of new infrastructure or facilities. Therefore the Project would not result in additional impact on accommodation and housing, community facilities and services.

The Project would prolong the life of the Colliery and provide ongoing employment for the existing 93 personnel for an additional nine years beyond the existing life of the mine. Other community benefits would include the continuation of indirect employment, contributions through sponsorship programs and flow on benefits to the local economy. The Project would also have a positive economic impact through payment of mining royalties to the State Government.

If the Project were not to proceed, economic impacts would primarily be negative due to the reduction in employment following closure of the Colliery in 2021 and a reduction in the flow on benefits to the wider community. Payment of royalties to the State Government would cease and the economic benefits of the remaining coal reserves would go unrealised.

Bloomfield currently undertakes a number of monitoring, management and mitigation activities in relation to identified community concerns, which include noise, blasting and air quality monitoring; rehabilitation of land to minimise visual impact; manning of a 24 hour community hotline; and regular meetings of the CCC. It also contributes to wider community needs through the Bloomfield Foundation and other programs. These programs and protocols would continue to be implemented throughout the life of the Project which would ensure that social amenity impacts are minimal and community benefit is maximised.

Other Matters – Aboriginal and Historic Heritage

Aboriginal Heritage

The Aboriginal Heritage Impact Assessment undertaken for the previous 2008 EA included a review of the archaeological background of the Project Area, searches of relevant heritage databases, and field survey of the Project Area. This included a comprehensive program of consultation with the local Aboriginal community, including the Mindaribba Local Aboriginal Land Council (LALC), the Lower Hunter Wonnarua Council and the Awabakal Traditional Owners Aboriginal Corporation.

The Project would have no additional impact on Aboriginal heritage sites as mining would be undertaken within the existing approved extraction area. The previous Aboriginal Heritage Impact Assessment concluded that potential impacts of the mining operations on Aboriginal heritage would be low.

Mining operations are currently undertaken in accordance with the approved Aboriginal Cultural Heritage Management Plan (ACHMP) prepared for the site, which documents the procedures for archaeological survey, collection, documentation and storage of Aboriginal heritage items in consultation with Aboriginal groups and regulatory authorities. The approved ACHMP would continue to be implemented for the management of Aboriginal cultural heritage within the Project Area.

Historic Heritage

The 2008 EA did not identify any heritage listed items in the Project Area, however there are now three heritage items in the vicinity of the Project Area that are listed on the Cessnock LEP 2011 or on the Hunter Water Corporation section170 Register.

The Buttai Reservoir No. 1 and No. 2 are listed on the Hunter Water Corporation section 170 Register and are located approximately 330m from the Project Area at its nearest point and approximately 1km north of proposed extraction areas. The Reservoirs continue to function within the modern water supply system. Given the distance of these items from the existing active mining pits, the Project would not result in direct impact to these items.

The Buttai Cemetery is listed on the Cessnock LEP 2011 as locally significant and is located on Bloomfield owned land adjacent to the Project Area to the south. The cemetery contains a range of monuments dating from 1874 to 1976, documenting the history of the Elliot family. General mining activities, such as the operation of large vehicles and blasting activities, in particular the associated ground vibrations, have the potential to impact the structural integrity of heritage sites, such as the Buttai Cemetery. Blast monitoring results reported in Bloomfield's AEMRs indicate that blasting results at the closest blast monitoring point complied with the blasting criteria set in EPL396.

It is noted that the most vibration-intensive activities south of the Project Area have already occurred, and potential vibration impacts to the Buttai Cemetery would become less likely to occur as mining progresses further north.

Existing management measures would adequately manage potential impacts to Aboriginal and historic heritage items. Mining operations would continue to be undertaken in accordance with the approved ACHMP and relevant legislative requirements. Bloomfield would continue to consult with the Aboriginal community groups and regulatory authorities as per the procedures set out the ACHMP. Blast monitoring would continue to be conducted to confirm that airblast and ground vibration levels meet relevant blasting criteria. The existing EMS and relevant management plans would be updated to incorporate the Project.

Other Matters – Hazards and Risks

Potential hazards and risks associated with operation of the existing Colliery include the storage of hazardous goods, hydrocarbon contamination, bushfire, spontaneous combustion and mine subsidence.

The Project is not seeking changes to the intensity or general extent of mining, and does not involve changes in the mining equipment fleet or mining method compared to existing operations. Therefore the Project is not expected to pose additional hazards and risks above those associated with the existing operation of the Colliery. These aspects would continue to be managed through implementation of the existing mine management framework.

Other Matters – Waste

Wastes generated at the Colliery are classified and separated in accordance with the EPA's Waste Classification Guidelines (EPA, 2014) and managed in accordance with Bloomfield's Waste Management System.

The Project does not involve an increase in production levels at the Colliery and typical waste types and volumes expected to be generated by the Project would be similar to existing levels

Waste management procedures currently implemented at the Colliery are considered to be sufficient to manage potential waste impacts associated with the Project and as such additional waste mitigation measures would not be required.

Cumulative Impacts

As the impact of the individual factors of the Project would be minimal, no significant cumulative impact is anticipated for the Project provided the measures recommended in the EA are implemented. The cumulative impact of the Project with other known projects currently operating or proposed for the area are considered to be minimal.

Environmental Management and Monitoring

The Colliery currently operates under an EMS to meet the various regulatory requirements of the existing Project Approval and EPL 396. This EMS would continue to be adopted during the Project and would be updated to include the relevant management measures included in this EA.

As part of the detailed assessment of the Project a range of management and mitigation measures have been identified in order to manage the potential impacts to the environment that may occur as a result of the Project. Bloomfield commits to the implementation of those management and mitigation measures as identified in this EA. Bloomfield also commits to the ongoing review of the EMS and subordinate management plans and procedures to maintain appropriate management measures as the Project progresses. Furthermore both the implementation of measures and the preparation of environmental management documentation would be undertaken in consultation with relevant government agencies.

Project Justification

The existing Colliery has a well-established relationship with the local community and surrounding areas. As the Colliery has been operating since the 1960s, its ongoing operation into the future does not represent a significant new disruption to the local community or the wider Hunter Region.

Bloomfield has demonstrated through the operation of the Colliery to date that it is keenly focused on minimising impacts on the environment and community. Bloomfield has also developed a close working relationship with the local community during this time.

This EA has provided a thorough assessment of the potential environmental impacts of the Project and recommended measures to manage impacts to acceptable levels. Subject to the implementation of such measures, the assessment of the Project in accordance with the principals of Ecologically Sustainable Development has concluded that the Project:

- Would be undertaken in a manner which affords due consideration to the biophysical, economic and social environment within which the Project would operate, at local regional and national scales;
- Has appropriately considered and implemented the precautionary principal during planning to minimise and avoid where possible impacts on the environment and community;
- Has demonstrated that the Project would not be expected to result in inequities between generations as a result of undue environmental impact, short term economic gain or a lack of appropriate management measures to prevent or minimise environmental impacts;
- Would be undertaken in a manner that would not result in impacts to biodiversity that would be significant or lead to a loss of integrity to flora or fauna such that significant impacts may occur;
- Would not be undertaken in a manner that degrades the pricing or valuation of resources by present day pricing or knowingly increases the costs of resources in the future; and
- Does not represent a significant contributor to global Greenhouse Gas emissions such that it could significantly impact the processes of climate change or the greenhouse effect.

Based on these findings the Project is considered to represent an ecologically sustainable development that would not result in inequalities between present and future generations.

Conclusion

This EA has assessed the Project against the requirements of the *Environmental Planning and Assessment Act 1979* and the principles of Ecologically Sustainable Development. This assessment has concluded that the Project is consistent with the objectives of the Act and principles of Ecologically Sustainable Development.

In summary the Project would:

- Utilise existing mine infrastructure to continue resource extraction within an established operation;
- Provide continued employment for 93 existing site personnel;
- Contribute to the local and regional economy through ongoing contracts to a range of longstanding suppliers and contractors, servicing of existing customer contracts and payment of royalties and taxes;
- Facilitate increased spending in other sectors, stimulating the demand for goods and services; and
- Provide other social benefits which flow from community engagement and sponsorships programs.

The benefits of the Project would outweigh its potential impacts, with the implementation of the proposed management, mitigation and offset measures, as recommended by this EA, in place. It is considered that it is appropriate and in the public interest to approve the Project.

1.0 Introduction

1.1 Overview

1.1.1 Background to the Project

The Bloomfield Colliery (the Colliery) is an existing open cut mining operation located approximately 20 kilometres north-west of Newcastle (refer to **Figure 1** and **Figure 2**). The Colliery is operated by Bloomfield Collieries Pty Limited (Bloomfield), part of the Bloomfield Group of companies. The Colliery currently operates in accordance with Project Approval 07_0087 issued under Part 3A (repealed) of the *Environmental Planning and Assessment Act 1979 (*EP&A Act)*,* with approved production levels of 1.3 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal. Mining operations under the existing approval may take place until 31 December 2021 within the approved Project Area.

Based on current annual mining rates and an estimate of remaining coal reserves inside the approval area, mining is expected to extend beyond 2021. Bloomfield is therefore seeking a modification to the Project Approval to allow for the continuation of mining within Consolidated Coal Lease (CCL) 761 and Mining Lease (ML) 1738 beyond the life of its current consent.

The Project would allow the Colliery to continue its open cut mining operations and use existing mine infrastructure to process up to 1.3Mtpa of ROM coal until 31 December 2030. The Project also includes a modification of the previously approved final landform by moving the final void approximately 200m to the west. The Project includes widening of a haul road and upgrade of an adjacent watercourse and this would require clearing of approximately 3.5 ha of previously rehabilitated landform (refer to **Figure 3**). The area to be cleared includes 0.34 ha of native vegetation and 3.2 ha of non-native vegetation dominated by exotic grasses.

1.1.2 Existing Operations

Coal has been mined on the site for approximately 170 years. The Colliery which has been operating since 1966 produces approximately 0.8 to 1.3 million tonnes of ROM coal by open cut methods per year. Product coal is predominantly thermal coal with some soft coking coal for the Asian export market. Current open cut mining operations are located in the southern portion of the CCL 761 and ML 1738 lease area from within the S Cut and Creek Cut open cut pits (**Figure 3**). Coal is extracted from coal seams within the Tomago Coal Measures, including the Buttai, A, B and C, Whites Creek, Elwells Creek, Donaldson and Big Ben seams.

The current operation includes an on-site Coal Handling and Preparation Plant (CHPP) and rail loading facility approved under the Abel Underground Mine Project Approval (MP 05_0136) ("Abel Project Approval") which was granted to Donaldson Coal Pty Ltd on 7 June 2007. Bloomfield operates the CHPP and rail loading facility under agreements with Donaldson Coal and in accordance with the Abel Project Approval Statement of Commitments. The Abel Underground Mine is located south-east of the Colliery and is currently in 'care and maintenance'.

The Colliery is a multi-seam, multi bench system, mining up to 13 seams or splits. Heavy earth moving equipment delivers the ROM coal to the onsite CHPP via internal haul roads. ROM coal is processed at the CHPP including size reduction, washing and screening. Product coal is stockpiled adjacent to the CHPP before being loaded into rail wagons at the Bloomfield rail loading facility, and transported by rail to the Port Waratah Coal Services terminal at the Port of Newcastle.

The Colliery has approval to operate 24 hours per day, seven days per week, and employs 93 personnel over 15 shifts a week across its operations, including the mining, administration and maintenance areas. A range of real time and predictive monitoring is undertaken at the Colliery with the results regularly reviewed and reported annually to ensure the effective and transparent operation of management controls.

1.1.3 Development Consents and Leases

Table 1 provides a summary of the consents, leases and licenses for the Colliery. The Project Approval (MP 07_0087) for mining operations at the Colliery was issued on 3 September 2009. Prior to this, mining operations had previously been carried out pursuant to existing use rights.

Various mining items and activities at the Colliery have previously been approved as part of the Abel Project Approval (MP 05_0136) for the Abel Underground Mine, granted by the Minister for Planning to Donaldson Coal Pty Limited on 7 June 2007. These infrastructure items and activities include:

- CHPP and associated water management;
- Rail loading facility; and
- Coarse reject and tailings disposal and coal handling.

While the Abel Underground Mine is currently in care and maintenance, Bloomfield Colliery continues to operate these facilities in accordance with the relevant Abel Project Approval conditions of consent. The Project would synchronise the approval timeframe of Project Approval 07_0087 to coincide with the Abel Project Approval consent limit of 31 December 2030.

Table 1 History of Development Consents for the existing Bloomfield Colliery mine operations

Year	Approval and Consent Authority	Detail / Comment
2009	Project Approval 07_0087 Minister for Planning (refer **Appendix A**)	Approval to mine up to 1.3 Mtpa of ROM coal until 31 December 2021.
1991	CCL 761 Granted by Minister for Natural Resources	Granted by the Minister for Mineral Resources under the *Mining Act 1992.*
2007	Project Approval 05_0136 (Abel) Granted by Minister for Planning	Includes certain surface infrastructure (CHPP and rail loading facility) that Bloomfield Colliery relies upon for operation. Approval to operate until 31 December 2030.
2007	Environmental Protection Licence (EPL) 396 Environment Protection Agency	Issued by the Environmental Protection Authority (EPA) under the *Protection of the Environment Operations Act 1997* (POEO Act).
2011	Project Approval Modification, 07_0087_ Mod 1. Minister for Planning	Modification to mine plan and operations including: · Emplacing overburden on, and rehabilitation of previously rehabilitated land south-east of the S Cut pit; · Reshaping and rehabilitating two unvegetated areas, north of the Creek Cut pit and east of the S Cut pit respectively; · Constructing a new haul road east of the Creek Cut pit; and · Constructing an easement and overhead powerline west of the S Cut pit.
2012	Project Approval Modification, 07_0087_ Mod 2. Minister for Planning	Approval to extend the date required for the submission of two Management Plans required by the Project Approval by six months.
2013	Project Approval Modification, 07_0087_ Mod 3. Minister for Planning	Amendment to the area of vegetation clearing covered by the Mine's Biodiversity Offset Area.
2016	ML 1738 granted by Minister for Industry, Resources and Energy	Removal of surface exclusions.

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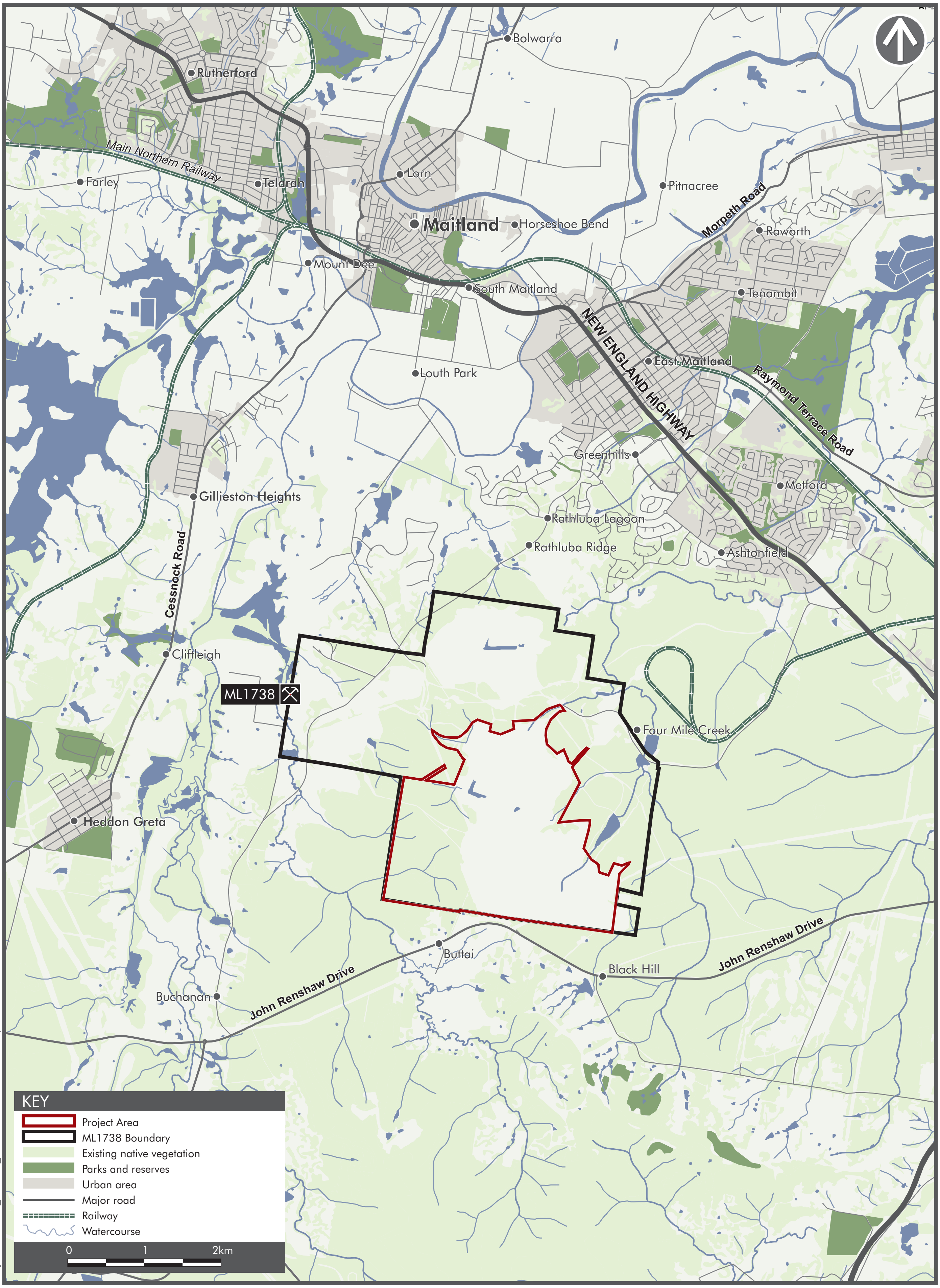
AECOM

REGIONAL CONTEXT
Bloomfield Project

FIGURE 1



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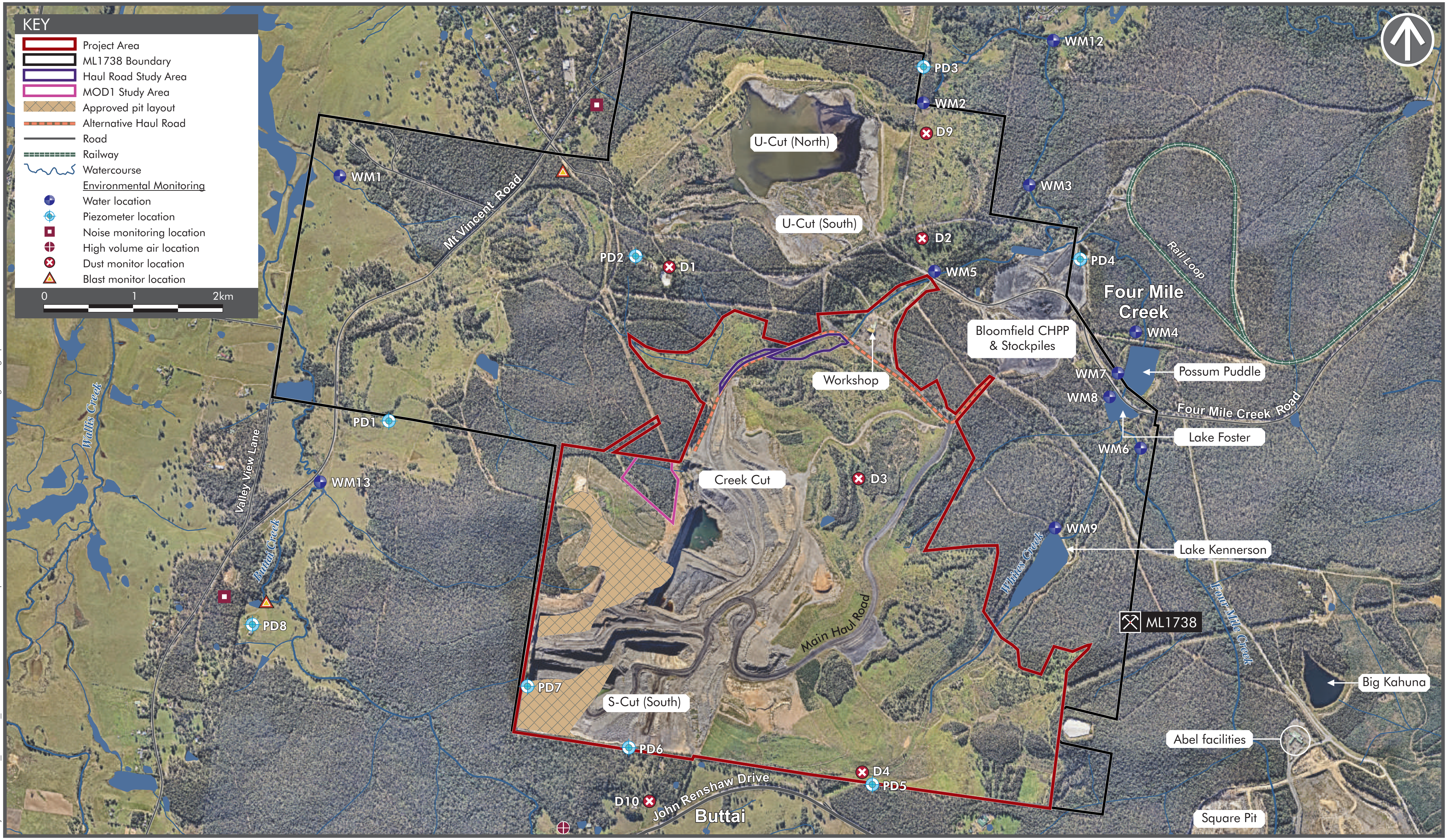
SITE LOCATION
Bloomfield Project

FIGURE 2



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F3 Existing Mining Operations 19 12 2017 TO

AECOM

EXISTING MINING OPERATIONS
Bloomfield Project

FIGURE 3

1.2 Modification Outline

1.2.1 Life of Mine

The Proponent is seeking a modification to the Project Approval MP 07_0087 to extend the life of mining at the Colliery until 31 December 2030. This modification would align the Bloomfield mining operations consent limit to the Abel Underground Mine consent limit.

1.2.2 Mining Method

Existing mining methods would continue to be employed as part of the Project. The Colliery currently uses multi-seam bench open cut techniques to extract coal from a variety of seams within the Tomago Coal Measures. The mining process at the Colliery generally comprises vegetation stripping and topsoil removal, drilling and blasting of overburden, removal and stockpiling of overburden, and extraction of coal. Coal is transported by truck to the ROM coal stockpile via internal haul roads. Overburden emplacement areas are reshaped and rehabilitated to create the final landform.

This modification proposes a revised mine plan which includes extraction of deeper coal seams that were not previously considered to be a recoverable resource in the *Bloomfield Colliery Completion of Mining and Rehabilitation: Part 3A Environmental Assessment* (2008 EA) prepared by Business Environment Pty Ltd. The proposed change would result in a modification of the previously approved final landform by moving the final void approximately 200m to the west.

1.2.3 Mine Infrastructure

Existing infrastructure, including the workshop, fuel storage area, offices, bathhouse, internal access roads and water management structures, are considered sufficient for the proposed remaining life of mine. No new infrastructure is proposed to be constructed or brought onto the site.

1.2.4 Production Rates

The Proponent has long standing thermal and semi-soft coking coal contracts with customers predominantly in Japan, Korea and Taiwan. In order to continue servicing these contracts, maximum annual production levels at the Colliery would continue at 1.3 Mtpa ROM coal.

1.2.5 Reject Management

Process waste from the CHPP, including coarse rejects and fine tailings, would be disposed of in the existing tailings emplacement area (U-Cut North and South), i.e. the disused open cut pits. The management and disposal of tailings into the existing tailings emplacement area is approved under the Abel Project Approval and therefore does not form part of this Project. As the current tailings emplacement area is anticipated to reach capacity during the life of the mine extension, future tailings disposal would be undertaken as described in full in **Section 4.3.3**.

1.2.6 Haul Road Expansion

The Project proposes additional clearing of approximately 3.5 ha of previously rehabilitated landform (refer to **Figure 3**), including 0.34 ha of native vegetation and 3.2 ha of non-native vegetation dominated by exotic grasses. The proposed vegetation clearing is required for the widening of a haul road and upgrade of the adjacent watercourse. Further detail is provided in **Section 4.3.4** and an assessment of potential impacts to biodiversity is provided in **Section 8.1**.

2.0 Site Location and History

2.1 Site Location

The Colliery is located approximately 20km northwest of Newcastle, centrally located between the suburbs of Kurri Kurri, East Maitland and Beresfield. The Colliery is situated north of John Renshaw Drive, Buttai and east of Buchanan Road, Buchanan. The land along the western boundary of the Project Area is mainly open forest. To the north and east, the Project Area is generally bounded by rehabilitated mined land. Land adjoining the south of the Project Area, near John Renshaw Drive, has been cleared for grazing. John Renshaw Drive is the nearest public road to the Project Area.

A number of residences are located to the south of the Project Area. These are mainly rural residential properties adjacent to John Renshaw Drive and extending southwards along Lings Road and Browns Road. Residential properties are also located to the west adjacent to Buchanan Road and to the north-west at Louth Park. The nearest urban residential area is Ashtonfield, approximately 2.25 kilometres north-east of the workshop area. The nearest residence to the Project Area not owned by Bloomfield is located approximately 600 metres south of the southern boundary of the Project Area. **Figure 4** shows residences within the vicinity of the Project Area, as well as local land uses.

Mining operations in the vicinity of the Project include:

- Abel Underground Mine south-east of the Colliery (in care and maintenance since June 2016);
- Donaldson Open Cut Mine, on the eastern boundary of the Colliery (in care and maintenance since June 2016);
- Tasman Underground Mine, south of the Colliery (closed, rehabilitation completed in 2014); and
- Bloomfield CHPP and rail loading facility approved as part of the Abel Project Approval.

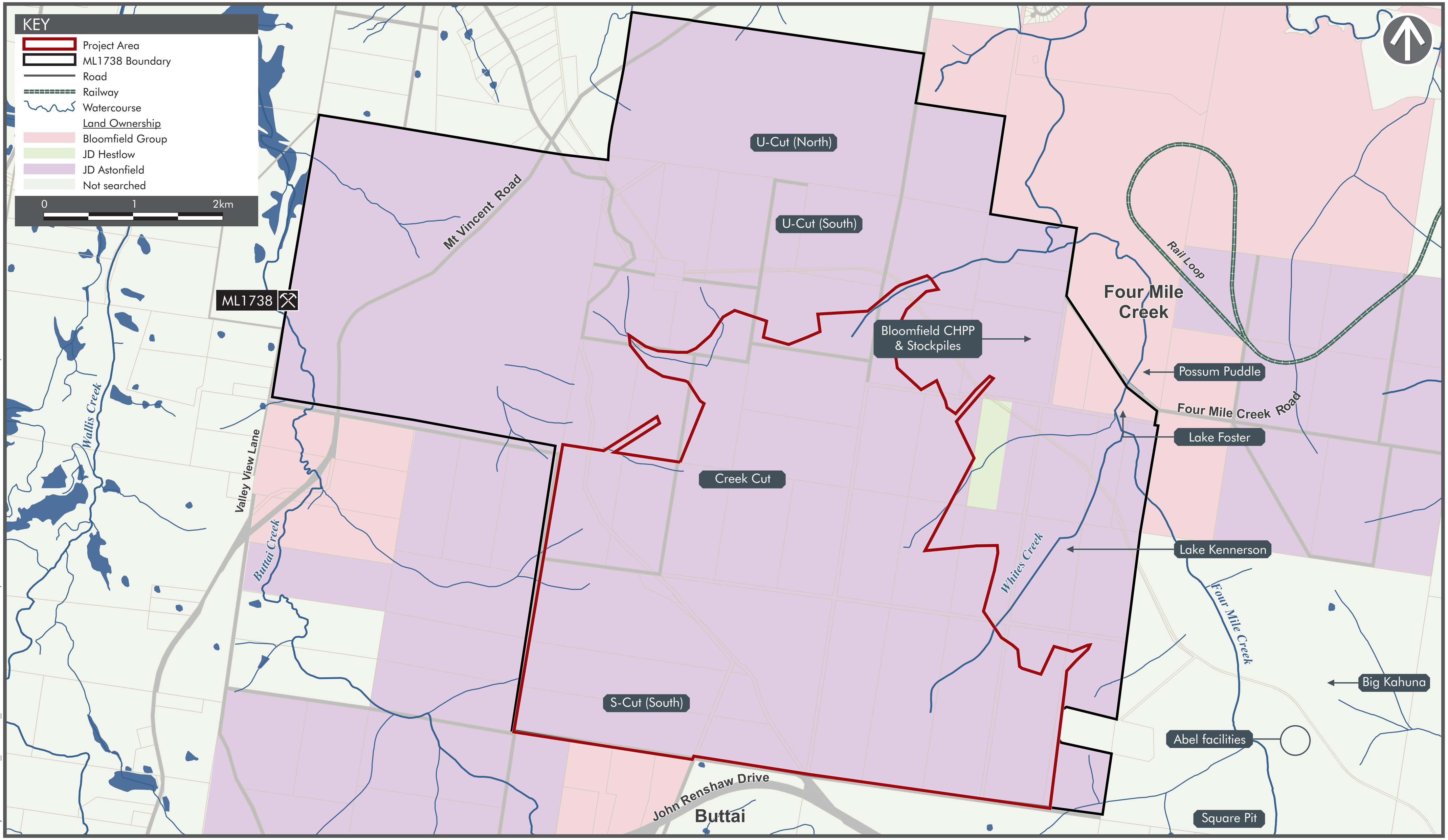
The Project Area is located within CCL 761 and ML 1738 and includes the following:

- The current and proposed active open cut coal mining areas;
- The unshaped and shaped overburden dump areas;
- Workshop and surrounding area used for maintenance and fuel storage;
- Road linking the current and proposed coal mining areas with the ROM coal stockpiles adjacent to the CHPP; and
- Road linking the current and proposed coal mining areas to the workshop.

2.2 Ownership and Legal Description

All land within the Project Area is owned by Ashtonfields Pty Limited (Ashtonfields), an independent third party with a long standing relationship with Bloomfield, and is held by Bloomfield under a commercial lease. Land use within the Project Area is exclusively associated with the extraction, stockpiling and transport of coal. The land consists of active mining areas and associated infrastructure (that is, hardstands, laydown areas, roadways, overburden stockpiles, dams, drains), rehabilitated mined areas and undisturbed vegetated areas.

Figure 4 shows land ownership within the Project Area, as well as land owned by the Proponent adjacent to the Project Area.



AECOM

LAND OWNERSHIP
Bloomfield Project

FIGURE 4

2.3 Site History

Coal has been mined on the site by both underground and open cut means for approximately 170 years. Bloomfield purchased the operation in 1937, and commenced underground mining of the Donaldson, Big Ben and Rathluba seams. Underground mining on the site ceased in 1992.

Bloomfield's open cut mine commenced in 1966, using bulldozers and tractor scrapers. CCL 761 was granted on 20 November 1991 and forms the boundary of the Colliery. ML 1738 was granted 29 June 2016, to remove surface exclusions from within areas of CCL 761. The open cut has continued to expand and develop with the introduction of new machinery and technology.

Mining operations at the adjacent Abel Underground Mine (now in care and maintenance) required the use of certain Bloomfield infrastructure (the CHPP and rail loading facility). To enable this use, the Abel Project Approval granted on 7 June 2007 includes approval for the operation of Bloomfield CHPP and rail loading facility, including associated water management and process waste management. An Integrated Water Management System for the three adjoining mines of Bloomfield, Abel and Donaldson was approved on 5 May 2008.

Project Approval (MP 07_0087) for the Colliery was granted on 3 September 2009 for the staged completion of mining and progressive rehabilitation of the disturbed land. Prior to this, the Colliery had operated pursuant to existing use rights.

Mining operations are currently undertaken in open cut pits known as S Cut and Creek Cut (refer to **Figure 3**). Mining in S Cut is progressively moving west, while extraction within Creek Cut is moving towards the south and west. These pits mine a range of coal seams within the Tomago Coal Measures.

Areas within CCL 761 and ML 1738 where mining has been completed have been progressively stabilised and rehabilitated over time. To date, approximately 488 hectares of land within the Project Area has been rehabilitated. Areas of the rehabilitated land are being used for cattle grazing and for the control of surface runoff to water storage dams or natural watercourses.

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3.0 Project Need and Benefits

3.1 Project Objectives

The objectives of this Project are to:

- Complete the program of open cut mining within the Colliery, including operation of the associated workshop, haul road and access road that links the workshop, open cut pits and CHPP;
- Undertake rehabilitation of the site in accordance with commitments to the landowner, relevant regulatory requirements and planning considerations; and
- Liaise with local landholders to ensure community concerns are identified and addressed in the design and operation of the mining activities.

3.2 Project Needs

Under the current Project Approval (MP_07_0087) Schedule 2 Condition 5, mining operations may take place on the site until 31 December 2021. However, mining is now predicted to extend beyond 2021 for the following reasons:

- The originally predicted ROM coal production levels have been lower than anticipated over the life of the project to-date;
- Changes to the mine fleet have allowed extraction of seams that were not previously considered to be a recoverable resource as part of the original 2008 EA. This has increased the amount of recoverable resource at the Mine and therefore the time required for extraction; and
- Further exploration has been undertaken which has identified other previously unrecoverable resources that the new fleet can now access.

As a result of these factors, Bloomfield has identified up to 13 million tonnes of ROM coal remaining inside the approval area. Approval of the Project would therefore enable Bloomfield to extract the identified resource of saleable coal until 31 December 2030.

The Project would see the existing economic and social benefits of the Colliery operations continue over the life of the extended Project Approval.

3.3 Project Benefits

3.3.1 Land Use and Existing Operations

The key benefit of using existing mine infrastructure for ongoing mining activities is the ability to continue resource extraction within an established operation with significant environmental management initiatives in place and the majority of the required disturbance area already cleared, or approved for clearance. In addition the entire land holding designated for future mining is under operational control of the Proponent and has been managed with this intent over many years. Further acquisition of land in the surrounding area is not required.

3.3.2 Employment and Social Benefits

The Project would prolong the life of the Colliery and provide ongoing direct employment for the existing 93 personnel at the Colliery for an additional nine years beyond the life of the current mine approval. Further to the direct employment benefits the Colliery generates, a significant number of indirect jobs are supported through the use of contractors for a variety of services.

In addition to the social benefits that secure employment provides to the community, other social benefits which flow from community engagement and sponsorships programs are detailed in **Section 8.7**.

3.3.3 Economic Benefits

The Project would provide a range of ongoing economic benefits at the local, regional and State level through:

- Ongoing contracts to a range of longstanding suppliers and contractors;
- Servicing of existing contracts and the potential to service future coal markets;
- The payment of royalties and taxes; and
- Local and regional benefits from capital investment and purchasing carried out by a wholly owned Hunter Valley private company, where all profits are subjected to the Australian taxation system. Bloomfield has no overseas based companies.

Without approval of this modification, operations at the Colliery would cease in 2021 which would prevent further economic benefits of the Colliery being realised. Conversely, if approved, the Project would prolong the life of the Colliery and enable recovery of a greater proportion of the existing resource, which in turn would enable ongoing supply to existing customers and direct employment for the existing employees for a further nine years.

4.0 Existing Operations and Proposed Modification

4.1 Overview

The Proponent is seeking a modification to the Project Approval MP 07_0087 to extend the life of mining at the Colliery until 31 December 2030. The modification is not seeking to amend the currently approved annual tonnage limits, which would continue to be up to 1.3 Mtpa of ROM coal.

Open cut mining methods would be used to extract coal from within the existing approved extraction area. A number of seams of the Tomago Coal Measures would be mined, from the surface to the Big Ben seam. Once the coal has been extracted, it would be processed at the Colliery's existing CHPP, stockpiled at the rail loading facility, and then transported via the Mine's approved rail loop to the Port of Newcastle for export.

This application to modify the Project Approval MP 07_0087 relates to those infrastructure items and activities at the Colliery which are not included in the Abel Project Approval. These include:

- The current and proposed open cut mine areas;
- The unshaped and shaped overburden dump areas;
- The workshop;
- The road between the open cut pit areas and the ROM coal stockpile at the CHPP; and
- The road that links the workshop, open cut pits and CHPP.

The above areas that are the subject of this Application are referred to throughout this document as the 'Project Area' (refer **Figure 3**). Operation of the CHPP associated water management, the rail loading facility, and coarse reject and tailings disposal are approved under the Abel Project Approval and do not form part of this modification application.

4.2 Existing Mining Operations

4.2.1 Mining Method

Mining at Bloomfield is generally undertaken as a multi-seam truck and excavator / face shovel operation, conducted in sequential mining blocks. The existing mining process for each block includes:

- Vegetation removal;
- Topsoil/pre-strip;
- Drilling and blasting;
- Overburden removal and stockpiling;
- Coal removal (followed by interburden removal and coal removal for lower seams); and
- Overburden reshaping and rehabilitation.

The majority of the area to be mined has previously been cleared of vegetation, with grasses and low vegetation allowed to regenerate to stabilise the surface until it is required for mining. Topsoil material is pushed up with dozers and loaded onto haul trucks with front-end loaders, or excavated and loaded directly onto haul trucks with an excavator. It is then placed on reshaped overburden dumps in preparation for rehabilitation. Topsoil stockpiling is avoided where possible for operational and topsoil quality reasons.

Following topsoil/pre-strip removal, blast hole patterns are drilled into the overburden, in preparation for blasting. Blast pattern and hole depth is designed in accordance with excavator capability and safe blast design. The holes are then loaded with explosives and detonated. After blasting, loose overburden material is removed by excavator/face shovel and placed onto rear dump haul trucks for hauling to overburden emplacements.

The exposed coal seam is then ripped and pushed up with dozers, loaded onto coal trucks and transported to the ROM coal stockpile via internal haul roads.

The interburden/coal extraction process is repeated for each seam until the basal Big Ben seam has been removed. The resultant void is then available for backfilling with the overburden from subsequent mining blocks. Emplacements are reshaped by dozer to create the final contour shape.

4.2.2 Mine Access

The Project would use the existing infrastructure at the Mine for employee and material access. This includes temporary internal mine roads constructed as required to access mine areas, and permanent access roads linking major infrastructure components such as the CHPP and ROM coal stockpile pad (as shown on **Figure 3**). The primary site access is via Four Mile Creek Road off the New England Highway, with secondary access available via Buttai Road. The secondary site access is restricted with a locked gate and is not used as a daily access point.

4.2.3 Approved Mine Production Schedule

The Colliery has approval to extract up to 1.3 Mtpa of ROM coal. A Mining Operations Plan (MOP) was prepared for the Project and approved by the Department of Primary Industries (DPI). The MOP covers the period 2012 – 2016, however in December 2016 the MOP period was extended to June 2017 and in April 2017 the MOP period was further extended to 31 December 2017. In consultation with Division of Resources and Geosciences (DRG)[1], a MOP Amendment has been submitted to DRG to extend the MOP period to June 2018 to allow time for this modification application to be processed. The mining production schedule outlined in the approved MOP 2012-2016 is shown in **Table 2**.

Table 2 Approved Mine Production Schedule

Material	2012	2013	2014	2015	2016	2017[2]
Stripped topsoil (m^3)	40,000	40,000	40,000	40,000	40,000	10,000
Overburden (m^3)	5,500,000	5,500,000	5,500,000	5,500,000	5,500,000	5,985,000
Ore (Kt)	900	900	900	900	900	1211
Processing Waste[1] (Kt)	1830	1830	1830	1830	1830	581
Product coal (Kt)	500	500	500	500	500	630

1. Abel Underground Mine currently under care and maintenance. Processing waste figure may increase if Abel operations resume during MOP period.
2. Figures taken for 2017 from the draft 2017 – 2019 MOP update which is yet to be approved.

4.2.4 Existing Plant and Equipment Fleet

Bloomfield currently uses an excavator or face shovel and a fleet of rear dump trucks for the removal of topsoil, pre-strip, overburden and interburden material. Previous extraction machinery used a large shovel which was unable to separate thinner seams from overburden. Bloomfield has since acquired an excavator that allows thinner seams to be extracted.

Two drill rigs are used for blast-hole drilling. A coaling fleet comprising a front-end loader or excavator, rear-dump trucks and a fleet of road trucks is used to transport the ROM coal. It is proposed that the same, or similar, equipment would be used for the Project. As Bloomfield also operates the Rix's Creek North and South Mines it sometimes rotates equipment based on the production needs at each of its mines.

4.2.5 Mine Infrastructure and Facilities

Major infrastructure components in the Project Area, all of which currently exist, consist of the following:

- Open cut workshop, fuel storage area, offices and bathhouse;
- Temporary internal mine roads constructed as required to access mine areas;
- Permanent access roads linking major infrastructure components such as the workshop, and the ROM coal stockpile pad;

[1] Formerly known as the Department of Resources and Energy (DRE)

- Water management system including 'clean' and mine water management structures; and
- Dust suppression water tank storage.

The CHPP and associated facilities and the rail loading facility are approved under the Abel Project Approval and do not form part of this Project.

Existing infrastructure is considered sufficient for the proposed remaining life of mine. No new infrastructure is proposed to be constructed or brought onto the site.

4.2.6 Overburden and Rejects Management

Overburden Emplacement

Overburden is the strata between the surface and the upper-most coal seam, and is removed prior to accessing the coal. For the purpose of this EA, management of overburden also includes the management of interburden which is the non-resource material located between coal seams.

Overburden is stockpiled in emplacement areas for use as backfill and for rehabilitation purposes. Overburden is placed in progressive spoil dumps which are subsequently reshaped to re-establish a landscape that blends with the surrounding undisturbed topography. Overburden dumps are typically reshaped with a maximum slope of 18 degrees. Where steep slopes are constructed, suitable erosion and sediment control banks are incorporated to provide stability.

Reshaping of overburden emplacement areas is undertaken in accordance with the procedures documented in the Rehabilitation Management Plan prepared for the Colliery.

Rejects Management

Reject material is generated from the CHPP during the cleaning and preparation of coal for transport. Management of process waste from the CHPP is approved under the Abel Project Approval and does not form part of this Project. The following information is provided for background purposes only.

Process waste from the CHPP consists of breaker reject (large diameter (>150mm) rocks and coal rejects), coarse rejects and fine rejects (tailings). Breaker reject is hauled by truck to operational open cut pits and placed under advancing overburden dumps. Coarse rejects are currently disposed of under advancing overburden dumps. Fine tailings are currently pumped out as 20% solids slurry to the Tailings emplacement area (a disused open cut pit in the north of the mine site). Reject fines settle out of the slurry, gradually backfilling the pit, whilst the decant water is returned to the CHPP for re-use in processing.

4.2.7 Water Management

The Colliery's surface water management system (further discussed in **Section 8.4**) integrates water management for the open cut and the CHPP and has been assessed and approved under the Abel Project Approval. The Bloomfield water management system forms part of the Integrated Water Management System approved on 5 May 2008 for the three adjoining mines of Bloomfield, Abel and Donaldson.

A specific Water Management Plan has been prepared for the Colliery to address the water management issues within the Project Area covered by the Project Approval MP 07_0087 (that is, it does not include water management related to operation of the CHPP, which is covered in the Abel Project Approval). The current Water Management Plan includes:

- A Site Water Balance prepared in accordance with the conditions of consent which details the sources and security of water supply, water use and on site management, and measures to minimise overall water use;
- An Erosion and Sediment Control Plan which identifies the potential sources of sediment during mining operations, the control measures to be implemented, and the monitoring and maintenance requirements to ensure control structures are operating effectively;
- Surface Water Monitoring Plan, which provides the baseline hydrology and assessment criteria and details the locations and schedule for monitoring of surface water in accordance with the Colliery's EPL 396;

- Groundwater Monitoring, which provides baseline data for groundwater levels and quality, impact assessment criteria, and details the monitoring program for the ongoing measurement of groundwater quality and levels against baseline levels; and
- Surface and Groundwater Response Plan, which describes the measures that would be implemented in the event of unexpected adverse impacts or water quality degradation.

The Project would continue to operate under the existing water management system and Water Management Plan.

4.2.8 Service Infrastructure

Service infrastructure at the Colliery has adequate capacity to accommodate the Project. No additional servicing or utility infrastructure connections would be required for the Project.

A modification to the Project Approval MP 07_0087 was approved on 16 May 2011 enabling the relocation of a 330m section of powerline located northwest of the Project Area. Relocation of the powerline and associated infrastructure was required to enable mining within Creek Cut to be completed, as the original powerline corridor was within the path of approved works. These works were completed in 2011 and the powerline currently provides power for site equipment.

4.2.9 Workforce and Hours of Operation

The Colliery currently employs approximately 93 personnel across its operation and has approval to operate 24 hours a day, seven days per week but typically operates an eight hour shift roster five days per week, with additional production during the weekend using overtime if required. The Project would continue to operate within the approved limits.

Blasting activities at the Colliery are regulated by EPL 396. In accordance with the EPL, blasting is carried out between 09:00 and 17:00 Monday to Saturday. Blasting would continue to be undertaken where feasible during these standard hours. No blasting would be undertaken on Sundays or public holidays without prior approval from the EPA. No changes to blasting time are proposed as part of the Project.

4.2.10 Rehabilitation and Landscape Management

Rehabilitation aims, objectives and procedures were discussed in detail in Section 3 of the 2008 EA. Rehabilitation works are closely integrated with mine production and are undertaken progressively as mining proceeds in accordance with the approved Rehabilitation Management Plan (RMP). The approved final landform for the mine as described in the 2008 EA is shown in **Figure 5**.

Bloomfield has demonstrated through its progressive rehabilitation efforts a successful rate of vegetation growth on existing rehabilitation areas. A total of 488 ha have been rehabilitated within the mine lease area to date.

An indicative final land use plan (further discussed at **Section 4.4.4**) has been developed by the Stony Pinch Group, a consortium established by the major landowners in the area including Bloomfield, Ashtonfields, and Yancoal to develop the large combined landholdings of the member companies post mining. A legal agreement between the landowners ensures that individual landowner interests in the site are replaced by a single, shared interest in all land use and development outcomes.

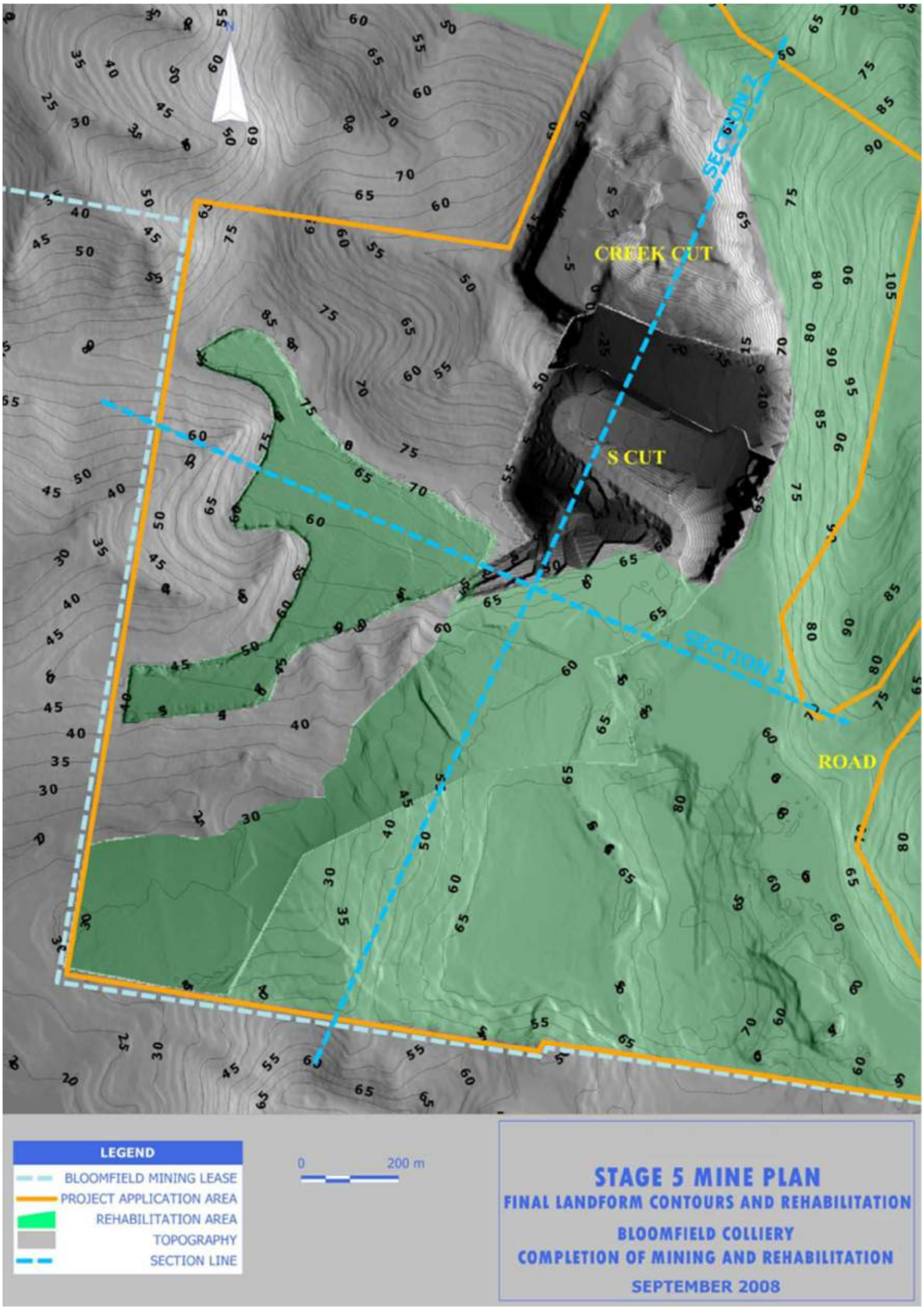


Figure 5 Approved Final Landform (2008 EA) (Source: Business Environment (2008))

4.2.11 Environmental Management and Monitoring (Operations)

The Bloomfield Mining Operations Environmental Management System (EMS) has been developed in general accordance with the principles of Australian Standard *AS/NZS ISO 14001:2016 Environmental Management Systems*. It contains an Environmental Policy as well as relevant environmental systems and procedures to guide current operations. This EMS would continue to be applied to Project operations, until the completion of mining. Any additional requirements resulting from conditions of the Project Approval or Mining Lease would be incorporated into the existing EMS.

Existing systems and procedures that have been developed to manage the impacts and operation of activities on the site include:

- Environmental Management Strategy;
- Noise Monitoring Plan;
- Aboriginal Cultural Heritage Management Plan;
- Air Quality Monitoring Program;
- Blast Monitoring Program;
- Water Management Plan;
- Landscape Management Plan;
- Rehabilitation Management Plan;
- Final Void Management Plan;
- Mine Closure Plan;
- Biodiversity Offset Management Plan; and
- Energy Savings Action Plan.

4.3 Proposed Modification

4.3.1 Overview

Bloomfield is seeking a modification to the Project Approval MP 07_0087 to extend the life of mining at the Colliery until 31 December 2030. This modification would align the Bloomfield mining operations consent limit to coincide with the Abel Underground Mine consent limit.

Existing mining methods would continue to be employed as part of the Project to extract up to 1.3 Mtpa of ROM coal from within the existing approved extraction area. Changes to the mine fleet have allowed extraction of seams that were not previously considered to be a recoverable resource in the 2008 EA. In addition, further exploration has identified other previously unrecoverable resources that the new fleet can now access. This modification therefore proposes a revised mine plan which includes extraction of deeper coal seams than originally approved.

The revised mine plan proposed as part of this Project would result in a modification of the previously approved final landform by moving the final void approximately 200m to the west.

4.3.2 Revised Mine Plan

The Project is seeking approval to continue mining at the currently approved maximum annual tonnage of 1.3 Mtpa ROM coal until 31 December 2030. Indicative upper coal production rates for each year of mining are shown in **Table 3**. Note that these are upper limits of potential production out to 2025. Experience has indicated that due to market conditions actual production rates may vary. Low productions rates which have occurred in recent years have partly resulted in the need to extend the current life of mining. Similarly through seeking a new end of mining date of 31 December 2030 Bloomfield would have the flexibility to reduce production rates in response to market forces without having to seek further mine of life extensions in the future.

Table 3 Indicative Production Rate over the Life of the Project

Year (ending March)	ROM Coal (Mtpa)	Saleable Coal (Mtpa)
2018	1.0	0.6
2019	1.1	0.6
2020	1.1	0.6
2021	1.3	0.7
2022	1.1	0.6
2023	1.1	0.6
2024	1.1	0.6
2025	0.55	0.3

Figure 6 details the existing and proposed layout of the mine in 2018, assuming mining activities proposed under this modification are commenced in 2018. Note that this represents the continuation of the existing mining activities as currently being progressed by the mine.

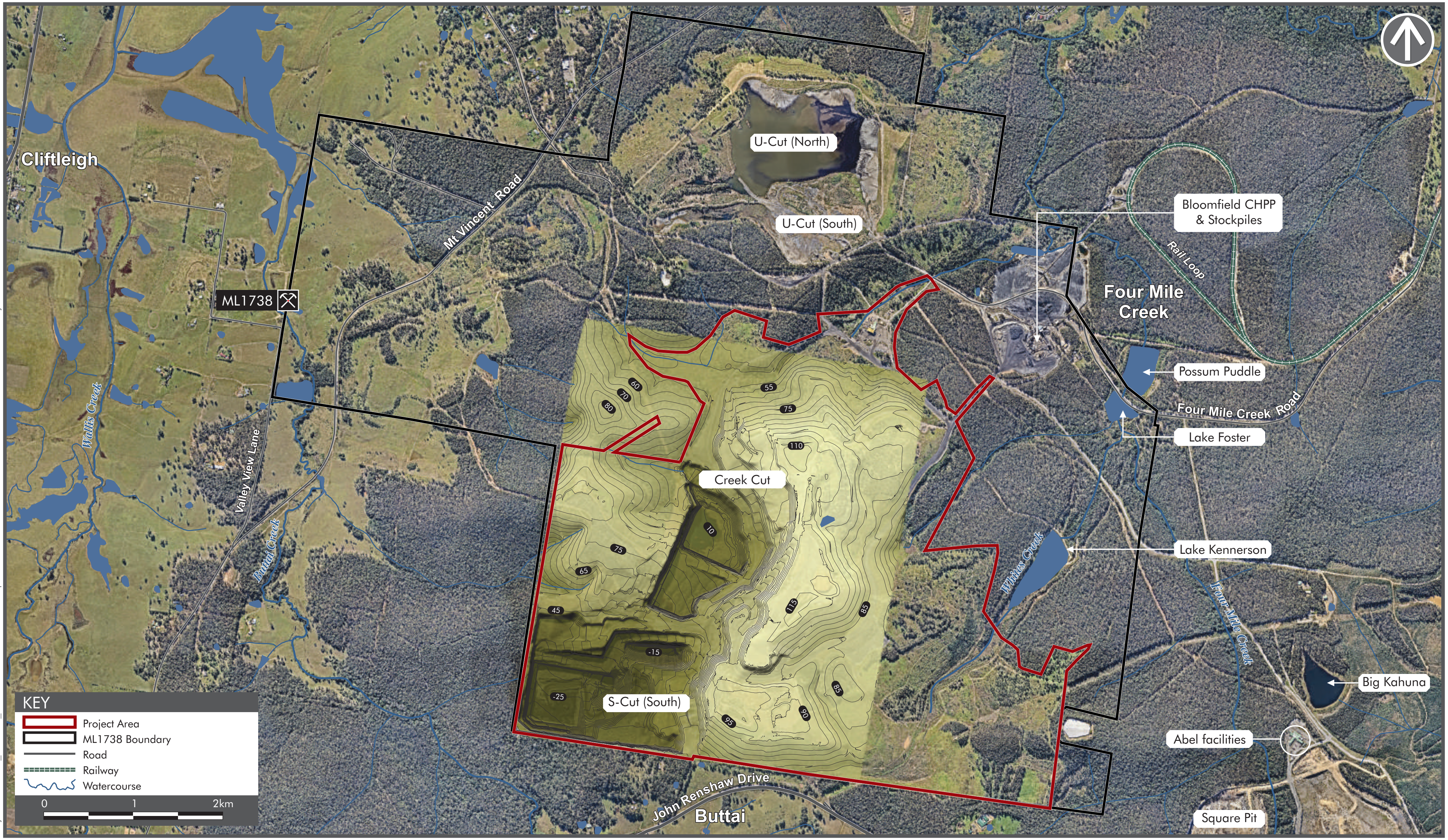
With 2021 scheduled to be the year of greatest material movement and given it falls approximately halfway through the proposed life of mine extensions, it has been used as a basis for calculating worst case air quality and noise impacts in this EA as detailed in **Section 8.0**. The progression of mining in 2021 is detailed in **Figure 7.**

The approved final landform incorporates a final void on the Colliery site to be used as a tailings facility for the ongoing operations at Abel Underground Mine. With the Abel Underground Mine currently in care and maintenance, the final landform proposed as part of this modification would depend on whether the Abel Underground Mine resumes operations. Therefore final landform designs have been prepared for two scenarios:

- One which assumes the Abel Underground Mine remains in care and maintenance; and
- A second scenario which assumes Abel Underground Mine resumes operations.

The indicative final landform for both of these scenarios is shown in **Figure 8** and **Figure 9**.

Specific details regarding the rehabilitation process on the Colliery site and the management of post mining land is detailed in **Section 8.6** of this EA and Section 3 of the 2008 EA. The final landform presented in this EA may change over time depending on the status of the Abel Underground Mine or with the advent of new technologies. Any changes to the final landform would be subject to discussion with the relevant agencies (including DRG).



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F6 Landform at the Start of Project 2018 18 12 2017 TO

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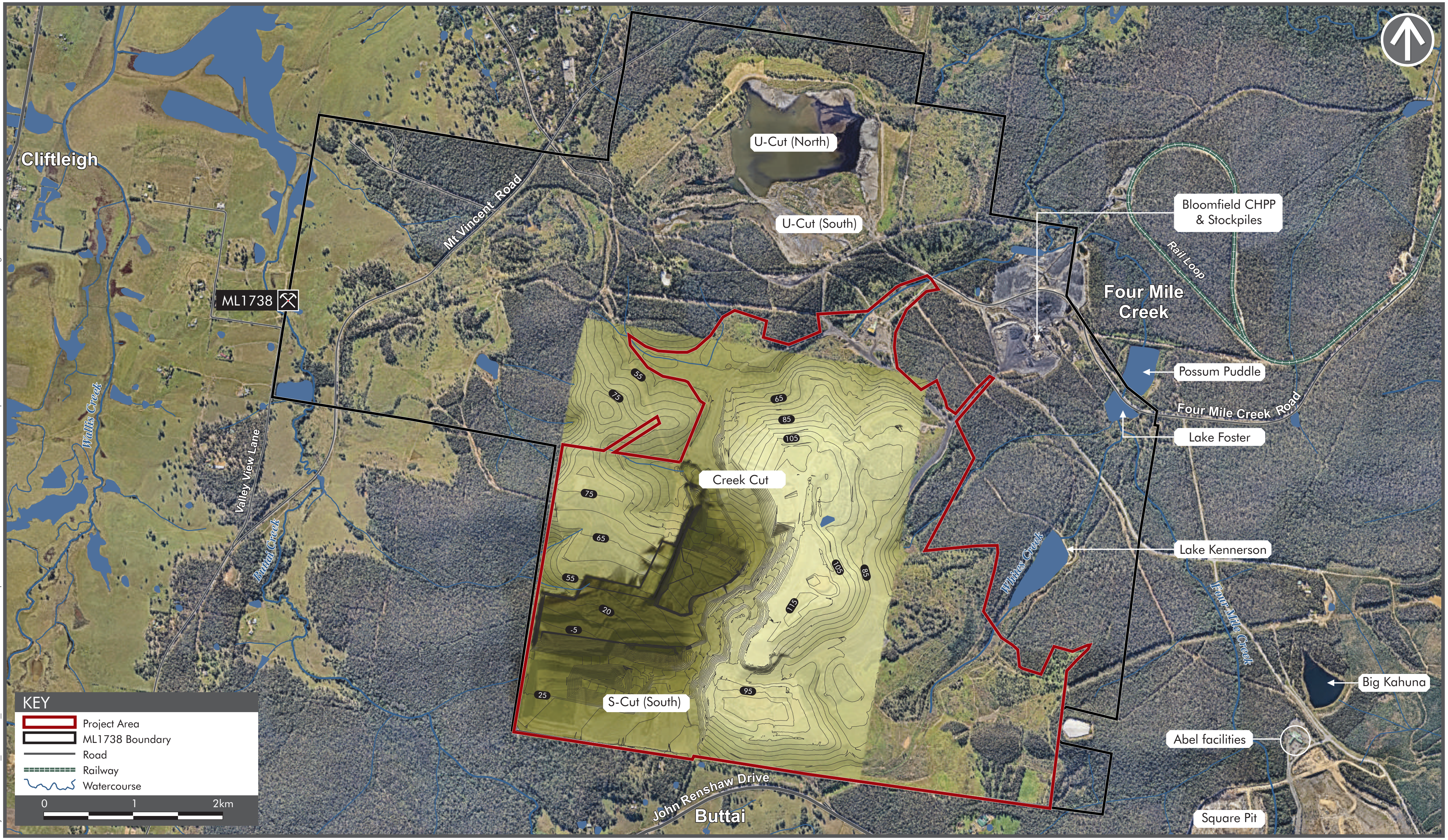
LANDFORM AT THE START OF PROJECT - 2018
Bloomfield Project

FIGURE 6



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F7 Proposed Landform - Max Year of Mining Activity - 2021 18 12 2017 TO

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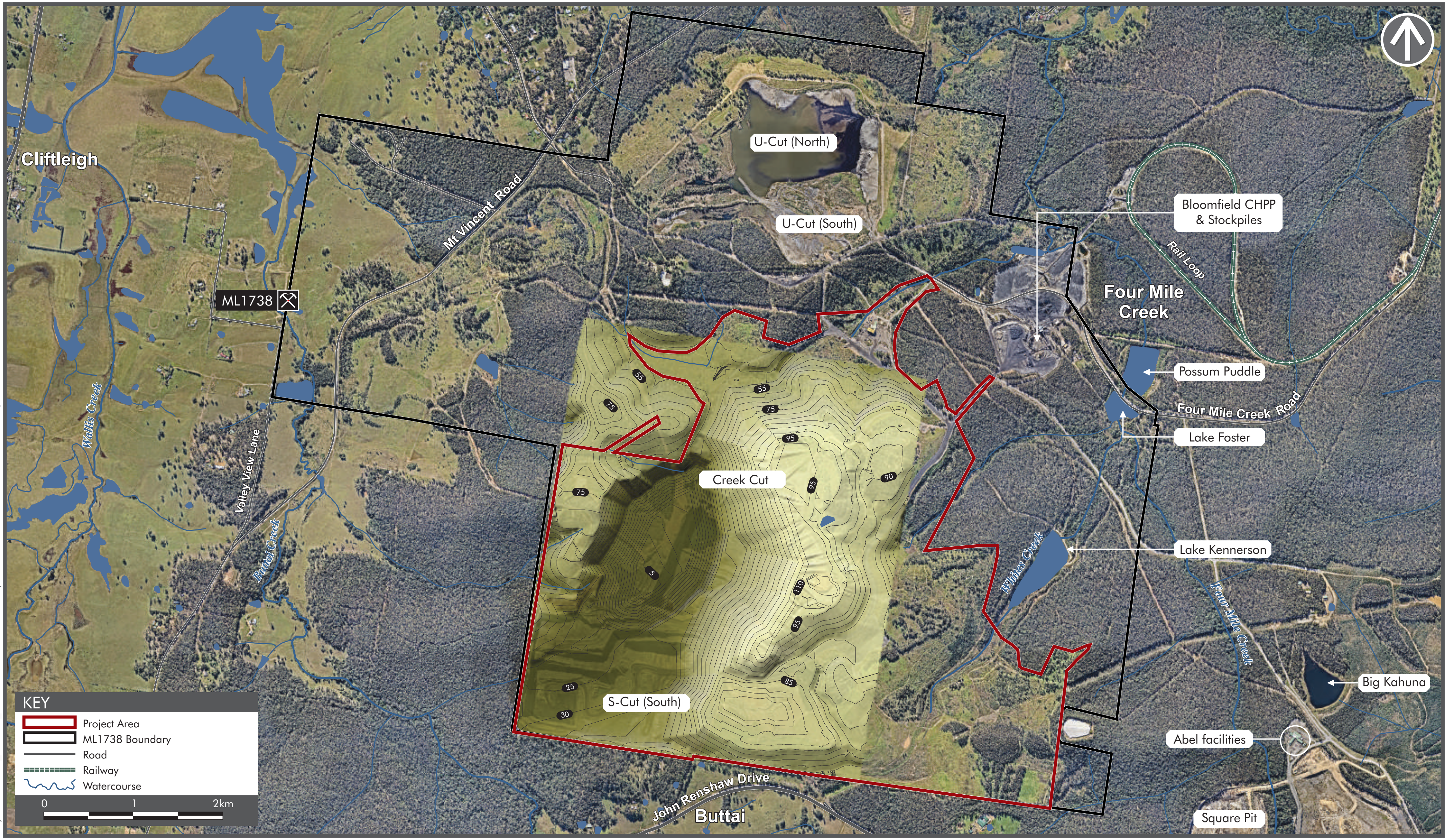
PROPOSED LANDFORM - MAXIMUM YEAR OF MINING ACTIVITY - 2021

Bloomfield Project

FIGURE 7



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F8 Proposed Final Landform - Abel Coal Mine in Care and Maintenance 18 12 2017 TO

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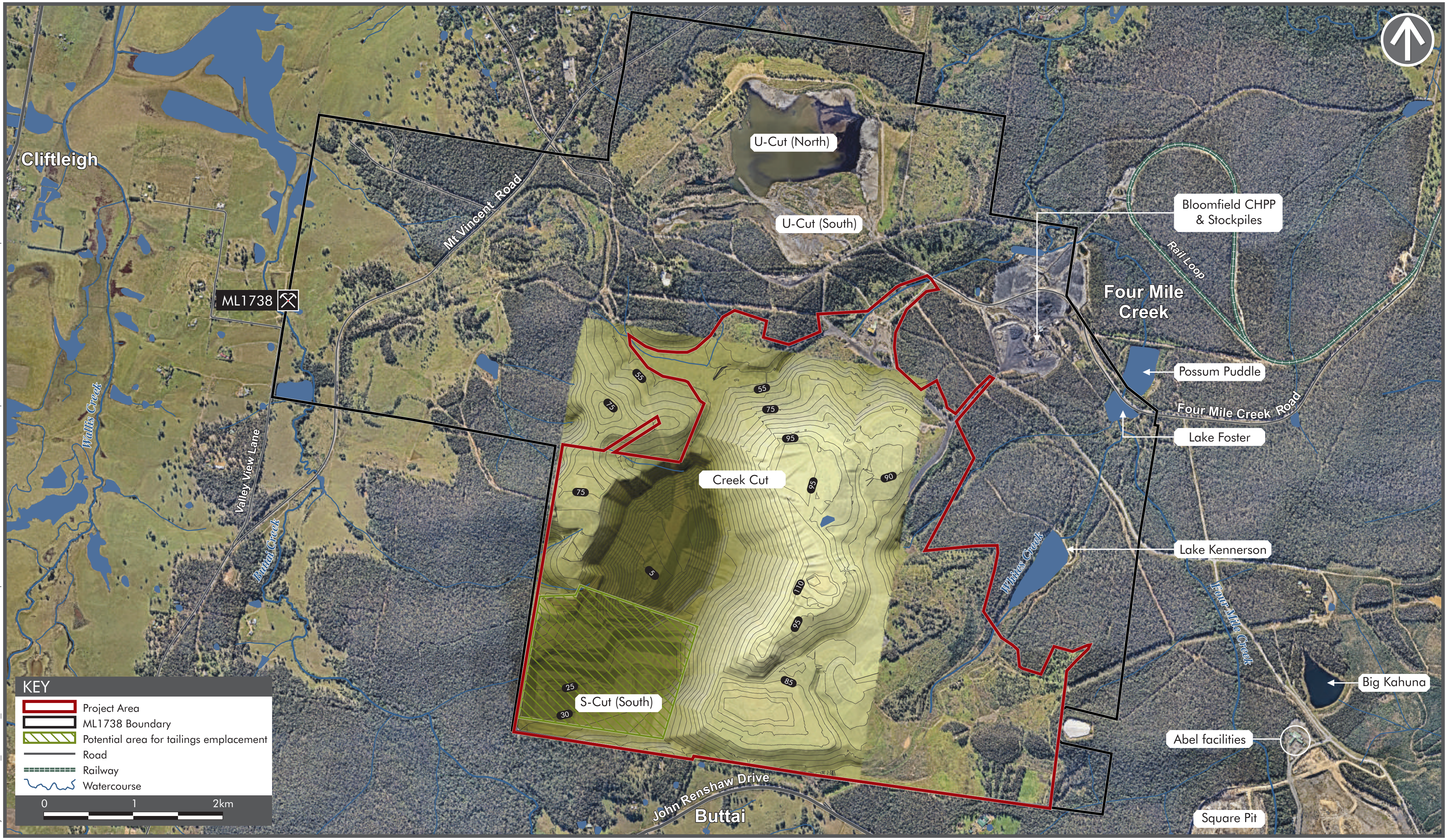
PROPOSED FINAL LANDFORM - ABEL COAL MINE IN CARE AND MAINTENANCE

Bloomfield Project

FIGURE 8



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PROPOSED FINAL LANDFORM - ABEL RESUMES OPERATION

Bloomfield Project

FIGURE 9

4.3.3 Tailings Emplacement

The current tailings emplacement area (U-Cut North and South, as shown on **Figure 3**) has approval under the Abel Project Approval. At current production levels (i.e. with Abel in care and maintenance) the current emplacement area is expected to be filled during 2019. Bloomfield has approval from the Dam Safety Committee to raise the wall on the current tailings emplacement area (a prescribed dam) which, if constructed, would provide enough tailings capacity for Bloomfield process waste throughout the remainder of the Project (assuming no tailings from Abel Underground Mine).

As it is currently unknown if Abel Underground Mine would commence operations in the future, there are a number of variables with regard to tailings emplacement. The future tailings emplacement strategy would therefore need to be reassessed on a regular basis to consider the status of the Abel Underground Mine. A potential tailings disposal area has therefore been established within the current approval area (refer **Figure 10**), inside which tailings disposal could occur over the modified consent period. This would allow the flexibility required to continue mining in the open cut pits while retaining the option to create tailings emplacement areas throughout the modified consent period.

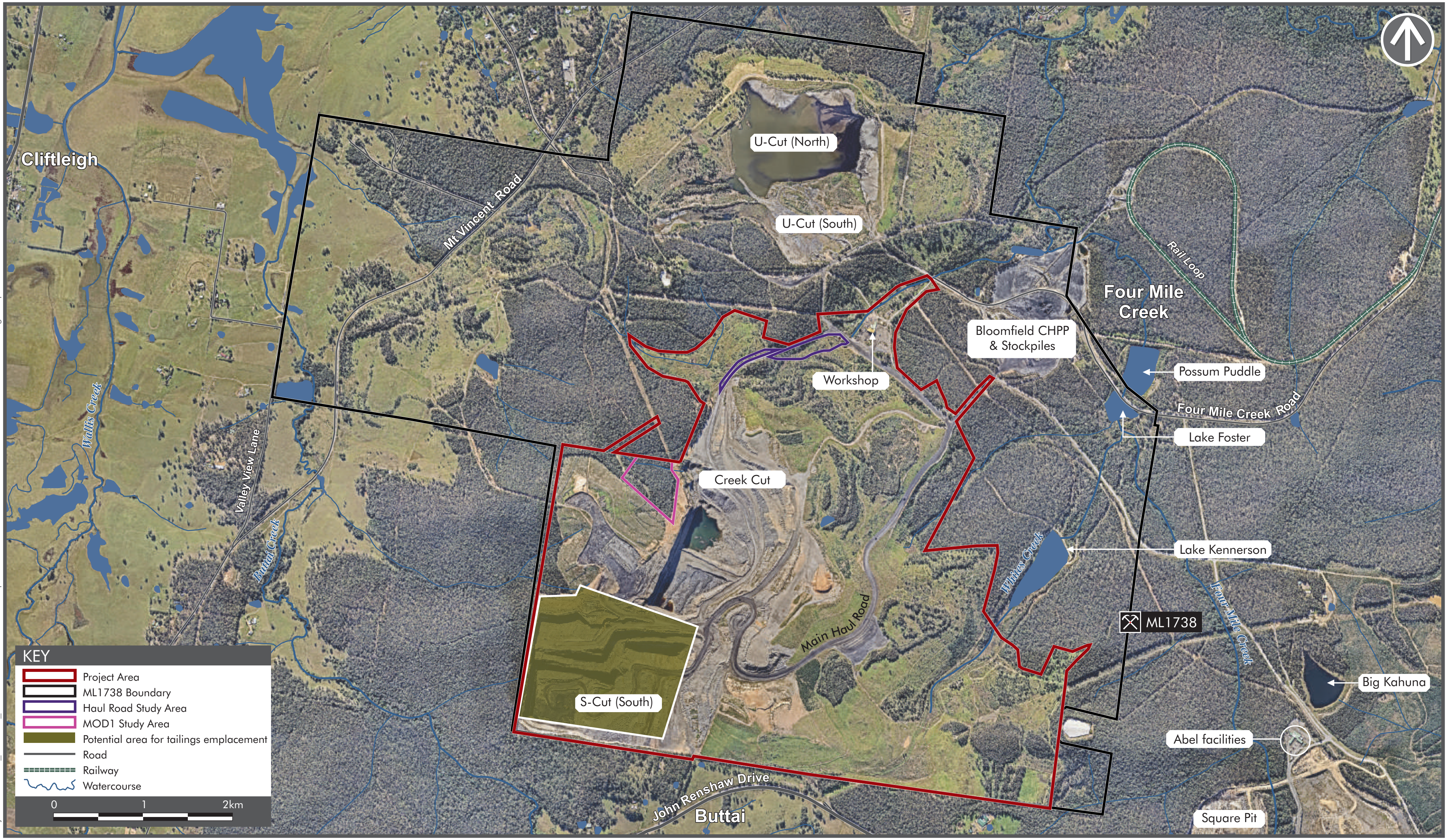
Mining operations would move progressively north which means the lowest point of the pit floor would remain down-dip (lower in the pit) of operations, allowing mining operations to continue in isolation of tailings and decant water facilities. The potential tailings area is bound by a combination of high-walls generally at an inclination of 75 degrees and spoil material at a natural rill angle (37 degrees). The in-pit tailings emplacement areas would be dewatered via a decant wall (refer **Figure 11**). This means that free surface water would be kept to a minimum as the water would drain through the decant wall and be pumped back through the mine dirty water system.

This methodology has previously been used successfully on site in the U-North tailings facility. The decant walls would be limited to 65m high resulting in overall tailings depths similar to the current U-Cut North tailings facility.

The likely strength and capping capability of future tailings was modelled using shear test results and geotechnical advice obtained from studying the current U North Tailings facility. The seams mined at the Colliery have remained largely consistent over many years and as such there is confidence that going forward the tailings will display similar strength characteristics to that shown in the existing tailings dam. A Preliminary Geotechnical Assessment (Lambert Geotech, 2017) was undertaken for the capping of the existing tailings emplacement area (U-Cut North and South). This assessment included shear testing and stability analysis. Lambert Geotech (2017) indicates that there are generally three strength zones of tailings emplacement areas (refer **Figure 12**).

Recommendations for each zone include:

- Zone 1 (lowest strength) - Tailings of insufficient strength to support capping load. This would require advancing a high spoil face (approximately 10m) to displace the tailings. Large settlements and cracking of tip head anticipated; would require close survey control and geotechnical oversight;
- Zone 2 (intermediate strength) - Tailings suitable to support 1.5m of capping pushed out with a dozer; and
- Zone 3 (highest strength) – Tailings suitable to support 2.5m of capping pushed out with a dozer.



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POTENTIAL AREA FOR TAILINGS EMPLACEMENT

Bloomfield Project

FIGURE 10

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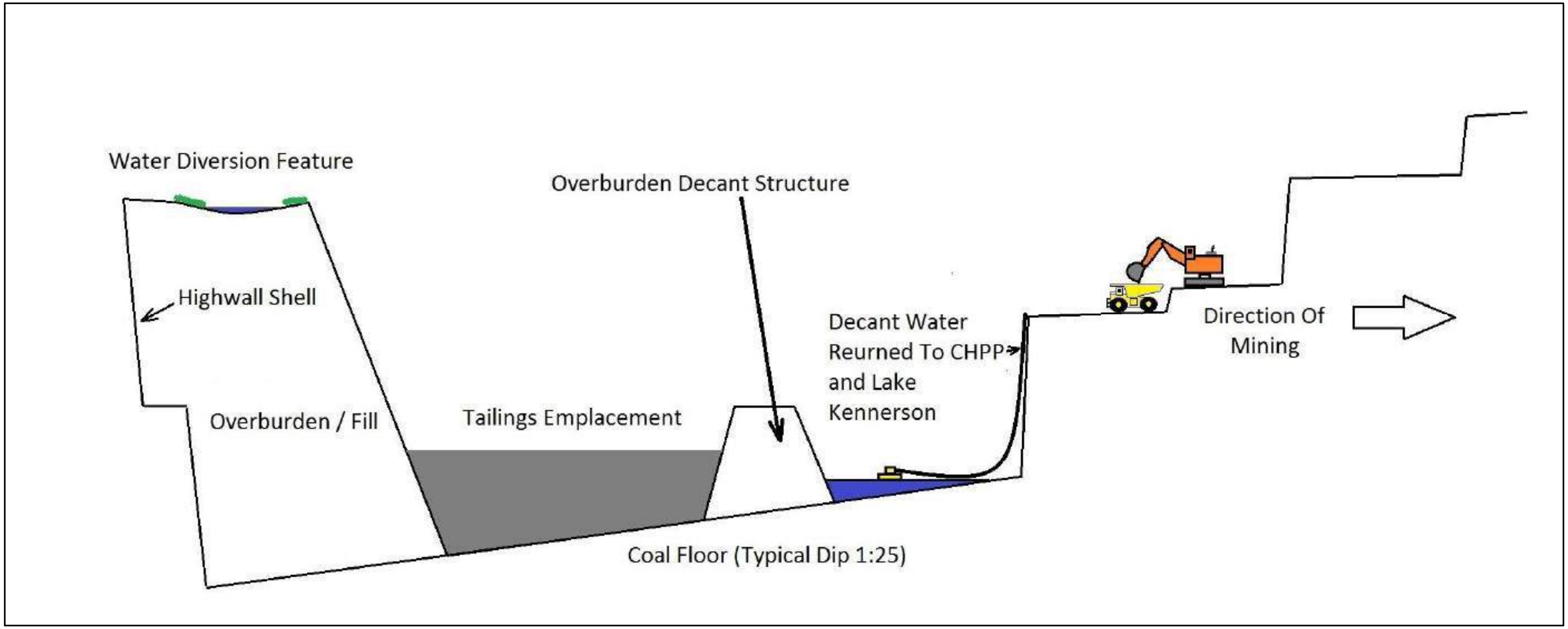

Figure 11 Typical In-pit Tailings Emplacement Area

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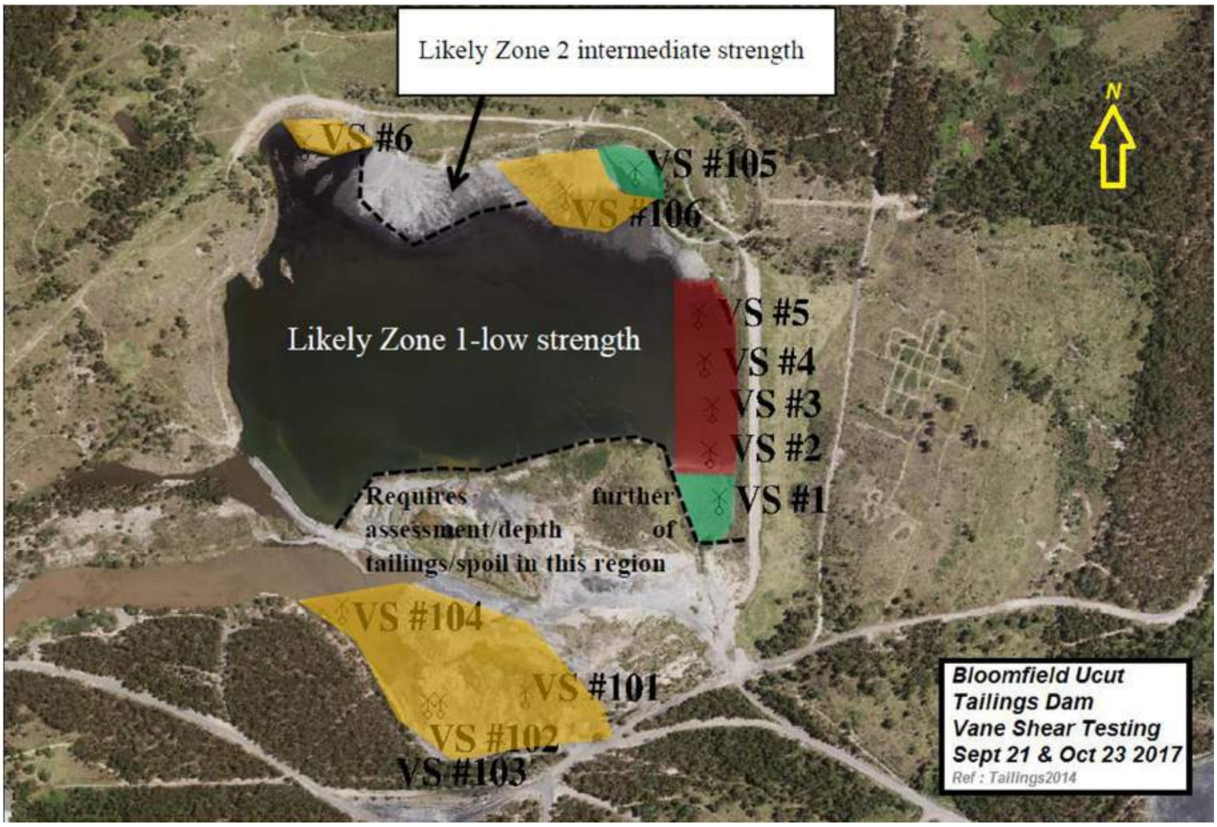

Figure 12 Strength Zones Within the Existing Tailings Emplacement Area

Note: Red shading = Zone 1 lowest strength. Amber shading = Zone 2 intermediate strength. Green shading = Zone 3 highest strength

Results of the geotechnical investigations for the existing tailings emplacement area (Lambert Geotech, 2017) indicate dried tailings can potentially hold 2.5m of inert cover. Given that a similar source of material (that is, the Colliery and Abel Underground Mines) would be used for tailings emplacement as part of the Project compared to that of the existing tailings emplacement area, similar characteristics are expected. The recommended management strategies for each zone (as detailed above) would be implemented for the Project.

However the in pit emplacement areas may have significantly higher capping loads, with large dumps progressing over top as the rehabilitation progresses. The depth of capping would depend on the future status of the Abel Underground Mine and the timing and volumes of coal being processed through the CHPP. As the existing tailings have displayed reasonable shear strength, it's feasible to assume that smaller capping depths would allow for traditional capping methodologies to be applied (refer to **Figure 13**).

However, in the event that larger capping depths are required (i.e. Abel resumes operations) an alternative capping method would be applied, which would allow the lower strength tailings (that is, zone 1 tailings emplacement) to rise in elevation and mix with the newly deposited spoil (refer to **Figure 14**). This new material would require monitoring to ensure it remains within the approved emplacement areas.

4.3.4 Haul Road Expansion

As part of the Project approximately 3.5 ha of previously rehabilitated landform (refer **Figure 3**) would be cleared for the proposed widening of a haul road and upgrade of the adjacent watercourse. The area to be cleared includes 0.34 ha of native vegetation and 3.2 ha of non-native vegetation dominated by exotic grasses. Two areas of land adjacent to the haul road would be impacted for the expansion and upgrade works, which would comprise:

- Widening of the haul road to allow for two way travel of large rear dump trucks. This would impact upon 0.8 ha of rehabilitated landform that is located to the north of the current haul road; and
- Widening of the same haul road and upgrade of adjacent previously rehabilitated watercourse. This would impact upon 2.7 ha of rehabilitated landform located to the south of the current haul road.

The potential ecological impacts associated with these works are assessed in **Section 8.1**.

4.3.5 Interfaces with Abel Underground Mine

The Colliery and the Abel Underground Mine share a range of infrastructure and processes, including the Bloomfield CHPP and associated water management; the Bloomfield Rail loading facility; and coarse reject and tailings disposal.

Integration of the Colliery operations with the adjacent mining operation has been a key consideration in mine planning and impact assessment studies. Key aspects of the Project that are integrated with the operations of the adjacent Abel Underground Mine include:

- Delivery of coal from the Project and other mines to the ROM coal stockpile areas adjacent to the CHPP;
- Water management system components utilised by multiple operations, such as the Bloomfield and Abel coal mines and the Bloomfield CHPP, with the open cut water management forming part of the overall integrated water balance;
- Integrated rehabilitation planning, considering the final land use proposed for multiple sites; and
- Integrated environmental monitoring program for the adjacent sites.

Although the Abel Underground Mine is currently in care and maintenance, for the purposes of assessing worst case potential impacts, relevant technical studies (for example, air quality and noise) have considered the cumulative impacts of the Project with the Abel Underground Mine operational.

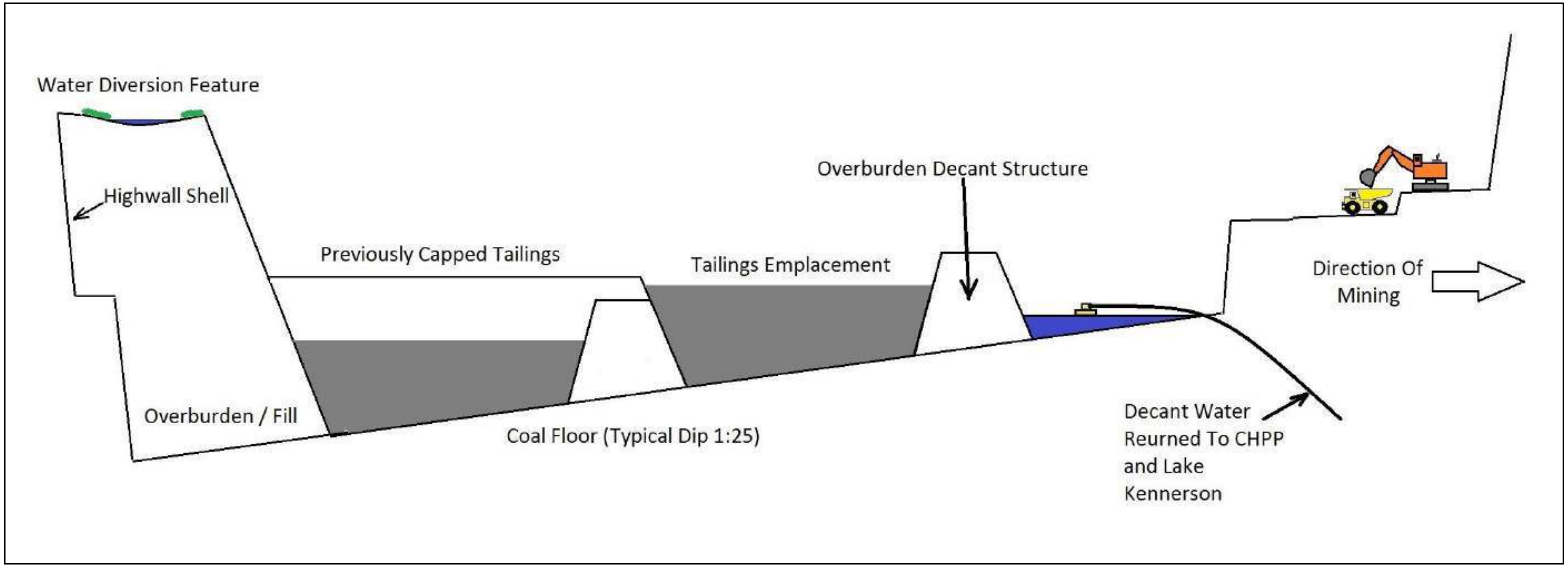

Figure 13 Traditional Capping Methods

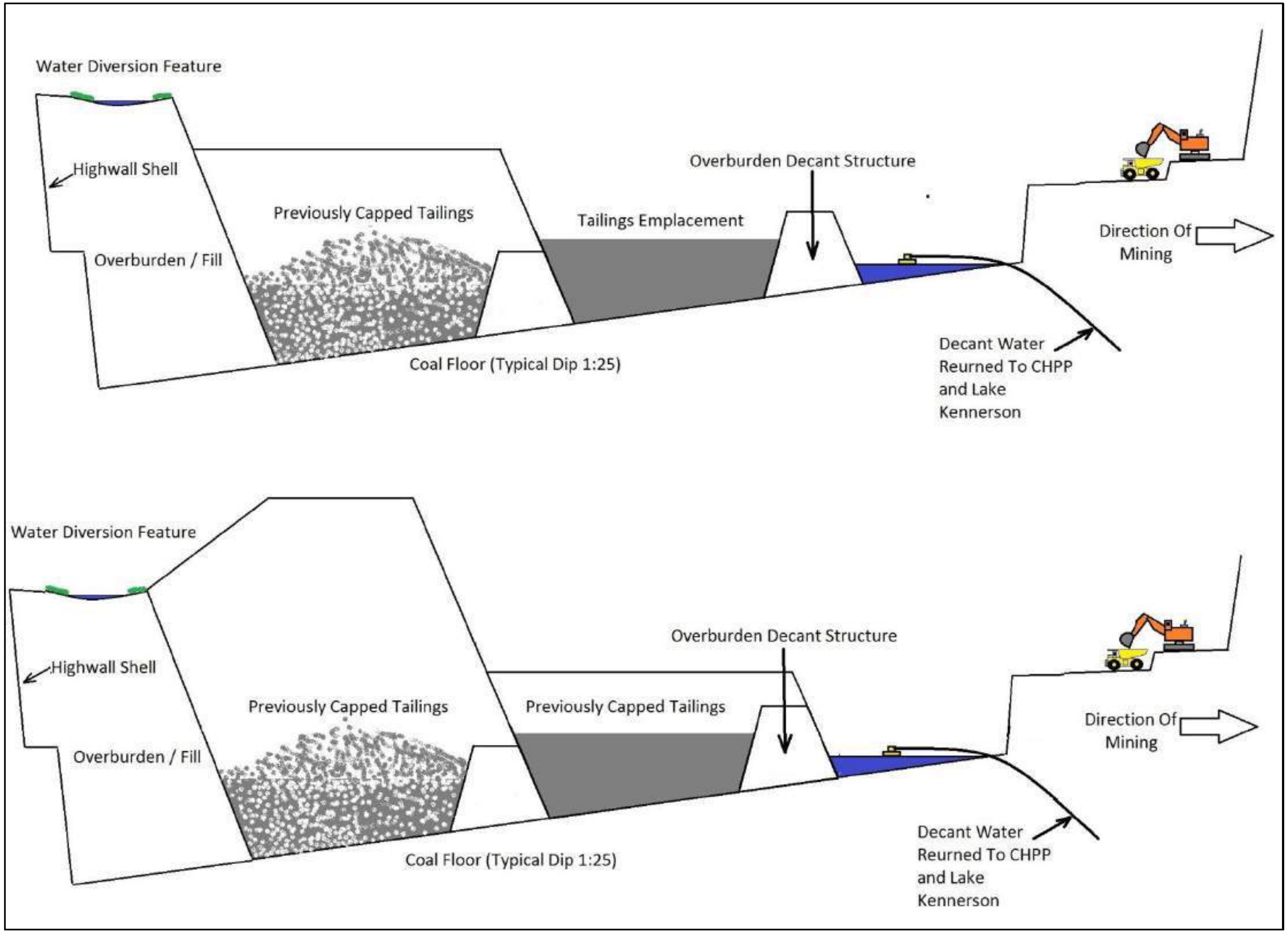

Figure 14 Alternative capping method for larger capping depths (applicable for lower strength tailings)

4.4 Alternatives

4.4.1 Mine Plan and Final Landform Options

The following options have been considered in the development of the proposed mine plan and subsequent final landform:

- Option 1 – Existing approved final landform (do nothing scenario);
- Option 2 – No final void;
- Option 3 – The large void plan; and
- Option 4 – The flat area plan.

Each of these options is discussed further below.

Option 1 – Existing approved final landform (the 'do nothing' option)

Option 1 represents the current approved final landform under the Project Approval 07_0087 (shown on **Figure 5**). Following closure of the Colliery in 2021, the final void within the combined S Cut and Creek Cut is to be utilised as a tailings emplacement area by Abel Underground Mine under the Abel Project Approval 05_0136. Rehabilitation of the final void would occur following completion of Abel Underground Mine operations and forms part of the Abel Project Approval.

This plan allows for open cut operations with minimal haul lengths and therefore has many economic advantages compared to other options. However this option does not allow for the mining of the remaining 13 million tonnes of ROM coal that can be accessed within the deeper coal reserves and potential benefits to the local community and economy would not be realised.

Without the Project, the extraction of coal at the Colliery could not continue beyond the time limit set by the Project Approval MP 07_0087 (that is, 31 December 2021). Option 1 would therefore lead to closure of the Colliery in 2021 and the loss of approximately 93 jobs.

Under this option closure of the Colliery would mean that a large portion of the 13 million tonnes of ROM coal identified within the approval area would remain undeveloped. This represents a potential loss to local, regional and State economies through the loss of: revenue from mining royalties, direct and indirect employment and flow on effects to the local economy. Coal is a major commodity export for Australia and Option 1 would prevent Bloomfield from continuing to supply thermal and metallurgical coal to the global market.

Under Option 1 the final landform would include a relatively large final void which is intended for use as a tailings emplacement area for Abel Underground Mine. This final void is not likely to be filled completely by future tailings emplacement from Abel Underground Mine and would remain relatively large following use as a tailings emplacement. Further to this if Abel Underground Mine does not recommence operations, the void under this option would not be used as a tailings emplacement and would remain significantly larger. The 2008 EA stated that '*if the objectives of the Abel Project altered in future or were not met, rehabilitation to appropriate final landforms would be completed with material from within the site*'. There would not be sufficient quantities of material within the site to achieve this objective and imported material would be required to create the final landform. Therefore Option 1 would not meet the previous 2008 EA commitment.

The final landform under this option also includes approximately 1.1 km of highwall (greater than 18 degrees slope) on the western side of the void which would remain in place following closure of the Abel Underground Mine. For reasons such as public safety and stability, options that include a highwall were considered to be less preferable to options that do not include a highwall (e.g. Option 4 below).

The negative consequences associated with Option 1 include loss of employment opportunities, sterilisation of the remaining coal resource and unrealised financial benefits to the local and regional communities and to the State Government. The final landform as currently approved includes a large final void and approximately 1.1km of highwall. For the reasons set out above, Option 1 was not considered to be the preferred option.

Option 2 – No final void;

Option 2 includes continued operations to extract the additional 13 million tonnes of ROM coal identified within the approval area and to fill the remaining void following extraction of the coal reserves.

The benefit of this option is that no final void would remain within the final landform. However this option has several disadvantages. Following extraction of the remaining coal reserves, approximately 13.5 million cubic metres of spoil would be required to completely fill the remaining void. This would equate to more than two years of concentrated overburden operations with no economic return during this period. Option 2 is therefore not considered to be economically feasible.

The coal mining operations would not generate enough spoil to completely fill the final void. The only other source of spoil on the site would be the currently rehabilitated land. Disturbance of rehabilitated land would prolong air quality, noise and ecological impacts for the duration of these additional works. This is not considered to be consistent with the rehabilitation objectives for the site.

Option 2 would be excessively cost prohibitive and would extend air quality, noise and ecological impacts through disturbance of currently rehabilitated land and therefore is not considered to be the preferred option.

Option 3 – The large void plan

The Option 3 final landform features two voids within the combined S Cut and Creek Cut, including a temporary void to the south which would be used for tailings emplacement from Abel Underground Mine (if required) and a larger final void to the north (shown on **Figure 15**). In the event that Abel Underground Mine does not recommence operations, the temporary void to the south would be filled and the remaining final void to the north would be larger.

One benefit of this option is that the final void would not contain any highwalls. However, this option would require longer and higher haul routes for open cut operations as more spoil would be used to form the larger footprint of high dumps. Final landform shaping would then require relocation of this spoil to achieve the final landform in the lower slope areas. This would greatly increase the mining cost and would restrict progressive final landform shaping and rehabilitation, leaving more exposed spoil with potential for air quality impacts from dust generation.

With Abel Underground Mine in care and maintenance and its future uncertain, hauling spoil along longer and higher haul routes to leave such a significant final void is not economically viable. The resulting higher and steeper final landforms are also not compatible with the landowner’s future commercial development plans (refer **Section 4.4.4**). The final landform is required to deliver land surfaces that would encourage commercial and residential development.

Whilst Option 3 is considered to be an improvement over Option 1, disadvantages include a higher and steeper final landform with a significant final void and expensive long and high haul routes during mining operations. Option 3 is therefore not considered to be the preferred option.

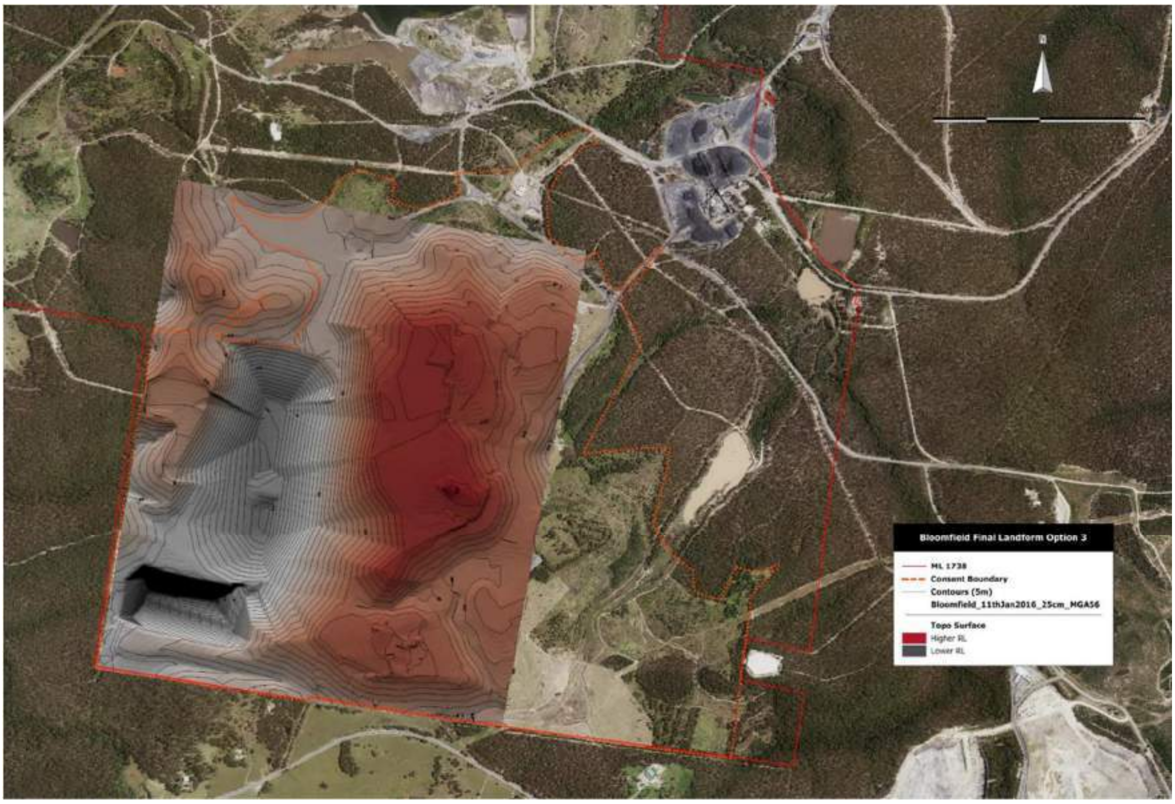

Figure 15 Option 3 – Large Void Plan

Option 4 – The flat area plan

Option 4 is characterised by a large flat area and also features two voids within the combined S Cut and Creek Cut. These include a smaller temporary void to the south which would be used for tailings emplacement from the Abel Underground Mine (if required) and a larger final void to the north, with an associated reduction in the slopes of the final landform. In the event that Abel Underground Mine does not reopen, the temporary void to the south would be filled and the final void to the north would be slightly larger. Option 4 is the preferred option and forms the basis of this modification application. The final landforms associated with both scenarios (that is, with Abel Underground Mine remaining in care and maintenance and with Abel Underground Mine recommencing operations) are shown on **Figure 8** and **Figure 9**.

Under Option 4, the higher dump footprint is minimised compared to Option 3 and open cut operations would not require any abnormally long or high haul routes. Therefore from an economic perspective, Option 4 is preferable to Option 3. Another benefit of Option 4 is that it doesn't contain highwalls, which reduces public safety and stability risks. Also importantly this option has the smallest final depression when compared to Option 1 and Option 3.

The extent of higher elevation land in the Option 4 final landform is reduced compared to that of Option 3, which would lessen the visual impact for surrounding landholders. The slope of the final landform is not as steep as that of Option 3 and is more suitable for inclusion into the development plans for the final land use (refer to **Section 4.4.4**). The landforms would be stabilised and sown to pasture to ensure a continuing stable landform and post mining grazing would allow consolidation of the landforms.

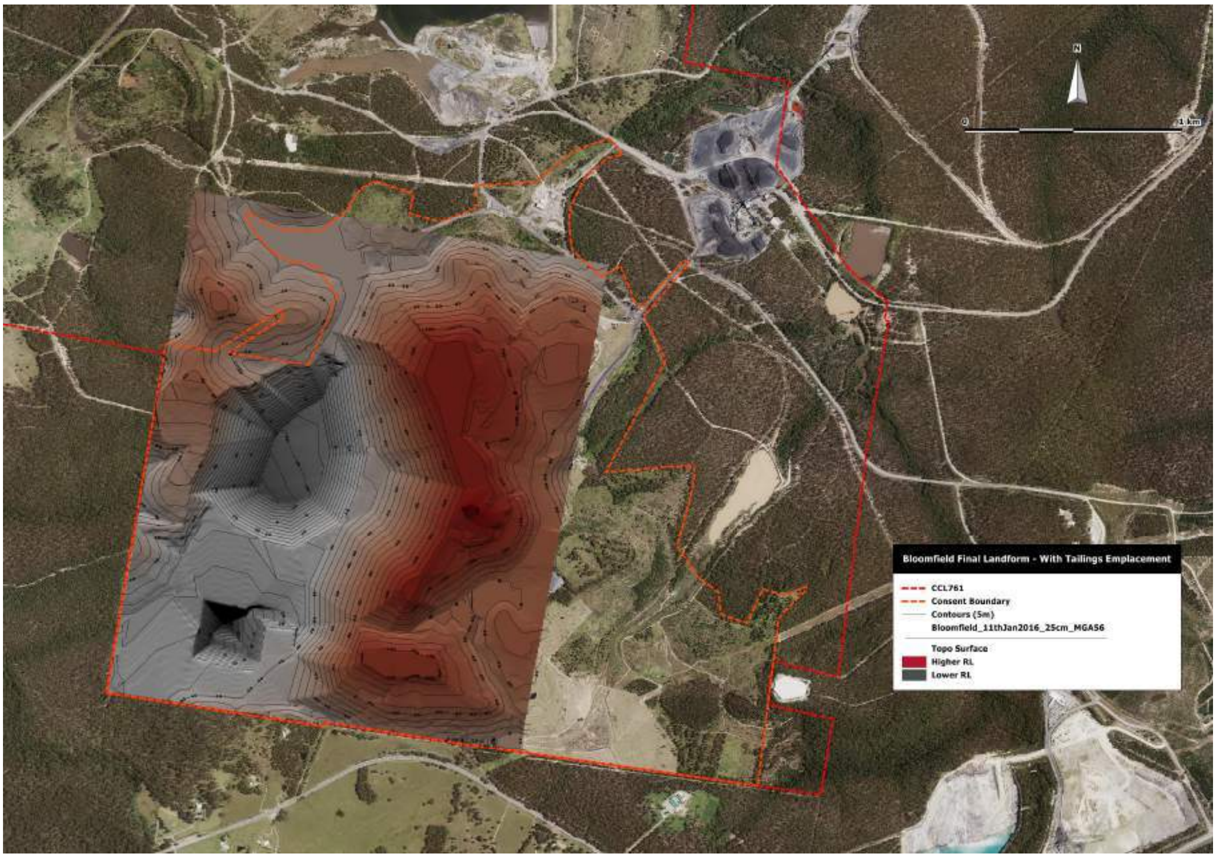

Figure 16 Option 4 - The Flat Area Plan

Preferred Option

Option 4 is the preferred option as assessed in this EA. As described above, Option 4 was considered to be the best option as it achieves the following:

- Allows Bloomfield to offer continued employment on the site and to service existing contracts and provides the economic and flow on benefits to the local community by developing the remaining coal reserves (as opposed to the ‘do nothing’ option);
- A resulting landform which offers the best shape and slope for post mining commercial utilisation by the land owner;
- Removal of highwalls from the final landform which reduces the public safety risk; and
- Reduction in the extent of higher elevation land which reduces the visual impact for surrounding landholders.

4.4.2 Mine Scheduling

This Project would include approval to extract up to a maximum of 1.3 mtpa ROM coal up until 31 December 2030. This rate is the same or similar to historical operations. While this represents the maximum annual tonnage limit, extraction may be undertaken at a slower rate, depending on market requirements.

An alternative option to the Project would be more rapid extraction, to remove more material per year thereby completing mining on the site over a shorter timeframe. Bloomfield, however, blends coal from both the Bloomfield operations and Rix’s Creek Mine (located near Singleton) to meet market specifications. Rix’s Creek and Bloomfield are both multi seam, open cut mining operations with varying coal qualities and yields.

The scheduling of coals to be mined from the various locations in the Bloomfield mine plan is designed to provide flexibility to meet changes in coal quality from Rix’s Creek and/or changes in market requirements. Minor variations to the sequencing and scheduling of mining blocks may be required over the life of the Project, to meet individual shipments and fulfil Bloomfield and Rix's Creek market volume and quality obligations. Therefore the Project proposes to continue mining operations within the existing approved maximum annual tonnage limits.

4.4.3 Transport Methods

Overburden is currently removed from the pit via dump truck and placed on emplacement areas which are then shaped and rehabilitated. Coal is removed from the pits by the coaling fleet and transported via an internal haul road to the ROM coal stockpile at the CHPP.

An alternative to this current transport method would be to provide an in-pit crushing system feeding a conveyor that transports coal to the ROM coal stockpile pad at the CHPP. This would require Bloomfield to maintain a central extraction point, which is not possible as flexibility is required in extraction areas due to the multi-seam environment and varying coal quality requirements.

It is therefore proposed to continue using the existing transport methods and haul road. This haul road provides direct access to the ROM coal stockpile and its impact in terms of potential noise and air quality impacts has been modelled and use of the haul road considered to have minimal impact outside the Project Area (refer to **Sections 8.2** and **8.3**).

4.4.4 Rehabilitation and Final Land Use Considerations

A range of final land uses for the Project Area have previously been considered by Bloomfield and the landowner. Selection of an appropriate post-mining land use and development of a suitable post mining landform is discussed in the 2008 EA and the current MOP. Factors influencing the selection of an appropriate post-mining landform and land use are:

- DRG requirements with regard to landform stability and safety;
- The Hunter Regional Plan 2036 (DP&E, 2016) a 20 year blueprint for the future of the Hunter region. The vision is to create a leading regional economy in Australia with a biodiversity-rich natural environment, thriving communities and greater housing choice and jobs. Therefore any decisions regarding the post-mining landform and land use would need to take this, and any additional detailed plans that may be prepared in the future, into consideration;
- The majority of the mining lease area is owned by Ashtonfields and any decision regarding post mining landform and land use would need to take the obligations under the commercial lease agreement between Bloomfield and Ashtonfields into consideration;
- The Stony Pinch Group has been established by the major landowners of the site and surrounding areas to act as a coordinated and single entity in the planning and development of the overall site. An indicative final land use plan has been developed (**Figure 17**) and this plan has been issued to Council and regulatory authorities for consideration; and
- The Bloomfield CHPP, rail loading facility and associated infrastructure would continue to operate after the mining as currently approved is scheduled to be completed, so active CHPP infrastructure and transport would continue in the mining lease area.

Alternative final land uses considered in the 2008 EA and the current MOP include residential, industrial, open forest / bushland or undulating grazing land / rural landscape. While the final landform would depend on the future operational status of the Abel Underground Mine, the Project Area would be rehabilitated to a standard acceptable to DPI and the landowner. Following consideration of these options and the requirements under the commercial lease agreement with the landowner, Bloomfield determined that rehabilitated land suitable for a variety of future land uses, whilst enabling the retention of habitat areas, is the most appropriate choice.

As the site and surrounding area has been identified as having potential for industrial-type uses in the future, Bloomfield considers that the mine site area should be rehabilitated in such a way that does not conflict with this future land use. Such rehabilitation would mean providing a flat to undulating topography suitable for mixed use industrial, seeded with grasses to stabilise, together with areas of trees for habitat, until such time as detailed determinations are made regarding any future industrial use of the site. Should no such future development eventuate, the site would remain as a stable, rural landscape. Bloomfield therefore proposes to rehabilitate the land to create a stable, undulating landscape with a mix of pasture and tree areas suitable for grazing and general habitat.

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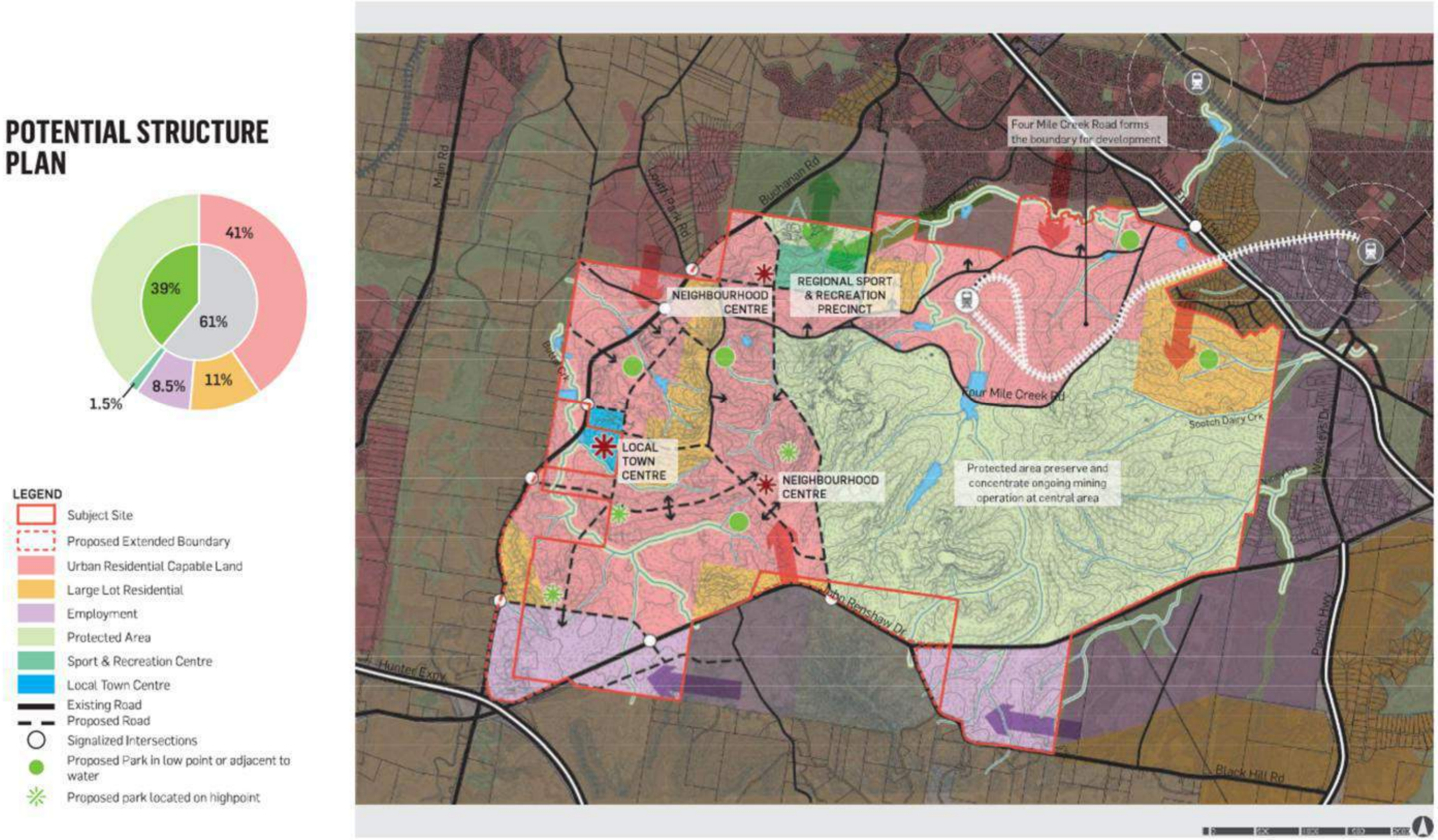

Figure 17 Indicative Final Land Use Plan (Stony Pinch Group, 2017)

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5.0 Statutory Context

5.1 Conditions Requiring Modification

A review of the existing conditions of consent for Project Approval 07_0087 as modified was undertaken. The review found that the following conditions would need to be amended if the Project is approved. Those conditions and suggested modifications are detailed below. Proposed additions or modifications are shown in **bold** and proposed deletions are shown in ~~strikethrough.~~

Schedule 2, Condition 2

2. The Proponent shall carry out the Project generally in accordance with the:

(a) EA;

(b) Statement of Commitments;

(c) modification application 07_0087 Mod 1 and Environmental Assessment titled Extension of the Project Approval Area for Out-of-Pit Overburden Emplacement and Rehabilitation, Alternative Haul Road and Powerline Relocation, prepared by Business Environment and dated September 2010;

(d) the Biodiversity Offset Strategy titled Bloomfield Colliery Project Modification 07_0087 MOD 1 – Proposed Offset Strategy, dated 31 March 2011;

(e) the modification application 07_0087 MOD 2 and letter entitled Bloomfield Coal Project – Modification of PA 07-0087, dated November 2011;

(f) the modification application 07_0087 MOD 3 as requested by letter entitled Bloomfield Coal Project – Modification of PA 07-0087, dated 17 December 2012; ~~and~~

(g) the modification application 07_0087 MOD 4 and Environmental Assessment for the proposed life of mine extension; and

(h) conditions of this approval

Schedule 2, Condition 5

5. Mining operations may take place on the site until 31 December ~~2021~~ **2030**.

5.2 Commonwealth Matters

5.2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires approval from the Commonwealth Minister for the Environment where an action has, or would have, a significant impact on a matter of National Environmental Significance (NES). The EPBC Act lists nine matters of NES that must be addressed.

A Protected Matters Search of NES Matters was undertaken on 7 April 2017 to determine what NES features may be present within 10 km of the Project Area. The results of this database search are summarised in **Table 4** and provided in full in the Biodiversity Assessment Report prepared for the Project (refer to **Section 8.1**).

Table 4 Consideration of Matters of NES under the EPBC Act

NES Matters	Comment
World Heritage properties	Nil
National Heritage places	Nil
Ramsar wetlands of international importance	The Hunter Estuary Wetlands Ramsar site is located approximately 11 km from the south-eastern point of the mining lease boundary. Given the distance from the Project site, there are no anticipated impacts to this Ramsar site.
Nationally threatened species and ecological communities	There are 44 listed threatened species and three threatened ecological communities which may occur within the Project area. Potential ecological impacts to matters of NES are assessed in **Section 8.1**. The biodiversity assessment prepared by EMM Consulting concluded that significant impacts to matters of NES would be unlikely to occur as a result of the proposed Project.
Migratory species listed under the EPBC Act	There are 33 listed migratory species which may occur within the vicinity of the Project area. Potential ecological impacts to matters of NES are assessed in **Section 8.1**. The biodiversity assessment prepared by EMM Consulting concluded that significant impacts to matters of NES would be unlikely to occur as a result of the proposed Project.
Commonwealth marine areas	Nil
Great Barrier Reef Marine Park	Nil
Nuclear actions (including uranium mining)	Nil
Water resources impacted on by a coal seam gas of large coal mining development	The Project involves operation of a coal mining development. Potential surface water and groundwater impacts are assessed in **Section 8.4** and **8.5**). The assessments concluded that the Project is unlikely to significantly impact surface water and groundwater resources.

The matters of NES of relevance to the Project include the potential impacts to listed threatened species, ecological communities and migratory species, and potential groundwater and aquifer impacts. Specialist studies were undertaken to assess potential biodiversity and groundwater impacts that may occur as a result of the Project (**Section 8.1** and **8.5**) and concluded that the Project would not significantly impact matters of NES. Nonetheless, Bloomfield has submitted an EPBC Act referral (reference number 2017/8132) to the Commonwealth Department of the Environment and Energy (DEE) seeking confirmation that the Project does not represent a Controlled Action requiring approval under the EPBC Act. A decision was pending on this referral at the time of lodgement of this environmental assessment. DP&E would be advised of the outcomes of the referral when a response is received from DEE.

5.3 State Matters

5.3.1 Environmental Planning and Assessment Act 1979

The overarching environmental planning approval framework in NSW is provided by the EP&A Act. Supporting this primary piece of legislation is the *Environmental Planning and Assessment Regulation 2000* (the EP&A Regulation) and environmental planning instruments, including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

The Colliery currently operates under Project Approval MP 07_0087, issued under Part 3A (repealed) of the EP&A Act. As it was for the purpose of coal mining, the original development was classified as a Major Project under the *State Environmental Planning Policy (Major Projects) 2005*, which triggered the former Part 3A approval pathway.

While Part 3A of the EP&A Act was repealed in 2011, transitional arrangements set out in Schedule 6A of the EP&A Act provide that Part 3A continues to apply to approved Part 3A projects, and that section 75W of the EP&A Act continues to apply for the purpose of modifications to Project Approvals. The current Project would therefore be undertaken as a modification to the existing Project Approval (MP 07_0087) under section 75W of the EP&A Act. The approval authority is the Minister for Planning.

It is noted that legislative amendments to the EP&A Act are currently being considered, as set out in the draft *Environmental Planning and Assessment Amendment Bill 2017*. One of the proposed amendments is the removal of transitional arrangements for Part 3A projects. If these proposed amendments are enacted, future modifications to the Project Approval MP 07_0087 would be assessed under section 96 of the EP&A Act depending on the status of this application at the time of the amendment bill coming into effect.

5.3.2 Mining Act 1992

The overarching objective of the *Mining Act 1992* is to encourage and facilitate the discovery and development of mineral resources in NSW, having regard to the need to encourage ecologically sustainable development. The *Mining Act 1992* controls the granting of exploration and mining titles and, amongst other legislative instruments, places controls on methods of exploration and extraction, the disposal of mining waste, rehabilitation and environmental management activities.

An authorisation under the *Mining Act 1992* is required prior to mining or carrying out a mining purpose in NSW. Examples of mining purposes relevant to the Project include the construction, maintenance or use of tailings emplacement areas, and the removal, stockpiling or deposition of overburden. The existing Colliery currently operates under authorisation CCL 761 and ML 1738. The Project disturbance area is located within the boundary of CCL 761 and ML 1738 and therefore a new mining lease or lease extension would not be required.

5.3.3 Protection of the Environment Operations Act 1997

Mining for coal is listed as a scheduled activity under clause 28(2)(a), Schedule 1 of the *Protection of the Environment Operations Act 1997* (POEO Act). The Project meets the definition of 'mining for coal', being mining for coal with a capacity to produce more than 500 tonnes of coal per day and is a 'scheduled activity' under Schedule 1 of the POEO Act requiring an EPL.

The Colliery currently operates in accordance with the conditions of EPL 396 issued by the EPA under the POEO Act. A variation to EPL 396 to accommodate the Project would be sought from the EPA if required, in order to take account of the amended operations resulting from the Project.

Potential also exists for the current noise, air quality, greenhouse gas, and water quality licence conditions to be modernised during the modification of EPL 396. Detailed noise, air quality, greenhouse gas, and water quality impact assessments have been undertaken as part of this EIS (refer to the relevant sections in **Part F**).

5.3.4 Dams Safety Act 2015

The Dams Safety Committee is the State's regulator for dam safety under the NSW *Dams Safety Act 2015* (DS Act). It is responsible for the development and implementation of policies and procedures for effective dam safety management to protect life, property and the environment from dam failures.

The Dams Safety Committee acts to prevent or mitigate any damage to a prescribed dam. A listing of prescribed dams is provided within Schedule 1 of the DS Act. Prescribed dams are surrounded by a Notification Area, within which mining companies are required to address risks of damage to dam structures. Bloomfield Colliery utilises a notified dam under the DS Act as detailed in **Table 5.**

Table 5 Dams Safety Committee Notification Area at Bloomfield Colliery

Object ID	Name	Plan Number	Gazettal Date	Gazettal Number	Dam Name
162	Bloomfield U Cut	204	13/08/2010	100	Bloomfield U Cut Tailings Dam

5.3.5 Water Management Act 2000 / Water Act 1912

The *Water Management Act 2000* sets out the water management principles and water sharing provisions relative to water sources across NSW. Water sources are currently managed in accordance with water sharing plans established under the *Water Management Act 2000* which are being progressively developed and enacted across NSW. In areas where a water sharing plan has not yet commenced, the *Water Act 1912* governs the issue of water licences.

Water sharing plans establish annual limits on water extraction, set water allocations through the issuing of water licences and determine trading rules surrounding water licences. Two water sharing plans are enacted in proximity to the Project:

- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*; and
- *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*.

The Project would involve water supply works and drainage works, as well as the taking of groundwater. The Mine has an existing licence for its current operations and this would be modified to accommodate the Project over its life.

Section 89J of the EP&A Act states that a water use approval under section 89, a water management work approval under section 90, or an activity approval under section 91 of the *Water Management Act 2000* are not required for an approved project.

NSW Aquifer Interference Policy

The *NSW Aquifer Interference Policy* (DPI Water, 2012) was released in September 2012. It defines the requirements for assessing the impacts of aquifer interference activities on water resources, with the aim of striking a balance between the water use requirements of towns, farmers, industry and the environment.

Under the requirements of the *NSW Aquifer Interference Policy*, the predicted impacts of an activity are considered acceptable if they do not exceed the Level 1 thresholds provided within the Policy by no more than the accuracy of an otherwise robust model.

A detailed assessment of potential impacts of the Project on relevant groundwater resources as part of this EIS indicates that the Project would not exceed the Level 1 thresholds and the impact on groundwater is considered minimal (refer to **Section 8.5**).

5.3.6 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* governs the establishment, preservation and management of national parks, historic sites and certain other areas, and the protection of Aboriginal relics. Section 86 of the *National Parks and Wildlife Act 1974* identifies offences relating to knowingly harming or desecrating Aboriginal objects. Section 87(1) of the *National Parks and Wildlife Act 1974* requires a permit to be obtained to remove any artefacts, while section 90 of the Act requires consent from the Director General of OEH to knowingly destroy, deface or damage a relic or Aboriginal place.

A comprehensive Aboriginal Heritage Impact Assessment was undertaken for the 2008 EA. Mining operations are currently undertaken in accordance with the approved Aboriginal Cultural Heritage Management Plan (ACHMP). The Project would have no additional impact on Aboriginal heritage sites as mining would be undertaken within the existing approved extraction area. Measures implemented to manage impacts to Aboriginal artefacts are described in **Section 8.8.1**.

5.3.7 Heritage Act 1977

The *Heritage Act 1977* aims to protect and conserve non-Aboriginal cultural heritage, including scheduled heritage items, sites and relics. The *Heritage Act 1977* is administered by the Heritage Council of NSW. The *Heritage Act 1977* makes provision for a place, building, work, relic, moveable object, precinct, or land to be listed on the State Heritage Register. If an item is the subject of an interim listing, or is listed on the State Heritage Register, a person must obtain approval under Section 58 of the *Heritage Act 1977* for works or activities that may impact on these items.

Given that mining has occurred on the site for approximately 170 years, there is potential for various relics to be on the site in the form of buried or disused equipment of other infrastructure. It is noted that under section 89J of the EP&A Act, the Project is exempt from the requirements for approvals administered under the *Heritage Act 1977*.

5.3.8 Threatened Species Conservation Act 1995 (repealed)

The *Threatened Species Conservation Act 1995* (TSC Act) was the key piece of legislation providing for the conservation of threatened species, populations and ecological communities and their habitats. The TSC Act also established a system for biodiversity certification and established the Biodiversity Banking and Offsets Scheme. For all major projects, impacts to biodiversity are assessed in accordance with the Framework for Biodiversity Assessment (FBA).

The TSC Act was repealed and replaced by the *Biodiversity Conservation Act 2016* (BC Act) on 25 August 2017, however transitional arrangements for major projects set out in the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* provide that development applications can be considered under the previous legislation (the TSC Act) if assessment requirements have been issued or substantial environmental assessment was undertaken before the 25 August 2017. SEARs for the Project were issued on 22 March 2017 (refer to **Section 6.1**) and therefore the Project would be assessed in accordance with the TSC Act.

EMM Consulting prepared a Biodiversity Assessment Report (refer to **Section 8.1**) to assess the potential impacts associated with the vegetation clearing required for expansion of the haul road and upgrade of the watercourse. Recommendations to avoid, minimise and mitigate impacts, including offsetting requirements, are provided at **Section 8.1.4**.

5.3.9 Biodiversity Conservation Act 2016

The BC Act repealed and replaced the TSC Act with effect from 25 August 2017. The BC Act provides for the conservation of threatened species, populations, and ecological communities of animals and plants. This conservation is achieved, in part, by protecting critical habitat of threatened species, populations and ecological communities, and eliminating or managing certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities. The BC Act also provides a framework to ensure that the impact of any action affecting threatened species is assessed.

The BC Act changes the way impacts to biodiversity are assessed and offset in NSW. However as discussed in **Section 5.3.8**, transitional arrangements for major projects provide that the Project can be assessed under the former provisions of the TSC Act (repealed).

5.4 State Environmental Planning Policies

State Environmental Planning Policies are all legal documents enacted under Part 3 of the EP&A Act that regulate land use and development. The following State Environmental Planning Policies enacted under Part 3 of the EP&A Act are considered relevant to the Project:

- State Environment Planning Policy (State Significant Precincts) 2005;
- State Environmental Planning Policy (Mining Petroleum Production and Extractive Industries) 2011;
- State Environmental Planning Policy No 33—Hazardous and Offensive Development;
- State Environmental Planning Policy No. 44 – Koala Habitat Protection; and
- State Environmental Planning Policy No. 55 – Remediation of Land.

5.4.1 State Environmental Planning Policy (State Significant Precincts) 2005

The *State Environmental Planning Policy (Major Projects) 2005* is now known as the *State Environmental Planning Policy (State Significant Precincts) 2005*. This SEPP previously provided the framework for major projects and identified those projects to which the Part 3A approval process would apply. Following the repeal of Part 3A of the EP&A Act, certain provisions of this SEPP were also repealed and the SEPP is subject to the transitional arrangements set out in Schedule 6A of the EP&A Act. The repeal of these provisions does not affect the declaration of the Project as a transitional Part 3A project. Therefore the Project can be assessed as a section 75W modification under the Part 3A transitional provisions.

5.4.2 State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environment Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (Mining SEPP) is the principal environmental planning instrument that governs the carrying out of the Project. The Mining SEPP recognises the importance of mining, petroleum production and extractive industries within the State. Clause 7 of the Mining SEPP identifies development which can be carried out only with development consent. The Project is permissible with consent under clause 7 of the Mining SEPP as it is classified as:

(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).

The aims of the Mining SEPP include:

a. *To provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and*

b. *To facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and*

c. *To establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.*

The Project would involve the extraction of up to 1.3 Mtpa of ROM coal from a number of seams of the Tomago Coal Measures, from the surface to the Big Ben seam. Through careful design and management, the Project would facilitate the orderly and economic use and development of land containing this coal resource within the existing and extended mining lease areas.

Additionally, the Project would support the social and economic welfare of the State by benefiting local, regional and State economies and communities through direct and indirect employment opportunities and the procurement of services, as well as through the payment of coal royalties, consistent with the aims of the Mining SEPP.

Table 6 responds to clauses 12 to 17 of the Mining SEPP which stipulates matters that the consent authority must consider before determining an application for consent for the purposes of mining.

Table 6 Heads of Consideration under Part 3 of the Mining SEPP

Matter for Consideration	Corresponding Assessment
Clause 12AB: non-discretionary development standards for mining	Clause 12AB identifies development standards the following matters that, if complied with, prevents the consent authority from requiring more onerous standards: · Cumulative noise level (refer to **Section 8.2**); · Cumulative air quality level (refer to **Section 8.3**); · Airblast overpressure (refer to **Section 8.2**); · Ground vibration (refer to **Section 8.2**); and · Aquifer interference ((refer to **Section 8.4**).
Clause 12: compatibility of the proposed development with other land uses	**Section 2.1** and **Section 3.3.1** describe the existing land uses in the vicinity of the Project, which include a number of open cut and underground coal mines, areas of open forest and rehabilitated mine land, grazing land and rural residential properties. The Project is considered to be appropriate with regard to existing and approved land uses
Clause 12A: consideration of voluntary land acquisition and mitigation policy	This clause applies to State Significant Development (SSD) applications for mining, petroleum and extractive industry development. This Project is a transitional Part 3A project and therefore not SSD. Nonetheless, this policy has been considered in the assessment of noise (**Section 8.2**) and air quality impacts (**Section 8.3**).

Matter for Consideration	Corresponding Assessment
Clause 13: Compatibility of proposed development with mining, petroleum production or extractive industry	**Section 1.0 - 4.0** of this EIS show the mining leases associated with the Project and outline the context of the Project within the Hunter Coalfields and surrounding resource projects.
Clause 14: Natural resource management and environmental management	Clause 14 relates to natural resource and environmental management and minimisation of impacts on water resources, ecology and greenhouse gas emissions. **Section 8.0** of this EIS provides a detailed assessment of the Project in relation to environmental impacts and management including the management of impacts to natural resources.
Clause 15: Resource recovery	The mine planning process for the Project has optimised the efficiency of resource recovery within the context of environmental and geological constraints. The mine planning process that was undertaken in consultation with DRG is presented in **Section 4.0**. **Section 8.7** describes the economic benefits of extraction of the resource. Indicative economic figures are provided in relation to royalties, capital expenditure, employment and overall importance of the Project to the economy.
Clause 16: Transport	**Section 8.8.4** discusses potential traffic impacts associated with the Project and details the measures proposed to mitigate and manage potential impacts of the transport of materials on local roads. As the Project involves the transport of coal by rail and there is no proposed changes or additions to road connections, this clause is not applicable.
Clause 17: Rehabilitation	**Section 8.6** of this EA and Section 3 of the 2008 EA describe the proposed rehabilitation and mine closure elements of the Project. In addition, a Mine Closure Plan, a Rehabilitation Management Plan and Final Void Management Plan have been developed for the Project and detail the proposed end use and final landform once rehabilitated.

Biophysical Strategic Agricultural Land

Part 4AA of the Mining SEPP makes provisions for SSD projects to meet certain assessment requirements if they have the potential to impact on Biophysical Strategic Agricultural Land. The Project Area is not located within the Upper Hunter Region of the Strategic Agricultural Land Map and is not on land mapped as Biophysical Strategic Agricultural Land. Additionally, this Project is a transitional Part 3A project and not an SSD project and no change to the established mining lease area is proposed. Therefore Part 4AA of the Mining SEPP does not apply to the Project.

5.4.3 State Environmental Planning Policy 33 – Hazardous and Offensive Development

State Environmental Planning Policy No 33 – Hazardous and Offensive Development (SEPP 33) requires a consent authority to consider whether a development may constitute a hazardous or offensive industry as defined by SEPP 33. The instrument dictates that proposed mitigation measures are to be taken into account when determining whether a development is a hazardous or offensive industry, and that the consent authority must have sufficient information to make its determination and impose conditions to minimise impacts.

In order to determine whether the Project constitutes an ‘industry’ under SEPP 33, the definition of ‘industry’ under the Mining SEPP needs to be applied. The definition of ‘industry’ adopted by the Mining SEPP specifically excludes ‘mines, petroleum production facilities, and extractive industries’, and as a consequence the Project is not considered an ‘industry’ for the purposes of SEPP 33.

5.4.4 State Environmental Planning Policy 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) applies to all Local Government Areas (LGAs) listed in Schedule 1 of the SEPP and requires a consent authority to consider whether land subject to a development application is classified as potential koala habitat and/ or core koala habitat. Before development consent can be granted on land defined as core koala habitat, a plan of management must be prepared for that land.

SEPP 44 applies to the Cessnock Local Government Area (LGA). A Biodiversity Assessment Report prepared for the Project (refer to **Section 8.1**) including consideration of SEPP 44 and assessment of Koala habitat in impacted areas of the Project Area.

Two Koala feed trees were identified within the Haul Road Study Area (the vegetation clearing area for haul road expansion as defined in **Section 8.1**). However they do not make up greater than 15% of the tree species within the Haul Road Study Area. Therefore the vegetation within the Haul Road Study Area is not considered to be potential Koala habitat as defined under SEPP 44.

One Koala feed tree was identified within the MOD1 Study Area (the approved MOD 1 clearing area as defined in **Section 8.1**). However it did not constitute greater than 15% of the tree species within the MOD1 Study Area. Therefore the vegetation within the MOD1 Study Area is also not considered potential Koala habitat as defined under SEPP 44.

5.4.5 State Environmental Planning Policy 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) requires a consent authority, when assessing and determining a development application, to consider whether the land subject to the development is contaminated and if so, whether the land requires remediation before the intended land use can proceed.

There are no known major contaminated sites in the vicinity of the Project and contaminated land is not expected to be a significant constraint. However, in order to meet the requirements of SEPP 55, the EA has considered the potential for contaminated land to be encountered based on historical land use, and appropriate mitigation measures have been identified where required (refer **Section 8.4** and **Section 8.8.2**).

5.5 Local Matters

Local statutory and strategic environmental plans are considered below.

5.5.1 Cessnock Local Environmental Plan 2011

The *Cessnock Local Environmental Plan 2011* (Cessnock LEP 2011) applies to the Project Area. The mining area subject to this modification is zoned RU2 Rural Landscape. Mining is not listed as prohibited development in this zone, and is therefore considered permissible with consent. The Project aligns to the zoning objectives which seek to ensure that the mineral extraction potential within this zone is preserved. However, as discussed in **Section 5.4.2**, the Mining SEPP prevails over the LEP, therefore the Project is permissible with consent under the provisions of the Mining SEPP.

5.5.2 Cessnock City Wide Settlement Strategy

The Cessnock City Wide Settlement Strategy (CCWSS) was adopted by Cessnock City Council on 15 September 2010. The CCWSS acknowledges the continued importance of coal mining in the Hunter region, including the Bloomfield mining operations and recommends that known resources should be protected from sterilisation by inappropriate zoning or development on adjoining lands. The Project is consistent with the CCWSS in that it enables extraction of the remaining coal resource.

5.5.3 Maitland Local Environmental Plan 2011

The existing mine rail loop and tailings emplacement area (which are outside the Project Area and form part of the Abel Project Approval) extend beyond Cessnock LGA and lie partly within the Maitland LGA. Under the *Maitland Local Environmental Plan 2011* (Maitland LEP 2011) these areas are zoned RU2 Rural Landscape. Open cut mining is permitted with consent within this zone.

5.6 Summary of Approvals and Licences

The current operations at the Colliery are governed by the approvals and licenses detailed in **Table 7**.

Table 7 Existing Mine Approvals and Licences

Statutory Requirement	Licence / Approval Detail	Approval / Licence to continue to operate
Environmental Planning and Assessment Act 1979	Project Approval (MP 07_0087).	Yes. The existing Project Approval MP 07_0087 would continue to operate subject to any necessary modifications to accommodate the Project.
	MP 07_0087 MOD 1 – Modification to mine plan and operations.	
	MP 07_0087 MOD 2 – Extension of submission date for two management plans required by the Project Approval.	
	MP 07_0087 MOD 3 – Amendment to the area of vegetation clearing.	
Protection of the Environment Operations Act 1997	EPL 396 for coal works and mining for coal.	Yes. The existing EPL would continue to operate subject to any necessary modifications to accommodate the Project.
Water Act 1912 / Water Management Act 2000	Water Licence 20BL172035 licences abstraction of groundwater from the open pit	Yes. This licence would continue to operate during the Project.
Mining Act 1992	Consolidated Coal Lease 761 Mining Lease 1738	Yes. The Project would continue to operate within the existing CCL 761 and ML 1738 boundaries.

As detailed in the relevant sections of this EA, the approvals and licenses detailed in **Table 7** would be maintained for the ongoing operation of the Mine. No new approvals or licenses would be required for the Project

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6.0 Consultation

6.1 Director Generals Environmental Assessment Requirements

Following Bloomfield's initial consultation with the DP&E regarding the Project, DP&E compiled the Environmental Assessment Requirements (EARs) for the Project (issued 16 November 2015 and subsequently revised 22 March 2017). A copy of the EARs is attached as **Appendix B**. The key matters raised by the DP&E to be considered in the EIS are outlined in **Table 8**, together with the relevant section of the EIS which addresses that matter.

Table 8 Environmental Assessment Requirements for the EA as revised 22 March 2017

Description	Reference in EA
Preliminary requirements	
The EA for the modification application should include: · a clear description of the existing approved operation and the proposed development	**Section 4.0**
· the likely interactions between the development and any other existing, approved or proposed developments in the vicinity of the site	**Section 9.0** and **Section 1.1.3**
· a list of any approvals that must be obtained before the development may commence	No new approvals or licences would be required (refer to **Section 5.6**)
· an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including: - a description of the existing environment likely to be affected by the development, using sufficient baseline data; - an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice; - a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development, and an assessment of: § whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented; § the likely effectiveness of these measures; and § whether contingency plans would be necessary to manage any residual risks; and - a description of any measures that would be implemented to monitor and report on the environmental performance of the development if it is approved	**Section 8.0**
· consideration of the development against all relevant environmental planning instruments (including Part 3 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007)*	**Section 5.0**
· the reasons why the modification should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development	**Section 11.0**
Key Issues - Biodiversity	
· An assessment of any likely biodiversity impacts of the Project having regard to any advice and/or guidelines (eg. the Framework for Biodiversity Assessment) from OEH or the Commonwealth Department of Environment and Energy · Any resulting offset strategy, prepared in accordance with OEH and DoEE	**Section 8.1**

Description	Reference in EA
requirements	
Key Issues - Noise	
· A noise and blasting impact assessment of the likely operational noise impacts of the development under the *NSW Industrial Noise Policy* (INP), paying particular attention to the obligations in Chapters 8 and 9 of the INP	**Section 8.2**
Key Issues - Air Quality	
· An assessment of the likely air quality impacts of the development in accordance with the current *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*	**Section 8.3**
Key Issues - Soil and Water	
· The EA is required to demonstrate that the existing water management system is adequate in its existing, or in an upgraded form to accommodate the development. This should be in accordance with the *Managing Urban Stormwater: Soils & Construction Guideline Volume 2E: Mines and Quarries*. A new soil and water management plan may be required	**Section 8.4**
Key Issues - Groundwater	
· The EA is required to assess whether the recovery of deeper coal seams would cause any change to the groundwater resources intercepted by the development and any resultant changes to the site's water balance and water management system	**Section 8.5**
Key Issues - Visual Impacts and Rehabilitation	
· The EA should discuss any visual impacts that may be greater than approved due to the increased extraction of coal and movement of overburden and any changes to the proposed rehabilitation of the site	**Section 8.6**
· Changes to the final landform and how this may affect the rehabilitation of the mine need to be clearly shown in the EA. In particular, the EA should demonstrate that all reasonable and feasible measures have been implemented in mine planning to maximise the use of additional overburden from extracting deeper coal seams to minimise the size of final voids. This should include a scenario that assumes Abel Underground Mine does not recommence operations and transfer tailings for backfilling pits at Bloomfield	**Section 4.3.2** and **Section 4.4**
Key Issues - Social and Economic	
· The EA should identify the economic benefits (such as jobs) of the proposal and any implications on the demand for local infrastructure and services	**Section 8.7**
Consultation	
Finally, you should also consult with relevant local and State government authorities in particular, including Council, EPA, OEH, DRG and DoEE, any local landholders and/or residences who may be affected by the proposal, and any interested community groups. The EA should report on this consultation	**Section 6.0**

6.2 Consultation with Statutory Agencies and Groups

Consultation was undertaken with local, State and Commonwealth bodies listed in **Table 9.** Copies of meeting minutes from these consultation meetings are provided in **Appendix C.**

Table 9 Agency Consultation

Consultation / Date	Comment
Cessnock City Council	
Project Briefing meeting on 2 August 2017.	Items discussed included: · Background and need for Project; · Details of Project; · Status of neighbouring mines; · Road access arrangements; · Land ownership; and · Consultation requirements. Cessnock City Council had no specific requirements at the time of meeting however indicated feedback would be provided during the formal EA exhibition and referral from DP&E.
Maitland Council	
Project Briefing meeting on 23 August 2017	Items discussed included: · Background and need for Project; · Details of Project; · Timing of closure and post closure use of tailings emplacement area; · Status of neighbouring mines; · Proposed future developments nearby; · Mine access roads; · Land ownership; and · Consultation requirements. Maitland Council had no specific requirements at the time of meeting. Further opportunity to comment would be provided during the formal EA process.
Environment Protection Authority	
Consultation by email dated 12 October 2017 (offer to meet in person was declined).	· The EPA indicated it would review the environmental assessment through the planning referral process and use that as an opportunity to provide feedback on the Project. · The EPA advised that acceptance of a waste at a premises must only occur under a valid Resource Recovery Order or Exemption (refer to **Section 8.8.3**). · The EPA indicated that the proponent should consider the transport of course reject from one premises to another and co-disposal pursuant to the requirements of the EPAs Resource Recovery Order and Exemptions (refer to **Section 8.8.3**).
Department of Planning and Environment – Division of Resources and Geosciences (DRG)	
Project Briefing meeting on 12 September 2017. Site inspection and Project update on 16 October 2017	Items discussed include: · Background and need for Project; · Details of Project. DRG requires the EA to include an analysis of alternative mine plans and final land forms considered and justification of the chosen mine plan (refer **Section 4.4**). · Timing of closure and post closure use of tailings emplacement area and tailings strategy for use of pit areas for tailings disposal (Refer **Section 4.3.3**). · Status of Abel Underground Mine. · Final void reuse options and final landform. · The timing for the preparation and submission of a revised MOP for the Project. · Rehabilitation. The EA needs to address each of the headings listed in Section E: Rehabilitation of the Indicative SEARs for SSD mining projects (NSW Government, 2015) (refer **Section 8.6.3**).

6.3 Community Consultative Committee

The Proponent operates the Bloomfield Community Consultative Committee (CCC) which meets three times a year to provide opportunities for the Mine, Councils and the community to have an open discussion regarding a range of matters in relation to the Mine.

From the inception of the Project and during the preparation of the EA, the CCC was briefed on the Project and mine plan. Minutes from CCC meetings are available for public viewing on Bloomfield's website.

6.4 Mindaribba Local Aboriginal Land Council

As part of the consent process for Project Approval 07_0087, Bloomfield entered into an agreement with the Mindaribba Local Aboriginal Land Council (LALC) for the provision of funds to support programs such as operation of Mindaribba's pre-school. The current agreement is scheduled to lapse in 2018.

Representatives from Bloomfield met with Mindaribba LALC on 20 June 2017 regarding the current agreement and Project. The Mindaribba LALC Board is currently formulating a proposal to Bloomfield for the continuation of the current agreement as well as review of the updated ACHMP. A draft version of the updated ACHMP (updated to include the previously salvaged artefacts) was supplied to the LALC for review on 11 September 2017.

7.0 Identification and Prioritisation of Issues

An Environmental Risk Assessment (ERA) was undertaken as part of the original 2008 EA to identify environmental risks associated with the coal operations at the Colliery. The risk assessment process included a workshop session attended by key personnel with knowledge, experience and understanding of the Colliery site, the Project operations, and the environmental effects of the activities undertaken at the site. The ERA provided the preliminary screening of potential environmental impacts to identify those impacts that have higher levels of risk and those impacts unlikely to result in significant risks to the environment.

As the activities proposed in this modification application would be similar to the activities currently undertaken on the site, and were subject to risk assessment as part of the 2008 EA, the previous ERA has been used as the basis for the prioritisation of issues for this modification application.

The ERA prioritises environmental issues in the absence of appropriate safeguard measures to manage environmental effects. This analysis was then used to inform the environmental assessment and the engineering and environmental design of the Project and in the identification of appropriate safeguards. The prioritisation of environmental issues relating to the Project is provided below.

Key issues:

- Biodiversity;
- Noise and vibration;
- Air quality and greenhouse gases;
- Soils and water;
- Groundwater;
- Visual impacts and rehabilitation; and
- Social and economic.

Other issues:

- Aboriginal and historic heritage;
- Hazards and risks;
- Traffic and transport; and
- Waste.

An assessment of the potential impacts of the Project in relation to each of the key and other issues is provided in **Section 8.0.**

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8.0 Environmental Assessment

8.1 Biodiversity

8.1.1 Introduction

This section provides an assessment of the potential impacts of the Project on biodiversity. EMM Consulting prepared a Biodiversity Assessment Report (BAR) for the Project (provided at **Appendix D** and summarised below). The BAR assessed the potential impact of the additional clearing proposed as part of the Project. The BAR also includes a gap analysis of previous ecological assessments undertaken within the Project Area and an assessment of potential impacts of the Project on matters of NES.

Documents reviewed as part of the desktop assessment include the following:

- *Flora, Fauna & Threatened Species Assessment: Bloomfield Colliery Completion of Mining and Rehabilitation, Part 3A Environmental Assessment*, prepared by EcoBiological, November 2008;
- *Bloomfield Colliery East Maitland, Part 3A variation ecology* report, prepared by Hunter Eco, May 2010; and
- *Bloomfield Colliery East Maitland, Biodiversity Assessment – Creek Cut Highwall,* prepared by Hunter Eco, November 2012.

8.1.2 Existing Environment

Previous ecological assessment (2008 EA)

The 2008 EA included an assessment of potential impacts to flora and fauna, including threatened species, populations and ecological communities. This assessment comprised the following:

- Desktop assessment and review of ecological databases to compile a list of threatened flora and fauna likely to occur on the site;
- Field survey to locate listed threatened species or communities occurring on the site;
- Assessment of potential ecological impacts; and
- Identification of mitigation measures to be implemented during the mining operations.

One Endangered Ecological Community and six threatened (TSC Act) fauna species were recorded in the vegetated disturbance areas. No species listed as threatened in the Commonwealth EPBC Act were found. An assessment of the impact of the loss of habitat on the EEC and the threatened species concluded that there would be no impact that would place any local populations at risk of extinction.

MOD 1 Clearing Area – 'MOD1 Study Area'

An additional disturbance area was approved to be cleared as part of the MOD 1 modification to the Project Approval (MP 07_0087) to allow for relocation of a powerline corridor and associated infrastructure. The MOD 1 assessment covered the 6.12ha of vegetation proposed to be cleared as part of the current Project to facilitate the further extraction of coal resources. This area is hereafter referred to as the 'MOD1 Study Area' (refer to **Figure 18**). Given that there would be no additional vegetation clearing in the MOD1 Study Area above that already approved under Project Approval MP 07_0087 (as modified), no further assessment under the BC Act is required to support the application for the MOD1 Study Area. Further assessment would only be required if the Project is likely to cause additional impacts compared to that which has previously been assessed and approved.

The gap analysis prepared by EMM Consulting (refer to Appendix A of **Appendix D**) identified that the previous ecology impact assessment undertaken for MOD 1 (Hunter Eco, 2010) did not address the matters of NES listed under the Commonwealth EPBC Act. Hunter Eco (2010) did not undertake a Protected Matters Search to determine if species or ecological communities listed under the EPBC Act were likely to be present. Also Hunter Eco (2010) did not prepare assessments of significance to determine the likelihood that the Project would significantly impact species and /or communities listed under the EPBC Act, or if a referral was required.

In the light of this omission, EMM Consulting prepared an assessment of the potential impacts of vegetation clearance within the MOD1 Study Area on matters of NES as listed under the EPBC Act (refer to Appendix A of **Appendix D**).

Additional Clearing Area –'Haul Road Study Area'

An additional 3.5 ha of previously rehabilitated landform (including 0.34 ha of native vegetation) would be cleared as part of the Project for the proposed widening of a haul road and upgrade of a watercourse. There are two defined areas that would be impacted on either side of the haul road and these combined areas are hereafter referred to as the Haul Road Study Area (refer to **Figure 18**). The Haul Road Study Area was rehabilitated before the Project Approval MP 07_0087 was granted in 2009. Whilst this area is within the existing approval area for the Colliery, it is not part of the approved extraction of disturbance footprint.

As the Project would involve clearing of native vegetation and increase of the Colliery's disturbance footprint, the BAR (refer **Appendix D**) included an assessment of likely biodiversity impacts of the Project on the Haul Road Study Area, having regard to guidelines such as the Framework for biodiversity Assessment (FBA).

Site Description

MOD1 Study Area

The MOD1 Study Area is a forested area of 6.12 ha south-west of the operating Creek Cut pit. To the south and south-west of the MOD1 Study Area is cleared land, also associated with the mine. To the north and north-west, the MOD1 Study Area is also bound by forest. The 6.12 ha of forest within the MOD1 Study Area is approved to be cleared under the Project Approval (MP 07_0087 as modified).

Database searches (including NSW OEH Atlas of Wildlife and Commonwealth Protected Matters Search Tool) were conducted by EMM Consulting on 7 April 2017 to obtain recent data on flora and fauna species, populations, communities and habitat listed under the EPBC Act that may occur in the MOD1 Study Area.

Field surveys were undertaken within the MOD1 Study Area targeted at identifying species and communities listed under the EPBC Act. Flora and vegetation surveys consisted of meander searches to document the vegetation structure and dominant flora species and to target threatened flora species. Fauna species were recorded opportunistically as they were encountered during the field survey. Evidence of fauna such as tracks, scats, scratches on and around trees and potential fauna habitat features were noted.

The entire MOD1 Study Area is forested although it appears to have been historically cleared as there is a lack of large trees and a large number of trees of a similar size, indicating a single regeneration event. A single vegetation type was identified within the MOD1 Study Area – the *Spotted Gum – Broad leaved Mahogany – Red Ironbark shrubby open forest*. A description of this community is provided at Appendix A ,of **Appendix D**. This community does not meet the listing of the Critically Endangered Ecological Community (CEEC) Central Hunter Valley eucalypt forest and woodland (CHVEFW) due to the frequent occurrence of contraindicative canopy species, including Red Ironbark and Forest Oak.

The vegetation within the MOD1 Study Area represents potential habitat for Black-eyed Susan (*Tetratheca juncea*) however targeted flora surveys did not detect the species, nor any other threatened flora listed under the EPBC Act.

No EPBC listed threatened fauna species or migratory fauna species were recorded during the field surveys within the MOD1 Study Area. Potential habitat for a number of EPBC listed threatened species, including the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox and migratory species including the Satin Flycatcher and Rufous Fantail was identified within the MOD1 Study Area.

One Koala (*Phascolarctos cinereus)* feed tree species listed under SEPP 44 was recorded within the MOD1 Study Area (the Grey Gum (*Eucalyptus punctata*)). However, no primary or secondary feed trees listed for the North Coast Koala Management Area (KMA) were found and therefore it is unlikely that there are sufficient foraging resources to support the Koala within the MOD1 Study Area. No Koala scats were detected during the searches.

Haul Road Study Area

The Haul Road Study Area comprises two areas of land covering approximately 3.5 ha and is located north-east of the operating Creek Cut pit. The Haul Road Study Area is bound by rehabilitated landform and haul roads associated with the Colliery's current operations.

Database searches (including NSW OEH Atlas of Wildlife and Commonwealth Protected Matters Search Tool) were conducted by EMM Consulting on 7 September 2017 to obtain information about the flora and fauna species, populations, communities and habitats likely to occur within 10km of the Haul Road Study Area. An initial site investigation was conducted to gain an understanding of the vegetation structure and dominant flora species within the Haul Road Study Area. Mapping was conducted using a hand-held GPS unit, mobile tablet computers and aerial photo interpretation. The BAR included mapping of vegetation within an inner assessment circle of 100 ha and an outer assessment circle of 1000 ha (refer to **Figure 18**). Targeted flora surveys were then undertaken and fauna species were recorded opportunistically as they were encountered during the field surveys.

The previously rehabilitated landform is very disturbed. Within the Haul Road Study Area, the previous rehabilitation occurs as:

- Patches of regenerating forest (consisting of stands of regenerating trees of a similar size, no very large trees , a spars mid-storey and grassy understorey); and
- Exotic grassland dominated by grass species that are common to mine rehabilitation, especially Rhodes Grass (*Chloris gayana)*, with *Acacia sp.* Regrowth in the mid storey and no canopy layer.

The Haul Road Study Area supports 0.34 ha of native vegetation, occurring as small patches. The two Plant Community Types (PCTs) identified within the Haul Road Study Area are set out in **Table 10**. These PCTs represent the *Lower Hunter Spotted Gum- Ironbark Forest in the Sydney Basin Bioregion*, which is an Endangered Ecological Community (EEC) listed under the BC Act. These two PCTs were assessed as being in moderate / good condition in accordance with the FBA.

Table 10 Plant Community Types within the Haul Road Study Area

Plant Community Type	Vegetation formation	Vegetation class	Area (ha)
PCT 1590 – *Spotted Gum – Broad leaved Mahogany – Red Ironbark shrubby open forest*	Dry Sclerophyll Forests (shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	0.05
PCT 1592 – *Spotted Gum – Red Ironbark – Grey Gum – grass open forest of the Lower Hunter*	Dry Sclerophyll Forests (shrub/grass sub-formation)	Hunter-Macleay Dry sclerophyll Forests	0.29

A 3.2 ha area of non-native vegetation dominated by exotic grasses was identified; however this area had a site value score of less than 17 and is not considered further in the assessment of offsets. Descriptions of each PCT / vegetation zone are provided in Tables 4.3 to Table 4.5 of **Appendix D**.

Targeted flora surveys were undertaken for the following species, however no target flora species were recorded within the Haul Road Study Area:

- Black-eyed Susan (*Tetratheca juncea*);
- Netted Bottle Brush (*Callistemon linearifolius*);
- Scant Pomaderris (*Pomaderris queenslandica);*
- Singleton Mint Bush *(Prostanthera cineolifera);*
- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora),* and
- White-flowered Wax Plant (*Cynanchum elegans).*

The regenerating forested areas are likely to provide habitat for a range of common fauna species. No tree hollows were observed within the forested patches in the study area, as a result of the relatively young canopy. Therefore, it is unlikely that the Haul Road Study Area provides shelter for arboreal mammals or nesting habitat for hollow dependent birds, although these species may occasionally forage in these areas.

The regenerating forested areas may provide foraging habitat for a number of threatened bird species, forest owls, micro bats that are associated with the recorded vegetation types recorded. A list of ecosystem credit species predicted to occur within the Haul Road Study Area is provided in Table 5-2 of **Appendix D**. A list of species credit species predicted to occur and an assessment of whether the Haul Road Study Area provides suitable habitat is provided in Table 5-3 of **Appendix D**.

No threatened flora or fauna species listed under the BC Act or EPBC Act were recorded during the targeted surveys. Potential seasonal foraging habitat for a number of EPBC listed threatened species, including the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox was identified, however the Haul Road Study Area does not provide habitat for an ecologically significant proportion of these species.

Two Koala feed tree species listed under SEPP 44 were recorded within the Haul Road Study Area; the Forest Red Gum and Grey Gum. Forest Red Gum comprised a small proportion of the canopy (5%) in PCT 1590 and Grey Gum a small proportion of the canopy (10%) in PCT 1592. The primary feed tree Forest Red Gum was recorded within PCT 1590 and no secondary feed trees listed for the North Coast KMA were found. Stringybark/supplementary species White Stringybark was recorded within PCT 1592. No Koala scats were detected during searches around the base of primary and supplementary feed tree species. Given the lack of records, the small proportion of Forest Red Gum and Grey Gum in the canopy, as well as the fragmented and disturbed nature of the area, it is unlikely that there are sufficient foraging resources to support the Koala within the Haul Road Study Area.

8.1.3 Impact Assessment

MOD1 Study Area

The direct impact of the Project on matters of NES includes clearance of vegetation. The impact assessment assumes complete disturbance/removal of Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest, which occupies an area of 6.12 ha within the MOD1 Study Area.

Significant impact assessments were prepared for the following EPBC listed species (detailed in Appendix A of **Appendix D**), in accordance with the criteria listed in the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE, 2013):

- Critically endangered species:
  - Regent Honeyeater;
  - Swift Parrot;
- Vulnerable species:
  - Large eared Pied Bat;
  - Grey Headed Flying Fox;
- Migratory species:
  - Satin Flycatcher; and
  - Rufous Fantail.

Potential habitat for these species was found to be of poor value, primarily due to its condition, fragmented nature, existing threats and location next to an existing operating open cut mine. The habitat is unlikely to support important populations of matters of NES or be critical to the survival of a population or the species. Assessments of significance undertaken for these EPBC listed species concluded that significant impacts to matters of NES within the MOD1 Study Area would be unlikely to occur as a result of the proposed Project.

Nonetheless, a precautionary assessment approach has been adopted, and the Regent Honeyeater and Swift Parrot have been assumed to occasionally forage within the MOD1 Study Area. Accordingly, measures were recommended to mitigate potential impacts of the Project on potential habitat for the Regent Honeyeater and Swift Parrot.

Haul Road Study Area

The Project has potential for direct and indirect impacts within the Haul Road Study Area. Direct impacts would include the removal of 0.05 ha of PCT 1590 - *Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest* in moderate / good condition, and the removal of 0.29 ha of PCT 1592 – *Spotted Gum – Red Ironbark – Grey Gum – grass open forest of the Lower Hunter* in moderate / good condition.

Potential indirect impacts arising from the Project include:

- Temporarily increased noise levels from construction equipment, leading to disturbance of fauna (particularly during breeding season); and
- Temporary slight increase of traffic volume during construction as a result of upgrade of the haul road, leading to higher chance of fauna strike and increased noise levels leading to disturbance of fauna.

The Haul Road Study Area already occurs as small patches of vegetation and is already heavily impacted by edge effects. The Project would not significantly increase edge effects given the high level of existing clearance.

The upgrade of the haul road would not result in a permanent increase in traffic volume and impacts on biodiversity from operation of the proposed upgrade would be negligible. Residual impacts of the Project would include loss and minor increases in fragmentation of native vegetation and species habitat, and the potential for species to no longer utilise potential habitat within the Haul Road Study Area.

Consideration of the thresholds for assessment and offsetting in accordance with Section 9 of the FBA was undertaken and the following points are noted:

- The Haul Road Study Area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links. Therefore there are no impacts to the landscape features that require further consideration;
- One TSC Act listed EEC *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion* occurs within the Haul Road Study Area. The proposal would clear 0.34 ha of this EEC.
- The Haul Road Study Area does not include any areas of critical habitat. No impacts on critically endangered or endangered species would result from the proposal, and there are no impacts on species or populations requiring further consideration; and
- The proposal would result in the removal of 0.05 ha of PCT 1590 *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest* (HU804), and 0.29 ha of PCT 1592 *Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter* (HU806). Impacts upon these PCTs would require offsetting.

The BAR included an assessment of biodiversity credits required as a result of impacts on the biodiversity values within the Haul Road Study Area. The assessment concluded that 10 ecosystems credits would be required to offset the residual impacts to native vegetation and a Biodiversity Offset Strategy was prepared. The Biobanking public register was checked for the availability of credits of the same PCTs as those being impacted. Credits were available for PCT 1592 (HU806) on the public register. There were no matching credits for PCT 1590 however the credit profile report includes PCT 1592 as an offset option for PCT 1590.

The PCTs and corresponding number of credits generated under the FBA were entered into the online Biodiversity Offset Payment Calculator on 9 November 2017. The calculator estimates a price of $2,000.64 per credit. The total payment required for the Project is $22,007.08 (including GST). Due to the small number of credits to be offset, payment into the Biodiversity Conservation Trust is the preferred option to secure offsets for this Project.

The assessment concluded that significant impacts on matters of NES under the EPBC Act would be unlikely to occur within the Haul Road Study Area as a result of the Project.

8.1.4 Mitigation Measures

Existing measures

The Colliery has established clearing practices in place as part of its EMS (as detailed in **Section 4.2.11**). These include minimisation of disturbance areas, pre-clearance surveys, salvaging and reusing material on site for habitat enhancement, conserving and reusing topsoils and weed management. These clearing practices would continue to be implemented for the Project in accordance with the approved EMS.

Pre-clearance surveys

Pre-clearance surveys of the forest to be removed would be conducted within 24 hours prior to commencement of clearing to identify any fauna species or habitat within areas of impact. Where clearing of vegetation and fauna habitat occurs, clearing protocols would be put in place, including checking trees for the presence of arboreal fauna prior to felling. Where feasible, animals found to be occupying trees would be safely relocated into nearby forest that would not be disturbed. Where feasible, transportable habitat features such as large logs and boulders would be placed in adjacent retained areas or in areas ready for seeding, to allow their continuation as potential fauna refuge sites.

Regent Honeyeater and Swift Parrot

In addition to these general fauna pre-clearance methods, the following measures would be implemented to mitigate potential impacts on habitat for the Regent Honeyeater and Swift Parrot:

- A qualified ecologist would undertake a targeted pre-clearance survey within 24 hours prior to the commencement of removal of potential foraging habitat for the Regent Honeyeater and Swift Parrot (potential foraging habitat includes the entire 6.12 ha study area);
- Pre-clearance surveys would be undertaken over a period of two days and surveys would be undertaken in the morning (i.e. within 3 hours of sunrise) to target the species highest activity period. Dependent on the clearing schedule, the survey effort would comprise:
  - 20 minute searches in areas up to 5 ha; or
  - 40 minute searches in areas of 6 – 30 ha.
- If Regent Honeyeaters or Swift Parrots **are not found** within the clearance area, then searches for Regent Honeyeater or Swift Parrot habitat trees (foraging trees) are not required;
- If Regent Honeyeaters or Swift Parrots **are found** within the clearance area, targeted searches for Regent Honeyeater or Swift Parrot habitat trees would be undertaken by a qualified ecologist;
- If habitat trees are found within the clearance area, a qualified ecologist would mark the trees with flagging tape and spray paint (e.g. with a ‘H’, denoting habitat tree);
- The two stage clearance protocol for habitat trees comprises:
  - Stage 1: Non-habitat trees would be cleared 24 hours prior to any habitat trees being cleared, to encourage Swift Parrots to move out of the habitat area; and
  - Stage 2: When Stage 1 is complete, habitat trees can be removed.

Weed control, microhabitat retention and demarcation

Other management strategies would include:

- Appropriate weed controls to avoid incursion of exotic weed species into the remaining surrounding forest;
- Salvaging microhabitat features, such as woody debris and logs, within adjacent suitable habitat, where possible to mitigate potential impacts to ground-swelling fauna; and
- Habitat adjacent to the proposed clearing would be demarcated to avoid accidental clearing. Vegetation clearing would be minimised and avoided where possible. Where opportunities for reduction in clearing extents occur, these would be implemented and micro-habitat features retained.

Construction of Haul Road Upgrade

Additional mitigation measures to be implemented during construction of the haul road upgrade would include:

- Appropriate exclusion fencing would be installed around vegetation to be retained directly adjacent to the development footprint;
  - Appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' would be installed;
  - The location of any 'No Go Zone' would be identified in site inductions;
  - Fencing would be secured with star pickets and would use high visibility bunting;
- All material stockpiles, vehicle parking and machinery storage would be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation;
- A licenced wildlife salvage team would be on-site during vegetation removal to catch and relocate (if appropriate) wildlife encountered;
- Where appropriate, native vegetation cleared from the development site would be mulched for reuse on the site, to stabilise bare ground;
- Temporary stormwater controls would be implemented during construction to ensure that discharges to the drainage channels are consistent with existing conditions; and
- Sediment and erosion control measures would be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect drainage channels. These would conform to relevant guidelines, would be maintained throughout the construction period and would be carefully removed following the completion of works.

Biodiversity Offset Strategy

Ten ecosystem credits would be required to offset the impacts arising from the Project, and Bloomfield would pay the required offsetting cost (currently estimated to be $22,007.08 including GST) into the Biodiversity Conservation Trust.

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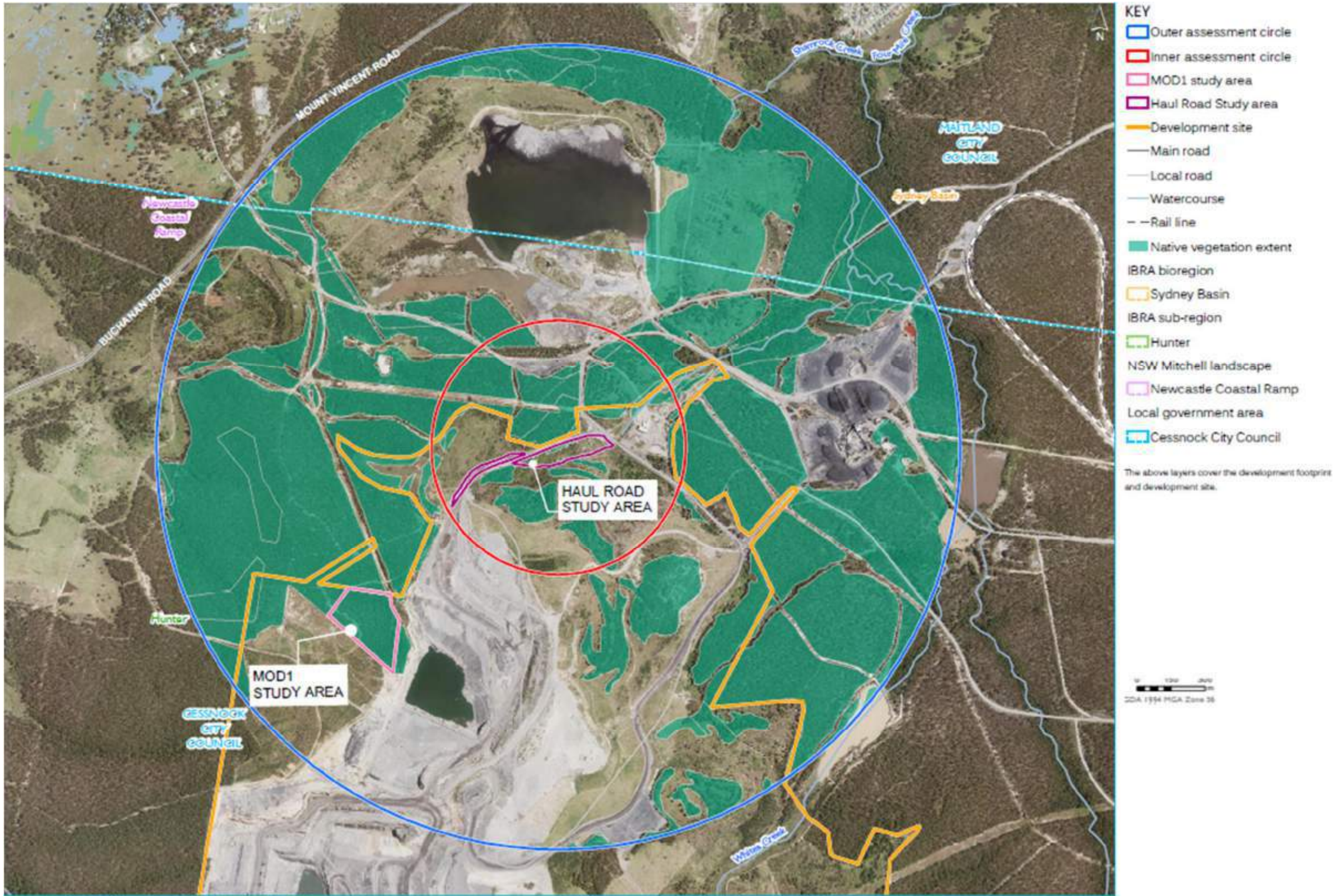

Source: EMM (2017); The Bloomfield Group (2017); GA (2017); OEH (2017)

Figure 18 MOD1 Study Area and Haul Road Study Area for Biodiversity Assessment (Source: EMM Consulting, 2017)

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8.2 Noise, Vibration and Blasting

8.2.1 Introduction

This section provides an assessment of potential noise, vibration and blasting impacts associated with the Project. SLR Global Environmental Solutions (SLR) prepared a Noise and Vibration Impact Assessment (NVIA) which is provided at **Appendix E** and summarised below. The NVIA was completed with reference to the following guideline documents:

- *NSW Industrial Noise Policy* (INP) (EPA, 2000)[2];
- *Australian Standard AS 2187: Part 2-2006 Explosives - Storage and Use - Part 2: Use of Explosives;* and
- *Technical basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC, 1990).

It is noted that the INP was withdrawn and replaced by the *Noise Policy for Industry* (EPA, 2017) in October 2017. However the EPA's *Implementation and transitional arrangements for the Noise Policy for Industry (2017)* provides that, where SEARs were issued for a project prior to the release of the new policy, the assessment requirements referenced in the SEARs apply. The SEARs for the Project were issued in March 2017 and specifically require a noise and blasting assessment under the INP. Therefore the INP remains the relevant guideline with which to assess the Project.

The Project would utilise the existing rail loop and CHPP facilities already assessed as part of the approved Abel Underground Mine Project. Therefore, the noise impact from these facilities is only considered as part of the cumulative assessment. No changes to road and rail traffic would occur as a result of the Project nor are any construction activities proposed. Accordingly, road noise, rail noise and construction noise are not considered further in this noise assessment.

8.2.2 Existing Environment

There are numerous residential properties in the vicinity of the Project area. The sensitive receivers assessed in the NVIA are shown on **Figure 19**.

In accordance with the existing Noise Monitoring Program, quarterly noise monitoring is undertaken at locations around the Project area. Noise monitoring consists of continuous, unattended noise logging and operator attended noise surveys. Background noise monitoring was conducted at locations F, G, L, M and N (refer to **Figure 19**).

Attended noise surveys found that the noise environment at the assessed locations is dominated by road traffic and natural noises such as insect, frog, cicada and bird noise. Significant sources of road traffic noise in the region include the John Renshaw Drive, New England Highway, Buchanan Road and Hunter Expressway (which opened on 22 March 2014). The Rating Background Levels (RBLs) for the Project were reassessed to determine the change in the background noise levels within the Project area since the Hunter Expressway was opened.

The measured RBLs during the quarterly noise monitoring surveys conducted between April 2015 and March 2017 were used to calculate the representative long term RBL at each monitoring location (Table 7 of **Appendix E**). In accordance with the INP Application Notes for the modification of existing industrial premises, the RBLs and $L_{Aeq(period)}$ amenity levels were determined in the absence of existing Bloomfield Colliery operations (Table 9 of **Appendix E**).

Review of wind data from the on-site meteorological station between 2011 and 2017 indicated that prevailing wind conditions are a feature of the area and as such have been considered as part of the NVIA. Review of data from the Beresfield weather station indicated that the frequency of occurrence of F Class temperature inversions is greater than 30% and therefore this weather condition has been considered as part of the NVIA. The meteorological parameters used in the NVIA therefore included prevailing wind conditions and F Class temperature inversions.

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[2] The INP has been replaced by the NSW Noise Policy for Industry (2017), however transitional arrangements provide that the INP remains the applicable noise guideline for the Project.

The existing Blast Monitoring Program is implemented for all blasting activities associated with the Colliery's mining operations. Blasting only occurs between 9am and 5pm Monday to Saturday, with no blasting conducted on Sundays and public holidays. Bloomfield operates a network of blast monitors to provide feedback on ground vibration and airblast levels for each blast. Data collected from the monitors is correlated with blast parameters such as charge weight and location and used to ensure future blasts are adequately designed to avoid exceedances of appropriate noise and vibration criteria.

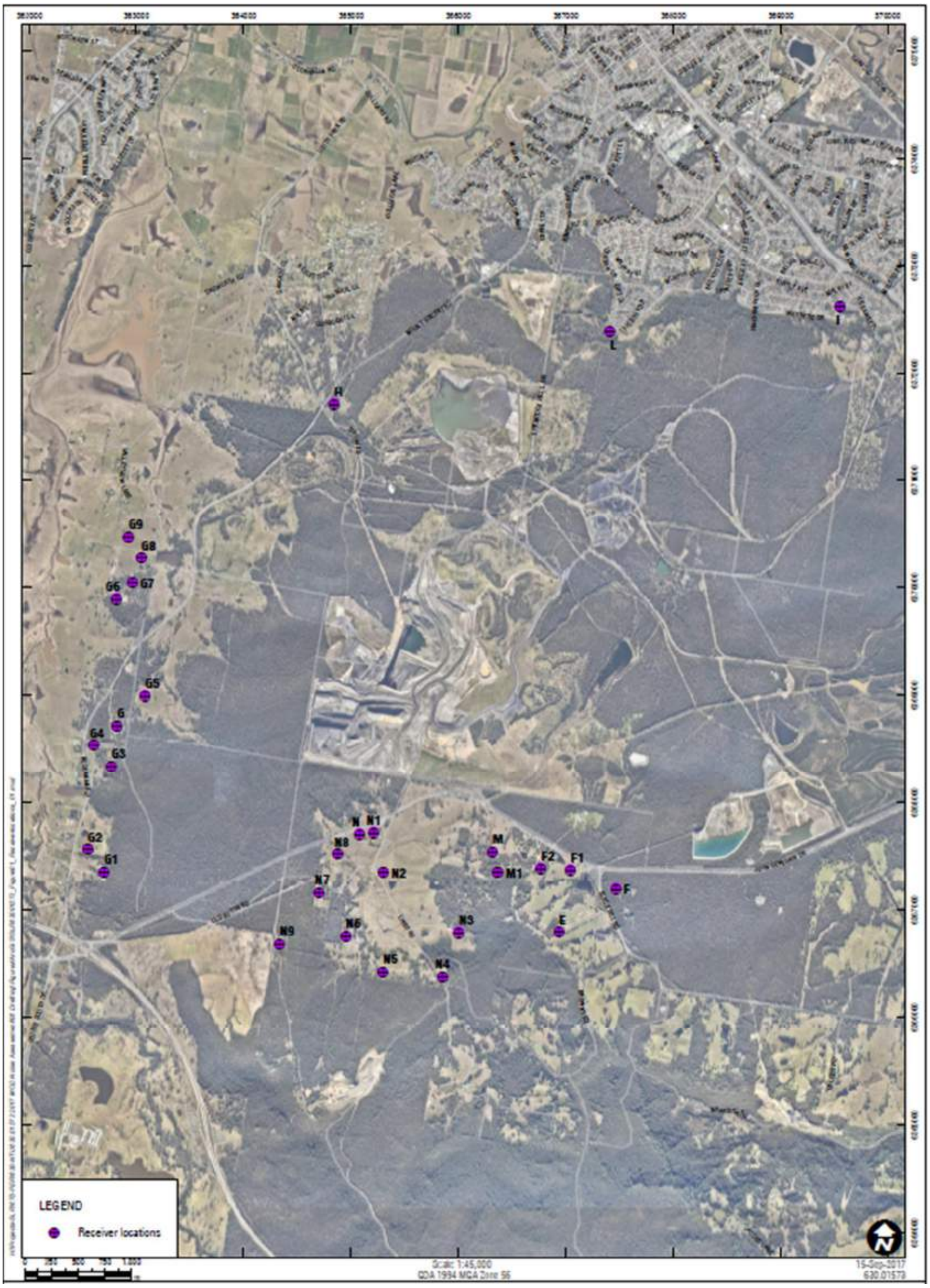


Figure 19 Sensitive Receivers Assessed in the NVIA

8.2.3 Noise Criteria

INP Intrusiveness and Amenity Criteria

The INP provides the framework and process for deriving noise criteria for the regulation of noise from industrial premises. The policy sets two separate noise criteria to meet environmental noise objectives; one to account for intrusive noise and the other to protect the amenity of particular land uses.

For assessing intrusiveness, the background noise level is measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5dB above the measured background level (L_{A90}).

The amenity assessment is based on noise criteria specific to land use and associated activities. The amenity criteria relate only to industrial-type noise and do not include road, rail or community noise. Where the existing noise level from industrial sources approaches the acceptable noise level, noise from new sources must be limited to protect the amenity of the area. Amenity criteria for receivers such as residences, schools, and recreation areas are provided in Table 4 of **Appendix E**.

Project Specific Noise Criteria

Project Specific Noise Levels (PSNLs) for the Project have been established in accordance with the procedures in the INP. The amenity criteria have been established using the results of ambient noise measurements (refer to **Section 8.2.2**) with adjustments to account for existing industrial noise contributions as necessary. The acoustic environment typifies that of suburban environments. The PSNLs for all assessed receptors are provided in **Table 11**.

Table 11 Project Specific Noise Levels

Location	Locality Area (Noise Amenity Area)	Period	Adopted RBL[1]	Intrusive Criteria[1, 2], $L_{Aeq(15min)}$ dBA	Amenity Criteria[1, 3] $L_{Aeq(period)}$ dBA
E, F – F2	Black Hill (Suburban)	Day	45	50	55
		Evening	42	47	45
		Night	40	45	40
G – G9, H	Buchanan & Louth Park (Suburban)	Day	40	45	55
		Evening	38	43	45
		Night	31	36	40
L, I	Ashtonfield (Suburban)	Day	34	39	55
		Evening	34	39[1]	45
		Night	33	38	40
M – M1, N – N9	Buttai (Suburban)	Day	44	49	55
		Evening	44	49	45
		Night	37	42	40

1. Evening RBL and criteria adjusted to be no greater than the daytime in accordance with the INP application notes
2. Intrusiveness criteria = Adopted RBL + 5 dB
3. Amenity criteria = Adopted RBL adjusted to account for existing industrial noise sources

Sleep Disturbance

The INP Application Notes provide guidance on setting sleep disturbance criteria. The EPA recognises that the current $L_{A1(1\ minute)}$ sleep disturbance criterion of 15dBA above the prevailing background $L_{A90(15min)}$ noise level is not ideal. However as there is insufficient information to determine a suitable alternative criterion, in the interim, the INP guideline suggests that the $L_{A1(1minute)}$ level of 15dBA above the RBL is a suitable screening criteria for sleep disturbance for the night-time period.

The night time $L_{A1(1\ minute)}$ Sleep Disturbance Noise Levels determined in accordance with the INP Application Notes are presented in **Table 12**.

Table 12 Sleep Disturbance Noise Levels

Location	Period	Adopted Night-time RBL	Sleep Disturbance Noise Goal LA1(1minute) dBA
E, F – F2	Night-time (10 pm – 7:00 am)	40	55
G – G9, H		31	46
L, I		33	48
M – M1, N – N9		37	52

Blasting and Vibration Criteria

Ground vibration and airblast levels which cause human discomfort are lower than recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally ensures that the potential to cause structural damage is negligible. The EPA currently adopts the ANZEC (1990) guidelines for assessing potential annoyance from blasting during daytime hours, as set out in **Table 13**.

Table 13 Blasting and Vibration Criteria

Blasting impact	Criteria
Airblast overpressure	≤ 115 dBL for 95% of blasts in a 12 month period ≤ 120 dBL for all blasts
Ground Vibration	≤ 5 mm/s for 95% of blasts in a 12 month period ≤ 10 mm/s for all blasts

8.2.4 Methodology

Operational Noise Modelling

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling software (Version 7.4) to predict noise emissions from the Project. Prediction of noise emission levels was carried out under the meteorological parameters discussed at **Section 8.2.2** which included prevailing wind conditions and F Class temperature inversion. Plant and equipment considered in the modelled operational scenarios include an excavator, rear dump trucks, mining drills, dozers, graders and watercarts.

Noise predictions were carried out for three operational years, namely:

- Year 2018 - Representative of Bloomfield operations at the commencement of the Project;
- Year 2021 - Representative of Bloomfield operations midway through Project related mining operations; and
- Year 2025 - Representative of the furthest extent of Project related operations to the west.

For each of these operational years, three operational scenarios were modelled during each period (that is, day, evening, night, and night reduced operations). The operational scenarios included:

- Scenario 1: Coaling via the main (eastern) haul route (refer **Figure 3**);
- Scenario 2: Coaling via the alternate (western) haul route (refer **Figure 3**); and
- Scenario 3: Overburden.

Vibration and Blasting

The approach of this assessment was to determine the limiting factors to the blast design for the Project with the aim of achieving the relevant criteria at all locations. In order to predict the levels of blast emissions (ground vibration and airblast) at the surrounding receivers from the Project, the measured ground vibration and airblast levels from blasting operations conducted in 2014 to 2016 were used to develop blast emissions site laws.

The ground vibration and airblast criteria cater for the inherent variation in emission levels from a given blast design by allowing a 5% exceedance of a general criterion up to a (never to be exceeded) maximum. Correspondingly, the "5% exceedance" (95% confidence) levels have been used in the blast emission site laws. Calculations were conducted using the respective 5% site law equations in order to determine the Maximum Instantaneous Charge (MIC).

8.2.5 Impact Assessment

Operational Noise

The predicted daytime, evening and night-time operational noise levels to the nearest residential receiver areas for year 2018, 2021 and 2025 operations are presented in full in **Appendix E** and summarised below. The predicted noise levels were compared against the Project Approval MP 07_0087 noise limits as well as the PSNLs.

Year 2018

Exceedances (by 1 - 4dBA) of the Project Approval noise limits are predicted at Locations E, F, G, and M. However, at Locations E, F and M, Project Approval noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at Locations E, F and M.

At Location G exceedance (by 1 - 3dBA) of the Project Approval noise limits and PSNLs are predicted during the night-time. Exceedances (by 1 - 4dBA) of the PSNLs are predicted at Locations G5, G6, G7, G8, G9 and N2 during the night-time.

During reduced night-operations, compliance with the relevant PSNLs and Project Approval noise limits are predicted at all receiver locations with the exception of Location G5, which is owned by Bloomfield, and Location M. However when using the alternate haul route (that is, Scenario 2) noise levels comply with the PSNLs and Project Approval noise limits and as such coal haulage is possible at any time under prevailing weather conditions.

Year 2021

One exceedance (by 1dBA) of the Project Approval noise limits is predicted at Location M. However, at this location Project Approval noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at Location M. At Location G5, exceedance (by 1dBA) of the night-time PSNL is predicted for Scenario 3 (overburden operations).

During reduced night-operations, compliance with the relevant PSNLs and Project Approval noise limits are predicted at all receiver locations.

Year 2025

One exceedance (by 1dBA) of the Project Approval noise limits is predicted at Location M. However, at this location Project Approval noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at Location M.

During reduced night-operations, compliance with the relevant PSNLs and Project Approval noise limits are predicted at all receiver locations.

Discussion of Results

Predicted noise levels show that generally Project operations have the potential to exceed the relevant PSNLs and Project Approval noise limits under prevailing noise enhancing weather conditions. During reduced night-time operations, noise levels at all locations (with the exception of Location G5 and Location M during operational Year 2018) are predicted to meet the relevant PSNLs and Project Approval noise limits under prevailing noise enhancing weather conditions.

Current mining activities at Bloomfield Colliery are guided by predicted upcoming weather conditions and mining areas that may pose a noise risk (due to working heights, topographical shielding etc.) under those weather conditions. This allows for the scheduling of mining operations to reduce noise impacts to the surrounding receivers as much as practicable. Given the flexibility in mining operations, fleet composition and haul routes, the Project would be able to meet the relevant PSNLs and Project Approval 07_0087 noise limits at all locations under prevailing weather conditions.

Sleep Disturbance

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significant plant and equipment to be used at the Colliery were used to predict noise emissions at the nearest residential areas. Noise events considered included loading haul trucks, haul truck movements, dozer and front end loader operations as well as haul trucks dumping.

A summary of the highest predicted sleep disturbance noise levels at the most affected locations for each of the assessed mining years is presented in Table 23 of **Appendix E**. The predicted maximum night-time noise levels would meet the relevant sleep disturbance criteria and Project Approval noise limits at all nearest residential receiver areas.

Cumulative Noise Impacts

Existing, approved and proposed mining in the vicinity of the Project includes the existing Abel Underground Mine, Donaldson Open Cut Mine and the Tasman Extension Underground Mine.

Given the separation distance between the Tasman Extension Underground Mine and the Project, cumulative impacts are expected to be negligible and therefore have not been considered. Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Therefore cumulative impacts from the Donaldson Open Cut Mine have not been included.

Abel Underground Mine was placed in care and maintenance on 28 April 2016, however given that future operation of the site is possible, and the current use of the Bloomfield CHPP under the Abel Underground Mine consent, cumulative impacts have been assessed.

To asses cumulative impacts from the Project and Abel Underground Mine, predicted intrusive noise levels were logarithmically added, with the result being adjusted to the equivalent amenity level for comparison against the amenity criterion for each location. The cumulative noise levels from the Project plus the Abel Underground Mine are not predicted to exceed the amenity criteria at relevant receiver locations or on more than 25 percent of, any privately owned land, with the exception of Lot 30/DP1113350 (vacant land owned by JD Hestlow (refer to **Figure 4**)).

Noise from Bloomfield coal haulage operations (i.e. Scenario 1 and Scenario 2) are predicted to exceed the relevant amenity criteria on more than 25 percent of Lot 30/DP1113350, however no exceedance is predicted during overburden operations (Scenario 3). Given the land is within 40 m of the existing haul route, mitigation of noise across Lot 30/DP1113350 would not be considered reasonable and feasible. Furthermore, it is noted that the Project does not seek to modify operations of the existing haul routes in the vicinity of Lot 30/DP1113350, and as such noise levels from Bloomfield Colliery on Lot 30/DP1113350 would not increase due to the Project.

Blasting

Table 14 presents the predicted airblast and ground vibration levels calculated using the respective 5% site law equations for Bloomfield Colliery. The MIC values used would depend on the location of the area being mined and its relation to the nearest affected receiver. Bloomfield utilises independent technical advice with regards to initiation techniques and timing as well as blast hole loading profiles to control the airblast and ground vibration impacts from mine blasting.

Table 14 Allowable Maximum Instantaneous Charge (MIC) and Blast Emissions Predictions

Year	Distance to Nearest Receiver (m)	Allowable MIC based on Ground Vibration or Airblast	Blast Emissions Prediction Based on Allowable MIC	
			Predicted PVS Ground Vibration (mm/s)	Predicted Airblast Level (dB Linear)
2018	1500	280	1.7	115
2021	1200	145	1.4	115
2024	1500	280	1.7	115

8.2.6 Mitigation Measures

Bloomfield would continue to implement noise and blasting management measures in accordance with the Noise Monitoring Plan and the Blasting Monitoring Program currently utilised at the Colliery to minimise the noise and vibration impacts to surrounding receivers. This includes scheduling of mining operations with regard to predicted weather conditions. During reduced night-time operations under prevailing weather conditions, potential noise impacts at Location M would be minimised by undertaking coal haulage via the alternate haul road (that is, Scenario 2).

The Noise Monitoring Plan and Blasting Monitoring Program would continue to be implemented for the duration of the Project and would be updated to reflect the Project as required.

8.3 Air Quality

8.3.1 Introduction

This section provides an assessment of potential air quality impacts associated with the Project. Todoroski Air Sciences prepared an Air Quality Impact Assessment (AQIA) which is provided at **Appendix F** and summarised below. The AQIA was completed with reference to the following documents:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016); and
- *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments* (NSW Government, 2014).

8.3.2 Existing Environment

The general area surrounding the Colliery is comprised of coal mining operations, agricultural activities and woodland. Suburban residential areas are located in relatively close proximity to the north of the Project. The Colliery is surrounded by dense forest (which would have a positive effect in limiting the transport of dust off-site). The sensitive receptors considered in the AQIA are shown on **Figure 20.**

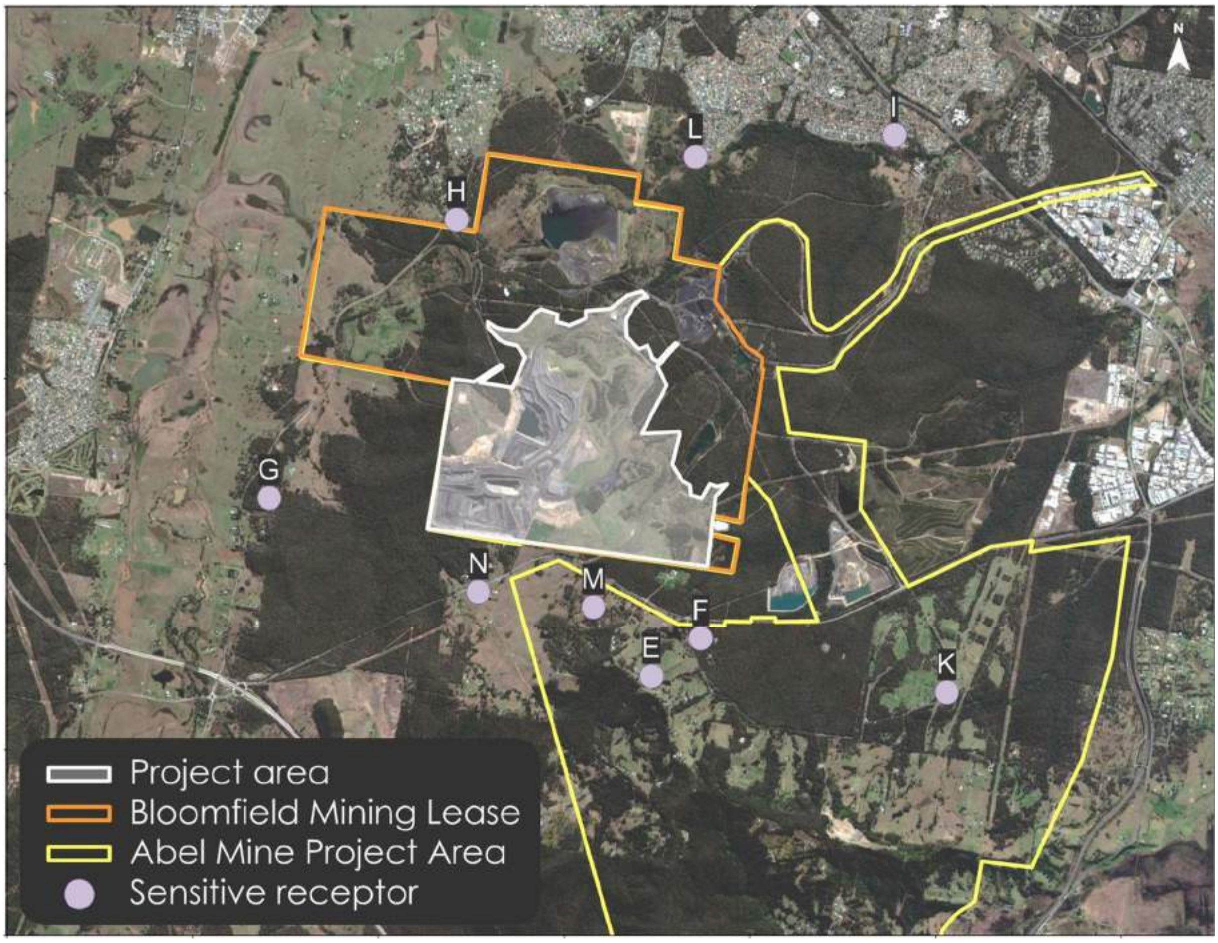


Figure 20 Air Quality Sensitive Receptors

Local Climate

Long term climatic data collected at the Bureau of Meteorology (BoM) weather station at Cessnock Airport were analysed to characterise the local climate in the proximity of the Project. The Cessnock Airport monitoring station is located approximately 21 km west of the Colliery. A summary of the long term data is provided in Section 4.1 of **Appendix F** and indicates the following:

- January is the hottest month with a mean maximum temperature of 30.1°C and July is the coldest month with a mean minimum temperature of 4.1°C;
- The annual average rainfall for the area is 743 mm over 73 days per year, with rainfall peaking during the summer months and declining during winter. February is the wettest month with an average rainfall of 97.8 mm and July is the driest month with an average rainfall of 29.0 mm;
- Relative humidity levels exhibit variability over the day, with higher humidity levels in the morning compared to the afternoon; and
- Wind speeds were found to be higher during the afternoon compared to the morning. Wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the colder months.

Local Meteorology

The Colliery operates a meteorological station to assist with environmental management of site operations. Analysis of annual and seasonal windroses indicates that winds are generally light, with stronger winds occurring during the autumn and winter months. On an annual basis the general wind direction is along the west-northwest to east-southeast axis. Very few, almost non-existent, winds originate from the northeast quadrant throughout the year.

Local Air Quality Monitoring

The main sources of particulate matter in the wider area include active mining, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities.

Ambient air quality monitoring data from a number of monitoring locations were reviewed (Section 4.3 of **Appendix F**). This included data collected during 2012 to 2016 from Bloomfield's High Volume Air Samplers (HVAS), dust deposition gauges and the NSW EPA monitoring station at Beresfield. The review indicated the following:

- Annual average PM_{10} concentrations recorded at both the Bloomfield HVAS and Beresfield monitoring station were below the relevant annual average criterion (25 µg/m³). The maximum 24-hour average PM_{10} concentrations recorded at Bloomfield's HVAS monitor were below the relevant 24-hour average criterion (50 µg/m³), however there were occasional exceedances recorded at the Beresfield monitoring station;
- Annual average Total Suspended Particulate (TSP) concentrations at the Bloomfield HVAS were less than half the criterion (90 µg/m³). The recorded 24-hour average TSP concentrations follow a similar trend to the PM_{10} HVAS monitoring data;
- Dust monitoring gauges recorded an annual average insoluble deposition level below the criterion (4g/m^2/month);
- Annual average $PM_{2.5}$ concentrations at the Beresfield monitoring station were below the relevant criterion (8 µg/m³) for all periods except 2013 which recorded an annual average of 8.2 µg/m³. The 24-hour average $PM_{2.5}$ levels generally complied with the relevant criterion (25µg/m^3), with occasional exceedances recorded. Ambient $PM_{2.5}$ levels are likely to be governed by many non-mining background sources such as wood heaters and motor vehicles; and
- Nitrogen dioxide levels at the Beresfield monitoring station were well below the NSW EPA 1-hour average goal (246 µg/m³).

8.3.3 Methodology

Meteorological Modelling

Dispersion modelling was undertaken using the CALPUFF modelling suite. A key input into the dispersion modelling is the assessment of local meteorological conditions. The meteorological modelling methodology applied a 'hybrid' approach which includes a combination of prognostic model data from The Air Pollution Model (TAPM) with surface observations in the CALMET model.

The 2015 calendar year was selected as the period for modelling the Project. This period was selected based on a review of the long-term meteorological and ambient air quality conditions which a representative of the prevailing conditions. Accordingly, the available meteorological data for January 2015 to December 2015 from five nearby meteorological monitoring sites were used in the simulation, including:

- Bloomfield Colliery Weather Station;
- Williamtown RAAF Bureau of Meteorology (BoM) Station;
- Newcastle Nobbys Signal Station BoM Station;
- Cessnock Airport BoM Station; and
- Paterson (Tocal) BoM Station.

Modelling Scenario

One modelling scenario was used to represent the Project. A single indicative mine plan year (Year 2021) was chosen to represent potential worst-case impacts in regard to the quantity of material extracted in each year, the location of the operations and the potential to generate dust at the receptor locations. The scenario chosen for assessment (Year 2021) nominally represents the highest level of proposed activity for the modification in future years with a target of 1.3 million tonnes of ROM coal extracted.

For the modelled scenario, dust emission estimates were calculated by analysing the various types of dust generating activities taking place and utilising suitable emission factors. The emission factors were sourced from both local documentation and from the United States EPA (US EPA) developed documentation. Detailed emission inventories and emission estimate calculations are presented in Appendix C of **Appendix F**.

The estimated emissions are commensurate with a mining operation utilising reasonable and feasible best practice dust mitigation applied where applicable. Further detail regarding the dust control measures applied for the Colliery is provided below.

In addition to the estimated dust emissions from the Project, emissions from nearby approved mining operations (i.e. Abel Underground Mine) were also modelled, in accordance with the current consent (or current proposed project), to assess potential cumulative dust effects. Emissions estimates from Abel Underground Mine were derived from information provided in the air quality assessments for the Abel Underground Mine available in the public domain at the time of modelling.

The assessment of diesel emissions from the Project is focused on the potential emissions of oxides of nitrogen (NO_x), generally assessed as NO_2, arising from diesel powered equipment. Emissions from diesel powered equipment were estimated on the basis of manufacturer's data.

Dust Mitigation and Management

A range of air quality mitigation measures are applied at the Colliery to achieve a standard of mine operation consistent with current best practice for the control of dust emissions from coal mines in NSW. The measures applied to the Project reflect those outlined in the NSW EPA document, *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone, 2011).

Where applicable, these controls were applied in the dust emission estimates. A summary of key dust controls applied to current operations at the Project is shown in **Table 15.**

Table 15 Summary of Key Dust Mitigation Measures

Activity	Dust mitigation measure
Drilling	· Dust suppression system. · Prevent disturbance of drill cuttings. · Application of water on dusty areas prior to drilling. · Ceasing operations when visible dust generated.
Blasting	· Water blast areas to suppress dispersion of drill cuttings. · Review meteorological and blast forecast prior to blasting.
Hauling on unsealed roads	· Water haul road surfaces. · Prevent material being deposited / spilled on haul roads. · Restrict general vehicle speed. · Trafficable areas clearly marked, vehicle movements restricted to these areas. · Trafficable areas and vehicle manoeuvring areas maintained. · Fleet optimisation to reduce vehicle kilometres travelled.
Material extraction/unloading	· Application of water on dusty areas prior to extraction. · Sheltered dumping during periods of adverse weather. · Minimise the fall distance of materials during loading and unloading. · Cease operation during high dust periods.
Unloading ROM coal to hopper	· Three-sided enclosure at ROM pad · Slower tipping during adverse weather conditions. · Drop heights reduced as far as practicable. · Visual triggers for dust mitigation.
Conveyors and transfers	· Enclosed conveyors. · Belt cleaning. · Enclosed chutes.
Dozer operation	· Avoid use during unfavourable conditions. · Minimise travel speed in dusty conditions. · Travel on watered routes between work areas.
Graders	· Travel on watered routes. · Water haul roads immediately after grading, where possible.
Exposed areas	· Minimise area of disturbance, rehabilitate areas as soon as feasible. · Apply interim stabilisation on areas inactive for long periods.
Coal processing	· Enclosed facility with internal water sprays.
Rehabilitation	· Rehabilitation expedited to achieve maximum coverage rate. · Vegetation actively managed.
ROM coal and product stockpiles	· Automated water sprays during high winds. · Minimise drop heights when stacking. · Manual implementation of water sprays and/or water cart during dusty periods. · Visual surveillance of dust plumes during activity. · Stockpiling and recovery of ROM coal is minimised where practical.
Rail operations	· Streamlined and consistent profiled coal surface within rail wagons. · Minimise spillage and parasitic loading. · Clean and collect any spillage on regular basis.

Background Dust Levels

All significant dust generating mining operations in the vicinity of Bloomfield Colliery were included in the dispersion model to assess the total potential dust impact. The total predicted effects from the Project (including existing effects) were added with the measured background levels (which also include any existing effects from the colliery). This approach is conservative (would lead to overestimation of impacts) as the existing colliery emissions are double counted in the assessment.

Ambient air quality monitoring data collected from the Colliery air quality monitoring network during 2015 were applied to represent the prevailing background dust levels. For $PM_{2.5}$, the ratio of the measured PM_{10} levels at the Colliery and Beresfield monitors to the Beresfield $PM_{2.5}$ level was applied to estimate the potential $PM_{2.5}$ level in the vicinity of the Colliery.

8.3.4 Impact Assessment

Predicted Dust Concentrations

The particulate dispersion modelling results for the Project operating in isolation (incremental impact) at each of the assessed sensitive receptor locations are shown in **Table 16**. The predicted cumulative $PM_{2.5}$, PM_{10}, TSP and dust deposition levels due to the Project with the estimated background levels are presented **Table 17.**

The results indicate the predicted levels would be below the relevant criteria at the assessed sensitive receiver locations.

Table 16 Dispersion Modelling Results for Sensitive Receptors – Incremental Impact

Receptor ID[1]	PM2.5 (µg/m³)		PM10 (µg/m³)		TSP (µg/m³)	Dust Deposition (g/m2/month)
Averaging Period	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average
Criterion	-	-	-	-	-	2
E	3	<1	17	2	3	<0.1
F	4	1	21	3	5	0.1
G	7	1	38	4	7	0.1
H	7	1	35	7	10	0.1
I	2	<1	9	1	2	<0.1
K	3	<1	16	1	2	<0.1
L	3	1	13	3	5	0.1
M	6	1	29	3	5	0.1
N	4	<1	18	2	4	<0.1

1 – Refer to Figure 20 for location of receptors

Table 17 Dispersion Modelling Results for Sensitive Receptors – Cumulative Impact

Receptor ID[1]	PM2.5 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)	Dust Deposition (g/m2/month)
Averaging Period	Annual average	Annual average	Annual average	Annual average
Criterion	8	25	90	4
E	6	16	32	1.5
F	6	17	34	1.6
G	6	18	36	1.6
H	7	21	39	1.6
I	6	15	31	1.5
K	6	15	31	1.5
L	6	17	34	1.6
M	6	17	34	1.6
N	6	16	33	1.5

*1 – Refer to **Figure 20** for location of receptors*

Dust Impacts on more than 25 per cent of privately-owned land

Potential impacts due to the Project, extending over more than 25 per cent of privately-owned land, were evaluated using predicted pollutant dispersion contours.

The predicted maximum 24-hour average PM_{10} level was found to have the greatest extent of the other assessed dust metrics and hence represents the most impacting parameter. The dispersion contours (**Figure 21**) indicate that there is only one privately-owned land parcel (Lot 30 / DP1113350) which would be impacted more than 25 per cent.

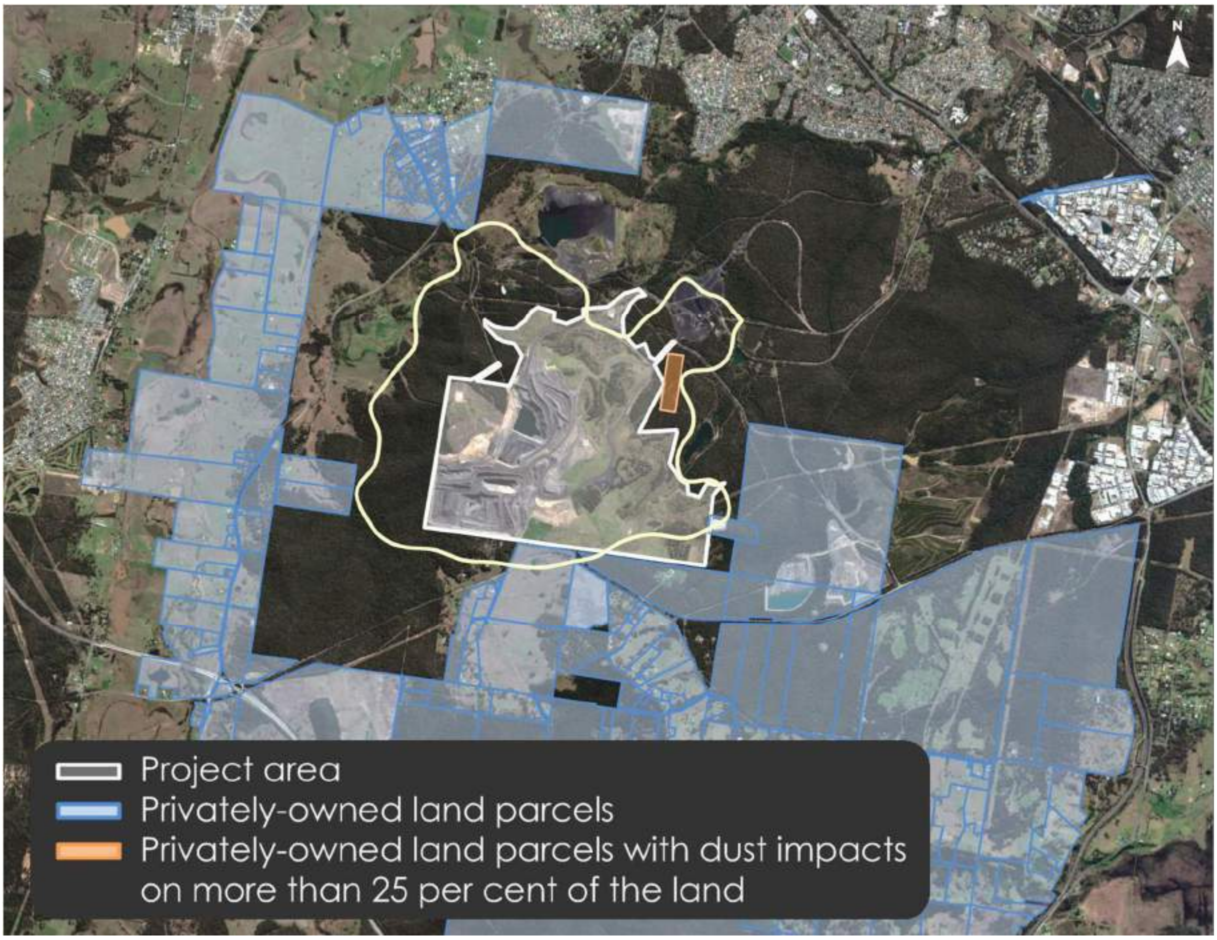


Figure 21 Predicted Maximum 24-hour Average PM_{10} Level (Source: Todoroski Air Sciences, 2017)

Total (Cumulative) 24-hour Average $PM_{2.5}$ and PM_{10}

As discussed in **Section 8.3.2**, maximum background levels have in the past reached levels near to the 24-hour average $PM_{2.5}$ and PM_{10} criteria. Due to these elevated levels in the monitoring data, the screening Level 1 NSW EPA approach of adding maximum background levels to maximum predicted Project only levels would not be appropriate for assessing the potential 24-hour average impacts on these elevated days.

In such situations, the NSW EPA approach applies a more thorough Level 2 assessment whereby the measured background level on a given day is added contemporaneously with the corresponding Project only level predicted using the same day's weather data. The results of the Level 2 contemporaneous assessment at each sensitive receptor location are shown in **Table 18.**

Table 18 NSW EPA Contemporaneous Assessment - Max No. of Additional Days Above the 24-hour Average Criterion

Receptor ID	$PM_{2.5}$ analysis	PM_{10} analysis
E	0	1
F	0	1
G	0	0
H	0	0
I	0	0
K	0	0
L	0	0
M	0	3
N	0	2

The results indicate that there is potential for cumulative 24-hour average PM_{10} impacts to occur at the assessed locations, without the use of reactive or predictive management systems to control short term dust levels. Further analysis (refer Section 6.3 of **Appendix F**) indicates that the predicted exceedances at these locations only marginally exceed the criteria. Given the conservatism in the assessment (double counting the existing Colliery emissions etc.) these effects may not actually occur, however the small reductions needed could easily be achieved through predictive and reactive dust control strategies, which would be operated at the site to mitigate such potential impacts.

Current predictive and reactive dust control measures applied at the Colliery include the use of predictive meteorological modelling software which incorporates regional weather station data and forecasts to predict daily weather events which may exacerbate dust impacts from planned operations. This forward planning is coupled with the use of real-time on-site weather station data to assist with planning decisions.

The Colliery also operates a network of portable real-time dust monitors. These monitors are nominally positioned upwind and downwind of mining activity with the measured levels providing an estimate of the potential amount of dust generated from the operations which can signal if excessive dust is being generated and further dust control is required.

Visual inspections of dust plumes are also used to identify those activities which require further controls to be applied at times such as watering, or activities which may need to be modified to reduce the amount of dust being generated, such as temporarily ceasing a particular activity.

To evaluate the effectiveness of the implementation of such predictive and reactive measures at the Project, the dispersion modelling was re-run to consider the effects of applying additional control measures and temporarily pausing activities in the pit and overburden areas during periods of elevated dust. Only the activities that can be controlled in the pit and overburden areas were ceased in the model, and dust from other sources such as wind erosion was still assumed for the purpose of the revised modelling. With the implementation of these reactive measures, modelling results predicted there would be no additional days above the 24-hour average criterion (Table 6-4 of **Appendix F**).

Predicted NO_2 Concentrations

Table 19 presents the predicted NO_2 dispersion modelling results, with isopleth diagrams presented in **Appendix F**. The results indicate that the predicted 1-hour and annual average NO_2 concentrations would be below the relevant criteria at each of the assessed sensitive receptor locations.

Table 19 Dispersion Modelling Results for Sensitive Receptors - NOs Concentrations (µg/m³)

Receptor ID	Incremental Impact		Cumulative Impact	
Averaging period	24-hour average	Annual average	24-hour average	Annual average
Criterion	-	-	246	62
E	60	0.8	105	40
F	65	1.0	110	40
G	60	2.0	105	41
H	70	2.2	115	41
I	26	0.4	71	40
K	27	0.5	72	40
L	35	0.6	80	40
M	102	1.4	147	40
N	118	1.2	164	40

Greenhouse gas emissions

Greenhouse gas (GHG) emissions are characterised into three different scopes, including Scope 1 (direct emissions), Scope 2 (indirect emissions from purchasing electricity) and Scope 3 (indirect emissions occurring as a result of the company's business activity but from sources not controlled by the company).

Bloomfield is required to report its GHG emissions in accordance with the requirements of the *National Greenhouse and Energy Reporting Act 2007*. Big Ben Holdings Pty Ltd is the controlling corporation which reports GHG emissions for the Colliery, Rix's Creek South and Rix's Creek North. For the Colliery, the 2016 reporting data provides a conservative estimate of GHG emissions during the life of the Project as the total ROM coal produced at the Colliery during this period was close to the proposed maximum (1.245 Mtpa compared to a proposed maximum of 1.3 Mtpa). Data for the 2016 reporting period were therefore used to calculate the GHG emissions over the life of the Project (**Table 20**).

Table 20 Summary of CO_2-e emissions per scope

Period	CO_2-e emissions (t CO_2-e)	
	Scope 1 Emissions	Scope 2 Emissions
Annual	23,079	5,549
Total (life of Project)	207,710	49,944

The estimated annual GHG emission for Australia for the year to December 2016 was 543.3 Mt CO_2-e (DoEE, 2017a). In comparison, the conservative estimated annual average GHG emission for the Project is 0.029 Mt CO_2-e (Scope 1 and Scope 2) which represents approximately 0.005% of the Australian annual GHG emissions.

At a State level, the GHG emissions for NSW in 2015 (the latest available data) were estimated to be 133.4 Mt CO_2-e (DoEE, 2017b). In comparison, the conservative estimated annual average GHG emission for the Project represents approximately 0.021% of the NSW annual GHG emission.

The contribution of GHG emissions from the Project relative to the national and state emissions are low and the predicted change would not be discernible. Bloomfield has prepared an Energy Savings Action Plan (ESAP) in accordance with the conditions of the Project Approval and the requirements of the *Guidelines for Energy Savings Actions Plans* (Department of Energy, Utilities and Sustainability, 2005). The ESAP aims to identify opportunities to reduce GHG emissions from the Project Area and ensure annual reporting of GHG emissions and tracking of energy savings opportunities are undertaken. Bloomfield would continue to monitor and report its GHG emissions in accordance with the ESAP and legislative requirements.

Summary

As the Project is not seeking changes to the intensity or general extent of mining, or changes in the mining equipment fleet or mining method, the Project is not expected to result in significant changes to the existing level of impact.

Dispersion modelling indicates that dust levels would be below the relevant criterion at the privately-owned receptor locations. The results also indicate that without reactive or predictive mitigation measures, there is some potential for cumulative 24-hour average PM_{10} levels to marginally exceed the EPA impact assessment criteria. However, with the use of the now routine day-to-day reactive and predictive systems at the operations, no unacceptable levels of impact would be expected to arise.

It is noted that the approach taken in the AQIA is conservative, and would significantly overestimate the likely impacts. For example, conservative emission estimation is applied using maximum mining rates, the dispersion modelling does not include the effect of rainfall or in-pit dust retention, and the background levels used mean that existing dust emissions from the Colliery are double counted in the cumulative assessment.

Overall, the potential air quality impacts associated with the Project are not expected to be significantly different from the existing approved operations.

8.3.5 Mitigation Measures

Bloomfield would continue to implement air quality management measures currently used at the Colliery, including the predictive management system, to mitigate air quality emissions from its operations as discussed in **Section 8.3.3**. This includes a reactive dust mitigation strategy and forecast management system. Bloomfield would continue to monitor and report its GHG emissions in accordance with the ESAP and legislative requirements.

The Air Quality Monitoring Program and Blast Monitoring Program would continue to be implemented for the duration of the Project. Existing management plans and procedures would be updated to reflect the Project as required.

8.4 Soils and Water

8.4.1 Introduction

This section provides an assessment of the potential impacts of the Project on soils and water. This assessment is supported by a Surface Water Assessment prepared by AECOM, which is provided at **Appendix G** and summarised below. The Surface Water Assessment was prepared in accordance with the following guidelines:

- *National Water Quality Management Strategy Australian Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000);
- *ANZECC Guidelines and Water Quality Objectives in NSW* (DEC, 2006);
- *Managing Urban Stormwater: Soils & Construction – Volume 2E: Mines and Quarries* (DECC, 2008); and
- *Managing Urban Stormwater Soils and Construction – Volume 1* (Landcom, 2004).

8.4.2 Existing Environment

Geology and Soils

The *Newcastle Coalfield Regional Geology Map (1:100 000)* (Hawley et al, 1995) indicates that the Project Area is underlain by Paleozoic, Late Permian sandstone which makes up the Tomago Coal Measures. Sediments above, below and between the coal seams comprise predominantly interbedded mudstone, siltstone and sandstone.

Review of the *Soil Landscapes of the Newcastle 1:100 000 Sheet* (Matthei, 1995) indicates that the derived soils are comprised of the Shamrock Hill erosional landscape, the Beresfield residual landscape and areas of disturbed terrain.

A search of the EPA Contaminated Land Record indicates that land within the Project Area is not identified as contaminated land. Review of the Australian Soil Resource Information System and the Cessnock LEP 2011 indicates that there is an extremely low probability of occurrence of acid sulfate soils within the Project Area.

Mine Water Management System

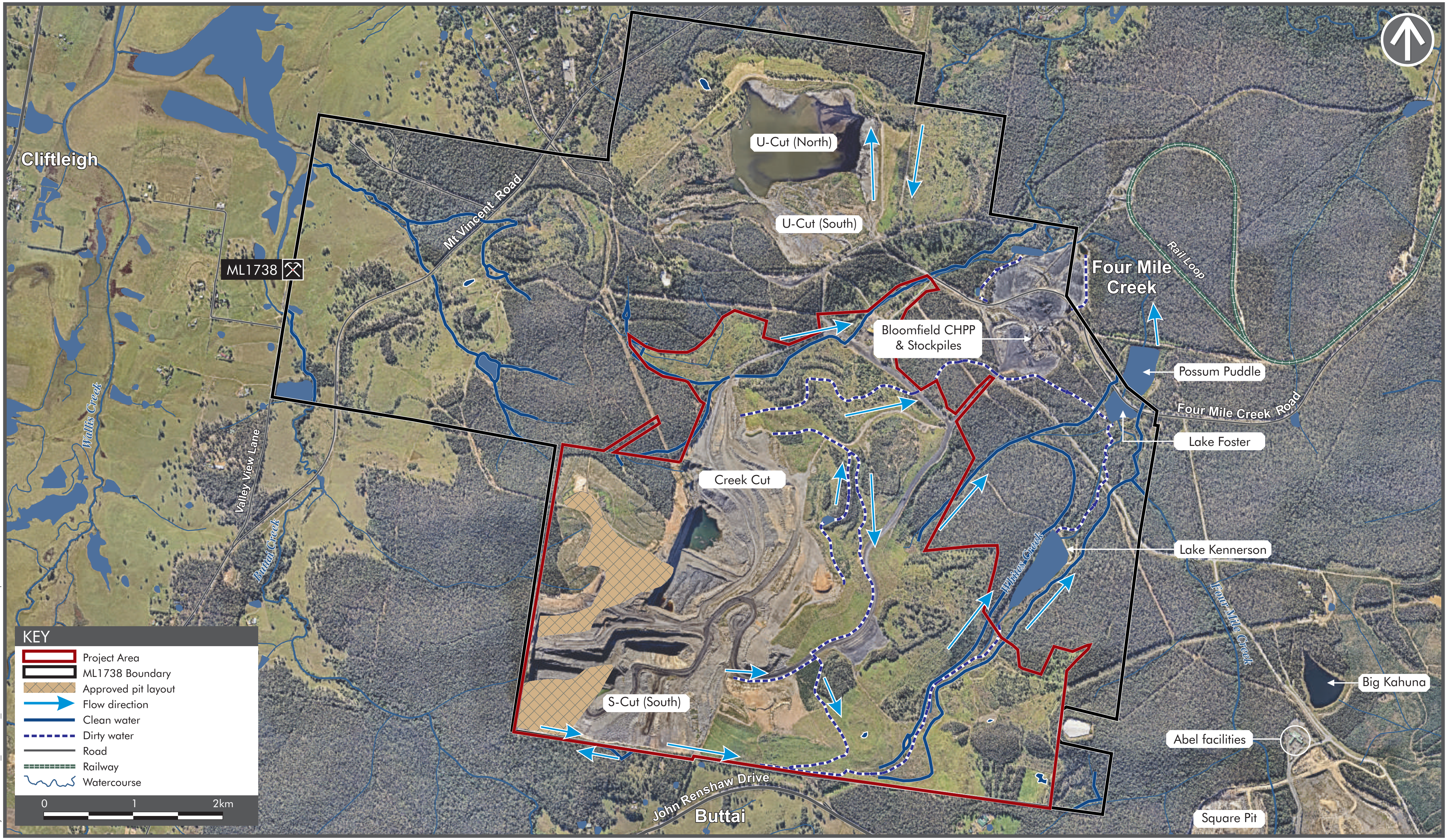
The existing water management system at the Colliery has been developed in collaboration with neighbouring mine sites (particularly the Abel Underground Mine). The integrated system involves the management of all surface runoff and groundwater sources associated with the Abel, Bloomfield and Donaldson mines, ensuring continuous supply to the Bloomfield CHPP whilst minimising discharge to Four Mile Creek from the operational areas.

The existing water management system incorporates:

- Removal of water from active pits;
- Storage of water in lakes and voids;
- Controlled discharge into Four Mile Creek in accordance with EPL requirements;
- Control of stormwater pollution from ‘dirty catchments’ such as the:
  - Overburden dumps;
  - Waste disposal areas utilised by the CHPP;
  - Stockpile areas; and
  - Workshop area.

Figure 22 shows the clean and dirty water flow paths around the Project Area, as well as the location of current water storage dams, active operational areas and tailings emplacement area.

\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F22 Surface Water Flow Paths 2017 TO



SURFACE WATER FLOW PATHS
Bloomfield Project

FIGURE 22

Clean water

The major natural creek running through the site is Four Mile Creek. Most of the operational mining areas at Bloomfield are located within the catchment of Four Mile Creek. A series of drains and levees direct Four Mile Creek around Lake Foster (mine water storage) and into Possums Puddle (clean water storage). From Possums Puddle, clean water overflows, or is discharged, back into Four Mile Creek.

Runoff from undisturbed and rehabilitated areas is directed away from operational areas and mine water storages via diversion banks and channels. These banks and channels direct runoff into clean water dams or natural watercourses.

The major clean water storage dam is Possums Puddle. Clean water is not accessed for operational purposes and these dams overflow into natural drainage systems.

Dirty water

Dirty water is managed through a series of storages and interconnecting pipelines, including:

- Lake Kennerson (200 ML capacity) – receives all the dirty water from the open cut pits (S-Cut and Creek Cut), except the drain at the northern end of the cut which goes directly to Lake Foster. From Lake Kennerson it is either discharged off-site via a clean water diversion drain in accordance with EPL 396, or sent to Lake Foster if required for use in the Bloomfield CHPP or for dust suppression. A pipeline connects the “Big Kahuna”, the main water storage for Abel, to Lake Kennerson;
- Lake Foster (45 ML capacity) receives all other dirty water from site, the tailings return water, CHPP stockpile runoff dams, and the one dirty water drain from the open cut (seen at the northern end of the cut). Lake Foster feeds the Bloomfield CHPP and water cart for dust suppression; and
- Stockpile Dam (22 ML capacity) collects runoff from the stockpile near the CHPP and is transferred to Lake Foster for use in the CHPP.

Mine water

Mine water is defined as pit water, mining water, water that collects in the Bloomfield S-cut (south) and Bloomfield Creek-cut (north) and which has been removed by water management methods to continue the operations of the mine. This water may have elevated total dissolved solids (TDS), above the values that represent fresh water as defined by ANZECC and ARMCANZ (2000).

Bloomfield has two major mine water storage facilities, the Lake Kennerson and Lake Foster. Water pumped from the open cuts (S-Cut and Creek Cut) travels via open drains to Lake Kennerson. Runoff from disturbed areas (i.e. high wall, haul roads, overburden dumps awaiting rehabilitation) which has the potential to carry suspended solids, is also directed to Lake Kennerson. Lake Kennerson dissipates velocity and allows the settlement of suspended solids.

Lake Kennerson has a valve-controlled pipe which, when opened, feeds to Lake Foster. Lake Foster also receives decant water from the tailings storage facility (U-Cut) and water from the stockpile dam, which collects the runoff from the CHPP and coal stockpile pads. Mine water is pumped, primarily from Lake Foster, to the CHPP for use in coal processing and for dust suppression purposes by spraying on the coal stockpile pads.

Mine water is discharged, via lockable valve pipes, into an open drain that flows to Four Mile Creek. Discharges are undertaken in accordance with the conditions of EPL 396. Water sampling is undertaken during discharge, and a monitoring station continuously monitors electrical conductivity (EC) and water level.

Currently, fine coal rejects (tailings) are transferred for disposal to a disused open cut pit (contiguous to the old underground workings) which forms a tailings emplacement area to the north of the active mining area. Water from the historic underground workings is used in dust suppression and coal processing.

Wastewater

Wastewater generated on site, consisting of domestic waste from bathhouses, administration offices and associated amenity areas, passes through a Cessnock City Council approved anaerobic wastewater treatment system.

Access Road, Bloomfield CHPP and stockpile area

The main access road between Creek Cut, S-Cut North and the ROM coal stockpile is drained, via a table drain, to a low (vegetated) detention basin on the southern side of road. This detention basin acts as a sediment control pond. Once the basin is sufficiently full, water overflows through a culvert under the access road and discharges into the drainage line that flows along the western side of the workshop area and eventually becomes Elwells Creek, a tributary of Four Mile Creek.

The current water supply to the Bloomfield CHPP is primarily pumped from Lake Foster. Mine water from the open cut pit areas is transferred to the mine water storage facilities (Lake Kennerson and Lake Foster) and then back to the CHPP. Surface water runoff from the Bloomfield CHPP and stockpile areas are directed to the Stockpile Dam where is it transferred to Lake Foster for reuse in the CHPP.

Erosion and sediment management

Erosion and sedimentation control is an integral part of the site's water management system. The design of rehabilitated areas incorporates water management structures to effectively shed run-off water, whilst minimising erosion and sediment load. Progressive rehabilitation of disturbed areas also reduces the potential for erosion and downstream sedimentation. There are a number of sediment basins around the site that are positioned to intercept runoff from other disturbed areas on-site, such as from haul roads, stockpile pads, infrastructure areas, and recently rehabilitated areas.

Silt traps along the edges of haul roads and hardstand areas are cleaned at regular intervals. They have been designed to capture surface runoff during rain events and allow sediment to settle. All silt traps, dams, drains, bunds, lines, valves and other infrastructure used to manage runoff are inspected on a quarterly basis as part of the site EMS.

Tailings Management

Disposal of coarse rejects and fine tailings are approved as part of the Abel Project Approval, and are described here for background purposes. The size of the void storage required on the Project Area (discussed at **Section 4.3.2**) is subject to tailings production from Abel, which is currently in care and maintenance. The latest estimate of the tailings storage required for disposal indicates that for every one million tonnes of ROM coal per annum, approximately 0.17 million tonnes comprises tailings reject material.

Groundwater – surface water interaction

Groundwater in the alluvium associated with Wallis Creek and the Hunter River floodplain is believed to be in direct hydraulic connection with the surface water in these wetlands areas. These localised occurrences of surficial groundwater do not represent a significant or regionally extensive aquifer system, and should really be considered to be part of the surface water flow system. There is believed to be minimal interaction between the surface drainage system (including the alluvial and other surficial groundwater), and the deeper groundwater within the coal measures. Potential groundwater impacts associated with the Project are assessed separately in **Section 8.5**.

Water Balance

A site water balance was developed by Evans and Peck (2012) for the Abel EA and assessed the operation of both Bloomfield and Abel over the life of the Abel project (up to and including 2030). The water balance model considered both mines as the water management is integrated across both sites. There are formal agreements in place between Abel and Bloomfield including protocols relating to the transfer of water from Abel to Bloomfield.

Bloomfield Colliery

The site water balance model indicates that the Project is capable of meeting all water needs for dust suppression from the groundwater inflows and surface runoff into the mine pits, and typically generates a net surplus of water that can contribute to the water supply required for operation of the Bloomfield CHPP.

Abel Underground Mine

The Abel Upgrade Modification Surface Water Assessment (Evans and Peck 2012) staged the impact assessment of surface water management for the Abel project into two stages:

Stage 1: 2013 – 2018:

- Use of the Donaldson Square Pit to store the higher salinity water expected from the Abel Underground Mine as well as tailings from the Bloomfield CHPP when required;
- Use of spare capacity in the Donaldson Square Pit for storage of tailings; and
- Treatment of mine water (i.e. using a reverse osmosis [RO] plant) to a standard suitable for discharge to Four Mile Creek.

Stage 2: 2019 – 2030:

- Transfer of water from Abel Underground Mine to Lake Foster for use in the Bloomfield CHPP;
- Placement of tailings in one of the major Bloomfield Colliery voids (S-Cut [South] and S-Cut [North]) as they become available; and
- Placement of any excess mine water in one of the major Bloomfield Colliery voids as required.

The Abel project includes the construction of a reverse osmosis treatment plant in the future. The intention of the reverse osmosis treatment plant would be to treat surplus mine water and enable discharge to Four Mile Creek, via the Big Kahuna. In order to ensure opportunities for licensed discharge can be compliant with water quality limits, the salinity in the Big Kahuna needs to be maintained below 2,000 µS/cm.

The Abel Underground Mine Water Management Plan (Donaldson Coal, 2014), noted the following key aspects of mine water management since the 2012 Project Approval:

- The use of the Donaldson Square Pit is no longer considered viable (see Stage 1 above);
- Since August 2013, some areas of old underground workings have been allowed to progressively fill with groundwater – only inflow from localised areas has been transferred to the Big Kahuna;
- Water for underground operational purposes is drawn from the Hunter Water potable supply;
- Water from the Big Kahuna is used for on-site operational purposes, principally dust suppression;
- Water is periodically transferred from the Big Kahuna (Abel) to Lake Kennerson (Bloomfield) via a pipeline, which has a capacity of 8 ML/day; and
- When conditions permit under Abel's EPL, water is discharged to Four Mile Creek from the Big Kahuna Dam.

To date, the Abel Underground Mine water make has been significantly less than the annual rates previously predicted due to lower rates of production and the practice of allowing water to accumulate in parts of the worked-out areas of the mine. Due to the changes in Abel's operations since the original Project Approval, "Stage 1" of the surface water assessment is likely to extend well beyond 2018, and the need for the construction of a reverse osmosis treatment plant has not yet been triggered.

Water balance inputs

The catchment areas and storage volumes used in the water balance are presented in **Table 21**.

Table 21 Water Balance Catchment Areas and Storage Volumes

Catchments	Area (ha)	Storage volume (ML)
West Pit	28.7	-
Abel Mine Facilities	2.1	-
Storage / Voids		
Big Kahuna	4.9	400
Donaldson Square Pit	21	2,900
S-Cut (South) and catchment	55	10,000
Creek-Cut (S-Cut North) and catchment	68	10,000

Water requirements for mine operations comprise water use for dust suppression on haul roads, work areas and stockpiles, with the largest water requirement for the Bloomfield CHPP. The adopted water transfers and storage operating rules were modelled by Evans and Peck (2012) and stated as follows:

- Discharge from Big Kahuna to Four Mile Creek is modelled to occur at a rate of 8 ML/day for 5 days following any day over 10 mm of rainfall;
- Transfer from Big Kahuna to Lake Kennerson occurs at a rate of 8 ML/day, after 3-4 days following discharge to Four Mile Creek;
- The RO plant is assumed to have an inflow of 4 ML/day with the waste brine (assumed to be 25% of the inflow) returned to the Donaldson Square Pit. The output of the RO plant is assumed to have a salinity of 150 mg/L (250 µS/cm); and
- 'Top-up' supply to account for the assumed 10% loss from water supplied for the underground operations is assumed to be taken from the Donaldson Square Pit.

Water Balance results

The water balance by Evans and Peck (2012) noted that the overall water balance is dominated by the groundwater inflow to Abel underground. The effect of climate on water use for dust suppression and the number of opportunities for discharge to Four Mile Creek are secondary factors in the overall site water balance.

The water balance assumed that Bloomfield S-Cut (South) would be available for storage of tailings and water from the end of 2018. However, Abel has been in care and maintenance since June 2016. Lower extraction rates and ability to store water in Abel's unused underground workings has resulted in less mine water make than previously projected.

Surface Water Quality

Routine monthly ambient water quality monitoring is undertaken at thirteen locations within and around the Project Area, including along Four Mile Creek and its tributaries (upstream to downstream). Water quality monitoring data has been collected since 1996. A summary of background water quality data is provided in Table 5 and Table 6 of **Appendix G.**

Controlled discharges to Four Mile Creek occur from EPL Point 1 (the Lake Foster discharge pipe outlet). During a planned discharge event, water samples are collected and analysed in accordance with the requirements of EPL 396. Summaries of annual discharges from Lake Kennerson and associated water quality data are provided in Table 7 and Table 8 of **Appendix G.**

To date there have been four unplanned discharges as a result of large rainfall events or pipe failure which resulted in water overflowing from storage dams and leaving the site. These incidents were reported to the EPA in accordance with Project Approval and EPL requirements. Of the planned discharges, there have been a small number of isolated incidents where water quality was outside of EPL compliance limits.

The water management system is designed so that uncontrolled discharges should not occur. However in the event that an uncontrolled discharge occurs, procedures include sampling and analysis for the same suite of pollutants as for a controlled discharge event.

8.4.3 Impact Assessment

Mine Water Management

Recent differences in Abel's mine water make, water budget and projections of tailings production (compared to the 2012 projections) are not an impediment to the ongoing operations of Bloomfield through to 2030. Abel's Project Approval includes an allowance for disposal of surplus water to Bloomfield voids in future years, and that if Bloomfield is still operational, appropriate means are available to dispose of surplus water (if that were to occur) via an RO plant if necessary and modifications to the Donaldson Square Pit, which could then be discharged to Four Mile Creek under appropriate conditions.

With Abel in care and maintenance mode, and the volume of ROM coal processed by the CHPP well below maximum approved rates, there is no need to create additional storage for tailings in the interim, not required. Currently the U-cut north and south pit is being used for disposal of tailings and is projected to have sufficient capacity up until 2019. Bloomfield has an approved (Dam Safety Committee) augmentation plan to increase the capacity of this tailings emplacement area if required.

The proposed extension of mining is not predicted to have significant impacts on water supply or demand, or offsite water quality impacts. Management on site is consistent with current guidelines, in that:

- Natural catchments are managed to divert clean water;
- Mine water and runoff from disturbed areas is captured and stored on site; and
- Mine water is reused on site for CHPP operations and dust suppression to minimise the use of higher quality water.

The design and operation of the existing water management system allows a high degree of flexibility in and significant capacity to account for variations in climatic conditions and production rates. No further impacts to surface water management, beyond that approved under the current Project Approval are predicted.

Catchments

The Project includes a modification of the previously approved final landform by moving the final void approximately 200m to the west. The amended final landform would result in the following changes to the existing approved design:

- The final eastern slopes of the overburden dump would drain east towards Four Mile Creek. The catchment area draining towards Four Mile Creek would increase by approximately 40 Ha and the catchment area draining to Buttai Creek and its tributaries would has increase by approximately 188 Ha, as compared to the currently approved final landform design; and
- The proposed catchment area draining towards the final void would be approximately 52 Ha, a decrease from the 240 Ha under the currently approved final landscape design.

A reduced catchment draining to the final void would have a positive effect on Four Mile Creek and Buttai Creek and its tributaries, as it results in less water being removed from the natural catchment hydrology in the post-mining phase, and less water draining to the final mining void.

Surface Water Quality

The potential impacts of Bloomfield's current and future operations relate to the risks of contamination from disturbed catchments, mine water, and process water being released off site to natural waterbodies.

Controlled discharges from the Colliery to Four Mile Creek occur from the Lake Foster discharge pipe outlet and are monitored and reported in accordance with EPL 396. The Project would not increase or decrease the probability of unplanned discharges, or water quality risks, from Bloomfield's operations. However the risks of unplanned discharges would continue to exist up until the end of extraction

(2030) and until such time as the site is rehabilitated noting that risks would decrease with the progressive rehabilitation of post mining areas across the life of the Project.

Soils – Erosion and Sediment Control

The Project would involve removal of up to 3.5 ha of previously rehabilitated landform for the proposed widening of the haul road and upgrade of the adjacent watercourse. However the potential impact to soils associated with these works would be minor and temporary provided the management measures set out in the Erosion and Sediment Control Plan are implemented during these works.

The extension of mining to 2030 is considered to have negligible potential impact to soils. The mining operations would continue to extract within previously nominated pit limits, as the new mining fleet is capable of extracting coal that was previously considered unrecoverable.

The amended final landform would result in an increased proportion of the rehabilitated catchment areas draining to Four Mile Creek and Buttai Creek and its tributaries as opposed to the final void. These potential impacts would be mitigated through current site practices, for example the design and operation of drainage lines, sediment basins and erosion and sedimentation controls (refer to **Section 8.4.4**).

Cumulative Impact

The Abel and the Colliery's existing operations have a cumulative impact on the local soil and water environment. The sites are operating within their approved limits, and would continue to do so up until the approved limit of mining in 2030.

There are minor additional impacts related to soil, water quality and surface water as a result of the Project. These can be addressed by the mitigation measures provided in **Section 8.4.4**. Therefore, no additional impacts are predicted when considering other projects within the region.

8.4.4 Mitigation Measures

Mine Water Management

The existing Water Management Plan would be reviewed and revised to incorporate the Project and ensure that the management of soil and water continues to:

- Stay current and consistent with relevant guidelines and best practice;
- Account for projected changes in operation; and
- Update water balance modelling and projections on the basis of observed results (i.e. variations in mine water make, groundwater monitoring).

At such time that Abel returns to production, reconsideration of the water balance would be undertaken as part of the ongoing management plan review process. This would enable and support appropriate planning to ensure mine water and tailings would continue to be contained on site.

Catchments

Rehabilitated catchments would continue to be managed as per the existing Water Management Plan and Rehabilitation Management Plan, in accordance with the following principles:

- Rehabilitated landform would be progressively rehabilitated;
- Runoff from areas undergoing rehabilitation would be managed with appropriately designed water and sediment management structures (contour banks, drains, and drop structures); and
- Ongoing monitoring of the landform would be carried out to repair and restore areas of erosion or instability.

Discharge of water from the final landform would not occur to Four Mile Creek or Buttai Creek and its tributaries until the catchment is considered 'rehabilitated' in accordance with the Rehabilitation Monitoring Plan and associated regulator sign-off and approvals.

Surface Water Quality

Potential impacts to receiving waters would be mitigated through implementation of the mine water management system, which includes:

- Runoff from undisturbed and rehabilitated areas would be directed away from operational areas and mine water storages via diversion banks and channels; and
- Mine and sediment water would be collected for treatment before discharge via Lake Kennerson, Lake Foster and sediment basins to intercept runoff from disturbed areas.

Surface water monitoring would continue to be undertaken in accordance with Bloomfield's EPL 396. The existing monitoring program would be periodically reviewed to ensure the program continues to be adequate and consistent with current guidelines and policy requirements.

Erosion and Sediment Control

The erosion and sediment control plan would continue to be implemented to ensure that the discharge of all water from the site is managed and meets appropriate quality standards. Key elements of the erosion and sediment control plan include:

- Coordination of mining to minimise exposure to disturbed soils;
- Separation or diversion of clean water catchments from disturbed areas to minimise sediment laden and mine water volumes for management;
- Collection and management of runoff sediment control devices;
- Appropriate storage and handling of topsoil materials;
- Revegetation of disturbed areas following site disturbance; and
- A maintenance program for control structures.

8.5 Groundwater

8.5.1 Introduction

This section provides an assessment of potential impacts of the Project on groundwater resources. AECOM prepared a Groundwater Impact Assessment which is provided at **Appendix H** and summarised below. The Groundwater Impact Assessment assessed the hydrogeological impacts of the Project including potential changes to the site water balance and water management system at the Colliery. The assessment was based on data from a predictive groundwater model for the Colliery developed independently by HydroSimulations (attached as Appendix B of **Appendix H**). The Groundwater Impact Assessment was completed with reference to the following documents:

- *NSW Aquifer Interference Policy* (DPI Water, 2012);
- *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*; and
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*.

8.5.2 Existing Environment

Local hydrogeology

The topography surrounding the Project Area is dominated by gentle undulations to low hilly country. The Project Area is located within the Permian Tomago Coal Measures of the Hunter Valley Coalfields within the Sydney Basin. The target coal seams are the Big Ben, Donaldson, Elwells Creek, Whites Creek and Upper and Lower Buttai seams. Interburden between the coal seams consists of interbedded mudstone, siltstone and sandstone along with minor uneconomical coal seams. The overlying Newcastle coal measures do not outcrop at the site. The sediments dip to the south and south-west. Minor dykes and faults cross cut the strata.

To the west of the Project Area, Quaternary alluvial deposits of gravel, sand, silt and clay are associated with Wallis Creek which in part forms a wetland system of disconnected ponds and swamps. To the east, Quaternary sediments are associated with the Hunter River floodplain. Hexham Swamp has formed within the Quaternary sediments of the floodplain. Across the Project Area there are minor alluvial deposits associated with creeks such as Four Mile Creek and Buttai Creek.

There are two aquifer groups that dominate the Upper Hunter Valley, the alluvial deposits of the Quaternary and consolidated sedimentary rocks of the Permian. Within the Project Area, the hard rock Permian coal measures are the main aquifer unit, with the coal seams themselves representing the most permeable material within the formation. Groundwater typically is restricted to the cleat and fractures within the coal. Groundwater is also present in the Quaternary alluvium, swamp, floodplain and estuarine sediments. The alluvial groundwater is shallow with groundwater levels being topographically controlled.

The Bloomfield groundwater monitoring network consists of five standpipe piezometers and five bores with datalogged Vibrating Wire Piezometers (VWPs) (refer **Figure 23**). Monitoring of groundwater levels indicates a progressive decline with depth, with stronger vertical gradients on the southern boundary and minimal gradients at the western sites. The highest groundwater levels are in the northern part of the site where the coal measures outcrop.

Long-term mining effects on the local groundwater system can be seen through a decrease in groundwater elevation in piezometers monitoring the deeper coal seam aquifers, which isn't seen in the upper alluvial aquifer. This infers the alluvium/ weathered overburden and the deeper coal measures are not hydraulically connected.

Recharge and discharge

Recharge for the surficial alluvial aquifers and outcrop areas is dominated by rainfall. The alluvial aquifer is likely to be connected to Wallis Creek and Hexham Swamp, and would discharge to the streams. Coal seams are recharged by rainfall only at outcrop areas. At depth the coal seams are recharged by lateral flow down-gradient from outcrop areas and vertical flow through the overburden.

Groundwater discharge occurs by:

- Evapotranspiration in shallow water table areas;
- Spring flow;
- Baseflow contributions in wet periods
- Evaporation from in-pit pools and seepage faces
- Direct pump out

Groundwater Usage

There are 22 registered bores within 4.5km of the Project Area (refer **Figure 23**), most of which are monitoring bores. Four of the registered bores are listed as being for domestic / stock / farming purposes (GW051353, GW051647, GW058760 and GW061307).

Groundwater Dependent Ecosystems

There are no high priority Groundwater Dependent Ecosystems (GDEs) listed in the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources* or the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* in the vicinity of the Project Area.

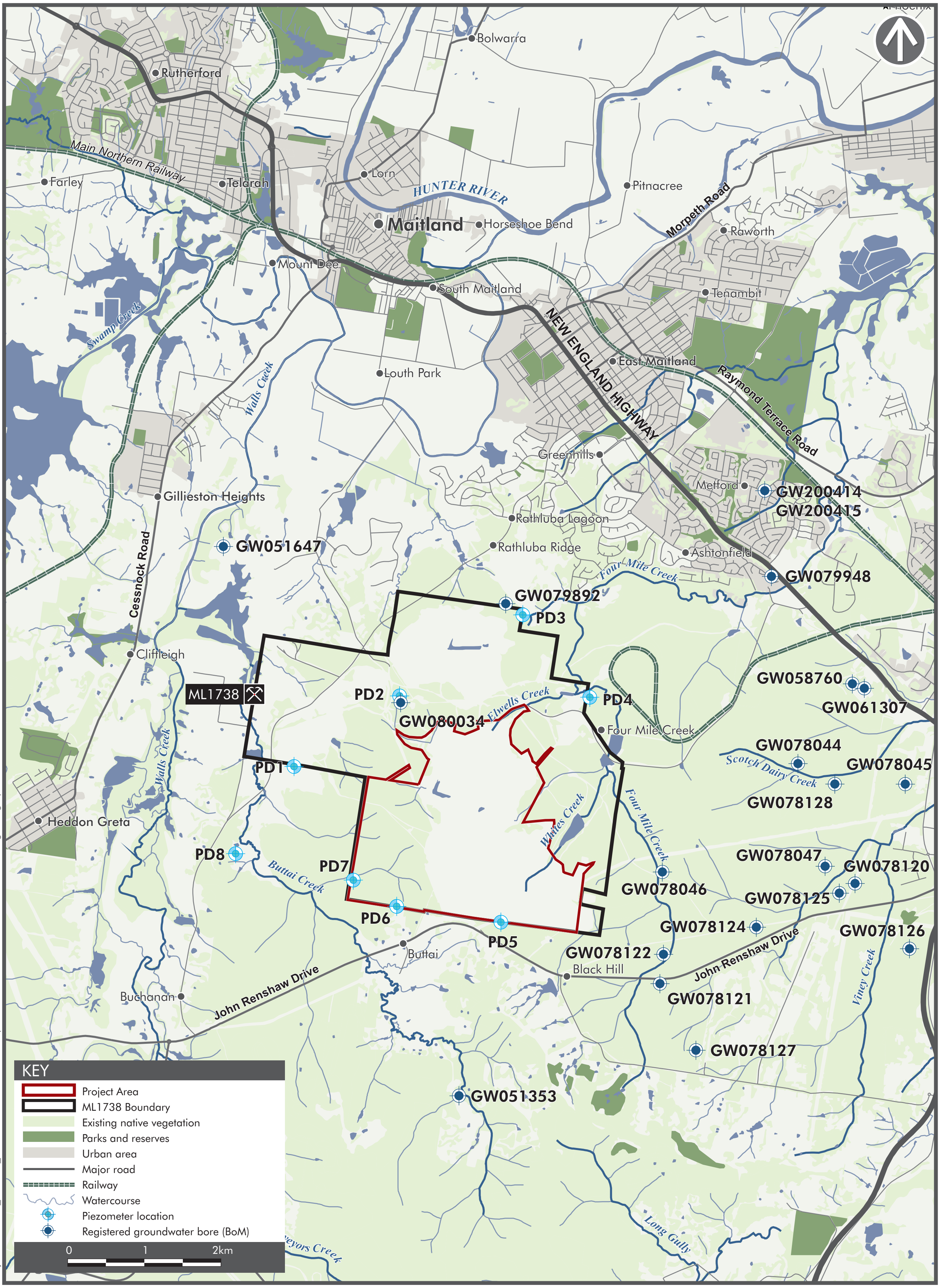
Groundwater Quality

Groundwater in the vicinity of the Project Area is generally saline and of negligible beneficial use. The concentration of Total Dissolved Solids ranged from 1000 mg/L to 13,000 mg/L and the pH is generally close to neutral.

Groundwater surface water interaction

The shallow alluvial aquifer, which is associated with Wallis Creek and the Hunter River floodplain, is inferred to be in direct hydraulic connection with the lower reaches of the major tributary streams in the area. Groundwater in the localised surficial weathered bedrock is inferred to be in hydraulic connection with the high-level streams. These limited occurrences of surficial groundwater do not represent a significant or regionally extensive aquifer system. There is no evidence of connectivity between surface waters and the deeper aquifers of the coal measures.

Modelling of the groundwater and surface water interactions for surface water systems surrounding Bloomfield found that all watercourses were inferred to be gaining systems with the exception of Buttai Creek and Hexham Swamp.



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F3 Existing Mining Operations 24 09 2017 TO

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GROUNDWATER MONITORING BORES AND SURROUNDING REGISTERED BORES
Bloomfield Project

FIGURE 23

8.5.3 Impact Assessment

Groundwater extraction

Groundwater extraction via mine inflows was modelled as part of the predictive groundwater model prepared by HydroSimulation (Appendix B of **Appendix H**). During the calibration period (2006 – 2017) simulated inflows were modelled to be 0.9 ML/day at the start of mining (2006), peaking at 1.6 ML/day in 2013. During the prediction and recovery period (2018 – 2031) simulated inflows were predicted to peak at 1.5 ML/day during 2020-2021, with inflows at the cessation of mining in 2025 predicted to be approximately 1.0 ML/day.

The Groundwater Impact Assessment noted that the groundwater model is conservative and applies a higher rainfall recharge at various locations across the model domain, resulting in higher predicted mine flows. Two areas of increased modelled recharge include:

- Mine spoil area; and
- Catchments of surface water run-off diversions.

The mine spoil area (43.3 ha) and the hardstand workshop area (7.5 ha) west of the mine spoil area will receive no rainfall recharge as runoff is captured from these areas and discharged off-site.

Clean water catchments across the site divert clean surface water runoff to storage dams which are part of the natural surface water system limiting rainfall recharge. There are four clean water sub-catchments (Buttai Creek, Four Mile Creek, Possum Puddle west and Possum Puddle east) with a total surface area of 623 ha.

The modelled inflow rates were therefore refined to remove these areas from the model, which resulted in a reduction of mine inflows by a total of 78.0 ML/year. The estimated annual water requirements for licensing is summarised in **Table 22**.

The predicted licence requirements from the refined inflows vary from 369.5 ML/year in 2016/17, reaching a maximum of 482 ML/year in 2020/21 and declining to zero in 2026/27. These predicted mine inflows are within the existing water licence requirement of 500 ML/year.

Table 22 Modelled and Refined Mine Inflows for each Operational Year

Year	Licence Requirement (ML / year)	
	Modelled inflow	Refined Inflow
2016/17	447.5	369.5
2017/18	487.5	409.5
2018/19	520	442
2019/20	540.5	462.5
2020/21	560	482
2021/22	491	413
2022/23	338	260
2023/24	310	232
2024/25	367	289
2025/26	183.5	105.5
2026/27	0	0

Predicted alluvial takes from the Wallis Creek Water Source and the Newcastle Water Source were considered in the overall mine inflow rates. During the prediction period and subsequent 100 year recovery period (2018 – 2132), the maximum and mean take from the Wallis Creek Water Source was predicted to be 26 ML/year and 12 ML/ year respectively, and the maximum and mean take from the Newcastle Water Source was predicted to be 8 ML/year and 2 ML/year respectively.

The final void would remain a sink and would a wide spread effect of lowering water levels in the vicinity of the Project Area in the long term. A hypothetical monitoring point within the final void is predicted to only recover 15m after 100 years, with a void water surface of -40m Australian Height Datum (AHD).

Groundwater drawdown

Predicted groundwater heads were modelled to show groundwater level and drawdown at the completion of mining in 2025. The results indicate the following:

- Drawdown as a result of mining activities at the Colliery are expected to reach a maximum in the Mine Year 20 or 2025, at which time mining activities are scheduled to cease in the southern end of the approved extraction area and the groundwater levels would start to recover;
- Drawdown of 100 m is predicted in the surficial aquifer layer 1 in the Bloomfield extraction area and final mine void (alluvial and regolith) although it is limited in extent;
- Significant drawdown is also evident within the lease area to the north-west of approved extraction area corresponding with historical open cut and underground mining;
- Drawdown is generally less than 0.5 m outside the Bloomfield lease area apart from the south-west corner where the 2 m drawdown contour extends outside the lease approximately 600 m beneath Buttai Creek;
- The predicted drawdowns are not expected to negatively impact GDE's as historical mining in the area has previously lowered water levels far below the ground surface;
- The Donaldson open cut and final void are predicted to experience significant drawdown, however there is no overlap of the water table drawdowns produced by the various mines;
- Predicted drawdowns at the end of mining in nearby registered bores (within 5 km) are generally predicted to be less than 1 m, however drawdowns between 1 – 2 m are predicted for three bores (GW078047, GW078128 and GW078044) which is within the Aquifer Interference Policy threshold of 2 m; and
- Larger drawdowns are predicted for GW078124 and GW078124, with 20 m and 17 m drawdown respectively due to the final void at the Donaldson mine.

Groundwater quality impacts

Groundwater within the Bloomfield mine lease is saline and of negligible beneficial use. The potential impacts of Bloomfield's current and future operations relate to the risks of contamination from disturbed catchments, mine water, and process water being released off site to natural waterbodies.

As previously noted in **Section 8.4.3**, controlled discharges to Four Mile Creek from the Colliery occur from the Lake Foster discharge pipe outlet and are monitored and reported in accordance with EPL 396. The Project would not increase or decrease the probability of unplanned discharges, or water quality risks, from Bloomfield's operations. However these risks would continue to exist up until the end of extraction (2030) and until such time as the site is rehabilitated noting that risks would decrease with the progressive rehabilitation of post mining areas across the life of the project.

Baseflow impacts

The predictive model included assessment of potential impacts on baseflow for local watercourses. The model can predict reductions to baseflow for gaining streams, but cannot predict increases in leakage from losing streams. Baseflows were extracted from the model for both the mining and the null case simulations, for cumulative stresses imposed by all mines in the vicinity of the Project Area. The results indicate that:

- Four Mile Creek was predicted to have converted from a gaining stream to a losing stream around 2011, therefore its average baseflow of 0.24 kL/day (equivalent to 0.1 ML/year) would have been lost at that time;
- The difference between mining and null case simulations for all other watercourses was negligible, indicating that Bloomfield mining is having an insignificant effect on baseflow capture; and

- The leakages from Hexham Swamp differed by no more than 1 kL/day between null and mining simulations, which would be within numerical error bounds.

Aquifer Interference Policy

The Groundwater Impact Assessment included a minimal impact assessment for the groundwater potentially impacted by the Project in accordance with the Aquifer Interference Policy. The majority of the Project Area is considered to be within a 'Less Productive Groundwater Source' within fractured rock, based on the low number of registered bores in the area. The minimal impact considerations for 'highly productive groundwater' in a fractured rock aquifer and for 'less productive groundwater' in a coastal aquifer are presented in

Table 23 Minimal Impact Considerations for a 'Highly Productive Groundwater Alluvial Aquifer'

Minimal impact considerations	Response
Water Table – Level 1 Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post water sharing plan' variations, 40 m from any: High priority groundwater dependent ecosystem; or High priority culturally significant site listed in the schedule of the relevant water sharing plan, or A maximum of a 2 m decline cumulatively at any water supply work.	There are no high priority groundwater dependent ecosystems listed under the *North Coast Fractured and Porous Rock Groundwater Sources.* No culturally significant sites were identified within the *North Coast Fractured and Porous Rock Groundwater Sources.* Groundwater modelling indicates that drawdown effects on the surficial aquifer are not expected to have any adverse impact on groundwater dependent ecosystems because the groundwater levels are already well below ground surface.
Water Table – Level 2 If more than 10% cumulative variation in the water table, allowing for typical climatic 'post water sharing plan' variations, 40 m from any: High priority groundwater dependent ecosystem; or High priority culturally significant site; listed in the schedule of the relevant water sharing plan, if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long term viability of the dependent ecosystem or significant site. If more than a 2 m decline cumulatively at any water supply work then make good provisions should apply.	The alluvium of both the Wallis Creek Water Source and the Newcastle Water Source (along the lower Hunter) are classified as 'Highly Productive' by DPI Water. The calculated alluvial takes (rounded to the nearest ML/year) for separate simulation phases are discussed at **Section 8.5.3 Groundwater Extraction**. These takes are due only to Bloomfield mining. The standpipe SP4-2 is located near Four Mile Creek. It is more likely that the water level in this bore is influenced by water level in the creek, when it flows. The simulated hydrograph shows a rising trend for some years, followed by stabilisation. SP7-1 is located at the western border of the Bloomfield mine. The prediction and recovery stages of the simulated hydrograph suggest that the water level will decline due to mining and not recover significantly. This bore would remain within the zone of influence of the final void. Most of the drawdown for registered bores calculated by the model are much less than 1 m, while drawdown greater than 1 m and up to 2 m are predicted at three bores (GW078047, GW078128 and GW078044), which is within the AIP's 2 m threshold. Large predicted drawdowns of 20 m and 17 m at bores GW078124 and GW078123 are due to the final void at the Donaldson mine.

Minimal impact considerations	Response
	Mitigation measures have been recommended for GW078124 and GW078123 located near the Donaldson Mine where it has been predicted that the drawdown exceeds a water level decline of more than 2 m. The predicted groundwater level decline will not prevent the long term viability of the bore and make good provisions will be covered by the Donaldson Mine groundwater management plan.
Water Quality – Level 1 Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	Not applicable
Water Quality – Level 2 If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long term viability of the dependent ecosystem, significant site or affected water supply works.	Not applicable

Table 24 Minimal Impact Considerations for a 'Less Productive Fractured Rock Aquifer'

Minimal impact considerations	Response
Water Pressure – Level 1 A cumulative pressure head decline of not more than a two metre decline, at any water supply work.	Significant drawdown is also evident within the lease area to the north-west of the approved extraction area, coincident with historical open cut and underground mining. Drawdown from open cut mining is propagating into the high-permeability underground voids, with some spatial confinement offered by a north-westerly trending dyke. The drawdown is generally less than 0.5 m outside the Bloomfield lease boundary except for the south-west corner where a 2-m drawdown contour extends off-lease. The 2 m of drawdown extends beneath Buttai Creek for a distance of about 600 m.
Water Pressure – Level 2 If the predicted pressure head decline is greater than condition 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long term viability of the affected water supply works unless make good provisions apply.	Whites Creek Seam: All three vibrating wire piezometers (VWP) lie along the southern boundary of the Bloomfield lease. All simulated hydrographs show significant mining effects, with the degree of recovery being minimal but increasing from east to west, due to the effects of adjacent underground mining. Donaldson Seam: Four out of seven bores (SP2-1, VW1(35m), VW6(114m) and VW7(95m)) in this layer show slow water level recovery post-mining. Water levels at bores SP3-1 and VW5(71m) show no sign of recovery. Most bores are influenced by

Minimal impact considerations	Response
	adjacent underground mining. Big Ben Seam: All simulated hydrographs show significant declines due to mining, with slow or negligible recovery in some cases. Most bores are influenced by adjacent or historical underground mining.
Water Quality – Level 1 Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	Not applicable
Water Quality – Level 2 If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long term viability of the dependent ecosystem, significant site or affected water supply works.	Not applicable

All predicted impacts are less than Level 1 minimal impact considerations (as defined in the Aquifer Interference Policy) and are therefore considered acceptable with appropriate monitoring during operation.

8.5.4 Mitigation Measures

Monitoring

Ongoing quarterly monitoring of the onsite piezometer network and monthly surface water monitoring would continue to be implemented to monitor the drawdown effects from depressurisation of the regional aquifer. The installation of additional monitoring points would be considered where areas of predicted drawdown are significantly different to that of actual drawdown.

The frequency of water level measurements within the pit should be compatible with evaporation rates obtained from the site's weather station which will allow refinement of model calibration and inflow predictions.

Management

Bloomfield has an existing Water Management Plan (WMP) which details the monitoring and management measures which are currently in place for the management of groundwater (and surface water) at the Colliery. The WMP would be reviewed and updated in accordance with the conditions of consent to monitor groundwater levels in monitoring wells and in the pit. Groundwater discharge would be monitored to quantify pit inflows to ensure the discharge licence conditions are satisfied.

The monitoring data collected from groundwater and surface water systems enables management of groundwater by:

- Establishment of groundwater and surface water trigger levels based on the beneficial use of each water body;
- Development of mitigation measures which may include the provision of 'make good' measures in bores where excessive drawdown may be experienced. This could involve deepening a water supply bore or providing an alternative water supply. No surface water mitigation measures are proposed due to the minimal predicted impacts; and
- Plotting of groundwater level data as hydrographs and comparing to rainfall.
- Collation of the results of the groundwater monitoring program on an annual basis and presenting in an annual report as required under the conditions of consent.

8.6 Visual Impacts and Rehabilitation

8.6.1 Introduction

This section provides an assessment of the potential visual impacts of the Project and the proposed rehabilitation activities.

8.6.2 Existing Environment

Visual Environment Previously Assessed (2008 EA)

An assessment of the visual environment, including lighting, was undertaken as part of the 2008 EA. This previous assessment identified viewing points around the site (shown on **Figure 24**) with the potential to view operations occurring within the site, particularly residences or other places of public access such as roads or public buildings. The visual impact of the Colliery operations was then determined for both day and night-time operations. The assessment did not address the visual impacts of the CHPP, which forms part of the Abel Project Approval.

The existing visual environment of the Project Area would be similar to that assessed in the 2008 EA as there have been no substantial changes to the Colliery infrastructure or operations since the previous visual assessment was prepared. The 2008 EA assessed the following four main visual elements of the operations:

- The open cut mining area, consisting of the active mine pits, emplacement areas, haul ramps and areas of active rehabilitation;
- Haul road for the transportation of ROM coal from the open cut mining area to the ROM coal stockpile at the CHPP;
- Access road from the open cut mining area to the workshop; and
- The workshop area consisting of the workshop/maintenance shed, fuel farm and hard stand area for equipment storage.

The landscape and visual setting of the Project area and its surrounds is defined by undulating rural hills. Three major visual features of this landscape are the existing Colliery, Donaldson Open Cut Mine, and the natural feature of Elliots Hill. There are extensive small rural landholdings surrounding the Colliery to the north, south and west. Residential areas of Ashtonfield are visible to the north.

The Project area cannot be viewed from the east due to intervening ridgelines and vegetation. A vegetated ridgeline to the west prevents close views from this direction, although distant views from Kurri Kurri may be possible. Some Louth Park, East Maitland and Ashtonfield residences to the north and north-east have views to the disturbed grasslands that form part of the tailings management system, however most views are limited by an east-west running ridgeline. South of the Colliery, rural residences are located along John Renshaw Drive, Lings Road, Black Hill Road and Browns Road. Bloomfield operations are generally screened by native vegetation and an intervening ridgeline which includes Elliots Hill.

Viewers along John Renshaw Drive are generally limited to passing motorists. John Renshaw Drive functions primarily as a link road and large proportion of motorists would use the road to commute to work or to transport goods. This suggests that they would be less sensitive to changes in the visual environment than, for example, recreational users or tourists. Views towards the Colliery are restricted to works along the southern boundary which, when rehabilitated, would block views of active mining operations as they progress northwards.

Generally the assessment of visual impact identified a low visual impact level associated with the Colliery operations. Only one viewing location (Location D – Buttai Valley south of John Renshaw Drive) was considered to have moderate-low visual impact during operations, and it was noted that this would diminish over time as the overburden dump and rehabilitation progresses west out of their line of sight behind Elliots Hill.

The assessment of lighting included direct and diffuse light effects. Locations that were considered to have direct line of sight to night lighting are Buttai Valley and, at a further distance, Black Hill to the south. Potential impacts of direct lighting are managed through consultation with residents and attention to the direction of fixed site lighting. A diffuse effect of the lighting and its interaction with atmospheric conditions may from time to time create a glow around the Project Area.

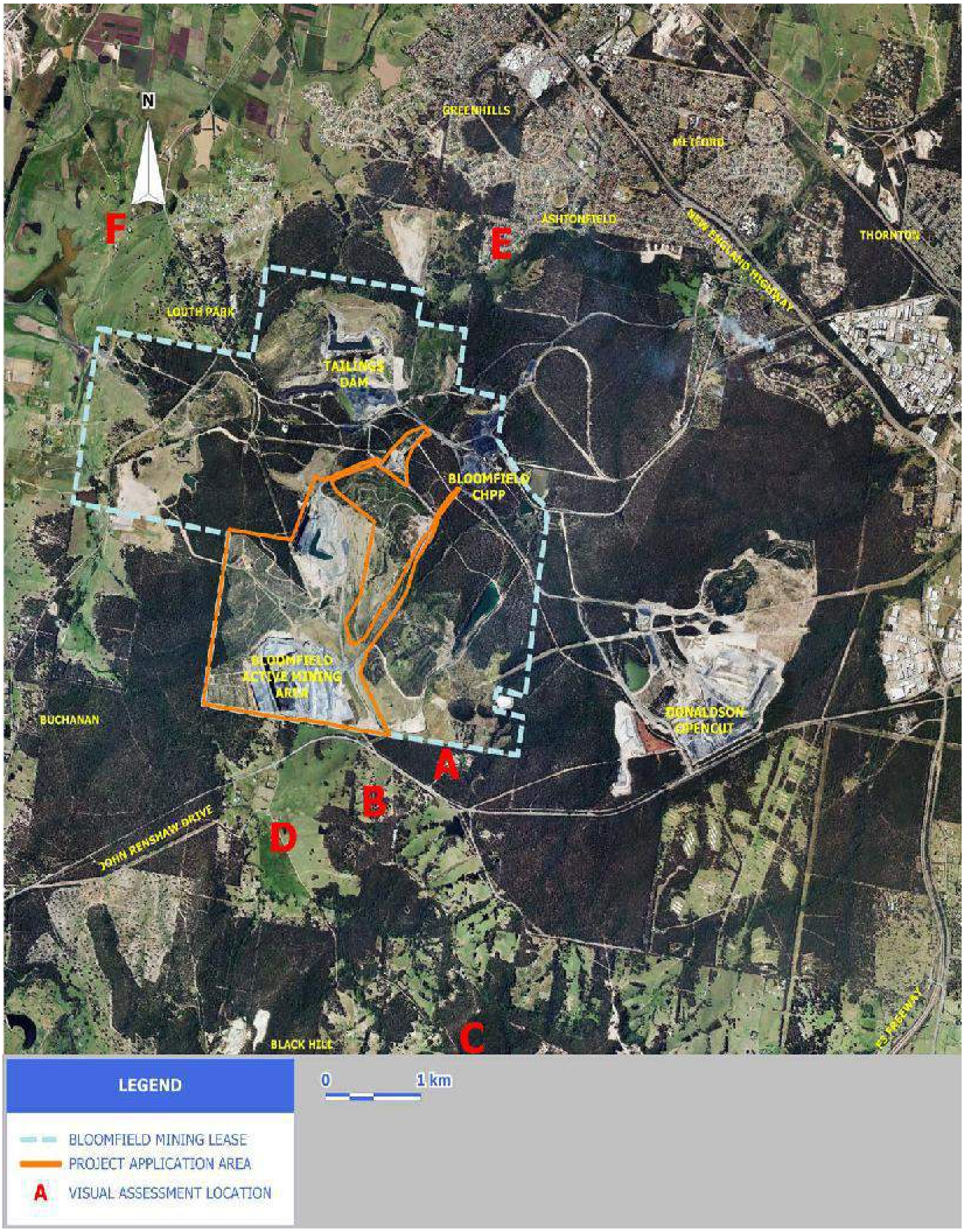


Figure 24 Visual Assessment Site Locations from 2008 EA (Source: Business Environment, 2008)

Current Rehabilitation Strategy

Rehabilitation at the Colliery is currently undertaken in accordance with the Rehabilitation Management Plan (RMP) and the current MOP developed by Bloomfield for the Colliery site. The RMP has been prepared in accordance with the Project Approval 07_0087 conditions of consent, requirements of EPL 396 and mining leases, and commitments outlined in Bloomfield's Environment Management Policy. The current MOP has been prepared in accordance with the requirements of the mining leases (CCL 761 and ML 1738).

The overall aim of rehabilitation at the Colliery is to provide a safe and stable landform, compatible with the surrounding landscape, which allows for a range of possible post-mining land-uses including mixed-used development. The general rehabilitation, landform and vegetation objectives of the RMP and the current MOP are based on those detailed in the 2008 EA and include:

General Rehabilitation Objectives

- Land will be rehabilitated in accordance with relevant DRE standards applicable at the time of rehabilitation;
- Rehabilitated land will represent a minimal source of off-site environmental impacts, such as dust, water pollution, visual amenity and weeds;
- All infrastructure owned by Bloomfield Colliery must be removed under the terms of its Commercial Lease with the landowner (Ashtonfields);
- Rehabilitated land will require ongoing management inputs no greater than similar adjacent land; and
- Rehabilitation will be compatible with the proposed post-mining land-use (mixed-used development).

Landform Objectives

- Rehabilitated land will be safe and stable;
- Land capability will be returned to a class similar to that existing prior to the commencement of mining; and
- Mined land will be re-contoured to a landform compatible with the surrounding natural landscape.

Vegetation Objectives

- Rehabilitated land will be top-dressed, fertilised and sown with grass seed and/or native vegetation species; and
- A sustainable vegetation cover will be established on rehabilitated land.

The RMP also sets out the specific completion criteria and progress indicators for each of the rehabilitation objectives.

The rehabilitation methodology implemented at the site is detailed in Section 3.4 of the 2008 EA and in Appendix A of the current RMP. Rehabilitation works generally consist of reshaping of overburden dumps and re-establishment of a vegetative cover. This is divided into the following stages:

- Landform reshaping;
- Preparation of the ground surface (e.g. topdressing material application);
- Species selection and revegetation; and
- Site monitoring and maintenance.

Rehabilitation activities are carried out throughout the year, with the aim of timing vegetation seeding operations in spring and autumn. As reported in the Bloomfield 2016 AEMR, to date 488 hectares have been rehabilitated within the Project area.

Under the current consent, mining at the Colliery will cease in 2021. In accordance with the Abel Project Approval, the Bloomfield CHPP would continue to process coal from the neighbouring Abel

Underground Mine until 31 December 2030. The approved final landform incorporates a final void remaining on the Colliery site following cessation of Bloomfield mining operations, to be used for disposal of tailings from the CHPP. Previous estimates have indicated that 20 million m^3 of storage capacity would be required for the final void as a tailings facility. This includes disposal of approximately 18 million m^3 of waste rejects and a further 2 million m^3 of overburden capping. Tailings material would be capped with 2 metres of overburden material and soil and rehabilitated.

Given that the final void would be utilised for tailings emplacement from the Abel Underground Mine, rehabilitation of the final void currently forms part of the Abel Project Approval. Section 2.13.2 of the *Abel Underground Mine Part 3A Environmental Assessment* (Abel EA) (Donaldson Coal, 2006) states the following:

> *It is proposed to fill former open cut areas within Bloomfield Colliery with tailings from the coal washing process. This will assist in filling and rehabilitating these areas. Rehabilitation will be undertaken in accordance with DPI guidelines which require the Bloomfield Mine Operations Plan, required as a condition of the Bloomfield mining lease, to provide details on proposed outcomes to be achieved through rehabilitation and final landform. Dewatering of these tailings areas will continue to be undertaken in accordance with current methods, which include the pumping of excess water back to the washery for settling and reuse, and the covering of dewatered areas with soil, landform shaping and seeding for tree cover.*

The current MOP sets out the following rehabilitation objective for the Active Mining Area domain:

> *After mining operations conclude the remaining final void will be utilised as a tailings disposal area. After tailings operations are completed (est 2030) the landform will be graded and contoured to be compatible with surrounding natural landscape as far as possible. The mining void remaining in the post mining landscape will be safe, stable and non-polluting. Final void batters will be seeded with a pasture grass seed mix suitable for grazing purposes or seeded with a mix of native tree and shrub species similar to the surrounding vegetation community.*

8.6.3 Impact Assessment

Visual Impacts

The Project would involve the ongoing extraction of coal from within existing approved extraction areas. Following on from the visual impact assessment previously undertaken for the approved Project elements and infrastructure (identified in **Section 8.6.2**), the visual impact of the Project on these elements was reviewed.

A number of these elements such as the workshop and haul roads are not visible at offsite receiver locations now or during the proposed mine life extension. The potential visual impacts of the Project relate primarily to the change in final landform which would see a shift in the final void approximately 200m to the west. This means that views to the overburden emplacement area may change compared to that originally assessed.

The potential visual impacts associated with the proposed overburden emplacement area were assessed through the development of photomontages to illustrate the visual effect from two of the most impacted viewing locations (locations shown on **Figure 25**). Photomontages (provided at **Plate 1** and **Plate 2**) indicate that the visual impact of the Project would be minimal.

\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F25 Plate Location and Direction of View 18 12 2017 TO

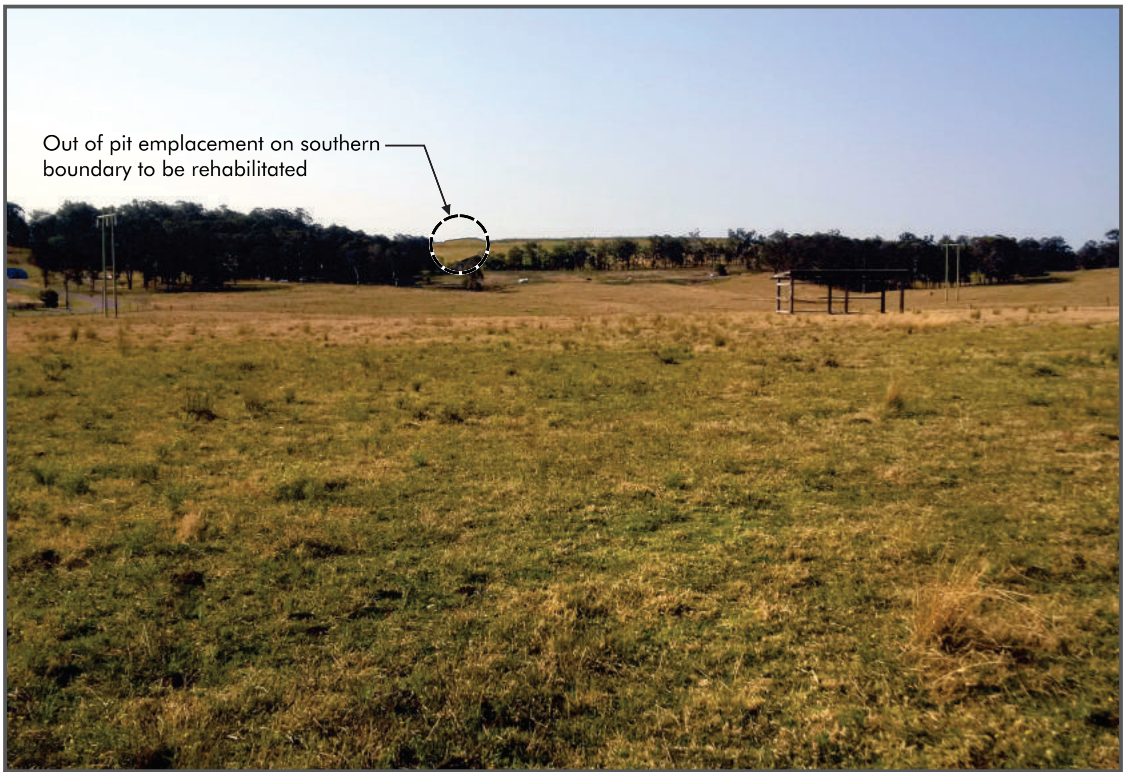
AECOM

VIEWPOINT LOCATIONS

Bloomfield Project

FIGURE 25

EXISTING VIEW



WITH PROJECT

RESIDENCE - LINGS ROAD, BUTTAI

Bloomfield Project

PLATE 1

EXISTING VIEW

WITH PROJECT

\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 Plate 2 06 10 2017 TO

Rehabilitation and Final Landform

The existing rehabilitation methods and monitoring procedures would continue to be implemented across the Project area, and the RMP and MOP would be updated to incorporate the Project.

As noted in **Section 6.2**, DRG requested that the EA include consideration of Section E: Rehabilitation of the Indicative SEARs for SSD Mining projects (NSW Government, 2015). The following sections address each of the headings set out in Section E of the Indicative SEARs.

Post-mining land use

Post mining land use options are discussed in **Section 4.4.4**. This includes identification of post mining land use options, justification of the preferred approach and how this relates to the rehabilitation strategies of neighbouring mines within the region.

Rehabilitation objectives and domains

The general rehabilitation, landform and vegetation objectives are described in **Section 8.6.2**, while the rehabilitation objectives specific to the relevant primary and secondary domains are provided in Table 10 of the current MOP. The objectives, performance indicators, measures and completion criteria for the relevant defined domains are set out in Table 12 of the current MOP.

Rehabilitation methodology

As discussed in **Section 8.6.2** the existing rehabilitation methods are detailed in Appendix A of the RMP and Section 6 of the current MOP. At the commencement of the MOP term, all available areas have been rehabilitated. Shaping and rehabilitation of existing overburden emplacement areas would not be able to continue until backfilling areas within the void have reached the final landform.

Geotechnical investigations would be undertaken to confirm shear strength of tailings emplacement areas and capping requirements. Preliminary geotechnical investigations of the existing tailings emplacement area have been undertaken (as discussed at **Section 4.3.3**), and similar characteristics are expected given the similar source of material. Recommendations provided by geotechnical specialists would be implemented during tailings emplacement for the Project.

The indicative development of the open cut and overburden emplacement domain and proposed final landform for the key production milestones is shown in **Figure 6** to **Figure 9**, including the commencement of the Project (2018), the maximum year of mining activity (2021) and completion of the Project (proposed final landform) with and without Abel Underground Mine resuming operations .

Conceptual final landform design

The final landform for the Project would depend on the future operational status of the Abel Underground Mine, which is currently in care and maintenance. As such, indicative final landforms for two scenarios have been prepared, including a scenario with Abel Underground Mine remaining in care and maintenance (**Figure 8**) and a scenario with Abel Underground Mine resuming operations (**Figure 9**). The final landform design will be reassessed on a regular basis to consider the status of the Abel Underground Mine and to inform the rehabilitation strategy. The indicative final land use for the site is discussed in **Section 4.4.4** and shown on **Figure 17**.

Monitoring and research

The rehabilitation monitoring program undertaken at the site is detailed in Section 7 of the current MOP and includes maintenance inspections, rehabilitation monitoring and review of inspection data over time to assess rehabilitation performance. Monitoring is currently undertaken at 24 locations throughout the mine site. A Trigger Action Response Plan is included in the RMP which sets out the proposed intervention and adaptive management measures to be implemented in the event of unexpected variations or impacts to rehabilitation outcomes.

Post-closure maintenance

The progress of rehabilitated areas is monitored as part of the ongoing assessment program which is used to collect sufficient data on the rehabilitated land to compare against the completion criteria to assess rehabilitation development, sustainability and suitability for sign-off.

Rehabilitation monitoring data is reviewed upon completion of monitoring. Remedial actions for significant anomalies detected during monitoring (i.e. failed rehabilitation, failed water management structures, significant weed infestations) are included in environmental works planning. Monitoring data is compared with previous years' data, to identify long-term trends in rehabilitation development. Once three sets of data have been collected, this information is compared to completion criteria and areas deemed suitable for sign-off are identified.

Rehabilitated areas that are not progressing towards the completion criteria are identified and corrective strategies are devised or the monitoring period is extended. The results of rehabilitation monitoring are reported in the AEMR.

Barriers or limitations to effective rehabilitation

Bloomfield has completed an overarching risk assessment to identify the potential threats to the success of rehabilitation at the site. Results of the risk assessment are detailed in Section 3 of the current MOP. Key aspects include:

- Disturbance of Aboriginal Heritage;
- Disturbance of European Heritage;
- Erosion and sedimentation;
- Fire Hazard;
- Dust;
- Noise;
- Contamination of surface and ground water resources;
- Storage and management and hydrocarbons including spills and leaks; and
- Introduction of weeds.

The proposed mitigation measures to reduce the key risks identified in the risk assessment are presented in the Trigger Action Response Plan in the RMP.

The alternative final void options considered during the development of the mine plan are discussed in **Section 4.4**. The preferred final landform has removed the need to retain a highwall as part of the final void. The impact of the Project on surface water and groundwater in relation to the likely final water level in the void has been assessed at **Section 8.4** and **Section 8.5** respectively.

8.6.4 Mitigation Measures

The Colliery has established rehabilitation and monitoring procedures as part of its RMP and MOP for the site. These rehabilitation methods would continue to be implemented for the duration of the Project. Geotechnical investigations would be conducted by qualified geotechnical specialists to guide the tailings emplacement strategy and capping requirements and management strategies recommended would be implemented for the Project.

Existing management plans and procedures, including the RMP and MOP, would be updated to reflect the Project as required. Any changes to the final landform would be subject to discussion with the relevant agencies (including DRG).

8.7 Social and Economic

8.7.1 Introduction

This section provides an assessment of potential social and economic impacts and benefits associated with the Project.

8.7.2 Existing Environment

Regional Profile

The 2008 EA included discussion of the socio-economic regional profile, including analysis of the 2006 census data. The 2006 census indicated the population of the Cessnock LGA was 48,265 with approximately 7.7% of the employed people in Cessnock working in the mining sector.

The 2011 census data (ABS 2011) showed a population increase of 5.3% in the Cessnock LGA compared to 2006 data, with 50,840 people in the LGA, of which 10.2% were employed in the mining sector and 8.7% specifically in the coal mining industry. In comparison, approximately 0.6% and 0.4% of working people in NSW and Australia wide respectively were employed in the coal mining industry. This shows the continuing importance of coal mining in the local economy.

The 2016 census data (ABS 2016) shows strong population growth of approximately 9.3% compared to 2011 data, with approximately 55,560 people living in the Cessnock LGA. Employment data for the 2016 census was not yet available at the time of writing this EA.

The Hunter Region has a diverse and changing economy, with the mining and tourism industries overtaking the region’s traditional agricultural base (the viticulture and equine industries). In addition to direct employment in the mining sector, employment in downstream industries (e.g. transport, health and other service) as a result of the presence of the mining sector, adds to the regional importance of the mining industry.

Bloomfield Group Workforce

A summary of the Bloomfield Group workforce (which includes the Colliery, Rix’s Creek North and Rix’s Creek South mines, and associated engineering companies) was provided in the *Environmental Impact Statement for the Rix’s Creek Mine Continuation of Mining Project* (AECOM, 2015). This information provides an insight into the social context of the mines and functional linkages with the local community and economy. The key characteristics of The Bloomfield Group’s workforce are as follows:

- Over 96% of the workforce is employed on a permanent full time basis. The average length of employment for The Bloomfield Group is 10 years while average length of employment in the mining industry is 16 years, characteristic of a relatively stable workforce;
- The most common level of school education completed by employees was Year 10 or below (55%), while 32% of employees completed Year 12. Nearly half of the workforce holds a Trade/TAFE qualification; and
- Approximately 53% of employees have a mortgage while 25% own their property outright; approximately 14% of employees are renting.

The majority of the workforce resides in or in the vicinity of Maitland (33%), followed by Singleton (11%) and Lake Macquarie (10%). Approximately 35% of employees at the Mine live in Singleton. Total household expenditure was highest in Maitland, Newcastle, Singleton and Lake Macquarie, which together account for $14.7 million per annum or 70% of spending estimated across all Bloomfield employees. As anticipated, employees at the Mine have a high proportion of expenditure in Singleton (38%), and workers from Bloomfield Mine and other surveyed organisations have a high proportion of their expenditure in Maitland and surrounding suburbs (45%).

Bloomfield Group Suppliers

The survey of the principal Bloomfield Group suppliers (local, State and national suppliers) showed that an estimated annual expenditure of approximately $52.47 million was directly dependent upon The Bloomfield Group operations. Local businesses/suppliers (Singleton) generated expenditure of

$13.12 million and $22.03 million was generated from regional businesses/suppliers (wider Hunter Valley).

Community Funding

The Bloomfield Group financially supports local organisations through The Bloomfield Group Foundation and other sponsorship programs, and encourages employees to participate in charitable and community events. Through sponsorship programs and The Bloomfield Group Foundation, the Bloomfield Group donated almost $3.4 million to the community between March 2006 and March 2017.

Community Consultative Committee

The Bloomfield CCC commenced in 2010 following issue of the Project Approval in 2009. The CCC is currently comprised of a chairperson, three community representatives and three Colliery employees. Cessnock City Council has recently withdrawn representation on the committee. The CCC meets three times per year and provides a forum for open discussion between Bloomfield and the community on issues directly related to the Colliery's operations, environmental performance and community relations.

8.7.3 Assessment of Impacts

Principles for Social Impact Assessment

The International Principles for Social Impact Assessment (Vanclay, 2003) summarises the key elements that should be considered when determining the potential social impacts of an activity or development:

- People's way of life – that is, how they live, work, play and interact with one another on a day-to-day basis;
- Their culture – that is, their shared beliefs, customs, values and language or dialect;
- Their community – its cohesion, stability, character, services and facilities;
- Their political systems – the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose;
- Their environment – the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
- Their health and wellbeing – health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity;
- Their personal and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties; and
- Their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

An assessment of each of these elements in relation to the Project is provided in **Table 25**.

Table 25 Project Social Impact Assessment

Potential Social Impact Element	Project Impact Assessment
People's way of life	The Project is located within an established mining area. The assessments undertaken have indicated that the Project would have a minimal impact on surrounding areas, therefore it is considered unlikely that the Project would have a measurable impact on any peoples' way of life.
Culture	An assessment of the potential impacts of the Project on the indigenous and historical culture of the locality is provided in **Section 8.8.1**. This assessment concludes that the Project would have a negligible impact on heritage values. There are no cultural land uses (religious, community organisations, etc.) in close proximity to the Project Area that would be impacted by the Project.
Community	The Project as designed, after considering all options, would maximise the continued social and economic benefits from the use of the Project area. There would be no impact to community cohesion. There would be local and regional flow-on benefits from the Project related to capital investment, ongoing employment and purchasing carried out during operations.
Political systems	The Project would have a negligible impact on political systems at any scale. Community participation regarding the Colliery operation is currently provided through the CCC and this would continue to be provided throughout the Project.
Environment	This EIS includes a comprehensive environmental impact assessment aimed at determining the scale and nature of the Project's potential environmental impacts (refer to **Section 8.0**). Where the potential for impacts to occur has been identified, management actions and mitigation measures have been recommended to maintain impacts to acceptable levels. With these management measures in place, it is considered that the Project would not have a significant environmental impact.
Health and wellbeing	An assessment of potential hazards, risks and human health impacts of the Project is provided in **Section 8.0** in relation to a number of potential aspects including noise, air quality and social and economic impacts. These assessments concluded that the Project is unlikely to pose a risk to the health or wellbeing of the community.
Personal and property rights	The Project is located on land owned by an independent third party and held by Bloomfield under a long standing commercial lease. No additional land holdings or acquisitions would be required. The Project site is located within an established mining area with appropriate offsets to sensitive (residential) land uses, meaning the Project is unlikely to have an impact on personal or property rights.
Fears and aspirations	The Project would prolong the life of the Colliery and provide ongoing employment for the existing 93 personnel for an additional nine years beyond the existing life of the mine. Other community benefits would include the continuation of indirect employment, contributions through sponsorship programs and flow on benefits to the local economy.

Based on the assessment provided in **Table 25**, the Project would not have an adverse impact on the social fabric of the local community.

Social Amenity

Potential impacts and community concerns relating to social amenity have largely been identified via CCC meetings and community hotline data (complaints) for 2009 - 2016. The Bloomfield AEMR show a decline in the number of community complaints received, with about 20 complaints in 2009 and 2010, about 10 complaints in 2011 - 2014, and five complaints in 2015 and 2016 (Bloomfield, 2016).

The main concerns related to noise and blasting, with fewer community complaints related to air quality (dust and odour), transport, wild dogs and weeds. Impacts on social amenity from the Colliery operations are summarised in **Table 26**, together with their risk ranking (low, medium or high).

Table 26 Impacts on Social Amenity

Issue	Impact*	Social / community Risk
Blasting	Blasting related complaints constitute the most prominent issue for the community, with almost half (47%) of all complaints between 2009 and 2016. Blasting complaints generally refer to overpressure levels and vibration. The majority of these blasting complaints were received during 2009 and 2010, with only one or two each year since 2012.	Low/Moderate
Noise	Noise impacts constituted over a third (37%) of all complaints between 2009 and 2016. Complaints are generally related to operational noise from the Mine, however noise from coal trains passing residential areas was also considered to be an issue. Noise complaints have also declined, with only one or two received each year since 2015.	Low/Moderate
Air Quality	Air quality complaints (including dust and odour issues) accounted for 10% of all complaints received. Complaints relating to dust and odour may be attributed to blasting activities and other operational activities such as bulldozing and haulage. Generally only one or two complaints per year relating to dust or odour have been received.	Low
Other	All other complaints including traffic (2%), wild dogs (3%), and weeds (1%) were relatively minor.	Low

*Figures have been rounded.

Community Infrastructure and Services

Project factors that can impact community services and infrastructure include:

- Changing demand due to an increase in temporary or permanent population;
- Changing behaviours of users, such as workforce rosters determining patterns of peak service utilisation; and/or
- Direct impacts on physical infrastructure during Project construction and/or operation.

The Project involves the continuation of existing mining activities with the existing workforce and would not require construction of new infrastructure or facilities. Therefore the Project would not result in additional impact on accommodation and housing, community facilities and services.

Economic Impacts

The continuation of mining activities at the Colliery would have positive economic impacts through the provision of ongoing employment to existing employees and flow-on benefits to other industries. Other industries that may benefit include those supplying inputs to the mining sector (such as trade, manufacturing and professional services), those that support the mining sector through its supply chain (such as property and business services), and consumer oriented industries (such as retail and hospitality services). The Project would also have a positive economic impact through payment of mining royalties to the State Government.

If the Project does not proceed, economic impacts would primarily be negative due to the reduction in employment following closure of the Colliery in 2021 and a reduction in the flow on benefits to the wider community. Payment of royalties to the State Government would cease and the economic benefits of the remaining coal reserves would go unrealised.

8.7.4 Mitigation Measures

Bloomfield currently undertakes a number of monitoring, management and mitigation activities in relation to identified community concerns, which include noise, blasting and air quality monitoring; rehabilitation of land to minimise visual impact; manning of a 24 hour community hotline; and regular meetings of the CCC. It also contributes to wider community needs through the Bloomfield Foundation and other programs. These programs and protocols would continue to be implemented throughout the life of the Project which would ensure that social amenity impacts are minimal and community benefit is maximised. No additional mitigation measures related to social and economic impacts would be required for the Project.

8.8 Other Matters

8.8.1 Aboriginal and Historic Heritage

Introduction

This section provides an assessment of the potential impacts of the Project on Aboriginal and historic heritage. Documents reviewed as part of the desktop assessment include the following:

- *Aboriginal Heritage Impact Assessment: Bloomfield Colliery Completion of Mining and Rehabilitation, Part 3A Environmental Assessment*, prepared by South East Archaeology, November 2008;
- *Bloomfield Colliery, Hunter Valley, New South Wales: Completion of Mining and Rehabilitation Project – Report on Salvage of Aboriginal Objects*, prepared by South East Archaeology, July 2012;
- *Bloomfield Colliery, Hunter Valley, New South Wales: Completion of Mining and Rehabilitation Project – Aboriginal Heritage Impact Assessment – Addendum Report on Assessment of Additional Area*, prepared by South East Archaeology, September 2012;
- *Bloomfield Colliery, Hunter Valley, New South Wales – Report on Salvage of Artefacts Identified During Aboriginal Monitoring*, prepared by South East Archaeology, April 2014; and
- *Bloomfield Colliery, Hunter Valley, New South Wales – Report on Salvage of Artefacts Identified During Aboriginal Monitoring*, prepared by South East Archaeology, February 2016.

In addition, searches of the following databases were undertaken on 13 July 2017 to identify previously recorded heritage items in proximity to the Project area:

- Aboriginal heritage:
  - Aboriginal Heritage Information Management System (AHIMS) (OEH, 2017);
- Historic Heritage:
  - State Heritage Register;
  - Cessnock LEP 2011;
  - Maitland LEP 2011; and
  - National Heritage List.

Copies of the searches results are provided in **Appendix I.**

Existing Environment

Aboriginal Heritage

A search of the AHIMS database was undertaken on 13 July 2017[3] and identified 15 previously recorded Aboriginal heritage sites in the vicinity of the Project Area (refer **Appendix I**).

The Aboriginal Heritage Impact Assessment undertaken for the previous 2008 EA included a review of the archaeological background of the Project area, searches of relevant heritage databases, and field survey of the Project Area. This included a comprehensive program of consultation with the local Aboriginal community, including the Mindaribba LALC, the Lower Hunter Wonnarua Council and the Awabakal Traditional Owners Aboriginal Corporation.

A predictive model was constructed to identify areas of high archaeological potential, in which the Project area was divided into 'modified' and 'unmodified' areas based on past and existing land use. 'Modified' areas included land that had been extensively impacted by past mining activities, earthmoving works or building, such that there was negligible potential for Aboriginal heritage items to survive. 'Unmodified' areas included land yet to be mined (immediately west of the S Cut and southwest of the Creek Cut) in which there remained some potential for heritage evidence.

[3] The AHIMS search remains valid for twelve months

The field surveys identified a total of six Aboriginal heritage sites (referred to as B2, B16, B18, B19, B20 and B22), comprising 19 loci of identified evidence within the 'unmodified' area. These were all stone artefact occurrences, containing 53 lithic items in a very low density distribution. These sites were assessed as being of low scientific significance within a local context.

Project Approval (MP 07_0087) was granted for the Project on 3 September 2009. An ACHMP was subsequently prepared in accordance with the Project Approval conditions of consent. The ACHMP was prepared in consultation with the OEH and was approved by the DP&E on 27 May 2010.

Archaeological salvage of the six Aboriginal heritage sites identified during the field surveys was undertaken by South East Archaeology in 2010 in accordance with the ACHMP. Representatives from Mindaribba LALC participated and monitored the process, which included surface collection of all visible artefacts and documentation of artefacts collected. In all, 79 artefacts were salvaged and are being stored at the Colliery.

Several other heritage investigations have since been conducted at the Colliery, including archaeological monitoring during the stripping of vegetation and topsoil in preparation for mining activities. In 2014, representatives of the Mindaribba LALC monitored the initial vegetation and topsoil removal from within a 3.8 hectare area of previously undisturbed land. Six stone artefacts were identified and were recorded, assessed and collected by South East Archaeology and Mindaribba LALC. The salvaged artefacts are being stored at the Colliery.

In 2014 an additional 3.8 hectares was stripped of topsoil in preparation for mining activities. In accordance with the approved ACHMP Bloomfield engaged an archaeologist and the Mindaribba LALC to monitor the ground disturbance works and salvage identified artefacts. A further six stone artefacts were salvaged and are being stored at Bloomfield Colliery.

In 2016 an additional three hectares was cleared of vegetation and stripped of topsoil in preparation for mining activities. Representatives of the Mindaribba LALC and South East Archaeology monitored the ground disturbance works and one additional artefact was identified. The stone artefact was recorded, assessed and collected in accordance with the ACHMP and is being stored at Bloomfield Colliery.

Historic Heritage

Historical records indicate that there has been a long period (approximately 180 years) of non-Aboriginal use of the Project area, including for timber harvesting, coal extraction and pastoral use. During this time, mining has occurred on the site using both underground and open cut methods.

A search of relevant heritage databases was undertaken on 13 July 2017. There are three listed heritage items in the vicinity of the Project Area (refer **Figure 26**):

- Buttai No. 1 Reservoir (Lot 1, Buttai Road);
- Buttai No. 2 Reservoir (Lot 1, Buttai Road); and
- Buttai Cemetery / Elliot Family Graves (659 John Renshaw Drive).

The Buttai Reservoir No. 1 and No. 2 are listed on the Hunter Water Corporation Section 170 Register and are located approximately 330m from the Project Area at its nearest point and approximately 1km north of proposed extraction areas. Buttai Reservoir No. 1 is the oldest operating reservoir within the Hunter Water system and was constructed as an intermediate water storage for the original water supply scheme which pumped water from the Hunter River into Newcastle. Buttai Reservoir No. 2 was part of the 1920s expansion to the Walka system and was built adjoining Reservoir No. 1. The Reservoirs continue to function within the modern water supply system.

The Buttai Cemetery is listed on the Cessnock LEP 2011 as locally significant and is located on Bloomfield owned land adjacent to the Project Area to the south. The cemetery contains a range of monuments dating from 1874 to 1976, documenting the history of the Elliot family.

Impact Assessment

Aboriginal Heritage

The Project would have no additional impact on Aboriginal heritage sites as mining would be undertaken within the existing approved extraction area. The previous Aboriginal Heritage Impact Assessment concluded that potential impacts of the mining operations on Aboriginal heritage would be low.

Mining operations are currently undertaken in accordance with the approved ACHMP prepared for the site, which documents the procedures for archaeological survey, collection, documentation and storage of Aboriginal heritage items in consultation with Aboriginal groups and regulatory authorities. The approved ACHMP would continue to be implemented for the management of Aboriginal cultural heritage within the Project area.

Historic Heritage

Given the historical use of the site for underground and open cut mining, various relics may be on the site in the form of buried disused equipment or other infrastructure. However as noted in the previous 2008 EA, the requirement to obtain an excavation permit under the *Heritage Act 1977* does not apply to transitional Part 3A projects assessed under the former Part 3A (repealed) provisions of the EP&A Act.

The 2008 EA did not identify any heritage listed items in the vicinity of the Project Area, however there are three heritage items on or adjacent to the Project Area that are now listed on the Cessnock LEP or on the Hunter Water Corporation s.170 Register. This EA therefore includes consideration of the potential impact to these items as a result of the Project.

The Buttai Reservoir No. 1 and No. 2 are located over 1km from the proposed extraction areas. Given the distance of these items from active mining pits, the Project would not result in direct impact to these items.

The Buttai Cemetery is on land owned by Bloomfield and is immediately adjacent to the Project Area, south of the active open cut pit S-Cut (South) (**Figure 26**). General mining activities, such as the operation of large vehicles and blasting activities, in particular the associated ground vibrations, have the potential to impact the structural integrity of heritage sites, such as the Buttai Cemetery.

Blasting activities are undertaken in accordance with EPL 396 conditions and requirements, which includes the following criteria:

- The airblast overpressure level from blasting must not exceed 115 dB (Lin peak) for more than 5% of the total number of blasts each year, and must not exceed 120dB (Lin peak) at any time, at the relevant blast monitoring points; and
- The ground vibration peak particle velocity from blasting operations must not exceed 5 mm/second for more than 5% of the total number of blasts each year, and must not exceed 10 mm/second at any time, at the relevant blast monitoring points.

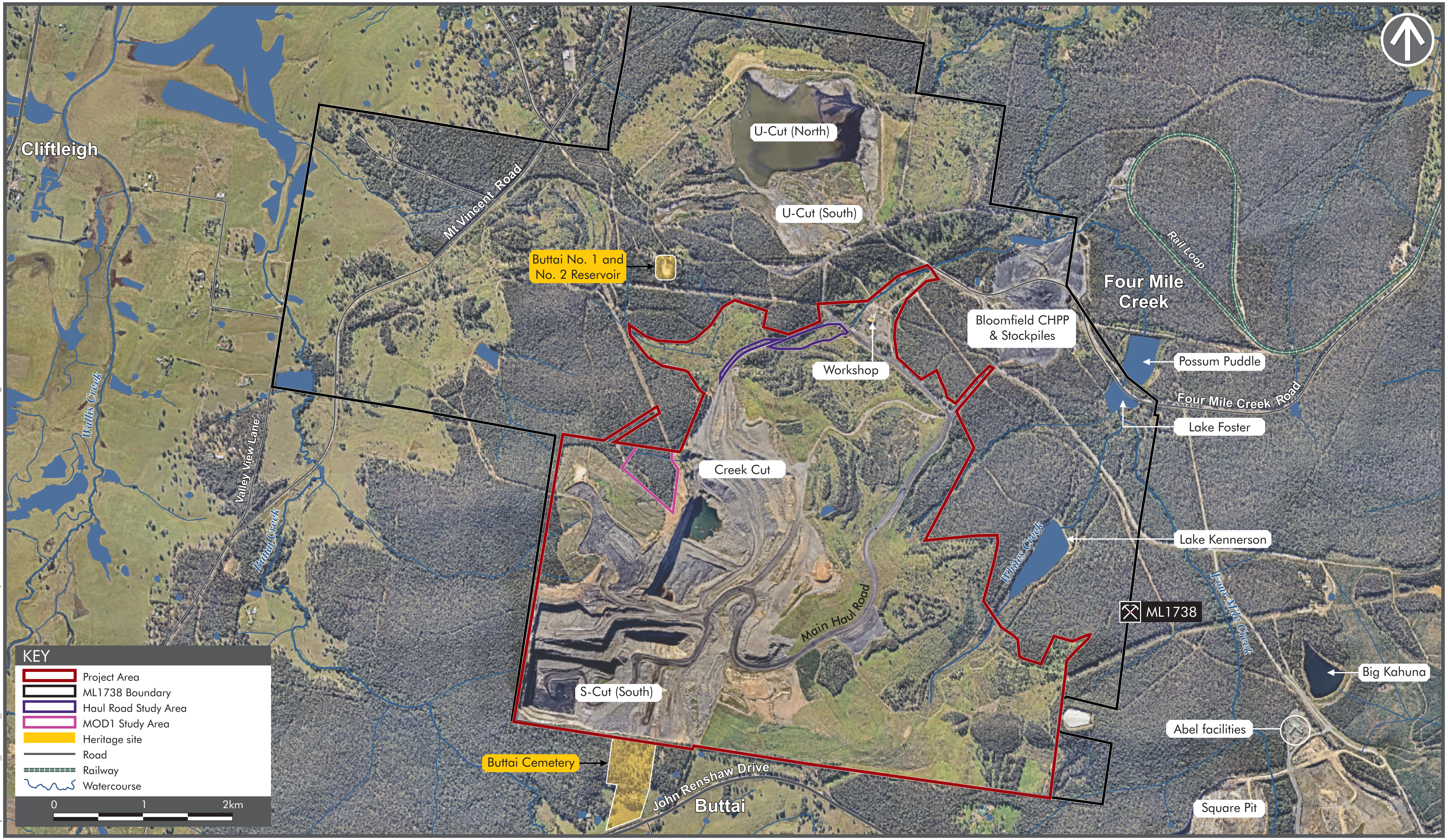
A blast monitoring plan is implemented at the site and blast monitoring is undertaken at four nearby residences for ground vibration and overpressure. The nearest blast monitoring point to the Buttai Cemetery is monitoring point N (refer **Figure 19**), which is located south of the John Renshaw Drive. Review of Bloomfield's AEMRs for the previous five years (2012 – 2016) indicates that blasting results at monitoring point N complied with the EPL criteria.

The 2008 EA included an assessment of potential blasting impacts and concluded that the predicted airblast and ground vibration levels would meet the relevant blasting criteria at all residences surrounding the development during all operational stages of the Project. Monitoring results reported in Bloomfield's AEMRs demonstrate that mean and median ground vibration and overpressure are at or below the levels predicted in the 2008 EA.

It is noted that the most vibration-intensive activities south of the Project area have already occurred, and potential vibration impacts to the Buttai Cemetery would become less likely to occur as mining progresses further north.

Mitigation Measures

Existing management measures would adequately manage potential impacts to Aboriginal heritage items. Mining operations would continue to be undertaken in accordance with the approved ACHMP and relevant legislative requirements. Bloomfield would continue to consult with the Aboriginal community groups and regulatory authorities as per the procedures set out the ACHMP. Blast monitoring would continue to be conducted to confirm that airblast and ground vibration levels meet relevant blasting criteria. The existing EMS and relevant management plans would be updated to incorporate the Project.



HERITAGE ITEMS
Bloomfield Project

FIGURE 26

8.8.2 Hazard and Risk

Existing Environment

Potential hazards and risks associated with operation of the existing Colliery include the storage of hazardous goods, hydrocarbon contamination, bushfire, spontaneous combustion and mine subsidence.

Storage of Hazardous Goods

Bloomfield has submitted a dangerous goods notification to SafeWork NSW (formerly known as WorkCover NSW) and holds a licence to store and handle explosives in accordance with Work Health and Safety (WHS) legislation for substances stored on site. The notification covers depots for explosives, distillate, gas cylinder stores, sodium hydroxide and methyl isobutyl carbinol (MIBC) reagent.

Explosives are stored in an explosive magazine located on site. The magazine complies with the relevant standards for storage of explosives. Bulk materials are also stored on site in a hopper for loading into a mobile mixing unit. This area is enclosed within concrete bunding and spillages are directed into a collection tank for periodic evacuation by a licensed contractor.

A bunded fuel farm, designed in accordance with Australian Standard *AS 1940: 2004 The storage and handling of flammable and combustible liquids*, is used for bulk distillate storage at the open cut workshop. Spill protected racks are used for small volume oil and lubricant storage. Distillate, MIBC and sodium hydroxide used for coal processing in the CHPP are stored in tanks contained in bunded enclosures.

ChemAlert is an online Material Safety Data Sheet (MSDS) database service and is used to provide current MSDS information. If new chemicals are introduced to site, they must comply with system requirements and be approved by the Mine Manager.

Hydrocarbon Contamination

There are no areas of hydrocarbon contamination previously identified within the Colliery mining lease area. Existing management practices therefore focus on prevention of contamination. Bulk hydrocarbon storages are located within bunded areas with a volume capable of containing greater than 110 per cent of the largest storage tank.

All machinery is fitted with quick fill mechanisms. The inlets and outlets, at the refuelling bay and mobile tanker are positively closed with an automatic cut off when full. This refuelling method is quick and minimises any potential for spillage during the refuelling operation.

Hydrocarbon storage infrastructure at the CHPP and open cut is inspected regularly and documented maintenance check sheets are completed quarterly. A dedicated contaminated soil land farming area is established on-site to treat hydrocarbon contaminated soils due to accidental spills.

Bushfire

A Bushfire Management Plan for Bloomfield Colliery was prepared in consultation with representatives of the NSW Rural Fire Service (RFS). The plan divides the site into 44 fire management sectors, describes fire risk levels across the site, and outlines site features relevant to fire management such as vegetation type, access trail locations, asset locations, and water supplies. Periodic inspections are undertaken in conjunction with the RFS to identify areas requiring bushfire control measures.

Weather conditions permitting, hazard reduction burns are conducted periodically by the RFS. Selection of burn location is based on risk levels, as determined by fuel load assessment and location of assets/asset protection zones. Hazard reduction clearing/slashing is also undertaken by Bloomfield along fire trails, asset protection zones and the mine boundary, in consultation with the RFS.

Spontaneous Combustion

Historically, the Colliery site does not have a problem with spontaneous combustion. Routine mine inspections include monitoring for spontaneous combustion. As reported in the last three AEMRs submitted by Bloomfield, no major spontaneous combustion incidences were recorded, with only a small area of spontaneous combustion identified in an overburden dump. Management practices include capping with clay to seal off the available air supply.

Mine Subsidence

Areas of the Bloomfield mining site (CCL 761 and ML 1738) are undermined by historic underground workings, some relatively shallow. Sink holes associated with shallow workings are infrequent, but have previously been identified. In the event that sink holes are identified, the standard management procedure is to flag off and isolate the sink hole from access, back fill the holes and monitor for further subsidence. Once deemed stable, the area is rehabilitated and period inspections are undertaken.

Impact Assessment and Mitigation

The Project is not seeking changes to the intensity or general extent of mining, and does not involve changes in the mining equipment fleet or mining method compared to existing operations. Therefore the Project is not expected to pose additional hazards and risks above those associated with the existing operation of the Colliery. These aspects would continue to be managed through implementation of the existing mine management framework.

The hazardous goods required for the Project would be the same as those currently required for the Colliery operations, and the storage of hazardous goods would continue to be managed under the existing management procedures.

The Project would not result in increased risk of bushfire. As the mine plan progresses and final landform levels are reached, rehabilitation would result in the progressive increase in vegetation. Initially this would comprise grasslands with those areas marked for greater vegetation coverage progressively rehabilitated. Revegetation and existing grassland areas would be subjected to ongoing management (e.g. cattle grazing or slashing) to minimise fuel levels. The Colliery would also continue to undertake hazard reduction burns in accordance with existing procedures and in consultation with the RFS to manage fuels load.

The Project would not result in an increased risk of contamination as a result of fuel or hydrocarbon spills. The potential impacts of contamination to the receiving environment would be mitigated through the continued implementation of existing plant maintenance schedules, management systems and protocols. Incidents and emergencies would continue to be managed in accordance with the Bloomfield Incident Management System, the Bloomfield Mining Operations Incident Notification Procedure and the relevant Hazard Management System.

Given the historically low potential for spontaneous combustion at the Colliery, the ongoing mining within the same coal seams is not likely to increase the potential for spontaneous combustion within spoil material in emplacement areas. Monitoring for spontaneous combustion would continue to be undertaken as part of routine mine inspections.

Mining activities proposed as part of the Project would be within the existing approved extraction area, and the mine plan has been developed with consideration of previous underground workings. Existing procedures for monitoring, remediation and rehabilitation of subsidence would continue to be implemented where required.

8.8.3 Waste

Existing Environment

Wastes generated at the Colliery are classified and separated in accordance with the EPA's Waste Classification Guidelines (EPA, 2014) and managed in accordance with Bloomfield's Waste Management System. Waste volumes generated in 2015 and 2016 at the Colliery are provided in **Table 27**, as reported in the respective AEMRs for the Colliery (Bloomfield, 2015; 2016).

Table 27 Waste Volumes Generated

Waste Stream	2015	2016
ROM coal produced	1,220,000	1,245,000
Waste rock (bank cubic metre)	5,912,000	5,918,000
Processing waste (tonnes)	477,000	498,000
Waste oil (litres)	74,000	81,000
Waste oil filters (tonnes)	4	3
Waste metal (tonnes)	210	254
General waste (tonnes)	45	41
Waste paper and cardboard (tonnes)	10	9

Waste oil filter, general waste, paper and cardboard and paint waste are collected by licensed contractor for disposal. Wastes are recycled where possible.

Waste oil from scheduled maintenance of mining equipment and the workshop oil separator is collected in a storage tank and periodically evacuated for reprocessing and re-use by a licensed waste oil contractor. The waste contractor re-synthesises the waste oil to a fuel oil product for re-use in ammonium nitrate – fuel oil (ANFO) explosive for blasting operations.

Bloomfield has a well implemented scrap metal recycling program, and has a high rate of onsite re-use of suitable steel. If no longer suitable for re-use, scrap metal is collected in designated skips and sold for recycling.

As there is no recycling process available for heavy earthmoving machinery types, waste tyres are used on site wherever possible for the protection of the base of concrete plinths and metal columns located in areas where heavy vehicles are operated. Surplus tyres are disposed of progressively in the open cut void, then backfilled with overburden and rehabilitated in accordance with rehabilitation procedures.

Waste generated on site, consisting of domestic waste from bathhouses, administration offices and associated amenity areas, passes through a Cessnock City Council approved anaerobic waste water treatment system.

The management and disposal of process waste from the CHPP, which includes reject material and fine tailings, is approved under the Abel Project Approval and therefore does not form part of this Project.

Impact Assessment and Mitigation

The Project does not involve an increase in production levels at the Colliery and therefore are not expected to increase the wastes generated. Typical waste volumes generated by the Project would be similar to existing levels as shown in **Table 27**. Waste management procedures currently implemented at the Colliery are considered to be sufficient to manage potential waste impacts associated with the Project and as such additional waste mitigation measures would not be required.

Waste Resource Exemptions

As advised by the EPA, Bloomfield must take into consideration the disposal of mine wastes, including tailings and course rejects, pursuant to any relevant resource recovery order and exemption. Two exemption orders have been identified as potentially applicable to the Mine, being:

- The coal washery rejects order and exemption; and
- The coal washery rejects (coal mine void) order and exemption.

Process waste from the CHPP, including coarse rejects and tailings emplacement, is managed under the conditions of EPL 396. As the process waste from the CHPP would remain within the same EPL premises, these exemptions are not applicable to the Project. Current waste management practices would continue to be implemented for the Project.

8.8.4 Traffic and Transport

Existing Environment

The Colliery is located north of John Renshaw Drive, east of Buchanan Road, and west of the New England Highway. The nearest public road to the Project area is the John Renshaw Drive, which provides a critical connection between the M1 Pacific Motorway, the Hunter Expressway and the New England Highway.

Access to the Colliery is via Four Mile Creek Road off the New England Highway. A secondary access point is available via Buttai Road, however this is not used as a daily access point and is restricted with a locked gate.

There are a number of internal mine roads within the Project area which provide access to active mining areas and link major infrastructure components of the Colliery (e.g. the workshop, CHPP and ROM coal stockpile).

Saleable coal is transported via rail to the Port of Newcastle for export. Operation of the rail loading facility is approved under the Abel Project Approval and does not form part of this Project.

Potential Impacts

The Project would not result in an increase in traffic movements or transportation of materials. The Project would utilise the existing workforce and there would be no increase in traffic movements associated with site personnel. Transport of materials within the Project area would remain consistent with existing approved operations. As such, additional traffic mitigation measures would not be required.

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9.0 Cumulative Impacts Summary

Cumulative impacts result from the aggregation and interaction of impacts on a receptor and may be the product of past, present or future activities (Franks, et al. 2010). There are two separate levels of cumulative impacts considered:

- Localised cumulative impacts of the Project on the Project area. This includes the interaction of Project impacts that in combination can cause increased effects on the environment or sensitive receptors; and
- Regional interaction with other mining developments in the area. This includes the contribution of the Project to other impacts occurring at a regional scale.

Specific consideration of cumulative impacts of the Project has been incorporated into the impact assessment for the following environmental aspects;

- Air quality (**Section 8.3**);
- Noise, vibration and blasting (**Section 8.2**); and
- Water resources, including groundwater (**Section 8.5**) and surface water (**Section 8.4**).

The impact assessments for these environmental aspects concluded that the cumulative impacts of the Project would be unlikely to represent a significant impact. While there is some potential for cumulative impacts to occur, the use of reactive and predictive mitigation systems would reduce the likelihood of these impacts occurring. For example, predictive meteorological modelling software can be used to identify weather conditions that may exacerbate dust impacts from planned operations, and therefore operational procedures can be amended to prevent these impacts from occurring.

The interaction between Abel Underground Mine operations has also been incorporated into the assessment of potential impacts. While Abel Underground Mine is currently in care and maintenance, this EA has assessed the potential impacts of the Project with the operation impacts from the Abel Underground Mine included. This has provided a conservative estimate of potential impacts and incorporates the potential for Abel Underground Mine to resume operations in the future.

9.1 Conclusion

As the impact of the individual factors of the Project are minimal, no significant cumulative impact is anticipated for the Project provided the measures presented in **Section 10.2** are implemented. The cumulative impact of the Project with other known projects currently operating or proposed for the area as described above, is also considered to be minimal.

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10.0 Statement of Commitments

10.1 Environmental Management and Monitoring Program

10.1.1 Operation Environment Management System

The Mine currently operates under the EMS discussed in **Section 4.2.11**. Management plans that form the basis of the EMS have been developed to identify, analyse, evaluate and manage all significant potential and actual risks and impacts of activities and operations on the environment and the community. The EMS would continue to be adopted during the Project and would be updated and augmented where required to incorporate additional environmental management requirements.

10.2 Mitigation Measures

Management and mitigation measures outlined in this section would be implemented throughout the detailed planning, construction and operational phases of the Project, should it proceed. These safeguards would minimise any potential adverse impacts arising from the Project on the surrounding environment. The management and mitigation measures recommended for the Project are summarised in **Table 28**.

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Table 28 Summary of management and mitigation measures

Ref#	Management and Mitigation Measures	Timing
Biodiversity		
1	**Existing measures** The Colliery has established clearing practices in place as part of its EMS. These include minimisation of disturbance areas, pre-clearance surveys, salvaging and reusing material on site for habitat enhancement, conserving and reusing topsoils and weed management. These clearing practices would continue to be implemented for the Project in accordance with the approved EMS.	Duration of the Project
2	**Pre-clearance surveys** Pre-clearance surveys of the forest to be removed would be conducted within 24 hours prior to commencement of clearing to identify any fauna species or habitat within areas of impact. Where clearing of vegetation and fauna habitat occurs, clearing protocols would be put in place, including checking trees for the presence of arboreal fauna prior to felling. Where feasible, animals found to be occupying trees would be safely relocated into nearby forest that would not be disturbed. Where feasible, transportable habitat features such as large logs and boulders would be placed in adjacent retained areas or in areas ready for seeding, to allow their continuation as potential fauna refuge sites.	Prior to clearing activities
3	**Regent Honeyeater and Swift Parrot** In addition to these general fauna pre-clearance methods, the following measures would be implemented to mitigate potential impacts on habitat for the Regent Honeyeater and Swift Parrot: · A qualified ecologist would undertake a targeted pre-clearance survey within 24 hours prior to the commencement of removal of potential foraging habitat for the Regent Honeyeater and Swift Parrot (potential foraging habitat includes the entire 6.12 ha study area); · Pre-clearance surveys would be undertaken over a period of two days and surveys would be undertaken in the morning (i.e. within 3 hours of sunrise) to target the species highest activity period. Dependent on the clearing schedule, the survey effort would comprise: - 20 minute searches in areas up to 5 ha; or - 40 minute searches in areas of 6 – 30 ha. · If Regent Honeyeaters or Swift Parrots **are not found** within the clearance area, then searches for Regent Honeyeater or Swift Parrot habitat trees (foraging trees) are not required; · If Regent Honeyeaters or Swift Parrots **are found** within the clearance area, targeted searches for Regent Honeyeater or Swift Parrot habitat trees would be undertaken by a qualified ecologist; · If habitat trees are found within the clearance area, a qualified ecologist would mark the trees with flagging tape and spray paint (e.g. with a ‘H’, denoting habitat tree); · The two stage clearance protocol for habitat trees comprises: - Stage 1: Non-habitat trees would be cleared 24 hours prior to any habitat trees being cleared, to encourage	Prior to and during clearing activities

Ref#	Management and Mitigation Measures	Timing
	Swift Parrots to move out of the habitat area; and - Stage 2: When Stage 1 is complete, habitat trees can be removed.	
4	**Weed control, microhabitat retention and demarcation** Other management strategies would include: · Appropriate weed controls to avoid incursion of exotic weed species into the remaining surrounding forest; · Salvaging microhabitat features, such as woody debris and logs, within adjacent suitable habitat, where possible to mitigate potential impacts to ground-swelling fauna; and · Habitat adjacent to the proposed clearing would be demarcated to avoid accidental clearing. Vegetation clearing would be minimised and avoided where possible. Where opportunities for reduction in clearing extents occur, these would be implemented and micro-habitat features retained.	Duration of the Project
5	**Construction of Haul Road Upgrade** Additional mitigation measures to be implemented during construction of the haul road upgrade would include: · Appropriate exclusion fencing would be installed around vegetation to be retained directly adjacent to the development footprint; - Appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' would be installed; - The location of any 'No Go Zone' would be identified in site inductions; - Fencing would be secured with star pickets and would use high visibility bunting; · All material stockpiles, vehicle parking and machinery storage would be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation; · A licenced wildlife salvage team would be on-site during vegetation removal to catch and relocate (if appropriate) wildlife encountered; · Where appropriate, native vegetation cleared from the development site would be mulched for reuse on the site, to stabilise bare ground; · Temporary stormwater controls would be implemented during construction to ensure that discharges to the drainage channels are consistent with existing conditions; and · Sediment and erosion control measures would be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect drainage channels. These would conform to relevant guidelines, would be maintained throughout the construction period and would be carefully removed following the completion of works.	During haul road upgrade works
6	**Biodiversity Offset Strategy** Ten ecosystem credits would be required to offset the impacts arising from the Project, and Bloomfield would pay the required offsetting cost (currently estimated to be $22,007.08 including GST) into the Biodiversity Conservation Trust.	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
Noise		
7	Bloomfield would continue to implement noise and blasting management measures in accordance with the Noise Monitoring Plan and the Blasting Monitoring Program currently utilised at the Colliery to minimise the noise and vibration impacts to surrounding receivers. This includes scheduling of mining operations with regard to predicted weather conditions. During reduced night-time operations under prevailing weather conditions, potential noise impacts at Location M would be minimised by undertaking coal haulage via the alternate haul road (that is, Scenario 2). The Noise Monitoring Plan and Blasting Monitoring Program would continue to be implemented for the duration of the Project and would be updated to reflect the Project as required.	Duration of the Project
Air Quality		
8	Bloomfield would continue to implement air quality management measures currently used at the Colliery, including the predictive management system, to mitigate air quality emissions from its operations as discussed in **Section 8.3.3**. This includes a reactive dust mitigation strategy and forecast management system. Bloomfield would continue to monitor and report its GHG emissions in accordance with the ESAP and legislative requirements. The Air Quality Monitoring Program and Blast Monitoring Program would continue to be implemented for the duration of the Project. Existing management plans and procedures would be updated to reflect the Project as required.	Duration of the Project
Soils and Water		
9	**Mine Water Management** The existing Water Management Plan would be reviewed and revised to incorporate the Project and ensure that the management of soil and water continues to: · Stay current and consistent with relevant guidelines and best practice; · Account for projected changes in operation; and · Update water balance modelling and projections on the basis of observed results (i.e. variations in mine water make, groundwater monitoring). At such time that Abel returns to production, reconsideration of the water balance would be undertaken as part of the ongoing management plan review process. This would enable and support appropriate planning to ensure mine water and tailings would continue to be contained on site.	Duration of the Project
10	**Catchments** Rehabilitated catchments would continue to be managed as per the existing Water Management Plan and Rehabilitation Management Plan, in accordance with the following principles: · Rehabilitated landform would be progressively rehabilitated; · Runoff from areas undergoing rehabilitation would be managed with appropriately designed water and sediment management structures (contour banks, drains, and drop structures); and · Ongoing monitoring of the landform would be carried out to repair and restore areas of erosion or instability. Discharge of water from the final landform would not occur to Four Mile Creek or Buttai Creek and its tributaries until	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
	the catchment is considered 'rehabilitated' in accordance with the Rehabilitation Monitoring Plan and associated regulator sign-off and approvals.	
11	**Surface Water Quality** Potential impacts to receiving waters would be mitigated through implementation of the mine water management system, which includes: · Runoff from undisturbed and rehabilitated areas would be directed away from operational areas and mine water storages via diversion banks and channels; and · Mine and sediment water would be collected for treatment before discharge via Lake Kennerson, Lake Foster and sediment basins to intercept runoff from disturbed areas. Surface water monitoring would continue to be undertaken in accordance with Bloomfield's EPL 396. The existing monitoring program would be periodically reviewed to ensure the program continues to be adequate and consistent with current guidelines and policy requirements.	Duration of the Project
12	**Erosion and Sediment Control** The erosion and sediment control plan would continue to be implemented to ensure that the discharge of all water from the site is managed and meets appropriate quality standards. Key elements of the erosion and sediment control plan include: · Coordination of mining to minimise exposure to disturbed soils; · Separation or diversion of clean water catchments from disturbed areas to minimise sediment laden and mine water volumes for management; · Collection and management of runoff sediment control devices; · Appropriate storage and handling of topsoil materials; · Revegetation of disturbed areas following site disturbance; and · A maintenance program for control structures.	Duration of the Project
Groundwater		
13	**Monitoring** Ongoing quarterly monitoring of the onsite piezometer network and monthly surface water monitoring would continue to be implemented to monitor the drawdown effects from depressurisation of the regional aquifer. The installation of additional monitoring points would be considered where areas of predicted drawdown are significantly different to that of actual drawdown. The frequency of water level measurements within the pit should be compatible with evaporation rates obtained from the site's weather station which will allow refinement of model calibration and inflow predictions.	Duration of the Project
14	**Management** Bloomfield has an existing Water Management Plan (WMP) which details the monitoring and management measures which are currently in place for the management of groundwater (and surface water) at the Colliery. The WMP would be reviewed and updated in accordance with the conditions of consent to monitor groundwater levels in monitoring	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
	wells and in the pit. Groundwater discharge would be monitored to quantify pit inflows to ensure the discharge licence conditions are satisfied. The monitoring data collected from groundwater and surface water systems enables management of groundwater by: · Establishment of groundwater and surface water trigger levels based on the beneficial use of each water body; · Development of mitigation measures which may include the provision of 'make good' measures in bores where excessive drawdown may be experienced. This could involve deepening a water supply bore or providing an alternative water supply. No surface water mitigation measures are proposed due to the minimal predicted impacts; · Plotting of groundwater level data as hydrographs and comparing to rainfall; and · Collation of the results of the groundwater monitoring program on an annual basis and presenting in an annual report as required under the conditions of consent.	
Visual Impacts and Rehabilitation		
15	The Colliery has established rehabilitation and monitoring procedures as part of its RMP and MOP for the site. These rehabilitation methods would continue to be implemented for the duration of the Project. Geotechnical investigations would be conducted by qualified geotechnical specialists to guide the tailings emplacement strategy and capping requirements and management strategies recommended would be implemented for the Project. Existing management plans and procedures, including the RMP and MOP, would be updated to reflect the Project as required. Any changes to the final landform would be subject to discussion with the relevant agencies (including DRG).	Duration of the Project
Social and Economic		
16	Bloomfield currently undertakes a number of monitoring, management and mitigation activities in relation to identified community concerns, which include noise, blasting and air quality monitoring; rehabilitation of land to minimise visual impact; manning of a 24 hour community hotline; and regular meetings of the CCC. It also contributes to wider community needs through the Bloomfield Foundation and other programs. These programs and protocols would continue to be implemented throughout the life of the Project which would ensure that social amenity impacts are minimal and community benefit is maximised. No additional mitigation measures related to social and economic impacts would be required for the Project.	Duration of the Project
Aboriginal and Historic Heritage		
17	Existing management measures would adequately manage potential impacts to Aboriginal heritage items. Mining operations would continue to be undertaken in accordance with the approved ACHMP and relevant legislative requirements. Bloomfield would continue to consult with the Aboriginal community groups and regulatory authorities as per the procedures set out the ACHMP. Blast monitoring would continue to be conducted to confirm that airblast and ground vibration levels meet relevant blasting criteria. The existing EMS and relevant management plans would be updated to incorporate the Project.	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
Hazard and Risk		
18	Hazards and risks would continue to be managed through implementation of the existing mine management framework: · The storage of hazardous goods would continue to be managed under the existing management procedures. · The Colliery would continue to undertake hazard reduction burns in accordance with existing procedures and in consultation with the RFS to manage fuels load. · The potential impacts of contamination to the receiving environment would be mitigated through the continued implementation of existing plant maintenance schedules, management systems and protocols. · Incidents and emergencies would continue to be managed in accordance with the Bloomfield Incident Management System, the Bloomfield Mining Operations Incident Notification Procedure and the relevant Hazard Management System. · Monitoring for spontaneous combustion would continue to be undertaken as part of routine mine inspections. · Existing procedures for monitoring, remediation and rehabilitation of subsidence would continue to be implemented where required.	Duration of the Project
Waste		
19	Current waste management practices would continue to be implemented for the Project.	Duration of the Project

11.0 Justification for Approval

11.1 Introduction

11.2 Biophysical, Economic and Social Considerations

Pursuant to Schedule 2, Clause 7(f) of the EP&A Regulation, the Project is justified in terms of biophysical, economic and social considerations as described below.

11.2.1 Biophysical

An assessment of the potential biophysical impacts of the Project has been undertaken as provided in **Section 8.0** of this EA. Assessment of potential biodiversity impact has demonstrated that the Colliery site is void of significant threatened biodiversity and the Project is unlikely to result in impacts to any listed species populations or communities. Assessment of potential surface and groundwater impacts identified that potential impacts would be minor and easily managed in accordance with current and proposed management practices.

11.2.2 Economic

The economic assessment addressed the potential impact, both positive and negative that the Project may have on a local, regional, State and national scale. This assessment concluded that the economic benefits far outweigh any potential negative economic benefits. The Project would support the ongoing employment of the mine existing workforce.

11.2.3 Social

The existing Colliery has a well-established relationship with the local community and surrounding areas. As the Colliery has been operating since the 1960s, its ongoing operation into the future does not represent a significant new disruption to the local community or the wider Hunter Region. The Project would have negligible impact on social aspects such as employment opportunities, housing, the provision of social services or impacts to social infrastructure. In fact, the Colliery would support the community through Bloomfield's ongoing support of various community, environmental and education groups, and the Bloomfield Foundation. Community participation regarding the Colliery is provided through the CCC, which would continue to be provided throughout the Project.

11.3 Ecologically Sustainable Development

Schedule 2 of the EP&A Regulation establishes four primary principles of ecologically sustainable development (ESD): the precautionary principle; intergenerational equity; biological diversity and ecological integrity; and valuation and pricing of environmental resources. The application of these principles to the assessment of the Project is discussed below.

11.3.1 Precautionary Principal

The Precautionary Principle, in summary, holds that where there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

A precautionary and conservative approach to development of the MOP has been employed to avoid or minimise potential impacts to the environment and community, including the following:

- Identifying sensitive environmental and manmade (John Renshaw Drive) features of the Project area and avoiding impacts to these features where possible and otherwise implementing measures to minimise unavoidable impacts; and
- Implementing predictive noise and air quality models to identify potential impacts ahead of time allowing operations to be modified and impacts avoided where possible.

A detailed understanding of the issues and potential impacts associated with the Project has been obtained through consultation and assessment to a level commensurate with the scale of the Project, industry standards, the level of environmental risk and the legislative framework under which the

Project is permitted. Specialist assessments, including the use of engineering and scientific modelling, have previously been undertaken to aid the design of the mine and for impacts relating to, air quality, noise and vibration, ecology, groundwater, surface water, biodiversity, Aboriginal heritage, European heritage, traffic, and visual to be understood. Assessment has also been undertaken for other issues, including social, economic, waste, hazards, and rehabilitation. To this end, there has been careful and thorough evaluation undertaken in order to recognise the potential for and then avoid where possible, serious or irreversible damage to the environment.

11.3.2 Intergenerational Equity

Intergenerational Equity is centred on the concept that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. There is a moral obligation to ensure that today's economic progress, which would benefit both current and future generations, is not offset by environmental deterioration.

The primary objective of the Project is to allow continued operation of mining and maintain the continuity of coal production from existing and proposed mining areas, optimising resource recovery for the life of mining in an environmentally and socially responsible manner. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases of the Project have been transparent. The contents of this EA (including appendices) has enabled the potential implications of the Project to be understood, and Bloomfield has committed to management strategies, mitigation measures and monitoring activities to ensure potential impacts are appropriately minimised.

11.3.3 Biological Diversity and Ecological Integrity

The principle of Conservation of Biological Diversity and Ecological Integrity should be a fundamental consideration for development proposals. The potential environmental impacts of the Project, including upon ecological communities and habitat values, and measures to ameliorate these potential impacts are described within this EA.

The Project has initially aimed to avoid and minimise potential impacts on ecological values during mine planning. A detailed ecological assessment undertaken for the Project in combination with the body of ecological knowledge obtained during the operation of the Colliery over the previous 25 years was used to provide a high level of certainty regarding the ecological constraints of the Project area. The ecological assessment concluded that the Project is unlikely to have a significant impact on any listed species, population or ecological community. Further to provide for the ongoing sustainability of regional ecology, impacts to native vegetation would be compensated for through the acquisition of offset areas as well as through the rehabilitation of native vegetation at appropriate locations within the Project areas.

11.3.4 Improved Valuation and Pricing of Environmental Resources

The principle of Improved Valuation and Pricing of Environmental Resources is based on environmental factors being included in the valuation of assets and services. The cost associated with using or impacting upon an environmental resource is seen as a cost incurred to utilise that resource.

As the Project seeks approval for the continuation of an existing mining operation with established mining infrastructure, no significant draw on resources is required to enable the Project to proceed. Therefore there would be negligible impacts to the price and value of resources as a result of the Project proceeding.

In order to mitigate the potential impacts of the Project, Bloomfield acknowledges and accepts the financial costs associated with all the measures required to avoid, minimise, mitigate and manage potential environmental and social impacts for the Project. For example, the cost of rehabilitation activities undertaken to minimise impacts to land resources following the completion of mining.

11.3.5 Climate Change and Greenhouse Effect

The Colliery would be operated in accordance with an ESAP that would drive a reduction in energy use in operations over time. With efficiency measures in place, the Colliery would be operated in a manner that reduces GHG production to the extent possible.

12.0 Conclusion

The Project seeks to extend the life of the existing Bloomfield open cut mining operation until 31 December 2030. The Project would allow the Colliery to continue its open cut mining operations and use existing mine infrastructure to process up to 1.3Mtpa of ROM coal within existing approved extraction areas.

The 'do nothing' alternative is also deemed unacceptable as it would involve closure of the Colliery and the loss of 93 jobs and other employment opportunities. Closure of the Colliery would mean that a large portion of the 13 million tonnes of ROM coal identified within the approval area would remain undeveloped and the potential economic benefits would not be realised for the community or local economy. The Project is considered to present the best balance for the community and environment as opposed to any alternative as it would utilise existing infrastructure for continued extraction of a valuable resource, provide continued employment for an additional nine years for the existing 93 personnel, support the local economy through indirect employment, servicing of contracts, and community engagements and sponsorship.

This EA has assessed the potential impacts of the Project in accordance with the EARs for the Project (issued on 16 November 2015 and subsequently revised on 22 March 2017). All relevant regulatory requirements and the findings from the consultation program undertaken for the Project have also been considered in its preparation.

The Project as designed, after considering all options, would maximise the continued social and economic benefits from the extraction of this coal resource. At the same time it would minimise any impacts to the natural environment. This EIS has assessed the Project against the requirements of the EP&A Act and the principles of ESD. This assessment has concluded that the Project is consistent with the objective of the Act and principles of ESD.

A range of positive benefits associated with the development have also been identified including the economic benefits to the local, regional and State economies including ongoing employment for the established workforce, royalties and benefits to local and regional governments and flow on spending within the local and regional communities. Specifically the Project would:

- Utilise existing mine infrastructure to continue resource extraction within an established operation;
- Provide continued employment for 93 existing site personnel;
- Contribute to the local and regional economy through ongoing contracts to a range of longstanding suppliers and contractors, servicing of existing customer contracts and payment of royalties and taxes;
- Facilitate increased spending in other sectors, stimulating the demand for goods and services; and
- Provide other social benefits which flow from community engagement and sponsorships programs.

The benefits of the Project would outweigh its potential impacts, with the implementation of the proposed management, mitigation and offset measures, as recommended by this EA, in place. It is considered that it is appropriate and in the public interest to approve the Project.

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13.0 References

AECOM (2015) *Environmental Impact Statement: Rix's Creek Mine – Continuation of Mining Project*, AECOM Australia Pty Ltd, Newcastle.

ANZECC/ARMCANZ (2000) *National Water Quality Management Strategy: Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environmental and Conservation Council (ANZECC) and Agriculture and Resources Management Council of Australia and New Zealand (ARMCANZ), October 2000.

ANZEC (1990) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*, Australian and New Zealand Environment Council, September 1990.

Australian Bureau of Statistics (ABS) (2011) *Cessnock (C) (Local Government Area) 2011 Census QuickStats*, viewed 25 August 2016, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/LGA11720?opendocument

Australian Bureau of Statistics (ABS) (2016) *Cessnock (C) (Local Government Area) 2016 Census QuickStats*, viewed 25 August 2016, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA11720?opendocument

Australian Standard *AS 2187: Part 2-2006 Explosives - Storage and Use - Part 2: Use of Explosives*

Bloomfield (2015) *Annual Environmental Management Report 2015*, Bloomfield Collieries Pty Ltd, 17 March 2016

Bloomfield (2016) *Annual Environmental Management Report 2016*, Bloomfield Collieries Pty Ltd, 27 March 2017.

Business Environment (2008) *Bloomfield Colliery Completion of Mining and Rehabilitation: Part 3A Environmental Assessment Project Application 07_0087*, dated 12 November 2008.

Department of the Environment and Energy (DoEE) (2017a) *Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2016: Incorporating the Quarterly Update: September 2016 quarter: Australian National Greenhouse Accounts*, Australian Government, Canberra.

Department of the Environment and Energy (DoEE) (2017b) *State and Territory Greenhouse Gas Inventories 2015: Australian National Greenhouse Accounts*, Australian Government, Canberra.

Department of Energy, Utilities and Sustainability (DEUS) (2005) *Guidelines for Energy Savings Actions Plans*, NSW Government, Sydney.

Department of Environment (DoE) (2013) *EPBC Act "Matters of National Environmental Significance: Significant Impact Guidelines 1.1* ". Australian Government, Canberra.

Department of Environment and Climate Change (DECC) (2008) *Managing Urban Stormwater: Soils & Construction – Volume 2E: Mines and Quarries*, NSW Government, Sydney, NSW.

Department of Environment and Conservation (DEC) (2006) *Using the ANZECC Guidelines and Water Quality Objectives in NSW*, NSW Government, Sydney.

Department of Infrastructure, Planning and Natural Resources (2004) *A guide to the Water Sharing Plan for the Hunter Regulated River Water Sources, 04_2004*. NSW Government, Sydney.

Department of Planning and Environment (DP&E) (2016) *Hunter Regional Plan 2036*, NSW Government, Newcastle.

Department of Primary Industries – Office of Water (DPI Water) (2012) *NSW Aquifer Interference Policy*. NSW Department of Primary Industries – Office of Water, Orange NSW.

Environment Protection Authority (EPA) (2014) *Waste Classification Guidelines: Part 1 Classifying Waste*, NSW Government, Sydney.

Environment Protection Authority (EPA) (2016) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Approved Methods).

Environment Protection Authority (EPA) (2000) *NSW Industrial Noise Policy*, NSW Government, Sydney NSW.

Hawley, S.P., Glen, R.A. and Baker, C.J. (1995) *Newcastle Coalfield Regional Geology 1:100 000. Geological Survey of New South Wales*, Sydney.

Katestone Environmental Pty Ltd (2011) *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*, Katestone Environmental Pty Ltd prepared for DECCW, 2010.

Lambert Geotech (2017) *Preliminary Geotechnical Assessment for Proposed Capping of Tailings Dam at Bloomfield Collieries*, Lambert Geotech Pty Ltd, Ashtonfield.

Landcom (2004) *Managing Urban Stormwater: Soils and Construction*, Volume 1, 41'" Edition.

Matthei, L.E. (1995) *Soil Landscapes of the 1:100 000 Sheet*. NSW Department of Land and Water Conservation, Sydney.

NSW Government (2014) Voluntary Land Acquisition and Mitigation Policy: For State Significant Mining, Petroleum and Extractive Industry Developments, NSW Government, 15 December 2014.

NSW Government (2015) *Indicative Secretary's Environmental Assessment Requirements (SEARs): For state significant mining developments:* NSW Government, October 2015.

Vanclay, F. (2012) *International Principles for Social Impact Assessment*, Impact Assessment and Project Appraisal, 21:1, 5-12.

Appendix A

Existing Mine Development Consent

Appendix A Existing Mine Development Consent

Project Approval

Section 75J of the *Environmental Planning and Assessment Act 1979*

As delegate of the Minister for Planning, I approve the project referred to in schedule 1, subject to the conditions in schedules 2 to 5.

These conditions are required to:
- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the project.

	Sam Haddad **Director-General**
SIGNED 3 SEPTEMBER 2009	
Sydney	2009

SCHEDULE 1

Application No:	07_0087
Proponent:	Bloomfield Collieries Pty Limited
Approval Authority:	Minister for Planning
Land:	See Appendix 1
Project:	Bloomfield Coal Project

May 2011 modification in red
March 2012 modification in blue
February 2013 modification in green

TABLE OF CONTENTS

DEFINITIONS

AEMR	Annual Environmental Management Report
BCA	Building Code of Australia
Biodiversity Offset Strategy	The Biodiversity Offset Strategy titled *Bloomfield Colliery Project Modification (07_0087 MOD 1) – Proposed Offset Strategy*, dated 31 March 2011, including the proposed Biodiversity Offset Area shown in Appendix 6
CCC	Community Consultative Committee
CHPP	Coal handling and preparation plant
Council	Cessnock City Council
Day	The period between 7am and 6pm on Monday to Saturday and between 8am and 6pm on Sunday and Public Holidays
Department	Department of Planning and Infrastructure
Director-General	Director-General of Department of Planning and Infrastructure, or delegate
DRE	Division of Energy and Resources (within the Department of Trade and Investment, Regional Infrastructure and Services)
EA	Environmental Assessment prepared for the Bloomfield Group entitled *Bloomfield Colliery Completion of Mining and Rehabilitation Part 3A Environmental Assessment Project Application 07_0087* Volumes 1, 2 and 3 (November 2008), including the response to submissions
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPL	Environment Protection Licence issued under the *Protection of the Environment Operations Act 1997*
Evening	The period between 6pm and 10pm
Land	The whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
LGA	Local government area
Material harm to the environment	Material harm to the environment as defined in *Protection of the Environment Operations Act 1997*
Mining operations	The removal and emplacement of overburden and the extraction of coal
Minister	Minister for Planning and Infrastructure, or delegate
Morning shoulder	The period between 6am and 7am, Monday to Saturday (excluding Public Holidays)
Night	The period between 10pm and 6am, Monday to Saturday and between 10pm and 8am on Sunday and Public Holidays
NOW	NSW Office of Water (within the Department of Primary Industries)
OEH	Office of Environment and Heritage
Privately-owned land	Land that is not owned by a public agency, or a mining company (or its subsidiary)
Proponent	Bloomfield Collieries Pty Limited or any other person or persons who rely on this approval to carry out the project that is subject to this approval
Project	The Bloomfield Coal Project described in the EA
Reasonable and feasible	*Reasonable* relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements. *Feasible* relates to engineering considerations and what is practical to build
Response to submissions	The Proponent's response to issues raised in submissions, dated 5 February 2009
ROM	Run-of-mine
Site	Land to which the project application applies (see Appendix 1 and 2)
Statement of Commitments	The Proponent's Final Statement of Commitments for Site Operations and Management in Appendix 3

SCHEDULE 2
ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all reasonable and feasible measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
   (a) EA;
   (b) Statement of Commitments;
   (c) modification application 07_0087 Mod 1 and Environmental Assessment titled *Extension of the Project Approval Area for Out-of-Pit Overburden Emplacement and Rehabilitation, Alternative Haul Road and Powerline Relocation*, prepared by Business Environment and dated September 2010;
   (d) the Biodiversity Offset Strategy titled *Bloomfield Colliery Project Modification (07_0087 MOD 1) – Proposed Offset Strategy*, dated 31 March 2011;
   (e) the modification application 07_0087 MOD 2 and letter entitled *Bloomfield Coal Project – Modification of PA 07-0087*, dated November 2011;
   (f) the modification application 07_0087 MOD 3 as requested by letter entitled *Bloomfield Coal Project – Modification of PA 07-0087*, dated 17 December 2012; and
   (g) conditions of this approval.

   Notes:
   - *The general layout of the project is shown in Appendix 2; and*
   - *The Statement of Commitments is reproduced in Appendix 3.*

3. If there is any inconsistency between the above documents, the more recent document shall prevail to the extent of the inconsistency. However, the conditions of this approval shall prevail to the extent of any inconsistency.

4. The Proponent shall comply with any reasonable requirements of the Director-General arising from the Department's assessment of:
   (a) any reports, plans, programs, strategies or correspondence that are submitted in accordance with the conditions of this approval; and
   (b) the implementation of any actions or measures contained in these reports, plans, programs, strategies or correspondence.

Limits on Approval

5. Mining operations may take place on the site until 31 December 2021.

   Note: Under this Approval, the Proponent is required to rehabilitate the site to the satisfaction of the Director-General and DRE. Consequently this approval will continue to apply in all other respects other than the right to conduct mining operations until the site has been rehabilitated to a satisfactory standard.

6. The Proponent shall not extract more than 1.3 million tonnes of ROM coal a year from the site.

Hours of Operation

7. Project operations may take place 24 hours per day, 7 days per week.

Management Plans / Monitoring Programs

8. With the approval of the Director-General, the Proponent may submit any management plan or monitoring program required by this approval on a progressive basis.

9. The Proponent shall prepare revisions of any strategy, plan or program required under this project approval if directed to do so by the Director-General. Such revisions shall be prepared to the satisfaction of, and within a timeframe approved by, the Director-General.

10. With the approval of the Director-General, the Proponent may integrate any strategy, plan, program, review, audit or committee required by this approval with any similar requirement under the development consent for the Donaldson Coal Mine and the project approval for the Abel Coal Mine.

Structural Adequacy

11. The Proponent shall ensure that all new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:
- *Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for the proposed building works.*
- *Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.*

Demolition

12. The Proponent shall ensure that all demolition work is carried out in accordance with *Australian Standard AS 2601-2001: The Demolition of Structures*, or its latest version.

Operation of Plant and Equipment

13. The Proponent shall ensure that all plant and equipment used on site is:
    (a) maintained in a proper and efficient condition; and
    (b) operated in a proper and efficient manner.

Community Enhancement Fund

14. The Proponent shall establish a Community Enhancement Fund of a minimum of $500,000 and implement expenditure from that fund to the satisfaction of the Director-General. Proposals for expenditure from the fund must:
    (a) be prepared by the Proponent in consultation with Council and the CCC and be submitted to the Director-General for approval by 31 December 2009;
    (b) be expended over the ten calendar years 2010-2019; and
    (c) include:
        - a minimum of $180,000 on local infrastructure projects within Cessnock LGA, to be commenced no later than 30 September 2011; and
        - a minimum of $32,000 annually to locally-operating community charities.

SCHEDULE 3
SPECIFIC ENVIRONMENTAL CONDITIONS

NOISE

Noise Impact Assessment Criteria

1. The Proponent shall ensure that the noise generated by the project does not exceed at any residence on privately-owned land, or on more than 25% of any privately-owned land, the noise impact assessment criteria shown in Table 1 for the monitoring location nearest to that residence or land:

Table 1: Operational noise impact assessment criteria dB(A)

Morning shoulder	*Day*	*Evening*	*Night*		*Location and Locality*
$L_{Aeq(15\ min)}$	$L_{Aeq(15\ min)}$	$L_{Aeq(15\ min)}$	$L_{Aeq(15\ min)}$	$L_{A1(1\ min)}$	
40	35	35	35	45	**E** Browns Rd, Black Hill
42	35	35	35	45	**F** Black Hill Rd, Black Hill
43	39	42	37	45	**G** Buchanan Rd, Buchanan
35	35	35	35	45	**H** Mt Vincent Rd, Louth Park
35	35	35	35	45	**L** Kilshanny Ave, Ashtonfield
48	39	39	37	46	**M** John Renshaw Drive, Buttai
43	42	42	35	45	**N** Lings Road, Buttai

Notes:
- *To interpret the locations in Table 1, see Appendix 2.*
- *The limits in Table 1 are to apply under meteorological conditions of up to 3 m/s at 10 m above ground level, with the wind direction and frequency of occurrence determined in accordance with the requirements of the NSW Industrial Noise Policy, but excluding conditions of F and G class inversions as described in that Policy.*

However, if the Proponent has a written negotiated noise agreement with the landowner of any privately-owned land, and a copy of this agreement has been forwarded to the Department and OEH, then the Proponent may exceed the noise limits in Table 1 on that land in accordance with the negotiated noise agreement.

Cumulative Noise Criteria

2. The Proponent shall take all reasonable and feasible measures to ensure that the noise generated by the project combined with the noise generated by other mines does not exceed the following amenity criteria at any residence on, or on more than 25 percent of, any privately owned land:
   - $L_{Aeq(11\ hour)}$ *50dB(A) – Morning shoulder and Day;*
   - $L_{Aeq(4\ hour)}$ *45 dBA) – Evening; and*
   - $L_{Aeq(9\ hour)}$ *40 dB(A) – Night.*

Continuous Improvement

3. The Proponent shall:
   (a) implement all reasonable and feasible noise mitigation measures;
   (b) investigate ways to reduce the noise generated by the project; and
   (c) report on these investigations and the implementation and effectiveness of these measures in the AEMR,

   to the satisfaction of the Director-General.

Monitoring

4. The Proponent shall prepare and implement a Noise Monitoring Program for the project to the satisfaction of the Director-General. The Program must :
   (a) be prepared in consultation with OEH and be submitted to the Director-General for approval within 6 months of the date of this approval; and
   (b) include:
   - a combination of unattended and attended monitoring measures; and
   - a noise monitoring protocol for evaluating compliance with the noise impact assessment criteria in this approval.

BLASTING AND VIBRATION

Airblast Overpressure Limits

5. The Proponent shall ensure that the airblast overpressure level from blasting at the project does not exceed the criteria in Table 2 at any residence on privately-owned land.

Table 2: Airblast overpressure impact assessment criteria

Airblast overpressure level (dB(Lin Peak))	***Allowable exceedance***
115	5% of the total number of blasts in a 12 month period
120	0%

Ground Vibration Impact Assessment Criteria

6. The Proponent shall ensure that the ground vibration level from blasting at the project does not exceed the levels in Table 3 at any residence on privately-owned land.

Table 3: Ground vibration impact assessment criteria

Peak particle velocity (mm/s)	***Allowable exceedance***
5	5% of the total number of blasts in a 12 month period
10	0%

Blasting Hours and Frequency

7. The Proponent shall carry out blasting on site only between 9 am and 5 pm Monday to Saturday. No blasting is allowed on Sundays and Public Holidays.

8. The Proponent may carry out on the site a maximum of:
   (a) 2 blasts a day; and
   (b) 5 blasts a week, averaged over a 12 month period.

Operating Conditions

9. During mining operations on site, the Proponent shall implement best blasting practice to:
   (a) protect the safety of people, property, public infrastructure, and livestock; and
   (b) minimise the dust and fume emissions from blasting at the project,

   to the satisfaction of the Director-General.

10. The Proponent shall not undertake blasting within 500 metres of any privately-owned land, unless suitable arrangements have been made with the landowner and any tenants to minimise the risk of flyrock-related impact to the property to the satisfaction of the Director-General.

Public Notice

11. The Proponent shall:
    (a) notify the landowner/occupier of any residence within 2 kilometres of the mining area who registers an interest in being notified about the blasting schedule at the mine, or any other landowner nominated by the Director-General;
    (b) operate a blasting hotline, or alternate system agreed to by the Director-General, to enable the public to get up-to-date information on the blasting schedule at the project;
    (c) advertise the blasting hotline number in a local newspaper at least 4 times each year; and
    (d) publish an up-to-date blasting schedule on its website,

    to the satisfaction of the Director-General.

Property Inspections

12. The Proponent shall advise the owners of privately-owned land that they are entitled to a structural property inspection to establish the baseline condition of buildings and other structures on the property:
    (a) within 2 months of the date of this approval, for properties within 2 kilometres of blasting operations occurring at the date of this approval; and
    (b) at least 2 months prior to blasting within 2 kilometres of additional properties.

    If the Proponent receives a written request for a structural property inspection from any such landowner, the Proponent shall:
    - within 2 months of receiving this request commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to inspect the condition of any building or structure on the land (prior to blasting taking place within 2 km of the property, if possible), and recommend measures to mitigate any potential blasting impacts; and
    - give the landowner a copy of the property inspection report.

Property Investigations

13. If any landowner of privately-owned land within 2 kilometres of blasting operations, or any other landowner nominated by the Director-General, claims that buildings and/or other structures on his/her land have been damaged as a result of blasting at the project after the date of this approval, the Proponent shall within 3 months of receiving this claim:
    (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to investigate the claim; and
    (b) give the landowner a copy of the property investigation report.

    If this independent property investigation confirms the landowner's claim, and both parties agree with these findings, then the Proponent shall repair the damages to the satisfaction of the Director-General.

    If the Proponent or landowner disagrees with the findings of the independent property investigation, then either party may refer the matter to the Director-General for resolution.

    If the matter cannot be resolved within 21 days, the Director-General shall refer the matter to an Independent Dispute Resolution Process (see Appendix 5).

Blast Monitoring Program

14. The Proponent shall prepare and implement a Blast Monitoring Program for the project to the satisfaction of the Director-General. This program must:
    (a) be submitted to the Director General for approval within 6 months of the date of this approval; and
    (b) include a protocol for evaluating blasting impacts on, and demonstrating compliance with, the blasting criteria in this approval for all privately-owned residences and other structures.

AIR QUALITY

Impact Assessment Criteria

15. The Proponent shall ensure that dust emissions generated by the project do not cause additional exceedances of the criteria listed in Tables 4 to 6 at any residence on privately-owned land, or on more than 25 percent of any privately-owned land.

Table 4: Long term impact assessment criteria for particulate matter

Pollutant	***Averaging period***	***Criterion***
Total suspended particulate (TSP) matter	Annual	90 $\mu g/m^3$
Particulate matter < 10 µm (PM_{10})	Annual	30 $\mu g/m^3$

Table 5: Short term impact assessment criterion for particulate matter

Pollutant	***Averaging period***	***Criterion***
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m^3

Table 6: Long term impact assessment criterion for deposited dust

Pollutant	***Averaging period***	***Maximum increase in deposited dust level***	***Maximum total deposited dust level***
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS/NZS 3580.10.1-2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

Monitoring

16. The Proponent shall prepare and implement an Air Quality Monitoring Program for the project to the satisfaction of the Director-General. This program must:
    (a) be prepared in consultation with OEH and be submitted to the Director-General for approval within 6 months of the date of this approval; and
    (b) include:
    - a combination of high-volume samplers and dust deposition gauges to monitor the dust emissions of the project and provision for additional real time monitoring if required in response to monitoring results and/or complaints; and
    - an air quality monitoring protocol for evaluating compliance with the air quality impact assessment criteria in this approval.

METEOROLOGICAL MONITORING

17. During the project, the Proponent shall ensure there is a suitable continuously operating meteorological station on or adjacent to the site that complies with the requirements in *Approved Methods for Sampling of Air Pollutants in New South Wales* (DEC, 2007), or its latest version, to the satisfaction of the Director-General.

WATER MANAGEMENT

Discharge

18. Except as may be expressly provided for by an EPL, or in accordance with section 120 of the *Protection of the Environment Operations Act 1997*, the Proponent shall not discharge any mine water from the site. However, water may be transferred between the site and the adjoining Donaldson Coal Mine and/or Abel Coal Mine, in accordance with any approved Water Management Plan (see below).

Water Management Plan

19. The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with OEH and NOW and be submitted to the Director-General for approval within 6 months of the date of this approval;
    (b) be prepared by suitably qualified expert/s whose appointment/s have been approved by the Director-General; and
    (c) include:
    - a Site Water Balance;
    - an Erosion and Sediment Control Plan;
    - a Surface Water Monitoring Plan;
    - a Ground Water Monitoring Program; and
    - a Surface and Ground Water Response Plan.

Site Water Balance

20. The Site Water Balance must:
    (a) include details of:
    - sources and security of water supply;
    - water use and management on site;
    - any off-site water transfers or discharges; and
    - reporting procedures; and

    (b) describe measures to minimise water use by the project.

Erosion and Sediment Control

21. The Erosion and Sediment Control Plan must:
    (a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction (Volume 2E – Mines and Quarries)* manual (OEH 2008), or its latest version;
    (b) identify activities that could cause soil erosion and generate sediment;
    (c) describe measures to minimise soil erosion and the potential for transport of sediment downstream;
    (d) describe the location, function and capacity of erosion and sediment control structures; and
    (e) describe what measures would be implemented to maintain the structures over time.

Surface Water Monitoring

22. The Surface Water Monitoring Program must include:
    (a) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could potentially be affected by the project;
    (b) surface water and stream health impact assessment criteria;
    (c) a program to monitor the impact of the project on surface water flows, water quality and stream health; and
    (d) reporting procedures for the results of the monitoring program.

Groundwater Monitoring

23. The Groundwater Monitoring Program must include:
    (a) further development of the regional and local groundwater model;
    (b) detailed baseline data to benchmark the natural variation in groundwater levels, yield and quality (including at any privately owned bores in the vicinity of the site);
    (c) groundwater impact assessment criteria;
    (d) a program to monitor the impact of the project on groundwater levels, yield, quality, groundwater dependent ecosystems and riparian vegetation;
    (e) procedures for the verification of the groundwater model; and
    (f) reporting procedures for the results of the monitoring program and model verification.

Surface and Groundwater Response Plan

24. The Surface and Groundwater Response Plan must describe the measures and/or procedures that would be implemented to:
    (a) investigate, notify and mitigate any exceedances of the surface water, stream health and ground water impact assessment criteria;
    (b) compensate landowners of privately-owned land whose water supply is adversely affected by the project; and
    (c) mitigate and/or offset any adverse impacts on groundwater dependent ecosystems or riparian vegetation.

LANDSCAPE MANAGEMENT

Rehabilitation

25. The Proponent shall progressively rehabilitate the site in a manner that is generally consistent with the final landform set out in the EA to the satisfaction of the DRE and the Director-General.

    Note: the conceptual final landform is shown in Appendix 4.

Landscape Management Plan

26. The Proponent shall prepare and implement a detailed Landscape Management Plan for the project to the satisfaction of the Director-General and DRE. This plan must:
    (a) be prepared in consultation with OEH by suitably qualified expert/s whose appointment/s have been approved by the Director-General; and
    (b) include a:
    - Rehabilitation Management Plan to be submitted to the Director-General for approval within 6 months of the date of this approval;
    - Final Void Management Plan to be submitted to the Director-General for approval by 30 June 2012; and
    - Mine Closure Plan to be submitted to the Director-General for approval by 30 June 2012.

Rehabilitation Management Plan

27. The Rehabilitation Management Plan must include:
    (a) the rehabilitation objectives for the site;
    (b) a description of the short, medium, and long term measures that would be implemented to:
    - rehabilitate the site; and
    - manage the remnant vegetation and habitat on the site;

    (c) performance and completion criteria for the rehabilitation of the site;
    (d) a detailed description of the measures that would be implemented over the next 3 years, including the procedures to be implemented for:
    - minimising and rehabilitating disturbed areas;
    - protecting vegetation and soil outside the disturbance areas;
    - undertaking pre-clearance surveys;
    - managing impacts on fauna;
    - landscaping the site to minimise visual impacts;
    - conserving and reusing topsoil;
    - collecting and propagating seed for rehabilitation works;
    - salvaging and reusing material from the site for habitat enhancement;
    - controlling weeds and feral pests;
    - controlling access; and
    - bushfire management;

    (e) a program to monitor the effectiveness of these measures, and progress against the performance and completion criteria;
    (f) a description of the potential risks to successful rehabilitation and/or revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and
    (g) details of who would be responsible for monitoring, reviewing, and implementing the plan.

Final Void Management Plan

28. The Final Void Management Plan must:
    (a) justify the final location and future use of the final void;
    (b) incorporate design criteria and specifications for the final void based on verified groundwater modelling predictions and a re-assessment of post-mining groundwater equilibration; and
    (c) describe what actions and measures would be implemented to:
    - minimise any potential adverse impacts associated with the final void; and
    - manage and monitor the potential impacts of the final void.

Mine Closure Plan

29. The Mine Closure Plan must:
    (a) be prepared in consultation with DRE and Council;
    (b) define the objectives and criteria for mine closure;
    (c) investigate options for the future use of the site in a manner consistent with the *Lower Hunter Regional Strategy* (Department of Planning, 2006) and/or other extant regional planning strategies;
    (d) investigate ways to minimise the adverse socio-economic effects associated with mine closure, including reduction in local employment levels;
    (e) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
    (f) describe how the performance of these measures would be monitored over time.

Biodiversity Offsets

29A. By 31 December 2011, the Proponent shall make suitable arrangements to provide appropriate long-term security for the Biodiversity Offset Area (see Appendix 6) to the satisfaction of the Director-General.

Biodiversity Offset Management Plan

29B. By 31 December 2011, the Proponent shall prepare and implement a Biodiversity Offset Management Plan to the satisfaction of the Director-General. This plan must:
    (a) be generally consistent with OEH's "Principles for the use of biodiversity offsets in NSW";
    (b) include:
    - a description of the short, medium and long term measures that would be undertaken to implement the Biodiversity Offset Strategy;
    - detailed performance and completion criteria for the Biodiversity Offset Strategy; and
    - a detailed description of the measures that would be implemented within the Biodiversity Offset Area for:
        - revegetation and regeneration, including (where relevant) establishment of canopy, sub-canopy, understorey and ground cover;
        - appropriate protection, conservation and management of native vegetation and faunal habitat;
        - controlling weeds and feral pests;
        - management of public access; and
        - bushfire management.

Conservation Bond

29C. Within 6 months of the approval of the Biodiversity Offset Management Plan, the Applicant shall lodge a conservation bond with the Department to ensure that the Biodiversity Offset Strategy is implemented in accordance with the performance and completion criteria of the Biodiversity Offset Management Plan. The sum of the bond shall be determined by:
    (a) calculating the full remaining cost of implementing the offset strategy; and
    (b) employing a suitably qualified quantity surveyor to verify these costs,
    to the satisfaction of the Director-General.

If the Biodiversity Offset Strategy is completed to the satisfaction of the Director-General, the Director-General will release the conservation bond. If the Biodiversity Offset Strategy is not completed to the satisfaction of the Director-General, the Director-General will call in all or part of the conservation bond, and arrange for the satisfactory completion of the relevant works.

Conservation Funding

30. Within 6 months of the date of this approval, and again prior to 30 September 2011, the Proponent shall provide contributions of $20,000 to conservation projects within the Cessnock LGA, in consultation with OEH and to the satisfaction of the Director-General.

HERITAGE

Aboriginal Cultural Heritage Management Plan

31. The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in consultation with the OEH and the local Aboriginal community and be submitted to the Director-General for approval within 6 months of the date of this approval;
    (b) include a protocol for the ongoing consultation and involvement of Aboriginal communities in the conservation and management of Aboriginal heritage on site; and
    (c) describe the measures that would be implemented to protect Aboriginal sites on site, or if any new Aboriginal objects or skeletal remains are discovered during the project.

VISUAL

32. The Proponent shall:
    (a) take all reasonable and feasible measures to mitigate visual and off-site lighting impacts of the project; and
    (b) ensure that all external lighting associated with the project complies with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*,

    to the satisfaction of the Director-General.

GREENHOUSE GAS

Energy Savings Action Plan

33. The Proponent shall prepare and implement an Energy Savings Action Plan for the project to the satisfaction of the Director-General. This plan must:
    (a) be prepared in accordance with the *Guidelines for Energy Savings Action Plans* (DEUS, 2005), or its latest version, and be submitted to the Director-General for approval within 6 months of the date of this approval;
    (b) include consideration of energy use by mobile equipment;
    (c) include a program to monitor the effectiveness of measures to reduce energy use on site.

WASTE MINIMISATION

34. The Proponent shall:
    (a) monitor the amount of waste generated by the project;
    (b) investigate ways to minimise waste generated by the project;
    (c) implement all reasonable and feasible measures to minimise waste generated by the project; and
    (d) report on waste management and minimisation in the AEMR,

    to the satisfaction of the Director-General.

SCHEDULE 4
ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. If the results of the monitoring required in schedule 3 identify that impacts generated by the project are greater than the relevant impact assessment criteria, except where a negotiated agreement has been entered into in relation to that impact, then the Proponent shall, within 2 weeks of obtaining the monitoring results, notify the Director-General, the affected landowners and tenants (including tenants of mine owned properties) accordingly, and provide quarterly monitoring results to each of these parties until the results show that the project is complying with the criteria in schedule 3.

2. If the results of monitoring required in schedule 3 identify that impacts generated by the project are greater than the relevant air quality impact assessment criteria in schedule 3, then the Proponent shall send the relevant landowners and tenants (including tenants of mine owned properties) a copy of the NSW Health fact sheet entitled "Mine Dust and You" (and associated updates) in conjunction with the notification required in condition 1.

INDEPENDENT REVIEW

3. If a landowner considers the project to be exceeding the impact assessment criteria in schedule 3, then he/she may ask the Director-General in writing for an independent review of the impacts of the project on his/her land.

   If the Director-General is satisfied that an independent review is warranted, the Proponent shall within 2 months of the Director-General's decision:
   (a) consult with the landowner to determine his/her concerns;
   (b) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to conduct monitoring on the land, to:
      - determine whether the project is complying with the relevant impact assessment criteria in schedule 3; and
      - identify the source(s) and scale of any impact on the land, and the project's contribution to this impact; and
   (c) give the Director-General and landowner a copy of the independent review.

4. If the independent review determines that the project is complying with the relevant impact assessment criteria in schedule 3, then the Proponent may discontinue the independent review with the approval of the Director-General.

   If the independent review determines that the project is not complying with the relevant impact assessment criteria in schedule 3, and that the project is primarily responsible for this non-compliance, then the Proponent shall:
   (a) take all reasonable and feasible measures, in consultation with the landowner, to ensure that the project complies with the relevant criteria and conduct further monitoring to determine whether these measures ensure compliance; or
   (b) secure a written agreement with the landowner to allow exceedances of the relevant criteria,
   to the satisfaction of the Director-General.

   If further monitoring under paragraph (a) determines that the project is complying with the relevant criteria, then the Proponent may discontinue the independent review with the approval of the Director-General.

5. If the independent review determines that the relevant impact assessment criteria in schedule 3 are being exceeded, but that more than one mine is responsible for this non-compliance, then the Proponent shall, together with the relevant mine/s:
   (a) implement all reasonable and feasible measures, in consultation with the landowner, to ensure that the relevant impact assessment criteria are complied with, and conduct further monitoring to determine whether these measures ensure compliance; or
   (b) secure a written agreement with the landowner and other relevant mines to allow exceedances of the relevant impact assessment criteria in schedule 3,
   to the satisfaction of the Director-General.

   If the further monitoring referred to under paragraph (a) above determines that the project is complying with the relevant impact assessment criteria in schedule 3, then the Proponent may discontinue the independent review with the approval of the Director-General.

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT, MONITORING, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project, to the satisfaction of the Director-General. The strategy must:
   (a) be submitted to the Director-General for approval within 6 months of the date of this approval;
   (b) provide the strategic framework for environmental management of the project;
   (c) identify the statutory approvals that apply to the project;
   (d) describe the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the project;
   (e) describe the procedures that would be implemented to:
   - keep the local community and relevant agencies informed about the operation and environmental performance of the project;
   - receive, handle, respond to, and record complaints;
   - resolve any disputes that may arise during the course of the project;
   - respond to any non-compliance; and
   - respond to emergencies;

   (f) include:
   - copies of the various strategies, plans and programs that are required under the conditions of this approval once they have been approved; and
   - a clear plan depicting all the monitoring to be carried out in relation to the project.

Management Plan Requirements

2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:
   (a) detailed baseline data;
   (b) a description of:
   - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
   - any relevant limits or performance measures/criteria;
   - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;

   (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
   - impacts and environmental performance of the project;
   - effectiveness of any management measures (see (c) above);

   (e) a contingency plan to manage any unpredicted impacts and their consequences;
   (f) a program to investigate and implement ways to continually improve the environmental performance of the project over time;
   (g) a protocol for managing and reporting any:
   - incidents;
   - complaints;
   - non-compliances with statutory requirements; and
   - exceedances of the impact assessment criteria and/or performance criteria; and

   (h) a protocol for periodic review of the plan.

Annual Review

3. Each year, the Proponent shall review the environmental performance of the project to the satisfaction of the Director-General. This review must:
   (a) describe the works that were carried out in the past year, and the works that are proposed to be carried out over the next year;
   (b) include a comprehensive review of the monitoring results and complaints records of the mine complex over the past year, which includes a comparison of these results against the
   - the relevant statutory requirements, limits or performance measures/criteria;
   - the monitoring results of previous years; and

- the relevant predictions in the EA;

(c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
(d) identify any trends in the monitoring data over the life of the project;
(e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and
(f) describe what measure will be implemented over the next year to improve the environmental performance of the project.

Revision of Strategies, Plans and Programs

4. Within three months of:
(a) the submission of an annual review under Condition 3 above;
(b) the submission of an incident report under Condition 6 below;
(c) the submission of an audit report under Condition 7 below, or
(d) any modification of the conditions of this approval (unless the conditions require otherwise),
the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Director-General.

Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project.

Community Consultative Committee

4. Within 3 months of the date of this approval, the Proponent shall establish a Community Consultative Committee (CCC) for the project to the satisfaction of the Director-General. The CCC must be operated in general accordance with the *Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects* (Department of Planning, 2007, or its latest version).

Note: The CCC is an advisory committee. The Department and other relevant agencies are responsible for ensuring that the Proponent complies with this approval. In accordance with the Guideline, the Committee should comprise an independent chair and appropriate representation from the Proponent, affected Councils, recognised environmental groups and the general community. The CCC may also be combined with any similar CCC for the Donaldson Coal Mine or the Abel Coal Mine.

INCIDENT REPORTING

5. The Proponent shall notify the Director-General and any other relevant agencies of any incident associated with the project as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Director-General and any relevant agencies with a detailed report on the incident.

INDEPENDENT ENVIRONMENTAL AUDIT

6. Every 3 years, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
(a) be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General;
(b) include consultation with the relevant agencies;
(c) assess the environmental performance of the project and assess whether it is complying with the requirements in relevant project approvals and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals);
(d) review the adequacy of strategies, plans or programs required under these approvals; and
(e) recommend appropriate measures or actions to improve the environmental performance of the mine complex, and/or any assessment, plan or program required under these approvals.

Note: This audit team must be led by a suitably qualified auditor and include experts in any fields specified by the Director-General.

7. Within 6 weeks of the completion of this audit, or as otherwise agreed by the Director-General, the Proponent shall submit a copy of the audit report to the Director-General, together with its response to any recommendations contained in the audit report.

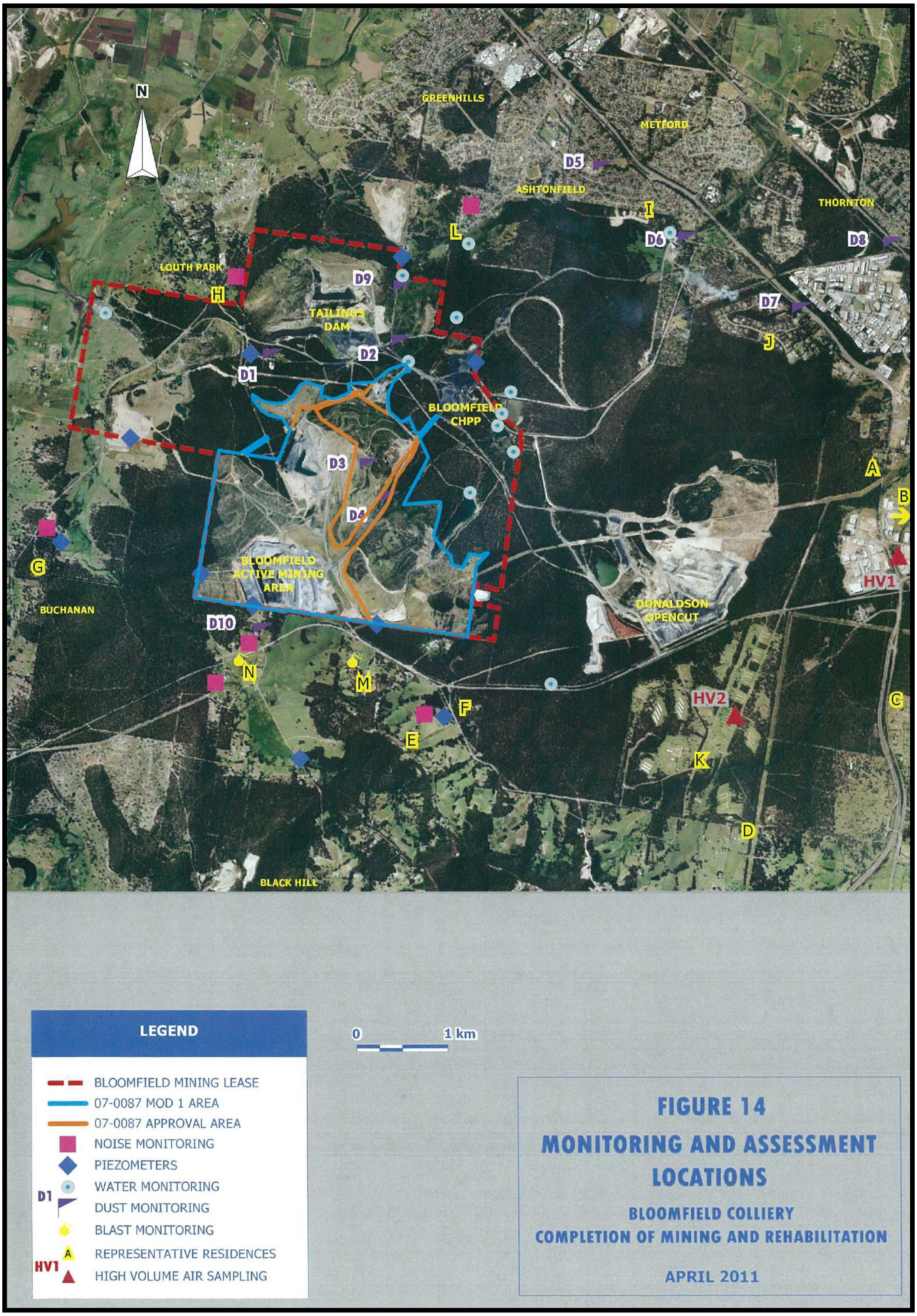
ACCESS TO INFORMATION

8. From the end of 2009, the Proponent shall make the following information publicly available on its website:
   (a) a copy of all current statutory approvals for the project;
   (b) a copy of the current environmental management strategy and associated plans and programs;
   (c) a summary of the monitoring results of the project, which have been reported in accordance with the various plans and programs approved under the conditions of this approval;
   (d) a complaints register, which is to be updated on a monthly basis;
   (e) a copy of the minutes of CCC meetings;
   (f) a copy of any Annual Reviews (over the last 5 years);
   (g) a copy of any Independent Environmental Audit, and the Proponent's response to the recommendations in any audit; and
   (h) any other matter required by the Director-General.

APPENDIX 1
SCHEDULE OF PROJECT LAND

Lot & DP Number	
Lot 36 DP 755260	Lot 1 DP 722210
Lot 35 DP 755260	Lot 26 DP 755260
Lot 34 DP 755260	Lot 25 DP 755260
Lot 48 DP 755260	Part Lot 23 DP 755260
Lot 30 DP 755260	Lot 43 DP 755260
Lot 29 DP 755260	Part Lot 1 DP 1045722
Lot 28 DP 755260	Part Lot 2 DP 1045722
Lot 27 DP 755260	Part Lot 11 DP 755237
Part Lot 26 DP 755260	Lot 13 DP 241097
Part Lot 43 DP 755260	Part Lot 1 DP 136865
Part Lot 25 DP 755260	Lot 1 DP 42349
Part Lot 24 DP 755260	Part Lot 4 DP 241097
Part Lot 18 DP 755237	Part Lot 5 DP 241097
Part Lot 19 DP 755237	Part Lot 6 DP 241097
Part Lot 20 DP 755237	Lot 44 DP 755260
Part Lot 23 DP 755237	Part Lot 45 DP 755260
Part Lot 29 DP 755237	Part Lot 46 DP 755260
Part Lot 13 DP 241097	Part Lot 2 DP 456999
Part Lot 1 DP 136865	Part Lot 10 DP 755237
Part Lot 3 DP 1045720	Part Lot 18 DP 755237
Part Lot 31 DP 755237	Lot 19 DP 755237
Part Lot 4 DP 241097 (Pipeline)	Lot 20 DP 75523
Part Lot 5 DP 241097 (Pipeline)	Lot 23 DP 755237
Part Lot 1 DP 617909 (Pump station)	Part Lot 29 DP 755237
Lot 1 DP 722210 (Road)	Part Lot 1 DP 42349 (Road)
Lot 6 DP 241097 (Pipeline)	Various Council Road Reserves
Crown Road Reserve	Hunter Water Pipeline

APPENDIX 2
PROJECT MAP



APPENDIX 3
STATEMENT OF COMMITMENTS

REF.	COMMITMENT	EA SECTION No. (Refer for further detail)
1.	**General**	
1.1	Bloomfield Collieries Pty Limited ('Bloomfield') will carry out the proposed development generally in accordance with this Part 3A Environmental Assessment ('EA'). If there is any inconsistency between this draft Statement of Commitments and the EA, the draft Statement of Commitments will prevail to the extent of the inconsistency.	1.4
1.2	Bloomfield will undertake mining within the Project Area, as defined by Figure 2 of the EA. The Project Area includes the following items and their associated mining activities: • The current and proposed active open cut coal mining areas; • The unshaped and shaped overburden dump areas within the Project Area; • The workshop and surrounding area used for maintenance and fuel storage; • The road linking the current and proposed coal mining areas with the ROM coal stockpiles adjacent to the coal washery; and • The road linking the current and proposed coal mining areas to the workshop.	1.1, 2.1
2.	**Production**	
2.1	A maximum of 0.88 mtpa ROM coal will be mined from the Bloomfield Mine during Stage 1 with a maximum of 1.3 mtpa ROM coal mined during Stages 2 to 4.	2.5
2.2	Active mining will occur over 4 stages, which total approximately 10 to 12 years. The final (5^{th}) stage is the completion of site rehabilitation.	2.5
2.3	All Run-of-Mine ('ROM') coal will be transported by internal haul roads to the approved ROM coal stockpiles at the Bloomfield washery.	2.6.1
3.	**Hours of Operation**	
3.1	Bloomfield Mine will operate 24 hours per day, seven days per week.	2.4
4.	**Rehabilitation**	
4.1	All site rehabilitation, including monitoring and maintenance will be undertaken in accordance with procedures documented in the EA and the existing Bloomfield Rehabilitation Management System.	3.2
4.2	Any additional rehabilitation requirements and plans for this Project will be included in the existing Bloomfield Rehabilitation Management System.	3.2
4.3	Land that has been mined will be rehabilitated to a safe and stable form with a land capability similar to that existing prior to mining, and with a landform compatible with the surrounding landscape.	3.3.2
4.4	Post mining landform and land use plans will be developed in consultation with the landowner and with reference to the objectives of	3.6.1

REF.	COMMITMENT	EA SECTION No. (Refer for further detail)
	the Lower Hunter Regional Strategy (DoP, 2006).	
5.	**Final Void**	
5.1	The final void will be retained for the deposition of washery reject material in accordance with the Abel Project Approval.	3.5
5.2	Rehabilitation of the final void forms part of the Abel Project Approval. However, rehabilitation of the tailings filled void at the completion of the Abel Project will remain the responsibility of Bloomfield as outlined in the Draft Bloomfield Closure and Rehabilitation Strategy (Abel).	Letter to DoP (11/5/09)
6.	**Environmental Management Systems and Plans**	
6.1	Bloomfield's existing environmental management systems, plans and procedures will be applied to this Project and will be amended where relevant to incorporate additional items required to manage, mitigate, or monitor impacts associated with this Project.	2.8, 2.11, 3.2
7.	**Environmental Monitoring and Reporting**	
7.1	Bloomfield will undertake ongoing environmental monitoring as detailed in this EA.	2.8
7.2	Bloomfield will implement and participate in the actions required for the Integrated Environmental Monitoring Program ('IEMP') that forms part of the Abel Project Approval and which includes elements of the Bloomfield Project.	2.8, 2.12, 15.2
7.3	An Annual Environmental Management Report ('AEMR') will be prepared and forwarded to relevant government departments, including DoP. The AEMR will include a summary of all monitoring undertaken during the year, including a discussion of any exceedances and responses taken to ameliorate these exceedances.	4.3.2
8.	**Consultation**	
8.1	Bloomfield will continue to consult with the local community throughout the life of the Project.	5
8.2	A specific representative of Bloomfield will be nominated and contact details provided so that members of the community may contact the mine with questions or complaints if required.	5
8.3	A record of any complaints received regarding the Project will be retained by Bloomfield for the duration of the Project.	2.8
9.	**Flora and Fauna**	
9.1	A Flora and Fauna Management Plan will be developed and implemented prior to any clearing occurring as part of the Project.	7.6
9.2	The existing Bloomfield pre-clearance protocol will be implemented prior to any clearing occurring as part of the Project.	7.6, 7.7
9.3	Bloomfield will commit to commensurate support to the value of $20,000 for a local activity or program related to biodiversity, to be commenced within the first two years of mining.	7.6, 7.7, Response to Submissions (29/1/09) and DECC meeting minutes (30/4/09)
10.	**Aboriginal Heritage**	

REF.	COMMITMENT	EA SECTION No. (Refer for further detail)
10.1	An Aboriginal Heritage Management Plan ('AHMP') will be prepared in consultation with Mindaribba LALC~~,~~ prior to any Project impacts occurring. This Plan will specify the policies and actions required to mitigate and manage the potential impacts of the Project on Aboriginal heritage. The plan will include: • Procedures for ongoing Aboriginal consultation and involvement; • Mitigation measures for the identified and potential Aboriginal evidence; • Management procedures for any previously unrecorded evidence or skeletal remains; • Training for relevant staff and contractors in their roles and responsibilities under the AHMP • Review of the plan.	8.8
10.2	The AHMP will include a program of salvage to be undertaken in the Project Area with representatives of Mindaribba LALC collecting identified stone artefacts from sites B2, B16, B18, B19, B20 and B22 prior to any development impacts occurring.	8.8
10.3	Should any skeletal remains be detected during the Project, work in that location will cease immediately and the finds will be reported to the appropriate authorities, including the Police, OEH and Mindaribba LALC.	8.8
10.4	In the event that Aboriginal objects are located during the Project, a protocol to ascertain the value of such finds, in consultation with the Aboriginal community representatives and a qualified archaeologist will be implemented and used to inform any management decision. OEH will be informed of any finds using the appropriate site recording cards.	8.8
10.5	Further consultation with and continued involvement of Mindaribba LALC will be continued through the Project, in relation to the contents and recommendations of Aboriginal Heritage studies.	8.8
11.	**Noise Management and Monitoring**	
11.1	A Noise Management Plan will be prepared and implemented for the Project. The Plan will include mitigation and monitoring requirements for the Project.	9.2
11.2	The following noise controls will be implemented to achieve noise criteria identified in this EA: During Year 1 (End of Stage 1): • The excavator and dump site will be situated in a shielded location during night-time operation; • No dozer operation at the drill location will occur during night and morning shoulder periods; and • The front end loader will replace the dozer at the dump site during the night-time period unless 4 dBA of noise suppression is achieved. During Year 5 (End of Stage 2): • The excavator and dump site will be situated in a shielded location during night-time operation;	9.5

REF.	COMMITMENT	EA SECTION No. (Refer for further detail)
	• No dozer operation at the drill location will occur during night and morning shoulder periods; and • The front end loader will replace the dozer at the dump site during the night-time period unless 4 dBA of noise suppression is achieved. During Year 10 (End of Stage 4): • The excavator and dump site will be situated in a shielded location during night-time operation; and • No dozer operation at the drill location will occur during the night period.	
11.3	Bloomfield may undertake a noise monitoring and investigation program during the Project, in consultation with OEH and DoP, to determine whether relevant noise criteria can be achieved without the use of the noise controls listed in 11.2. If such a study concludes that relevant criteria can be achieved, the above controls will be modified or removed.	9.5
11.4	Noise complaints received will be dealt with in accordance with Bloomfield's existing complaints protocol.	2.8
12.	**Blasting**	
12.1	Bloomfield will continue to consult with nearby residents regarding their blasting program, consistent with current practice and the Shot Firing and Explosives Management Plan.	2.8
12.2	Blasting will only be undertaken during the hours of 9.00 am to 5.00 pm Monday to Saturday. Blasting will not occur on Sundays or Public Holidays.	9.8
12.3	Blasts will be designed in consideration of vibration and airblast limits, wind speed and direction.	9.8
12.4	Blast monitoring will be conducted over the life of the mine in accordance with requirements provided by the Shot Firing and Explosives Management Plan.	2.8
12.5	All relevant personnel will be trained in Bloomfield's environmental obligations in relation to blasting controls.	2.8
13.	**Air Quality**	
13.1	An Air Quality Monitoring Program will be prepared and implemented for the Project. The Air Quality Monitoring Program will include monitoring at locations as described in the EA.	2.12
13.2	Dust generation on the Project Area will be minimised by implementation of the following: • All vehicles will be operated according to Mine Transport Management Plan, which requires vehicles to remain on specified routes; • Disturbed areas will be minimised where possible; • Dust suppression water spraying will be used on all active haul roads and stockpile areas where required; • All mobile equipment will be maintained in good working order; • Adequate stemming will be used in blast holes; and	2.8

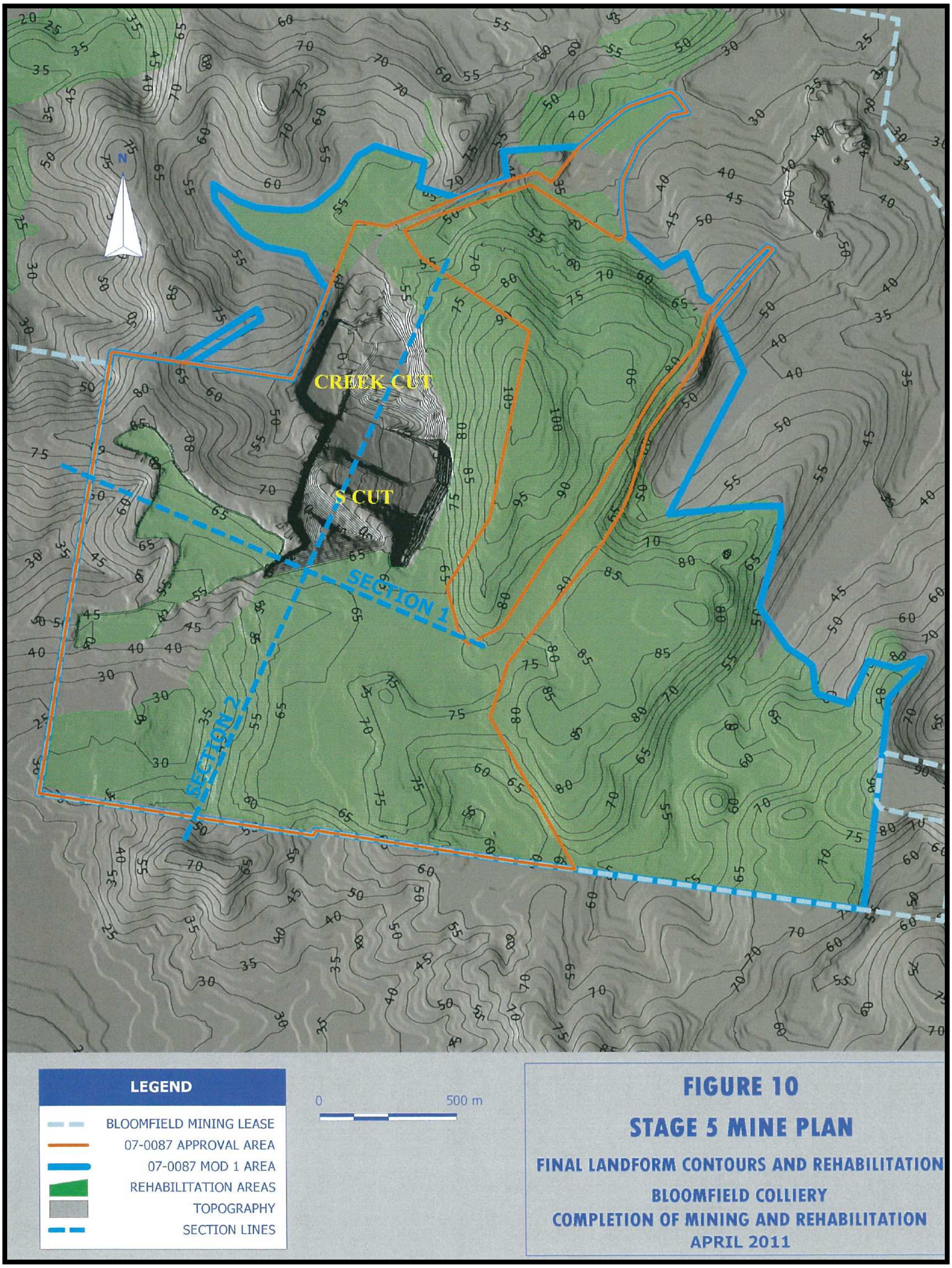
REF.	COMMITMENT	EA SECTION No. (Refer for further detail)
	• Meteorological conditions will be considered in the timing of blasts to minimise impacts of blast generated dust.	
14.	**Greenhouse Gas Monitoring and Energy Efficiency**	
14.1	Bloomfield will assess the viability of improving energy efficiency and reducing greenhouse gas emissions from its operations, including the mining fleet, stationary equipment and mining processes.	10.9
14.2	Bloomfield will monitor greenhouse gas emissions in accordance with the requirements of the current EEO and Greenhouse Challenge Plus programs and comply with any reporting requirements under the *NGER Act 2007*.	10.9
15.	**Surface Water Management**	
15.1	Surface water management for the Project will be undertaken in accordance with Bloomfield's existing Environmental Water Management System ('EWMS'). The EMWS will be modified to address the additional requirements for this Project provided in the Draft Water Management Plan (**Appendix H**).	2.8, 11.5
15.2	An Erosion and Sediment Control Plan will be prepared that will form part of the EWMS.	2.8, 11.3, 11.5
16.	**Surface Water Monitoring Program**	
16.1	Bloomfield's existing EWMS incorporates a Surface Water Monitoring Program which will be implemented for this Project and updated to include the additional monitoring point proposed for this Project in consultation with NOW.	11.5.2
16.2	A response/mitigation procedure will be developed as part of the EWMS for unforeseen surface or groundwater impacts being detected during the Project.	11.5.3, 12.4
17.	**Groundwater Monitoring**	
17.1	Bloomfield's existing EWMS will incorporate a Groundwater Monitoring Program, developed in consultation with NOW.	2.8, 12.4
18.	**Visual Amenity**	
18.1	Visual impacts of the Bloomfield Mine will be mitigated by the following strategies: • Rehabilitation of the southern boundary of the Project Area adjacent to John Renshaw Drive will be given priority during the early stages of mining; • Mobile directional lighting in active mine areas will be directed away from neighbouring properties and roadways; and • Complaints regarding lighting will be investigated by Bloomfield during the relevant shift.	14.6.1, 14.6.2
18.2	Tree areas will be incorporated into rehabilitation to assist the visual blending of overburden dumps with the surrounding landscape.	3.4.3
19.	**Staff Training**	
19.1	Bloomfield will ensure that all personnel receive training in their responsibilities to mitigate, manage and monitor potential environmental impacts.	2.8, 2.11, 3.2

REF.	COMMITMENT	EA SECTION No. (Refer for further detail)
20.	**Integration with Other Mining Operations – Roles & Responsibilities**	
20.1	Bloomfield will implement and participate in the actions required for the Integrated Environmental Monitoring Program ('IEMP') that forms part of the Abel Project Approval and which includes elements of the Bloomfield Project.	2.8, 2.12, 15.2
20.2	Bloomfield is responsible for the operation, maintenance and monitoring of all water management systems and structures within its Project Area.	15.3.2 Letter to DoP (11/5/09)
20.3	Rehabilitation of the final void forms part of the Abel Project Approval. However, rehabilitation of the tailings filled void at the completion of the Abel Project will remain the responsibility of Bloomfield as outlined in the Draft Bloomfield Closure and Rehabilitation Strategy (Abel).	Letter to DoP (11/5/09)
21.	**Community Enhancement Fund**	
21.1	Bloomfield will establish a Community Enhancement Fund (CEF) that will provide a range of practical commitments to local community projects and contributions to the local community.	Response to Submissions (29/1/09) and email to DoP (7/5/09)
21.2	The CEF will comprise two components: • Within two years of the Bloomfield Mine being approved, $180,000 will be provided by Bloomfield for a local infrastructure project within Cessnock Local Government Area, to be determined in consultation with Cessnock City Council. • Over a period of ten years from the date of the Bloomfield Mine being approved, $320,000 will be provided by Bloomfield for a community welfare based charity/s focussed within the Cessnock LGA, to be determined in consultation with Cessnock City Council.	Email to DoP (7/5/09)

REF.	COMMITMENTS FOR THE PROPOSED S75W MODIFICATION (07_0087 MOD 1)	S75W Modification EA Section
1.	**General**	
1.1	Bloomfield Collieries will carry out the proposed development generally in accordance with the Section 75W Environmental Assessment ('EA') and the Part3A Environmental Assessment (07_0087). If there is any inconsistency between this draft Statement of Commitments and the EA, the Statement of Commitments will prevail to the extent of the inconsistency.	1.4
1.2	Bloomfield will undertake mining and rehabilitation activities within the Project Area as defined by the Schedule of Land (Figure 8). The proposed Modification Activities include: • Upgrade and use of Wattle Tree Drive as an alternative haul route (Area A); • Additional overburden emplacement and rehabilitation - east of Save a Mile Haul Road (Area B) • Additional out-of-pit landform reshaping and rehabilitation – northern and south-eastern areas (Area C and E) • Construction of a corridor and overhead powerline from an existing powerline onto the open cut mine site, together with some clearing for an associated infrastructure area (Area D)	1.1, Chapter 2
2.	**Hours of Operation and Operational Controls**	
2.1	Bloomfield Mine will operate 24 hours per day seven days per week except for the proposed Modification Activities. No Modification Activities will occur during the night-time period (10.00pm-6.00am). To manage noise from the various Modification Activities the following hours of operation will be followed: • Wattle Tree Drive construction (Area A) and Powerline Corridor (Area D) a. Construction hours (for the powerline corridor and construction of Wattle Tree Drive) will between the hours of 7.00am and 6.00pm Monday to Friday and 8.00am to 1.00pm Saturdays. b. A bund will be constructed adjacent to Wattle Tree Drive and trees will be planted to screen this area, thereby minimising aesthetic impacts and stray light. • East of Save-a-Mile haul road (Area B) c. Daytime operations (7.00am to 6.00pm Mondays to Saturdays, 8.00am to 6.00pm Sundays) will be in the southern part of the dump to raise the dump and provide screening for the evening (6.00pm-10.00pm) and morning shoulder (6.00am-7.00am) operations. d. The height of the overburden emplacement area will be limited to an RL of 100 metres	6.6

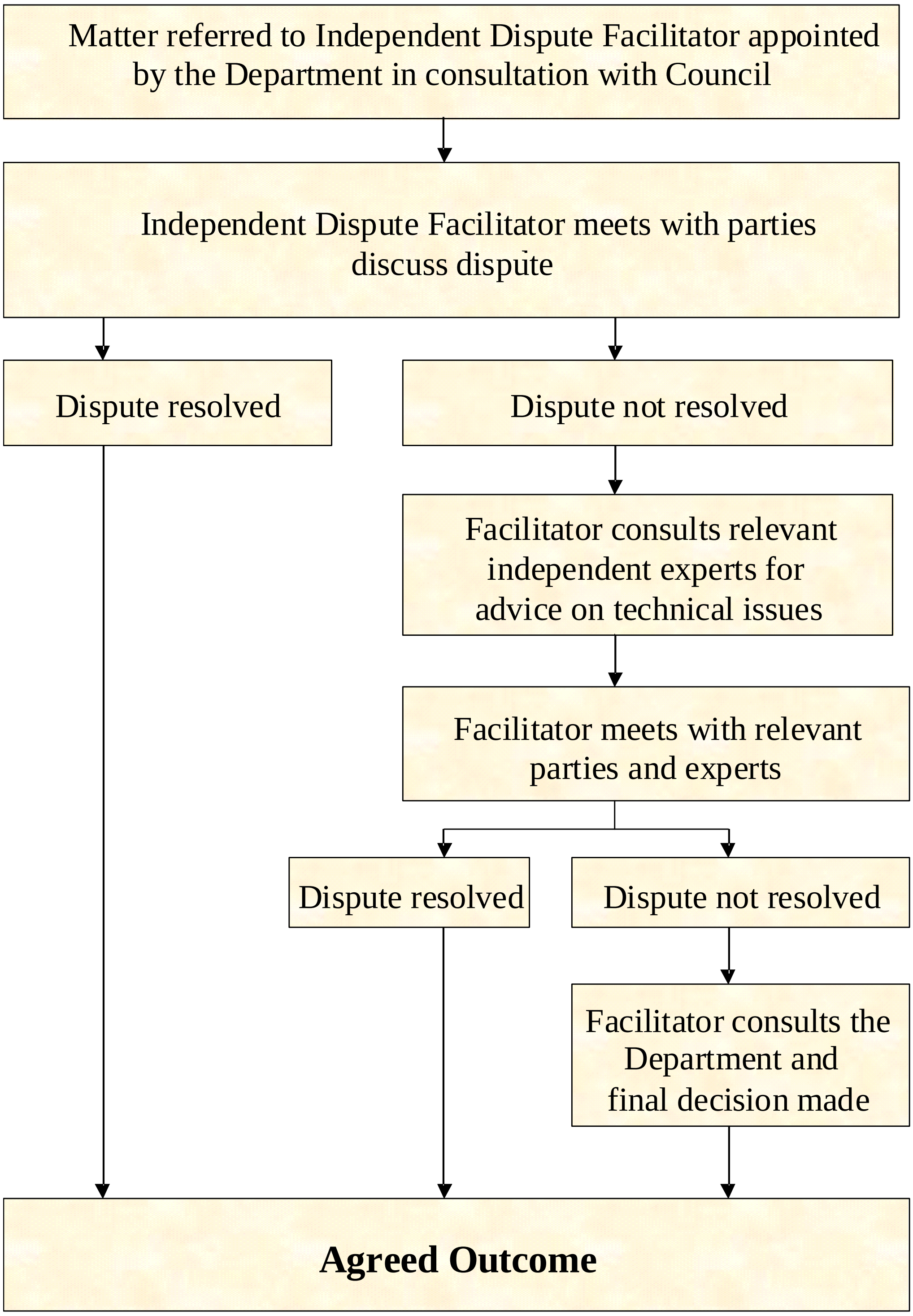
	e. During evening and morning shoulder periods, the following controls will be in place: i. the drill and clearing dozer will be worked in a shielded location; dumping will only occur in the northern part of the dump; ii. the dozer will only operate in a shielded location in the northern part of the dump; iii. an earthern bund will be constructed in the approved dumping area to the south of the existing haul road to a minimum height of 80 metres RL; and iv. There will be no coal haulage from S-Cut during the morning shoulder period. • Northern area (Area C) f. Dumping and rehabilitation during the daytime period only. • South-eastern area (Area E) g. Dumping and rehabilitation during the daytime period only (7.00am to 6.00pm Mondays to Saturdays, 8.00am to 6.00pm Sundays) h. Dumping will be restricted to a maximum of 70 hours of work; and i. A front end loader will replace the dozer at the Area E dump once the emplacement reaches an RL of 52 metres.	
3.	**Ecology**	
3.1	A pre-clearing protocol to protect any threatened species using trees within the powerline clearing area will be implemented during construction of the corridor.	6.3
3.2	The identified nesting tree adjacent to the powerline clearing area will be protected during construction of the powerline and associated infrastructure to prevent accidental damage by machinery.	6.3
3.3	Bloomfield will commit to providing a biological offset to compensate for the loss of native vegetation. The offset will be agreed with and designed to satisfy the requirements of the Department of Planning and generally be consistent with OEH's "Principles for the use of biodiversity offsets in NSW".	
3.4	Bloomfield will commit to providing $20,000 towards the Stanford Merthyr Conservation Project being managed by the Land and Property Management Group within 6 months of Director General's approval of the modification.	
4.	**Water Management**	
4.1	The existing water drainage channel to Lake Kennerson will be re-routed around the disturbance area prior to commencement of works in the south-eastern area	6.9.1
4.2	Diversion banks and sediment control measures will be provided at the toe of the proposed batter of the emplacement area adjacent to Save-a-Mile haul road prior to works commencing to protect downstream areas	6.9.1

APPENDIX 4
CONCEPTUAL FINAL LANDFORM



APPENDIX 5
INDEPENDENT DISPUTE RESOLUTION PROCESS

Independent Dispute Resolution Process (Indicative only)



APPENDIX 6
BIODIVERSITY OFFSET AREA

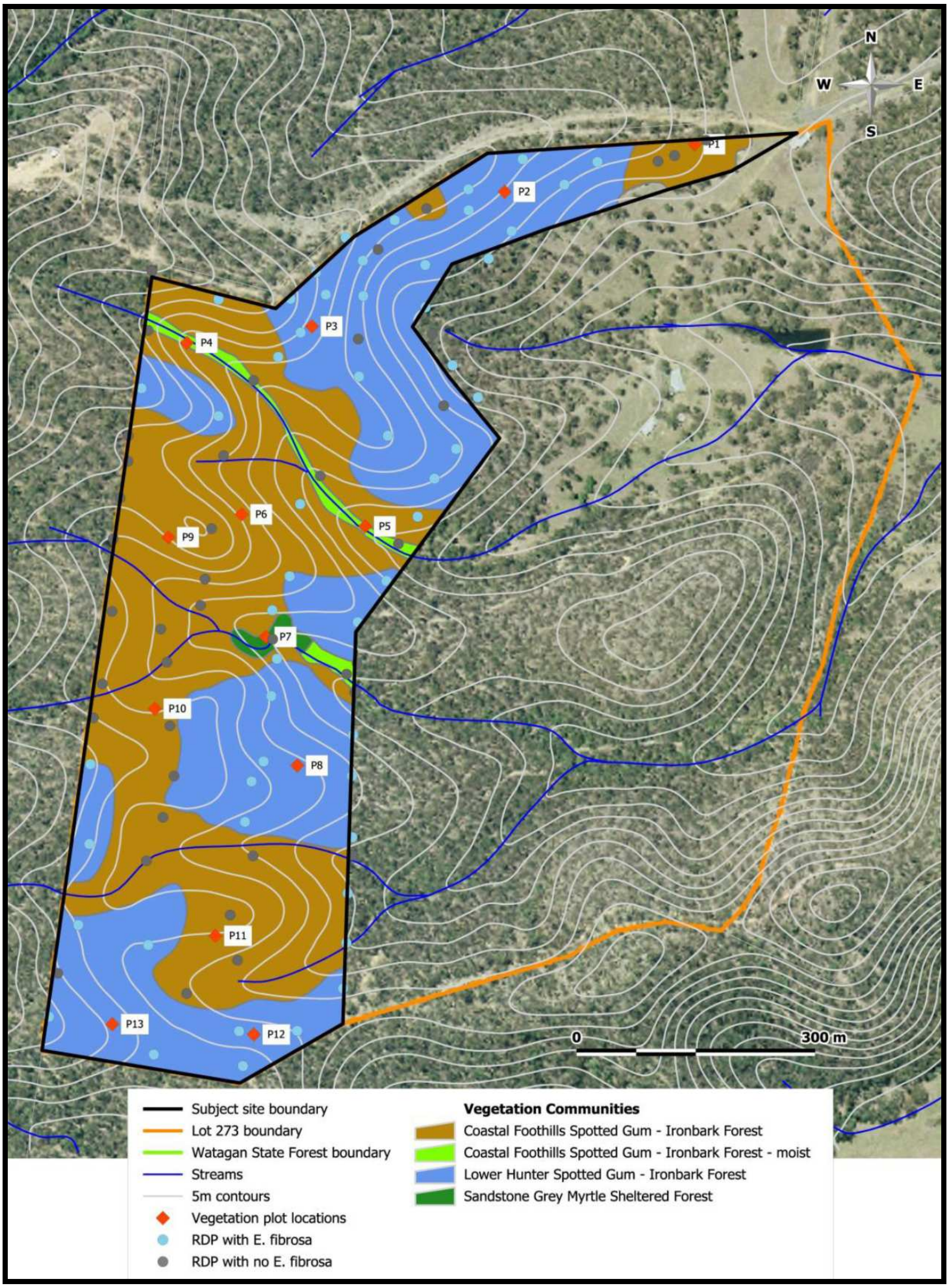


Figure 1: *Biodiversity Offset Area (Part Lot 237 DP 1017683 Thursbys Road, Congewai)*

Appendix B

Secretary's Environmental Assessment Requirements

Appendix B Secretary’s Environmental Assessment Requirements

ONeill, Alison

From: Garry Bailey <gBailey@bloomcoll.com.au>
Sent: Wednesday, 22 March 2017 2:04 PM
To: Murphy, Simon; Greg Lamb; Simon Grassby; Jeff Dunn
Cc: Brendon Clements
Subject: FW: Bloomfield Collieries Proposed Modification

Simon

Thomas has come back with the requirements for the modification. Bloomfield will discuss the biodiversity with Hunter Eco re the biodiversity and develop the additional rehabilitation plan required.

Regards

Garry

From: thomas.watt@planning.nsw.gov.au [mailto:thomas.watt@planning.nsw.gov.au]
Sent: Wednesday, 22 March 2017 1:52 PM
To: Garry Bailey <gBailey@bloomcoll.com.au>
Cc: Howard.Reed@planning.nsw.gov.au
Subject: FW: Bloomfield Collieries Proposed Modification

Hi Garry,

Thanks for consulting further with us on the environmental assessment requirements (EARs) for the proposed modification at Bloomfield Colliery.

We have reviewed the EARs and made some revisions (marked up in red below). In summary, these revisions include:

- additional requirements in relation to biodiversity;
- consideration of all reasonable and feasible measures to minimise final voids, including a scenario in which Abel mine does not recommence operations (ie. no further tailings are available for backfilling pits).

We have also included advice about proposed legislative changes to Part 3A transitional arrangements (ie. removal of s.75W).

Regards,

Thomas Watt
Senior Planning Officer
Resource Assessments
320 Pitt Street | GPO Box 39 | Sydney NSW 2001
T 02 9274 6375

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From: Garry Bailey [mailto:gBailey@bloomcoll.com.au]
Sent: Tuesday, 21 March 2017 3:31 PM
Cc: Howard Reed <Howard.Reed@planning.nsw.gov.au>; Thomas Watt <thomas.watt@planning.nsw.gov.au>
Subject: RE: Bloomfield Collieries Proposed Modification

Hi Howard

The email below was the departments requirements for a Bloomfield Mine consent modification, that would enable mining operations to continue up to the approved mining operations limit at the Abel Mine. Mining will be contained within the current approval area. Bloomfield has a preliminary engagement with suitable environmental specialists to complete this task when the departments final requirements are known.

Are there any additional or changed requirements for Bloomfield to complete this consent modification?

Kind regards, Garry

Garry Bailey
General Manager of Mining Development
The Bloomfield Group - *Celebrating 80 years in Business*
PO Box 4, EAST MAITLAND NSW 2323
Tele: 612 4930 2618 | Fax: 612 4933 8940 | Mob: 0407 938 003
Email: gbailey@bloomcoll.com.au | Website: www.bloomcoll.com.au

From: Colin.Phillips@planning.nsw.gov.au [mailto:Colin.Phillips@planning.nsw.gov.au]
Sent: Monday, 16 November 2015 3:05 PM
To: Garry Bailey
Cc: Howard.Reed@planning.nsw.gov.au; thomas.watt@planning.nsw.gov.au
Subject: FW: Bloomfield Collieries Proposed Modification

Good Afternoon Garry,

I refer to your letter dated 9 November 2015 requesting environmental assessment requirements for the modification (by S.75w) of Bloomfield Coal Project to extend the operational life of the mine from 2021 until 2030 and recover additional available coal resources from within the existing approved extraction area.

The Department considers, based on the information presented, that the proposed modification falls within the scope of a Section 75W modification.

However, as you may be aware, current legislative updates propose the removal of transitional arrangements for Part 3A projects, including s.75W (refer here for more information). In the event that this occurs while you are preparing your application, the project approval may be transitioned to an SSD, which can only be modified under s.96 of the EP&A Act. In the event that this occurs, the modification would need to demonstrate that the proposed development remains substantially the same as the development originally approved (see for example s.96(2) of the EP&A Act).

It is recommended that you further consult with the Department if and when these changes to the EP&A Act are made.

The Department considers the environmental assessment for the modification application should include the following requirements:

Preliminary requirements

- a clear description of the existing approved operation and the proposed development;
- the likely interactions between the development and any other existing, approved or proposed developments in the vicinity of the site;
- a list of any approvals that must be obtained before the development may commence;
- an assessment of the likely impacts of the development on the environment, focussing on the specific issues identified below, including:
  - a description of the existing environment likely to be affected by the development, using sufficient baseline data;
  - an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice;
  - a description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development, and an assessment of:
    - whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented;
    - the likely effectiveness of these measures; and
    - whether contingency plans would be necessary to manage any residual risks; and
  - a description of any measures that would be implemented to monitor and report on the environmental performance of the development if it is approved;

- consideration of the development against all relevant environmental planning instruments (including Part 3 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007)*; and
- the reasons why the modification should be approved having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.

Biodiversity

- An assessment of any likely biodiversity impacts of the project having regard to any advice and/or guidelines (eg. the Framework for Biodiversity Assessment) from OEH or the Commonwealth Department of Environment and Energy.
- Any resulting offset strategy, prepared in accordance with OEH and DoEE requirements.

Noise

- A noise and blasting impact assessment of the likely operational noise impacts of the development under the *NSW Industrial Noise Policy* (INP), paying particular attention to the obligations in Chapters 8 and 9 of the INP.

Air quality

- An assessment of the likely air quality impacts of the development in accordance with the current *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.*

Soil and Water

- The EA will be required to demonstrate that the existing water management system is adequate in its existing, or in an upgraded form to accommodate the development. This should be in accordance with the *Managing Urban Stormwater: Soils & Construction Guideline Volume 2E: Mines and Quarries*. A new soil and water management plan may be required.

Groundwater

- The EA will be required to assess whether the recovery of deeper coal seams would cause any change to the groundwater resources intercepted by the development and any resultant changes to the site's water balance and water management system.

Visual impacts and rehabilitation

- The EA should discuss any visual impacts that may be greater than approved due to the increased extraction of coal and movement of overburden and any changes to the proposed rehabilitation of the site.
- Changes to the final landform and how this may affect the rehabilitation of the mine need to be clearly shown in the EA. In particular, the EA should demonstrate that all reasonable and feasible measures have been implemented in mine planning to maximise the use of additional overburden from extracting deeper coal seams to minimise the size of final voids. This should include a scenario that assumes Abel mine does not recommence operations and transfer tailings for backfilling pits at Bloomfield.

Social and economic

- The EA should identify the economic benefits (such as jobs) of the proposal and any implications on the demand for local infrastructure and services.

Consultation

- Finally, you should also consult with relevant local and State government authorities in particular, including Council, EPA, OEH, DRE and DoEE any local landholders and/or residences who may be affected by the proposal, and any interested community groups. The EA should report on this consultation.

Appendix C

Consultation

Appendix C Consultation

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Minutes of Meeting

Bloomfield Colliery Life of Mine Extension Modification

Subject	Briefing and Mine Operations Plan Discussion: Resources and Energy	Page	2
Venue	Resources and Geoscience - Maitland	Time	0900
Participants	Monique Meyer (MM) – Resources and Energy. Dam Adams (DA) – Resources and Energy. John Trotter (JT) – Resources and Energy. Garry Bailey (GB) – Bloomfield. Greg Lamb (GL) – Bloomfield. Jeff Dunn (JD) – Bloomfield. Brendon Clements BC) – Bloomfield. Simon Murphy (SM) – AECOM.		
Apologies	None		
File/Ref No.	60289290	Date	12-Sep-2017
Distribution	As above		

No	Item	Action	Date
1.	GB – Provided overview of the proposed Bloomfield life of mine extension project. Advised that Bloomfield are progressing the Environmental Assessment (EA) for the Mod had have come to consult / seek input from DRG. Also advised Bloomfield are seeking confirmation in regards to required Mine Operations Plans (MOP) updates and submission.	-	-
	MM – Enquired about Secretary's Environmental Assessment Requirements (SEARs) for the project. DRG has not seen SEARs but would be required to assess against relevant SEARS. GB – Discussions have been has with Department of Planning and Environment (DP&E as far back as 2015 regarding the Mod. Draft SEARs have been received by email from DP&E although they are not extensive. MM – Requested a copy of the SEARS.	GB to send a copy of the SEARs to MM.	Complete – by email 12/9/17.
	MM/JT – The EA will need to provide an adequate level of information in regards to final landform and rehab and the options/alternatives reviewed as part of the EA process to demonstrate environmental impacts have been considered. GB/JD – Briefly described options which are primarily driven by tailings and the need to potentially accommodate Abel tailings subject to Abel coming out of care and maintenance.	-	-
	MM/JT – Enquired about Abel reopening and impacts to the project. GB – Bloomfield is not aware of what Yancoal's intentions	-	-

No	Item	Action	Date
	are for Abel. GB – When considering the project to be assessed surface infrastructure and the existing tailings dam are outside the approval area and within the Abel consent. Note existing tailings dam has approx. 3 years capacity remaining. GB – The EA will need to present two final landforms with / without Abel coming out of care and maintenance to account for this due to the need to potentially accommodate Abel tailings. .		
	JT / MM – How would Abel tailings be disposed of in the Bloomfield pit? JD – Tabled conceptual final landform showing proposed tailings emplacement area in the south-western corner of the Bloomfield pit area. Depending on timing, this tailings emplacement area could be provided or alternatively the final void used for tailings disposal. JT / MM – how are tailings currently transferred to the existing dam? BG – Pump slurry to multiple points within the existing tailings dam and beached for drainage.	-	-
	JT / MM – The EA would need to demonstrate the viability of these tailings disposal areas in regards to dewatering and achieving stable final landform (justification of proposed capping thicknesses). How would you dewater from the final void if used for tailings emplacement? GB – Use a decant wall structure for dewatering.. JT – Will need these management measures detailed in the EA.	-	-
	JT – Are there any proposed reuse options for the final void water? GB – Not currently. Future use of the void and entire site will be subject to decisions by the landowners. Note that portions of the site have been earmarked for future use for appropriate development e.g. industrial park. This would not be proposed in the final landform as it would be subject to future applications by others i.e. it is outside the scope of this project.	-	-
	GB – As the currently MOP will run out prior to the current approval process being complete what is DRGs preference for remedying this? New MOP or extension to existing MOP? MM – DRG are happy to accept a modified MOP for the interim period. A 6 month extension should allow enough buffer time.	-	-
	GL – Would DRG also be happy to accept a draft version of the proposed new future MOP for early review? MM – Yes happy to review and provide preliminary comment when ready.	-	-

From: Garry Bailey <gBailey@bloomcoll.com.au>
Sent: Thursday, 12 October 2017 12:35 PM
To: Greg Lamb; Murphy, Simon; Brendon Clements
Subject: FW: Bloomfield Colliery

From: Natasha Ryan [mailto:Natasha.Ryan@epa.nsw.gov.au]
Sent: Thursday, 12 October 2017 12:00 PM
To: Garry Bailey <gBailey@bloomcoll.com.au>
Subject: Bloomfield Colliery

Hi

Thanks for phoning me today. As advised in our discussion the Environment Protection Authority ("EPA") is unable to meet with you regarding your proposed extension project to Bloomfield Colliery. The EPA will review the environmental assessment through the planning referral process.

As discussed you should ensure that you consider the transport of coarse reject from one premises to another and co-disposal in dumps for final landform under the auspices of EPAs' Resource Recovery Order and Exemptions. The EPA advise you that an acceptance of waste at a premises must only occur under a valid Resource Recovery Order and/or Exemption.

Yours Sincerely

Natasha Ryan
Regional Operations Officer - Hunter
North Branch, NSW Environment Protection Authority
+61 2 4908 6833
hunter.region@epa.nsw.gov.au www.epa.nsw.gov.au @EPA_NSW
Report pollution and environmental incidents 131 555 (NSW only) or +61 2 9995 5555

Right-click here to download pictures. To help protect your privacy, Outlook prevented automatic download of this picture from the Internet.
http://www.environment.nsw.gov.au/images/email-signature/epa-logo.png

Please provide all correspondence to hunter.region@epa.nsw.gov.au

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Minutes of Meeting

Bloomfield Colliery - Project Approval modification to extend life of mine

Subject	Cessnock City Council Project Briefing	Page	3
Venue	Cessnock City Council	Time	09:00
Participants	Gareth Curtis(GC) – Director Planning and Environment, Cessnock City Council Janine McCarthty (JM) – Development Services Manner, Cessnock City Council Garry Bailey (GB) - Bloomfield Greg Lamb (GL) - Bloomfield Simon Murphy (SM) - AECOM		
Apologies	Stephen Glen (General Manager, Cessnock City Council)		
File/Ref No.	60286290	Date	02-Aug-2017
Distribution	As above		

No	Item	Action	Date
1.	GB - Provided brief a history of Bloomfield Colliery and the existing consent, subsequent modifications and approval relationship with the Abel mine: · Outlined existing Bloomfield consent (07_0086) as modified. · Detailed how surface infrastructure currently falls under Abel Mine consent.	-	-
2.	GB - Provided background to the need for the current modification: · Bloomfield seeking to extend the life of the current consent to 2030 to align with Abel. · Also seeking to gain access to additional coal resource. Refer attached figures showing proposed disturbance area and proposed final landform as tabled.	-	-
3.	GC – Enquired about the nature of the operation (open cut) and changes to the existing operation that will allow additional resource extraction? GB – Operation is, and will continue to be open cut: · Previous extraction used a large shovel which didn't have the ability to allow thinner seams to be separated from overburden. · Bloomfield has since acquired an excavator that allows thinner seams to be extracted. · Regardless of additional total resources identified in the Modification, annual extraction would not exceed the currently approved 1.3 Million tonne per year Run of Mine (ROM) coal.	-	-

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No	Item	Action	Date
4.	GB – Explained how coal extracted at Bloomfield is mixed with coal from the Bloomfield Groups Rix's Creek Mine at Singleton to achieve qualities (moisture, ash and sulfur content) required by customers. Blending occurs at coal loaders in the Port of Newcastle. Transport of coal to the port is by rail out-loaded from the mines rail loader and rail loop.	-	-
5.	GC – Enquired about status of Donaldson Coal? BG – Confirmed it is currently in care-and-maintenance. Timing for any change to the current status is unknown however the modification environmental assessment for the modification would assess cumulative impacts as if both mines are in operation.	-	-
6.	GC – Asked to confirm road access arrangements? GB / GL – Primary site access is via Four Mile Creek Road to the New England Highway (In the Maitland Local Government Area (LGA)). Secondary site access is available via Buttai Rd to Buchanan Rd however this access has a locked gate and is not used as a day-to-day access.	-	-
7.	GB – Land ownership. The mine footprint falls on land primarily owned by Ashtonfield Pty Ltd. A number of residual lots are also owned by the Bloomfield Group. Refer to attached ownership figure as tabled.	-	-
8.	GC – General comments: · Cessnock City Council is supportive of the mining industry particularly given the historical connection to the LGA. · Cannot recall any community complaints or other issues arising in relation to Bloomfield. · Community focus in this area is primarily related to quarries at Blackhill and Buttai.	-	-
9.	GB – Explained that Bloomfield Community Consultative Committee (CCC) no longer had a representative from Cessnock Council. Previous council rep didn't deem attendance necessary. GC – Questioned this and indicated they would review internally within Council.	GC to confirm Councils requirement for a CCC rep.	TBA.
10.	SM – Confirmed the approval process: · Modification to the mines existing Part 3A Project Approval under transitional provisions of the EP&A Act. · Indicated technical specialist studies are in the process of being prepared including but not limited to noise, air quality, surface and groundwater. · Department of Planning and Environment have confirmed approval pathway and issues environmental assessment requirements (SEARS).	-	-

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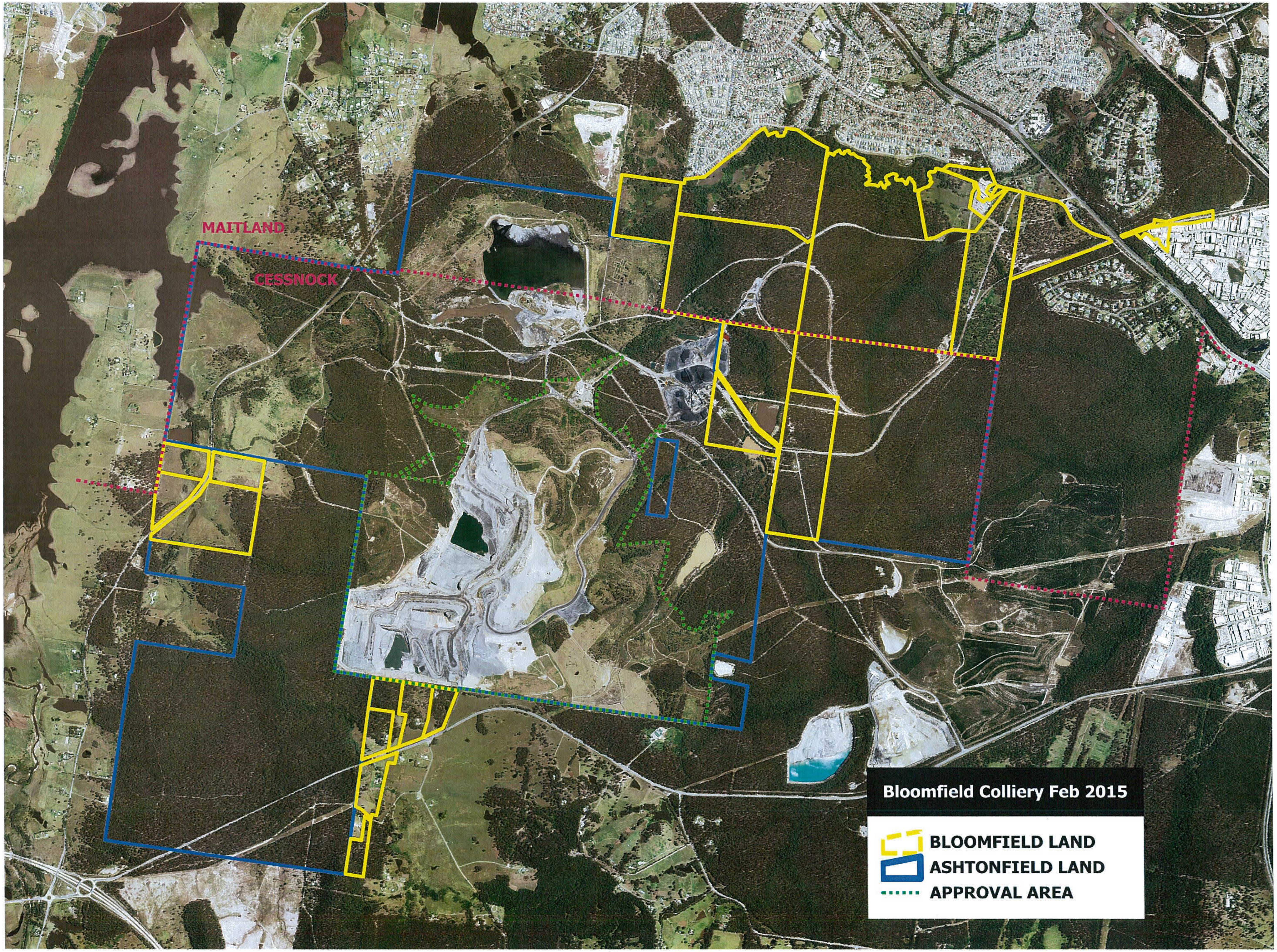
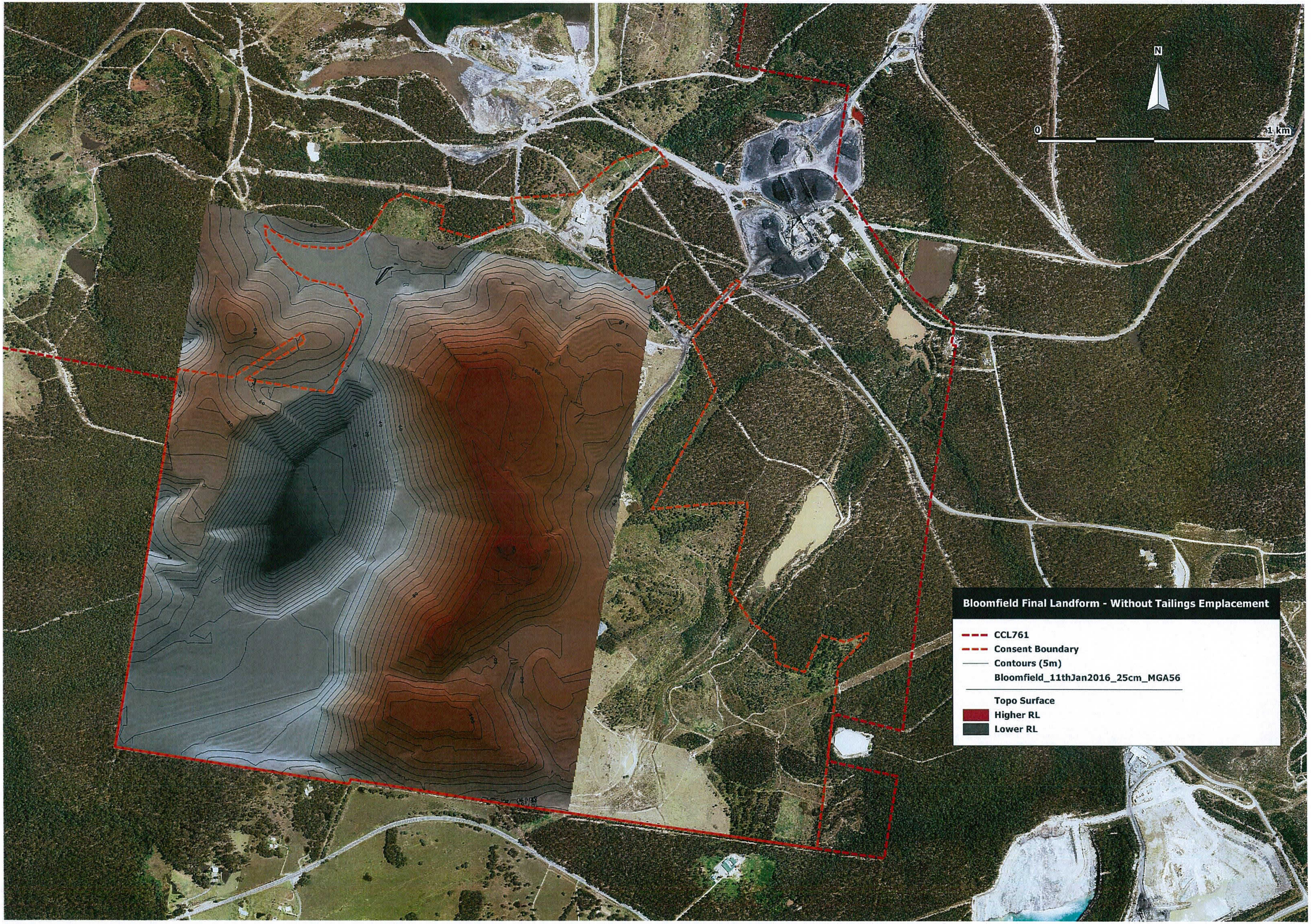
No	Item	Action	Date
	· As part of the EA preparation we are briefing Council to seek any comments/questions they may so these can be addressed in the environmental assessment as appropriate.		
11.	GC/JM – Confirmed that additional consultation was not required at this stage. Council would have opportunity to comment as part of the formal assessment process. Minutes of meeting to be recorded as evidence of consultation.	SM to circulate these minutes as evidence of consultation.	-
12.	Close.	-	-


MAITLAND
CESSNOCK
Bloomfield Colliery Feb 2015
BLOOMFIELD LAND
ASHTONFIELD LAND
APPROVAL AREA


N
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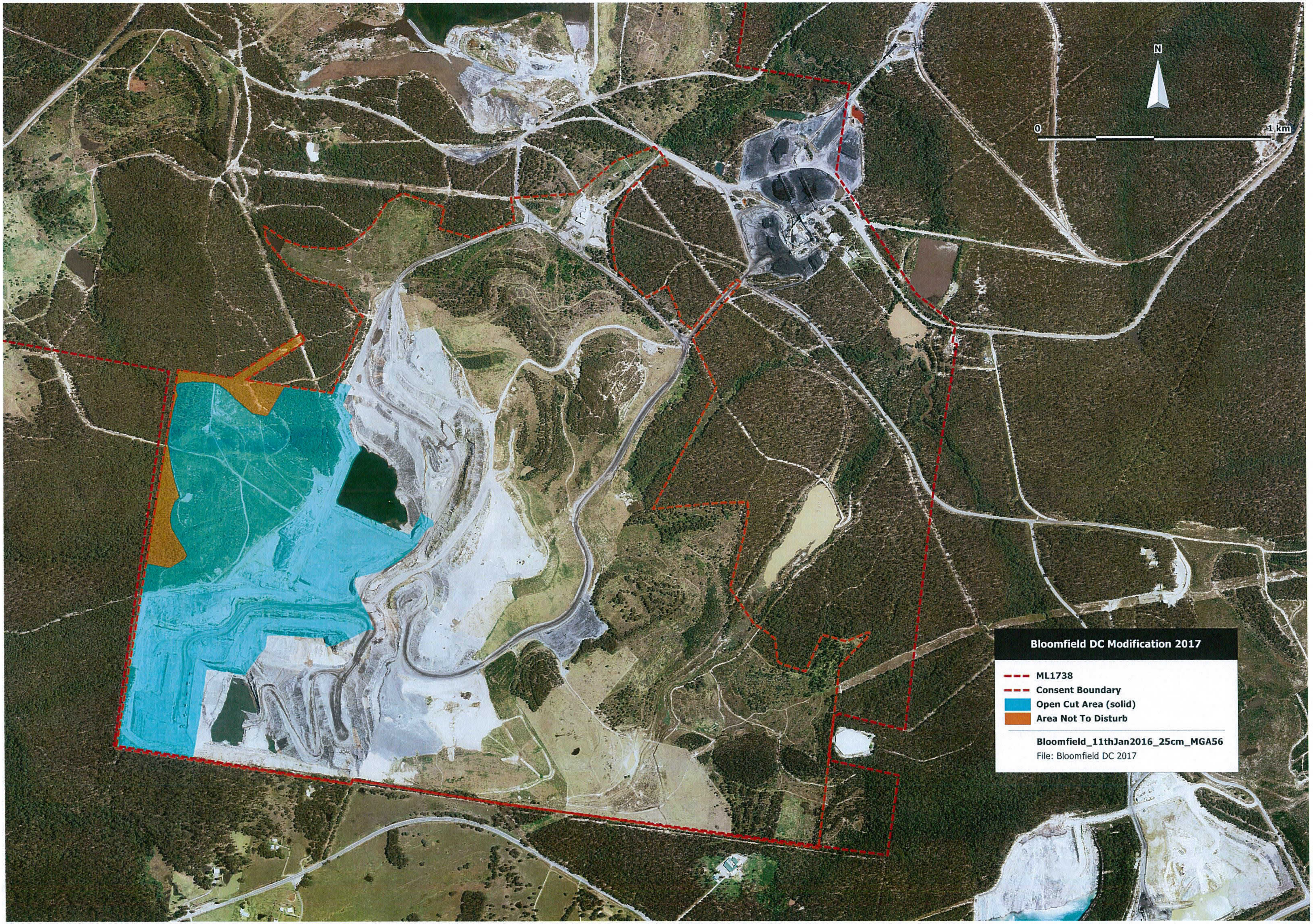
1 km
Bloomfield Final Landform - Without Tailings Emplacement
CCL761
Consent Boundary
Contours (5m)
Bloomfield_11thJan2016_25cm_MGA56
Topo Surface
Higher RL
Lower RL


N
0
1 km
Bloomfield DC Modification 2017
ML1738
Consent Boundary
Open Cut Area (solid)
Area Not To Disturb
Bloomfield_11thJan2016_25cm_MGA56
File: Bloomfield DC 2017

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Minutes of Meeting

Bloomfield Colliery - Project Approval modification to extend life of mine

Subject	Maitland City Council Project Briefing	Page	2
Venue	Maitland City Council	Time	14:00
Participants	David Simm (DS) – Manager Development and Environment, Maitland Council Leanne Harris (LH) – Development Assessment Coordinator, Maitland Council Stephen Punch (SP) – Principal Planner, Maitland Council Garry Bailey (GB) - Bloomfield Greg Lamb (GL) - Bloomfield Simon Murphy (SM) - AECOM		
Apologies	None		
File/Ref No.	60286290	Date	23-Aug-2017
Distribution	As above		

No	Item	Action	Date
1.	GB - Provided brief a history of Bloomfield Colliery and the existing consent, subsequent modifications and approval relationship with the Abel mine: • Outlined existing Bloomfield consent (07_0086) as modified. • Detailed how surface infrastructure currently falls under Abel Mine consent. Coal preparation plant and rail loop are currently running well below approved limits as there is no production from Abel.	-	-
2.	GB - Provided background to the need for the current modification: • Bloomfield seeking to extend the life of the current consent to 2030 to align with Abel. • Also seeking to gain access to additional coal resource. Refer attached figures showing proposed disturbance area and proposed final landform as tabled.	-	-
3.	SP – Enquired about the timing for the closure of the tailings dam. GB – Indicated likely within the next 3 or 4 years however would be dependent on whether Abel becomes operational again as this may accelerate its closure. DS – Enquired about post closure uses of the tailings dam. Capped and rehabilitated, potential use as a landfill? GB – Confirmed current plans are to rehabilitate. All – Noted interconnectedness of ground and	-	-

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No	Item	Action	Date
	surface waters on the mine site due to historical - underground workings relationship with current open-cut operations.		
4.	SP – Enquired about status of Abel Mine? BG – Confirmed it is currently in care-and-maintenance. Specific timing for future operation of the mine currently unknown by Bloomfield.	-	-
5.	LH / SP – Described proposed future development in Louth Park as this would likely be the closest residents to the mine (specifically the tailings dam) as these areas are developed. Confirmed that Louth Park would likely be progressively developed over the long term.	-	-
6.	LH – Enquired about the use of the mine access road of Mt Vincent Road? GB / GL – Indicted that this is a locked gate that is sometimes used by mine employees and contractors as an alternative assess. Confirmed that the primary site access is, and will continue to be, via Four Mile Creek Road and the New England Highway.	-	-
7.	GB – Described Land ownership. The mine footprint falls on land primarily owned by Ashtonfield Pty Ltd. A number of residual lots are also owned by the Bloomfield Group. Refer to attached ownership figure as tabled.	-	-
8.	All – Discussed community consultation and the operation of the CCC. Council involvement not deemed necessary in recent year due to the level of potential impact to, and limited location within, the Maitland LGA.	-	-
9.	SM – Confirmed the approval process: • Modification to the mines existing Part 3A Project Approval under transitional provisions. • Indicated technical specialist studies are in the process of being prepared including but not limited to noise, air quality, surface and groundwater. • Department of Planning and Environment have confirmed approval pathway and issues environmental assessment requirements (SEARS). • Maitland Council would be provided with opportunity to provide further feedback on the project as part of the formal Environmental Assessment process.	-	-
10.	MCC – Confirmed that additional the minutes of this meeting along with a request for any further comments / questions would suffice for consultation at this stage of the project.	SM to issue minutes to all attendees.	ASAP following meeting.
11.	Close.	-	-

Appendix D

Biodiversity Assessment

Appendix D Biodiversity Assessment

Biodiversity assessment report

Modification 4 works | Bloomfield Colliery

Prepared for The Bloomfield Group | 1みNovember 2017

Biodiversity assessment report

Modification 4 works | Bloomfield Colliery

Prepared for The Bloomfield Group | 14 November 2017

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Biodiversity assessment report

Final

Report J17089RP2 | Prepared for The Bloomfield Group | 14 November 2017

Prepared by	**Erin Lowe**	Approved by	**Nathan Garvey**
Position	Senior Ecologist	Position	Associate Ecologist
Signature		Signature	
Date	14/11/2017	Date	14/11/2017

Document Control

Version	Date	Prepared by	Reviewed by
1	10/11/2017	Erin Lowe	Nathan Garvey
2	14/11/2017	Erin Lowe	Nathan Garvey

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Appendices

Tables

Figures

1 Introduction

1.1 Project background

The Bloomfield Open Cut Colliery is an existing open cut coal mine located south of East Maitland, approximately 20 km north-west of Newcastle (Figure 1.2). The Colliery is owned and operated by Bloomfield Group (Bloomfield).

Mining has occurred at the Bloomfield Open Cut Colliery for over 100 years and the mine currently operates in accordance with Project Approval (PA) 07_0087, which was originally granted in 2009 under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

PA 07_0087 has received three previous modifications under section 75W of the EP&A Act. These are:

- Modification 1, granted in May 2011, which extended the project approval area by 259 ha to allow for additional out-of-pit overburden emplacement, relocation of a power line corridor, and the upgrade and use of an alternative haul road;
- Modification 2, a minor administrative modification approved in March 2012 to amend the required date for submission of management plans; and
- Modification 3, which changed the areas of vegetation clearing covered by the mine's biodiversity offset area.

Bloomfield is currently seeking an additional modification (Mod 4) to facilitate the recovery of additional coal resources within the approved extraction area, and to extend the operational life of the mine from 2021 to 2030 (the proposal). As a part of the proposal, Bloomfield proposes to clear approximately 3.5 ha of rehabilitated landform, including 0.34 ha of native vegetation, for the proposed widening of a haul road and upgrade of a watercourse, and an additional 6.12 ha of vegetation for the facilitation of further extraction of coal resources within the Bloomfield Open Cut Colliery.

This Biodiversity Assessment Report (BAR) forms part of the application for consent modification (Mod 4). It documents the biodiversity assessment methods and results, the initiatives built into the proposal design to avoid and minimise biodiversity impacts, and the additional mitigation and management measures proposed, including offsets, to address any residual impacts not able to be avoided.

1.2 Assessment guidelines

On 22 March 2017, the Department of Planning and Environment (DPE) provided Secretary's Environmental Assessment Requirements (SEARs) for Mod 4. In relation to biodiversity, the SEARs require:

- *an assessment of any likely biodiversity impacts of the project having regard to any advice and/or guidelines (eg. the Framework for Biodiversity Assessment) from OEH or the Commonwealth Department of Environment and Energy, and*
- *any resulting offset strategy, prepared in accordance with OEH and DoEE requirements.*

1.3 Previous assessments summary

Previous ecological assessments have been undertaken to support the previous applications to modify Bloomfield's Project Approval (Hunter Eco 2010 & 2012). One of these assessments (Hunter Eco 2010) covered the 6.12 ha of vegetation proposed to be cleared to facilitate the further extraction of coal resources. This area is defined as the MNES study area and is shown in Figure 1.1. The MNES study area is located within the approved extraction footprint and was approved under Modification 1. Given that no vegetation clearing over and above that approved under PA 07_0087, as modified, it is considered that no further assessment under the NSW *Threatened Species Conservation Act 1995* (TSC Act) (now the *Biodiversity Conservation Act 2016* (BC Act)) is required to support the application for the MNES study area. Further assessment would only be required if the project is likely to cause additional impacts compared to that which has previously been assessed and approved.

Notwithstanding this, the previous ecology impact assessments for the MNES study area did not adequately assess protected matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore EMM prepared an assessment of the potential impacts of vegetation clearance on Matters of National Environmental Significance (MNES) (EMM 2017), as listed under the EPBC Act, to support the Mod 4 application. For the purposes of a consolidated report as part of the application for Mod 4, the assessment of the potential impacts of the 6.12 ha of vegetation clearance on MNES within the MNES study area has been included within this BAR (Appendix A).

The remaining 3.5 ha of rehabilitated landform (including 0.34 ha of native vegetation) to be impacted by the proposed widening of a haul road and upgrade of a watercourse was rehabilitated before the existing PA 07_0087 was granted in 2009. Whilst this area is within the existing approval area for the mine, it is not part of the approved extraction or disturbance footprint. The PA area of approved disturbance, as modified, only included those areas of the larger existing Bloomfield Colliery site that were specifically required for active mining and other activities associated with the winning of coal. Rehabilitated areas that were within the existing mine lease and adjacent to the open cut pits were not included.

Because native vegetation will be cleared, consent modification (Mod 4) is required to permit additional clearing beyond the approved extraction or disturbance footprint. As this modification will increase the mine's approved disturbance footprint, further assessment of any likely biodiversity impacts of the project, having regard to guidelines such as the Framework for Biodiversity Assessment (FBA), is required to support the application (as per the SEARs). Hence the 3.5 ha of rehabilitated landform to be impacted by the proposal is assessed within this BAR.

1.4 Development proposal

1.4.1 Haul road and watercourse upgrade

Bloomfield proposes to clear approximately 3.5 ha of rehabilitated landform for the proposed widening of a haul road and upgrade of a watercourse, within the Bloomfield Open Cut Colliery. Bloomfield has identified the two areas, located within the north west of the Development site (Figure 1.1), that require upgrade comprising:

- upgrade of the haul road (widening) to allow for two way travel of large rear dump trucks. This will impact upon 0.8 ha of rehabilitated landform that is located to the north of the current haul road; and
- upgrade of the same haul road (widening) and adjacent previously rehabilitated watercourse. This will impact upon 2.7 ha of rehabilitated landform located to the south of the current haul road.

The study area is defined as the maximum area to be directly impacted by the proposal and any additional areas likely to be indirectly affected by the development. The development site is defined as the entire PA 07_0087 area. Both the study area and the development site are shown on Figure 1.1.

1.4.2 Further extraction of coal resources

Bloomfield proposes to clear an additional 6.12 ha of vegetation to facilitate the further extraction of coal resources. This area is defined as the MNES study area and is shown on Figure 1.1. The MNES study area has been assessed only for potential impacts of the vegetation clearance on MNES, as outlined in Section 1.3.

1.5 Site description

The development site is located south of East Maitland, within the Cessnock City Council Local Government Area (LGA) (refer to Figure 1.1). Mining has occurred on the development site for over 100 years, and the site contains haul roads, open pits, a coal handling and preparation plant, overburden dumps, a tailings dam, coal stockpiles, water storage facilities and a range of other surface infrastructure associated with the operating coal mine. The development site also contains areas of previously rehabilitated mining landform.

The study area, as shown in Figure 1.1, is within the existing approval area of the mine (the development site), but is not part of the approved extraction or disturbance footprint. The study area covers approximately 3.5 ha and is located north-east of the operating Creek Cut pit, as shown in Figure 1.1. The study area is bound by rehabilitated landform and haul roads associated with the current mine operations. The Bloomfield Colliery has undergone a staged process of rehabilitation since 1988. Some areas have been sown with native plant species while other areas have been sown with exotic grasses for stabilisation or to produce pasture. Within the study area, areas to the north-west of the haul road were rehabilitated to pasture in 1999, while areas to the south were rehabilitated in 1999 using native species. A patch of native forest occurs to the north of the study area, beyond the existing haul road and outside of the study area and development site.

Due to the long history of disturbance, there is a lack of natural watercourses within the development site. There are a series of diversion banks and channels that direct water into the main natural drainage system that runs through the development site, Four Mile Creek. Most of the operational mining areas at the development site are located within the catchment of Four Mile Creek. Within the study area, a previously rehabilitated watercourse occurs; the upgrade of this watercourse is proposed as a part of Mod 4.

The development site is within the:

- Sydney Basin Biogeographic Regionalisation for Australia (IBRA) region;
- Hunter IBRA subregion;
- Hunter-Central Rivers Catchment Management Area (CMA), and
- Cessnock City Council LGA.

1.6 Information sources

1.6.1 Publication and databases

In order to provide context for the development site, information about flora and fauna species, populations, communities and habitats from within 10 km (the locality) was obtained from the following databases:

- Office of Environment and Heritage (OEH) *BioNet Atlas of NSW Wildlife* (Bionet) for previous threatened species records (search undertaken 07/09/2017);
- Commonwealth Department of Environment and Energy (DoEE) *Protected Matters Search Tool* (PMST) for MNES, including threatened species likely to occur within the study area (search undertaken 07/09/2017); and
- The NSW Plant Community Types, as held within the Vegetation Information System (VIS) Classification 2.1 database.

The following reports were also reviewed:

- Bloomfield Colliery MNES Assessment (EMM 2017); and
- previous ecological assessments conducted for the Bloomfield Colliery (Hunter Eco 2010 & 2012, Australian Museum Consulting 2014).

1.6.2 Spatial data

Mapping was conducted using a hand-held GPS unit (GDA94), mobile table computers and aerial photo interpretation.

Aerial photography was supplied by NSW Land and Property Information (LPI) (dated 2016) and by Bloomfield.

Base map data was obtained from DFSI NSW databases, with cadastral data obtained from DFSI digital cadastral database. Mapping for stream orders was obtained from DPI (2015).

The following spatial datasets were utilised during the development of this report:

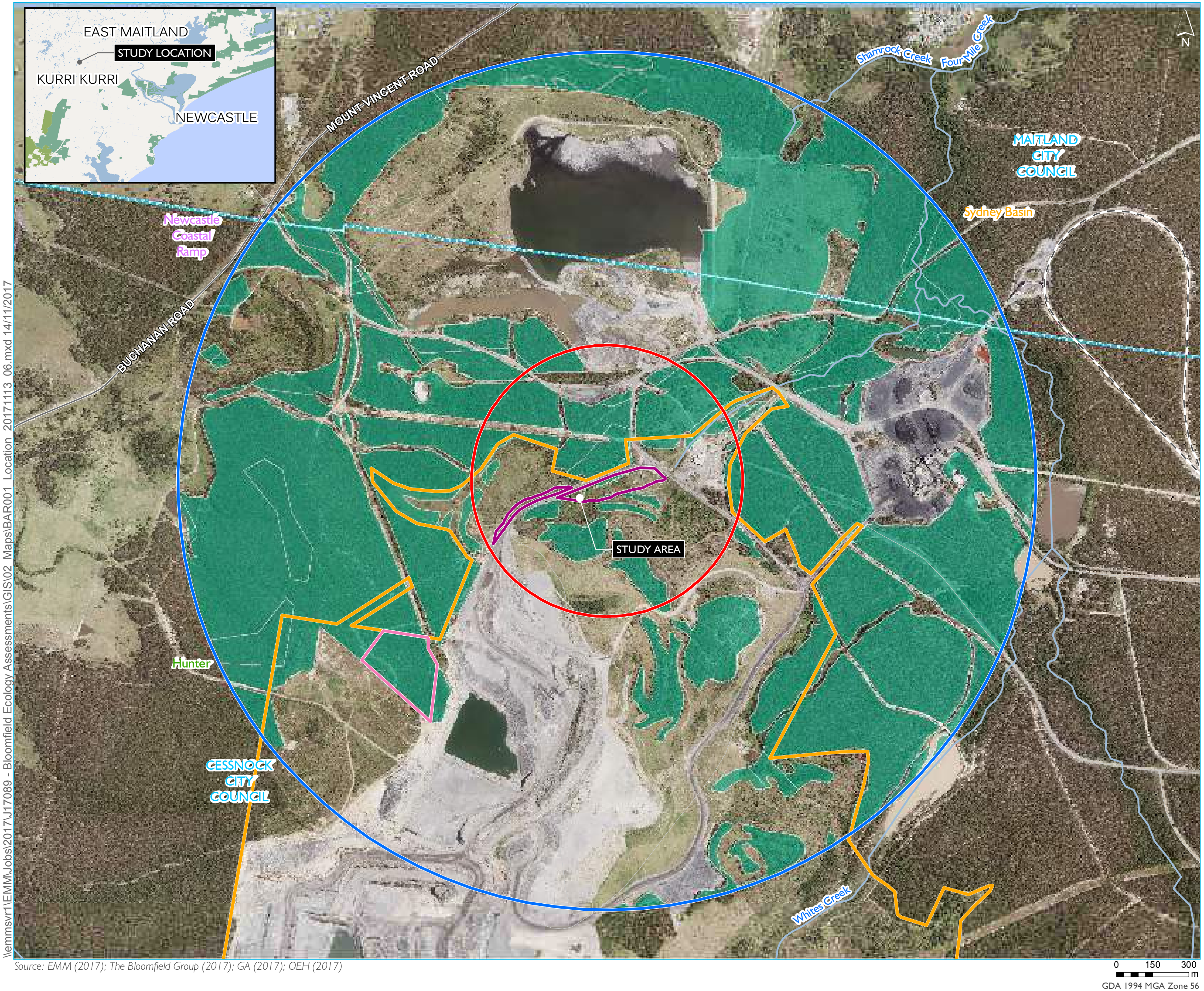
- Mitchell Landscapes Version 3.1 (OEH 2016a);
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7 (OEH 2016b); and
- State Environmental Planning Policy (SEPP) 14 Wetlands.

Mapping has been produced using a Geographic Information System (GIS; ArsGIS 10.5).

1.7 Additional legislative requirements

The project has been assessed against the key biodiversity legislation and government policy, including:

- *Environment Protection and Biodiversity Conservation Act 199* (EPBC Act);
- *Environmental Planning and Assessment Act 1979* (EP&A Act);
- *Threatened Species Conservation Act 1995* (TSC Act);
- *Biodiversity Conservation Act 2017* (BC Act);
- *Fisheries Management Act 1994* (FM Act), and
- *Biosecurity Act 2015* (BS Act).



Source: EMM (2017); The Bloomfield Group (2017); GA (2017); OEH (2017)

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KEY

- Outer assessment circle
- Inner assessment circle
- MNES study area
- Study area
- Development site
- Main road
- Local road
- Watercourse
- Rail line
- Native vegetation extent

IBRA bioregion

- Sydney Basin

IBRA sub-region

- Hunter

NSW Mitchell landscape

- Newcastle Coastal Ramp

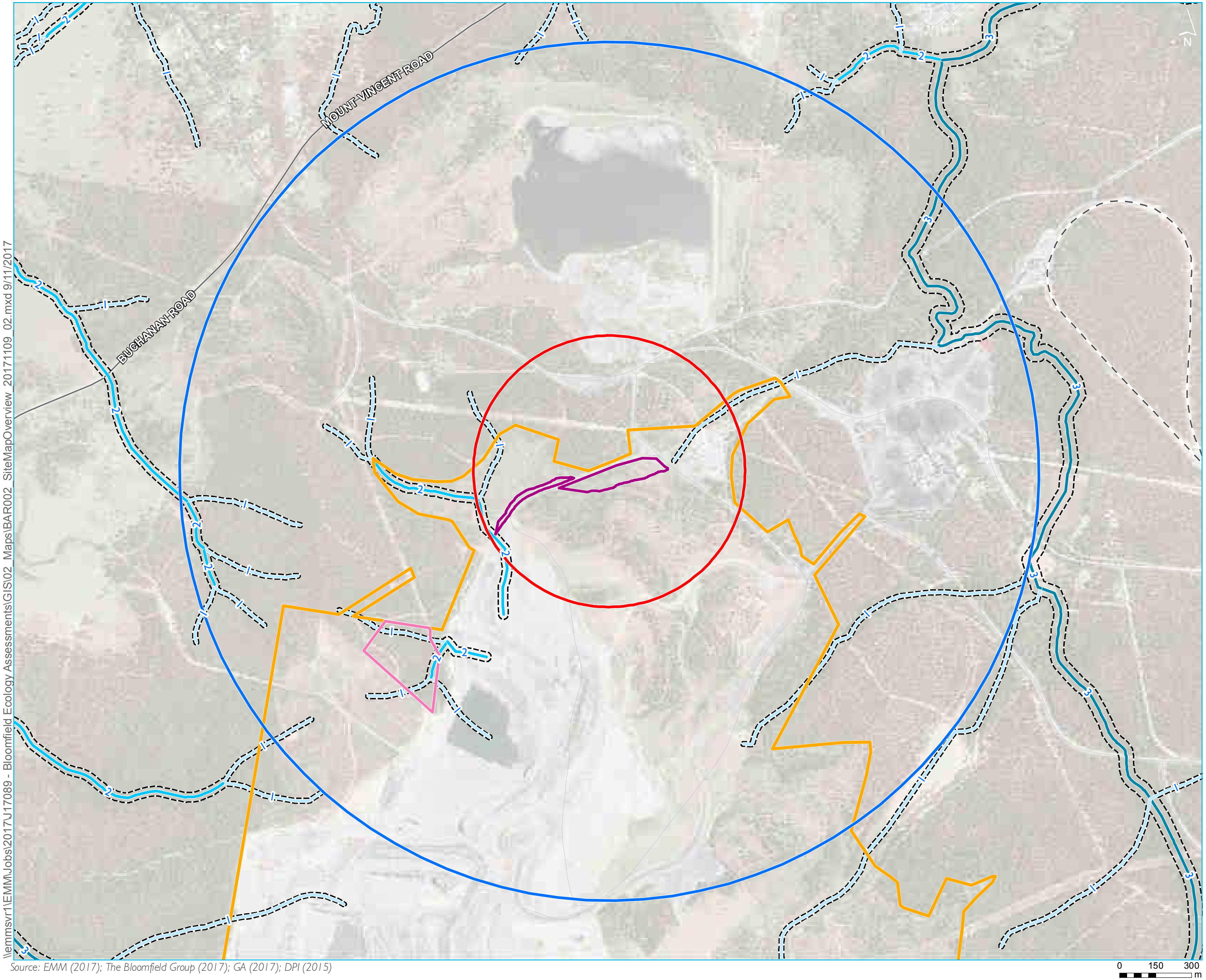
Local government area

- Cessnock City Council

The above layers cover the development footprint and development site.

Location map

Bloomfield Colliery
Biodiversity assessment report
Figure 1.1



KEY
- Outer assessment circle
- Inner assessment circle
- MNES study area
- Study area
- Development site
- Strahler stream order
  - 1
  - 2
  - 3
- 10 m buffer (first order streams), 20 m buffer (second order streams), 30 m buffer (third order streams)
- Main road
- Local road
- Rail line

Source: EMM (2017); The Bloomfield Group (2017); GA (2017); DPI (2015)

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Site map

Bloomfield Colliery

Biodiversity assessment report

Figure 1.2

EMM

2 Legislative context

This chapter provides a brief outline of the key biodiversity legislation and government policy considered in this assessment.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as MNES (Matters of National Environmental Significance) under the EPBC Act. These are:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- nuclear actions (including uranium mining), and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, an action that may have a significant impact on a MNES is deemed to be a 'controlled action' and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially have a significant impact on a MNES is to be referred to DoEE for determination as to whether or not it is a controlled action.

The proposal is unlikely to have a significant impact on MNES and, therefore, is not required to be referred to DoEE for approval from the Commonwealth Minister for the Environment, as explained in Section 8.1 of this report.

Further, the MNES study area, as outlined within Section 1.4.2, was assessed only for impacts to MNES to accompany the Mod 4 application. This assessment can be found within Appendix A. Although it is concluded that this portion of the proposal is also unlikely to significantly impact upon MNES and is therefore not required to be referred to DoEE, a number of recommendations in regards to mitigation and management are described in Appendix A, for the MNES study area.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the consideration and management of impacts of proposed development or land-use changes on the environment and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DPE).

The EP&A Act provides the overarching structure for planning in NSW; however is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

Biodiversity impacts arising from the major project are assessed under the FBA (OEH 2014a). Project Approval (PA) 07_0087 was originally granted in 2009 under Part 3A of the EP&A Act; this includes the proposed clearing of 6.12 ha of vegetation to facilitate the further extraction of coal resources. Therefore, this BAR only considers the impacts to biodiversity arising from the proposed clearing of 3.5 ha of rehabilitated landform (including 0.34 ha of native vegetation) for the proposed widening of a haul road and upgrade of a watercourse.

i State Environmental Planning Policies (Part 3 Division 2)

State Environmental Planning Policies (SEPPs) outline policy objectives relevant to state wide issues. The SEPP relevant to the current development is *SEPP No. 44 Koala Habitat Protection.*

SEPP 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in Councils listed in Schedule 1 of the SEPP. The study area is located in the Cessnock City Council LGA, which is listed in Schedule 1; therefore Koala habitat has been considered within this assessment.

2.2.2 Threatened Species Conservation Act 1995

The TSC Act was the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and ecological communities and the declaration and mapping of their critical habitats, as well as the identification of key threatening processes.

The TSC Act also established a system for biodiversity certification and established the Biodiversity Banking and Offsets Scheme. For all major projects, impacts to biodiversity are assessed in accordance with the FBA.

The TSC Act was replaced by the BC Act on 25 August 2017; however, it is still relevant for this proposal, as outlined in the following section.

2.2.3 Biodiversity Conservation Act 2016

In August 2017 the BC Act commenced operation. This new Act changes the way impacts to biodiversity are assessed and offset in NSW, with offsetting required for any projects exceeding certain clearing thresholds outlined in the *Biodiversity Conservation Regulation 2017* (BC Regulation).

Concurrent with the commencement of the BC Act, the NSW Government released the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* (Savings and Transitional Regulation). This Regulation sets out a number of transitional arrangements, including arrangements for Major Projects. Under this section of the Savings and Transitional Regulation, development applications can be considered under the previous legislation if assessment requirements have been issued or substantial environmental assessment was undertaken before the 25 August 2017. These development applications must be submitted within 18 months of 25 August 2017.

As the SEARs related to the proposal were issued on 22 March 2017 (referring to the FBA), this section of the Savings and Transitional Regulation is relevant, and the application for Mod 4 can be made within 18 months of the BC Act commencing and will be considered under the previous legislation.

These deadlines can be extended by the Department of Planning and Environment to up to 3 years from 25 August 2017 by reissuing the assessment requirements

2.2.4 Fisheries Management Act

The FM Act provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through the Assessment of Significance process under Section 220ZZ of the FM Act and Section 5A of the EP&A Act.

Two key objectives of the FM Act are to conserve fish stocks and key fish habitats, and conserve threatened species, populations and ecological communities of fish and marine vegetation. When reviewing applications, the Department of Primary Industries (DPI) will assess the likelihood of impacts to waterways in relation to their sensitivity (TYPE) and waterway class (CLASS).

Buttai Creek to the south-west and Four-mile Creek to the north-west of the study area are mapped as Key Fish Habitat by DPI. Most of the operational mining areas at the development site are located within the catchment of Four Mile Creek. However, no impacts to any drainage lines that drain into these identified waterways will result from the proposal and no further consideration is required.

2.2.5 Biosecurity Act 2015

The NSW Biosecurity Act 2015 (BS Act) has superseded the Noxious Weeds Act 1993, which has now been repealed.

The primary object the BS Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

The BS Act stipulates management arrangements for weed biosecurity risks in NSW, with the aim to prevent, eliminate and minimise risks. Management arrangements include:

- any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about;
- applies to all land within NSW and all waters within the limits of the State; and
- local strategic weed management plans will provide guidance on the outcomes expected to discharge duty for the weeds in that plan.

The *Hunter Regional Strategic Weed Management Plan* (Hunter Local Land Services 2017) outlines how government, industry, and the community will share responsibility and work together to identify, minimise, respond to and manage weeds. The plan also supports regional implementation of the BS Act. The study area contains priority weeds as listed within the plan and this is discussed further in Section 8.3.

3 Landscape

3.1 Bioregions and landscapes

The study area occurs within the Sydney Basin IBRA Bioregion and the Hunter IBRA sub-region, which covers the entire development site and is the subregion used in this assessment, as shown in Figure 1.1.

The study area occurs within the Hunter Coastal Ramp Mitchell Landscape, which covers the entire development site and is the Mitchell Landscape used in this assessment.

3.2 Waterways and wetlands

The development site is located within the Hunter catchment, east of the Great Dividing Range in eastern NSW. The Hunter catchment is bound by the Manning and Karuah catchments in the north, and by the Lake Macquarie and Hawkesbury-Nepean catchments in the south.

Due to the long history of disturbance, there is a lack of natural watercourses within the development site and study area. There are a series of diversion banks and channels that direct water into the main natural drainage system that runs through the development site, Four Mile Creek. Most of the operational mining areas at the development site are located within the catchment of Four Mile Creek. Within the development footprint, a previously rehabilitated watercourse occurs, that is subject to the current Mod 4. Strahler stream order classes within the study area are mapped within Figure 1.2.

3.3 Native vegetation extent

The smallest allowable combination of an inner assessment circle of 100 ha and an outer assessment circle of 1000 ha were used. This combination was sufficient to allow the inner and outer assessment circles to cover the entire study area, which contains all the vegetation that will be impacted by the project (Figure 3.1).

Mapping of vegetation within the inner and outer assessment circles was undertaken using aerial mapping interpretation and Lower Hunter Vegetation mapping (Parsons Brinkerhoff 2013). This mapping was modified using the vegetation extent as mapped by EMM (see Section 4). Vegetation within the inner and outer assessment circles is shown in Figure 3.1.

Regional mapping of the native vegetation communities within the outer assessment circles includes:

- Blackbutt – Turpentine – Sydney Blue Gum mesic tall open forest on ranges of the Central Coast;
- Disturbed – Rehabilitation;
- Grey Gum – Smooth-barked Apple – Blue-leaved Stringybark shrub – grass open forest on coastal ranges of the Sydney Basin;
- Smooth-barked Apple – Red Bloodwood - Brown – Hairpin Banksia heathy open forest of coastal lowlands;
- Spotted Gum – Narrow-leaved Ironbark shrub – grass open forest of the central and lower Hunter;
- Spotted Gum – Red Ironbark – Grey Gum shrub – grass open forest of the Lower Hunter;

- Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub-grass open forest of the lower Hunter, and

- White Mahogany – Spotted Gum – Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley.

3.4 Assessment of landscape value

Landscape value has been calculated using the method for site-based developments, outlined in Appendix 4 of the FBA (OEH 2014a).

3.4.1 Assessment of the current extent of native vegetation cover

The extent of native vegetation cover before development for both the inner and outer assessment circles was determined as the sum of areas of the native vegetation map units listed above.

To determine the extent of native vegetation cover after development, the extent of native vegetation to be removed for the development (0.34 ha) was subtracted from the extent of native vegetation cover before development. Table 3.1 provides a summary of the extent of native vegetation cover in the inner and outer assessment circles, before and after development.

Table 3.1 Extent of native vegetation cover before and after development

Assessment circle	Before development		After development	
	Area (ha)	%	Area (ha)	%
Outer assessment circle	465.69	47	465.35	47
Inner assessment circle	37.86	38	37.52	38

There will be no significant change in the extent of native vegetation in either the inner or outer assessment circles as a result of the development.

3.4.2 Assessment of connectivity value

The study area does not contain the following:

- an area identified as being part of a state significant biodiversity link;

- a riparian buffer 50 metres (m) either side of a 6th order stream;

- a riparian buffer 50 m around an important wetland or estuarine area;

- an area identified as being part of a regionally significant biodiversity link; or

- a riparian buffer either side of a 4th or 5th order stream.

Therefore the proposed development will not impact upon any state significant biodiversity links or regionally significant biodiversity links.

The study area was assessed as being part of a single connective link (see Figure 3.1) and the connectivity width category before and after the development will remain at >5-30 m. The development will not result in a linkage width threshold being crossed.

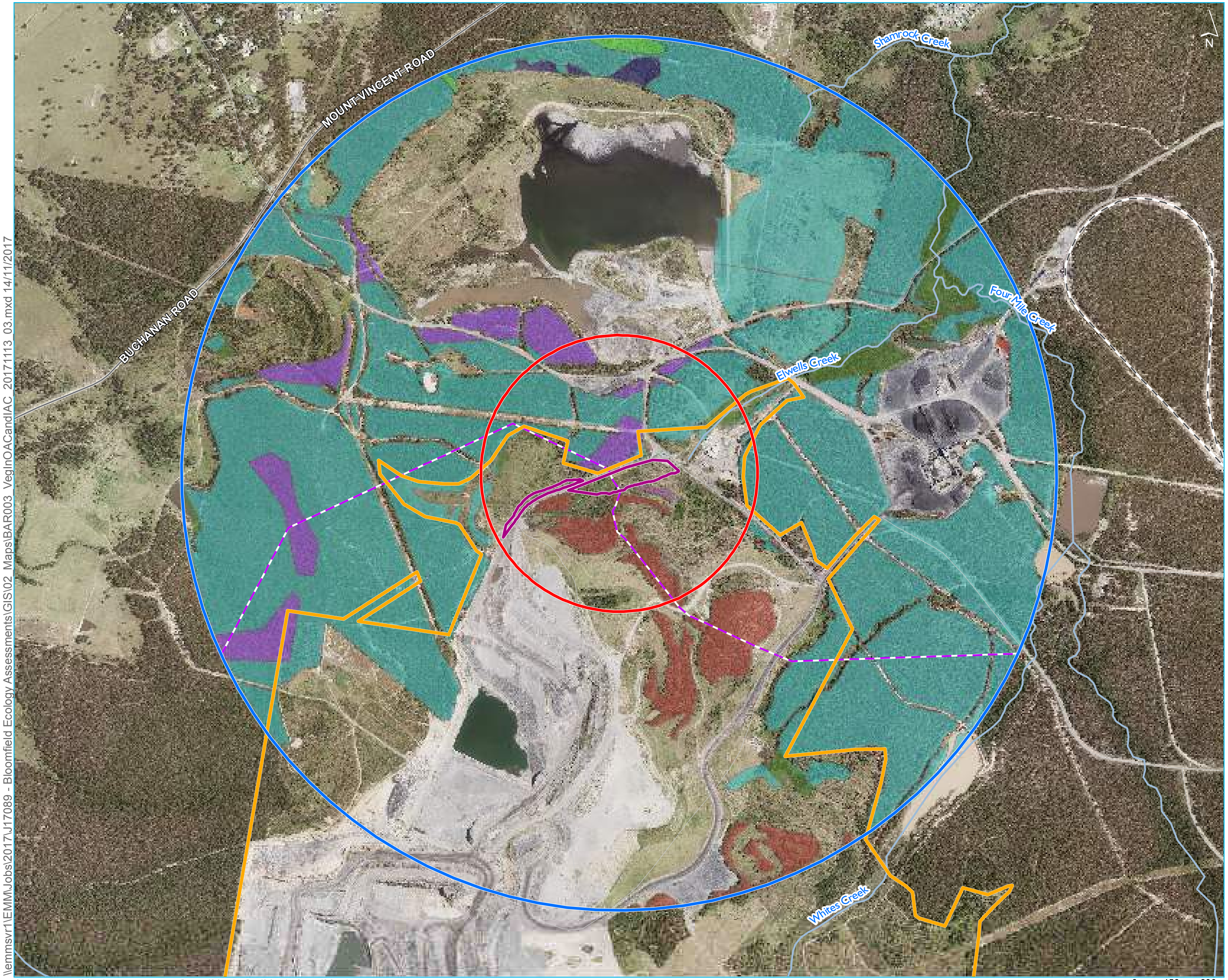
Overstorey condition for the connective link was assessed based on aerial photo interpretation and onground assessment. Overstorey vegetation within the connective link was assessed as being in benchmark condition. No change in overstorey condition will result from the proposal. Midstorey/groundcover condition was assessed based on a rapid assessment of vegetation within the locality, with vegetation reviewed from roadsides. Midstorey vegetation within the connective link was assessed as being less than 50 per cent of benchmark condition. No change to midstorey/groundcover condition will result from the LSF.

The proposed development will not result in any change in linkage condition classes.

3.4.3 Assessment of patch size

Patch size was assessed using a select process in ArcGIS, using existing vegetation mapping (Parsons Brinkerhoff 2013) and aerial imagery. All vegetation not defined as low condition and separated by a distance of less than 100 m (woody vegetation types) and 30 m (non woody vegetation types) was mapped sequentially. This process showed that the vegetation within the development footprint forms part of a very large patch of connecting vegetation with a patch size larger than 1,000 hectares (ha).

The Newcastle Coastal Ramp Mitchell Landscape is estimated to be 54 per cent cleared. A patch size of >200 ha fits into the 'Extra Large' patch size class; therefore, the patch size is Extra Large.



KEY
- Outer assessment circle
- Inner assessment circle
- Study area
- Development site
- Main road
- Local road
- Watercourse
- Rail line

Native vegetation - plant community type
- Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
- Disturbed - Rehabilitation
- Grey Gum - Smooth-barked Apple - Blue-leaved Stringybark shrub - grass open forest on coastal ranges of the Sydney Basin
- Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
- Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter
- Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
- Untitled Polygon
- White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley
- Connective links

Source: EMM (2017); The Bloomfield Group (2017); GA (2017); OEH (2017)

0 150 300
m
GDA 1994 MGA Zone 56

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Vegetation in the inner and outer assessment circles, including connective links - overview map

Bloomfield Colliery
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Figure 3.1

EMM

4 Native vegetation

The extent of native vegetation within the development site was determined using Section 5 of the FBA (OEH 2014), as summarised within this chapter.

4.1 Background review

A review of regional vegetation mapping (Parsons Brinkerhoff 2013) was undertaken to inform the site investigation. Parsons Brinkerhoff identifies three vegetation communities within the inner assessment circle including:

- Blackbutt – Turpentine – Sydney Blue Gum mesic tall open forest on ranges of the Central Coast;
- Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands, and
- Spotted Gum – Red Ironbark – Grey Gum shrub - grass open forest of the Lower Hunter.

4.2 Methods

4.2.1 Site investigation

An initial investigation of the study area was conducted by two senior EMM ecologists on Thursday 24 August 2017. The purpose of this assessment was to gain an understanding of the vegetation structure and dominant flora species within the study area. Floristic plot and transects, as well as Rapid Data Points (RDPs) to record dominant species in each vegetation layer (ground, shrub and canopy), were undertaken to identify vegetation communities. The above aided in identifying plant community types (PCTs), whether those communities may be representative of EECs, and to identify potential habitat for threatened flora and fauna species.

Detailed mapping of vegetation communities was conducted using hand-held GPS units (GDA94), mobile table computers and aerial photo interpretation. Where possible, vegetation communities were classified into PCTs using the vegetation information system (VIS) classification database version 2.1. The VIS database contains descriptions of PCTs and was established as the NSW standard community level vegetation classification for use in site based planning processes and standardised vegetation mapping. Areas of native vegetation for which a PCT could be assigned were then identified and delineated in the field.

Through an iterative design process, which considered biodiversity values, Bloomfield reduced the initial area of the proposed development and restricted it to the current study area. EMM used the data in the initial assessment to inform the current biodiversity assessment.

Following the stratification of Vegetation Zones, site value was assessed using data obtained via plots and transects, as per the methodology outlined in Section 5 of the FBA (OEH 2014). Plot and transect data was collected from the development site on 11 October 2017 and included:

- 20 m x 50 m quadrats and 50 m transects for assessment of site attributes, and
- 20 m x 20 m quadrats, nested within the larger quadrats outlined above, for full floristic survey to determine native plant species richness.

The minimum number of plots and transects per Vegetation Zone was determined using Table 3 of the FBA (OEH 2014a). A total of four plots and transects were completed within the study area (Figure 4.1).

Floristic data, including plot and transect data, is included within Appendix B.

The site investigation methods undertaken within the MNES study area to assess the vegetation present are included within Appendix A.

4.3 Results

4.3.1 Vegetation description

The study area is currently used as part of the operating Bloomfield Open Cut Colliery and contains rehabilitated landform and haul roads associated with past and current mine operations. The study area has been historically cleared for open cut mining and occurs on heavily disturbed land that is rehabilitated landform. Within the study area, this rehabilitation occurs as:

- patches of regenerating forest, consisting of stands of regenerating trees of a similar size, no very large trees, a sparse mid storey and grassy understorey; and
- exotic grassland dominated by grass species that are common to mine rehabilitation, especially Rhodes Grass (*Chloris gayana*), with *Acacia* sp. regrowth in the mid storey and no canopy layer.

It is noted that the landform is very disturbed. As a result, regenerating woodland within the study area may be a result of planted revegetation, natural regeneration from the existing seed bank, natural regeneration as a result of seeds from the surrounding vegetation types that contain older trees, or a combination of these. PCTs have been assigned based on best possible fit, considering past land use and adjacent PCTs.

The study area supports 0.34 ha of native vegetation, occurring as small patches. The vegetation identified within the study area with descriptions and photographs of each is provided in the following section.

The two plots and transects completed within the exotic grassland resulted in a site value score of less than 17, therefore there is no requirement to determine an offset. The following section describes the exotic grassland, however it is not considered further within the impact assessment.

The vegetation description for the MNES study area is included within Annex A.

4.3.2 Plant community types

Site investigations, including determination of vegetation communities using the methods described in Section 4.2.1, identified the presence of two PCTs within the study area (Figure 4.1). The PCT, vegetation formation and vegetation class (Keith 2004) are described in Table 4.1.

Table 4.1 Plant community types of the study area and corresponding formation and class

Plant community type	Vegetation formation	Vegetation class	Area (ha
PCT 1590 - Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	0.05
PCT 1592 – Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	0.29

The two PCTs identified within the study area were assessed as being in moderate/good condition in accordance with the FBA. One area of non-native vegetation, dominated by exotic grasses, was also identified (Figure 4.1). This area had a site value score of less than 17, and is not considered further for offsets.

As there are only two PCTs, with each one having no change in condition across the study area, no further stratification of PCTs was required nor the use of an ancillary code. This has resulted in two vegetation zones identified for the study area; one for each PCT, as outlined in Table 4.2.

Table 4.2 Vegetation zones mapped within the study area

Vegetation zone	Plant community type	Condition	Ancillary code	Area (ha)
1	PCT 1590 - Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	Moderate/Good	-	0.05
2	PCT 1592 – Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter	Moderate/Good	-	0.29

Descriptions of each vegetation zone are provided in Tables 4.3 and 4.4 and a description of the exotic grassland is provided within Table 4.5. The PCTs and exotic grassland are mapped within Figure 4.1.

Table 4.3 Vegetation zone 1 description

Vegetation zone 1 –Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	
PCT ID	1590
Biometric vegetation type ID	HU804
Common name	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
Condition class	Moderate/good
Extent within study area	0.05 ha (Figure 4.1)
Description	The canopy layer of this community is dominated by Spotted Gum (*Corymbia maculata*) with Forest Red Gum (*Eucalyptus tereticornis*) also present. Both canopy species were to approximately 16 m in height. Native Mistletoe (*Dendrophthoe vitellina*) was also recorded at low abundance within the canopy. The mid storey is sparse containing the non-indigenous Golden Wreath Wattle (*Acacia saligna*). This species is from Western Australia and has become naturalised along parts of the coast of NSW and is common to revegetation plantings. Sydney Golden Wattle (*Acacia longifolia*) and Swamp Wattle (*Acacia elongata*) are also present within the mid-storey in low abundance. The ground layer is dominated by exotic Rhodes Grass (*Chloris gayana*), a widely cultivated pasture species, also used as a soil stabilizer. Native grass species Wiry Panic (*Entolasia stricta*) and Blady Grass (*Imperata cylindrica*) are also present at much lower abundance. Other native species in the ground layer, also recorded at low abundance, included Many-flowered Mat-rush (*Lomandra multiflora*) and Whiteroot (*Pratia purpurascens*) Other exotic species present in the ground layer include Fireweed (*Senecio madagascariensis*), Red Natal Grass (*Melinis repens*), Black-berry Nightshade (*Solanum nigrum*), Lantana (*Lantana camara*), Scarlet Pimpernel (*Lysimachia arvenses*) and African Daisy (*Senecio pterophorus*).
Survey effort	2 plots, one within the study area and one adjacent due to changes during detailed design.
Condition description	This community is generally in poor condition with a high cover of introduced grasses due to the surrounding land use and associated edge impacts. Based on the community composition, it is concluded that this community is planted revegetation.
Characteristic species used for identification of PCT	According to the NSW VIS Classification Version 2.1, the canopy layer species recorded within this community that align with the dominant species listed as characteristic of this PCT include Spotted Gum. Aligning ground layer species include Blady Grass, White Root and Many-flowered Mat-rush.
Justification of evidence used to identify the PCT	Apart from the species composition, the stated distribution is low ranges of the lower Hunter Valley and Central Coast including within the Hunter IBRA subregion and the Newcastle Coastal Ramp Mitchell Landscape. The occurrence of the community on a low rise (hillslope) is also consistent with Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest PCT. The characteristic species, as listed above, are consistent with the PCT, particularly in less disturbed parts of the community adjacent to the study area. This vegetation is planted revegetation, and PCT 1590 is considered best fit.
Status	Commonwealth EPBC Act: not listed NSW TSC Act: listed as Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion endangered ecological community.
Estimate of percent cleared value of PCT in the major catchment area	48%

Table 4.3 Vegetation zone 1 description

Vegetation zone 1 –Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	
Photograph 1: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest Plot 1	
Photograph 2: Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest Plot 5 (outside of study area due to changes during detailed design)	

Table 4.4 Vegetation zone 2 description

Vegetation zone 2 – Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter	
PCT ID	1592
Biometric vegetation type ID	HU806
Common name	Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter
Condition class	Moderate/good
Extent within study area	0.29 ha (Figure 4.1)
Description	This community has a mixed canopy of Smooth-barked Apple (*Angophora costata*), Grey Gum (*Eucalyptus punctata*), Spotted Gum, White Stringybark (*Eucalyptus globoidea*) and Broad-leaved White Mahogany (*Eucalyptus umbra*) to approximately 16 m in height. Cheese Tree (*Glochidion ferdinandi*) was also present in this layer. The mid storey is relatively sparse, with Blackthorn (*Bursaria spinosa*) being the most dominant native species. Black Wattle (*Acacia decurrens*) and non-indigenous Golden Wreath Wattle are also present and sub-dominant in the mid storey. Native Silver-stemmed wattle (*Acacia parvipinnula*) is present in low abundance. The ground layer is dominated by native Threeawn Speargrass (*Aristida vagans*). Other native ground layer species include Speargrass (*Austrostipa* sp.), Wiry Panic, Wattle Mat-rush (*Lomandara filiformis*), Purple Coral Pea (*Hardenbergia violacea*), Whiteroot, Wonga Wonga Vine (Pandorea pandorana), Blue Flax-Lily (*Dianella longifolia*), Apple Berry (*Billardiera scandens*), Hairy Bush Pea (*Pultenaea villosa*), Prickly Beard-heath (*Leucopogon juniperinus*), Old Man's Beard (*Clematis aristata*) and Rockfern (*Cheilanthes sieberi*). Exotic species within the ground layer include Fleabane (*Conyza* sp.), Scarlet Pimpernel, Lantana and Plantain (*Plantago lanceolata*). Exotic grasses Whisky Grass (*Andropogon virginicus*), Rhodes Grass and Pampas Grass (*Cortaderia selloana*) were more abundant on the edge of community.
Survey effort	One plot/transect within the study area (plot 2)
Condition description	This community is generally in good condition with a moderately diverse ground and mid layer within the mapped occurrence. However, a high cover of introduced grasses occurs on the edges of the community due to the surrounding land use and associated edge impacts. Based on the community composition, it is concluded that this community is planted revegetation with some natural regeneration influenced from the stand of native vegetation upslope of the haul road.
Characteristic species used for identification of PCT	According to the NSW VIS Classification Version 2.1, the canopy layer species recorded within this community that align with the dominant species listed as characteristic of this PCT include Spotted Gum and Grey Gum. Aligning mid storey and ground layer species include Native Blackthorn, Threeawn Speargrass and Whiteroot.
Justification of evidence used to identify the PCT	Apart from the species composition, the stated distribution is the lower Hunter Valley including within the Hunter IBRA subregion and the Newcastle Coastal Ramp Mitchell Landscape. The occurrence of the community on a hillslope is also consistent with Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter PCT. The characteristic species, as listed above, are consistent with the PCT. This vegetation is a mix of revegetation and natural regeneration, and PCT 1592 is considered best fit based on a natural form of this PCT being located upslope.
Status	Commonwealth EPBC Act: not listed NSW TSC Act: listed as Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion endangered ecological community.
Estimate of percent cleared value of PCT in the major catchment area	44%

Table 4.4 Vegetation zone 2 description

Vegetation zone 2 – Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter	
Photograph 1: Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter Plot 2	
Photograph 2: Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter Plot 2	

Table 4.5 Exotic grassland description

Exotic grassland	
PCT ID	N/A
Biometric vegetation type ID	N/A
Common name	Exotic grassland
Condition class	N/A
Extent within study area	3.2 ha (Figure 4.1)
Description	This community does not have a canopy layer. The mid layer is open and contains scattered Sydney Golden Wattle (*Acacia longifolia*), non-indigenous Golden Wreath Wattle and Swamp Wattle (*Acacia elongata*). Hairy Bush-pea (*Pultenaea villosa*), Large-leaf Hop-bush (*Dodonaea triquetra*) and Cheese Tree are present in low abundance. The ground layer is dominated by exotic Rhodes grass, seeded as mine site rehabilitation. Exotic Whiskey Grass is the sub-dominant species in this layer. Other exotic grasses include Quaking Grass (*Briza maxima*), Couch (*Cynodon dactylon*) and Perennial Ryegrass (*Lolium perenne*). Other exotic species in the ground layer include Fireweed, Fleabane, Cobblers Pegs (*Bidens pilosa*), Plantain, Crofton Weed (*Ageratina adenophora*), Catsear (*Hypochaeris radicata*), Scotch Thistle (*Onopordum acanthium*), African daisy (*Senecio pterophorus*), Purpletop (*Verbena bonariensis*) Exotic Lantana was also present in this layer in low abundance. Some native species were recorded within the ground layer in low abundance, namely Indian Pennywort (*Centella asiatica*), Pennywort (*Hydrocotyle tripartite*), Pimpernel (*Lysimachia arvensis*) Small St. John's Wort (*Hypericum gramineum*) and Whiteroot.
Survey effort	Two plot/transects within the study area (plot 3 and plot 4)
Condition description	This community has a very high cover of exotic grass species, has a mid layer dominated by non-indigenous wattle species, has no canopy layer and is on highly disturbed landform that is unlikely to have a seed bank. It is concluded that this community is planted revegetation (using exotic Rhodes Grass) with some natural regeneration influenced from the stands of native vegetation upslope.
Characteristic species used for identification of PCT	N/A
Justification of evidence used to identify the PCT	N/A
Status	Commonwealth EPBC Act: not listed NSW TSC Act: not listed
Estimate of percent cleared value of PCT in the major catchment area	N/A

Table 4.5 Exotic grassland description

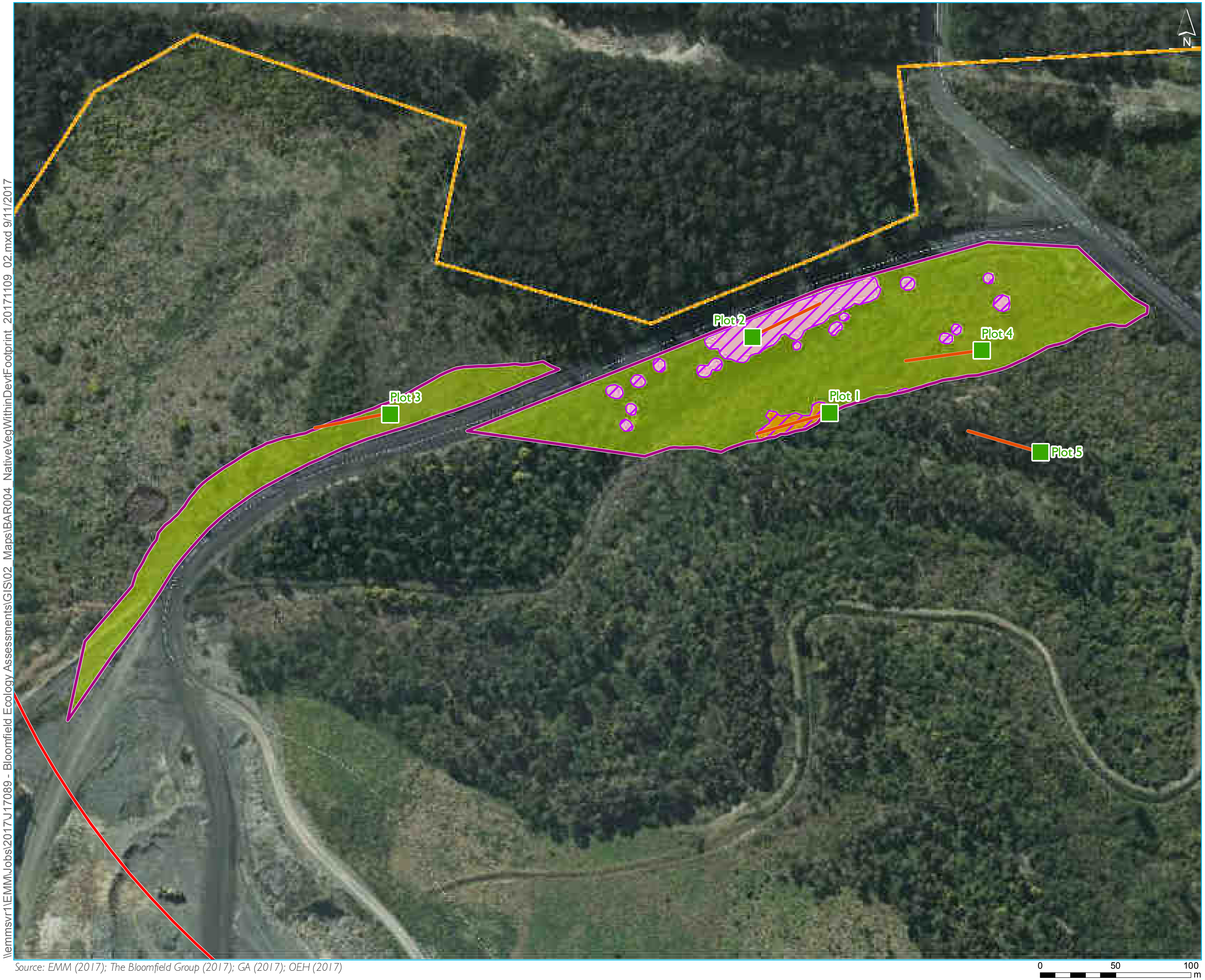
Exotic grassland	
Photograph 1: Exotic grassland Plot 3	
Photograph 2: Exotic grassland Plot 4	

4.3.3 Site value scores

Site value scores for each vegetation zone are presented in Table 4.5.

Table 4.6 Site value score for the Vegetation Zones

Vegetation zone	Plant community type	Area (ha)	Site value score
1	PCT 1590 Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest	0.05	30.21
2	PCT 1592 Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter	0.29	35.42



KEY
- Plots
- Transect
- Inner assessment circle
- Study area
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion Endangered Ecological Community
- PCT 1590 - Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
- PCT 1592 – Spotted Gum – Red Ironbark – grass open forest of the Lower Hunter
- Exotic grassland
- Development site

Source: EMM (2017); The Bloomfield Group (2017); GA (2017); OEH (2017)

GDA 1994 MGA Zone 56

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Native vegetation within the development footprint, including flora survey effort

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Biodiversity assessment report
Figure 4.1

EMM

5 Threatened species

5.1 Methods

Flora and fauna assessments of the study area were undertaken on 24 August and 11 October 2017.

Targeted flora surveys were undertaken in accordance with OEH (2016) and involved walking parallel transects approximately 5 m apart through all native vegetation within the study area (refer to Figure 5.1). Targeted flora surveys were undertaken for the following species:

- Black-eyed Susan (*Tetratheca juncea*);
- Netted Bottle Brush (*Callistemon linearifolius*);
- Scant Pomaderris (*Pomaderris queenslandica);*
- Singleton Mint Bush *(Prostanthera cineolifera);*
- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora),* and
- White-flowered Wax Plant (*Cynanchum elegans).*

Fauna species were recorded opportunistically as they were encountered during the field survey. Any evidence of fauna such as tracks, scats, scratches on and around trees, and any potential fauna habitat features were also noted, including:

- the presence of nesting/sheltering/basking sites such as tree hollows, litter, fallen timber and logs and rocks;
- the cover/abundance of ground, shrub and canopy layers;
- drainage and the presence of freshwater habitats noting their permanency (ie permanent, semi-permanent or ephemeral);
- connectivity to adjacent areas of habitat;
- the extent and nature of previous disturbances, including the presence of fire scars and dieback;
- vegetation assemblage and structure;
- soil type and topography; and
- habitat surveys for Koala habitat and feed trees, including opportunistic surveys for individuals and scats (faeces).

The primary purpose of the fauna habitat assessment was to consider the potential for any listed species to occur within the study area.

5.2 Fauna habitat assessment results

The regenerating forested areas within the study area are likely to provide habitat for a range of common fauna species. No tree hollows were observed within the forested patches in the study area, as a result of the relatively young canopy. Therefore, it is unlikely that the study area provides shelter for arboreal mammals or nesting habitat for hollow dependant birds. These species may occasionally forage in these areas.

The terrestrial habitat in the regenerating forested areas have limited shelter provided by occasional fallen trees and other woody debris and may provide habitat for small mammals and reptiles. However, the scarcity of fallen timber and other debris, combined with the small patch size and fragmented landscape means the habitat is insufficient and suboptimal for larger mammals such as the Spotted-tailed Quoll (*Dasyurus maculatus*).

The regenerating forested areas may provide foraging habitat for a number of threatened bird species that are associated with the PCTs recorded within and nearby to the study area. These bird species include the Speckled Warbler (*Chthonicola sagittata),* Varied Sittella (*Daphoenositta chrysoptera),* Scarlet Robin (*Petroica boodang)* and the Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).

The regenerating forested areas may also provide foraging habitat for a number of threatened forest owls that are associated with the vegetation types recorded within and nearby to the study area. These include the Barking Owl (*Ninox connivens),* Powerful Owl (*Ninox strenua)* and Masked Owl (*Tyto novaehollandiae).* These species are unlikely to utilise the study area for roosting and nesting due to lack of suitable hollows due to the age of regeneration; however, it is possible that they may forage in the study area, considering the larger intact areas of vegetation in the locality that may support these species.

The regenerating forested areas may also provide foraging habitat for a number of threatened cave roosting and hollow roosting micro bats as identified in Table 5.2. These species are unlikely to utilise the study area for roosting due to lack of suitable habitat, however it is possible that they may forage in the study area, considering the larger intact areas of vegetation in the locality that may provide suitable roosting habitat for these species.

Two Koala (*Phascolarctos cinereus)* feed tree species, as listed under SEPP 44, were recorded within the study area; namely, the Forest Red Gum and Grey Gum. Forest Red Gum comprised a small proportion of the canopy (5%) in PCT 1590 and Grey Gum a small proportion of the canopy (10%) in PCT 1592. The study area is included within the north coast Koala Management Area (KMA) (OEH 2017) which lists three tiers of koala feed tree; Primary, Secondary and Stringybarks/supplementary species. The primary feed tree Forest Red Gum was recorded within PCT 1590 and no secondary feed trees listed for the KMA were found. Stringybark/supplementary species White Stringybark was recorded within PCT 1592. No Koala scats were detected during searches around the base of primary and supplementary feed tree species and due to the lack of records, small proportion of Forest Red Gum and Grey Gum in the canopy, as well as the fragmented and disturbed nature of the study area, it is unlikely that there are sufficient foraging resources to support the Koala within the Study area.

Spotted Gum occurs within the study area, which is a favoured foraging resource for BC Act and EPBC Act listed Regent Honeyeater (*Anthochaera Phrygia)* and Swift Parrot (*Lathamus discolour)*. Relatively young trees, such as those within the study area, do not produce as high nectar yields compared to larger and older trees; and therefore these species would only be considered vagrant in the study area, as per Section 6.5.1.3 of the FBA (OEH 2014a) and are unlikely to use the habitat within the study area.

Other threatened species, namely the Little Lorikeet (*Glossopsitta pusilla)* and Turquoise Parrot (*Neophema pulchella)* may utilise the forested areas of study area as a seasonal foraging resource.

The exotic grassland habitat has a dense grassy ground layer that may be suitable habitat for a range of common grassland fauna species, but provides very little habitat value in terms of mid storey or canopy structure. As the canopy layer is absent there is no opportunity for species that use tree hollows for shelter and nesting or the canopy layer for foraging, shelter and roosting.

Aquatic habitat within the study area is minimal and limited to the existing modified drainage line. The drainage line is ephemeral and contained no water at the time of the field survey, and is highly disturbed and infested with exotic grass species. The study area does not contain suitable breeding habitat for any BC Act or EPBC Act listed frog species.

Two migratory species, the Fork-tailed Swift and White-throated Needletail, will possibly occur within the study area. However, due to their almost exclusive aerial nature, potential impacts are unlikely to occur.

Source: EMM (2017); The Bloomfield Group (2017); GA (2017); OEH (2017)

KEY

- Targeted flora tracks
- Inner assessment circle
- Study area
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion Endangered Ecological Community
- PCT 1590 - Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
- PCT 1592 – Spotted Gum – Red Ironbark – grass open forest of the Lower Hunter
- Exotic grassland
- Development site

Targeted survey effort

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Figure 5.1

EMM

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5.3 Geographical habitat features

An assessment of the occurrence of geographic habitat features, in accordance with Section 6.3 of the FBA (OEH 2014) was undertaken, along with the determination of whether impacts to these habitat features will result from the proposal. The results of this assessment, along with the species generated by the calculator associated with the FBA are shown in Table 5.1.

Table 5.1 Assessment of geographical features within the development site

Common name	Scientific name	Feature	Present in development site	Justification
Green and Golden Bell Frog	*Litoria aurea*	Land within 100 m of emergent aquatic or riparian vegetation.	No	The study area is not within 100 m of emergent aquatic or riparian vegetation. The rehabilitated watercourse within the study area is dominated by exotic Rhodes Grass and does not contain emergent aquatic vegetation or riparian vegetation.
Green-thighed Frog	*Litoria brevipalmata*	Land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.	No	The study area is not within 100 m of a semi-permanent or ephemeral pond or depression. The rehabilitated watercourse within the study area does not contain leaf litter as it is dominated by exotic Rhodes Grass.
Large-eared Pied Bat	*Chalinolobus dwyeri*	Land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.	No	The study area does not contain escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels.
Heath Wrinklewort	*Rutidosis heterogama*	Heath on sandy soils, or moist areas in open forest.	No	The study area does not contain heath on sandy soils, or moist areas in open forest.
Pale-headed Snake	*Hoplocephalus bitorquatus*	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber.	No	The study area is not within 40 m of a watercourse.
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Land within 1 km of rock outcrops or cliff lines.	No	The study area is not within 1 km of rock outcrops or cliff lines.
Common Planigale	*Planigale maculata*	Rainforest, eucalypt forest, heathland, marshland, grassland or rocky areas.	Yes	The study area contains small patches of eucalypt forest.
-	*Eucalyptus parramattensis subsp. decadens*	Deep, low-nutrient sands.	No	The study area is not on deep, low-nutrient sand.

The study area supports suitable geographic features for one species; the Common Planigale. Further consideration is given to this species in Section 5.6.

5.4 Targeted survey results

No target species were recorded within the study area during targeted survey.

5.5 Ecosystem credit species

A list of ecosystem credit species predicted to occur within the study area, based on the PCTs present and generated by the calculator associated within the FBA (OEH 2014) is provided in Table 10. The potential for these species to occur within the study area was assessed in accordance with Section 6.3 of the FBA (OEH 2014).

Table 5.2 Assessment of ecosystem credit species within the development site

Scientific name	Common name	TS Offset multiplier
Barking Owl	*Ninox connivens*	3.0
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	1.3
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	2.0
Bush-stone Curlew	*Burhinus grallarius*	2.6
Diamond Firetail	*Stagonopleura guttata*	1.3
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2.2
Eastern Freetail-bat	*Mormopterus norfolkensis*	2.2
Gang-gang Cockatoo	*Callocephalon fimbriatum*	2.0
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	1.8
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2.2
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	1.3
Hooded Robin (south-eastern form)	*Melanodryas cucullata subsp. cucullata*	1.7
Little Eagle	*Hieraaetus morphnoides*	1.4
Little Lorikeet	*Glossopsitta pusilla*	1.8
Masked Owl	*Tyto novaehollandiae*	3.0
Painted Honeyeater	*Grantiella picta*	1.3
Powerful Owl	*Ninox strenua*	3.0
Scarlet Robin	*Petroica boodang*	1.3
Speckled Warbler	*Chthonicola sagittata*	2.6
Spotted-tailed Quoll	*Dasyurus maculatus*	2.6
Square-tailed Kite	*Lophoictinia isura*	1.4
Squirrel Glider	*Petaurus norfolcensis*	2.2
Swift Parrot	*Lathamus discolor*	1.3
Turquoise Parrot	*Neophema pulchella*	1.8
Varied Sittella	*Daphoenositta chrysoptera*	1.3
Yellow-bellied Glider	*Petaurus australis*	2.3
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2.2

Notes: *1.The threatened species offset multiplier is the inverse of the species Tg value. The Tg value is the ability of a species to respond to improvements in site value at an offset site. The species with the highest threatened species offset multiplier determines the multiplication factor on the number of ecosystem credits.*

The presence of these species could not be discounted using the methodology outlined in Section 6.3 of the FBA (OEH 2014). It was therefore assumed that these species may occur within the study area. The Barking Owl, Masked Owl and Powerful Owl have the lowest Tg value and therefore the highest threatened species (TS) offset multiplier. No adjustment to the TS offset multiplier value has been undertaken.

5.6 Species credit species

A list of species credit species predicted to occur within the study area, based on the PCTs present, along with an assessment of whether the study area provides suitable habitat and whether the species will be impacted by the development is provided within Table 5.3. The potential for a species to occur within the study area was assessed in accordance with Section 6.5 of the FBA (OEH 2014).

Table 5.3 Species credit species and status within the development site

Scientific name	Common name	Habitat present within the development site	Recorded during field surveys	Impacted by development	Justification
Flora					
Black-eyed Susan	*Tetratheca juncea*	Yes	No	No	The species has been recorded 2.2 km to the east of the development site. This species is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover (OEH 2017a), and potential habitat exists in the study area within PCT1592. The species has not been recorded during previous field surveys conducted within the development site (Hunter Eco 2010), nor in adjacent communities (Hunter Eco 2012). The targeted survey failed to detect this species, and it is considered unlikely that the species is present within the study area.
Bynoe's Wattle	*Acacia bynoeana*	No	–	No	This species has been recorded within the locality, approximately 5 km to the west of the study area. Occurs in heath or dry sclerophyll forest on sandy soils. Prefers open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood (*Corymbia gummifera*), Scribbly Gum (*Eucalyptus sclerophylla*), Parramatta Red Gum (*Eucalyptus parramattensis)*, Saw Banksia (*Banksia serrata*) and Narrow-leaved Apple (*Angophora bakeri)* (OEH 2017a). There are no sandy soils within the study area and none of the associated canopy species were recorded. There is no suitable habitat for this species within the study area therefore it is unlikely to occur.
Large-leafed Monotaxis	*Monotaxis macrophylla*	No	–	No	The species has not been recorded within the locality. The distribution and rarity of *Monotaxis macrophylla* within NSW is related to the occurrence of fire. At least within NSW, the species has not been found in the absence of fire. There is a great diversity in the associated vegetation within NSW, encompassing coastal heath, arid shrubland, forests and montane heath from almost sea level to 1300 m altitude. Grows on rocky ridges and hillsides. Displays the properties of a fire ephemeral species in many ways. Germination is stimulated by the passage of fire, individual plants have a short life span, a large biomass is produced in a short period of time, flowering occurs shortly after germination, and populations do not persist in the absence of fire. It is considered unlikely that the species is present within the study area considering the history of disturbance.
Leafless Tongue-orchid	*Cryptostylis hunteriana*	No	–	No	The species has not been recorded within the locality. Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland (OEH 2017a). The larger populations typically occur in woodland dominated by Scribbly Gum, Silvertop Ash (*E. sieberi*), Red Bloodwood and Black Sheoak (*Allocasuarina littoralis*). Preferred habitat for this species does not exist within the study area and the species is considered unlikely to occur.
Netted Bottle Brush	*Callistemon linearifolius*	Yes	No	No	There are records of this species within the locality, the closest being approximately 6 km to the south-east of the study area. Netted Bottlebrush grows in dry sclerophyll forest on the coast and adjacent ranges, and suitable marginal habitat is considered present. The species was not detected during targeted surveys therefore is considered unlikely to occur.

Table 5.3 Species credit species and status within the development site

Scientific name	Common name	Habitat present within the development site	Recorded during field surveys	Impacted by development	Justification
North Rothbury Persoonia	*Persoonia pauciflora*	No	–	No	The species has not been recorded within the locality. It is found in dry open forest or woodland dominated by Spotted Gum (*Corymbia maculata*), Broad-leaved Ironbark (*Eucalyptus fibrosa*) and/or Narrow-leaved Ironbark (*E. crebra*) and supporting a moderate to sparse shrub layer and grassy groundcover. The majority of the population is known to occur on silty sandstone soils derived from the Farley Formation. Preferred habitat for this species does not exist within the study area (Broad-leaved Ironbark and/or Narrow-leaved Ironbark are absent) and is considered unlikely to occur.
-	*Ozothamnus tesselatus*	No	-	No	The species has not been recorded within the locality, and is restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. The study area is well outside the known range of the species and is therefore considered unlikely to occur.
Rough Doubletail	*Diuris praecox*	No	-	No	The species has not been recorded within the locality. Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Suitable habitat is not present within the study area and as the study area is outside the known range of the species it is considered unlikely to occur.
Scant Pomaderris	*Pomaderris queenslandica*	Yes	No	No	The species has not been recorded within the locality. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. The species was not recorded during targeted surveys.
Singleton Mint Bush	*Prostanthera cineolifera*	Yes	No	No	The species has not been recorded within the locality. Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands. Fire response is unknown, but other *Prostanthera* species are fire sensitive, with recruitment occurring from the soil seed bank following a fire. Known to be associated with the PCTs within the study area. However, was not recorded during surveys.
Slaty Red Gum	*Eucalyptus glaucina*	No	–	No	Records exist within the locality, with the closest being approximately 4.5 km to the north-east. Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest in deep, moderately fertile and well-watered soils. It is likely that the soils of the study area are too shallow and infertile to be optimal for this species.
Small Snake Orchid	*Diuris pedunculata*	No	–	No	The species has not been recorded within the locality. Grows on grassy slopes or flats, often on peaty soils in moist areas. Also on shale and trap soils, on fine granite, and among boulders. Although it is known to be associated with the PCTs in the study area, it is not known or predicted within the Hunter IBRA subregion. It is considered unlikely that the study area provides suitable habitat.

Table 5.3 Species credit species and status within the development site

Scientific name	Common name	Habitat present within the development site	Recorded during field surveys	Impacted by development	Justification
Small-flower Grevillea	*Grevillea parviflora subsp. parviflora*	Yes	No	No	In the Hunter this species has been recorded in Kurri Sand Swamp Woodland and many records exist within the locality. Occurs in a range of vegetation types from heath and shrubby woodland to open forest (OEH 2017). Targeted survey failed to detect this species, and it is considered unlikely that the species is present within the study area.
White-flowered Wax Plant	*Cynanchum elegans*	Yes	No	No	The species has not been recorded within the locality. Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. Although the species is known to be associated with the PCTs within the study area, targeted survey failed to detect this species, and it is considered unlikely that the species is present within the study area.
Fauna					
Brush-tailed Phascogale	*Phascogale tapoatafa*	No	–	No	This species has not been recorded in the locality. Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. It is an agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater for invertebrates, nectar and small vertebrates. The species nests and shelters in tree hollows with entrances 2.5 – 4 cm wide. Although vegetation formations associated with this species are within the study area, it is regrowth with a limited potential for the species. Nectivorous resources within the study area are sparse, due to a limited mid stratum and young age of trees, with a paucity of tree hollows which the species requires for shelter. This is likely to correspond with a limited ecological function and lower abundance of invertebrates too. This, combined with the fragmented and partially cleared nature of the study area, means that species is considered unlikely to occur.
Common Planigale	*Planigale maculata*	No	–	No	This species has not been recorded in the locality. Inhabits rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. Nests in crevices, hollow logs, beneath bark or under rocks. Preys on insects and small vertebrates. This species is known to be associated with the PCTs recorded within the study area. However, the fragmented and partially cleared nature of the vegetation within the study area, as well as the young age of the regrowth vegetation means that there is limited habitat for this species. Further, the study area is not close to a permanent water source and lacks hollow logs, rocks and other woody debris that is suitable as shelter for the species. It is unlikely that the species is likely to occur within the study area.

Table 5.3 Species credit species and status within the development site

Scientific name	Common name	Habitat present within the development site	Recorded during field surveys	Impacted by development	Justification
Eastern Pygmy-possum	*Cercartetus nanus*	No	-	No	This species has not been recorded in the locality. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (e.g. grass-tree skirts). Tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Appear to be mainly solitary, each individual using several nests, with males having non-exclusive home-ranges of about 0.68 ha and females about 0.35 ha. Although vegetation formations associated with this species occur within the study area, it is regrowth with a limited potential for the species. Nectivorous resources within the study area are sparse, due to a limited mid stratum and young age of trees, with a paucity of tree hollows which the species requires for shelter. This is likely to correspond with a limited ecological function and lower abundance of invertebrates too. This combined with the, fragmented and partially cleared nature of the study area, means that species is unlikely to occur.
Emu population, NSW North Coast Bioregion and Port Stephens Local Government Area	*Dromaius novaehollandiae* - endangered population	No	-	No	The study area is located in the Sydney Basin Bioregion and Cessnock LGA. The study area is outside the distribution of the threatened population.
Koala	*Phascolarctos cinereus*	Yes	No	No	There are records of this species within the study area, the closest being approximately 2 km to the south-east. This species inhabits eucalypt woodlands and forests and feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species (OEH 2017a). Two Koala feed tree species, as listed under SEPP 44, were recorded within the study area; namely, the Forest Red Gum and Grey Gum. Forest Red Gum comprised a small proportion of the canopy (5%) in PCT 1590 and Grey Gum a small proportion of the canopy (10%) in PCT 1592. The study area is included within the north coast Koala Management Area (KMA) (OEH 2017) which lists three tiers of koala feed tree; Primary, Secondary and Stringybarks/supplementary species. The primary feed tree Forest Red Gum was recorded within PCT 1590 and no secondary feed trees listed for the KMA were found. Stringybark/supplementary species White Stringybark was recorded within PCT 1592. No Koala scats were detected during searches around the base of primary and supplementary feed tree species and due to the small proportion of Forest Red Gum and Grey Gum in the canopy, as well as the fragmented and disturbed nature of the study area, it is unlikely that there are sufficient foraging resources to support the Koala within the Study area.

Table 5.3 Species credit species and status within the development site

Scientific name	Common name	Habitat present within the development site	Recorded during field surveys	Impacted by development	Justification
Regent Honeyeater	*Anthochaera phrygia*	No	-	No	The Regent Honeyeater has a patchy distribution and is highly mobile, occurring only irregularly in most sites, and in variable numbers, often with long periods with few observation anywhere. Within the current distribution there are four known key breeding areas where the species is regularly recorded. These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria (DoE 2016). Key eucalypt species identified in the National Recovery Plan for the Regent Honeyeater (DoE 2016) comprise Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. Melliodora*), White Box (*E. albens*), Yellow Gum (*E. leucoxylon*), Spotted Gum *(Corymbia maculata*) (recorded in the study area), Swamp Mahogany (*E. robusta*), Needle-leaf Mistletoe (*Amyema cambagei*) which grows on River Oak (*Casuarina cunninghamiana)*, Box Mistletoe (*A. miquellii*) and Long-flower Mistletoe (*Dendropthoe vitellina)* (recorded in the study area). Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events of Regent Honeyeaters. Flowering of associated species such as thin-leaved stringybark (*E. eugenioides*) and other stringybark species, and broad-leaved ironbark (*E. fibrosa*) can also contribute important nectar flows at times. Two records exist within the locality, with the closest record located approximately 7 km to the west of the study area. Additionally, more records exist just outside of the locality, approximately 10 km to the south-west of the project area within the Tomalpin Woodlands, south-west of Kurri Kurri in the Lower Hunter Valley Important Bird Area (IBA). These records are associated with a known breeding event that occurred in this woodland during 2007 and 2008 (Roderick et al. 2014, Birdlife Australia 2014). The study area does not comprise breeding habitat. Suitable foraging species (Spotted Gum and Long-flower Mistletoe) occur within the study area however the Spotted Gum trees are young. The area has been historically cleared, and has a lack of large trees and many trees of a similar size, indicating a single regeneration event. Considering this vegetation is regrowth, it is unlikely to provide masses of nectar resources due to its younger age. Regent Honeyeaters prefer taller and larger diameter trees for foraging, as these typically produce more nectar (Franklin et al., 1989; Webster & Menkhorst 1992; Menkhorst et al., 1999; Oliver 2000, in DoE 2016). With the smaller trees having limited fruiting resources and limited nectar it is unlikely that the species is reliant on foraging resources within the study area, nor are any substantial numbers of the species likely to occur within the study area. Therefore the Regent Honeyeater would only be considered vagrant in the study area, as per Section 6.5.1.3 of the FBA (OEH 2014a) and is unlikely to use the habitat within the study area.

No threatened flora or fauna species were recorded during targeted surveys.

6 Impact assessment (biodiversity values)

This chapter identifies the potential impacts of the proposal on the biodiversity values of the study area. Measures taken to date to minimise impacts are summarised and recommendations to assist Bloomfield to design a development that further avoids and minimises impacts are provided.

6.1 Impact summary

The proposal has potential for both direct and indirect impacts. The direct impacts arising from the proposal include:

- the removal of 0.05 ha of PCT 1590 - *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest* in moderate/good condition, and

- the removal of 0.29 ha of PCT 1592 – *Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter* in moderate/good condition.

Potential indirect impacts arising from the proposal include:

- temporarily increased noise levels from construction equipment, leading to disturbance of fauna, especially during breeding seasons; and

- temporary slight increase of traffic volume (during construction) resulting from the upgrade of the haul road, leading to higher chance of fauna strike and increased noise levels leading to disturbance of fauna.

The study area already occurs as small patches of vegetation and edge already heavily impacted by edge effects. The proposal will not significantly increase edge effects given the high level of existing clearance.

6.1.1 Recommendations to avoid, minimise and mitigate impacts

The principal means to reduce impacts to biodiversity values within the study area has been to minimise the removal of native vegetation and fauna habitat. Additional recommendations include measures to mitigate residual impacts after all measures to avoid and minimise impacts have been considered. Recommendations are broken down into site selection and planning, construction and operation.

i Site selection and planning

The site selection is based upon the need to upgrade the haul road and adjacent previously rehabilitated watercourse. Bloomfield has considered all biodiversity values and sought advice from EMM in the planning stages of the proposal to avoid, where possible, direct impacts to identified biodiversity values.

The study area contains and is bound by rehabilitated landform and haul roads associated with the current mine operations, and thus has a long history of disturbance. As a result, removal of native vegetation is limited to small patches surrounded by previously disturbed land. Refinements Bloomfield has made to the proposed development footprint, as far as reasonably practical for the proposed project, have further minimised impacts on PCT 1590, reducing the proposed area of clearance from 0.54 ha to 0.05 ha, thus also reducing any impacts on the fauna species that may utilise this PCT.

ii Construction

No additional direct impacts are expected to occur as a result of the construction phase, as site access for the construction of the proposal will occur along the existing haul roads that have current frequent vehicle movement.

However, indirect impacts may occur on retained biodiversity values. Additional mitigation measures to avoid and minimise impacts include:

- installation of appropriate exclusion fencing around vegetation to be retained directly adjacent to the development footprint;
  - appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' should be installed;
  - identify the location of any 'No Go Zone' in site inductions;
  - fencing should be secured with star pickets and use high visibility bunting;
- all material stockpiles, vehicle parking and machinery storage will be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation;
- a licenced wildlife salvage team should be on-site during vegetation removal to catch and relocate (if appropriate) any wildlife encountered;
- where appropriate, native vegetation cleared from the development site should be mulched for re-use on the site, to stabilise bare ground;
- implementation of temporary stormwater controls during construction is necessary to ensure that discharges to the drainage channels are consistent with existing conditions; and
- sediment and erosion control measures should be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect drainage channels. These should conform to relevant guidelines, should be maintained throughout the construction period and should be carefully removed following the completion of works.

The Bloomfield Open Cut Colliery has established clearing practices in place, as part of their Environmental Management Strategy (Bloomfield 2011). These include minimisation of disturbance areas, pre-clearance surveys, salvaging and reusing material on site for habitat enhancement, conserving and reusing topsoils, and weed management. These clearing practices will be implemented for the project in accordance with Bloomfield's management strategy.

iii Operation

The upgrade of the haul road will not result in a permanent increase in traffic volume and therefore any impacts on biodiversity arising from the operation of the proposed upgrade are negligible, considering the proposal will not alter, in any way, the current daily operations of the open cut coal mine.

6.1.2 Residual impacts

Residual impacts arising from the proposal include loss and minor increases in fragmentation of native vegetation and species habitat and potential for species to no longer utilise potential habitat within the study area.

6.2 Thresholds for assessment and offsetting

This section outlines the thresholds for assessment and offsetting in accordance with Section 9 of the FBA (OEH 2014a).

6.2.1 Impact requiring further consideration

This section provides an assessment of impacts requiring further consideration in accordance with Section 9.2 of the FBA (OEH 2014a).

i Landscape features

The study area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links. The study area does not support any important wetlands. Therefore there are no impacts to the landscape features that require further consideration.

ii Native vegetation

One TSC Act listed EEC, *Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion,* occurs within the study area. The proposal will clear 0.34 ha of this EEC. However, as this EEC was not nominated within the SEARs, there are no impacts to native vegetation requiring further consideration.

iii Species and populations

The study area does not include any areas of critical habitat. No impacts on critically endangered or endangered species will result from the proposal, and there are no impacts on species or populations requiring further consideration.

6.2.2 Impacts requiring offsets

i Impacts on native vegetation

This section provides an assessment of the impacts on native vegetation requiring offsetting in accordance with Section 9.3.1 of the FBA (OEH 2014a).

The proposal will result in the removal of the following:

- 0.05 ha of PCT 1590 *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest* (HU804), and
- 0.29 ha of PCT 1592 *Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter* (HU806).

Impacts upon these PCTs will require offsetting. The remainder of the development site contains non-native vegetation. No further consideration of these areas is required.

ii Impacts on species and populations

The project will not result in any impacts on species and populations that require offsetting.

6.2.3 Impacts not requiring offsets

A 3.2 ha area of non-native vegetation, dominated by exotic grasses, was identified within the study area (Figure 4.1). Two plots/transects were completed in this area. This area had a site value score of less than 17. As such, under Section 9.4 of the FBA (OEH 2014a) offsets are not required.

7 Biodiversity credits

This chapter provides a summary of biodiversity credits required from impacts on the biodiversity values within the study area, following consideration of measures to avoid, minimise and mitigate impacts.

Table 7.1 provides a summary of the ecosystem and species credits from the proposed development. The full credit profile is provided in Appendix C.

Table 7.1 Summary of ecosystem credits for all management zones

Vegetation zone	PCT code	PCT name	Management zone area (ha)	Loss in landscape value	Loss in site value score	EEC offset multiplier	Credits required for TS	TS with highest credit requirement	TS offset multiplier	Ecosystem credits required
1	HU804	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	0.05	15	30.21	3.0	2	Barking Owl	3.0	1
2	HU806	Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	0.29	15	35.42	3.0	9	Barking Owl	3.0	9

8 Assessment of biodiversity legislation

8.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the impacts of the proposed development on MNES within the study area was prepared to determine whether referral of the proposal to the Commonwealth Minister for the Environment is required. Matters of MNES relevant to the study area are summarised in Table 8.1.

Table 8.1 Assessment of the proposal against the EPBC Act

MNES	Proposal specifics	Potential for significant impact
Threatened species	16 flora species and 28 fauna species have been recorded or are predicted to occur within the locality. The majority of these species are considered unlikely to occur within the study area. Potential seasonal foraging habitat for the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox has been identified within the study area. However, the study area does not provide habitat for an ecology significant proportion of any of these species.	Significant impact unlikely to result from the proposed development.
Threatened ecological communities	No threatened ecological communities, as listed under the EPBC Act, were recorded within the study area.	Significant impact unlikely to result from the proposed development.
Migratory species	33 migratory species have been recorded or are predicted to occur within the locality. The study area does not provide important habitat for an ecologically significant proportion of any of these species.	Significant impact unlikely to result from the proposed development.
Wetlands of international importance	The study area does not flow directly into a Ramsar site and the development is not likely to result in a significant impact.	Significant impact unlikely to result from the proposed development.

Similarly, the habitat within the MNES study area is unlikely to support important populations of MNES or be critical to the survival of a population or the species. Impact assessments have been undertaken for each of the identified species against EPBC Act significant impact criteria. These assessments concluded that it is unlikely that significant impacts to MNES will occur as a result of the proposal, within the MNES study area. Refer to Appendix A for full conclusions of assessment of MNES within the MNES study area.

8.2 Environmental Planning and Assessment Act 1979

8.2.1 SEPP No 44

Two Koala feed trees, as defined within Schedule 1 of the SEPP were identified within the study area. However, they do not make up greater than 15 percent of the tree species within the study area. Therefore, the vegetation within the study area is not considered potential Koala habitat as defined under SEPP 44. Additional assessment of habitat within the study area further ruled out the area as potential habitat for the Koala.

One Koala feed tree, as defined within Schedule 1 of the SEPP was identified within the MNES study area. However, it does not make up greater than 15 percent of the tree species within the MNES study area. Therefore, the vegetation within the MNES study area is also not considered potential Koala habitat as defined under SEPP 44 (refer to Appendix A).

8.3 Biosecurity Act 2015

A number of state level and regional level priority weeds, as identified within the *Hunter Regional Strategic Weed Management Plan* (Hunter Local Land Services 2017) occur within the study area. These include Fireweed, Lantana and Pampas Grass

Bloomfield Open Cut Colliery has an active weed management program, as covered by the Bloomfield Environmental Management Strategy (Bloomfield 2011a) and the Bloomfield Rehabilitation Management Plan (Bloomfield 2011b).

9 Biodiversity offset strategy

Ten ecosystem credits are required to offset the impacts arising from the proposal.

A biodiversity offset strategy has been prepared to identify how offsets to compensate for the project's impacts will be delivered. Preparation of this strategy has involved the following steps:

- attempt to identify like-for-like offsets. Like-for-like offsets are identified as the same PCT, or a PCT in the same vegetation class that has been cleared to an equal or greater extent (OEH 2014b). Offsets must be provided in the same or an adjacent IBRA subregion;
- if, after undertaking "reasonable steps", a proponent is unable to identify like-for-like credits, then the variation rules may be applied. The variation rules allow impacts on a PCT to be offset with a PCT from the same vegetation formation that has been cleared to an equal or greater extent anywhere in NSW;
- supplementary measures may apply where offsets are not feasible and other options are needed; and
- payment into the Biodiversity Conservation Trust, with costs determined using the Biodiversity Offsets Payment Calculator.

In the first instance, every effort to obtain like-for-like offsets was explored. The BioBanking public register has been checked for the availability of credits of the same PCT as that being impacted or those listed in the credit profile report (Appendix C). At the time of writing, there are credits for PCT 1592 (HU806) available on the public register. There are no matching ecosystem credits for PCT 1590 (HU804) available on the public register; however, the credit profile report includes PCT 1592 as an offset option for this PCT.

As credits are available, variation rules and supplementary measures are not warranted.

The PCTs and corresponding number of credits generated under the FBA were entered into the online Biodiversity Offset Payment Calculator on 9 November 2017. The calculator estimates a price of $2,000.64 per credit. The total payment required for the project is $22,007.08 (including GST). For a more detailed breakdown per PCT, refer to Appendix D.

Due to the small number of credits to be offset, payment into the BCT is the preferred option to secure offsets for this project, based on current payment requirements.

10 Conclusions

This assessment has been completed in accordance with the NSW *Biodiversity Offsets Policy for Major Projects* (OEH 2014a) and FBA (OEH 2014b) on behalf of Bloomfield.

The site assessment identified areas of PCT 1590 *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest* (HU804) and PCT 1592 *Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter* (HU806) within the study area. These PCTs represent *Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion*, an EEC listed under BC Act.

Measures to avoid and minimise impacts to vegetation were considered during the design and planning stage of the proposal, resulting in minimisation of impacts on native vegetation. Additional recommendations to mitigate any minor residual impacts are provided in Section 6.1.3. Through an iterative design process, which considered the above biodiversity values, the residual impact of the proposal will be limited to removal of 0.34 ha of native vegetation.

Residual impacts to native vegetation will require retirement of 10 ecosystem credits, as outlined in Table 10.1.

Table 10.1 Summary of credits to be retired

PCT code/species name	PCT name/common name	Credits required
1590	*Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest*	1
1592	*Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter*	9
	Total	**10**

Residual impacts will be offset in accordance with the Biodiversity Offset Strategy.

References

Australian Museum Consulting 2014, *Stony Pinch Fauna Study,* prepared for the Stony Pinch Consortium.

Birdlife Australia 2014, *IBAs in Danger Report, The state of Australia's Important Bird and Biodiversity Areas*, November 2014.

Bloomfield 2011a, *Mining Operations (Bloomfield) Environmental Management Strategy*, Revised Final Draft, August 2011.

Bloomfield 2011b, *Mining Operations (Bloomfield) Rehabilitation Management Plan*, Revised Final Draft, June 2011.

DoE 2013, *Matters of National Environmental Significance – Significance Impact Guidelines 1.1,* Department of the Environment.

DoE 2016, *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygria)*, Commonwealth of Australia Department of the Environment, April 2016.

DoEE 2017a, *Protected Matters Search Tool*, Department of Environment and Energy, search undertaken 07/09/2017, http://www.environment.gov.au/epbc/protected-matters-search-tool

DoEE 2017b, *Species Profile and Threats Database,* Department of Environment and Energy, viewed June 2017, http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

EMM 2017, *MNES Assessment – Terrestrial Ecology, Bloomfield Colliery*, prepared by EMM Consulting Pty Limited for the Bloomfield Group.

Hunter Eco 2010, *Bloomfield Colliery East Maitland, Part 3A variation ecology report*, prepared for the Bloomfield Group.

Hunter Eco 2012, *Bloomfield Colliery East Maitland, Biodiversity Assessment – Creek Cut Highwall*, prepared for the Bloomfield Group.

Hunter Local Land Services 2017, *Hunter Regional Strategic Weed Management Plan 2017-2022,* published June 2017, State of NSW through Local Land Services.

OEH 2014a, *Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Projects*, NSW Office of Environment and Heritage, Sydney.

OEH 2014b, *NSW Biodiversity offsets policy for major projects.* NSW Office of Environment and Heritage, Sydney.

OEH 2016a, *Mitchell Landscapes Version 3.1*, State Government of NSW and NSW Office of Environment and Heritage.

OEH 2016b, *Interim Biogeographic Regionalisation of Australia (IBRA) Version 7*, NSW Office of Environment and Heritage, Sydney.

OEH 2016c, *NSW Guide to Surveying Threatened Plants,* NSW Office of Environment and Heritage, Sydney.

OEH 2017a, *BioNet Atlas of NSW Wildlife*, search undertaken 07/09/2017, http://www.bionet.nsw.gov.au/

OEH 2017b, *Threatened Species Profile Database,* viewed August 2017 http://www.environment.nsw.gov.au/threatenedspeciesapp/

Parsons Brinkerhoff 2013, *Lower Hunter Vegetation mapping,* prepared for Department of Sustainability, Water, Population and Communities.

Roderick, M, Geering D.J and Ingwersen, D.A 2014, *Significant breeding event of Regent Honeyeaters Anthochaera phrygia near Kurri Kurri, New South Wales, during spring 2007*, Australian Field Ornithology 2014, 31, 113–121.

TSSC 2015, *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community*, Threatened Species Scientific Committee, Canberra: Department of the Environment.

Appendix A

MNES Report

MNES Assessment - Terrestrial Ecology

Bloomfield Colliery

Prepared for The Bloomfield Group | ろ Ẁ⅓⇄2017

MNES Assessment - Terrestrial Ecology

Bloomfield Colliery

Prepared for The Bloomfield Group | 19 July 2017

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MNES Assessment - Terrestrial Ecology

Final

Report J17089RP1 | Prepared for The Bloomfield Group | 19 July 2017

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Date	19 July 2017	Date	19 July 2017

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1 Introduction

1.1 Background

Bloomfield Open Cut Colliery operates in accordance with its existing Part 3A project approval (PA 07_0087), granted in 2009. The Bloomfield Group (Bloomfield) proposes to modify their existing project approval to extend the lifespan of the colliery and extract further coal resources within the approved extraction area (the project).

Project Approval PA 07_0087 has been modified on three occasions. Mod 1 enabled an increase in the Project Approval area by 259 hectares (ha) for additional out-of-pit overburden emplacement, relocation of a powerline corridor, and the upgrade and use of an alternative haul road. Mod 2 was a minor administrative modification to amend the required date for submission of management plans, and Mod 3 allowed a change to areas of vegetation clearing covered by the mine's biodiversity offset area.

Bloomfield is seeking a further modification to PA 07_0087 (Mod 4) under section 75W of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) to extend the operational life of the mine from 2021 to 2030, and to recover additional coal resources available within the existing approved extraction area. No additional clearing of native vegetation is proposed as part of the modification.

Previous ecological assessments have been undertaken to support the applications to modify Bloomfield's Project Approval. Given that no vegetation clearing over and above that approved under PA 07_0087, as modified, is proposed as part of Mod 4, it is considered that no further assessment under the NSW *Threatened Species Conservation Act 1995* (TSC Act) is required to support the application for the project. Further assessment would only be required if the project is likely to cause additional impacts compared to that which has previously been assessed and approved.

Notwithstanding, the previous ecology impact assessments did not adequately assess protected matters listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A protected matters search was not undertaken to determine if any species or ecological community listed under the EPBC Act was likely to be present. Assessments of significance were not undertaken to determine the likelihood that the project would significantly impact species and/or communities listed under the EPBC Act, or if a referral was required. Therefore, EMM Consulting (EMM) has been engaged by Bloomfield to undertake an assessment of Matters of National Environmental Significance (MNES) under EPBC Act for the project to determine if significant impacts are likely to occur.

1.2 Location, project description, and study area

Bloomfield Open Cut Colliery is an existing open cut coal mine, located to the north of John Renshaw Drive, Buttai and east of Buchanan Road, Buchanan, approximately 20 km north-west of Newcastle (refer to Figure 1.1). Mining has occurred on the site for approximately 170 years and the current project is part of a modification for the continued operation of the mine within the existing approved extraction area.

A study area for which this assessment of MNES is to be undertaken has been defined, as illustrated in Figure 1.1. This area is within the Project Approval area and approved disturbance footprint of the mine, and was approved to be cleared as part of Mod 1 for the relocation of a powerline corridor and associated infrastructure. However, the ecological assessment for Mod 1 which covered this area did not address MNES, as described above in Section 1.1.

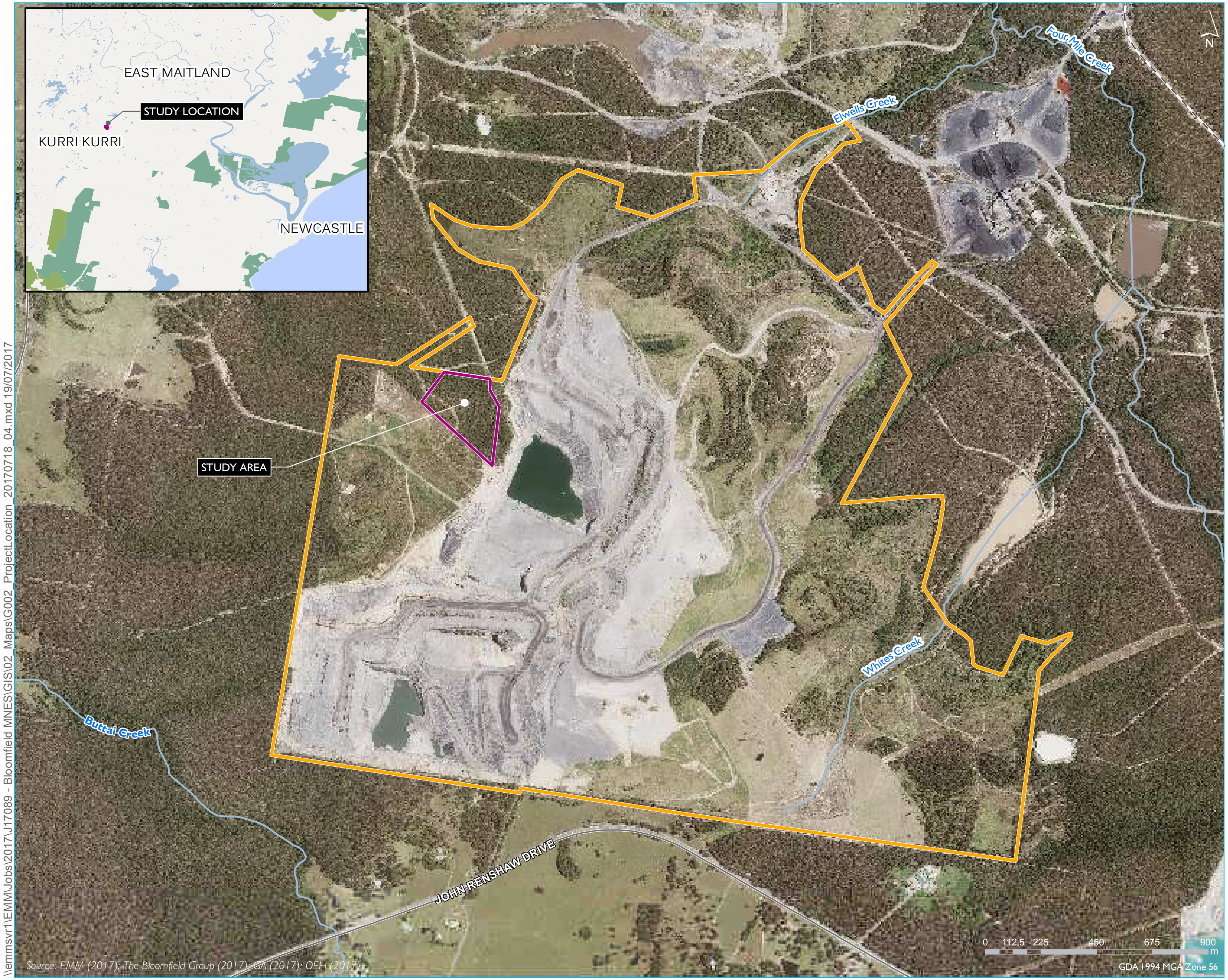
The study area covers 6.12 ha and is south-west of the operating Creek cut pit, as shown in Figure 1.1. To the south and south-west of the study area is cleared land, also associated with the mine. To the north and north-west, the study area is bound by forest. The 6.12 ha of forest within the study area will be cleared as part of activities approved under PA 07_0087.

1.3 Purpose of this report

The purpose of this report is to provide an assessment of potential impacts of the project on MNES.

The scope of the assessment comprises:

- review of existing reports and mapping for the project;
- desktop assessment of the likely presence of MNES in the study area;
- field survey targeting MNES with potential to occur in the study area, and
- assessment of potential impacts of the project on MNES, and their level of significance.



KEY

- Study area
- Approval area
- Main road
- Local road
- Watercourse
- Rail line

Project location

Bloomfield Colliery
MNES assessment
Terrestrial ecology
Figure 1.1

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2 Legislative framework

2.1 EPBC Act

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as MNES (Matters of National Environmental Significance), as defined under the EPBC Act as:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, an action that may have a significant impact on a MNES is deemed to be a 'controlled action' and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially have an impact on a MNES is to be referred to Commonwealth Department of the Environment and Energy (DoEE) for determination as to whether or not it is a controlled action.

The project is unlikely to have a significant impact on MNES and, therefore, is not required to be referred to DoEE for approval from the Commonwealth Minister for the Environment, as explained in the following sections of this report. Although it is concluded that the project is unlikely to significantly impact upon MNES, a number of recommendations in regards to mitigation and management are described in Section 6.

3 Methods

3.1 Desktop review

3.1.1 Previous local studies

Two ecological assessments have been conducted on which included the current study area (Hunter Eco2009 & 2010). These assessments focussed upon species and communities listed under the TSC Act, with no detailed assessment of EPBC listed species and communities conducted. Field survey methods included:

- threatened flora transects;
- terrestrial and arboreal mammal trapping (Elliot's and cage trapping);
- collection of mammal hair samples from hair tubes;
- spotlighting for nocturnal mammals and birds;
- call broadcasting for threatened owls;
- harp trapping and Anabat survey for microbats;
- diurnal bird surveys;
- funnel traps along a drift line targeting reptiles; and
- assessment of hollow bearing trees and other habitat surveys.

3.1.2 Database searches

Background literature reviews and database searches were conducted by EMM prior to the field survey to obtain recent data on flora and fauna species, populations, communities and habitats. The search area included the study area and the locality (defined as within 10 km of the study area). Background information reviewed included:

- topographic map, aerial photograph and geographic information system (GIS) interpretations;
- the NSW OEH Atlas of NSW Wildlife database (Bionet 2017) to identify threatened and migratory species records. The search was limited to include species listed under the EPBC Act only; and
- the Commonwealth Department of the Environment's (DoE) online Protected Matters Search Tool (PMST) to identify species and ecological community habitat listed under the EPBC Act (refer to Appendix A for the full report).

The results of the literature review and database search informed field survey effort and design through the identification of threatened species, populations and ecological communities as listed under the EPBC Act that may occur in the study area.

3.2 Field survey

The field investigation was targeted at identifying species and communities listed under the EPBC Act in the study area, with survey effort tailored correspondingly. The fauna surveys were not designed to detect all resident and transitory species within the study area. Instead, it aimed to provide an overall assessment of the ecological features and habitat of the study area, building on and updating the previous ecological surveys completed. Two senior EMM ecologists conducted a field survey on Wednesday 19 April 2017. The methods used are described in the following sections.

3.2.1 Flora and vegetation

Vegetation structure and dominant flora species were recorded within the study area. Notes were taken describing any disturbances (such as weed invasion, human disturbance) to assess the vegetation condition. Dominant species in each vegetation layer (ground, shrub and canopy) were recorded to identify vegetation communities, particularly that representative of EECs, and to identify potential habitat for threatened flora species. Meander searches were conducted through native vegetation to target threatened flora species.

Where possible, vegetation communities were classified into PCTs described by OEH. The vegetation information system (VIS) classification database (OEH 2016) contains descriptions of all Plant Community Types (PCTs) identified. The database was established as the NSW standard community level vegetation classification for use in site based planning processes and standardised vegetation mapping.

3.2.2 Fauna

Targeted fauna surveys were not undertaken and fauna species were recorded opportunistically as they were encountered during the field survey. Any evidence of fauna such as tracks, scats, scratches on and around trees, and any potential fauna habitat features were also noted, including:

- the presence of nesting/sheltering/basking sites such as tree hollows, litter, fallen timber and logs and rocks;
- the cover/abundance of ground, shrub and canopy layers;
- drainage and the presence of freshwater habitats noting their permanency (ie permanent, semi-permanent or ephemeral);
- connectivity to adjacent areas of habitat;
- the extent and nature of previous disturbances, including the presence of fire scars and dieback;
- vegetation assemblage and structure;
- soil type and topography; and
- habitat surveys for Koala habitat and feed trees, including opportunistic surveys for individuals and scats (faeces).

4 Results

4.1 Previous local studies

Hunter Eco (2009 & 2010) listed the dominant vegetation community within the study area as Lower Hunter Spotted Gum – Ironbark Forest, which meets the TSC Act listed EEC, Lower Hunter Spotted Gum – Ironbark Forest. This community may also meet the EPBC listed CEEC Central Hunter Valley Eucalypt Forest and Woodland (CHVEFW); depending on the composition of key dominants and contraindicative canopy species. The potential occurrence of CHVEFW within the study area is considered in Section 4.3.1 and Appendix B.

Hunter Eco (2009 & 2010) recorded the following ecological features within their studies, which included the current study area:

- a total of 54 flora species were recorded during field surveys, although none were listed under either the TSC or EPBC Act;
- a total of 23 hollow bearing trees were mapped within the current study area; and
- a total of 2 amphibian, 7 reptile, 12 mammal and 45 bird species were recorded during field surveys. Of these, six are threatened fauna species listed under the NSW TSC Act - *Ninox strenua* (Powerful Owl), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat), *Mormopterus norfolkensis* (East Coast Freetail Bat), *Miniopterus australis* (Little Bent-wing Bat), *Miniopterus schreibersii* (Large Bent-wing Bat), and *Scoteanax rueppellii* (Greater Broad-nosed Bat).

No EPBC listed species were recorded during the previous field surveys, however suitable habitat was considered present for two TSC listed species that were not recorded, which are also listed under the EPBC Act. These are the Swift Parrot and Grey-headed Flying-fox (*Pteropus poliocephalus*). Assessments of significance under TSC Act concluded that there would not be a significant impact for either of these species. Both of these species area are considered in this assessment under the EPBC Act Significant Impact Guidelines (DoE 2013).

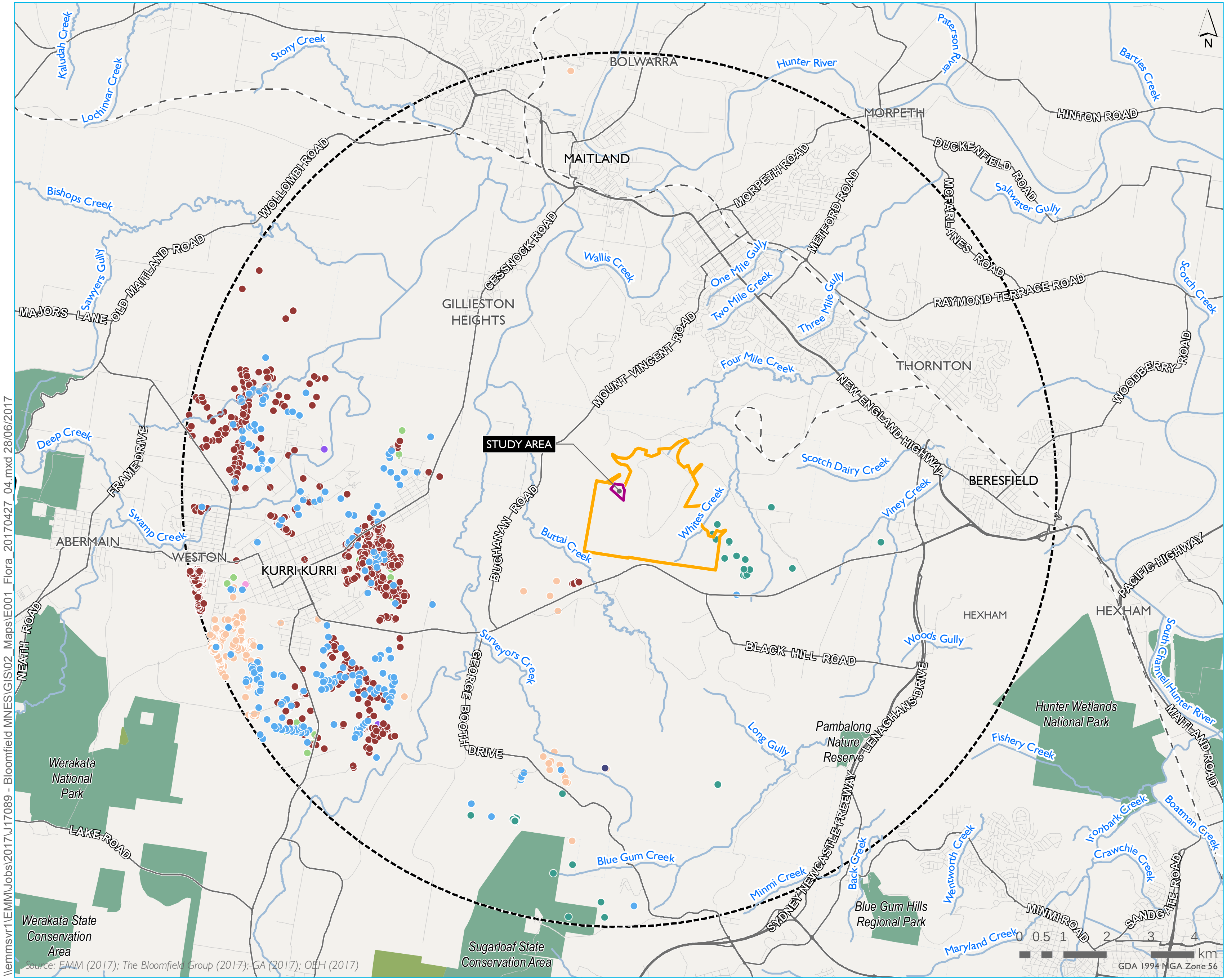
4.2 Database searches

The PMST tool identified the following Matters of National Environmental Significance (MNES) which may occur within, or in the vicinity of the study area (refer to Appendix A):

- one wetland of international importance;
- three threatened ecological communities, which may occur within the area;
- 44 listed threatened species which may occur within the area or have suitable habitat within the area; and
- 33 listed migratory species which may occur within the area.

The Bionet (2017) search identified eight EPBC listed threatened plant species within the locality (Figure 4.1). A total of 11 EPBC listed threatened fauna species have also been recorded within the locality, consisting of six mammals, two frogs and three birds (Figure 4.2). An additional five migratory species were also recorded (Figure 4.2).

None of these entities were located within the study area itself, rather recorded within the locality (10 km radius of the site). Refer to Appendix B for the list of species recorded within the locality, their listing status and likelihood of occurrence assessment.



KEY

- Study area
- Approval area
- 10 km buffer

Threatened flora

- *Acacia bynoeana*
- *Eucalyptus glaucina*
- *Eucalyptus parramattensis* subsp. *decadens*
- *Grevillea parviflora* subsp. *parviflora*
- *Pterostylis gibbosa*
- *Rutidosis heterogama*
- *Syzygium paniculatum*
- *Tetratheca juncea*
- Watercourse
- Rail line
- Main road
- Local road
- NPWS reserve
- State forest

Threatened species records – flora

Bloomfield Colliery
MNES assessment
Terrestrial ecology
Figure 4.1

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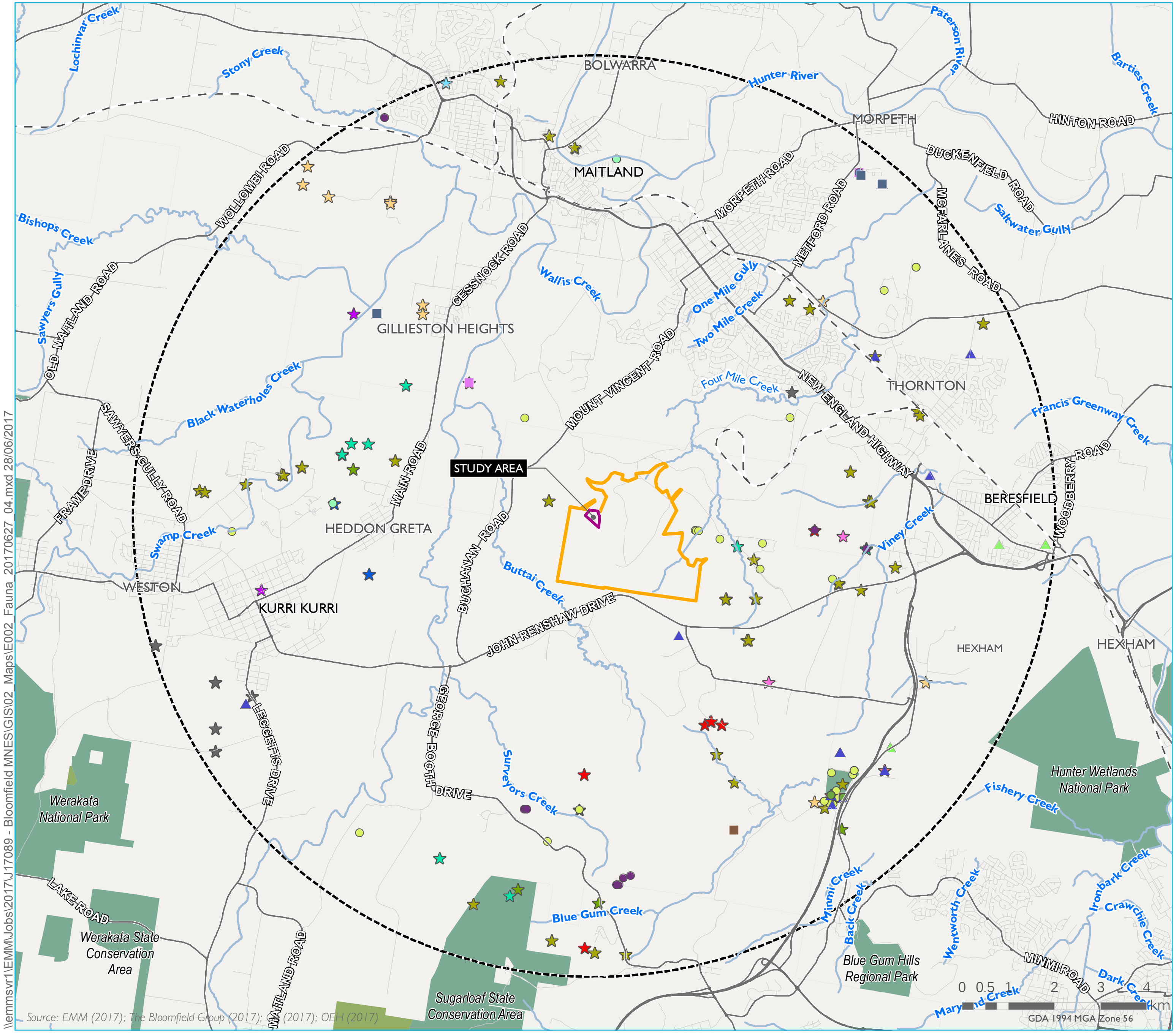

KEY

- Study area
- Approval area
- 10 km buffer

Migratory species

- Common Greenshank
- Glossy Ibis
- Gull-billed Tern
- Latham's Snipe
- Little Curlew
- Little Tern
- Marsh Sandpiper
- Pectoral Sandpiper
- Red-necked Stint
- Sharp-tailed Sandpiper
- Wedge-tailed Shearwater
- White-bellied Sea-Eagle
- White-throated Needletail
- White-winged Black Tern
- Wood Sandpiper

Threatened fauna

- Australian Painted Snipe
- Greater Glider
- Green and Golden Bell Frog
- Grey-headed Flying-fox
- Koala
- Large-eared Pied Bat
- Littlejohn's Tree Frog
- New Holland Mouse
- Regent Honeyeater
- Spotted-tailed Quoll
- Swift Parrot
- NPWS reserve
- State forest
- Main road
- Local road
- Rail line
- Watercourse

Threatened species records – fauna

Bloomfield Colliery
MNES assessment
Terrestrial ecology
Figure 4.2

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4.3 Field survey

4.3.1 Flora and vegetation

The entire study area is forested, although it appears to have been historically cleared as there is a lack of large trees and a large number of trees of a similar size, indicating a single regeneration event. In several areas, ground disturbance was also evident with contour banks and a drainage line. A single vegetation type was identified within the study area (Figure 4.3) which is described below.

i PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest

Three co-dominant trees species were recorded; Spotted Gum (*Corymbia maculata*), Broad-leaved Mahogany (*Eucalyptus umbra*) and Forest Oak (*Allocasuarina torulosa*), with the percentage abundance at 22%, 25% and 24% respectively. Other canopy species recorded were White Stringybark (*E. globoidea*) (11%), Broad-leaved Ironbark (*E. fibrosa*) (10%), Grey Gum (*E. punctata*) (4%), Smooth-barked Apple (*Angophora costata*) (3%) and Red Bloodwood (*Corymbia gummifera*). The canopy of this community was dense, with on average 52 trees per 20 m x 20 m plot.

The mid-storey was relatively sparse with dominant species including Native Blackthorn (*Bursaria spinosa*), Gorse Bitter Pea (*Daviesia ulicifolia*), Narrow-leaved Geebung (*Persoonia linearis*), and Slender Wattle (*Acacia elongata*).

The ground layer was dominated by grasses including Kangaroo Grass (*Themeda aus*tralis), Wallaby Grass species (*Rytidosperma sp.*) and Wiry Panic (*Entolasia stricta*). Other ground cover species included White Root (*Pratia purpurescens*), Variable Sword Sedge (*Lepidosperma laterale*) and Pastel Flower (*Pseuderanthemum variabile*). Few weed species were present within the community with no Weed of National Environmental Significance (WoNS) recorded. Photograph 4.1 shows an example of the vegetation community within the study area.

Photograph 4.1 Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest

This community does not meet the listing of the CEEC Central Hunter Valley eucalypt forest and woodland (CHVEFW). This is due to the frequent occurrence of contraindicative canopy species, as described in the scientific determination; including Red Ironbark and Forest Oak (refer to Appendix B).

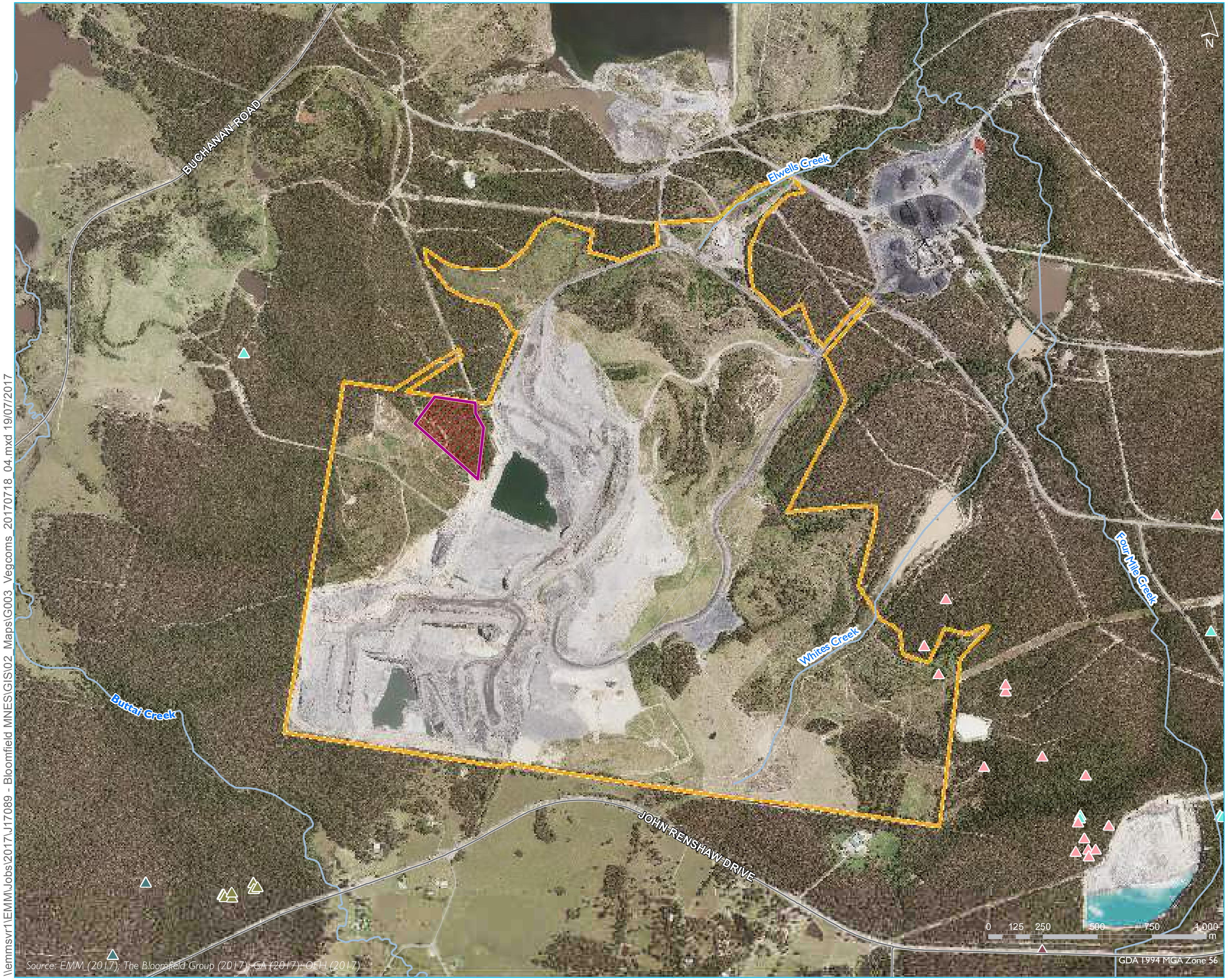
ii Flora

The vegetation within the study area represents potential habitat for Black-eyed Susan (*Tetratheca juncea*), however targeted flora surveys did not detect the species, nor any other threatened flora listed under the EPBC act.

4.3.2 Fauna

Fauna observed during the field survey were limited to common bird species including the Laughing Kookaburra (*Dacelo novaeguineae*), Yellow-tufted Honeyeater (*Lichenostomus melanops*) and Yellow-faced Honeyeater (*Lichenostomus chrysops*). The latter two species were observed foraging within flowering Spotted Gum. No EPBC listed threatened species or migratory species were recorded.

Domestic Dog (*Canis lupus familiaris*) footprints and a scat was recorded within the study area. Given the lack of surrounding residences these signs are likely to be from a feral animal.



KEY

Study area

Approval area

Threatened species records

Large-eared Pied-bat

Eucalyptus parramattensis subsp. *decadens*

Grey-headed Flying Fox

Grevillea parviflora subsp. parviflora

Koala

Rutidosis heterogama

Tetratheca juncea

Vegetation community

PCT 1590 Spotted Gum – Broad-leaved Mahogany – Red Ironbark open Forest

Main road

Local road

Rail line

Watercourse

Vegetation communities

Bloomfield Colliery
MNES assessment
Terrestrial ecology
Figure 4.3

EMM

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i Fauna habitat

The forested areas within the study area are likely to provide habitat for a range of common fauna species. The density of tree hollows is limited somewhat by the relatively young canopy, however 23 hollow bearing trees have been mapped within the study area. These are likely to provide shelter for a range of arboreal mammals and potential nesting habitat for hollow dependant birds.

The terrestrial habitat was relatively sparse with limited shelter provided by occasional fallen trees and other woody debris. Whilst this may provide habitat for small mammals and reptiles, it is likely to be insufficient and suboptimal for larger mammals such as the EPBC listed Spotted-tailed Quoll (*Dasyurus maculatus*).

One primary feed tree species listed within the North Coast Koala Management Area under SEPP 44 was recorded within the study area, the Grey Gum (*Eucalyptus punctata*). This tree species only composed small proportion (1.6%) of the canopy. The study area is included within the north coast KMA (OEH 2017) which lists three tiers of koala feed tree, Primary, Secondary and Stringybarks/supplementary species. No primary or secondary feed trees listed for the KMA were found within the study area and therefore it is unlikely that there are sufficient foraging resources to support the Koala within the Study area. No Koala scats were detected during searches around the base of Grey Gums.

Approximately a quarter of the canopy species within the study area is composed of Spotted Gum, which is a potential foraging resources for several EPBC listed species including Regent Honeyeater, Swift Parrot and the Grey-headed Flying-fox . Relatively young trees, such as those within the study area, do not produce as high nectar yields compared to larger and older trees, however given the relatively high density of feed trees and good connectivity to large areas vegetation, the study area is still considered potential habitat for the above species. Other canopy species with high nectar yields, within the study area include Smooth-barked Apple and Red Bloodwood, though these species occur less abundantly.

Aquatic habitat within the study area is minimal and limited to a drain and small dam. The drainage line is ephemeral and contained only very shallow water, with no pools present at the time of the field survey. The dam is highly turbid and disturbed with bare earth banks and no aquatic vegetation present. The study area does not contain suitable breeding habitat for any EPBC listed frog species.

5 Impact assessment

This chapter includes an assessment of the potential direct and indirect impacts of the proposed action on MNES. The direct impact of the project is the clearance of vegetation. The impact assessment for this project assumes complete disturbance/removal of PCT 1590 Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest, which occupies an area of 6.12 ha within the study area.

The following section provides the criteria that must be considered in the assessment of all threatened species listed under the EPBC Act.

5.1 Significant impact guidelines

In determining the significance of impact associated with the project, the relevant criteria listed in the Matters of National Environmental Significance – Significance Impact Guidelines 1.1 (DoE) dated 2013 was applied. This assessment has been undertaken for the following MNES values:

- Critically endangered species: Regent Honeyeater and Swift Parrot;
- Vulnerable species: Large eared Pied Bat and Grey Headed Flying Fox; and
- Migratory species: Satin Flycatcher and Rufous Fantail.

Two migratory species, the Fork-tailed Swift and White-throated Needletail, will possibly occur within the study area. However due to their almost exclusive aerial nature, potential impacts are unlikely to occur and no further assessment has been completed.

5.1.1 Significant impact criteria for critically endangered and endangered species

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;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

5.1.2 Significant impact criteria for vulnerable species

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;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

5.1.3 Significant impact criteria for listed migratory species

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

5.2 Assessments of Significance

Significant impact assessments have been prepared for species listed under the EPBC Act, in accordance with the criteria above.

5.2.1 Regent Honeyeater (*Anthochaera phrygia)* – critically endangered

The Regent Honeyeater (*Anthochaera phrygia*) is endemic to mainland south-east Australia and is listed as a critically endangered species under the EPBC Act. The species has a patchy distribution which extends from south-east Queensland, through New South Wales and the Australian Capital Territory, to central Victoria. However, it is highly mobile, occurring only irregularly in most sites, and in variable numbers, often with long periods with few observation anywhere. Within the current distribution there are four known key breeding areas where the species is regularly recorded.

These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria (DoE 2016). The Regent Honeyeater comprises a single population, with some exchange of individuals between regularly used areas (Garnett et al., 2011, cited in DoE 2016). The species can undertake large-scale nomadic movements in the order of hundreds of kilometres (OEH 2017).

Two Bionet (2017) records exist within the locality, with the closest record located 7 km to the west of the study area. Additionally, more records exist just outside of the locality, approximately 10km to the south-west of the study area within the Tomalpin Woodlands, south-west of Kurri Kurri in the Lower Hunter Valley Important Bird Area (IBA). These records are associated with a known breeding event that occurred in this woodland during 2007 and 2008 (Roderick et al. 2014). During this time about 20 nests fledged young, the most significant known recruitment of individuals in recent years. In 2012, around 100 Regent Honeyeaters were recorded in the Lower Hunter Valley IBA, remaining in the Tomalpin Woodlands for at least six months, and they may have bred there again (birds were observed constructing nests) (Birdlife 2014).

The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regionally, the Lower Hunter Spotted Gum forest has been shown to provide a valuable resource for this species (OEH 2017). The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes, targeting those which flower most profusely.

Key eucalypt species identified in the National Recovery Plan for the Regent Honeyeater (DoE 2016) comprise Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. Melliodora*), White Box (*E. albens*), Yellow Gum (*E. leucoxylon*), Spotted Gum , Swamp Mahogany (*E. robusta*), Needle-leaf Mistletoe (*Amyema cambagei*) which grows on River Oak (*Casuarina cunninghamiana*), Box Mistletoe (*A. miquellii*) and Long-flower Mistletoe (*Dendropthoe vitellina*). Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events of Regent Honeyeaters. Flowering of associated species such as thin-leaved stringybark (*E. eugenioides)* and other stringybark species, and Broad-leaved Ironbark can also contribute important nectar flows at times.

Spotted Gum is present within the study area, at a canopy cover percentage of approximately 22%, and Broad-leaved Ironbark at 10% canopy cover within the study area, and the Regent Honeyeater may forage within the study area. However, potential foraging may be limited due to lack of large mature trees within the study area. Regent Honeyeaters prefer taller and larger diameter trees for foraging, as these typically produce more nectar (Franklin et al., 1989; Webster & Menkhorst 1992; Menkhorst et al., 1999; Oliver 2000, cited in DoE 2016).

Nests are usually placed in the canopy of mature trees with rough bark, e.g. ironbarks, sheoaks (*Casuarina*) and rough-barked Apple (*Angophora*). A cup-shaped nest is constructed in which two to three eggs are laid. Nests may be near or far from food resources; one nest has been recorded 700 m from a resource tree (Geering & French, 1998, cited in DoE 2016). Pairs now mostly nest solitarily, but historical records show in the past they often nested in loose aggregations (DoE 2016). It is unlikely that the Regent Honeyeater would nest within the study area, due to relatively young stand of trees and lack of mature trees with rough bark.

Table 5.1 provides an assessment of significance for the removal of 6.12 ha of potential foraging habitat, in accordance with the relevant assessment criteria (Section 5.2.1).

Table 5.1 Assessment of significance for the Regent Honeyeater

Criteria	Discussion
1: long-term decrease in population size	An action that would lead to a long-term decrease of the Regent Honeyeater population would be one that is undertaken in a breeding area, or one that removes key feed species when foraging resources are sparse. As the proposed action is not located in a known breeding area for the species, it is not expected to result in a long-term decrease in population size. The study area includes Spotted Gum, identified as a key eucalypt species in the National Recovery Plan for the Regent Honeyeater (DoE 2016). Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events of Regent Honeyeaters. Flowering of broad-leaved ironbark can also contribute important nectar flows at times (DoE 2016). Spotted Gum is present within the study area, at a canopy cover percentage of approximately 22%, and Broad-leaved ironbark at 10% canopy cover within the study area, and the study area may provide foraging habitat for the species. However, potential foraging may be limited due to lack of large mature trees within the study area. Regent Honeyeaters prefer taller and larger diameter trees for foraging, as these typically produce more nectar (Franklin et al., 1989; Webster & Menkhorst 1992; Menkhorst et al., 1999; Oliver 2000, in DoE 2016). It is unlikely that the species is reliant on foraging resources within the study area, nor are any substantial numbers of the species likely to occur within the study area. As such, there is not likely to be any population level impacts.
2: reduce area of occupancy	A total area of 6.12 ha of potential foraging habitat that includes key tree species, Spotted Gum, as identified in the Regent Honeyeater recovery plan (DoE 2016), will be removed as a result of the project. The Regent Honeyeater is wide ranging, typically occurring in areas where profuse flowering of feed trees is occurring. It is unlikely that the loss of a small area of sub-optimal foraging habitat will significantly reduce the occupancy of the species. The study area is to the north-east of the Hunter Valley key breeding area, as identified in the recovery plan. However, the study area is unlikely to provide any potential breeding habitat, due to lack of mature rough-barked trees.
3: fragment a population	The Regent Honeyeater occurs as a single, contiguous population (DoE 2016). This species is highly mobile and able to cross open areas. As the study area would likely only form a small part of their wider occurrence, and the impact of loss of 6.12 ha of potential foraging habitat is on the edge of existing open cut mining operation (located to the east and south of the study area), fragmentation of a single contiguous population is unlikely to occur.
4: adversely affect critical habitat	Habitat critical to the survival of the Regent Honeyeater includes, any breeding or foraging habitat in areas where the species is likely to occur (as defined in Figure 1 of the National Recovery Plan (DoE 2016)); and any newly discovered breeding or foraging locations. The Lower Hunter Valley IBA is considered to include critical habitat for the species, and the study area is located approximately 10 km to the north-east of known breeding records, in the Tomalpin Woodland near Kurri Kurri, which is part of the IBA. However, the habitat which will be removed consists of sub-optimal foraging habitat only, as it is has been historically cleared, and has a lack of large trees and many trees of a similar size, indicating a single regeneration event. With limited large trees, and smaller trees having limited fruiting resources and limited nectar it is unlikely that the species is reliant on foraging resources within the study area, nor are any substantial numbers of the species likely to occur within the study area. While Spotted Gum, a key eucalypt species, is within the study area, it is unlikely to provide masses of nectar resources due to its younger age. The study area does not comprise breeding habitat. Therefore, the project will not affect any habitat critical to the survival of the Regent Honeyeater.
5: disrupt the breeding cycle of a population	The Regent Honeyeater has bred within the Tomalpin Woodland, located approximately 10 km south-west of the Study area. However, it is considered unlikely that breeding would occur within the areas to be impacted by the project, due to relatively young stand of trees and lack of mature trees with rough bark.

Table 5.1 Assessment of significance for the Regent Honeyeater

Criteria	Discussion
6: decrease availability or quality of habitat	The species have not been recorded within the study area and if it does occur, it is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat. The clearance of 6.12 ha of sub-optimal foraging habitat is not likely to cause any discernible impact to the species, and the species will remain largely unaffected by the project.
7: result in invasive species	Without management, vegetation clearing and topsoil stripping are likely to lead to weed invasion in surrounding remaining habitat to the north and west (to the east and south is existing open cut operations). Weed control protocols will be undertaken, in accordance with the proponent's relevant processes and procedures, to ensure plant entering the study area is weed free. Therefore the project will not result in invasive species that are harmful to the species becoming established in the habitat to the north and west of study area.
8: introduce disease	This species is not known to be particularly susceptible to disease and the project will not introduce any disease relevant to the Regent Honeyeater.
9: interfere with recovery	The recovery of the Regent Honeyeater is closely linked the extent and quality of habitat, and actions include the protection of intact (high quality) areas of Regent Honeyeater breeding and foraging habitat (DoE 2016). The study area is not within a known breeding area, and does not provide optimal breeding habitat. The study area is on the edge of edge of existing open cut mining operation (located to the east and south of the study area), and is not considered as intact. Although the habitat within the study area to be removed provides a potential foraging resource, including key eucalypt species Spotted Gum, it is not considered high quality as the habitat is missing a likely important ecological feature, being large trees with high quality nectar flows. It is unlikely that any individuals are reliant on the habitat.
Conclusion	The habitat to be removed is unlikely to be important for these species and the project is not anticipated to have a significant impact on the Regent Honeyeater as: • the study area is not within a known breeding area, and does not provide optimal breeding habitat for the species; and • if the species does occur, it is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat.

The proposed action is unlikely to result in a significant impact on the Regent Honeyeater. A precautionary assessment approach has been adopted, and the species has been assumed to occasionally forage within the study area. Accordingly, measures are proposed to mitigate potential impacts of the proposed action on potential habitat for the Regent Honeyeater (Section 6).

5.2.2 Swift Parrot (*Lathamus discolor*) – critically endangered

The Swift Parrot (*Lathamus discolor*) is listed as a critically endangered species under the EPBC Act. This species migrates from its Tasmanian breeding grounds to south-eastern Australia in the autumn and winter months. In NSW, the species mostly occurs on the coast and south-west slopes in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (OEH 2017). Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*).

Favoured feed trees within the study area include Spotted Gum and Red Bloodwood which occur at 22.3% and 1.6% of the total canopy species respectively. The Swift Parrot is not considered to be dependent on habitat in the study area and optimal habitat is likely to include areas with a higher density of larger preferred feed trees, however the species has been assessed as having the potential to occur given the presence of feed trees and several records of this species occurring within the locality.

A total of 6.12 ha of regrowth forest habitat that includes a total canopy density of 22.3% of Spotted Gum and 1.6% of Red Bloodwood, both favoured feed trees, will be removed as part of the project. Table 5.2 provides an assessment of significance for the removal of this potential foraging habitat, in accordance with the relevant assessment criteria (Section 5.2.1).

Table 5.2 Assessment of significance for the Swift Parrot

Criteria	Discussion
1: long-term decrease in population size	The study area has been historically cleared, and has a lack of large trees and many trees of a similar size, indicating a single regeneration event following disturbance. With limited large trees, and smaller trees having limited fruiting resources and limited nectar it is unlikely that the species is reliant on foraging resources within the study area, nor are any substantial numbers of the species likely to occur within the study area. As such, there is not likely to be any population level impacts.
2: reduce area of occupancy	A total area of 6.12 ha of potential foraging habitat will be removed as a result of the project. This species is wide ranging, typically occurring in areas where profuse flowering of feed trees is occurring. It is unlikely that the loss of 6.12 ha of sub-optimal foraging habitat will significantly reduce the occupancy of the species.
3: fragment a population	This species is highly mobile and is able to cross open areas. The loss of 6.12 ha of potential foraging habitat, that occurs on the edge of an existing open cut mine working areas, where clearing has historically taken place, will not cause any fragmentation effects.
4: adversely affect critical habitat	Habitats of particular importance to the Swift Parrot are outlined in the recovery plan for the species (Birds Australia 2011); including: • for nesting; • by large proportions of the Swift Parrot population; • repeatedly between seasons (site fidelity), or • for prolonged periods of time (site persistence). As the study area is within mainland Australia, there is no potential for nesting occur. The species has not been recorded within the study area or the immediate vicinity and there is no evidence of prolonged occurrence, repeat use or large number of the species occurring. Therefore, the project will not affect any habitat critical to the survival of the Swift Parrot.
5: disrupt the breeding cycle of a population	The Swift Parrot breeds within Tasmania and has no potential to breed within the study area.
6: decrease availability or quality of habitat	The species has not been recorded within the study area and if it does occur is likely to be on a transient basis only, passing through to more optimal areas of foraging habitat. The Swift Parrot is not considered to be dependent on habitat in the study area and the clearance of 6.12 ha of sub-optimal foraging habitat is not likely to cause any discernible impact to the Swift Parrot, and the species will remain largely unaffected by the project.
7: result in invasive species	Weed invasion impacting on habitat regeneration and health, and aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners are two key threats that invasive species pose on the Swift Parrot. Noisy Miners were not recorded in the study area during any the ecological investigations. Without management, vegetation clearing and topsoil stripping are likely to lead to weed invasion in surrounding remaining habitat to the north and west (to the east and south is existing open cut operations). Weed control protocols will be undertaken, in accordance with the proponent's relevant processes and procedures, to ensure plant entering the study area is weed free. Therefore the project will not result in invasive species that are harmful to the species becoming established in the habitat to the north and west of study area.
8: introduce disease	This species is vulnerable to Psittacine Beak and Feather Disease however the proposed activity does not play a role in the introduction of this threat.

Table 5.2 Assessment of significance for the Swift Parrot

Criteria	Discussion
9: interfere with recovery	The key action within the recovery plan for the Swift Parrot (Birds Australia 2011), which is relevant to the project, is the management and protection of Swift Parrot habitat at the landscape scale. The habitat within the study area is unlikely to be important for this species and there is expected to be no impact on its recovery as the result of the project.
Conclusion	It is unlikely that the species is reliant on foraging resources within the study area, therefore the habitat to be removed is unlikely to be important for the species and the project is not anticipated to have a significant impact on the Swift Parrot.

The proposed action is unlikely to result in a significant impact on the Swift Parrot. A precautionary assessment approach has been adopted, and the species has been assumed to occasionally forage within the study area. Accordingly, measures are proposed to mitigate potential impacts of the proposed action on potential habitat for the Swift Parrot (Section 6).

5.2.3 Large-eared Pied Bat (*Chalinolobus dwyeri*) – vulnerable

The Large-eared Pied Bat (*Chalinolobus dwyeri)* is listed as a vulnerable species under the EPBC Act. This species roosts in caves, crevices in cliffs, old mine workings, frequenting low to mid-elevation dry open forest and woodland, especially in gullies. The species probably forages for small, flying insects below the forest canopy. Females have been recorded raising young in maternity roosts in roof domes in sandstone caves and overhangs.

Records of this species exist approximately 2.5 km north-east of the study area. There is no breeding habitat for this species within the study area; however several records occur within the locality and the species may have the potential to pass over or forage within the study area.

Table 5.3 provides an assessment of significance for the removal of 6.12 ha of potential foraging habitat, in accordance with the relevant assessment criteria (Section 5.2.2).

Table 5.3 Assessment of significance for Large-eared Pied Bat

Criteria	Discussion
1. Long term decrease in population size	Actions that would cause a long-term decrease in Large-eared Pied Bat population size would be the removal of roosting habitat, maternity roosts and the substantial removal of foraging habitat. The proposal will not impact any roosting habitat, however requires removal of 6.12 ha of potential foraging habitat. The foraging habitat is considered sub-optimal given that it has been historically cleared, with a lack of large trees and an abundance of trees of a similar size, indicating a single regeneration event. With limited large trees, and smaller trees having limited fruiting resources and limited nectar, the removal of this small area is not likely to cause any population level effects.
2. Reduce area of occupancy	The study area is within the known and modelled distribution of the species, as identified within the national recovery plan (DERM 2011). Within NSW, based on available records, the largest concentration of populations appears to be in the sandstone escarpments of the Sydney Basin and northwest slopes of NSW (DERM 2011). It is unlikely that an important population is reliant on the study area for foraging, as the habitat is sub-optimal due to limited large trees, and there is no roosting habitat. The area of occupancy of the species is large and the removal of 6.12 ha of potential foraging habitat is unlikely to reduce this area of occupancy significantly.

Table 5.3 Assessment of significance for Large-eared Pied Bat

Criteria	Discussion
3. Fragment a population	Modelling based on presence-only data indicates that bats forage in fertile valleys and plains, as well as areas with moderately-tall to taller trees along water courses. The majority of records are from canopied habitat, suggesting a sensitivity to clearing, although narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used (DECC 2007, cited in DERM 2011). However, the loss of 6.12 ha of potential foraging habitat, that occurs on the edge of an existing open cut mine working area, where clearing has historically taken place, will not cause any significant fragmentation effects for the species.
4. Adversely affect critical habitat	Any maternity roosts must be considered habitat critical to the survival of the species (DERM 2011). Sandstone cliffs and fertile wooded valley habitat within close proximity of each other should also be considered habitat critical to the survival of the Large-eared Pied Bat (DECC 2007, cited in DERM 2011). As maternity roosting habitat and any nearby sandstone cliff is absent, the study area does not contain critical habitat for the Large-eared Pied Bat.
5. Disrupt the breeding cycle of a population	Maternity roosts are absent from the study area, and the habitat does not provide any opportunity for any future maternity roosts, therefore it will not disrupt the breeding cycle of a population.
6.Decrease availability or quality of habitat	Given the small area (6.12 ha) of clearing and the abundance of potential foraging habitat in the locality, this is not expected to impact the species such that it would decline.
7. Result in invasive species	Predation by introduced predators is listed as a threat to the species (recovery plan). It is possible that mortality is a factor particularly where roosts are limited and bats are forced to roost close to the ground, making them vulnerable to attack from cats, foxes and possibly rats. However, the study area does not contain roosting habitat therefore the species, which may only forage in the study area, is not affected by this threat. Weed controls and hygiene protocols will be implemented during the construction works, reducing the chance of introducing any invasive species to surrounding bushland.
8. Introduce disease	This species is subject to Australian Bat Lyssavirus. This disease becomes more prevalent when the species is stressed. As the works are not located in a roosting colony, and result in small clearance of only potential sub-optimal foraging habitat it is unlikely to cause stress such that a disease outbreak would occur.
9. Interfere with recovery	Recovery actions for this species rely on identifying priority roost and maternity sites for protection and implementing conservation and management strategies for priority sites. Also, educating the community and industry to understand and participate in the conservation of the large-eared pied bat, research the large-eared pied bat to augment biological and ecological data to enable conservation management, and determine the meta-population dynamics throughout the distribution of the large-eared pied bat. The project does not interfere with any of these priority actions.
Conclusion	The project will not have a significant impact on the Large-eared Pied Bat as: • no roost sites or roosting habitat will be directly impacted; and • the study area represents sub-optimal potential foraging habitat only.

5.2.4 Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable

The Grey-headed Flying-fox is listed as a vulnerable species under the EPBC Act. Individuals are generally found within 200 km of the eastern coast of Australia, from Bundaberg, Queensland to Melbourne, Victoria. In times of natural resource shortages, they may be found in unusual locations. They occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. 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.

The species occurs as a single, continuous population across its range and therefore important populations cannot be identified for the species. Roosting camps represent important habitat for the species, however these are absent from the study area. The species may occasionally forage within the study area as it is wide ranging and has been recorded within the locality.

Table 5.4 provides an assessment of significance potential impacts of the proposal on the Grey-headed Flying-fox, in accordance with the relevant assessment criteria (Section 5.2.2).

Table 5.4 Assessment of significance for Grey-headed Flying-fox

Criteria	Discussion
1. Long term decrease in population size	The Grey-headed Flying-fox occurs as a single population across its range, and therefore important populations cannot be identified for the species. Actions that would cause a long-term decrease in Grey-headed Flying-fox population size would be the removal of maternity camps and the substantial removal of foraging habitat. Roosting camps are absent from the study area, and therefore breeding habitat and breeding activities will not be affected by the project. However the project requires removal of 6.12 ha of potential foraging habitat. The foraging habitat is considered sub-optimal given that it has been historically cleared, with a lack of large trees and an abundance of trees of a similar size, indicating a single regeneration event. With limited large trees, and smaller trees having limited fruiting resources and limited nectar, the removal of this small area is not likely to cause any population level effects. This species is highly mobile and able to exploit foraging resources over large areas of NSW. As breeding habitat is absent from the study area, and only a small amount of sub-optimal potential foraging habitat, with a relatively young canopy, will be removed, the project will not lead to a long-term decrease in the Grey-headed Flying-fox population.
2. Reduce area of occupancy	The Grey-headed Flying-fox is a highly mobile species with a large area of occupancy along the east coast of Australia. The removal of 6.12 ha of potential foraging habitat is unlikely to reduce this area of occupancy significantly.
3. Fragment a population	The Grey-headed Flying-fox is a highly nomadic species with a wide distribution along the east coast of Australia, which occurs as a single, contiguous population. The removal of 6.12 ha of potential foraging habitat will not fragment the population.
4. Adversely affect critical habitat	Habitat critical to the survival of the species may include foraging habitat which can support 30,000 individuals within a 50 km radius, and productive habitat during seasonal bottlenecks (DECCW 2009). Roosting habitat critical to survival include those used as a camp >50% of years, or has a certain number of females during the final stages of pregnancy. As roosting camps and habitat are absent, the study area does not contain critical habitat for the Grey-headed Flying Fox.
5. Disrupt the breeding cycle of a population	Maternity roosts are absent from the study area, and the highly cleared landscape is unlikely to support any breeding in the future, therefore it will not disrupt the breeding cycle of a population.
6.Decrease availability or quality of habitat	Given the small area (6.12 ha) of clearing and the abundance of potential foraging habitat in the locality, this is not expected to impact the species such that it would decline.
7. Result in invasive species	Weed controls and hygiene protocols will be implemented during the construction works, reducing the chance of introducing any invasive species to surrounding bushland.
8. Introduce disease	This species is subject to Australian Bat Lyssavirus and Hendra virus. These diseases become more prevalent when the species is stressed. As the works are not located in a roosting colony, and result in small clearance of only potential sub-optimal foraging habitat it is unlikely to cause stress such that a disease outbreak would occur.
9. Interfere with recovery	Recovery actions for this species rely on identifying foraging resources, mapping critical habitat and documenting levels of flying-fox damage so non-invasive mitigation measures can be implemented. The project does not interfere with any of these priority actions.

Table 5.4 Assessment of significance for Grey-headed Flying-fox

Criteria	Discussion
Conclusion	The project will not have a significant impact on the Grey-headed Flying-fox as: • no roost sites or roosting habitat will be directly impacted; and • the study area represents sub-optimal potential foraging habitat only.

5.2.5 Satin Flycatcher (*Myiagra cyanoleuca*) and Rufous Fantail (*Rhipidura rufifrons*) – migratory species

The Satin Flycatcher is listed as a migratory species under the EPBC Act. It inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occurs in coastal forests, woodlands, mangroves and drier woodlands and open forests (DoE 2016). No records of this species exist within the locality, however given its wide range and forested habitat within the study area the species may occur intermittently.

The Rufous Fantail is listed as a migratory species under the EPBC Act. In east and south-east Australia, it mainly inhabits wet sclerophyll forests, and is often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands (DoE 2017). Records of this species exist within the locality. This species has the potential to occur within study area riparian forest.

Table 5.5 provides an assessment of significance that examines potential impacts of the proposal on these migratory species, in accordance with the relevant assessment criteria (Section 5.2.3).

Table 5.5 Assessment of significance for migratory species

Criteria	Discussion
1. Substantially modify destroy or isolate an area of important habitat.	The study area does not contain important habitat for the Satin Flycatcher or Rufous Fantail. While both species have the potential to occur given they are highly mobile and have broad habitat requirements whilst on migration, neither species will breed in the site considering that they both prefer taller forests in wetter habitats such as heavily forested gullies. The species are more likely to visit drier sclerophyll forest, such as that in the majority of the study area, only when on passage. Also, Satin Flycatchers are largely absent from re-growth forests (Loyn 1980; Loyn 1985a; Smith 1984; Taylor et al. 1997b, cited in DoE 2017).
2. Result in an invasive species becoming established in an area of important habitat.	As stated above, the study area does not contain important habitat for either species. Weed controls and hygiene protocols will be included during the construction works, reducing the chance of introducing any invasive species to surrounding bushland.
3. Disrupt the breeding cycle of a population	If either species occur within the study area, is anticipated to be on an intermittent basis only, and not include significant proportions of a population at any given time. There are no attributes of the study area which would cause large aggregations of individuals to occur. These species will not breed within the study area as suitable habitat is absent, therefore disruptions to the breeding cycle are unlikely.

Table 5.5 Assessment of significance for migratory species

Criteria	Discussion
Conclusion	The project will not have a significant impact on either migratory species, as: • the area does not contain important habitat; • no breeding habitat will be impacted; • foraging habitat is sub-optimal and considered unimportant within the landscape; and • no large aggregations of either species are likely to occur.

6 Avoidance and mitigation

6.1 Avoidance

Clearing is required in the study area to enable mine plans to progress as per the existing Part 3A project approval (PA 07_0087). Avoidance is not possible due to the location of the coal resource. The following sections provide recommended mitigation measures to reduce potential biodiversity impacts of the project.

6.2 Mitigation

The Bloomfield Colliery has established clearing practices in place, as part of their Environmental Management Strategy (Bloomfield 2011). These include minimisation of disturbance areas, pre-clearance surveys, salvaging and reusing material on site for habitat enhancement, conserving and reusing topsoils, and weed management. These clearing practices will be implemented for the project in accordance with Bloomfield's management strategy.

Pre-clearance surveys of the forest to be removed will be conducted within 24 hours prior to commencement of clearing to identify any fauna species or habitat within areas of impact. Where clearing of vegetation and fauna habitats occurs, clearing protocols will be put in place, including checking trees for the presence of arboreal fauna prior to felling. Where feasible, animals found to be occupying trees will be safely relocated into nearby forest that will not be disturbed. Where feasible, transportable habitat features such as large logs and boulders will be placed in adjacent retained areas or in areas ready for seeding, to allow their continuation as potential fauna refuge sites.

6.2.1 Pre-clearance surveys for MNES

Although the project is unlikely to result in a significant impact to MNES, the Regent Honeyeater and Swift Parrot have been assumed to occasionally forage within the study area and a precautionary assessment approach has been adopted for these two species. Accordingly, measures are proposed to mitigate potential impacts of the proposed action on potential habitat for the Regent Honeyeater and Swift Parrot. As well as the above general fauna pre-clearance methodology, targeted pre-clearance surveys by a suitably qualified ecologist should be undertaken for the Regent Honeyeater and Swift Parrot, prior to clearing the vegetation within the study area, as described below.

i Regent Honeyeater and Swift Parrot

A qualified ecologist will undertake a pre-clearance survey within 24 hours prior to the commencement of removal of potential foraging habitat for the Regent Honeyeater and Swift Parrot. Potential foraging habitat includes the entire 6.12 ha study area.

Pre-clearance surveys will be undertaken over a period of two days and surveys will be undertaken in the morning (ie within 3 hours of sunrise) to target the species highest activity period. Dependent on the clearing schedule, the survey effort will comprise:

- 20 minute searches in areas up to 5 ha; or
- 40 minute searches in areas of 6-30 ha.

If Regent Honeyeaters or Swift Parrots **are not found** within the clearance area, then searches for Regent Honeyeater or Swift Parrot habitat trees (foraging trees) are not required.

If Regent Honeyeaters or Swift Parrots **are found** within the clearance area, targeted searches for Regent Honeyeater or Swift Parrot habitat trees will be undertaken by a qualified ecologist.

If habitat trees are found within the clearance area, a qualified ecologist will mark the trees with flagging tape and spray paint (eg with a 'H', denoting habitat tree).

The two-stage clearance protocol for habitat trees comprises:

- Stage 1: Non-habitat trees will be cleared 24 hours prior to any habitat trees being cleared, to encourage Swift Parrots to move out of the habitat area.

- Stage 2: When Stage 1 is complete, habitat trees can be removed.

6.2.2 Weed control, microhabitat retention and demarcation

Other management strategies should include:

- appropriate weed controls to avoid incursion of exotic weed species into the remaining surrounding forest;

- salvaging microhabitat features, such as woody debris and logs, within adjacent suitable habitat, where possible to mitigate potential impacts to ground-dwelling fauna; and

- habitat adjacent to the proposed clearing should be demarcated to avoid accidental clearing. No vegetation should be cleared where it can be avoided. Areas that do not require clearing, come construction, should not be cleared. Where opportunities for reduction in clearing extents occur, these should be implemented and micro-habitat features retained.

7 Conclusion and recommendations

The study area has been subject to historical clearing and the vegetation in the study area is regrowth with a lack of large trees and a large number of trees of a similar size. In several areas, ground disturbance is also evident with contour banks and a drainage line. Although the study area has been previously degraded, the vegetation provides potential habitat for some MNES threatened species.

Potential habitat for a number of threatened species, including Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox and migratory species Satin Flycatcher and Rufous Fantail has been identified within the study area. However, habitat for these species is generally of sub-optimal value, primarily due to its condition, fragmented nature, existing threats and location next to an existing operating open cut mine.

The habitat is unlikely to support important populations of MNES or be critical to the survival of a population or the species. Impact assessments have been undertaken for each of these species against EPBC Act significant impact criteria. These assessments concluded that it is unlikely that significant impacts to MNES will occur as a result of the proposed Project.

It is recommended that the mitigation and management measures described in Section 6 are implemented.

References

Bionet 2017, *Atlas of NSW Wildlife*, Office of Environment and Heritage, http://www.bionet.nsw.gov.au/, viewed April 2017.

Birds Australia 2011, *National Recovery Plan for the Swift Parrot Lathamus discolour,* Prepared by Debbie Saunders and Chris Tzaros, Swift Parrot Recovery Team.

Birdlife Australia 2014, *IBAs in Danger Report, The state of Australia's Important Bird and Biodiversity Areas*, November 2014.

Bloomfield (2011) *Mining Operations (Bloomfield) Environmental Management Strategy*, Revised Final Draft, August 2011.

Department of Environment, Climate Change and Water NSW (DECCW) 2009, *Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus*, prepared by Dr Peggy Eby, Sydney.

Department of the Environment (DoE) 2013, *Matters of National Environmental Significance – Significance Impact Guidelines 1.1.*

DoE 2016, *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygria)*, Commonwealth of Australia, April 2016.

Department of the Environment and Energy (DoEE) 2017, *Species Profile and Threats Database,* http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl, viewed June 2017.

Department of Environment and Resource Management (DERM) 2011, *National recovery plan for the large-eared pied bat Chalinolobus dwyeri,* Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

Hunter Eco 2010, *Bloomfield Colliery East Maitland, Part 3A variation ecology report*, prepared May 2010.

Hunter Eco 2012, *Bloomfield Colliery East Maitland, Biodiversity Assessment – Creek Cut Highwall*, prepared November 2012.

Office of Environment and Heritage (OEH) 2016*, Vegetation information system (VIS) classification database.*

Office of Environment and Heritage (OEH) 2017, *Threatened Species Profile Database.* http://www.environment.nsw.gov.au/threatenedspeciesapp/.

Roderick, M, Geering D.J and Ingwersen, D.A 2014, *Significant breeding event of Regent Honeyeaters Anthochaera phrygia near Kurri Kurri, New South Wales, during spring 2007*, Australian Field Ornithology 2014, 31, 113–121.

Threatened Species Scientific Committee (TSSC) 2015, *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community*. Canberra: Department of the Environment.
http://www.environment.gov.au/biodiversity/threatened/communities/pubs/130-conservation-advice.pdf.

Appendix A

EPBC Act Protected Matters Search Tool

Australian Government
Department of the Environment and Energy

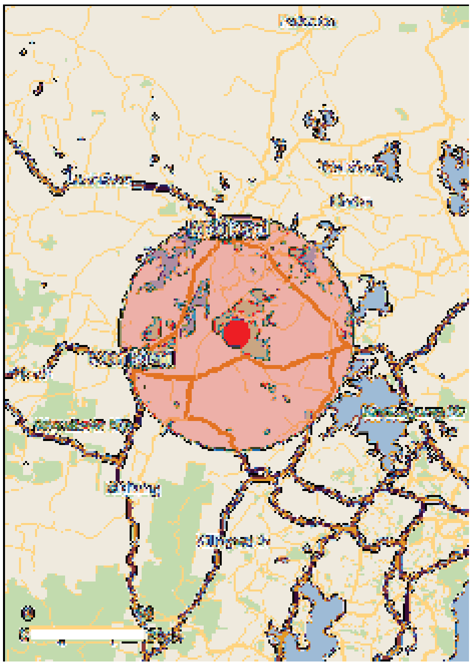
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 07/04/17 15:35:20



Coordinates
Buffer: 10.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	44
Listed Migratory Species:	33

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	7
Commonwealth Heritage Places:	1
Listed Marine Species:	42
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Hunter estuary wetlands	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area

Name	Status	Type of Presence
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Asterolasia elegans [56780]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Airservices Australia
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Director of Defence Service Homes
Commonwealth Land - Telstra Corporation Limited

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Maitland Post Office	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
LNE Special Management Zone No1	NSW
Pambalong	NSW
Sugarloaf	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.8019 151.5616

Appendix B

Likelihood of Occurrence Assessment

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing: TSC Act	Listing: EPBC Act	Source: Bionet	Source: PMST	Habitat preferences and distribution	Likelihood of occurrence
TECs							
Central Hunter Valley eucalypt forest and woodland			CE		y	The canopy of this CEEC is dominated by one or more of the following four eucalypt species; Narrow-leaved ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*), Slaty Gum (*E. dawsonii*) and Grey Box (*E. moluccana*) (TSSC 2015). One of the above species, Spotted Gum, occurs within the study area, representing 22% of the canopy species. However it is co-dominant with several other canopy species which are not indicative of the CEEC listing. To qualify as part of the Central Hunter Valley eucalypt forest and woodland ecological community Forest Oak (*Allocasuarina torulosa*), White Mahogany (*Eucalyptus acmenoides*) and Red Ironbark(*Eucalyptus fibrosa*) should be largely absent from the canopy. No white Mahogany were recorded within the study area, however Forest Oak and Red Ironbark were recorded with 24% and 10% of the canopy species respectively. The presence of these contraindicative species precludes the vegetation within the study area meeting the listing advice for this community.	Unlikely
Lowland Rainforest of Subtropical Rainforest			CE		y	This ecological community is generally a moderately tall (≥20 m) to tall (≥30 m) closed forest (canopy cover ≥70%). Tree species with compound leaves are common and leaves are relatively large (notophyll to mesophyll). Typically there is a relatively low abundance of species from the genera *Eucalyptus, Melaleuca* and *Casuarina*. Buttresses are common as is an abundance and diversity of vines. The tree canopy within the study area is dominated by *Eucalyptus* and *Corymbia* species with no typical rainforest trees recorded. This EEC does not occur within or adjacent to the study area.	Unlikely
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland			CE		y	The canopy stratum of this community is dominated by White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Blakely's Red Gum (*E. blakelyi*) community, none of which occur within the study area. This EEC does not occur within or adjacent to the study area.	Unlikely
Wetlands of International Importance							
Hunter Estuary Wetlands					y	The Hunter Estuary Wetlands Ramsar site is comprised of two components, Kooragang and Hunter Wetlands Centre Australia. The Kooragang component of the Hunter Estuary Wetlands Ramsar site is located in the estuary of the Hunter River, approximately 7 km north of Newcastle on the coast of New South Wales. Hunter Wetlands Centre Australia is 2.5 km from Kooragang. Whilst the study area is within the Hunter River Catchment, there are no watercourses linking the study area to the Hunter River or any of its tributaries.	Unlikely

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing: TSC Act	Listing: EPBC Act	Source: Bionet	Source: PMST	Habitat preferences and distribution	Likelihood of occurrence
Frogs							
Litoria aurea	Green and Golden Bell Frog	E	V	y	y	Inhabits marshes, dams and stream-sides, particularly those containing bulrushes (*Typha spp.*) or spikerushes (*Eleocharis spp.*). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites occur in highly disturbed areas (OEH 2017). The closest population, considered 'probably extant' (DoEE 2017), is part of the Middle Hunter Key Population, sub-population Wentworth Swamp. Individuals within this key population were last recorded in 2008, in two areas close to Gillieston Heights and Farley. No suitable breeding habitat was recorded within or adjacent to the study area and the species is unlikely to occur.	Unlikely
Litoria littlejohni	Littlejohn's Tree Frog	V	V	y	y	This species is restricted to sandstone woodland and heath communities at mid to high altitude. It forages both in the tree canopy and on the ground, with eggs and tadpoles mostly found in still or slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools (OEH 2017). The study area does not contain woodland or heath on sandstone and therefore no suitable habitat is likely to be present for the species.	Unlikely
Mixophyes balbus	Stuttering Frog	E	V		y	This species occurs in rainforest and wet tall open forest on plateaus, foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Eggs are laid on rock shelves or shallow riffles in small, flowing stream (OEH 2017). The species has not been recorded in the locality and no suitable habitat is present on the site.	Unlikely
Mixophyes iteratus	Giant Barred Frog	E	E		y	This species are found along freshwater streams with permanent or semi-permanent water, typically at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide (OEH 2017). The species has not been recorded within the locality and suitable habitat is absent from the study area.	Unlikely
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	E	V		y	The species is largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney (OEH 2017). It occurs in sclerophyll woodland with sandstone outcrops preferring ridges, buffs and slopes with a north west aspect. Thermally suitable microhabitat may be a limiting resource for the species (DoEE 2017). The species has not been recorded within the locality and no suitable sandstone habitat exists.	Unlikely

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing TSC Act	Listing EPBC Act	Source Bionet	Source PMST	Habitat preferences and distribution	Likelihood of occurrence
Birds							
Anthochaera phrygia	Regent Honeyeater	CE	CE	y	y	The species has a patchy distribution and is highly mobile, occurring only irregularly in most sites, and in variable numbers, often with long periods with few observation anywhere. Within the current distribution there are four known key breeding areas where the species is regularly recorded. These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria (DoE 2016). Key eucalypt species identified in the National Recovery Plan for the Regent Honeyeater (DoE 2016) comprise Mugga Ironbark (*Eucalyptus sideroxylon*), Yellow Box (*E. Melliodora*), White Box (*E. albens*), Yellow Gum (*E. leucoxylon*), Spotted Gum (*Corymbia maculata*), Swamp Mahogany (*E. robusta*), Needle-leaf Mistletoe (*Amyema cambagei*) which grows on River Oak (*Casuarina cunninghamiana*), Box Mistletoe (*A. miquellii*) and Long-flower Mistletoe (*Dendropthoe vitellina*). Other tree species may be regionally important. For example the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events of Regent Honeyeaters. Flowering of associated species such as thin-leaved stringybark (*E. eugenioides)* and other stringybark species, and broad-leaved ironbark (*E. fibrosa)* can also contribute important nectar flows at times. Two Bionet (2017) records exist within the locality, with the closest record located 7 km to the west of the study area. Additionally, more records exist just outside of the locality, approximately 10km to the south-west of the study area within the Tomalpin Woodlands, south-west of Kurri Kurri in the Lower Hunter Valley Important Bird Area (IBA). These records are associated with a known breeding event that occurred in this woodland during 2007 and 2008 (Roderick et al. 2014). During this time about 20 nests fledged young, the most significant known recruitment of individuals in recent years. In 2012, around 100 Regent Honeyeaters were recorded in the Lower Hunter Valley IBA, remaining in the Tomalpin Woodlands for at least six months, and they may have bred there again (birds were observed constructing nests) (Birdlife Australia 2014). Suitable foraging species occur within the study area and the species has been recorded within the locality, and the species has the potential to fly over or utilise seasonal foraging resources within the study area.	Potential
Botaurus poiciloptilus	Australasian Bittern	E	E		y	This species occurs in permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). No suitable wetland habitat exists within the study area.	Unlikely
Calidris canutus	Red Knot,		E		y	In Australasia the Red Knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts. No such habitat occurs within the study area.	Unlikely
Calidris ferruginea	Curlew Sandpiper	CE	E		y	The Curlew Sandpiper is a small, highly-gregarious, migratory shorebird. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. No suitable habitat for this species exists within the vicinity of the study area.	Unlikely
Charadrius leschenaultii	Greater Sand Plover	V	V		y	This species is almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks (OEH 2017). No such habitat occurs within the study area.	Unlikely
Charadrius mongolus	Lesser Sand Plover	V	E		y	This species is almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats (OEH 2017). No such habitat occurs within the study area.	Unlikely

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing TSC Act	Listing EPBC Act	Source Bionet	Source PMST	Habitat preferences and distribution	Likelihood of occurrence
Dasyornis brachypterus	Eastern Bristlebird	E	E		y	This species typically occurs in dense, coastal vegetation. The distribution has contracted to three disjunct areas of south-eastern Australia, none of which are close to the study area (OEH 2017).	Unlikely
Erythrotriorchis radiatus	Red Goshawk	CE	V		y	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers (OEH 2017). This species is now restricted to northern NSW and the preferred habitat does not exist within the study area.	Unlikely
Grantiella picta	Painted Honeyeater	V	V		y	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species exhibits seasonal north-south movements governed principally by the fruiting of mistletoe, with many birds moving after breeding to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory (DoEE 2017). The species has not been recorded within the study area or locality and there is a lack of preferred tree species within the study area.	Unlikely
Lathamus discolor	Swift Parrot	E	CE	y	y	This species migrates in the autumn and winter months to south-eastern Australia. In NSW, mostly occurs on the coast and south-west slopes in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (OEH 2017). Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*). Favoured feed trees within the study area include Spotted Gum and Red Bloodwood which occur at 22.3% and 1.6% of the total canopy species respectively. Optimal habitat is likely to include areas with a higher density of larger preferred feed trees, however the species has been assessed as having the potential to occur given the presence of feed trees and several records of this species occurring within the locality.	Potential
Limosa lapponica baueri	Bar-tailed Godwit (baueri)		V		y	This migratory species is typically forages on intertidal mudflats and sandflats. No Such habitat occurs within the study area.	Unlikely
Limosa lapponica menzbieri	Bar-tailed Godwit (menzbieri)		CE		y	This migratory species is typically forages on intertidal mudflats and sandflats. No Such habitat occurs within the study area.	Unlikely
Numenius madagascariensis	Eastern Curlew	-	CE, Mi		y	This migratory species is found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons. No suitable habitat for this species exists within the study area.	Unlikely
Rostratula australis	Australian Painted Snipe	E	E	y	y	The species inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans (OEH 2017). No suitable habitat for this species exists within the study area.	Unlikely

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing		Source		Habitat preferences and distribution	Likelihood of occurrence
		TSC Act	EPBC Act	Bionet	PMST		
Mammals							
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	y	y	This species roosts in caves, crevices in cliffs, old mine workings, frequenting low to mid-elevation dry open forest and woodland, especially in gullies. Females have been recorded raising young in maternity roosts in roof domes in sandstone caves and overhangs. Records of this species exist approximately 2.5 km north-east of the study area. There is no breeding habitat for this species within the study area; however several records occur within the locality and the species may have the potential to pass over or forage within the study area.	Potential
Dasyurus maculatus	Spotted-tailed Quoll	V	E	y	y	This species has been recorded from a wide range of habitats, unlogged forest or forest that has been less disturbed by timber harvesting is preferable. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves. Individuals require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage. Home ranges are estimated to be 620–2,560 ha for males and 90–650 ha for females (DoEE 2017). This species is unlikely to occur given the lack of suitable shelter and potential den sites. There are no rocky outcrops and a paucity of fallen timber and tree hollows.	Unlikely
Petauroides volans	Greater Glider		V	y	y	This species is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollow (DoEE 2017). The habitat within the study area is not suitable for this species given the low canopy heights and lack of old trees. Some hollows exist in the study area however they are not abundant.	Unlikely
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V		y	This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north (OEH 2017). This species has not been recorded in the locality and no potential habitat occurs.	Unlikely
Phascolarctos cinereus	Koala	V	V	y	y	This species inhabits eucalypt woodlands and forests and feeds on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species (OEH 2017). One primary feed tree species listed within the North Coast Koala Management Area under SEPP 44 was recorded, Grey Gum (*Eucalyptus punctata*). This tree composed small proportion (1.6%) of the canopy however and only 33 Grey Gums were recorded of the 314 surveyed. OEH lists seven koala management areas (KMA) within NSW. The study area is included within the north coast KMA, which lists three tiers of koala feed tree, Primary, Secondary and Stringybarks/supplementary species. No primary or secondary feed trees listed for the KMA were found within the study area and therefore it is unlikely that there are sufficient foraging resources to support the Koala within the Study area.	Unlikely
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V		y	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature (OEH 2017). This species has not been recorded within the locality and it likely to be absent from the study area.	Unlikely
Pseudomys novaehollandiae	New Holland Mouse		V	y	y	This species occurs in coastal areas and up to 100 km inland on sandstone country (OEH 2017). At inland sites the species frequents heathland and open woodland with a heathland understorey. The study area does not contain a heathland understory and is considered potential habitat.	Unlikely
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	y	y	The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (OEH 2017). This species has been recorded within the locality and suitable habitat exists within the study area.	Potential

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing		Source		Habitat preferences and distribution	Likelihood of occurrence
		TSC Act	EPBC Act	Bionet	PMST		
Flora							
Acacia bynoeana	Bynoe's Wattle	E	V	y	y	Occurs in heath or dry sclerophyll forest on sandy soils. Prefers open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstory species include Red Bloodwood (*Corymbia gummifera*), Scribbly Gum (*Eucalyptus sclerophylla*), Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple (OEH 2017). There are no sandy soils within the study area and none of the associated overstory canopy species were recorded. There is no suitable habitat for this species within the study area.	Unlikely
Asterolasia elegans		E	E		y	The species occurs in wet sclerophyll forest on moist hillsides. No records exist within the locality and the study area is outside the known range for this species. No suitable habitat exists within the study area.	Unlikely
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V		y	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland (OEH 2017). The larger populations typically occur in woodland dominated by Scribbly Gum, Silvertop Ash (*E. sieberi*), Red Bloodwood and Black Sheoak (*Allocasuarina littoralis*). The species has not been recorded within the locality and the preferred habitat for this species does not exist within the study area.	Unlikely
Dichanthium setosum	Bluegrass	V	V		y	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It is associated with heavy basaltic black soils and red-brown loams with clay subsoil. The species has not been recorded within the locality and the preferred habitat for this species does not exist within the study area.	Unlikely
Eucalyptus glaucina	Slaty Red Gum	V	V	y	y	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest in deep, moderately fertile and well-watered soils. Records exist within the locality however the species was not recorded in the study area and it is likely that the soils are too shallow and infertile to be optimal for this species.	Unlikely
Eucalyptus parramattensis subsp. decadens	Earps Gum	V	V	y	y	Generally occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey or as an emergent in dry or wet heathland. This species was not recorded within the study area, furthermore suitable soil types do not exist within the study area.	Unlikely
Euphrasia arguta	-	CE	CE		y	The species is known from grassy areas near rivers and has not been recorded in the locality. Not recorded within the study area.	Unlikely
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	y	y	Occurs in a range of vegetation types from heath and shrubby woodland to open forest (OEH 2017). In the Hunter it has been recorded in Kurri Sand Swamp Woodland and records exist 340 m south-east of the study area. Not recorded within the study area.	Unlikely
Melaleuca biconvexa	Biconvex Paperbark	V	V		y	This species generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. The species has not been recorded within the locality and was not recorded within the study area.	Unlikely
Pelargonium sp. Striatellum	Omeo Stork's-bill		E		y	This species typically occurs 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. No such habitat exists within the study area and the locality is outside the species know range.	Unlikely

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing TSC Act	Listing EPBC Act	Source Bionet	Source PMST	Habitat preferences and distribution	Likelihood of occurrence
Pterostylis gibbosa	Illawarra Greenhood,	E	E		y	All 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 Narrow-leaved Ironbark, Forest Red Gum and Black Cypress Pine (*Callitris endlicheri*.) The species has not been recorded within the locality and habitat within the study area is not suitable for this species.	Unlikely
Rhizanthella slateri	Eastern Underground Orchid	V	E		y	This species is highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Flowering occurs between September and November. Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. The closest records of this species are 75 km to the north west and 80 km to the north east and therefore it is considered that the species is unlikely to occur within the study area.	Unlikely
Rutidosis heterogama	Heath Wrinklewort	V	V	y	y	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides (OEH 2017). Such habitat is absent from the study area and the species was not recorded.	Unlikely
Syzygium paniculatum	Magenta Lilly Pilly	E	V	y	y	The species occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. Suitable habitat for this species does not exist within the study area.	Unlikely
Tetratheca juncea	Black-eyed Susan	V	V	y	y	This species is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover (OEH 2017). The species has been recorded 2.2 km to the east of the study area and potential habitat exists within the study area. The species has not been recorded during previous field surveys conducted within the study area (Hunter Eco 2010), nor in adjacent communities (Hunter Eco 2012). The most recent field survey conducted for this report also failed to detect the species. It is considered that the species is likely to be absent based on the field surveys conducted to date.	Unlikely
Thesium australe	Austral Toadflax	V	V		y	This species occurs in grassland and woodland, often in damp sites. It is a root parasite on native grasses, most notably Kangaroo Grass (*Themeda triandra*)*. There are no records of this species within the locality and the species was not recorded within the site.	Unlikely
Terrestrial Migratory Species							
Apus pacificus	Fork-tailed Swift		Mi		y	A wide ranging species flying over almost all habitat types within NSW. No records of this species exist within the locality, however given its wide range the species may fly over the study area.	Potential
Cuculus optatus	Oriental Cuckoo		Mi		y	An uncommon non-breeding migrant to south east Australia, occurring in a wide range of habitats. Very few records exist within the locality.	Unlikely
Hirundapus caudacutus	White-throated Needletail		Mi	y	y	In Australia, the species is almost exclusively aerial. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland (DoE 2016). Records of this species exist within the locality, and the species may fly over/forage over the study area.	Potential

Table B.1 Likelihood of occurrence assessment

Scientific Name	Common Name	Listing		Source		Habitat preferences and distribution	Likelihood of occurrence
		TSC Act	EPBC Act	Bionet	PMST		
Monarcha melanopsis	Black-faced Monarch		Mi		y	The species 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 temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest (DoEE 2017). No suitable habitat exists for this species within the study area.	Unlikely
Monarcha trivirgatus	Spectacled Monarch		Mi		y	This species prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves. The species is not known from the locality and suitable habitat does not occur.	Unlikely
Motacilla flava	Yellow Wagtail		Mi		y	This species is rarely recorded within NSW and is not anticipated to occur close to the study area, given the majority of records are clustered around Newcastle and Sydney coastal regions.	Unlikely
Myiagra cyanoleuca	Satin Flycatcher		Mi		y	This species inhabits 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 (DoEE 2017). No records of this species exist within the locality, however given its wide range and forested habitat within the study area the species may occur intermittently.	Potential
Rhipidura rufifrons	Rufous Fantail		Mi		y	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands (DoEE 2017). Records of this species exist within the locality. This species has the potential to occur within study area riparian forest.	Potential

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Appendix B

Flora data

Table B.1 Plot data

Species name	Common name	Cover				Abundance				Stratum	Growth habitat
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 1	Plot 2	Plot 3	Plot 4		
**Ageratina adenophora*	Crofton Weed			0.1				3		G	H
**Andropogon virginicus*	Whisky Grass		1	30	2		20	>1000	25	G	G
**Bidens pilosa*	Cobblers Pegs			1				20		G	H
**Briza maxima*	Quaking Grass			2				>1000		G	G
**Chloris gayana*	Rhodes Grass	95	6	65	95	>1000	500	>1000	>1000	G	G
**Conyza sp.*	Fleabane		0.5	0.5			20	30		G	H
**Cortaderia selloana*	Pampas Grass		3				1			G	G
**Cynodon dactylon*	Couch		4	1			30	10		G	G
**Hypochaeris radicata*	Catsear			1	1			50	50	G	H
**Lantana camara*	Lantana	0.5	2	0.1	2	10	2	1	100	M	S
**Lolium perenne*	Perennial Ryegrass			1				>1000		G	G
**Lysimachia arvensis*	Scarlet Pimpernel	0.1	0.2		0.5	20	10		100	G	H
**Melinis repens*	Red Natal Grass	0.2				20				G	G
**Onopordum acanthium*	Scotch thistle			0.1	0.5			1	2	G	H
**Plantago lanceolata*	Plantain		3	0.1	1		70	20	500	G	H
**Senecio madagascariensis*	Fireweed	0.2		0.1	0.5	20		20	100	G	H
**Senecio pterophorus*	African daisy	1		2	2	15		100	100	G	H
**Senna sp.*			0.1				1			M	S
**Solanum nigrum*	Black-berry Nightshade	0.5				5				G	H
**Verbena bonariensis*	Purpletop				1				50	G	H
Acacia decurrens	Black Wattle		3				5			M	S
Acacia elongata	Swamp Wattle	1		6	4	1		20	21	M	S

Table B.1 Plot data

Species name	Common name	Cover				Abundance				Stratum	Growth habitat
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 1	Plot 2	Plot 3	Plot 4		
Acacia longifolia	Sydney Golden Wattle	2		10	5	6		14	20	M	S
Acacia parvipinnula	Silver-stemmed wattle		1	2			3	2		M	S
Acacia saligna	Golden Wreath Wattle	2	2	8	5	5	8	31	6	M	S
Angophora costata	Smooth-barked Apple		5				4			O	T
Aristida vagans	Threeawn Speargrass		8				>1000			G	G
Austrostipa sp.	Speargrass		1				50			G	G
Billardiera scandens	Apple Berry		0.1				3			G	H
Bursaria spinosa	Blackthorn		10				15			M	S
Centella asiatica	Indian Pennywort			0.1				5		G	H
Cheilanthes sieberi	Rockfern		0.2				7			G	H
Clematis aristata	old man's beard		0.5				15			G	H
Corymbia maculata	Spotted Gum	20	7			6	6			O	T
Dendrophthoe vitellina	Mistletoe	3				5				O	S
Dianella longifolia	Blue Flax-Lily		0.6				6			G	G
Dodonaea triquetra	Large-leaf Hop-bush			0.5				4		M	S
Entolasia stricta	Wiry Panic	0.5	3		0.5	100	31		25	G	G
Eucalyptus globoidea	White Stringybark		7				3			O	T
Eucalyptus punctata	Grey Gum		10				8			O	T
Eucalyptus tereticornis	Forest Red Gum	20				6				O	T
Eucalyptus umbra	Broad-leaved White Mahogany		7				16			O	T
Glochidion ferdinandi	Cheese Tree		1	2	1		1	4	1	M	T
Glycine clandestina	Twining Glycine		0.1				5			G	H

Table B.1 Plot data

Species name	Common name	Cover				Abundance				Stratum	Growth habitat
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 1	Plot 2	Plot 3	Plot 4		
Hardenbergia violacea	Purple Coral Pea		0.1				10			G	H
Hydrocotyle tripartita	Pennywort			1	1			>1000	500	G	H
Hypericum gramineum	Small St. John's Wort			0.2	0.1			100	20	G	H
Imperata cylindrica	Blady Grass	2				100				G	G
Leucopogon juniperinus	Prickly Beard-heath		0.1				1			G	S
Lomandara filiformis	Wattle Mat-rush		0.1		1		3		12	G	G
Pandorea pandorana	wonga wonga vine		1				30			G	H
Pratia purpurascens	Whiteroot		0.1	0.1	0.1		20	10	5	G	H
Pultenaea villosa	Hairy Bush-pea		1	1	1		10	4	10	M	S

Stratum: *O = over storey, M = mid layer, G = Ground layer*

Growth form: *T = Tree, S = Shrub, H = Herb, G = Grass*

** = introduced species*

Table B.2 Biobanking metrics

Plot	Native plant species richness	Native overstorey cover	Native midstorey cover	Native groundcover (grasses)	Native groundcover (shrubs)	Native groundcover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Length of fallen logs	Latitude	Longitude
1	8	33	0	0	2	0	78	0	0.5	21	-32.795396°	151.570821°
2	23	36	0	40	4	24	10	0	0.2	2	-32.794939°	151.570284°
3	11	0	1.2	0	0	0	98	0	0.2	2	-32.795369°	151.567714°
4	10	0	1.7	0	0	0	88	0	0.2	5	-32.795036°	151.571904°

Appendix C

Credit report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 14/11/2017 Time: 11:09:40AM Calculator version: v4.0

Major Project details

Proposal ID:	190/2017/4632MP
Proposal name:	Bloomfield Colliery
Proposal address:	Four Mile Creek Road Ashtonfield NSW 2323
Proponent name:	The Bloomfield Group
Proponent address:	PO Box 4 East Maitland NSW 2323
Proponent phone:	02 4930 2618
Assessor name:	Erin Lowe
Assessor address:	LEVEL 4 45 WATT ST Newcaslte NSW 2300
Assessor phone:	02 4903 5500
Assessor accreditation:	190

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	0.05	1.32
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter	0.29	9.00
Total	0.34	10

Credit profiles

1. Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804)

Number of ecosystem credits created	1
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806)

Number of ecosystem credits created	9
IBRA sub-region	Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Appendix D

Biodiversity Offset Payment Calculator

Biodiversity Offset Payment Calculator

Version: 1.1.1.00
Last updated: 20/10/2017 13:00

Credit Offset Payment Calculator | Payments

Message!

If you would like to meet your offset obligation by making a payment to the Biodiversity Conservation Fund, please contact the BCT team at **bct@environment.nsw.gov.au**

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Baseline price per credit	Dynamic coefficient	Market coefficient	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Hunter	**1590** - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest ***Warning:*** ***This PCT has NO trades recorded***	$1,373.32	0.1683239	0.151096	25.00%	$20.00	1.0000	$2,000.64	1	$2,000.64
Hunter	**1592** - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter ***Warning:*** ***This PCT has NO trades recorded***	$1,373.32	0.1683239	0.151098	25.00%	$20.00	1.0000	$2,000.64	9	$18,005.80
									Subtotal (excl. GST)	**$20,006.44**
									GST	**$2,000.64**
									Total ecosystem credits (incl. GST)	**$22,007.08**

Calculated as on: **09-11-2017 18:58:53** | **Grand total** | **$22,007.08**

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Appendix E

Noise and Vibration Impact Assessment

Appendix E Noise and Vibration Impact Assessment

Bloomfield Colliery Modification

Noise and Vibration Impact Assessment

Report Number 630.01573-R01

19 November 2017

Bloomfield Collieries Pty Ltd
PO Box 4
EAST MAITLAND NSW 2323

Version: v1.1

Bloomfield Colliery Modification

Noise and Vibration Impact Assessment

PREPARED BY:

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.01573-R01-v1.1	19 November 2017	Martin Davenport	Dick Godson	Dick Godson
630.01573-R01-v1.0	29 September 2017	Martin Davenport	Mark Blake	Mark Blake

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APPENDICES

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Bloomfield Collieries Pty Ltd to undertake a Noise and Vibration Impact Assessment (NVIA) for the proposed Bloomfield Colliery Modification Project (the Project). This report presents the results and findings of the NVIA.

The NVIA has been prepared with reference to Australian Standards (AS) 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3.

The noise impacts for the Project have been guided by the assessment guidelines as presented in **Table 1**.

Table 1 Noise Impact Assessment Procedure Guidelines

Assessment Guideline	Criteria	Assessment
Modification Maximum, Intrusive and Amenity Noise A quantitative assessment guided by the requirements of the NSW *Industrial Noise Policy* (INP) (EPA[1], 2000) and associated INP Application Notes (EPA, 2013) in relation to assessing noise impacts from the modification, expansion or upgrade of existing industrial premises.	**Section 5**	**Section 6**
Cumulative Amenity Noise A quantitative assessment guided by the requirements of the INP in relation to existing and successive industrial development by setting acceptable (and maximum) equivalent continuous noise amenity levels ($L_{Aeq\ [period]}$) for all industrial (ie non-transport related) noise in a receiver area.	**Section 6.6**	**Section 6.6**
Blasting A quantitative assessment guided by the requirements of *Technical basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC, 1990).	**Section 7.1.2**	**Section 7.4**

It is noted that the NSW Draft Industrial Noise Guideline (DING) was released by the EPA for consultation in September 2015. When finalised, the DING is intended to update and replace the INP which has applied in NSW since 2000. At the time of this assessment, the DING has not yet been finalised and as such the INP remains the relevant guideline in setting out the EPA's requirements for the assessment and management of operational noise from industrial premises in NSW.

The Project will utilise the existing rail loop/loading and washery facilities already assessed as part of the approved Abel Coal Mine Project. Therefore, the noise impact from these facilities will only be considered as part of a cumulative assessment. No changes road and rail traffic will occur as a result of this project nor are any construction activities proposed. Accordingly, road noise, rail noise and construction noise are not considered further in this assessment.

In preparing this assessment SLR has considered several documents including the following:

- *30-1573-R1R1 Noise and Blasting Assessment - Bloomfield Project* (EA NIA) (Heggies, 2008).
- 30-1573-R2R1 Bloomfield Colliery Modification - Noise Impact Assessment (MOD NIA) (Heggies 2010)
- *630.01573-R3R3 Bloomfield Coal Project - Noise Monitoring Program* (NMP) (SLR 2013).
- *630.10334-R1 Abel Upgrade Modification - Noise Impact Assessment* (Abel MOD NIA) (SLR 2012).

2 PROJECT OVERVIEW

2.1 Introduction

Bloomfield Colliery currently operates in accordance with Project Approval 07_0087 (PA 07_0087) granted on 3 September 2009. PA 07_0087 has subsequently been modified on three separate occasions:

- Modification 1 - Amending overburden emplacement, rehabilitation works, construction of a new alternative haul route ("Wattle Tree Drive"/western haul route) and amending a powerline easement.
- Modification 2 - Seeking an extension for the submission of certain management plans.
- Modification 3 - Approval to modify approved vegetation clearing and Biodiversity Offset Area.

Mining may take place 24 hours per day, seven days per week under PA 07_0087 until 31 December 2021.

2.2 Project Description

Mine scheduling to support PA 07_0087 indicated that the remaining recoverable resource would be exhausted by the end of 2021, hence the current consent lapse date of 31 December 2021.

For the following reasons mining is now predicted to extend beyond the current consent lapse date:

- Run of Mine (ROM) coal production levels have been lower than the 1.3 million tonnes per annum (Mtpa) over the life of the project.
- Changes to the mine fleet have allowed extraction of coal seams that were previously considered not be a recoverable resource.
- Further exploration has been undertaken which has identified other previously unrecoverable resources that the mine fleet can now access.

As a result, Bloomfield has identified up to 13 million tonnes of recoverable ROM coal resource remaining in the approval area.

Therefore the Project consists of modifying the previously approved final landform by moving the final void approximately 200 m to the west.

Additionally the Project seeks to modify the current mining lapse date to coincide with the Abel consent limit of 31 December 2030.

The Project will:

- In general, include all currently approved operations,
- Continue to extract up to 1.3 million tonnes per annum (Mtpa) of run of mine (ROM) coal.
- Operate 24 hours per day and seven days per week.

2.3 Existing Project Approval and Consent Conditions

The relevant conditions relating to noise from PA 07_0087 as modified are reproduced below.

Schedule 3 NOISE

Noise Impact Assessment Criteria

1. *The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in* ***Table 2****:*

Table 2 Operational noise impact assessment criteria

Morning Shoulder	*Day*	*Evening*	*Night*		*Location and Locality*	
$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{Aeq(15min)}$	$L_{A1(1min)}$		
40	*35*	*35*	*35*	*45*	*E*	*Browns Road, Black Hill*
42	*35*	*35*	*35*	*45*	*F*	*Black Hill Road, Black Hill*
43	*39*	*42*	*37*	*45*	*G*	*Buchanan Road, Buchanan*
35	*35*	*35*	*35*	*45*	*H*	*Mt Vincent Road, Louth Park*
35	*35*	*35*	*35*	*45*	*L*	*Kilshanny Avenue, Ashtonfield*
48	*39*	*39*	*37*	*46*	*M*	*John Renshaw Drive, Buttai*
43	*42*	*42*	*35*	*46*	*N*	*Lings Road, Buttai*

Notes

- *To interpret the locations in Table 1, see Appendix 2.*
- *The limits in Table 1 are to apply under meteorological conditions of up to 3 m/s at 10 m above ground level, excluding F and G class inversions as described in the NSW Industrial Noise Policy.*

However, if the Proponent has a written negotiated noise agreement with the landowner of any land, and a copy of this agreement has been forwarded to the Department and DECC, then the Proponent may exceed the noise limits in Table 1 on that land in accordance with the negotiated noise agreement.

Cumulative Noise Criteria

2. The Proponent shall take all reasonable and feasible measures to ensure that the noise generated by the project combined with the noise generated by other mines does not exceed the following amenity criteria at any residence on, or on more than 25 percent of, any privately owned land:

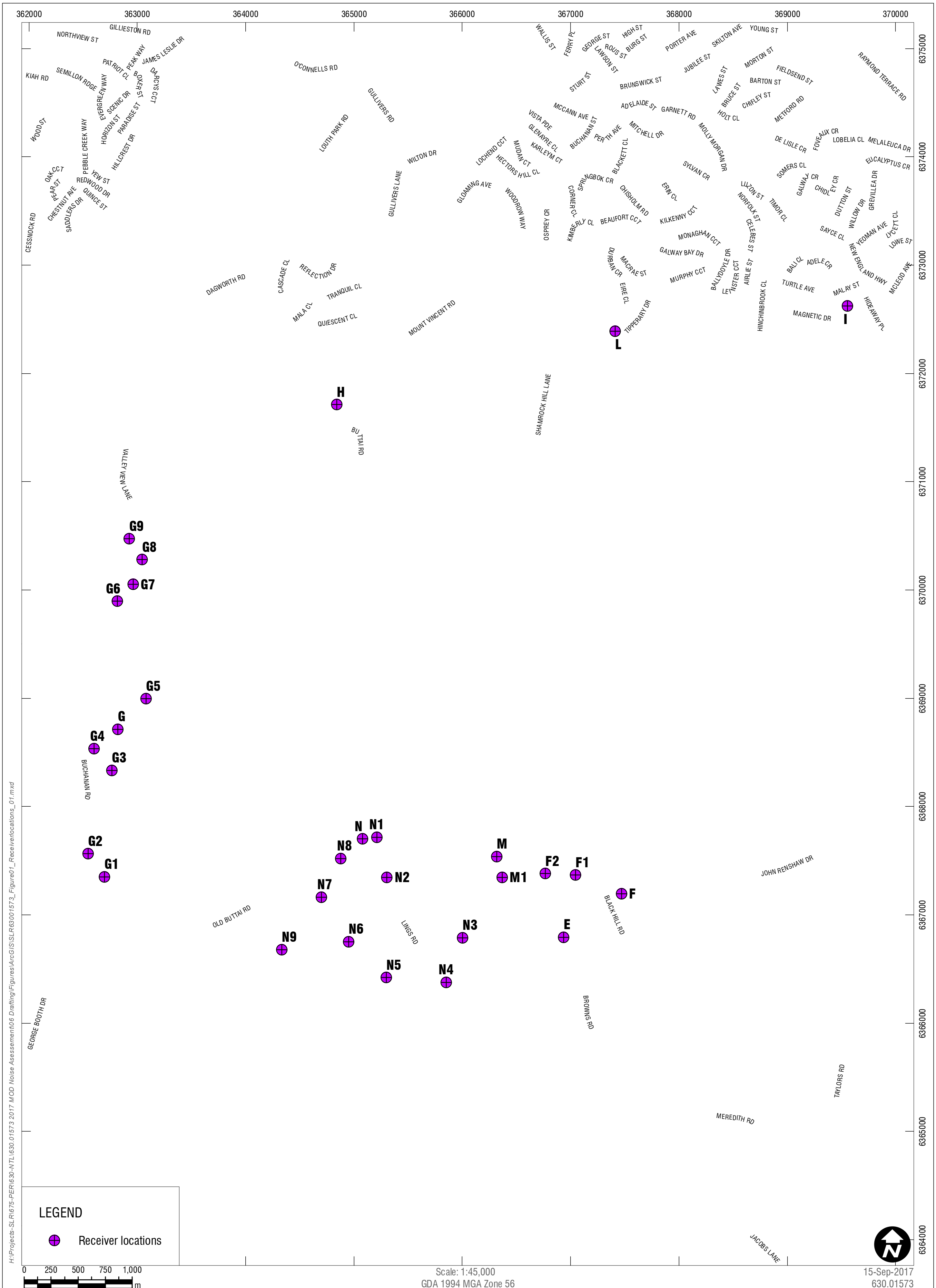
- *LAeq(11 hour) 50 dB(A) – Day;*
- *LAeq(4 hour) 45 dB(A) – Evening; and*
- *LAeq(9 hour) 40 dB(A) – Night.*

It should be noted that the project approval noise conditions given in **Table 2** are applicable to the assessed receiver locations given in Appendix 2 of PA 07_0087, and have been set based on achievable noise levels under prevailing weather conditions at the time of the EA NIA and MOD NIA.

Given the significant time since PA 07_0087 was granted additional receiver locations have been assessed in this NVIA where appropriate.

2.4 Sensitive Receptors

There are numerous residential properties in the vicinity of the Project. The closest most potentially affected residential receptors to the Project are provided in **Table 3** and shown in **Figure 1**.



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Receiver Locations

FIGURE 1

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Table 3 Nearest Sensitive Receptors

Receptor ID[1]	Locality	Receptor Type / Description	Receiver Location	
			Easting	Northing
E	Black Hill	Residential	366938	6366795
F[2]		Residential	367471	6367197
F1		Residential	367045	6367368
F2		Residential	366766	6367384
M	Buttai	Residential	366320	6367540
M1		Residential	366368	6367349
N		Residential	365080	6367704
N1		Residential	365214	6367719
N2		Residential	365305	6367349
N3		Residential	366005	6366790
N4		Residential	365851	6366379
N5		Residential	365301	6366422
N6		Residential	364953	6366755
N7		Residential	364699	6367165
N8		Residential	364879	6367523
N9		Residential	364333	6366682
G	Buchanan	Residential	362820	6368716
G1		Residential	362696	6367353
G2		Residential	362548	6367566
G3		Residential	362766	6368336
G4		Residential	362601	6368536
G5[3]		Residential	363081	6368997
G6		Residential	362818	6369897
G7		Residential	362963	6370052
G8		Residential	363046	6370282
G9		Residential	362925	6370475
H	Louth Park	Residential	364843	6371713
L	Ashtonfield	Residential	367414	6372389
I		Residential	369556	6372623

1 - The receptors listed here represent the nearest noise-sensitive receptors to the Project site. Other residential properties in the area are further from the Project.

2 Yancoal owned property.

3 Bloomfield owned property.

3 IMPACT ASSESSMENT PROCEDURES

3.1 Operational Noise - NSW Industrial Noise Policy

Responsibility for the control of noise emission in NSW is vested in Local Government and the EPA. The INP was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the relevant authority to regulate premises that are scheduled under the Protection of the Environment Operations Act, 1997.

Appendix A presents the INP Application Note which provides guidance with regard to the assessment of noise from the modification of existing industrial premises.

The specific policy objectives are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.
- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

The policy sets two separate noise criteria to meet environmental noise objectives; one to account for intrusive noise and the other to protect the amenity of particular land uses.

Assessing Intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five decibels above the measured background level (L_{A90}).

Assessing Amenity

The amenity assessment is based on noise criteria specific to land use (rural) and associated activities (**Table 4**). The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion (**Table 5**).

Table 4 Amenity Criteria Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal - external	All	Noisiest 1 hour period	35 50	40 55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Monday - Saturday: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am.
Sundays, Public Holidays: Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.
The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 5 Modification to Acceptable Noise Level (ANL)* to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} Noise Level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

* ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 4**

3.2 INP Project Specific Criteria

The INP Project Specific Noise Criteria are the more stringent of either the amenity or intrusive criteria. The *NSW Industrial Noise Policy – Application Notes*, approved by the EPA in December 2010 (INP Application Notes), clarify that this is not necessarily just a matter of comparing the magnitude of the amenity criteria to the intrusive criteria as they apply over different time periods. Three situations of comparative magnitude arise:

- *Predicted intrusiveness < amenity criteria* – The intrusive criteria applies
- *Predicted intrusiveness = amenity criteria* – The intrusive criteria applies
- *Predicted intrusiveness > amenity criteria* – Specified licence condition noise limits shall ensure that both the intrusive and amenity noise levels apply

The INP states that these criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

Table 6 provides the methodology for the noise impact assessment for the Project's intrusive and amenity assessment criteria.

Table 6 Noise Impact Assessment Methodology

Assessment Criteria	Project Specific Criteria	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dB	≤ 5 dB above Project specific criteria	> 5 dB above Project specific criteria
Amenity	INP based on existing industrial level	≤ 5 dB above Project specific criteria	> 5 dB above Project specific criteria

For the purposes of assessing the potential noise impacts the Project specific, management and affectation criteria are further defined as follows.

3.2.1 Project Specific Criteria

Most people in the broader community would generally consider exposure to noise levels corresponding to this zone acceptable.

3.2.2 Noise Management Zone

Depending on the degree of exceedance of the Project specific criteria (1 dB to 5 dB) noise impacts could range from negligible to moderate. It is recommended that management procedures be implemented including:

- Prompt response to any community issues of concern.
- Noise monitoring on site and within the community.
- Refinement of on-site noise mitigation measures and plant operating procedures where practical.
- Consideration of acoustical mitigation at receivers.
- Consideration of negotiated agreements with property holders.

3.2.3 Noise Affectation Zone

Exposure to noise levels exceeding the Project specific criteria by more than 5 dB may be considered unacceptable by some property holders and the INP recommends that the proponent explore the following:

- Discussions with relevant property holders to assess concerns and provide solutions.
- Implementation of acoustical mitigation at receivers.
- Negotiated agreements with property holders, where required.

3.3 Sleep Disturbance

The potential for sleep disturbance has been assessed using the guidance provided in the INP Application Notes.

The INP Application Notes recognises that the current $L_{A1(1minute)}$ sleep disturbance criteria of 15 dBA above the prevailing $L_{A90(15minute)}$ level is not ideal. The assessment of potential sleep disturbance is complex and poorly understood and the EPA believes that there is insufficient information to determine a suitable alternative criteria.

In the interim, the INP guideline suggests that the $L_{A1(1minute)}$ level of 15 dBA above the RBL is a suitable screening criteria for sleep disturbance for the night-time period.

Guidance regarding potential for sleep disturbance is also provided in the RNP. The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The RNP acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides the following conclusions from the research on sleep disturbance:

- Maximum internal noise levels below 50 - 55 dBA are unlikely to awaken people
- One or two noise events per night, with maximum internal noise levels of 65 - 70 dBA, are not likely to affect health and well-being significantly.

It is generally accepted that internal noise levels in a dwelling, with the windows open, are 10 dB lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dB, the first conclusion above suggests that short term external noises of 60 dBA to 65 dBA are unlikely to cause awakening reactions. The second conclusion suggests that one (1) or two (2) noise events per night with maximum external noise levels of 75 dBA to 80 dBA are not likely to affect health and wellbeing significantly.

4 EXISTING NOISE AND METEOROLOGICAL ENVIRONMENT

4.1 Existing Noise Environment

Although Bloomfield Colliery has approved noise limits in PA 07_0087, the INP procedures and associated Application Notes for the modification, expansion or upgrade of existing industrial premises require that noise impact assessments determine the relevant Rating Background Levels (RBLs) and noise amenity levels ($L_{Aeq(period)}$) in the absence of the existing industrial premises.

It should be noted that the criteria provided in PA 07_0087 for the approved operation differed from the Project Specific Noise Levels (PSNLs) established with reference to the INP as part of the EA NIA.

As part of the NMP, SLR has conducted noise monitoring on a quarterly basis at locations surrounding the Project. The noise monitoring consists of continuous, unattended noise logging and operator attended noise surveys. The operator attended noise surveys are used to define existing noise sources, including Bloomfield when detected, and the character of noise in the area and also used to qualify unattended noise logging results. Background noise monitoring was conducted at the locations F, G, L, M, and N as presented in **Appendix B.**

Operator attended noise surveys accompanying the unattended noise monitoring generally note that the noise environment at these locations is dominated by road traffic noise and natural noises such as insect, frog, cicada and bird noise.

Significant sources of road traffic noise in the Project region include the following major roads and highways:

- John Renshaw Drive.
- The New England Highway.
- Buchanan Road
- Hunter Expressway (opened 22 March 2014).

Given the foregoing, it is appropriate that the RBLs be reassessed to determine the change in the background noise levels in the Project area since the opening of the Hunter Expressway in March 2014

4.1.1 Unattended Continuous Noise Monitoring

A summary of the measured Rating Background Levels (RBLs) during the quarterly noise monitoring surveys conducted by SLR since the Q2 2015 (April - June 2015) quarterly monitoring period up until the Q1 2017 (January-March 2017) quarterly monitoring period are provided in **Table 7**. Also presented in **Table 7** is the overall RBL calculated from the Assessment Background Levels (ABLs) over the entire monitoring period and thus providing a robust dataset with which to calculate the representative long-term RBL at each monitoring location.

Table 7 Measured Background Noise Levels

Monitoring Location	Period	Measured RBL								
		Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Overall Q2 2015 to Q1 2017
F	Day	44	42	47	44	49	46	48	45	45
	Evening	41	48	43	39	46	53	43	37	42
	Night	39	41	42	31	44	43	42	35	40
G	Day	32	35	44	38	42	40	43	41	40
	Evening	34	38	44	37	34	39	38	39	38
	Night	29	30	48	31	30	30	33	38	31
L	Day	31	31	34	32	37	33	35	34	34
	Evening	34	33	37	37	32	34	35	37	36
	Night	30	27	35	40	28	30	31	42	33
M	Day	44	43	46	41	48	46	47	40	44
	Evening	41	44	45	44	45	46	44	40	44
	Night	37	34	42	36	41	34	39	36	37
N[1]	Day	46	44	45	36	49	42	44	43	43
	Evening	37	41	41	36	45	41	38	38	39
	Night	33	39	38	29	38	36	31	37	35

1. Alternative Logger Location at 699 John Renshaw Drive, adjacent Bloomfield Colliery.

4.1.2 Operator Attended Noise Monitoring Summary

In order to supplement the unattended logger measurements and to assist in identifying the character and duration of the noise sources, operator-attended daytime, evening, and night-time surveys were also conducted at each noise logging location, with the exception of Location N where monitoring was conducted at Lings Road. The operator-attended measurement results are summarised in **Table 8**.

Table 8 Quarterly Operator Attended Noise Monitoring Results – Q2 2015 to Q1 2017

Monitoring Location	Measured $L_{A90(15minute)}$ All Noise Sources			Bloomfield $L_{Aeq(15minute)}$ Contribution		
	Day	Evening	Night	Day	Evening	Night
F	45, 52, 51, 47, 50, 45, 52, 44	48, 54, 48, 54, 49, 49, 46, 45	44, 49, 40, 39, 43, 47, 45, 35	<35[1], <42[1], <41[1], <37[1], <40[1], <35[1], <42[1], <34[1]	<38[1], <44[1], <38[1], <54[1], <39[1], <39[1], <36[1], <35[1]	<34[1], <39[1], <30[1], <30[1], <33[1], <37[1], <35[1], <30[1]
G	30, 38, 43, 45, 39, 40, 55, 36	44, 41, 43, 42, 38, 38, 64, 38	31, 32, 45, 36, 34, 31, 44, 32	<30[1], <30[1], <33[1], <35[1], <30[1], <30[1], <45[1], <30[1]	42, <31[1], 36, 40, 40, <30[1], <54[1], <30[1]	<30[1], <30[1], <35[1], 36[1], 37, <30[1], <34[1], <30[1]
L	30, 38, 40, 38, 38, 33, 38, 32	34, 34, 42, 44, 35, 33, 36, 40	36, 31, 38, 34, 30, 25, 34, 40	<30[1], <30[1], <30[1], <30[1], <30[1], <30[1], <30[1], <30[1]	<30[1], <30[1], <32[1], <34[1], <30[1], 31, <30[1], <30[1]	<30[1], <30[1], <30[1], <30[1], <30[1], <30[1], <30[1], <30[1]
M	46, 51, 51, 46, 49, 45, 49, 43	48, 48, 47, 52, 51, 45, 44, 45	43, 41, 46, 38, 48, 40, 45, 39	<36[1], <41[1], <41[1], <36[1], <39[1], 32, <39[1], <33[1]	<38[1], 38, <37[1], <42[1], 33, <35[1], <34[1], <35[1]	37, 37, <36[1], <30[1], 48[2], 35, <35[1], <30[1]
N	58, 55, 53, 53, 53, 48, 53, 50	48, 48, 43, 52, 53, 50, 44, 48	38, 40, 51, 35, 41, 41, 49, 37	<48[1], <45[1], <43[1], <43[1], <43[1], <38[1], <43[1], <40[1]	40, <38[1], <33[1], <42[1], 40, <40[1], <34[1], <38[1]	<30[1], <32[1], <41[1], <30[1], <31[1], <31[1], <39[1], <30[1]

1 Bloomfield operations inaudible/not measurable. Any contribution would be at least 10 dB below the LA90 level. Where contribution would be less than 30 dB, estimated contribution is set to <30 dB.

2 Measured exceedance of PA 07_0087.

Where Bloomfield Colliery noise emissions are audible, operator attended noise monitoring indicates that measured noise emissions do not exhibit any discernible low frequency, intermittent or tonal characteristics at the nearest residential receiver areas and as such are not considered further in this NVIA.

4.1.3 Noise Monitoring Summary

Location F

Noise levels at this location are typically dominated by constant road traffic noise from John Renshaw Drive. Bloomfield Colliery operations are not audible at this location and would not impact on the long-term RBL.

Location G

Noise levels at his location are typically dominated by road traffic noise from Buchanan Road as well as insects. Bloomfield colliery operations, when audible, are typically below the measured L_{A90} background noise level during operator attended noise surveys. As such, Bloomfield Colliery operations would have a negligible influence on the long-term RBL at this location.

Location L

Noise levels at this location are typically dominated by road traffic, general suburban noise as well as natural noise such as frogs and insects. Bloomfield colliery operations are generally inaudible at this location and would have a negligible influence on the long-term RBL.

Location M

Noise levels at this location are typically dominated by constant road traffic noise from John Renshaw Drive. Bloomfield Colliery operations are intermittently audible at this location and generally below the measured L_{A90} background noise level during operator attended noise surveys. As such, Bloomfield Colliery operations would have a negligible influence on the long-term RBL at this location.

Location N

Noise levels during operator attended noise surveys at this location are dominated by constant road traffic noise from John Renshaw Drive. Bloomfield colliery operations, when audible, are typically below the measured L_{A90} background noise level during operator attended noise surveys.

In accordance with the NMP, unattended noise monitoring is conducted adjacent to Bloomfield Colliery operations at 699 John Renshaw Drive. Given that the monitoring location has a clear line of sight to open cut operations the long term RBL at this location would be, to an extent, influenced by Bloomfield Colliery operations. However it should be noted that the long term RBL measured at this location, despite the proximity to Bloomfield Colliery operations, is less than that of Location M, further indicating that Bloomfield colliery operations have a negligible impact on background noise levels at the surrounding receiver locations.

4.1.4 Background and Industrial Noise Levels in the Absence of Bloomfield Colliery Operations

In accordance with the INP Application Notes for the modification of existing industrial premises (refer **Appendix A**), the Rating Background Levels (RBLs) and $L_{Aeq(period)}$ amenity levels have to be determined in the absence of existing Bloomfield Colliery operations.

As described in **Section 4.1.3**, existing Bloomfield Colliery operations at Locations F, G, L and M would have a negligible influence on the measured long term RBLs. Accordingly, the RBLs in the absence of existing Bloomfield Colliery operations are presented in **Table 9**.

Table 9 Background and Industrial Noise in the Absence of Bloomfield Colliery Operations

Monitoring Location	Locality Area (Noise Amenity Area)	Adopted RBLs			Estimated $L_{Aeq(period)}$ Industrial Noise Contribution		
		Day	Evening	Night	Day	Evening	Night
F	Black Hill (Suburban)	45	42	40	<49	<39	<34
G	Buchanan & Louth Park (Suburban)	40	38	31	<49	<39	<34
L	Ashtonfield (Suburban)	34	36	33	<49	<39	<34
M	Buttai (Suburban)	44	44	37	<49	<39	<34

4.2 INP Assessment of Prevailing Weather Conditions

An assessment of prevailing meteorological conditions was carried out as part of the EA NIA. 12 months of weather data from an EPA weather station located at Francis Greenway High School near to Beresfield, approximately 7 km north east of Bloomfield Colliery was analysed. The prevailing meteorological parameters used in the EA NIA is provided in **Table 10**.

Table 10 EA NIA Meteorological Modelling Parameters

Modelling Situation	Air Temp	Relative Humidity	Wind Speed	Wind Direction	Temperature Gradient
Calm (All periods)	20°C	65%	N/A	N/A	N/A
South Easterly Wind (Evening and night)	10°C	65%	3 m/s	135°	N/A
North West Wind (Night)	10°C	65%	3 m/s	315°	N/A

Given the significant time since the previous meteorological assessment an updated analysis of prevailing weather has been conducted.

4.2.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration (in accordance with the INP). Where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

The INP provides two methods to assess wind effects; analysis of relevant weather data to determine whether wind is a feature based on the frequency of occurrence and wind speed (*detailed approach*) or simply assume that wind is a feature of the area (*simple approach*).

As stated in the INP Application Notes: *"The EPA has previously accepted (and will accept) noise predictions based on modelling noise emissions using long term weather data, as it can present a higher level of analysis than that required under the INP".* Furthermore, the, then, Australian Government Department of Industry, Innovation and Science best practice document *Airborne Contaminants, Noise and Vibration – Leading Practice Sustainable Development Program for the Mining Industry* dated October 2009 states that a noise model should require data on meteorological conditions over several years.

Wind data was obtained from the on-site meteorological station for a six year period from March 2011 to March 2017.

A summary of the most frequently occurring winds is contained within **Table 11**, **Table 12** and **Table 13**. The percentage occurrence figures provided in bold are those that exceed the 30% threshold.

Table 11 Seasonal Frequency of Occurrence of Wind Speed Intervals – Daytime

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	1.1%	ESE±45	23.8%	20.0%	**43.8%**
Autumn	8.6%	SE±45	19.1%	7.5%	26.6%
Winter	4.3%	W±45	22.6%	9.3%	**31.9%**
Spring	0.5%	ESE±45	18.9%	11.3%	**30.2%**

Table 12 Seasonal Frequency of Occurrence of Wind Speed Intervals – Evening

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	3.6%	ESE±45	56.7%	7.6%	**64.3%**
Autumn	19.3%	SE±45	33.2%	3.3%	**36.4%**
Winter	12.4%	WNW±45	18.7%	7.9%	26.5%
Spring	5.2%	ESE±45	46.4%	3.2%	**49.6%**

Table 13 Seasonal Frequency of Occurrence of Wind Speed Intervals – Night

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	10.1%	SE±45	48.0%	5.0%	**53.0%**
Autumn	21.2%	SW±45	27.2%	1.8%	29.0%
Winter	8.7%	WSW±45	37.7%	6.1%	**43.7%**
Spring	2.2%	WSW±45	6.4%	9.0%	15.5%

Long terms seasonal wind records indicate that prevailing conditions, in accordance with the INP assessment methodology, are a feature of the area. Therefore wind conditions have been considered as part of this assessment.

4.2.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. The NSW INP states that temperature inversions need only be considered for the night-time period. Note that the night-time period for determining inversion frequency is from one hour before sunset to one hour after sunrise (taken to be 6.00pm to 7.00am).

Temperature inversions were determined not to be a feature of the area in the EA NIA based on 12 months of data from the Beresfield weather station.

Data provided from the on-site weather station did not contain sigma theta data to enable the analysis of atmospheric stability classes. However 12 months of data from the Beresfield weather station for the year 2011 was analysed as part of the Abel MOD NIA.

The occurrence of atmospheric stability classes during the winter night-time period at the Beresfield weather station for the year 2011 are presented in **Table 14.**

Table 14 Night-time (6.00pm – 7.00am) Stability Frequency of Occurrence – Beresfield

Pasquil Stability Class	Frequency of Occurrence Percentage During Winter
A	0.0%
B	0.0%
C	0.0%
D	42.7%
E	13.0%
F	44.0%
G	0.3%

The frequency of occurrence of F Class temperature inversions, as determined in accordance with methodology provided in the INP, is greater than 30% and therefore this weather condition has been considered as part of this NVIA.

4.2.3 NVIA Meteorological Modelling Parameters

The resulting noise model meteorological parameters used in this NVIA following updated analysis of local meteorological conditions are provided in **Table 15**.

Table 15 NVIA Meteorological Modelling Parameters

Period	Meteorological Scenario	Air Temp	Relative Humidity	Wind Direction and Speed	Pasquil Stability Class
All Periods	Calm	10°C	70%	N/A	D
Day	Wind only	10°C	70%	3 m/s E, ESE, SE,SSE, W, WNW	D
Evening	Wind only	10°C	70%	3 m/s ENE, E, ESE, SE, SSE	D
Night-time	Wind only	10°C	70%	3 m/s E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW	D
Night-time	Inversion	10°C	70%	N/A	F
Night-time	Inversion with drainage flow	10°C	70%	3 m/s source to receiver	F

5 PROJECT SPECIFIC NOISE CRITERIA

5.1 Operational Noise Criteria

The Project Specific Noise Levels (PSNLs) noise emission design criteria for the Project have been established with reference to the INP outlined in **Section 3.1**.

The amenity criteria have been established using the results of ambient noise measurements provided in **Table 9** with adjustments to account for existing industrial noise contributions as necessary. The acoustical environment typifies that of suburban environments.

The project specific intrusive and amenity noise levels for all assessed receptors are contained within **Table 16**.

Table 16 Project Specific Noise Levels

Location	Locality Area (Noise Amenity Area)	Period	Adopted RBL	Intrusive Criteria $L_{Aeq(15minute)}$ dBA	Amenity Criteria $L_{Aeq(period)}$ dBA
E, F - F2	Black Hill (Suburban)	Day	45	50	55
		Evening	42	47	45
		Night	40	45	40
G - G9, H	Buchanan & Louth Park (Suburban)	Day	40	45	55
		Evening	38	43	45
		Night	31	36	40
L, I	Ashtonfield (Suburban)	Day	34	39	55
		Evening	34	39[1]	45
		Night	33	38	40
M - M1, N - N9	Buttai (Suburban)	Day	44	49	55
		Evening	44	49	45
		Night	37	42	40

1. Evening RBL and criteria adjusted to be no greater than the daytime in accordance with the INP application notes.

5.2 Sleep Disturbance Criteria

The night-time $L_{A1(1minute)}$ Sleep Disturbance Noise Levels (SDNLs) determined in accordance with the INP Application Notes are presented in **Table 17**.

Table 17 Sleep Disturbance Noise Goals

Location	Period	Adopted Night-time RBL	Sleep Disturbance Noise Goal $L_{A1(1minute)}$
E, F - F2	Night-time (10:00 pm – 7:00 am)	40 dBA	55 dBA
G - G9, H		31 dBA	46 dBA
L, I		33 dBA	48 dBA
M - M1, N - N9		37 dBA	52 dBA

6 OPERATIONAL NOISE IMPACT ASSESSEMENT

6.1 Operational Noise Modelling Parameters

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling software (Version 7.4) to predict noise emissions from the Project. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels at the nearest sensitive receivers.

Topographic contours and operational mine plans were supplied by Bloomfield for the purpose of modelling noise form the Project.

Noise predictions were carried out for three (3) operational years, namely;

- Year 2018 - Representative of Bloomfield operations at the commencement of the Project.

- Year 2021 - Representative of Bloomfield operations midway through Project related mining operations.
- Year 2025 - Representative of the furthest extent of Project related operations to the west.

Prediction of noise emission levels was carried out under the meteorological parameters given in **Table 15**.

The meteorological category used within the CONCAWE algorithm is assessed in accordance with Pasquill and Turner Stability Categories. The six meteorological categories used within the CONCAWE algorithm based on Pasquil Stability Category and vector wind speeds are shown in **Table 18**.

Table 18 CONCAWE Meteorological Category

Meteorological Category	Pasquill Stability Category		
	A, B	C, D, E	F, G
1	V< -3.0	-	-
2	-3.0 < V < -0.5	V < - 3.0	-
3	-0.5 < V < +0.5	-3.0 < V < -0.5	V < -3.0
4	+0.5 < V < +3	-0.5 < V < 0.5	-3.0 < V < -0.5
5	V > 3	0.5 < V < +3	-0.5 < V < +0.5
6	-	V> +3	+0.5 < V < +3

Other assumptions made relating to the Project operation in the modelling process include:

- All acoustically significant plant and equipment operates simultaneously.
- Mobile noise sources, such as haul trucks, were modelled at typical locations and assumed to operate in repetitive cycles.

6.2 Operational Scenario - Noise Model Summary

The operational scenario modelled during each period is summarised in **Table 19**. Equipment considered in operation is marked with a 'tick' (✓) and those not considered to be in operation are marked with a 'cross' (×). Where there is a number in parenthesis following a tick, this represents the number of pieces of the equipment that has been considered in the noise model during the relevant period. Sound power levels of relevant equipment are contained within **Appendix C**.

Table 19 Operational Scenario Considered in Noise Model

Scenario	Plant and Equipment	Period	
		Day/Evening/Night	Night - Reduced Operations
Scenario 1 Coaling via main (eastern) haul route. Scenario 2 Coaling via alternate (western) haul route.	Hitachi Excavator 5500	✓	✓
	Caterpillar Rear Dump Trucks 789 (or similar)	✓(5)	✓(5)
	Caterpillar Rear Dump Trucks 793 (or similar)	✓(3)	✓(3)
	SK75 Drill (or similar)	✓	×
	SK50 Drill (or similar)	✓	×
	D10 or D11 Dozer (or similar)	✓(2)	✓(1)
	Cat 24G Grader (or similar)	✓	✓
	Cat 777 Watercart (or similar)	✓	✓
Scenario 3 Overburden	Hitachi Excavator 5500	✓	✓
	Caterpillar Rear Dump Trucks 789 (or similar)	✓(3)	✓(3)
	Caterpillar Rear Dump Trucks 793 (or similar)	✓(3)	✓(3)
	SK75 Drill (or similar)	✓	×
	SK50 Drill (or similar)	✓	×
	D10 and/or D11 Dozer (or similar)	✓(3)	✓(1)
	992 Front End Loader (or similar) replacing dozer at overburden dump	×	✓
	Cat 24G Grader (or similar)	✓	✓
	Cat 777 Watercart (or similar)	✓	✓

6.3 Predicted Operational Noise Levels

The predicted daytime, evening and night-time operating intrusive $L_{Aeq(15minute)}$ noise levels to the nearest residential receiver areas for year 2018, 2021 and 2025 operations are presented in **Table 20**, **Table 21** and **Table 22**, respectively.

The intrusive $L_{Aeq(15minute)}$ noise level contours for the Year 2018 during reduced night-time operations are presented in **Appendix D**. The calculation of the noise contours involves numerical interpolation of a noise level array with a graphical accuracy of up to $\pm$2dBA. This means that in some cases the contour isopleths presented in **Appendix D** may differ from values presented in **Table 20**.

Table 20 Predicted Operating Intrusive $L_{Aeq(15minute)}$ Noise Levels - 2018

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
Black Hill	E	Day	30 / 27 / 27	**36** / 33 / 34	N/A	35	50
		Evening	30 / 27 / 27	31 / 26 / 25	N/A	35	47
		Night	30 / 27 / 27	**36** / 33 / 34	**36** / 33 / 34	35	45

Locality Area	**Location**	**Period**	**Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3**			**Noise Assessment Criteria (dBA)**	
			Calm	**Prevailing Wind**	**Temperature Inversion**	**PA 07_0087**	**PSNL**
		Night Reduced Operations	28 / 24 / 25	34 / 30 / 31	34 / 30 / 31	35	45
	F	Day	30 / 27 / 27	**36** / 33 / 33	N/A	35	50
		Evening	30 / 27 / 27	29 / 25 / 22	N/A	35	47
		Night	30 / 27 / 27	**36** / 33 / 33	**36** / 33 / 33	35	45
		Night Reduced Operations	29 / 23 / 24	35 / 29 / 30	35 / 30 / 30	35	45
	F1	Day	33 / 29 / 29	38 / 35 / 35	N/A	-	50
		Evening	33 / 29 / 29	32 / 29 / 25	N/A	-	47
		Night	33 / 29 / 29	38 / 35 / 35	38 / 35 / 35	-	45
		Night Reduced Operations	32 / 26 / 26	37 / 32 / 32	37 / 32 / 32	-	45
	F2	Day	34 / 30 / 30	39 / 36 / 36	N/A	-	50
		Evening	34 / 30 / 30	34 / 30 / 27	N/A	-	47
		Night	34 / 30 / 30	39 / 36 / 36	39 / 36 / 36	-	45
		Night Reduced Operations	33 / 27 / 27	38 / 32 / 32	38 / 32 / 32	-	45
Buchanan & Louth Park	G	Day	31 / 31 / 33	37 / 37 / 39	N/A	39	45
		Evening	31 / 31 / 33	37 / 37 / 39	N/A	42	43
		Night	31 / 31 / 33	**37** / **37** / **39**	**37** / **37** / **39**	37	36
		Night Reduced Operations	28 / 29 / 31	34 / 34 / 36	34 / 34 / 36	37	36
	G1	Day	27 / 27 / 29	33 / 33 / 35	N/A	-	45
		Evening	27 / 27 / 29	33 / 33 / 35	N/A	-	43
		Night	27 / 27 / 29	33 / 33 / 35	34 / 33 / 35	-	36
		Night Reduced Operations	25 / 25 / 27	31 / 31 / 33	31 / 31 / 33	-	36
	G2	Day	27 / 27 / 29	33 / 33 / 35	N/A	-	45
		Evening	27 / 27 / 29	33 / 33 / 35	N/A	-	43
		Night	27 / 27 / 29	33 / 33 / 35	34 / 34 / 35	-	36
		Night Reduced Operations	25 / 25 / 27	31 / 31 / 33	31 / 31 / 33	-	36
	G3	Day	16 / 16 / 18	22 / 22 / 23	N/A	-	45
		Evening	16 / 16 / 18	22 / 22 / 23	N/A	-	43
		Night	16 / 16 / 18	22 / 22 / 23	22 / 22 / 23	-	36
		Night Reduced Operations	13 / 13 / 15	19 / 19 / 21	19 / 19 / 21	-	36
	G4	Day	14 / 14 / 15	20 / 20 / 21	N/A	-	45
		Evening	14 / 14 / 15	20 / 20 / 21	N/A	-	43
		Night	14 / 14 / 15	20 / 20 / 21	20 / 20 / 21	-	36
		Night Reduced Operations	11 / 11 / 13	17 / 17 / 18	17 / 17 / 19	-	36
	G5	Day	33 / 33 / 35	39 / 39 / 40	N/A	-	45

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Evening	33 / 33 / 35	39 / 39 / 40	N/A	-	43
		Night	33 / 33 / 35	**39** / **39** / **40**	**39** / **38** / **40**	-	36
		Night Reduced Operations	30 / 30 / 32	36 / 36 / **38**	36 / 36 / **38**	-	36
	G6	Day	31 / 31 / 32	37 / 37 / 38	N/A	-	45
		Evening	31 / 31 / 32	37 / 37 / 38	N/A	-	43
		Night	31 / 31 / 32	**37** / **37** / **38**	**37** / **37** / **38**	-	36
		Night Reduced Operations	28 / 28 / 30	34 / 34 / 36	34 / 34 / 36	-	36
	G7	Day	31 / 31 / 32	37 / 37 / 38	N/A	-	45
		Evening	31 / 31 / 32	37 / 37 / 38	N/A	-	43
		Night	31 / 31 / 32	**37** / **37** / **38**	**37** / **37** / **38**	-	36
		Night Reduced Operations	28 / 28 / 29	34 / 34 / 35	34 / 34 / 35	-	36
	G8	Day	31 / 32 / 32	37 / 37 / 38	N/A	-	45
		Evening	31 / 32 / 32	37 / 37 / 38	N/A	-	43
		Night	31 / 32 / 32	37 / 37 / **38**	**37** / **37** / **38**	-	36
		Night Reduced Operations	28 / 28 / 29	34 / 34 / 35	34 / 34 / 35	-	36
	G9	Day	30 / 30 / 31	36 / 36 / 37	N/A	-	45
		Evening	30 / 30 / 31	36 / 36 / 37	N/A	-	43
		Night	30 / 30 / 31	36 / 36 / **37**	36 / 36 / **37**	-	36
		Night Reduced Operations	27 / 27 / 28	33 / 33 / 34	33 / 33 / 34	-	36
	H	Day	17 / 18 / 17	23 / 23 / 23	N/A	35	45
		Evening	17 / 18 / 17	23 / 23 / 23	N/A	35	43
		Night	17 / 18 / 17	23 / 23 / 23	23 / 23 / 23	35	36
		Night Reduced Operations	14 / 15 / 14	19 / 21 / 23	19 / 21 / 19	35	36
Ashtonfield	L	Day	26 / 28 / 22	32 / 34 / 28	N/A	35	39
		Evening	26 / 28 / 22	32 / 34 / 28	N/A	35	39
		Night	26 / 28 / 22	32 / 34 / 28	32 / 34 / 28	35	38
		Night Reduced Operations	25 / 27 / 15	30 / 33 / 28	30 / 32 / 21	35	38
	I	Day	17 / 18 / <10	24 / 25 / <10	N/A	-	39
		Evening	17 / 18 / <10	24 / 23 / <10	N/A	-	39
		Night	17 / 18 / <10	24 / 25 / <10	24 / 25 / <10	-	38
		Night Reduced Operations	17 / 18 / <10	24 / 25 / <10	24 / 25 / <10	-	38
Buttai	M	Day	36 / 33 / 34	**41** / 38 / 39	N/A	39	49
		Evening	36 / 33 / 34	38 / 34 / 31	N/A	39	49
		Night	36 / 33 / 34	**41** / **38** / **39**	**41** / **38** / **39**	37	42

Locality Area	**Location**	**Period**	**Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3**			**Noise Assessment Criteria (dBA)**	
			Calm	**Prevailing Wind**	**Temperature Inversion**	**PA 07_0087**	**PSNL**
		Night Reduced Operations	35 / 30 / 31	**39** / 35 / 36	**40** / 35 / 36	37	42
	M1	Day	34 / 31 / 32	39 / 37 / 38	N/A		49
		Evening	34 / 31 / 32	36 / 33 / 30	N/A		49
		Night	34 / 31 / 32	39 / 37 / 38	40 / 37 / 38		42
		Night Reduced Operations	33 / 28 / 30	38 / 34 / 35	38 / 34 / 35		42
	N	Day	23 / 22 / 29	26 / 26 / 32	N/A	42	49
		Evening	23 / 22 / 29	28 / 27 / 33	N/A	42	49
		Night	23 / 22 / 29	26 / 26 / 32	28 / 27 / 33	35	42
		Night Reduced Operations	21 / 19 / 26	25 / 23 / 29	26 / 24 / 30	35	42
	N1	Day	25 / 22 / 36	28 / 28 / 39	N/A	-	49
		Evening	25 / 22 / 36	30 / 28 / 40	N/A	-	49
		Night	25 / 22 / 36	28 / 28 / 39	30 / 27 / 39	-	42
		Night Reduced Operations	24 / 20 / 34	27 / 24 / 38	29 / 25 / 38	-	42
	N2	Day	34 / 34 / 39	39 / 39 / 42	N/A	-	49
		Evening	34 / 34 / 39	39 / 39 / 43	N/A	-	49
		Night	34 / 34 / 39	39 / 39 / 42	39 / 39 / **43**	-	42
		Night Reduced Operations	32 / 31 / 36	36 / 36 / 39	37 / 37 / 40	-	42
	N3	Day	32 / 30 / 34	37 / 36 / 40	N/A	-	49
		Evening	32 / 30 / 34	35 / 31 / 35	N/A	-	49
		Night	32 / 30 / 34	37 / 36 / 40	37 / 36 / 39	-	42
		Night Reduced Operations	30 / 27 / 32	35 / 33 / 37	36 / 33 / 37	-	42
	N4	Day	27 / 27 / 28	34 / 33 / 34	N/A	-	49
		Evening	27 / 27 / 28	31 / 30 / 31	N/A	-	49
		Night	27 / 27 / 28	34 / 33 / 34	34 / 33 / 35	-	42
		Night Reduced Operations	25 / 24 / 26	31 / 30 / 32	31 / 30 / 32	-	42
	N5	Day	29 / 29 / 32	35 / 34 / 37	N/A	-	49
		Evening	29 / 29 / 32	35 / 34 / 38	N/A	-	49
		Night	29 / 29 / 32	35 / 34 / 37	35 / 35 / 38	-	42
		Night Reduced Operations	28 / 26 / 29	32 / 32 / 35	33 / 32 / 35	-	42
	N6	Day	31 / 31 / 34	35 / 35 / 37	N/A	-	49
		Evening	31 / 31 / 34	37 / 36 / 40	N/A	-	49
		Night	31 / 31 / 34	35 / 35 / 37	37 / 36 / 40	-	42
		Night Reduced Operations	29 / 28 / 32	32 / 32 / 35	35 / 34 / 37	-	42
	N7	Day	33 / 33 / 36	36 / 36 / 40	N/A	-	49

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Evening	33 / 33 / 36	38 / 38 / 41	N/A	-	49
		Night	33 / 33 / 36	36 / 36 / 40	38 / 38 / 41	-	42
		Night Reduced Operations	30 / 30 / 33	34 / 34 / 37	35 / 35 / 38	-	42
	N8	Day	25 / 24 / 27	28 / 28 / 30	N/A	-	49
		Evening	25 / 24 / 27	30 / 29 / 32	N/A	-	49
		Night	25 / 24 / 27	28 / 28 / 30	30 / 29 / 32	-	42
		Night Reduced Operations	22 / 21 / 24	26 / 24 / 27	27 / 26 / 29	-	42
	N9	Day	30 / 29 / 32	35 / 35 / 37	N/A	-	49
		Evening	30 / 29 / 32	36 / 35 / 38	N/A	-	49
		Night	30 / 29 / 32	35 / 35 / 37	36 / 35 / 38	-	42
		Night Reduced Operations	28 / 27 / 30	33 / 32 / 35	33 / 33 / 35	-	42

1. Highest predicted level to each receiver from the day, evening and night INP meteorological conditions (**Table 15**).
2. Levels shown in **bold** indicate an exceedance of the PA 06_0087 and/or PSNL criteria.

2018 Results Summary

In summary, the predicted daytime, evening and night-time intrusive $L_{Aeq(15minute)}$ noise levels, show that:

- Exceedances of the PA 07_0087 noise limits are predicted at Locations E, F, G, and M. However, at locations E, F and M, PA 07_0087 noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at locations E, F and M. Exceedances of the PSNL's are predicted at Locations G5, G6, G7, G8, G9, and N2. At Location G exceedance of the PA 07_0087 noise limits and PSNLs are predicted.
- During reduced night-operations compliance with the relevant PSNLs and PA 07_0087 noise limits are predicted at all receiver locations with the exception of G5, which is in the same ownership as Bloomfield and Location M. Given that compliance with the PSNLs and PA 07_0087 is predicted at Location M under Scenario 2, coal haulage is possible at any-time under prevailing weather conditions.

Table 21 Predicted Operating Intrusive $L_{Aeq(15minute)}$ Noise Levels - 2021

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
Black Hill	E	Day	27 / 22 / 25	33 / 28 / 31	N/A	35	50
		Evening	27 / 22 / 25	29 / 22 / 25	N/A	35	47
		Night	27 / 22 / 25	33 / 28 / 31	33 / 28 / 31	35	45
		Night Reduced Operations	26 / 15 / 19	32 / 21 / 25	32 / 22 / 25	35	45
	F	Day	29 / 22 / 25	34 / 28 / 31	N/A	35	50
		Evening	29 / 22 / 25	28 / 22 / 23	N/A	35	47
		Night	29 / 22 / 25	34 / 28 / 31	34 / 28 / 31	35	45

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Night Reduced Operations	28 / 17 / 19	33 / 23 / 24	33 / 23 / 24	35	45
	F1	Day	31 / 24 / 27	36 / 30 / 33	N/A	-	50
		Evening	31 / 24 / 27	31 / 25 / 26	N/A	-	47
		Night	31 / 24 / 27	36 / 30 / 33	36 / 30 / 33	-	45
		Night Reduced Operations	30 / 18 / 21	35 / 24 / 27	35 / 24 / 27	-	45
	F2	Day	32 / 25 / 28	37 / 31 / 34	N/A	-	50
		Evening	32 / 25 / 28	34 / 25 / 28	N/A	-	47
		Night	32 / 25 / 28	37 / 31 / 34	37 / 31 / 34	-	45
		Night Reduced Operations	31 / 19 / 22	36 / 24 / 27	36 / 25 / 27	-	45
Buchanan & Louth Park	G	Day	29 / 29 / 30	35 / 35 / 36	N/A	39	45
		Evening	29 / 29 / 30	35 / 35 / 36	N/A	42	43
		Night	29 / 29 / 30	35 / 35 / 36	35 / 35 / 36	37	36
		Night Reduced Operations	25 / 24 / 24	30 / 30 / 30	30 / 30 / 30	37	36
	G1	Day	27 / 27 / 26	33 / 33 / 33	N/A	-	45
		Evening	27 / 27 / 26	33 / 33 / 33	N/A	-	43
		Night	27 / 27 / 26	33 / 33 / 33	33 / 33 / 33	-	36
		Night Reduced Operations	24 / 24 / 22	30 / 30 / 28	30 / 30 / 28	-	36
	G2	Day	26 / 26 / 26	32 / 32 / 32	N/A	-	45
		Evening	26 / 26 / 26	32 / 32 / 32	N/A	-	43
		Night	26 / 26 / 26	32 / 32 / 32	32 / 32 / 32	-	36
		Night Reduced Operations	23 / 22 / 20	29 / 28 / 27	29 / 28 / 27	-	36
	G3	Day	14 / 14 / 15	19 / 19 / 20	N/A	-	45
		Evening	14 / 14 / 15	19 / 19 / 20	N/A	-	43
		Night	14 / 14 / 15	19 / 19 / 20	19 / 19 / 20	-	36
		Night Reduced Operations	10 / 9 / 9	15 / 15 / 15	15 / 15 / 15	-	36
	G4	Day	11 / 11 / 13	17 / 17 / 19	N/A	-	45
		Evening	11 / 11 / 13	17 / 17 / 19	N/A	-	43
		Night	11 / 11 / 13	17 / 17 / 19	17 / 17 / 19	-	36
		Night Reduced Operations	7 / 7 / 8	13 / 13 / 14	13 / 13 / 14	-	36
	G5	Day	29 / 29 / 31	35 / 35 / 37	N/A	-	45
		Evening	29 / 29 / 31	35 / 35 / 37	N/A	-	43
		Night	29 / 29 / 31	35 / 35 / **37**	35 / 34 / **37**	-	36
		Night Reduced Operations	25 / 24 / 24	31 / 30 / 30	31 / 30 / 30	-	36
	G6	Day	27 / 27 / 28	32 / 32 / 34	N/A	-	45

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Evening	27 / 27 / 28	32 / 32 / 34	N/A	-	43
		Night	27 / 27 / 28	32 / 32 / 34	32 / 32 / 34	-	36
		Night Reduced Operations	22 / 21 / 24	28 / 27 / 30	28 / 27 / 30	-	36
	G7	Day	27 / 27 / 28	33 / 32 / 34	N/A	-	45
		Evening	27 / 27 / 28	33 / 32 / 34	N/A	-	43
		Night	27 / 27 / 28	33 / 32 / 34	33 / 32 / 34	-	36
		Night Reduced Operations	22 / 21 / 22	28 / 26 / 28	28 / 27 / 28	-	36
	G8	Day	27 / 27 / 29	33 / 33 / 34	N/A	-	45
		Evening	27 / 27 / 29	33 / 33 / 34	N/A	-	43
		Night	27 / 27 / 29	33 / 33 / 34	33 / 32 / 34	-	36
		Night Reduced Operations	22 / 21 / 24	28 / 27 / 30	28 / 27 / 30	-	36
	G9	Day	26 / 26 / 27	32 / 32 / 33	N/A	-	45
		Evening	26 / 26 / 27	32 / 32 / 33	N/A	-	43
		Night	26 / 26 / 27	32 / 32 / 33	32 / 32 / 33	-	36
		Night Reduced Operations	21 / 21 / 23	27 / 27 / 28	27 / 27 / 29	-	36
	H	Day	12 / 15 / 17	18 / 20 / 22	N/A	35	45
		Evening	12 / 15 / 17	18 / 20 / 22	N/A	35	43
		Night	12 / 15 / 17	18 / 20 / 22	18 / 20 / 22	35	36
		Night Reduced Operations	9 / 13 / 13	15 / 19 / 18	15 / 18 / 18	35	36
Ashtonfield	L	Day	25 / 27 / 25	31 / 32 / 31	N/A	35	39
		Evening	25 / 27 / 25	31 / 32 / 31	N/A	35	39
		Night	25 / 27 / 25	31 / 32 / 31	31 / 32 / 31	35	38
		Night Reduced Operations	24 / 26 / 20	30 / 32 / 26	30 / 32 / 26	35	38
	I	Day	17 / 19 / 16	23 / 25 / 23	N/A	-	39
		Evening	17 / 19 / 16	23 / 24 / 22	N/A	-	39
		Night	17 / 19 / 16	23 / 25 / 23	23 / 26 / 24	-	38
		Night Reduced Operations	17 / 19 / 12	23 / 25 / 19	23 / 26 / 19	-	38
Buttai	M	Day	33 / 28 / 31	38 / 33 / 37	N/A	39	49
		Evening	33 / 28 / 31	37 / 27 / 33	N/A	39	49
		Night	33 / 28 / 31	**38** / 33 / 37	**38** / 33 / 36	37	42
		Night Reduced Operations	32 / 21 / 26	36 / 25 / 31	37 / 26 / 31	37	42
	M1	Day	33 / 30 / 31	38 / 35 / 37	N/A		49
		Evening	33 / 30 / 31	36 / 28 / 32	N/A		49
		Night	33 / 30 / 31	38 / 35 / 37	38 / 35 / 37		42

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Night Reduced Operations	32 / 27 / 28	37 / 33 / 34	38 / 33 / 34		42
	N	Day	23 / 20 / 23	26 / 24 / 28	N/A	42	49
		Evening	23 / 20 / 23	27 / 25 / 29	N/A	42	49
		Night	23 / 20 / 23	26 / 24 / 28	27 / 25 / 29	35	42
		Night Reduced Operations	21 / 18 / 19	24 / 21 / 22	25 / 22 / 24	35	42
	N1	Day	24 / 21 / 29	27 / 25 / 34	N/A	-	49
		Evening	24 / 21 / 29	28 / 26 / 35	N/A	-	49
		Night	24 / 21 / 29	27 / 25 / 34	28 / 26 / 35	-	42
		Night Reduced Operations	23 / 19 / 27	26 / 22 / 31	27 / 24 / 32	-	42
	N2	Day	28 / 28 / 31	33 / 33 / 35	N/A	-	49
		Evening	28 / 28 / 31	33 / 33 / 37	N/A	-	49
		Night	28 / 28 / 31	33 / 33 / 35	33 / 34 / 37	-	42
		Night Reduced Operations	20 / 22 / 28	24 / 26 / 31	25 / 28 / 33	-	42
	N3	Day	30 / 29 / 31	35 / 34 / 37	N/A	-	49
		Evening	30 / 29 / 31	33 / 30 / 34	N/A	-	49
		Night	30 / 29 / 31	35 / 34 / 37	36 / 34 / 37	-	42
		Night Reduced Operations	29 / 27 / 28	33 / 33 / 34	34 / 33 / 34	-	42
	N4	Day	22 / 22 / 24	28 / 28 / 30	N/A	-	49
		Evening	22 / 22 / 24	25 / 24 / 28	N/A	-	49
		Night	22 / 22 / 24	28 / 28 / 30	28 / 28 / 30	-	42
		Night Reduced Operations	13 / 10 / 17	18 / 16 / 23	18 / 16 / 23	-	42
	N5	Day	25 / 24 / 28	29 / 29 / 34	N/A	-	49
		Evening	25 / 24 / 28	31 / 29 / 34	N/A	-	49
		Night	25 / 24 / 28	29 / 29 / 34	31 / 30 / 35	-	42
		Night Reduced Operations	22 / 18 / 24	27 / 22 / 29	28 / 24 / 30	-	42
	N6	Day	26 / 26 / 29	30 / 30 / 32	N/A	-	49
		Evening	26 / 26 / 29	32 / 32 / 34	N/A	-	49
		Night	26 / 26 / 29	30 / 30 / 32	32 / 32 / 34	-	42
		Night Reduced Operations	22 / 21 / 25	27 / 25 / 29	28 / 27 / 31	-	42
	N7	Day	29 / 28 / 32	33 / 32 / 36	N/A	-	49
		Evening	29 / 28 / 32	35 / 34 / 38	N/A	-	49
		Night	29 / 28 / 32	33 / 32 / 36	34 / 34 / 38	-	42
		Night Reduced Operations	26 / 24 / 30	30 / 28 / 33	31 / 29 / 35	-	42
	N8	Day	22 / 20 / 27	26 / 23 / 32	N/A	-	49

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Evening	22 / 20 / 27	27 / 25 / 32	N/A	-	49
		Night	22 / 20 / 27	26 / 23 / 32	27 / 25 / 32	-	42
		Night Reduced Operations	20 / 17 / 23	24 / 20 / 28	25 / 22 / 28	-	42
	N9	Day	26 / 26 / 30	32 / 31 / 36	N/A	-	49
		Evening	26 / 26 / 30	32 / 31 / 36	N/A	-	49
		Night	26 / 26 / 30	32 / 31 / 36	32 / 32 / 36	-	42
		Night Reduced Operations	24 / 22 / 27	29 / 28 / 33	29 / 28 / 33	-	42

1. Highest predicted level to each receiver from the day, evening and night INP meteorological conditions (**Table 15**).
2. Levels shown in **bold** indicate an exceedance of the PA 06_0087 and/or PSNL criteria.

2021 Results Summary

In summary, the predicted daytime, evening and night-time intrusive $L_{Aeq(15minute)}$ noise levels, show that:

- Exceedance of the PA 07_0087 noise limits are predicted at Location M. However, at this location PA 07_0087 noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at location M.
- During reduced night-operations compliance with the relevant PSNLs and PA 07_0087 noise limits are predicted at all receiver locations.

Table 22 Predicted Operating Intrusive $L_{Aeq(15minute)}$ Noise Levels - 2025

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
Black Hill	E	Day	26 / 20 / 26	31 / 26 / 32	N/A	35	50
		Evening	26 / 20 / 26	28 / 22 / 25	N/A	35	47
		Night	26 / 20 / 26	31 / 26 / 32	31 / 27 / 32	35	45
		Night Reduced Operations	25 / 14 / 19	30 / 20 / 24	30 / 21 / 24	35	45
	F	Day	26 / 18 / 16	32 / 24 / 22	N/A	35	50
		Evening	26 / 18 / 16	26 / 20 / 12	N/A	35	47
		Night	26 / 18 / 16	32 / 24 / 22	32 / 24 / 22	35	45
		Night Reduced Operations	26 / 16 / 9	32 / 22 / 15	32 / 22 / 15	35	45
	F1	Day	29 / 20 / 19	34 / 26 / 25	N/A	-	50
		Evening	29 / 20 / 19	30 / 23 / 16	N/A	-	47
		Night	29 / 20 / 19	34 / 26 / 25	34 / 26 / 25	-	45
		Night Reduced Operations	28 / 17 / 12	34 / 23 / 17	34 / 23 / 17	-	45
	F2	Day	30 / 23 / 30	36 / 29 / 36	N/A	-	50
		Evening	30 / 23 / 30	33 / 24 / 28	N/A	-	47
		Night	30 / 23 / 30	36 / 29 / 36	36 / 29 / 35	-	45

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Night Reduced Operations	30 / 17 / 23	35 / 22 / 28	35 / 23 / 28	-	45
Buchanan & Louth Park	G	Day	24 / 24 / 27	30 / 30 / 33	N/A	39	45
		Evening	24 / 24 / 27	30 / 30 / 33	N/A	42	43
		Night	24 / 24 / 27	30 / 30 / 33	30 / 30 / 33	37	36
		Night Reduced Operations	22 / 23 / 24	28 / 29 / 30	28 / 29 / 30	37	36
	G1	Day	21 / 21 / 24	27 / 27 / 30	N/A	-	45
		Evening	21 / 21 / 24	27 / 27 / 30	N/A	-	43
		Night	21 / 21 / 24	27 / 27 / 30	27 / 27 / 30	-	36
		Night Reduced Operations	20 / 20 / 22	26 / 26 / 28	26 / 26 / 28	-	36
	G2	Day	20 / 21 / 24	26 / 27 / 30	N/A	-	45
		Evening	20 / 21 / 24	26 / 27 / 30	N/A	-	43
		Night	20 / 21 / 24	26 / 27 / 30	26 / 27 / 30	-	36
		Night Reduced Operations	19 / 20 / 22	25 / 26 / 28	25 / 26 / 28	-	36
	G3	Day	9 / 9 / 13	15 / 15 / 18	N/A	-	45
		Evening	9 / 9 / 13	15 / 15 / 18	N/A	-	43
		Night	9 / 9 / 13	15 / 15 / 18	15 / 15 / 18	-	36
		Night Reduced Operations	8 / 8 / 9	14 / 13 / 15	14 / 14 / 15	-	36
	G4	Day	7 / 8 / 11	13 / 14 / 16	N/A	-	45
		Evening	7 / 8 / 11	13 / 14 / 16	N/A	-	43
		Night	7 / 8 / 11	13 / 14 / 16	14 / 14 / 17	-	36
		Night Reduced Operations	6 / 6 / 7	12 / 12 / 13	12 / 12 / 13	-	36
	G5	Day	25 / 26 / 28	31 / 31 / 34	N/A	-	45
		Evening	25 / 26 / 28	31 / 31 / 34	N/A	-	43
		Night	25 / 26 / 28	31 / 31 / 34	31 / 31 / 34	-	36
		Night Reduced Operations	23 / 24 / 25	29 / 30 / 31	29 / 30 / 31	-	36
	G6	Day	24 / 24 / 26	29 / 30 / 32	N/A	-	45
		Evening	24 / 24 / 26	29 / 30 / 32	N/A	-	43
		Night	24 / 24 / 26	29 / 30 / 32	29 / 30 / 32	-	36
		Night Reduced Operations	21 / 22 / 22	27 / 28 / 28	27 / 28 / 28	-	36
	G7	Day	24 / 24 / 26	30 / 29 / 32	N/A	-	45
		Evening	24 / 24 / 26	30 / 29 / 32	N/A	-	43
		Night	24 / 24 / 26	30 / 29 / 32	30 / 29 / 32	-	36
		Night Reduced Operations	20 / 20 / 22	26 / 26 / 28	27 / 26 / 28	-	36
	G8	Day	24 / 25 / 27	30 / 30 / 33	N/A	-	45

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Evening	24 / 25 / 27	30 / 30 / 33	N/A	-	43
		Night	24 / 25 / 27	30 / 30 / 33	30 / 30 / 33	-	36
		Night Reduced Operations	21 / 21 / 23	27 / 27 / 29	27 / 27 / 29	-	36
	G9	Day	23 / 23 / 25	29 / 29 / 31	N/A	-	45
		Evening	23 / 23 / 25	29 / 29 / 31	N/A	-	43
		Night	23 / 23 / 25	29 / 29 / 31	29 / 29 / 31	-	36
		Night Reduced Operations	20 / 20 / 21	26 / 26 / 27	26 / 26 / 27	-	36
	H	Day	12 / 15 / 14	18 / 20 / 19	N/A	35	45
		Evening	12 / 15 / 14	18 / 20 / 19	N/A	35	43
		Night	12 / 15 / 14	18 / 20 / 19	18 / 20 / 19	35	36
		Night Reduced Operations	10 / 13 / 10	15 / 18 / 15	15 / 18 / 15	35	36
Ashtonfield	L	Day	24 / 27 / 20	30 / 32 / 27	N/A	35	39
		Evening	24 / 27 / 20	30 / 32 / 27	N/A	35	39
		Night	24 / 27 / 20	30 / 32 / 27	30 / 32 / 27	35	38
		Night Reduced Operations	24 / 26 / 14	29 / 32 / 20	29 / 31 / 21	35	38
	I	Day	17 / 18 / <10	23 / 24 / <10	N/A	-	39
		Evening	17 / 18 / <10	23 / 23 / <10	N/A	-	39
		Night	17 / 18 / <10	23 / 24 / <10	23 / 24 / <10	-	38
		Night Reduced Operations	17 / 18 / <10	23 / 24 / <10	23 / 24 / <10	-	38
Buttai	M	Day	31 / 22 / 32	36 / 27 / 38	N/A	39	49
		Evening	31 / 22 / 32	36 / 24 / 32	N/A	39	49
		Night	31 / 22 / 32	36 / 27 / **38**	36 / 28 / 37	37	42
		Night Reduced Operations	31 / 19 / 26	35 / 23 / 31	36 / 25 / 31	37	42
	M1	Day	30 / 24 / 31	35 / 30 / 37	N/A		49
		Evening	30 / 24 / 31	34 / 25 / 31	N/A		49
		Night	30 / 24 / 31	35 / 30 / 37	35 / 30 / 37		42
		Night Reduced Operations	29 / 18 / 24	34 / 22 / 29	34 / 24 / 29		42
	N	Day	20 / 16 / 25	24 / 19 / 29	N/A	42	49
		Evening	20 / 16 / 25	25 / 21 / 30	N/A	42	49
		Night	20 / 16 / 25	24 / 19 / 29	25 / 21 / 29	35	42
		Night Reduced Operations	19 / 15 / 20	24 / 18 / 24	24 / 20 / 24	35	42
	N1	Day	20 / 18 / 24	23 / 22 / 28	N/A	-	49
		Evening	20 / 18 / 24	25 / 23 / 29	N/A	-	49
		Night	20 / 18 / 24	23 / 22 / 28	25 / 23 / 29	-	42

Locality Area	Location	Period	Predicted Intrusive Noise Level[1,2] (dBA) Scenario 1/Scenario 2/Scenario 3			Noise Assessment Criteria (dBA)	
			Calm	Prevailing Wind	Temperature Inversion	PA 07_0087	PSNL
		Night Reduced Operations	19 / 17 / 20	23 / 20 / 24	24 / 22 / 25	-	42
	N2	Day	28 / 28 / 29	32 / 33 / 33	N/A	-	49
		Evening	28 / 28 / 29	33 / 34 / 34	N/A	-	49
		Night	28 / 28 / 29	32 / 33 / 33	33 / 34 / 34	-	42
		Night Reduced Operations	25 / 26 / 25	29 / 30 / 28	30 / 31 / 30	-	42
	N3	Day	27 / 24 / 29	32 / 30 / 35	N/A	-	49
		Evening	27 / 24 / 29	32 / 27 / 33	N/A	-	49
		Night	27 / 24 / 29	32 / 30 / 35	33 / 30 / 35	-	42
		Night Reduced Operations	26 / 22 / 25	30 / 27 / 31	32 / 28 / 31	-	42
	N4	Day	17 / 16 / 25	23 / 22 / 31	N/A	-	49
		Evening	17 / 16 / 25	21 / 20 / 30	N/A	-	49
		Night	17 / 16 / 25	23 / 22 / 31	23 / 22 / 31	-	42
		Night Reduced Operations	13 / 10 / 18	18 / 16 / 24	19 / 17 / 24	-	42
	N5	Day	25 / 24 / 28	29 / 30 / 32	N/A	-	49
		Evening	25 / 24 / 28	30 / 30 / 34	N/A	-	49
		Night	25 / 24 / 28	29 / 30 / 32	31 / 30 / 34	-	42
		Night Reduced Operations	23 / 23 / 24	27 / 28 / 29	29 / 29 / 30	-	42
	N6	Day	25 / 25 / 28	29 / 28 / 33	N/A	-	49
		Evening	25 / 25 / 28	31 / 31 / 34	N/A	-	49
		Night	25 / 25 / 28	29 / 28 / 33	31 / 31 / 34	-	42
		Night Reduced Operations	23 / 23 / 25	28 / 26 / 29	28 / 29 / 30	-	42
	N7	Day	27 / 26 / 31	31 / 30 / 36	N/A	-	49
		Evening	27 / 26 / 31	33 / 32 / 36	N/A	-	49
		Night	27 / 26 / 31	31 / 30 / 36	33 / 32 / 36	-	42
		Night Reduced Operations	25 / 24 / 27	29 / 28 / 31	30 / 29 / 32	-	42
	N8	Day	21 / 17 / 32	26 / 20 / 37	N/A	-	49
		Evening	21 / 17 / 32	27 / 22 / 37	N/A	-	49
		Night	21 / 17 / 32	26 / 20 / 37	26 / 22 / 37	-	42
		Night Reduced Operations	20 / 14 / 27	25 / 18 / 31	25 / 19 / 31	-	42
	N9	Day	25 / 25 / 28	31 / 30 / 33	N/A	-	49
		Evening	25 / 25 / 28	31 / 31 / 34	N/A	-	49
		Night	25 / 25 / 28	31 / 30 / 33	31 / 31 / 34	-	42
		Night Reduced Operations	24 / 23 / 25	29 / 29 / 30	29 / 29 / 31	-	42

1. Highest predicted level to each receiver from the day, evening and night INP meteorological conditions (**Table 15**).
2. Levels shown in **bold** indicate an exceedance of the PA 06_0087 and/or PSNL criteria.

2025 Results Summary

In summary, the predicted daytime, evening and night-time intrusive $L_{Aeq(15minute)}$ noise levels, show that:

- Exceedance of the PA 07_0087 noise limits are predicted at Location M. However, at this location PA 07_0087 noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at location M.
- During reduced night-operations compliance with the relevant PSNLs and PA 07_0087 noise limits are predicted at all receiver locations.

6.4 Predicted Intrusive Noise Discussion and Noise Management

Predicted noise levels show that, generally, Project operations have the potential to exceed the relevant PSNLs and PA 07_0087 noise limits under prevailing noise enhancing weather conditions. During reduced night-time operations noise levels at all locations are predicted to meet the relevant PSNLs and PA 07_0087 noise limits under prevailing noise enhancing weather conditions with the exception of Locations G5 and M.

Current mining activities at Bloomfield Colliery are guided by predicted upcoming weather conditions and mining areas that may pose a noise risk (due to working heights, topographical shielding etc) under those weather conditions. This allows for the scheduling of mining operations to reduce noise impacts to the surrounding receivers as much as practicable. Given the flexibility in mining operations, fleet composition and haul routes, the Project would be able to meet the relevant PSNLs and PA 07_0087 noise limits at all locations, with the exception of Location G5, under prevailing weather conditions.

6.5 Sleep Disturbance

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significantly plant and equipment to be used at the subject site were used as input to the acoustic model and predictions of noise emissions were made at the nearest residential areas under adverse weather conditions at night. Noise events considered included loading haul trucks, haul truck movements, dozer and front end loader operations as well as haul trucks dumping.

The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is less than the L_{Amax}.

A summary of the highest predicted sleep disturbance noise levels at the most affected locations from the assessed mining years are contained within **Table 23**.

Table 23 Predicted Maximum Night-time L_{Amax} Noise Levels

Receptor ID[1]	Locality	Predicted Night-time L_{Amax} Noise Level[1] Night / Night - Reduced Operations			Noise Assessment Criteria $L_{A1(1minute)}$ (dBA)	
		2018	2021	2025	SDNL	PA 07_0087
E	Black Hill	38 / 38	38 / 32	39 / 38	55	45
F[2]		39 / 39	39 / 34	39 / 39	55	45
F1		42 / 42	42 / 36	42 / 42	55	-
F2		43 / 43	43 / 37	43 / 43	55	-
M	Buttai	45 / 45	45 / 40	45 / 45	52	46
M1		45 / 45	43 / 41	44 / 43	52	-
N		39 / 39	34 / 31	36 / 34	52	46
N1		52 / 52	42 / 38	35 / 33	52	-

Receptor ID[1]	Locality	Predicted Night-time LAmax Noise Level[1] Night / Night - Reduced Operations			Noise Assessment Criteria LA1(1minute) (dBA)	
		2018	2021	2025	SDNL	PA 07_0087
N2		48 / 48	39 / 39	43 / 43	52	-
N3		43 / 42	39 / 39	41 / 39	52	-
N4		37 / 37	32 / 30	38 / 29	52	-
N5		41 / 40	37 / 34	39 / 37	52	-
N6		42 / 42	40 / 40	39 / 37	52	-
N7		44 / 44	43 / 43	42 / 39	52	-
N8		36 / 36	41 / 41	44 / 40	52	-
N9		40 / 39	39 / 39	38 / 37	52	-
G	Buchanan	39 / 39	40 / 40	38 / 38	46	45
G1		36 / 36	36 / 36	34 / 34	46	-
G2		36 / 36	36 / 36	34 / 34	46	-
G3		25 / 25	23 / 22	23 / 21	46	-
G4		22 / 22	21 / 20	20 / 18	46	-
G5[3]		41 / 41	41 / 41	40 / 40	46	-
G6		39 / 39	37 / 37	36 / 36	46	-
G7		39 / 39	37 / 37	36 / 36	46	-
G8		39 / 39	37 / 37	36 / 36	46	-
G9		38 / 38	35 / 34	35 / 35	46	-
H	Louth Park	26 / 25	27 / 24	23 / 23	46	45
L	Ashtonfield	39 / 39	39 / 39	39 / 39	48	45
I		32 / 32	32 / 32	32 / 32	48	-

1. Highest predicted level to each receiver from the night INP meteorological conditions (**Table 15**)

As presented in **Table 23** predicted maximum night-time noise levels meet the relevant SDNLs and PA 07_0087 noise limits at all the nearest residential receiver areas.

6.6 Cumulative Noise Impact Assessment

Existing, approved and proposed mining in the vicinity of the Project includes the existing Abel Underground Mine, Donaldson Open Cut Mine and the Tasman Extension Underground Mine.

Given the separation distance between the Tasman Extension Underground Mine and the Project, cumulative impacts are expected to be negligible and therefore have not been considered. Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Therefore cumulative impacts from the Donaldson Open Cut Mine have not been considered.

Furthermore, Abel Underground Mine was placed on Care & Maintenance on 28 April 2016, however given that future operation of the site is possible, and the current use of the Bloomfield Coal Handling and Preparation Plant (CHPP) under the Abel Underground Mine consent cumulative impacts have been assessed.

6.6.1 $L_{Aeq(period)}$ Cumulative Noise Impact Assessment Criteria

The INP provides non-mandatory cumulative noise assessment guidelines that address existing and successive industrial development by setting acceptable (and maximum) cumulative $L_{Aeq(period)}$ noise amenity levels for all non-transport related industrial noise sources in a receiver area. It is noted that the INP does not set acceptable cumulative $L_{Aeq(15minute)}$ intrusive criteria for all industrial noise sources, but rather seeks to control cumulative noise via $L_{Aeq(period)}$ noise amenity criterion.

As presented in **Section 2.3**, PA 07_0087 contains cumulative noise criteria for the Project combined with other mines in the area based upon a combination of the suburban and rural acceptable $L_{Aeq(period)}$ noise amenity levels outlined in **Table 4**.

6.6.2 Cumulative Noise Levels

To assess the cumulative impacts from the Project and Able Underground Mine, predicted intrusive noise levels (i.e $L_{Aeq(15minute)}$) from the Project and Able Underground Mine have been logarithmically added, with the resulting noise level adjusted (by -3 dB) to the equivalent amenity level (i.e $L_{Aeq(period)}$) for comparison with the relevant amenity criteria for each location.

The predicted cumulative amenity levels during adverse weather conditions are presented in **Table 24**.

Table 24 Cumulative Noise Levels

Location	Period	Intrusive Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)		Cumulative Amenity Level $L_{Aeq(period)}$	Amenity Criteria (L_{Aeq})
		Abel Underground Mine	Project - Highest Predicted Managed Noise Level		
E	Day	30	34	32	50
	Evening	32	31	32	45
	Night	30	34	32	40
F	Day	32	33	33	50
	Evening	34	30	32	45
	Night	33	35	34	40
G	Day	30	39	37	50
	Evening	30	39	37	45
	Night	30	36	34	40
H	Day	30	30	30	50
	Evening	30	30	30	45
	Night	30	30	30	40
I	Day	36	30	34	50
	Evening	36	30	34	45
	Night	36	30	34	40
L	Day	40	34	38	50
	Evening	40	34	38	45
	Night	40	33	38	40

The cumulative noise levels from the Project plus the Abel Underground Mine are not predicted to exceed the amenity criteria at relevant receiver locations or on more than 25 percent of, any privately owned land, with the exception of Lot 30/DP1113350 (vacant land within the mining lease).

Noise from Bloomfield coal haulage operations (i.e. Scenario 1 and Scenario 2) are predicted to exceed the relevant $L_{Aeq(period)}$ amenity criteria on more than 25 percent of Lot 30/DP1113350, however no exceedance is predicted during overburden operations (Scenario 3). Given the land is within 40 m of the existing haul route, mitigation of noise across Lot 30/DP1113350 would not be considered reasonable and feasible. Furthermore, it is noted that the Project does not seek to modify operations of the existing haul routes in the vicinity of Lot 30/DP1113350, and as such noise levels from Bloomfield Colliery on Lot 30/DP1113350 would not increase due to the Project.

7 BLASTING IMPACT ASSESSMENT

7.1 Blasting Assessment Criteria

7.1.1 Australian Standard Criteria

Australian Standard (AS) 2187: Part 2-2006 *Explosives - Storage and Use - Part 2: Use of Explosives,* provides guidance in assessing blast-induced ground (and structural) vibration and airblast effects on buildings and their occupants, with details are presented in Appendix J of AS 2187.

Recommended vibration limits are based on international standards (or studies) as presented in Appendix J, Tables J4.5(A) and J4.5(B) of AS 2187, for human comfort and structural building damage respectively. Similarly, recommended human comfort and structural damage airblast limits are presented in Appendix J, Tables J5.4(A) and J5.4(B) AS 2187, respectively.

The guideline *Assessing Vibration: A Technical Guideline* (DEC, 2006) specifically does not consider blasting-induced vibration and, therefore, this guideline is not discussed further.

7.1.2 Human Comfort Airblast and Vibration Criteria

Ground vibration and airblast levels which cause human discomfort are lower than recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally ensures that the potential to cause structural damage is negligible. The EPA currently adopts the ANZEC *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* dated September 1990 for assessing potential annoyance from blasting during daytime hours, as follows:

- The recommended maximum level for airblast is 115dB Linear.
- The level of 115dB Linear may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120dB Linear at any time.
- The recommended maximum for ground vibration is 5mm/s, Peak Vector Sum (PVS) vibration velocity. It is recommended however, that 2mm/s PVS be considered the long-term regulatory goal for the control of ground vibration.
- The PVS level of 5mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10mm/s at any time.

The ANZEC criteria are generally consistent with AS 2187: Part 2-2006 Appendix J, Tables J4.5(A) and J5.4(A) with respect to vibration and airblast human comfort respectively.

7.2 Assessment of Blasting Impacts

In order to predict the levels of blast emissions (ground vibration and airblast) at the surrounding receivers from the Project, the measured ground vibration and airblast levels from blasting operations conducted in 2014 to 2016 were used to develop blast emissions site laws.

7.3 Blast Emission Site Laws

For each site law, using statistical analysis of the measured data and assuming a log-normal distribution of data, a 95% confidence line and 50% confidence levels were determined. The ground vibration and airblast criteria advocated by the EPA and ANZECC (refer to **Section 7.1.2**), cater for the inherent variation in emission levels from a given blast design by allowing a five percent exceedance of a general criterion up to a (never to be exceeded) maximum. Correspondingly, the "5% exceedance" (95% confidence) levels have been used in the blast emission site laws.

The 5% site laws for ground vibration and airblast are:

Ground Vibration

$$PVS\ (5\%) = 2275\ (SD_1)^{-1.6}$$

Airblast

$$SPL(5\%) = 174 - 25 \log (SD_2)$$

where PVS (5%) and SPL (5%) are the levels of ground vibration (Peak Vector Sum - mm/s) and airblast (dB Linear) respectively, above which 5% of the total population (of data points) will lie, assuming that the population has the same statistical distribution as the underlying measured sample.

SD_1 and SD_2 are the ground vibration and airblast scaled distances, where:

$$SD1 = \frac{\text{Distance}}{\sqrt{MIC}} \quad (m.kg^{-0.5})$$

and,

$$SD2 = \frac{\text{Distance}}{3\sqrt{MIC}} \quad (m.kg^{-0.33})$$

where MIC is maximum instantaneous explosive charge in kg.

7.4 95% MIC and Blast Emissions Predictions

The approach of this assessment was to determine the limiting factors to the blast design for the Modification with the aim of achieving the relevant criteria at all locations. Calculations were conducted using the respective 5% site law equations in order to determine the Maximum Instantaneous Charge (MIC).

Table 25 5% MIC and Blast Emissions Predictions

Year	Approximate Distance to Nearest Receiver (m)	MIC Based on Ground Vibration or Airblast (kg)	Blast Emission Prediction Based on MIC	
			Predicted PVS Ground Vibration (mm/s)	Predicted Airblast Level (dB Linear)
2018	1500	280	1.7	115
2021	1200	145	1.4	115
2025	1500	280	1.7	115

The levels of airblast and ground vibration have been predicted using the developed site laws for Bloomfield Colliery. The maximum instantaneous charge (MIC) may exceed (or be less than) the values in **Table 25**, depending on the location of the area being mined and its relation to the nearest affected receiver. Bloomfield will continue to utilise independent technical advice with regards to initiation techniques and timing as well as blast hole loading profiles to control the airblast and ground vibration impacts from mine blasting.

Bloomfield Colliery currently has a network of blast monitors within the surrounding residential areas which are used to provide feedback on ground vibration and airblast levels for each blast. Data collected from the monitors is correlated with blast parameters such as charge weight and location and used to ensure future blasts are adequately designed to avoid exceedances of appropriate noise and vibration criteria. This feedback and design process will continue to be appropriate for future blasts within the Project disturbance boundary.

8 CONCLUSION

SLR Consulting has conducted a NVIA for the proposed Project.

Operational Noise Modelling

A computer model was used to predict noise emissions from the operation of the Project.

Operational noise levels are predicted to meet the relevant project specific and PA 07_0087 noise levels at all receiver locations under calm and prevailing weather conditions provided existing noise management practices as described in **Section 6.4** are implemented as appropriate.

Sleep Disturbance Assessment

The predicted L_{Amax} noise levels meet the sleep disturbance criteria at all locations and therefore, are not likely to cause sleep disturbance at any assessed residential location.

Cumulative Impact Assessment

The cumulative impact of mining in the area surrounding the Project, including the Abel Underground Mine, is predicted to comply with the relevant amenity criteria set in accordance with the INP and PA 07_0087, at relevant receiver locations or on more than 25 percent of, any privately owned land, with the exception of Lot 30/DP1113350 (vacant land within the mining lease).

Blasting

Calculations were conducted in order to estimate the 5% exceedance MICs for compliance with the relevant vibration and airblast criteria at the nearest sensitive receivers. The maximum instantaneous charge (MIC) may exceed (or be less than) the predicted values depending on the location of the area being mined and its relation to the nearest affected receiver.

Data collected from blasts within the Project disturbance boundary will be monitored and managed to ensure future blasts are adequately designed to avoid exceedances of appropriate noise and vibration criteria. This feedback and design process will continue to be appropriate for future blasts within the Project disturbance boundary.

Noise impact assessment for the modification of existing industrial premises

Background

(see INP Section 10)

Section 10 of the NSW Industrial Noise Policy (INP) outlines the application of the policy to existing industrial premises.

As well as being used to assess noise emissions from new industrial premises, the INP is also applied to situations where existing industrial premises are modified, expanded or upgraded.

Where a modification is proposed, the noise level targets for the premises (termed Project Specific Noise Levels) are to be determined firstly excluding any noise from the subject premises. The noise from the existing premises is then assessed against these targets to determine if there is a need to consider noise mitigation for existing operations. The predicted noise level from the proposed modification is then assessed, both in isolation and in combination with noise from the existing premises.

The total noise emissions from the modified premises should ideally not exceed the Project Specific Noise Levels. If the existing premises cannot achieve these targets, the allowable noise emissions from the proposed modification will be set so that the modification does not significantly increase the existing noise emissions.

Recommended approach

This application note outlines these processes together with the degree of information required to support a proper assessment of modifications to an existing industrial premises.

A noise impact assessment for the modification of existing industrial premises should include, as a minimum:

- existing noise criteria contained in consents, approvals or licences, that are applicable to the premises;
- Project Specific Noise Levels (PSNLs) for the premises determined in accordance with the INP and relevant application notes (see, for example, Appendix A4 of the INP). Note: care should be taken to exclude noise from the existing premises when quantifying background and existing industrial noise levels (further guidance is in the INP in Section 11.1.2);
- where application of the INP results in a PSNL more stringent than existing noise criteria, the PSNL should be adopted for noise assessment purposes. Note: the INP acknowledges that the PSNL is a goal sought to be achieved through the application of feasible and reasonable noise mitigation measures and is not necessarily applied as a statutory limit by default.
- measured or predicted noise levels from the existing premises at noise sensitive receiver locations;
- predicted noise contribution from the proposed modification, in isolation, at noise sensitive receiver locations; and
- cumulative noise levels from the entire premises (i.e. combined level from existing and proposed modification) compared to the PSNL.

Where noise from the existing premises exceeds the PSNL

Where it can be determined that noise from the existing premises alone is currently exceeding the PSNL, a preliminary analysis of potential noise mitigation measures, and conceptual noise reductions, needs to be undertaken for the existing premises. Note: this does not mean that in all circumstances noise mitigation to existing premises will be required as part of a modification. Decisions of this nature will be determined on a case by case basis, taking into account various factors, for example, feasible and reasonable mitigation options, the absolute level of noise and existing measures of community impact, including complaints.

Once the conceptual mitigated level of noise performance of the existing premises (i.e. what can be achieved) has been determined, the contribution noise level goal for the modification can be determined. The noise level goal for the modification should be set at least 10dB below the PSNL, or where it has been determined that the existing premises cannot achieve the PSNL, it should be set at least 10dB below the conceptual mitigated noise performance of the existing premises.

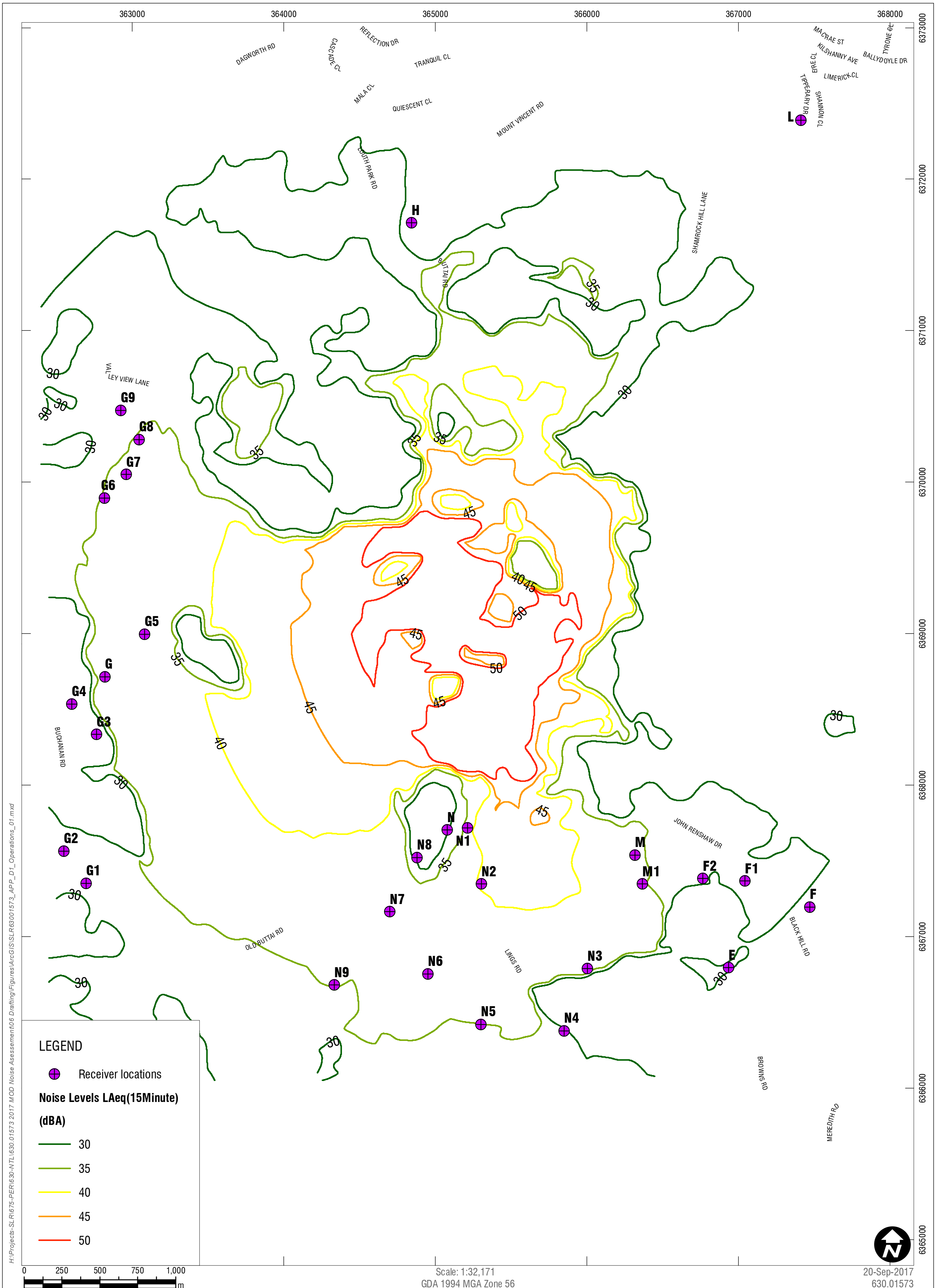
This approach is designed to ensure that noise from the modification does not become the limiting factor in noise from the entire premises potentially meeting the PSNL

Noise Monitor Locations

Sheet Size : A4

Appendix B

Equipment Description	Sound Power Level (SWL) Octave Band Centre Frequency (Hz) - dBA re 1pW										dBA Overall SWL
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Hitachi Excavator 5500	54	78	96	103	103	109	110	108	102	90	115
Caterpillar Rear Dump Trucks 789	67	82	93	103	106	106	105	104	96	81	112
Caterpillar 777 Watercart	67	82	93	103	106	106	105	104	96	81	112
Caterpillar Rear Dump Trucks 793	66	82	101	100	108	108	106	100	92	78	113
Caterpillar Front End Loader 992	77	90	99	103	103	106	107	110	104	91	114
Caterpillar Dozer D11	84	97	104	113	113	109	110	103	98	83	118
Caterpillar Dozer D10	84	97	104	113	113	109	110	103	98	83	118
Caterpillar Grader 24G	71	84	98	99	104	106	105	106	101	92	112
SK75 Drill	66	83	95	103	111	111	110	106	99	85	116
SK50 Drill	58	75	89	100	107	107	107	103	98	86	113



2018 Overburden
Night Reduced Operations
F Class Inversion

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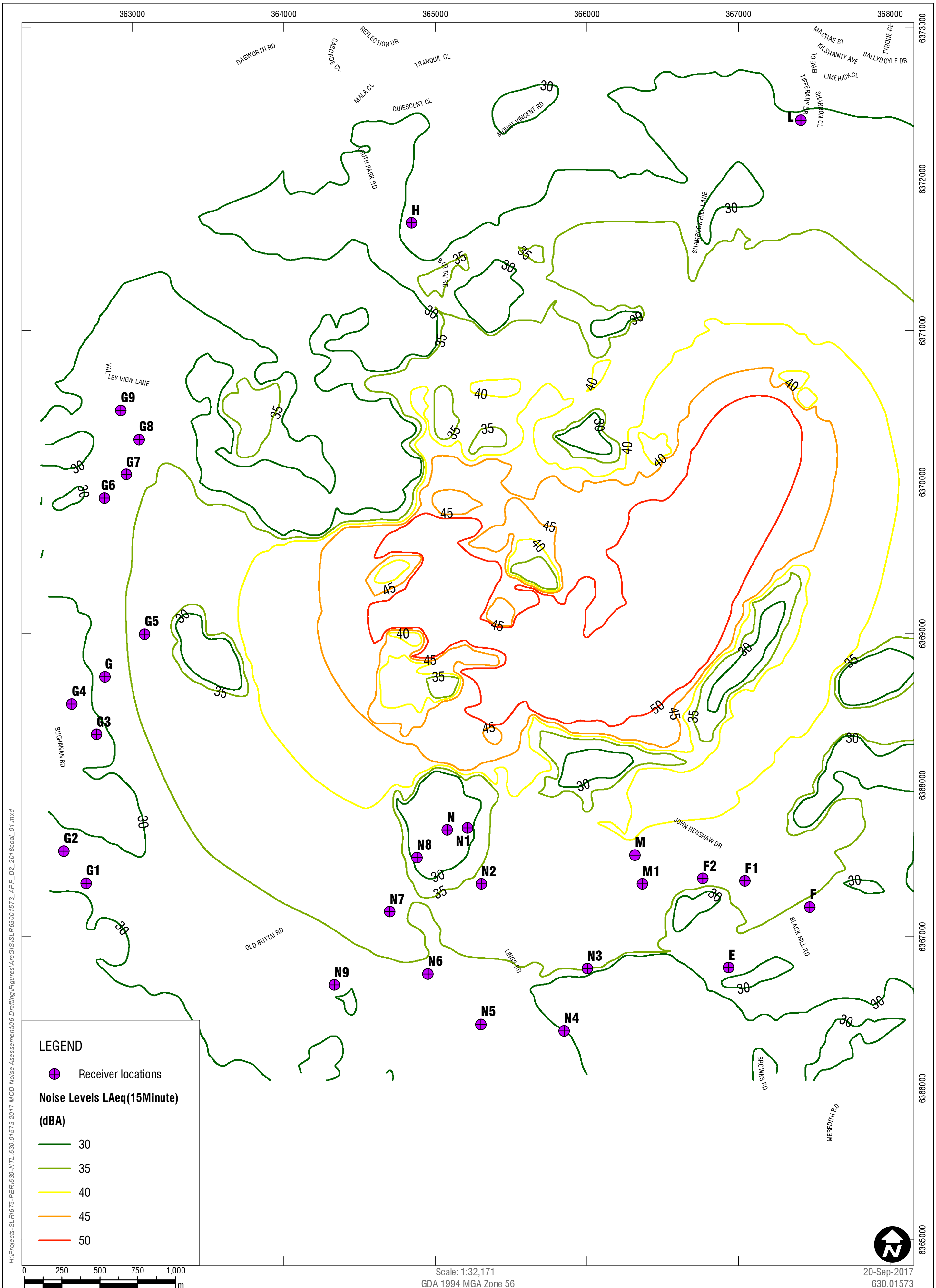
Appendix D1



2018 Coaling
Night Reduced Operations
F Class Inversion

Appendix D2

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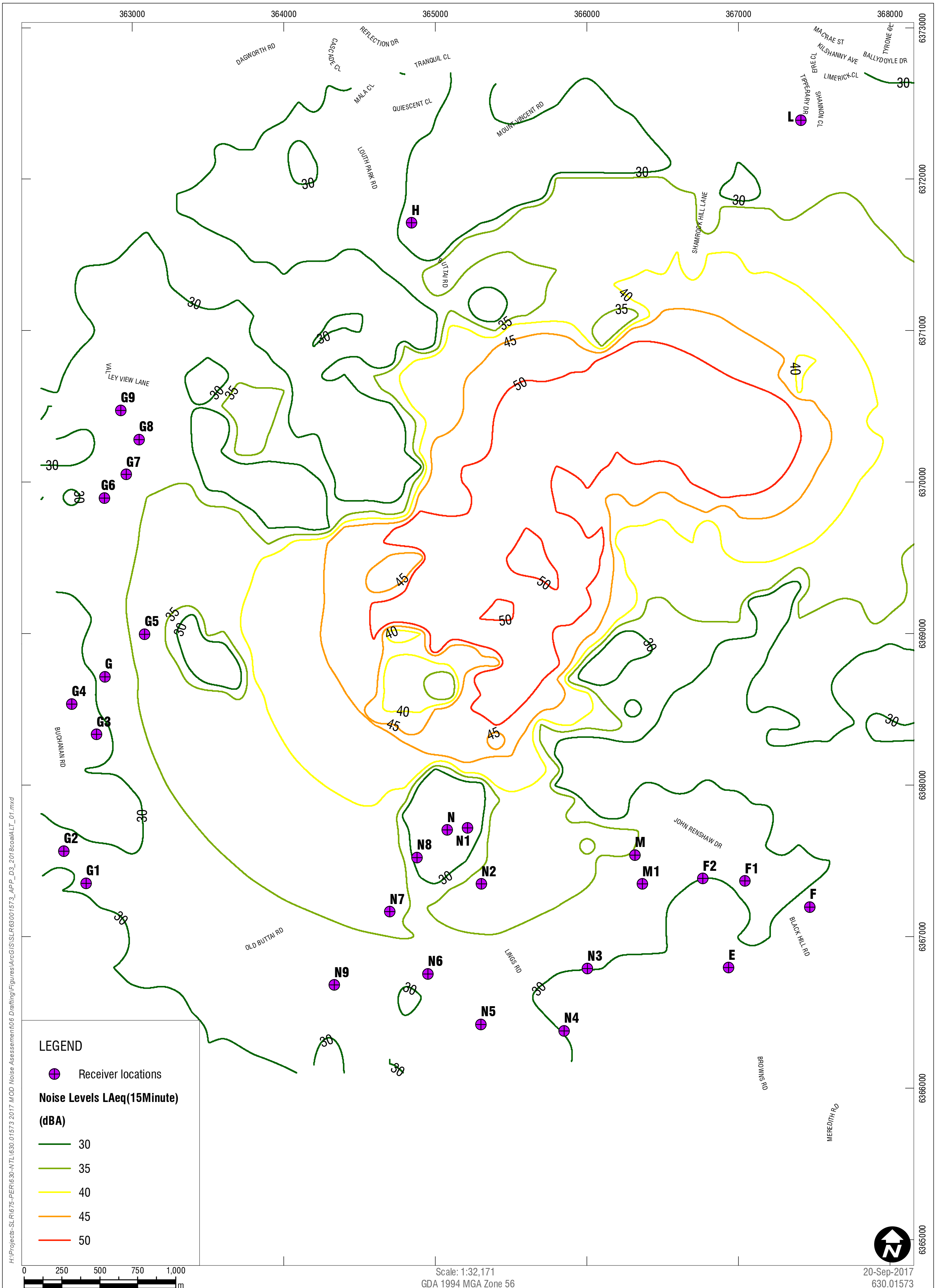

2018 Coaling - Alternate Haul Road
Night Reduced Operations
F Class Inversion

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Appendix D3

Appendix F

Air Quality Impact Assessment

Appendix F Air Quality Impact Assessment

AIR QUALITY IMPACT ASSESSMENT
BLOOMFIELD COLLIERY
MODIFICATION

The Bloomfield Group

20 September 2017

Job Number 17020662

Prepared by

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Air Quality Impact Assessment
Bloomfield Colliery
Modification

DOCUMENT CONTROL

Report Version	Date	Prepared by	Reviewed by
DRAFT – 001	01/08/2017	P Henschke	
DRAFT – 002	01/09/2017	P Henschke & A Todoroski	
FINAL - 001	06/09/2017	P Henschke & A Todoroski	
FINAL - 002	20/09/2017	P Henschke & A Todoroski	

This report has been prepared in accordance with the scope of works between Todoroski Air Sciences Pty Ltd (TAS) and the client. TAS relies on and presumes accurate the information (or lack thereof) made available to it to conduct the work. If this is not the case, the findings of the report may change. TAS has applied the usual care and diligence of the profession prevailing at the time of preparing this report and commensurate with the information available. No other warranty or guarantee is implied in regard to the content and findings of the report. The report has been prepared exclusively for the use of the client, for the stated purpose and must be read in full. No responsibility is accepted for the use of the report or part thereof in any other context or by any third party.

EXECUTIVE SUMMARY

This assessment investigates the potential air quality effects which may arise as a result of the proposed modification to the Bloomfield Colliery located in East Maitland in the Newcastle Coalfield, New South Wales.

The proposed modification seeks approval to access the deeper coal seams and a change in the boundary of the active operation by approximately 200 metres. Overall, as there is no significant change in the rate of emissions generated or in the operating areas, only small changes in the existing effects are likely to arise due to the Project.

This assessment aims to quantify the potential effects of the Project and to provide an assessment per the more stringent new EPA criteria. The assessment is prepared per the applicable regulatory guidelines and forms part of the environmental assessment prepared for the modification application.

The existing meteorological conditions in the area surrounding the Bloomfield Colliery are governed by the local terrain features and vegetation with the overall prevailing wind flows along a west-northwest and east-southeast axis, characteristic of the area. The ambient air quality levels that are monitored at various locations surrounding the Bloomfield Colliery indicate that air quality in the area is generally good and is typically below the relevant New South Wales Environment Protection Authority goals.

To assess the potential for air quality impacts associated with the proposed modification, one indicative mine plan year was selected to represent the range of potential worst-case impacts over the life of the proposed mining operation. The mine plan year was selected with reference to the scale and location of activities occurring at the operations which would likely contribute to the highest dust levels at sensitive receptor locations in each year.

Air dispersion modelling with the CALPUFF modelling suite is utilised in conjunction with estimated emission rates for the air pollutants generated by the various mining activities. All reasonable and feasible best practice mitigation and management measures are considered to ameliorate any potential adverse air quality impacts and to address government and community concerns regarding the contribution to air quality due to the mining activity.

The assessment predicts potential dust impacts would be below the relevant criteria for all of the assessed dust metrics, with the exception of cumulative 24-hour average $PM_{2.5}$ and PM_{10}. Generally minor and occasional potential short-term dust impacts at four privately-owned receptor locations surrounding Bloomfield Colliery were predicted to occur without the application of reactive and predictive measures in place. An analysis of these impacts indicate they are only marginally exceeding the criteria and would be easily mitigated through day-to-day management of the operations, (or may not occur at all in reality, given that the assessment conservatively double counts the existing and future mine emissions in the added background monitoring data). Overall, it is considered that with the nominated mitigation measures, no unacceptable impacts on air quality would arise due to the Project.

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1 INTRODUCTION

Todoroski Air Sciences has prepared this report for the Bloomfield Group (hereafter referred to as the Proponent). It provides an assessment of the potential air quality impacts associated with a proposed modification to the Bloomfield Colliery (hereafter referred to as the Project)

1.1 Overview of the Bloomfield Colliery

The Bloomfield Colliery is an existing open cut mining operation located in East Maitland in the Newcastle Coalfield. Coal has been mined on the property for over 100 years. Underground mining by the current owner commenced in 1937 and the last coal extracted from underground operations was in 1992. The open cut commenced operations in 1964.

Bloomfield Colliery operates per its current Project Approval (07_0087) which permits extraction of up to 1.3 million tonnes of run-of-mine (ROM) coal per year. ROM coal is transported via an internal road to the Bloomfield Coal Handling and Preparation Plant (CHPP) for processing and dispatch via rail. The Bloomfield CHPP is also approved to receive coal from other mining operations, including the Abel Underground and the now completed Tasman Underground Mine and Donaldson Open Cut Coal Mine.

1.2 Overview of the Modification

The Project is seeking approval to access the deeper coal seams previously thought to be inaccessible. Extraction of these resources would require an increase in the depth of the excavation and the overburden emplacement area and would result in an approximate 200 metre (m) change in the boundary of the active operational area.

All of the proposed activities are within the existing approved project boundary and there are no changes being sought to the extent or intensity of mining, mining equipment fleet or mining method.

In terms of air quality, there would be reduced off site effects from the key dust generating activities which occur in the pits as these would be deeper in the pit and more shielded from wind. However, the overburden dumps may be higher and thus more exposed to wind. This may release more emissions from the dumps, but the wind generating the emissions will also tend to better disperse these emissions and the overall effect may be relatively similar. Similarly, there may be a somewhat longer haul length, parts of which would be more shielded and parts more exposed. Overall, in such a case no major decrease or increase in off-site dust effects would be expected, however this assessment has been conducted to objectively evaluate the case and quantify the change.

2 LOCAL SETTING

The Bloomfield Colliery is located approximately 24 kilometres (km) northwest of Newcastle and approximately 9km south of Maitland. Other nearby regional centres include Beresfield, located approximately 9km to the northeast and Kurri Kurri located approximately 7km to southwest.

The general area surrounding the Bloomfield Colliery is comprised of coal mining operations, agricultural activities and woodland. Suburban residential areas are located in relatively close proximity to the north of the Project. The Bloomfield Colliery is surrounded by dense forest (which would have a positive effect in limiting the transport of dust off-site).

Figure 2-1 presents the location of the Bloomfield Colliery and the relevant sensitive receptor locations to this study. **Appendix A** provides a detailed list of all the sensitive receptor locations considered in this assessment.

Figure 2-2 presents a three-dimensional visualisation of the topography in the vicinity of the Bloomfield Colliery. To the southwest of the Bloomfield Colliery, the terrain is undulating and gradually forms well-defined steep slopes as the elevation increases. To the east, the terrain is generally open and is essentially flat along the river flood plain towards the coast. To the northwest the terrain opens into the Hunter Valley region.

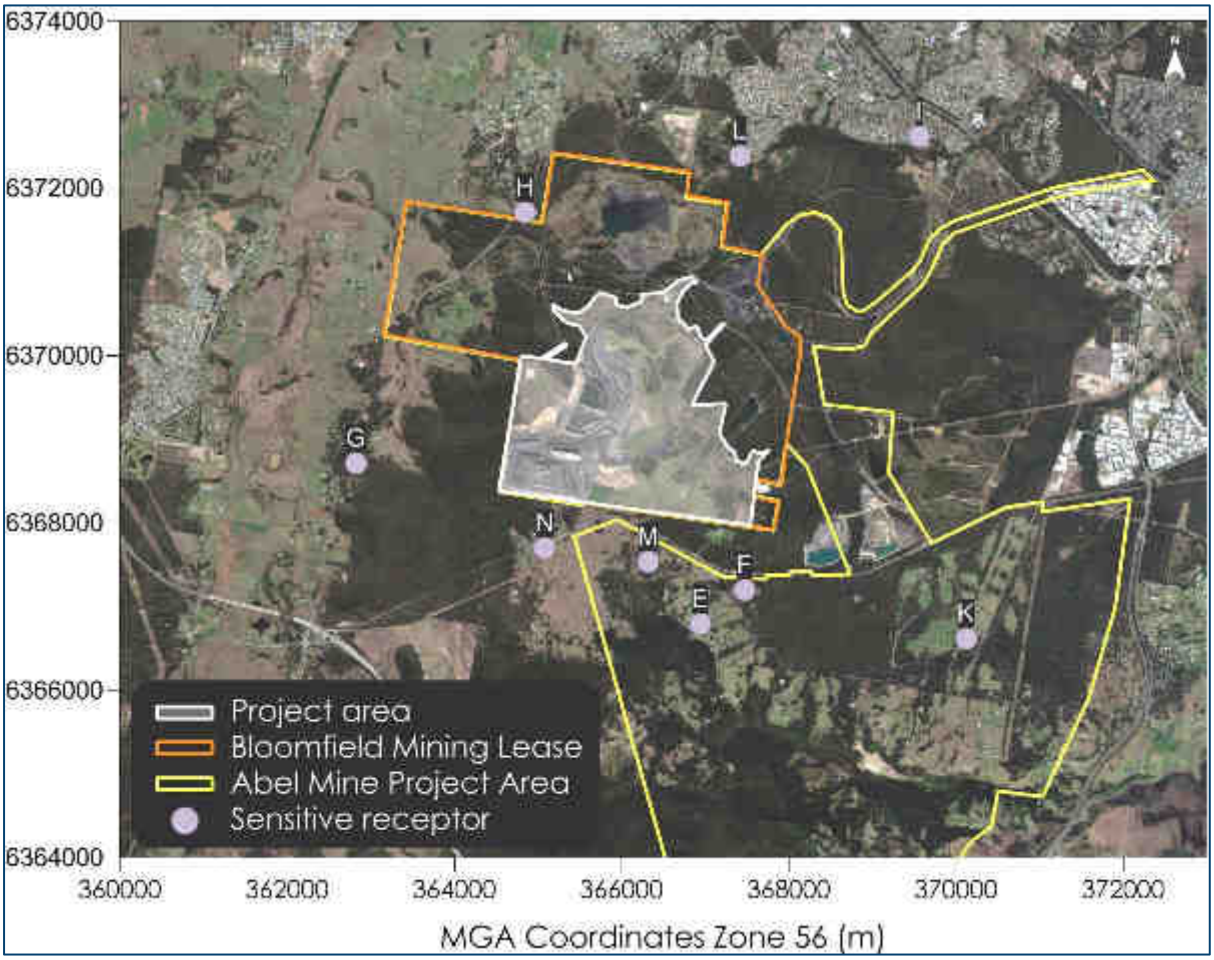

Figure 2-1: Local setting

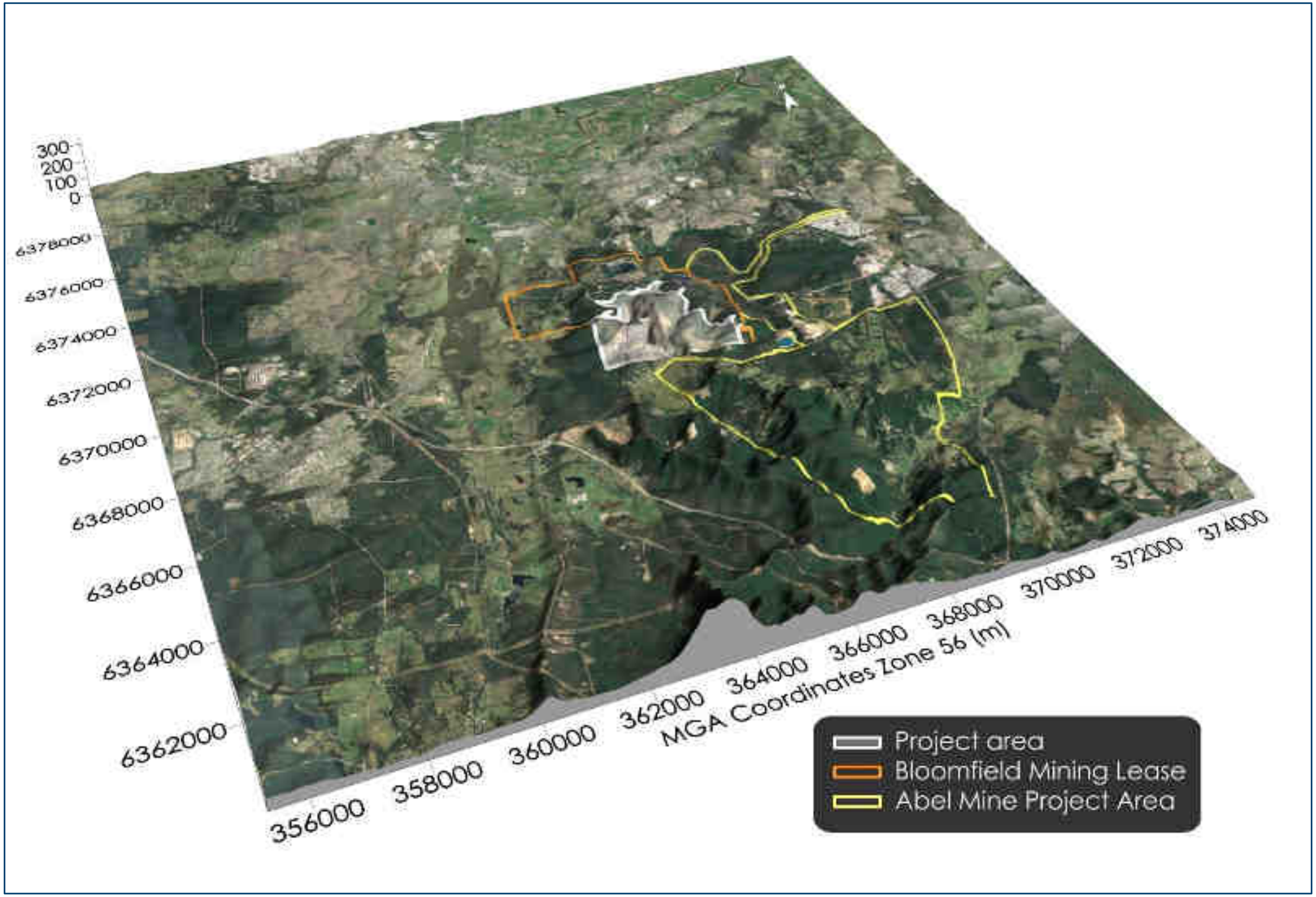

Figure 2-2: Topography surrounding the Project

3 AIR QUALITY ASSESSMENT CRITERIA

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential air emissions generated by the Project and the applicable air quality criteria.

3.1 NSW EPA impact assessment criteria

Table 3-1 summarises the air quality goals that are relevant to this assessment as outlined in the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2017**).

The air quality goals for total impact relate to the total burden in the air and not just from the Project. Consideration of background levels needs to be made when using these goals to assess potential impacts.

Table 3-1: NSW EPA air quality impact assessment criteria

Pollutant	Averaging Period	Impact	Criterion
Total suspended particulates (TSP)	Annual	Total	90µg/m³
Particulate matter ≤10µm (PM_{10})	Annual	Total	25µg/m³
	24 hour	Total	50µg/m³
Particulate matter ≤2.5µm ($PM_{2.5}$)	Annual	Total	8µg/m³
	24 hour	Total	25µg/m³
Deposited dust	Annual	Incremental	2g/m²/month
		Total	4g/m²/month
Nitrogen dioxide (NO_2)	1 hour	Total	246µg/m³
	Annual	Total	62µg/m³

Source: NSW EPA (2017)
µg/m³ = micrograms per cubic metre
g/m²/month = grams per square metre per month

3.2 NSW Voluntary Land Acquisition and Mitigation Policy (VLAMP)

Part of the NSW Voluntary Land Acquisition and Mitigation Policy dated 15 December 2014 and gazetted on 19 December 2014 describes the NSW Government's policy for voluntary mitigation and land acquisition to address particulate matter impacts from state significant mining, petroleum and extractive industry developments.

Voluntary mitigation rights may apply where, even with best practice management, the development contributes to exceedances of the criteria in **Table 3-2** at any residence or workplace. [1]

Table 3-2: Particulate matter mitigation criteria

Pollutant	Averaging period	Mitigation Criterion		Impact Type
PM_{10}	Annual	30µg/m³*		Human health
PM_{10}	24 hour	50µg/m³**		Human health
TSP	Annual	90µg/m³*		Amenity
Deposited dust	Annual	2g/m²/month**	4g/m²/month*	Amenity

Source: NSW Government (2014)
*Cumulative impact (i.e. increase in concentration due to the development plus background concentrations due to all other sources).
**Incremental impact (i.e. increase in concentrations due to the development alone), with zero allowable exceedances of the criteria.

[1] Where any exceedance would be unreasonably detrimental to workers health or carrying out of the business.

Voluntary acquisition rights may apply where, even with best practice management, the development contributes to exceedances of the criteria in **Table 3-3** at any residence, workplace or on more than 25 per cent of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls (vacant land).

Table 3-3: Particulate matter acquisition criteria

Pollutant	Averaging period	Acquisition Criterion		Impact Type
PM_{10}	Annual	30µg/m³*		Human health
PM_{10}	24 hour	50µg/m³**		Human health
TSP	Annual	90µg/m³*		Amenity
Deposited dust	Annual	2g/m²/month**	4g/m²/month*	Amenity

Source: NSW Government (2014)

*Cumulative impact (i.e. increase in concentration due to the development plus background concentrations due to all other sources).

**Incremental impact (i.e. increase in concentrations due to the development alone), with up to 5 allowable exceedances of the criteria over the life of the development.

4 EXISTING ENVIRONMENT

This section describes the existing environment including the climate and ambient air quality in the area surrounding the Project.

4.1 Local climate

Long term climatic data collected at the Bureau of Meteorology (BoM) weather station at Cessnock Airport Automatic Weather Station (AWS) were analysed to characterise the local climate in the proximity of the Project. The Cessnock Airport AWS is located approximately 21km west of the Bloomfield Colliery.

Table 4-1 and **Figure 4-1** show climatic parameters which have been collected from the Cessnock Airport AWS over a 13 to 26 year period for the various meteorological parameters.

The data indicate that January is the hottest month with a mean maximum temperature of 30.1 degrees Celsius (°C) and July is the coldest month with a mean minimum temperature of 4.1°C.

Rainfall peaks during the summer months and declines during winter. The data show February is the wettest month with an average rainfall of 97.8 millimetres (mm) over 7.8 days and July is the driest month with an average rainfall of 29.0mm over 4.1 days.

Relative humidity levels exhibit variability over the day. Mean 9am relative humidity levels range from 60 per cent in October to 80 per cent in March and June. Mean 3pm relative humidity levels vary from 42 per cent in August and September to 55 per cent in June.

Wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the colder months. The mean 9am wind speeds range from 8.7 kilometres per hour (km/h) in March to 14.0km/h in September. The mean 3pm wind speeds vary from 14.2km/h in May to 19.1km/h in September.

Table 4-1: Monthly climate statistics summary – Cessnock Airport AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temperature (°C)	30.1	29.2	27.3	24.2	20.7	17.8	17.3	19.4	22.5	25.3	26.9	28.9	24.1
Mean min. temperature (°C)	16.9	16.9	14.6	10.5	7.5	5.8	4.1	4.5	7.0	9.7	13.0	15.0	10.5
Rainfall													
Rainfall (mm)	81.2	97.8	70.0	58.0	41.7	58.5	29.0	34.6	45.4	51.1	74.4	80.3	743.3
Mean No. of rain days (≥1mm)	6.4	7.8	7.4	5.7	5.2	5.4	4.1	4.5	5.7	6.4	7.4	7.1	73.1
9am conditions													
Mean temperature (°C)	23.2	22.2	20.2	17.8	14.1	11.0	10.1	12.2	16.2	19.1	20.2	22.2	17.4
Mean relative humidity (%)	68	76	80	76	79	80	76	69	63	60	65	65	71
Mean wind speed (km/h)	11.5	10.2	8.7	10.1	10.4	11.5	11.5	13.0	14.0	13.7	12.7	11.8	11.6
3pm conditions													
Mean temperature (°C)	28.7	27.3	25.7	23.0	19.6	16.8	16.4	18.6	21.2	23.4	25.0	27.3	22.8
Mean relative humidity (%)	46	53	53	52	54	55	49	42	42	44	47	46	49
Mean wind speed (km/h)	18.5	17.3	15.7	14.6	14.2	15.1	15.3	17.3	19.1	18.7	18.6	18.3	16.9

Source: **Bureau of Meteorology (2017), accessed March 2017**

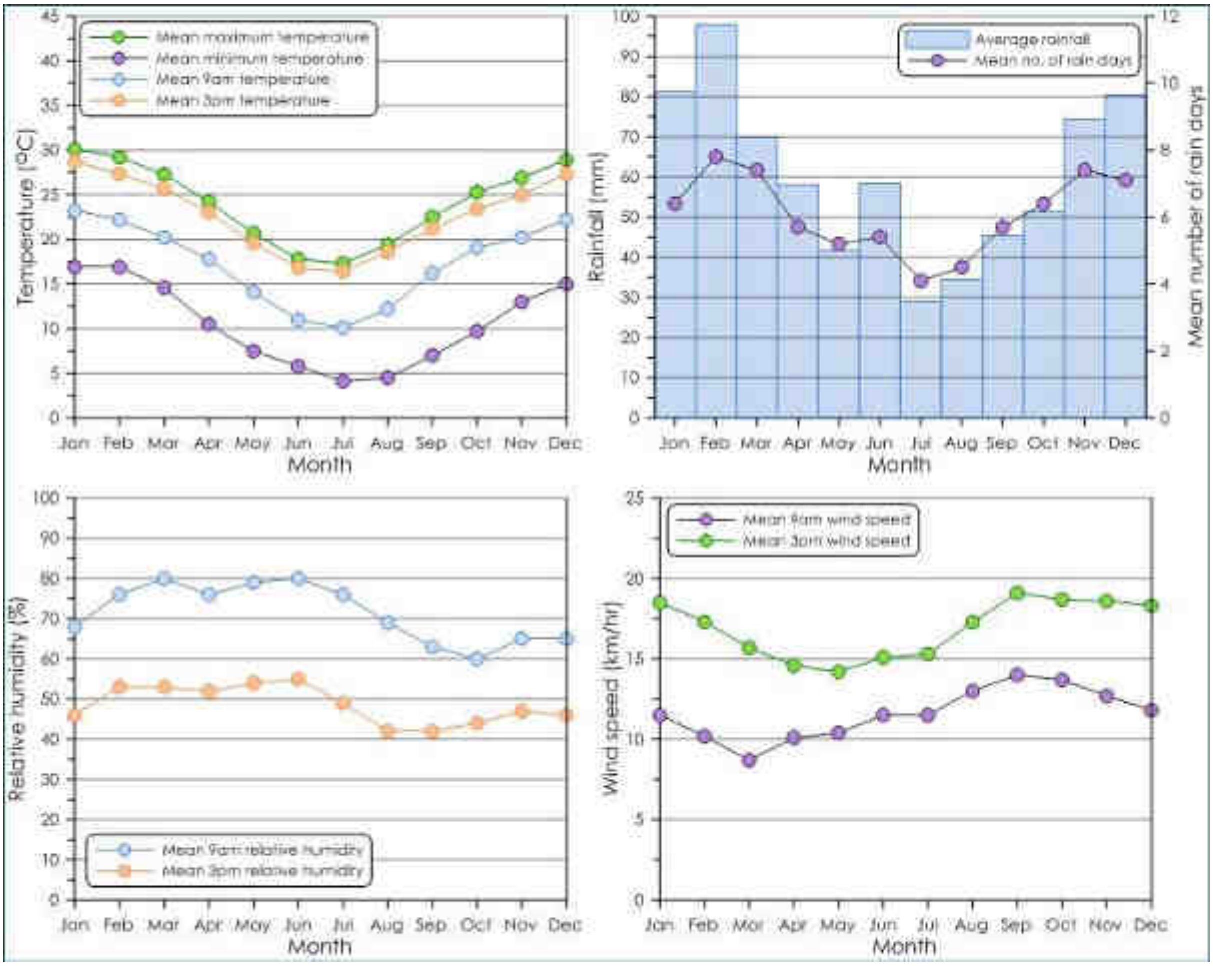

Figure 4-1: Monthly climate statistics summary – Cessnock Airport AWS

4.2 Local meteorological conditions

The Bloomfield Colliery operates a meteorological station to assist with environmental management of site operations. The location of this station is shown in **Figure 4-2**.

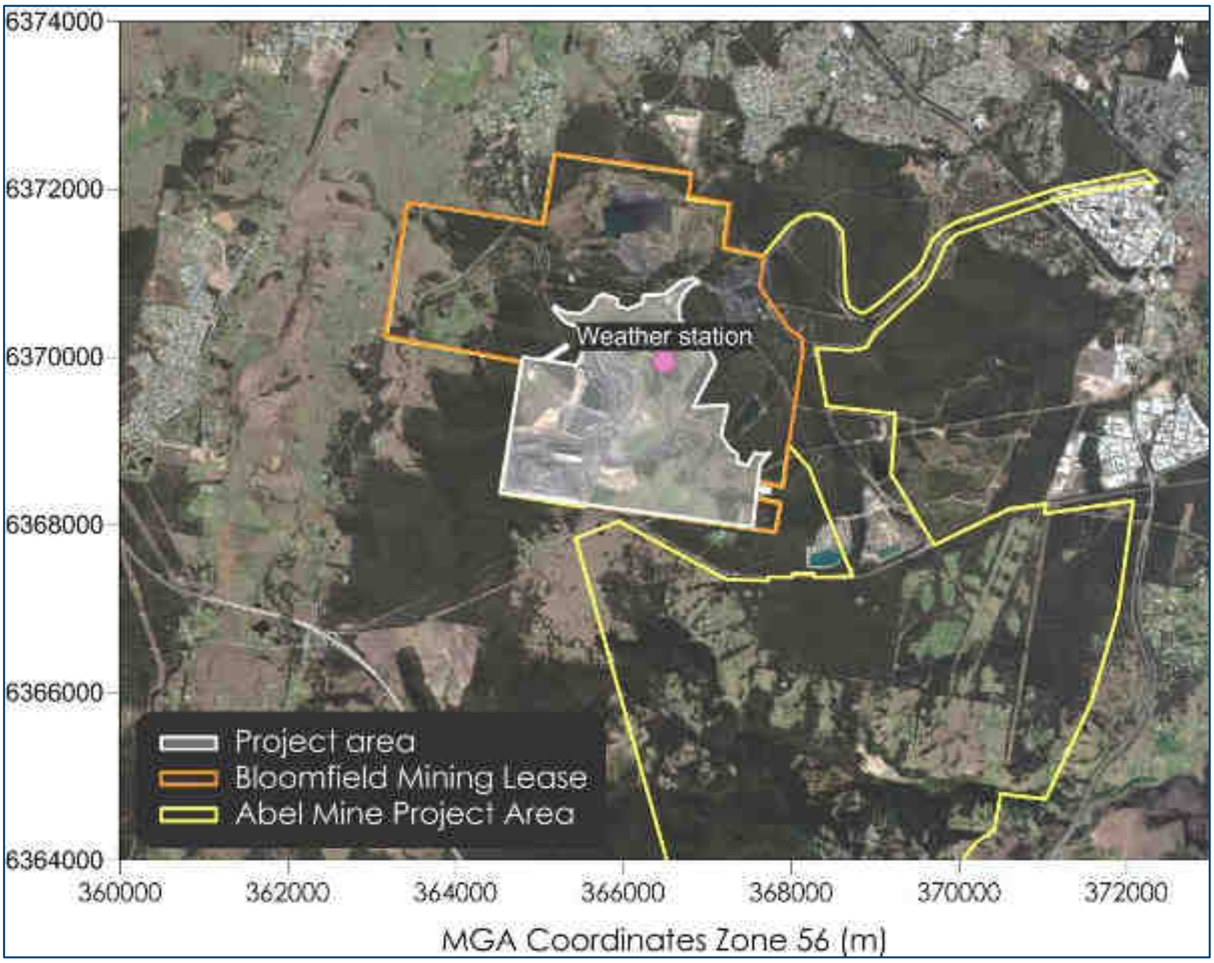

Figure 4-2: Bloomfield Colliery weather station location

Annual and seasonal windroses prepared from the available data collected for the 2015 calendar period for the station are presented in **Figure 4-3**.

Analysis of the windroses shows that winds are generally light. On an annual basis the general winds at the Bloomfield weather station are along the west-northwest to east-southeast axis. Very few, almost non-existent winds originate from the northeast quadrant throughout the year.

In summer the winds predominately occur from the southeast and east-southeast and are typically light. Winds from all other quadrants are almost absent. The autumn wind distribution shows dominance of light winds from the east-southeast followed by relatively stronger winds from the west-northwest. The autumn wind distribution is similar to the annual distribution. During winter, relatively stronger winds from the west-northwest are most frequent, followed by a few winds from the southwest quadrant. Winds from all other quadrants are almost absent. The spring windrose typically shares a similar wind distribution pattern to the annual distribution but with fewer and lighter winds from the west-northwest.

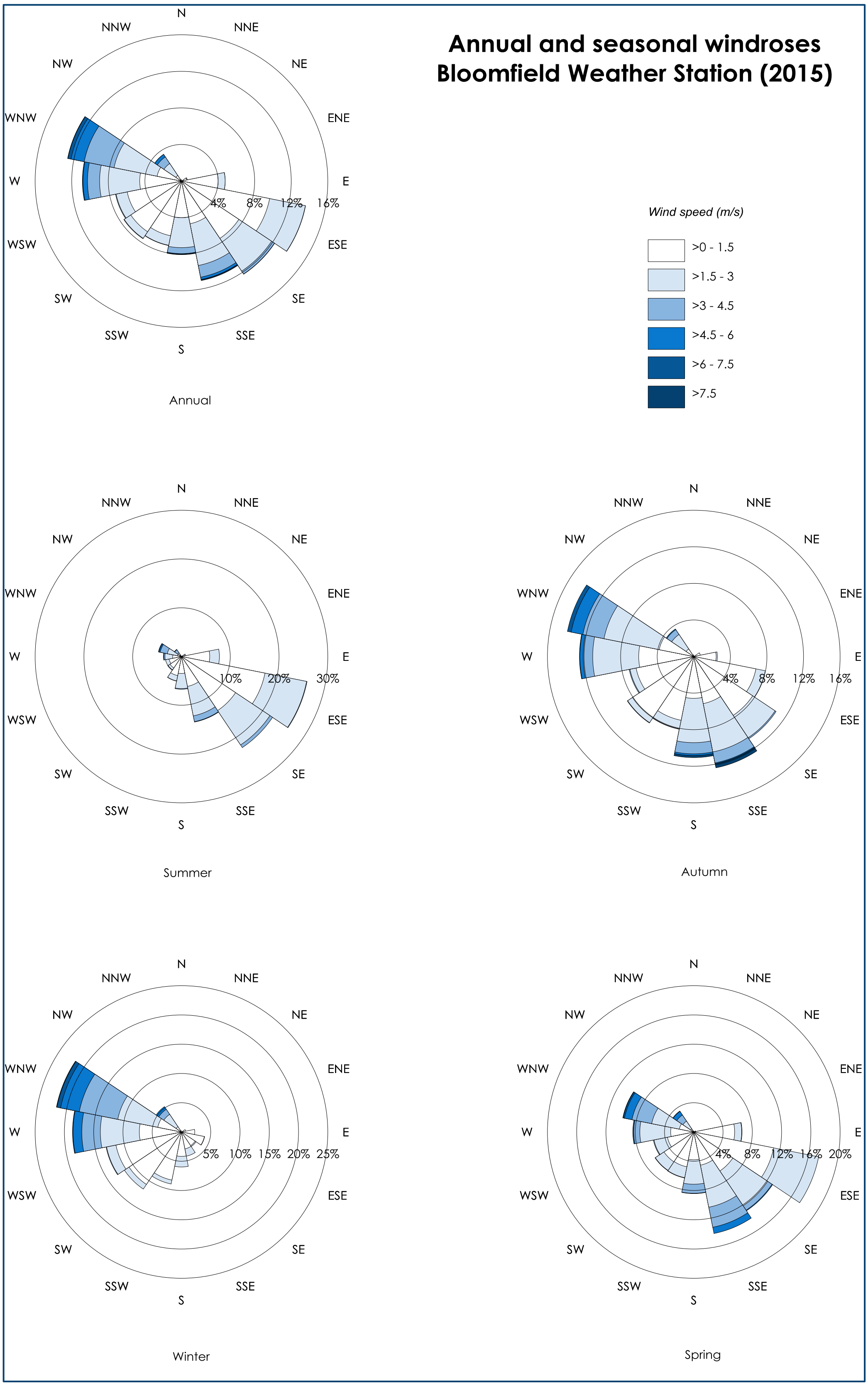

Figure 4-3: Annual and seasonal windroses for the Bloomfield Colliery weather station (2015)

4.3 Local air quality monitoring

The main sources of particulate matter in the wider area include active mining, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities.

This section reviews the ambient monitoring data collected from a number of ambient monitoring locations in the vicinity of the Project. The monitoring data reviewed in this assessment include data collected at High Volume Air Samplers (HVAS) measuring TSP and PM_{10}, ten dust deposition gauges measuring dust fallout, a Tapered Element Oscillating Microbalance (TEOM) measuring PM_{10} and a Beta Attenuation Monitor (BAM) measuring $PM_{2.5}$ and a monitor to measure NO_2.

Figure 4-4 shows the approximate location of each of the monitoring stations reviewed in this assessment.

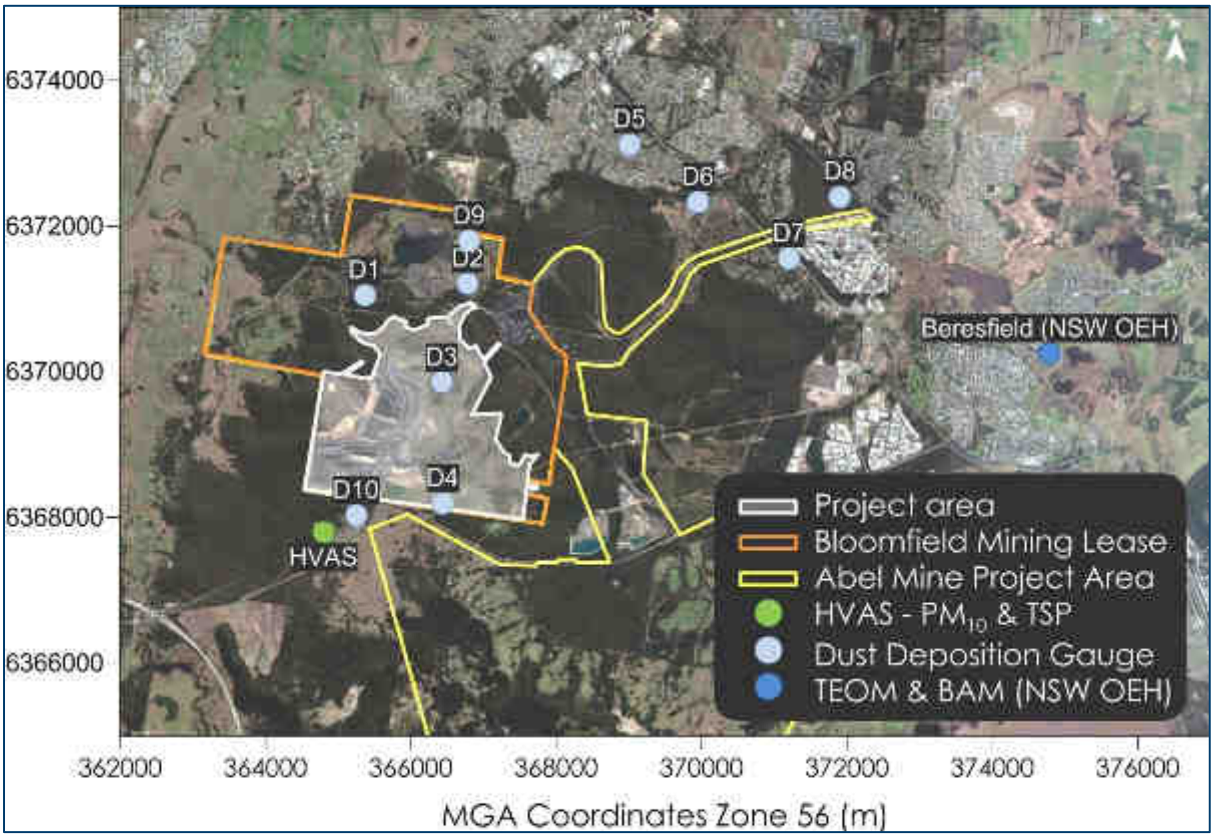

Figure 4-4: Monitoring locations

4.3.1 PM_{10} monitoring

A summary of the available ambient PM_{10} monitoring data from the Bloomfield Colliery HVAS and NSW OEH Beresfield TEOM monitoring station is presented in **Table 4-2**. Recorded 24-hour average PM_{10} concentrations are presented in **Figure 4-5**.

The monitoring data in **Table 4-2** include all emission sources in the general vicinity and indicate that the annual average PM_{10} concentrations for the monitoring stations were below the relevant criterion of 25µg/m³ for the period reviewed.

Table 4-2: Summary of PM_{10} levels from Bloomfield Colliery HVAS and NSW OEH Beresfield monitoring station (µg/m³)

Year	2012	2013	2014	2015	2016
Annual average					
Bloomfield	15.8	16.8	14.8	13.9	15.9
Beresfield	21.3	21.4	19.4	18.8	19.1
Maximum 24-hour average					
Bloomfield	33.0	46.0	36.0	48.0	45.0
Beresfield	50.8	55.3	45.4	64.9	48.0
Number of days >50µg/m³					
Bloomfield	0	0	0	0	0
Beresfield	1	5	0	2	0

The maximum 24-hour average PM_{10} concentrations (see **Figure 4-5**) recorded at the Bloomfield Colliery monitor were below the relevant criterion of 50µg/m³ for the review period. In contrast, the Beresfield monitoring station was found on occasion to exceed the maximum 24-hour average PM_{10} criterion.

It is noteworthy that on the days when both stations recorded 24-hour PM_{10} levels, the Beresfield monitor recorded levels that on average were 39 per cent higher than the levels at the Bloomfield monitor which is located in the vicinity of the existing mine.

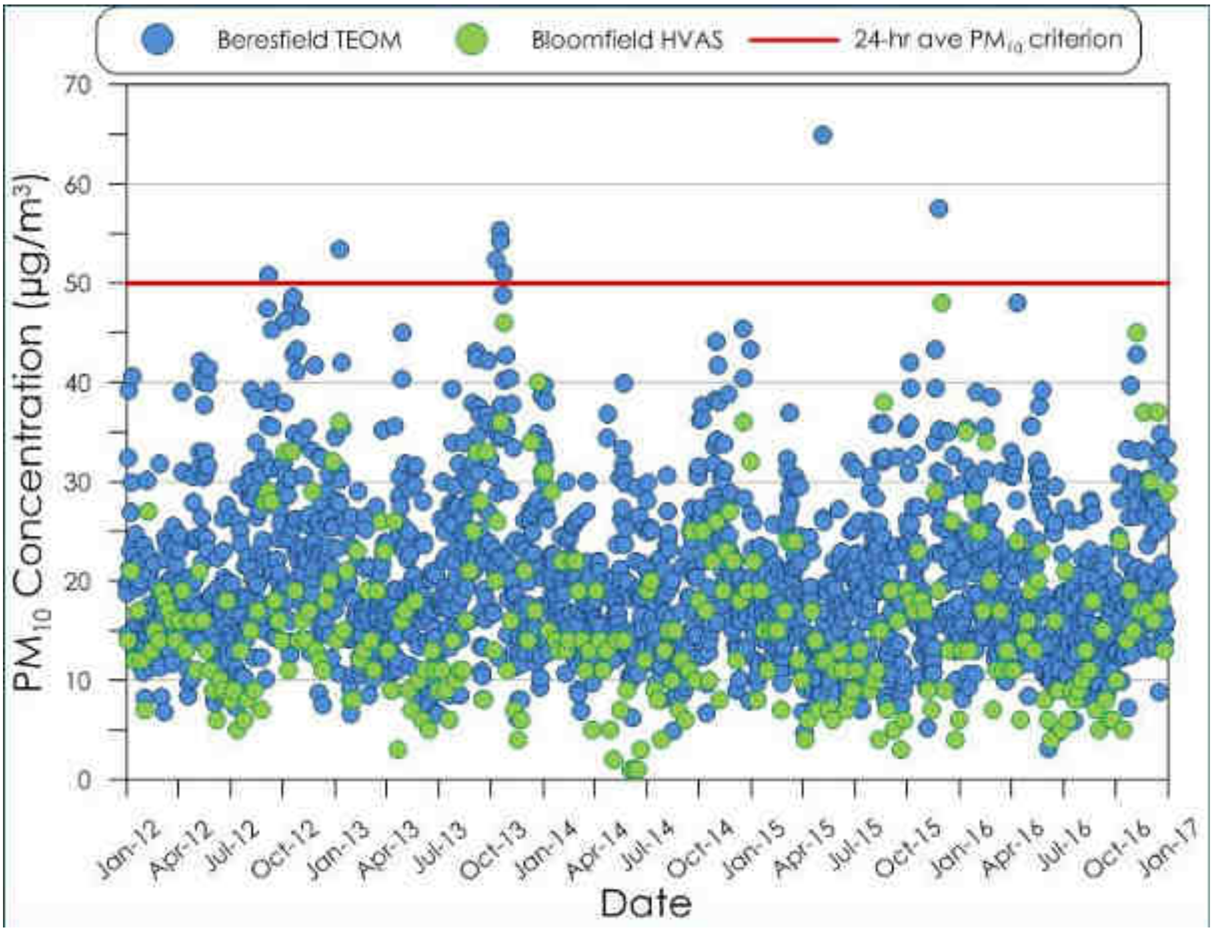

Figure 4-5: TEOM 24-hour average PM_{10} concentrations at NSW OEH Beresfield monitor

4.3.2 TSP monitoring

A summary of the available TSP monitoring data from the Bloomfield Collier HVAS collected between January 2012 and December 2016 is shown in **Table 4-3**. Recorded 24-hour average TSP concentrations are presented in **Figure 4-6**.

The monitoring data presented in **Table 4-3** indicate that the annual average TSP concentrations for the monitoring station are less than half the criterion of 90µg/m^3. **Figure 4-6** shows that the recorded 24-hour average TSP concentrations follow a similar trend to the PM_{10} HVAS monitoring data as expected.

Table 4-3: Summary of annul average TSP levels from Bloomfield Colliery HVAS monitoring (µg/m³)

Year	Annual average
2012	38.0
2013	38.2
2014	31.1
2015	29.0
2016	34.5

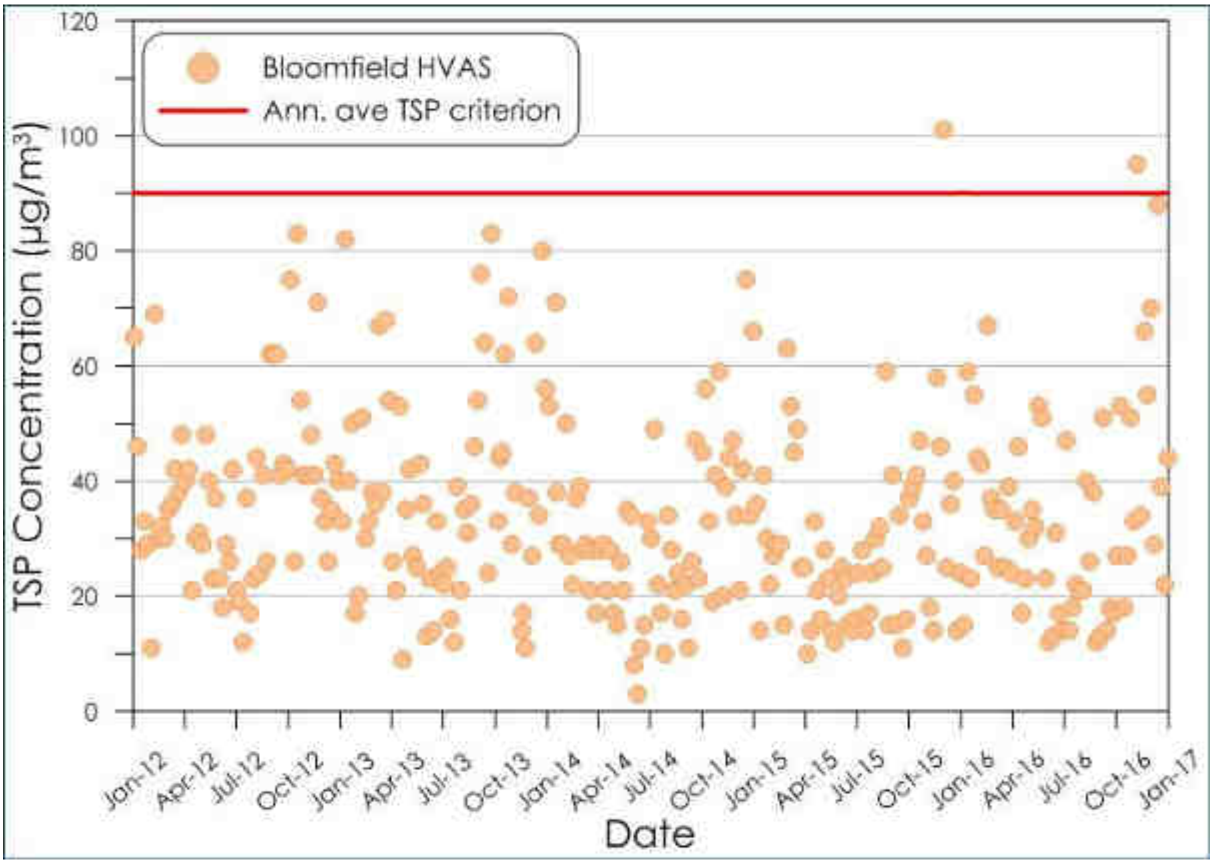

Figure 4-6: HVAS 24-hour average TSP concentrations (criteria is 90 µg/m³ as an annual average)

4.3.3 Dust deposition monitoring

Table 4-4 summarises the annual average deposition levels at each gauge during 2012 to 2016.

The monitoring data indicate that some of the samples were contaminated possibly with materials such as bird droppings, insects or plant matter. This is a relatively common occurrence for this type of monitoring, and accordingly, contaminated samples have been excluded from the reported annual average results.

All gauges recorded an annual average insoluble deposition level below the criterion of 4g/m^2/month and in general, the air quality in terms of dust deposition is considered good.

Table 4-4: Annual average dust deposition (g/m²/month)

Dust gauge	2012	2013	2014	2015	2016
D1	1.5	1.7	1.2	1.3	0.7
D2	1.7	1.6	1.4	1.3	1.3
D3	1.9	2.5	1.6	1.5	1.1
D4	3.1	1.3	1.5	1.4	1.3
D5	1.4	1.5	1.5	1.3	1.3
D6	3.4	2.5	2.5	1.3	1.5
D7	1.8	1.7	1.4	1.1	1.1
D8	1.6	1.7	1.7	1.3	1.4
D9	1.1	1.3	1.1	0.9	0.8
D10	2.2	1.5	1.5	1.5	2.2

4.3.4 $PM_{2.5}$ monitoring

A summary of the $PM_{2.5}$ readings from the NSW OEH Beresfield monitoring station is presented in **Table 4-5**. The recorded 24-hour average $PM_{2.5}$ concentrations are presented in **Figure 4-7**.

Table 4-5 indicates that the annual average $PM_{2.5}$ concentration was above the relevant criterion of 8µg/m^3 in 2013. For all other periods the annual average $PM_{2.5}$ concentrations were below the relevant criterion.

On occasion, the 24-hour average $PM_{2.5}$ levels were also found to be above the relevant criterion of 25µg/m^3 during the review period (see **Figure 4-7**). Ambient $PM_{2.5}$ levels are likely to be governed by many non-mining background sources such as wood heaters and motor vehicles.

Table 4-5: Summary of $PM_{2.5}$ levels from NSW OEH Beresfield monitoring station (µg/m³)

Year	Annual average	Maximum 24-hour average	Number of days >25µg/m³
2012	7.9	22.4	0
2013	8.2	40.8	2
2014	7.5	19.0	0
2015	7.3	25.9	1
2016	7.4	27.9	1

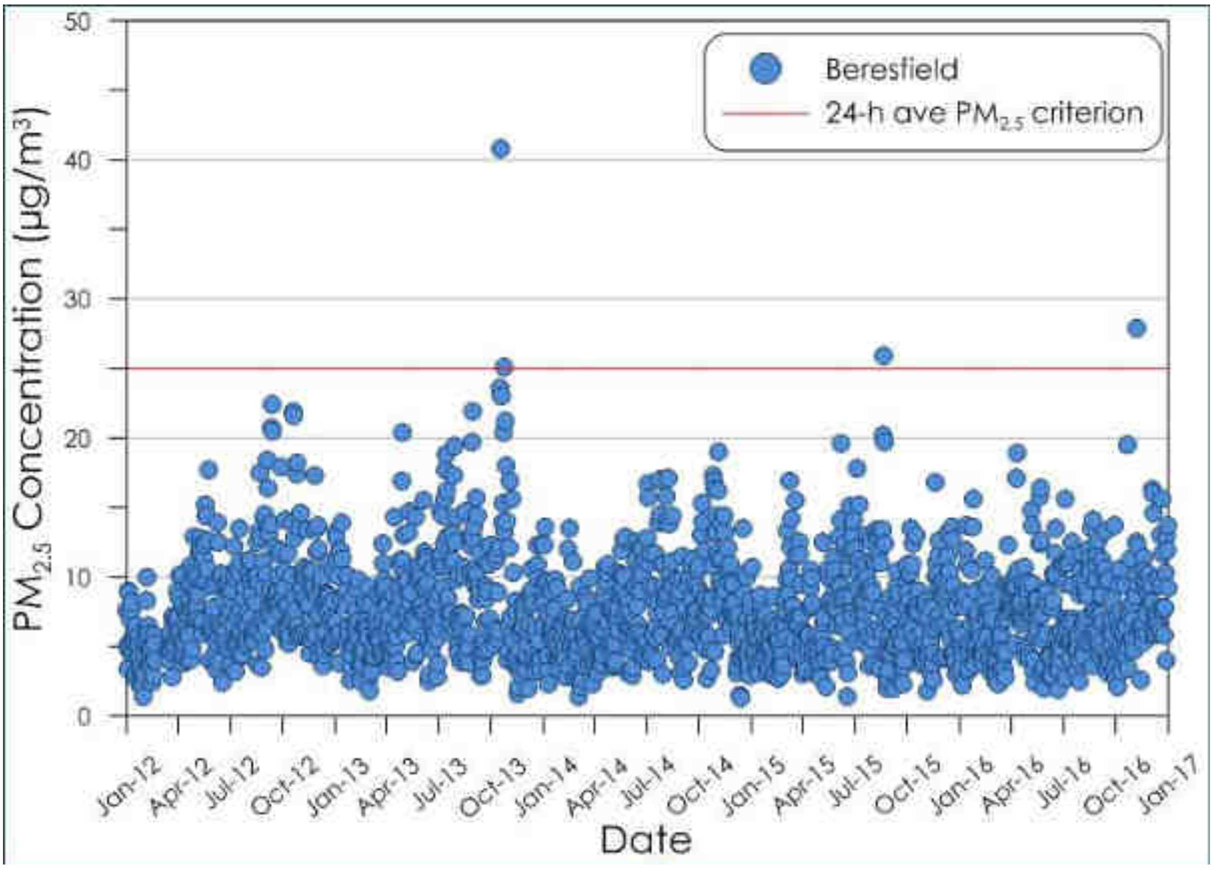

Figure 4-7: 24-hour average $PM_{2.5}$ concentrations at NSW OEH Beresfield monitoring station

4.3.5 Nitrogen dioxide

Figure 4-8 presents the maximum daily 1-hour average NO_2 concentrations from the NSW OEH Beresfield monitoring site from January 2012 to December 2016.

The monitoring data recorded are well below the NSW EPA 1-hour average goal of 246µg/m^3 during this period at all of the monitors. The data in **Figure 4-8** indicate that levels of NO_2 are relatively low compared to the criterion level and show a seasonal fluctuation.

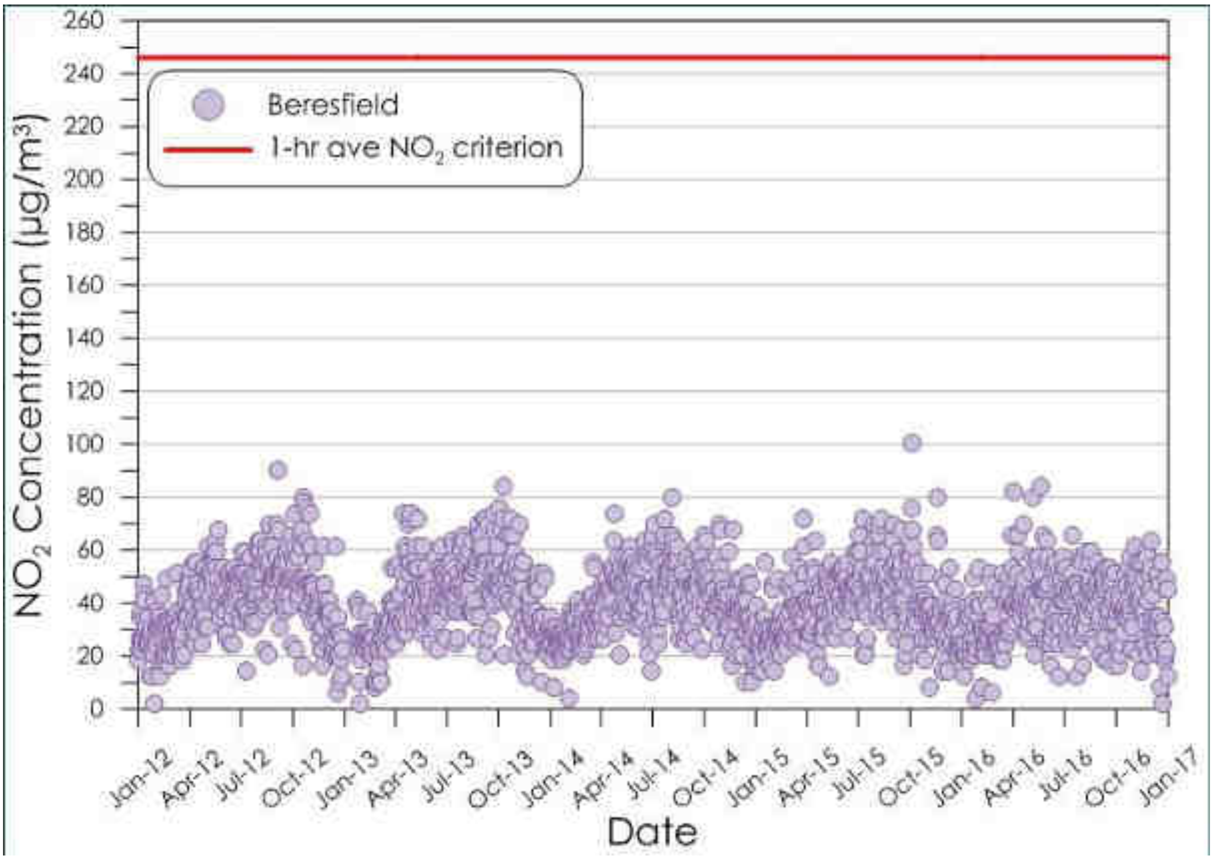

Figure 4-8: Daily 1-hour maximum NO_2 concentrations at NSW OEH Beresfield monitoring station

5 DISPERSION MODELLING APPROACH

5.1 Introduction

For this assessment the CALPUFF modelling suite is applied to dispersion modelling. The model was setup in general accordance with methods provided in the NSW EPA document *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'* (**TRC Environmental Corporation**, **2011**).

5.2 Meteorological modelling

The meteorological modelling methodology applied a 'hybrid' approach which includes a combination of prognostic model data from The Air Pollution Model (TAPM) with surface observations in the CALMET model.

The centre of analysis for the TAPM modelling used is 32deg48.5min south and 151deg33.5min east. The simulation involved an outer grid of 30km, with three nested grids of 10km, 3km and 1km with 35 vertical grid levels. The CALMET domain was run on a 20 x 20km grid with a 0.2km grid resolution.

The 2015 calendar year was selected as the period for modelling the Project. This period was selected based on a review of the long-term meteorological and ambient air quality conditions which are representative of the prevailing conditions. Accordingly, the available meteorological data for January 2015 to December 2015 from five nearby meteorological monitoring sites were included in the simulation. **Table 5-1** outlines the parameters used from each station.

Table 5-1: Surface observation stations

Weather Stations	Parameters						
	WS	WD	CH	CC	T	RH	SLP
Bloomfield Colliery Weather Station	✓	✓			✓	✓	
Williamtown RAAF (BoM) (Station No. 061078)	✓	✓	✓	✓	✓	✓	✓
Newcastle Nobbys Signal Station AWS (BoM) (Station No. 61055)							
Cessnock Airport AWS (BoM) (Station No. 061260)	✓	✓			✓	✓	✓
Paterson (Tocal) AWS (BoM) (Station No. 061250)	✓	✓			✓	✓	

WS = wind speed, WD= wind direction, CH = cloud height, CC = cloud cover, T = temperature, RH = relative humidity, SLP = station level pressure

The seven critical parameters used in the CALMET modelling are presented in **Figure 5-2**.

Table 5-2: Seven critical parameters used in CALMET

Parameter	Value
TERRAD	5
IEXTRP	-4
BIAS (NZ)	-1, -0.5, -0.25, 0, 0, 0, 0, 0
R1 and R2	8, 8
RMAX1 and RMAX2	15, 15

5.2.1 Evaluation of meteorological data

The outputs of the CALMET modelling are evaluated using visual analysis of the wind fields and extracted data and also through statistical evaluation.

Figure 5-1 presents a visualisation of the wind field generated by CALMET for a single hour of the modelling period. The wind fields are seen to follow the terrain well and indicate the simulation produces realistic fine scale flow fields (such as terrain forced flows) in surrounding areas.

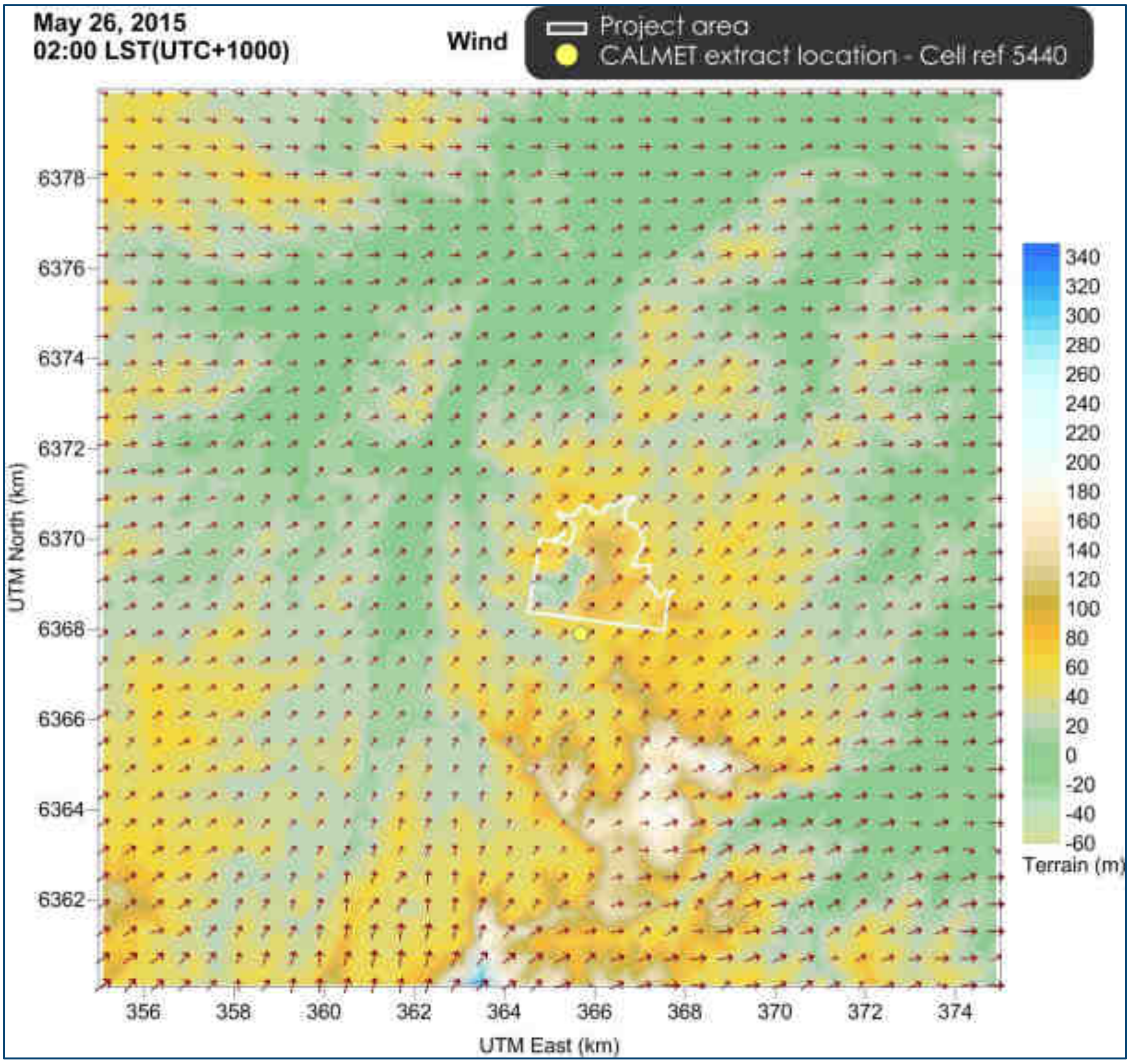

Figure 5-1: Example of the wind field for one of the 8,760 hours of the year that are modelled

CALMET generated meteorological data were extracted from a central point within the CALMET domain and are graphically represented in **Figure 5-2** and **Figure 5-3**.

Figure 5-2 presents annual and seasonal windroses extracted from one central point in the CALMET domain. As expected, the windroses show similar distributions at the Bloomfield weather station (see **Figure 4-3**).

Overall the windroses generated in the CALMET modelling reflect the expected wind distribution patterns of the area as determined based on the available measured data and the expected terrain effects on the prevailing winds. This is evident as the windroses based on the CALMET data also compare well with the windroses generated with the measured data, as presented in **Figure 4-3**.

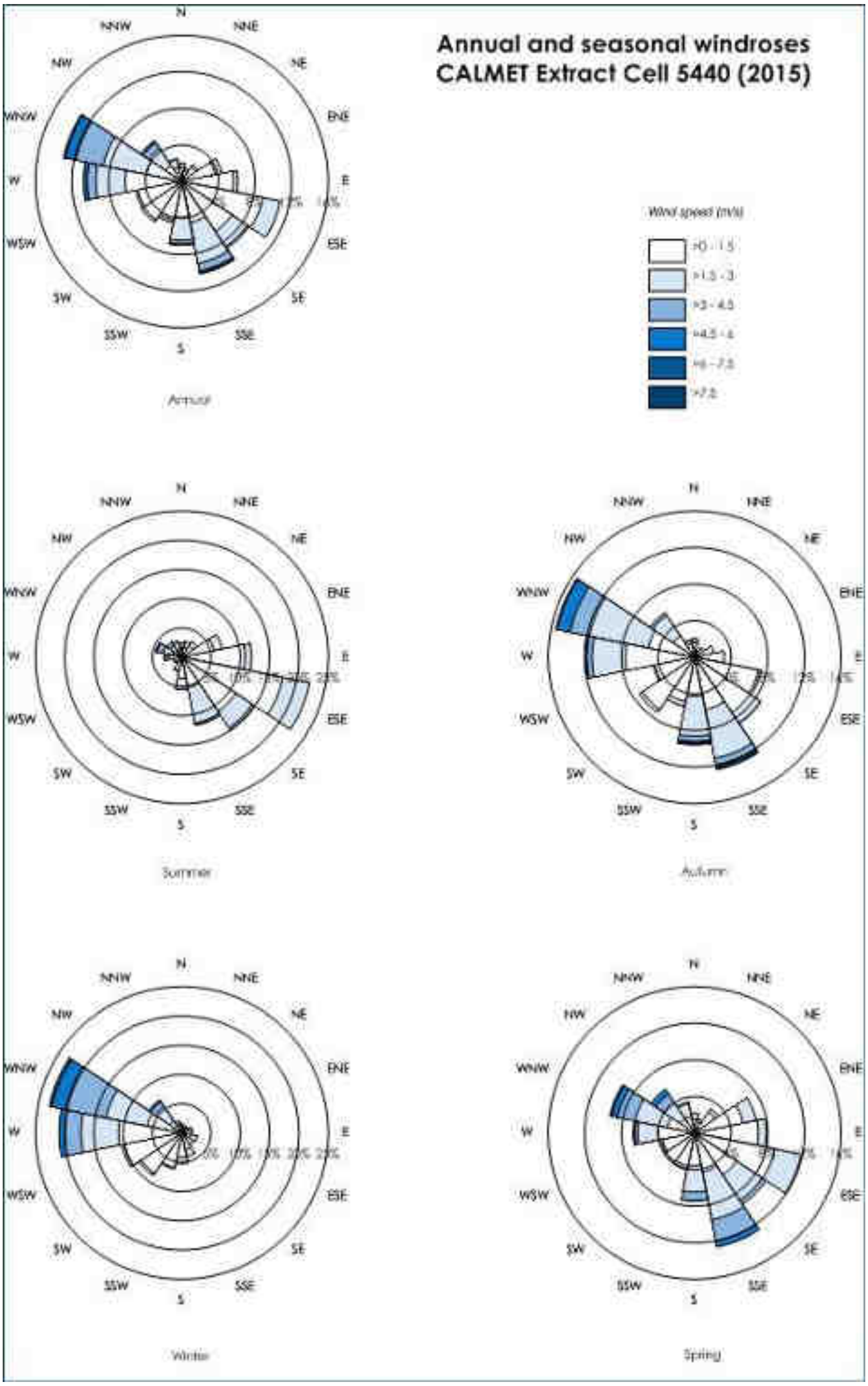

Figure 5-2: Windroses from CALMET extract (Cell ref 5440)

Figure 5-3 includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and shows sensible trends considered to be representative of the area.

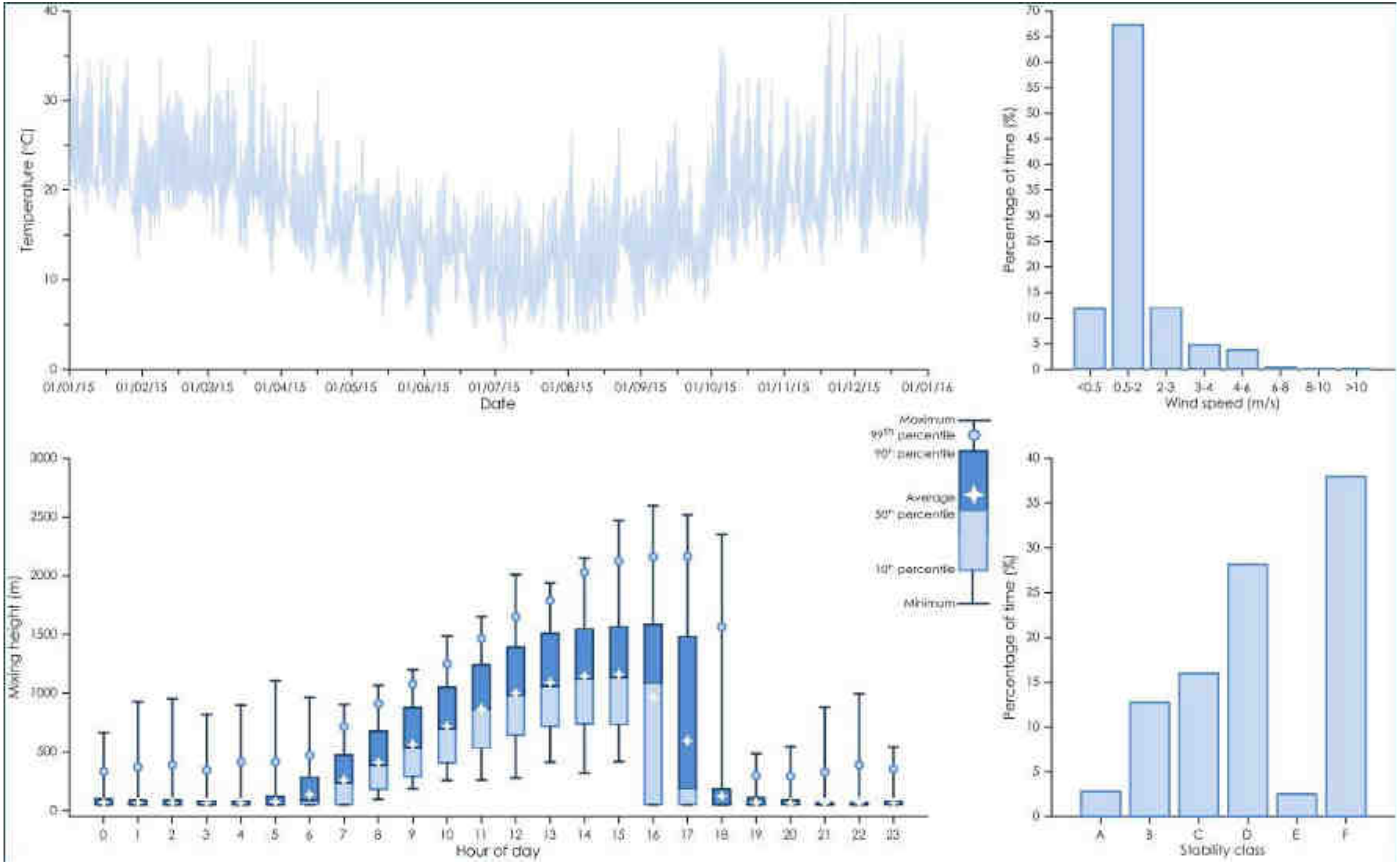

Figure 5-3: Meteorological analysis of CALMET extract (Cell ref 5440)

5.2.2 Dispersion modelling

CALPUFF modelling of dust emissions is based on the distribution of particles for each particle size category derived from the applied emission factor equations. Emissions from each activity were represented by a series of volume sources and were included in the CALPUFF model via an hourly varying emission file. Meteorological conditions associated with dust generation (such as wind speed) and levels of dust generating activity were considered in calculating the hourly varying emission rate for each source.

It should be noted that as a conservative measure, the effect of the precipitation rate (rainfall) in removing dust emissions from the atmosphere has not been considered in this assessment. As a result, the predicted impact can be expected to be elevated when examined against a typical year, especially for years with above average rainfall.

Dispersion modelling of the diesel powered equipment was conducted as point sources and impacts due to the Project were added to the ambient background level to assess potential impacts. Complete conversion of NO_X to NO_2 is conservatively assumed for these sources.

5.3 Modelling scenario

The assessment considers a single indicative mine plan year (scenario) to represent the proposed modification. The scenario is chosen to represent potential worst-case impacts in regard to the quantity of material extracted in each year, the location of the operations and the potential to generate dust at the receptor locations.

Mining operations at the Bloomfield Colliery consist of a truck and shovel operation to remove overburden material and extract the coal resources. Overburden emplacement typically occurs behind the progression of the mine extraction with rehabilitation of emplacement areas progressing as they are completed. The active mining areas and exposed areas are kept to a minimum for the efficiency of the operation and this also has a positive effect in minimising the potential amount of dust levels generated from the operations.

The scenario chosen for assessment (Year 2021) nominally represents the highest level of proposed activity for the modification in future years with a target of 1.3 million tonnes of ROM coal extracted. An indicative mine plan for the modelling scenario is presented in **Figure 5-4**.

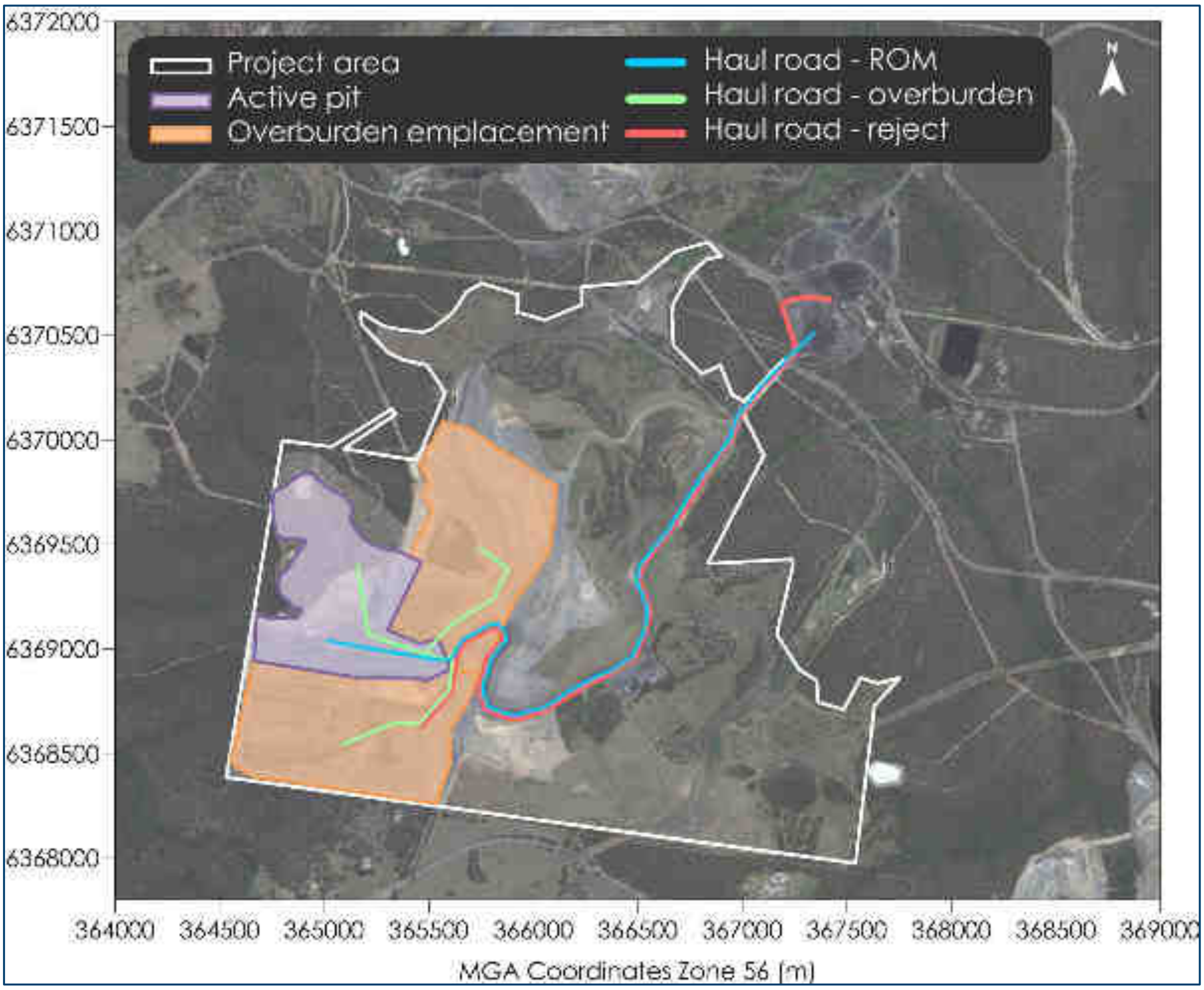

Figure 5-4: Indicative mine plan for modelling scenario

5.3.1 Emission estimation

For the modelled scenario, dust emission estimates have been calculated by analysing the various types of dust generating activities taking place and utilising suitable emission factors.

The emission factors were sourced from both locally developed and United States EPA (US EPA) developed documentation. Total dust emissions from all significant dust generating activities for the project are presented in **Table 5-3**. Estimated $PM_{2.5}$ emissions from diesel powered equipment are presented in **Table 5-4**. Detailed emission inventories and emission estimation calculations are presented in **Appendix B**.

The estimated emissions presented in **Table 5-3** are commensurate with a mining operation utilising reasonable and feasible best practice dust mitigation applied where applicable. Further details on the dust control measures applied for the Bloomfield Colliery are outlined in **Section 5.4**.

Table 5-3: Estimated emission for the proposed modification

Activity	TSP emission (kg/yr.)	PM_{10} emission (kg/yr.)	$PM_{2.5}$ emission (kg/yr.)
TS - Excavator loading topsoil from stockpile to haul truck	72	34	5
TS - Hauling topsoil to rehab area	889	195	21
TS - Emplacing topsoil at rehab area	72	34	5
TS - Rehandle topsoil at rehab area	7	3	1
OB - Drilling	6,018	3,129	181
OB - Blasting	24,871	12,933	746
OB - Excavator loading OB to haul truck	11,476	5,428	822
OB - Hauling to dump - to Creek cut	65,996	14,513	1,588
OB - Hauling to dump - to S cut	76,257	16,750	1,811
OB - Emplacing at dump - Creek cut	5,733	2,711	411
OB - Emplacing at dump - S cut	5,743	2,716	411
OB - Rehandle OB	1,148	543	82
OB - Dozers on OB in pit	19,632	4,744	2,061
OB - Dozers on OB working on dump + rehab	43,876	10,603	4,607
CL - Dozers ripping/pushing/clean-up	267	27	6
CL - Loading ROM coal to haul truck	5,688	818	108
CL - Hauling ROM to ROM Pad	43,516	9,969	1,532
CHPP - Unloading ROM to ROM Pad - Bloomfield	5,688	818	108
CHPP - Unloading ROM to ROM Pad - Abel	26,688	3,838	507
CHPP - Loading ROM to hopper	9,713	1,397	185
CHPP - Rehandle ROM at hopper	6,475	931	123
CHPP - Plant feed conveyor	14	7	1
CHPP - Crushing	4,440	1,998	370
CHPP - Screening	11,100	4,440	259
CHPP - No. 2 Conveying to CHPP	8	4	1
CHPP - Transfer	8,339	3,944	597
CHPP - Conveying to Product stockpile	17	8	1
CHPP - Unloading to Product stockpile	731	346	52
CHPP - Conveying to train load out	33	16	2
CHPP - Transfer	219	104	16
CHPP - Loading coal to train	731	346	52
CHPP - Dozers on Product stockpiles	1,926	252	42
OB - Loading Reject to haul truck	151	71	11
OB - Hauling Reject to dump	38,114	8,363	895
OB - Emplacing Reject at dump	151	71	11
WE - Overburden emplacement areas	97,835	48,918	7,338
WE - Open pit	43,775	21,888	3,283
WE - ROM stockpiles	23	12	2

Activity	TSP emission (kg/yr.)	PM_{10} emission (kg/yr.)	$PM_{2.5}$ emission (kg/yr.)
WE - Product stockpiles	185	93	14
OB - Grading roads	14,771	5,161	458
Locomotive idling	515	515	499
Total	**582,386**	**188,690**	**29,225**

TS – topsoil, OB – overburden, CL – coal, CHPP – coal preparation plant, WE – wind erosion

Table 5-4: Estimated $PM_{2.5}$ emissions from diesel powered equipment

Type	Plant detail	$PM_{2.5}$ emission (kg/yr.)
Excavator	EX500-5	580
Shovel	P&H 5700	71
Loader	994A	61
Dozer (Open Cut)	D11N	72
Dozer (Open Cut)	D10T	64
Dozer (Open Cut)	D10N	10
Dozer (Washed Coal)	D11R	47
Truck	793 C	850
Truck	789A	325
Truck	789C	81
Water Cart	777B WC	79
Water Cart	773-B	3
Grader	24H	69
Grader	16G	4
Drill	SK75	79
Drill	SK50	24
Loader	992C	118

5.3.2 Emissions from other mining operations

In addition to the estimated dust emissions from the proposed modification, emissions from all nearby approved mining operations were also modelled, in accordance with their current consent (or current proposed project), to assess potential cumulative dust effects.

Emissions estimates from these sources were derived from information provided in the air quality assessments available in the public domain at the time of modelling. These estimates are likely to be conservative, as in many cases, mines do not continually operate at the maximum extraction rates assessed in their respective environmental assessments. **Table 5-5** summarises the emissions adopted in this assessment for each of the nearby mining operations.

Table 5-5: Estimated emissions from nearby mining operations

Mining operation	TSP emission (kg/yr.)
Abel Underground*	51,064

*Source: Todoroski Air Sciences, 2012

Emissions from nearby mining operations would contribute to the background level of dust in the area surrounding the proposed modification, and these emissions were explicitly included in the modelling assessment. Additionally, there would be numerous smaller or very distant sources that contribute to the total background dust level. Modelling these sources explicitly is impractical; however, the residual level of dust due to all other such non-modelled sources has been included in the cumulative results, and the method for doing this is discussed further in **Section 5.5**.

5.3.3 Emissions from diesel powered equipment

The assessment of diesel emissions from the Project is focused on the potential emissions of oxides of nitrogen (NO_X), generally assessed as NO_2, arising from diesel powered equipment.

The ambient air quality goals for CO are set at higher concentration levels than the NO_2 goals. Based on the NO_2 monitoring data which are low compared to the goals, and consideration of the typical mix of ambient pollutant levels and associated emissions of CO, the indication is that predictions of CO would be well below the air quality goals and do not require further consideration.

Emissions from diesel powered equipment were estimated on the basis of manufacturer's data. It is noted that manufacturer's equipment performance specifications were typically categorised on the basis of the US EPA federal tier standards of emissions for diesel equipment (**Dieselnet**, **2017**).

Emissions for certain plant included non-methane-hydrocarbon (NMHC) and NO_X emissions as a single value. For the purpose of this assessment it has been conservatively assumed that the total emission (NHMC and NO_X) comprises NO_2.

The various types of diesel powered mining equipment operated at the Project is outlined in **Table 5-6**. The equipment are assumed to be equivalent to Tier 2 and plant hours of operation were based on assumed plant availability and utilisation rates for the specific equipment type. The emission rates used in the modelling are considered conservative and likely to overestimate actual emissions from mining equipment.

Table 5-6: Estimated NO_X emissions from diesel powered equipment

Type	Plant detail	NO_X emission (kg/yr.)
Excavator	EX500-5	26,579
Shovel	P&H 5700	3,241
Loader	994A	2,818
Dozer (Open Cut)	D11N	3,283
Dozer (Open Cut)	D10T	2,928
Dozer (Open Cut)	D10N	442
Dozer (Washed Coal)	D11R	2,155
Truck	793 C	38,952
Truck	789A	11,173
Truck	789C	3,724
Water Cart	777B WC	3,724
Water Cart	773-B	3,625
Grader	24H	145
Grader	16G	3,174
Drill	SK75	192
Drill	SK50	4,996
Loader	992C	1,499

5.4 Dust mitigation and management

A range of air quality mitigation measures are applied at Bloomfield Colliery to achieve a standard of mine operation consistent with current best practice for the control of dust emissions from coal mines in NSW.

The measures applied to the Project reflect those outlined in the NSW EPA document, *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*, prepared by Katestone Environmental (**Katestone, 2010**), and also imposed on mines in the current NSW EPA PRP's that relate to haul road emissions, and dust mitigation in response to adverse weather conditions.

Where applicable these controls have been applied in the dust emission estimates as shown in **Appendix B**. A summary of key dust controls applied to current operations at the Project are shown in **Table 5-7**.

Table 5-7: Summary of best practice dust mitigation measures

Activity	Dust mitigation measure
Drilling	✦ Dust suppression system. ✦ Prevent disturbance of drill cuttings. ✦ Application of water on dusty areas prior to drilling. ✦ Ceasing operations when visible dust generated.
Blasting	✦ Watering blast areas to suppress dispersion of drill cuttings. ✦ Review meteorological and blast forecast prior to blasting.
Hauling on unsealed roads	✦ Watering of haul road surfaces. ✦ Prevent material being deposited / spilled on haul roads. ✦ Restrict general vehicle speed. ✦ Trafficable areas clearly marked, vehicle movements restricted to these areas. ✦ Trafficable areas and vehicle manoeuvring areas maintained. ✦ Fleet optimisation to reduce vehicle kilometres travelled.
Material extraction/unloading	✦ Application of water on dusty areas prior to extraction. ✦ Sheltered dumping during periods of adverse weather. ✦ Minimise the fall distance of materials during loading and unloading. ✦ Ceasing operation during high dust periods.
Dozer operation	✦ Avoid use during unfavourable conditions. ✦ Minimise travel speed in dusty conditions. ✦ Travel on water watered routes between work areas.
Graders	✦ Travel on watered routes. ✦ Water haul roads immediately after grading, where possible.
Exposed areas	✦ Minimise area of disturbance, rehabilitate areas as soon as feasible. ✦ Apply interim stabilisation on areas inactive for long periods.
Rehabilitation	✦ Rehabilitation expedited to achieve maximum coverage rate. ✦ Vegetation is actively managed.

It should be noted that attainment of best practice requires ongoing improvement and thus the current best practice mitigation and dust management measures are likely to improve over time, as they are regularly reviewed and updated through the management plan framework.

5.5 Accounting for background air quality levels

All significant dust generating mining operations in the vicinity of Bloomfield Colliery were included in the dispersion model to assess the total potential dust impact. The total predicted effects from the Project (including any existing effects) were added with the measured background levels (which also include any existing effects from the colliery). This approach is conservative, (would lead to overestimation of impacts) as the existing colliery emissions are double counted in this assessment.

Ambient air quality monitoring data collected from the Bloomfield air quality monitoring network during 2015 have been applied to represent the prevailing background dust levels. For $PM_{2.5}$, the ratio of the measured PM_{10} levels at the Bloomfield and Beresfield monitors was applied to the Beresfield $PM_{2.5}$ level to estimate the potential $PM_{2.5}$ level in the vicinity of the Bloomfield Colliery.

The background dust levels applied in the assessment are presented in **Table 5-8**.

Table 5-8: Estimated contribution from other non-modelled dust sources

Dust metric	Averaging period	Unit	Estimated contribution
TSP	Annual	µg/m³	29.0
PM_{10}	Annual	µg/m³	13.9
$PM_{2.5}$	Annual	µg/m³	5.3
Dust deposition	Annual	g/m²/month	1.5

The NO_2 monitoring data presented in **Section 4.3.5** shows that the annual average NO_2 background level at the Beresfield monitor during 2015 was 39.1µg/m³, and the maximum measured 1-hour average NO_2 background level was 100.5µg/m³. In lieu of any data for the site, the annual average level at Beresfield was used and per the Victorian EPA approach[2], the 70th percentile level of 45.1µg/m³ obtained from the Beresfield data was used as the background level contributed to each of the 365 total cumulative 24 hour impact predictions.

[2]The Victorian Government's State Environment Protection Policy (Air Quality Management), **SEPP (2001)** states at Part B, 3(b) *"Proponents required to include background data where no appropriate hourly background data exists must add the 70th percentile of one year's observed hourly concentrations as a constant value to the predicted maximum concentration from the model simulation. In cases where a 24-hour averaging time is used in the model, the background data must be based on 24-hour averages. "*.

6 DISPERSION MODELLING RESULTS

The dispersion model predictions for the assessed scenario are presented in this section and include predictions for the operation in isolation (incremental impact) and the operation with other sources (total (cumulative) impact). The results show the estimated:

- Maximum 24 hour average $PM_{2.5}$ and PM_{10} concentrations;
- Annual average $PM_{2.5}$ and PM_{10} concentrations;
- Annual average TSP concentrations; and
- Annual average dust (insoluble solids) deposition rates.

It is important to note that when assessing impacts per the maximum 24-hour average $PM_{2.5}$ and PM_{10} criterion the predictions show the highest predicted 24-hour average concentrations that were modelled at each point within the modelling domain for the worst day (a 24-hour period) in the one year long modelling period. When assessing the total (cumulative) 24-hour average impacts based on model predictions, challenges arise with identification and quantification of emissions from non-modelled sources over the 24-hour period. Due to these factors, the 24-hour average impacts need to be calculated differently to annual averages and as such, the predicted total (cumulative) impacts for maximum 24-hour average $PM_{2.5}$ and PM_{10} concentrations have been addressed specifically in **Section 6.4.**

Each of the sensitive receptor locations (residences) shown in **Figure 2-1** and detailed in **Appendix A** were assessed individually as discrete receptors with the predicted results presented in tabular form in the following section. Associated isopleth diagrams of the dispersion modelling results are presented in **Appendix C**.

6.1 Predicted dust concentrations

Table 6-1 presents the predicted particulate dispersion modelling results at each of the assessed sensitive receptor locations. The predicted cumulative $PM_{2.5}$, PM_{10}, TSP and dust deposition levels due to the Project with the estimated background levels are presented in **Table 6-2**.

The results indicate the predicted levels would be below the relevant criteria at the assessed sensitive receptor locations.

Table 6-1: Dispersion modelling results for sensitive receptors – Incremental impact

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/month)
	Incremental impact					
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average
	-	-	-	-	-	2
E	3	<1	17	2	3	<0.1
F	4	1	21	3	5	0.1
G	7	1	38	4	7	0.1
H	7	1	35	7	10	0.1
I	2	<1	9	1	2	<0.1
K	3	<1	16	1	2	<0.1
L	3	1	13	3	5	0.1
M	6	1	29	3	5	0.1
N	4	<1	18	2	4	<0.1

Table 6-2: Dispersion modelling results for sensitive receptors – Cumulative impact

Receptor ID	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/month)
	Cumulative impact			
	Annual average			
	8	25	90	4
E	6	16	32	1.5
F	6	17	34	1.6
G	6	18	36	1.6
H	7	21	39	1.6
I	6	15	31	1.5
K	6	15	31	1.5
L	6	17	34	1.6
M	6	17	34	1.6
N	6	16	33	1.5

6.2 Dust impacts on more than 25 per cent of privately-owned land

The potential impacts due to the Project, extending over more than 25 per cent of any privately-owned land, have been evaluated using the predicted pollutant dispersion contours.

Figure 6-1 presents the extent of the maximum 24-hour average PM_{10} level ($50 \mu g/m^3$) due to the Project in isolation. The maximum 24-hour average PM_{10} level was found to have the greatest extent of any of the other assessed dust metrics and hence represents the most impacting parameter.

The isopleth in **Figure 6-1** indicates there is only one privately-owned land parcel (vacant land within the mining lease) which would be impacted more than 25 per cent.

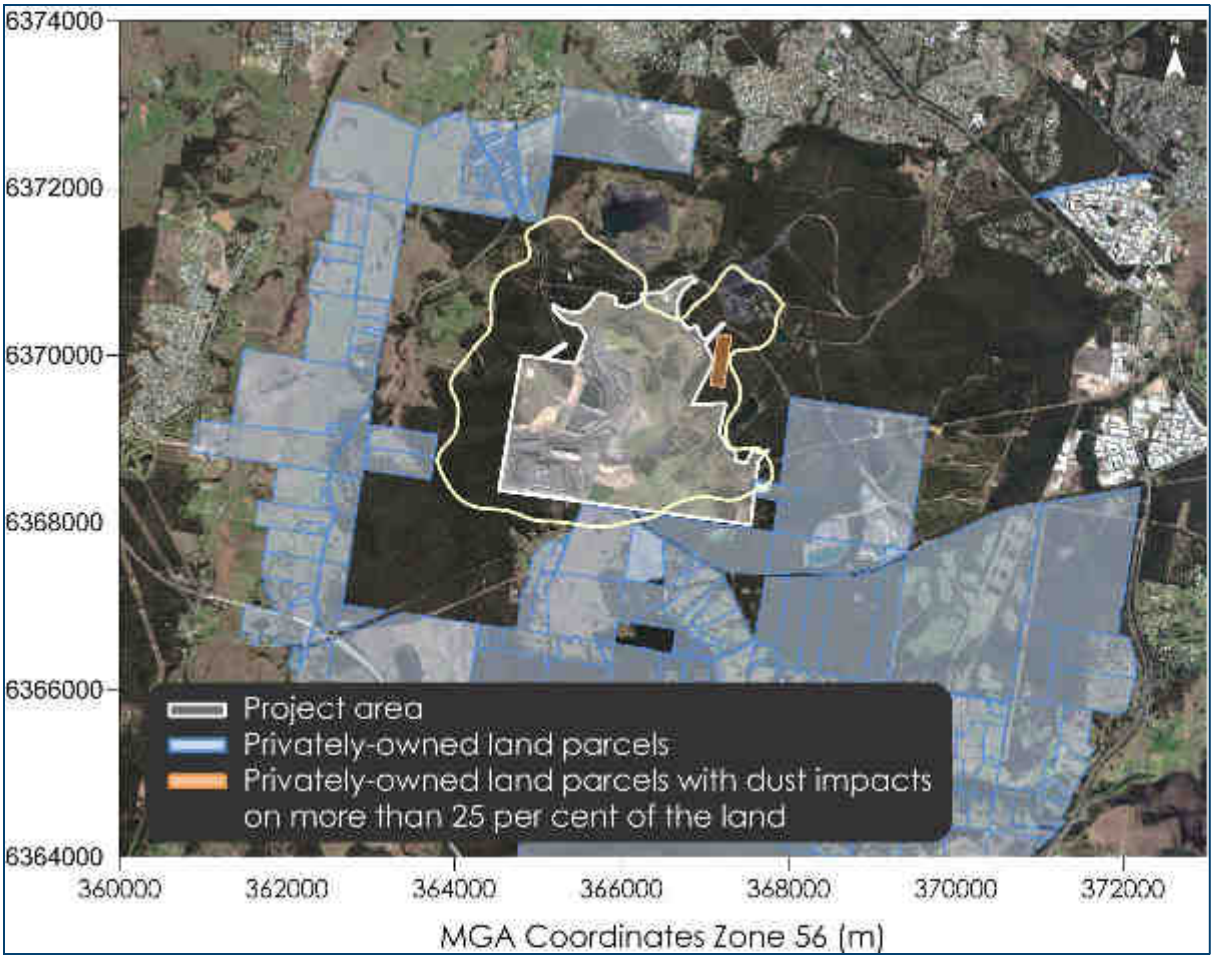

Figure 6-1: Predicted maximum 24-hour average PM_{10} level

6.3 Assessment of total (cumulative) 24-hour average $PM_{2.5}$ and PM_{10} concentrations

An assessment of cumulative 24-hour average $PM_{2.5}$ and PM_{10} impacts was undertaken in accordance with the methods outlined in Section 11.2 of the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA 2017**).

As shown in **Section 4.3**, maximum background levels have in the past reached levels near to the 24-hour average $PM_{2.5}$ and PM_{10} criterion level. Due to these elevated levels in the monitoring data, the screening Level 1 NSW EPA approach of adding maximum background levels to maximum predicted Project only levels would not be appropriate for assessing the potential 24-hour average impacts on these elevated days.

In such situations, the NSW EPA approach applies a more thorough Level 2 assessment whereby the measured background level on a given day is added contemporaneously with the corresponding Project only level predicted using the same day's weather data. This method factors into the assessment the spatial and temporal variation in background levels affected by the weather and existing sources of dust in the area on a given day. However, even with a detailed Level 2 approach, any air dispersion modelling has limitations in predicting short term impacts which may arise many years into the future, and these limitations need to be understood when interpreting the results.

Ambient (background) dust concentration data for January 2015 to December 2015 from the Bloomfield HVAS were used for the days on which the data are available, and data from the TEOM and BAM monitors at Beresfield were otherwise applied to complete the Level 2 contemporaneous 24-hour average assessment. The Beresfield monitoring station is the closest monitoring station where suitable data for a Level 2 assessment are available.

The data used for the background levels would already include emissions from various natural and anthropogenic sources including the existing Bloomfield Colliery and thus would provide a conservative estimate of the prevailing measured background levels in the vicinity. The assessment has thus double counted the existing emissions from the colliery, and will overestimate the actual levels by some margin.

Table 6-3 provides a summary of the findings of the contemporaneous assessment at each sensitive receptor location. Detailed tables of the full assessment results are provided in **Appendix D**.

Table 6-3: NSW EPA contemporaneous assessment - maximum number of additional days above 24-hour average criterion without implementation of predictive measures

Receptor ID	$PM_{2.5}$ analysis	PM_{10} analysis
E	0	1
F	0	1
G	0	0
H	0	0
I	0	0
K	0	0
L	0	0
M	0	3
N	0	2

The results in **Table 6-3** indicate that there is potential for cumulative 24-hour average $PM_{2.5}$ and PM_{10} impacts to occur at the assessed locations without the use of reactive or predictive management systems to control short term dust levels.

Further analysis of the predicted cumulative PM_{10} impacts at Receptor M and N are presented in **Figure 6-2** and **Figure 6-3**. The figures show time series plots of the 24-hour average $PM_{2.5}$ and PM_{10} concentrations predicted to be experienced as a result of the Project. The orange bars represent the existing ambient background level at the monitoring location and the blue bars represent the predicted incremental contribution due to the Project.

The predicted exceedances of the PM_{10} 24-hour average at these locations only marginally exceed the criteria (see **Figure 6-2** and **Figure 6-3**). Given the conservatism in the assessment due to double counting the existing colliery emissions, etc., these effects may not actually occur, however the small reductions needed could be easily achieved through predictive and reactive dust control strategies, which would be operated at the site to mitigate such potential impacts.

Current predictive and reactive dust control measures applied at the Bloomfield Colliery include the use of predictive meteorological modelling software which incorporates regional weather station data and forecasts to predict daily weather events which may exacerbate dust impacts from planned operations. This forward planning is coupled with the use of real-time on-site weather station data to assist with planning decisions.

Bloomfield Colliery also operate a network of portable real-time dust monitors. These monitors are nominally positioned upwind and downwind of mining activity with the measured levels providing an estimate of the potential amount of dust generated from the operations which can signal if excessive dust is being generated and further dust control is required.

Visual inspections of dust plumes are also used to identify those activities which require further controls to be applied at times such as watering, or activities which may need to be modified to reduce the amount of dust being generated, such as temporarily ceasing a particular activity.

To evaluate the effectiveness of the implementation of such predictive and reactive measures at the Project, the dispersion modelling was re-run to consider the effects of applying additional control measures and temporarily pausing activities in the pit and overburden areas during periods of elevated dust.

Only the activities that can be controlled in the pit and overburden areas were ceased in the model, and dust from other sources such as wind erosion remained as a source of dust in the modelling representing the implementation of mitigation measures.

Table 6-4 outlines the maximum number of additional days in a year predicted to exceed the 24-hour criterion with the implementation of reactive measures.

Table 6-4: NSW EPA contemporaneous assessment - maximum number of additional days above 24-hour average criterion with implementation of predictive measures

Receptor ID	PM_{10} analysis
E	0
F	0
G	0
H	0
I	0
K	0
L	0
M	0
N	0

While the modelling methodology will inherently over predict impacts, the results nevertheless indicate that all of the predicted additional exceedance days due to the Project would be prevented using the reactive controls that the mine would operate.

We note that as the Project is not seeking changes to the intensity or general extent of mining, or any changes in the mining equipment fleet or mining method, it is anticipated that the Project will not result in any significant change in the existing level of impact.

As observed in the monitoring data, the actual 24-hour PM_{10} levels in the vicinity of the receptor near the colliery are significantly lower than the levels measured in the urban areas nearby at Beresfield where the 24-hour PM_{10} levels are on average 39 per cent higher.

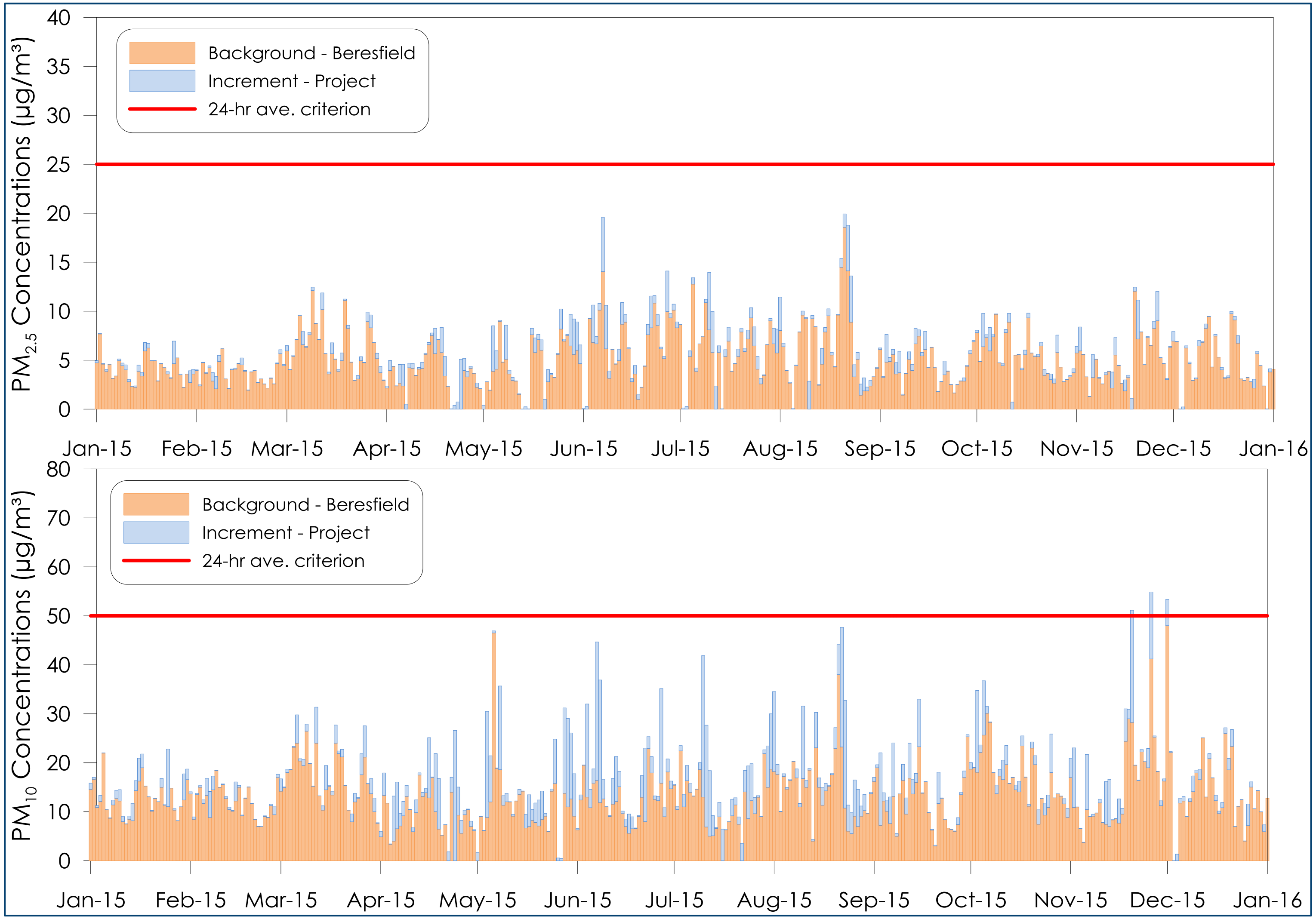

Figure 6-2: Predicted 24-hour average $PM_{2.5}$ and PM_{10} concentrations for sensitive receptor location M (unmitigated)

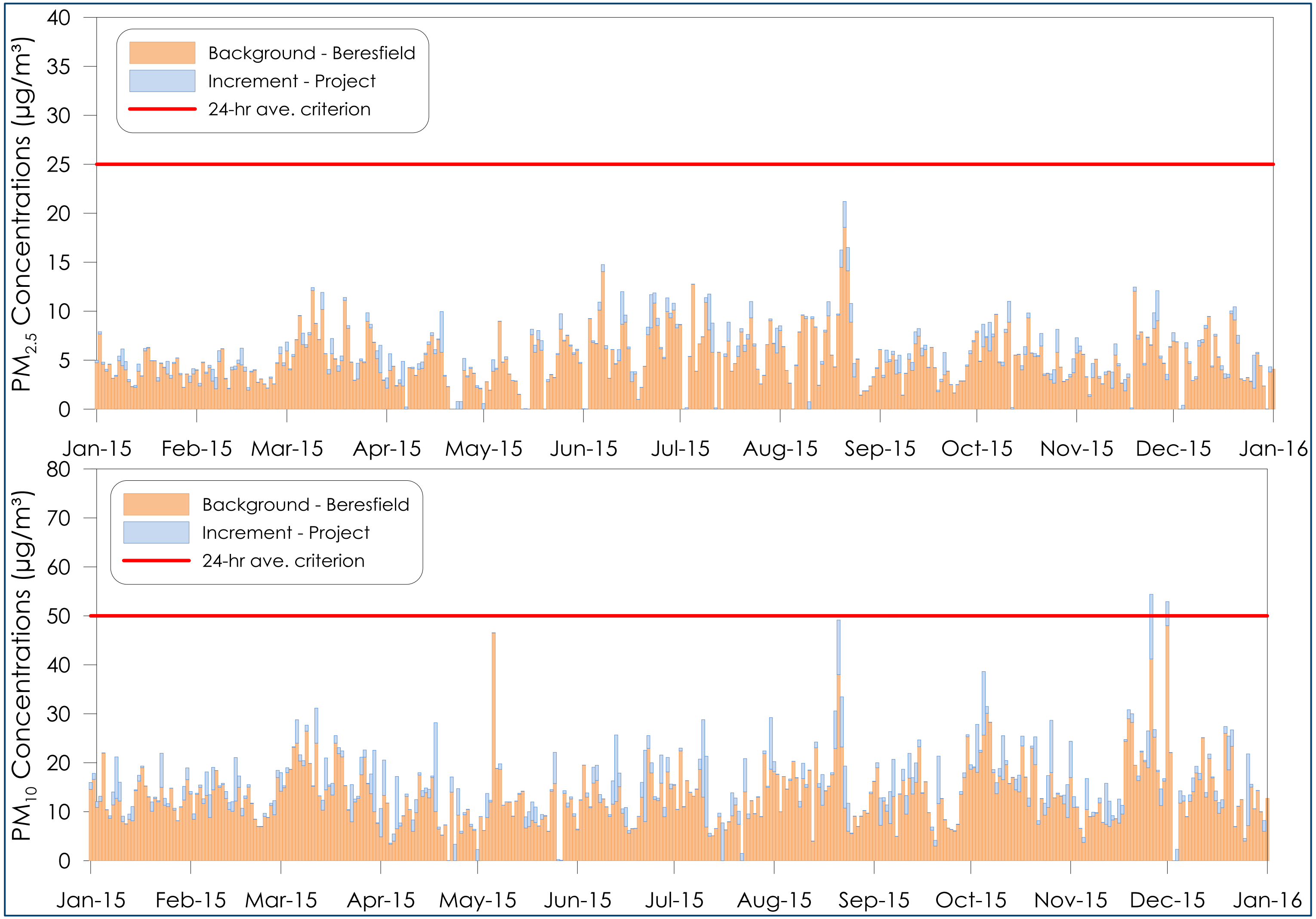

Figure 6-3: Predicted 24-hour average $PM_{2.5}$ and PM_{10} concentrations for sensitive receptor location N (unmitigated)

6.4 Predicted NO_2 concentrations

Table 6-5 presents the predicted NO_2 dispersion modelling results at each of the assessed sensitive receptor locations. Associated isopleth diagrams of the dispersion modelling results are presented in **Appendix C**.

The results in **Table 6-5** indicate the predicted 1-hour and annual average NO_2 concentrations would be below the relevant criteria at the assessed sensitive receptor locations.

Table 6-5: Dispersion modelling results for sensitive receptors – NO_2 concentrations (µg/m³)

Receptor ID	Incremental impact		Cumulative impact	
	24-hour average	Annual average	24-hour average	Annual average
	-	-	246	62
E	60	0.8	105	40
F	65	1.0	110	40
G	60	2.0	105	41
H	70	2.2	115	41
I	26	0.4	71	40
K	27	0.5	72	40
L	35	0.6	80	40
M	102	1.4	147	40
N	118	1.2	164	40

7 SUMMARY AND CONCLUSIONS

This study has examined potential air quality impacts that may arise from the proposed modifications to the Bloomfield Colliery per the current NSW EPA Approved Methods guidelines.

The approach taken in this study is conservative, and would significantly overestimate the likely impacts. For example, conservative emission estimation is applied using maximum mining rates, the dispersion modelling has not included the effect of rainfall, or in-pit dust retention, and the background levels used mean that the existing dust from the colliery is double counted in the cumulative assessment.

The modelling methodology uses recent and comprehensive weather and dust monitoring data and incorporates inventories for TSP, PM_{10} and $PM_{2.5}$ emissions from dust generating activity and diesel exhaust.

As the Project is not seeking changes to the intensity or general extent of mining, or any changes in the mining equipment fleet or mining method, it is anticipated that the Project will not result in any significant change in the existing level of impact.

As observed in the monitoring data, the actual 24-hour PM_{10} levels in the vicinity of the receptor near the colliery are significantly lower than the levels measured in the urban areas nearby at Beresfield, where the 24-hour PM_{10} levels are on average 39 per cent higher.

Thus, as expected, the results show that the dust levels would be below all relevant criteria at the privately-owned receptor locations for the proposed Project.

It is noted that the results also indicate that without reactive or predictive mitigation measures there is some limited potential for cumulative 24-hour average PM_{10} levels to marginally exceed the NSW EPA impact assessment criteria, but with the use of the now routine day-to-day reactive and predictive systems at the operations, no unacceptable levels of impact would be expected to arise.

Overall, the potential air quality impacts associated with the proposed modifications to the Bloomfield Colliery are not expected to be significantly different from the existing approved operations, and the results of the assessment demonstrate that if approved, the Project would not lead to any unacceptable impacts on air quality.

8 REFERENCES

Bureau of Meteorology (2017)

Climate statistics for Australian locations, Bureau of Meteorology website. Accessed March 2017 http://www.bom.gov.au/climate/averages

Dieselnet (2017)

Emission Standards – United States, Nonroad Diesel Engines, Dieselnet website. <https://www.dieselnet.com/standards/us/nonroad.php#tier3>. Accessed August 2017.

Katestone Environmental Pty Ltd (2010)

"NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining", Katestone Environmental Pty Ltd prepared for DECCW, 2010.

National Pollutant Inventory (2012)

"Emission Estimation Technique Manual for Mining Version 3.1", National Pollutant Inventory, January 2012.

New South Wales Environment Protection Authority (2014)

"NSW Coal Mining Benchmarking Study Best-practice measures for reducing non-road diesel exhaust emissions", December 2014.

NSW EPA (2017)

"Approved Methods for the Modelling and Assessment of Air Pollutants in NSW", January 2017.

NSW Government (2014)

"Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments". NSW Government, 15 December 2014.

Parsons Brinckerhoff (2012)

"Northern Sydney Freight Corridor Gosford Passing Loops Air Quality Impact Assessment", prepared by Parsons Brinkerhoff on behalf of Transport for NSW, June 2012

Todoroski Air Sciences (2012)

"Air Quality Impact and Greenhouse Gas Assessment Abel Underground Mine", prepared by Todoroski Air Sciences on behalf of Donaldson Coal Pty Ltd, November 2012.

TRC (2011)

"Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia", Prepared for the NSW Office of Environment and Heritage by TRC Environmental Corporation.

US EPA (1985 and updates)

"Compilation of Air Pollutant Emission Factors", AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

Appendix A

Sensitive receptor locations

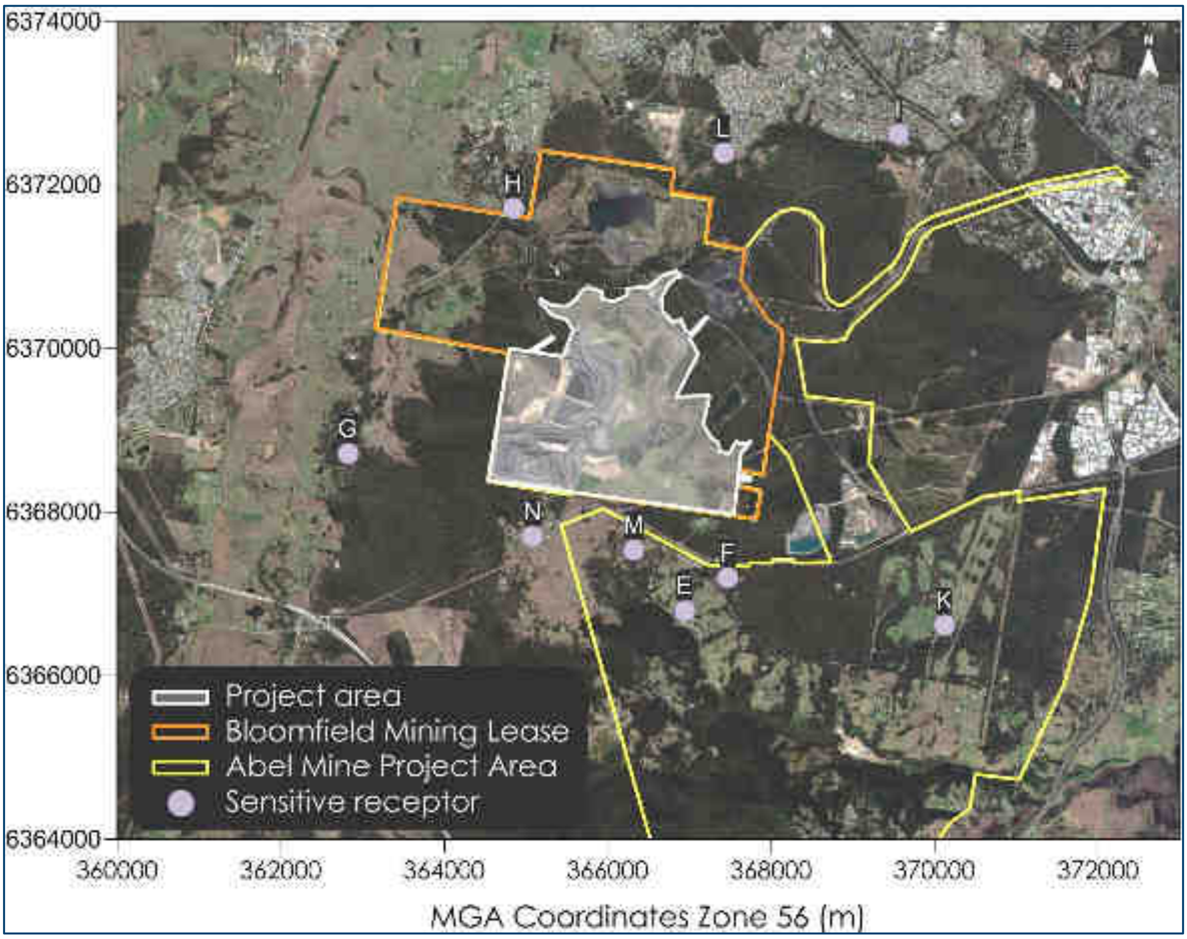

Figure A-1: Location of sensitive receptors assessed in this study

Table A-1: List of sensitive receptors assessed in this study

ID	Easting	Northing
E	366938	6366795
F	367471	6367197
G	362820	6368716
H	364843	6371713
I	369556	6372623
K	370119	6366617
L	367414	6372389
M	366319	6367539
N	365080	6367704

Appendix B

Emission Calculation

Emission Calculation

The mining schedule and mine plan designs provided by the Proponent have been combined with emissions factor equations that relate to the quantity of dust emitted from particular activities based on intensity, the prevailing meteorological conditions, and composition of the material being handled.

Emission factors and associated controls have been sourced from the US EPA AP42 Emission Factors (**US EPA, 1985 and Updates**), the National Pollutant Inventory document *Emission Estimation Technique Manual for Mining, Version 3.1* (**NPI, 2012**) and the NSW EPA document, *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining*, prepared by Katestone Environmental (**Katestone Environmental, 2010**).

The emission factor equations used for each dust generating activity are outlined in **Table C-1** below. A detailed emission inventory for the modelled year is presented in **Table C-2**.

Control factors include the following:

- Hauling on unpaved surfaces – 80% control for watering of trafficked areas. Note the control factor is only applied to the mechanically generated emissions and not the contributions from the diesel exhaust emissions.
- Drilling overburden material – 70% control for use of dust suppression.
- Unloading ROM to hopper at CHPP – 70% control for use of enclosure.
- Conveyor transfer points – 70% control enclosures.
- Conveyor – 70% control for enclosed conveyors.
- Coal stockpiles – 50% for watering stockpile surface.

Potential air emissions associated with locomotives idling at the rail loop have been included in the emissions inventory. Emission estimates assume three locomotives idling continuously with emission based on Class 81 locomotive emission rates (**Parsons Brinckerhoff, 2012**).

Air emissions associated with the operation of the diesel powered equipment have been estimated based on the number of equipment, power rating, hours of operation and emission factors sourced from the NSW EPA document *NSW Coal Mining Benchmarking Study Best-practice measures for reducing non-road diesel exhaust emissions* (**NSW EPA, 2014**). Emission factors are based on Tier 2 equipment. A detailed emission inventory for diesel emissions is presented in **Table C-3**.

Table C-1: Emission factor equations

Activity	Emission factor equation		
	TSP	PM_{10}	$PM_{2.5}$
Drilling (overburden)	$EF = 0.59\ kg/hole$	$0.52 \times TSP$	$0.03 \times TSP$
Blasting (overburden)	$EF = 0.00022 \times A^{1.5}\ kg/blast$	$0.52 \times TSP$	$0.03 \times TSP$
Loading / emplacing overburden & loading product coal to stockpile & conveyor transfer	$EF = 0.74 \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right)\ kg/tonne$	$EF = 0.35 \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right)\ kg/tonne$	$EF = 0.053 \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right)\ kg/tonne$
Hauling on unsealed surfaces	$EF = \left(\frac{0.4536}{1.6093}\right) \times 4.9 \times (s/12)^{0.7} \times (1.1023 \times M/3)^{0.45}\ kg/VKT$	$EF = \left(\frac{0.4536}{1.6093}\right) \times 1.5 \times (s/12)^{0.9} \times (1.1023 \times M/3)^{0.45}\ kg/VKT$	$EF = \left(\frac{0.4536}{1.6093}\right) \times 0.15 \times (s/12)^{0.9} \times (1.1023 \times M/3)^{0.45}\ kg/VKT$
Dozers on overburden	$EF = 2.6 \times \frac{s^{1.2}}{M^{1.3}}\ kg/hour$	$EF = 0.45 \times \frac{s^{1.5}}{M^{1.4}} \times 0.75\ kg/hour$	$EF = 2.6 \times \frac{s^{1.2}}{M^{1.3}} \times 0.105\ kg/hour$
Dozers on coal	$EF = 35.6 \times \frac{s^{1.2}}{M^{1.4}}\ kg/hour$	$EF = 8.44 \times \frac{s^{1.5}}{M^{1.4}} \times 0.75\ kg/hour$	$EF = 35.6 \times \frac{s^{1.2}}{M^{1.4}} \times 0.022\ kg/hour$
Loading / emplacing coal	$EF = \frac{\left(0.58 \times \left(\frac{s}{2}\right)^{1.2} \times \left(\frac{U}{2}\right)^{1.3}\right)}{M^{1.2}}\ kg/tonne$	$EF = \frac{\left(0.596 \times \left(\frac{s}{2}\right)^{0.9} \times \left(\frac{U}{2}\right)^{1.3}\right)}{M^{1.2}} \times 0.75\ kg/tonne$	$EF = TSP \times 0.019\ kg/tonne$
Wind erosion on exposed areas & conveyors	$EF = 850\ kg/ha/year$	$0.5 \times TSP$	$0.075 \times TSP$
Wind erosion on stockpiles	$EF = 1.9 \times \left(\frac{s}{1.5}\right) \times 365 \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right) kg/ha/year$	$0.5 \times TSP$	$0.075 \times TSP$
Grading roads	$EF = 0.0034 \times sp^{2.5}\ kg/VKT$	$EF = 0.0056 \times sp^{2.0} \times 0.6\ kg/VKT$	$EF = 0.0034 \times sp^{2.5} \times 0.031\ kg/VKT$

EF = emission factor, A = area of blast (m^2), U = wind speed (m/s), M = moisture content (%), s = silt content (%), VKT = vehicle kilometres travelled (km), p = number of days per year when rainfall is greater than 0.25mm (days), f = percentage of time that wind speed is greater than 5.4m/s (%), sp = speed of grader (km/h).

Table C-2: Emission inventory

ACTIVITY	TSP emission	PM10 emission	PM25 emission	Intensity	Units	Emission Factor - TSP	Emission Factor - PM10	Emission Factor - PM25	Units	Variable 1	Units	Variable 2	Units	Variable 3 - TSP	Variable 3 - PM10	Variable 3 - PM25	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
TS - Excavator loading topsoil from stockpile to hau	72	34	5	96,000	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
TS - Hauling topsoil to rehab area	889	195	21	96,000	t/yr	0.046	0.010	0.001	kg/t	195	tonnes/load	2.8	km/return trip	3.2	0.7	0.1	kg/VKT	2.2	% silt c	249	Ave weight (t	80	% Control
TS - Emplacing topsoil at rehab area	72	34	5	96,000	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
TS - Rehandle topsoil at rehab area	7	3	1	9,600	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
OB - Drilling	6,018	3,129	181	34,000	holes/yr	0.59	0.31	0.02	kg/hole													70	% Control
OB - Blasting	24,871	12,933	746	86	blasts/yr	289	150.4	8.7	kg/blast	12,000	Area of blast in m^2												
OB - Excavator loading OB to haul truck	11,476	5,428	822	15,360,000	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
OB - Hauling to dump - to Creek cut	65,996	14,513	1,588	7,673,328	t/yr	0.043	0.009	0.001	kg/t	195	tonnes/load	2.6	km/return trip	3.2	0.7	0.1	kg/VKT	2.2	% silt c	249	Ave weight (t	80	% Control
OB - Hauling to dump - to S cut	76,257	16,750	1,811	7,686,672	t/yr	0.050	0.011	0.001	kg/t	195	tonnes/load	3.0	km/return trip	3.2	0.7	0.1	kg/VKT	2.2	% silt c	249	Ave weight (t	80	% Control
OB - Emplacing at dump - Creek cut	5,733	2,711	411	7,673,328	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
OB - Emplacing at dump - S cut	5,743	2,716	411	7,686,672	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
OB - Rehandle OB	1,148	543	82	1,536,000	t/yr	0.00075	0.00035	0.00005	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	2	MC in %										
OB - Dozers on OB in pit	19,632	4,744	2,061	1,173	hrs/yr	16.7	4.0	1.8	kg/h	10	silt content in %	2	MC in %										
OB - Dozers on OB working on dump + rehab	43,876	10,603	4,607	2,622	hrs/yr	16.7	4.0	1.8	kg/h	10	silt content in %	2	MC in %										
CL - Dozers ripping/pushing/clean-up	267	27	6	321	hrs/yr	0.8	0.1	0.0	kg/h	0.25	silt content in %	5	MC in %										
CL - Loading ROM coal to haul truck	5,688	818	108	1,300,000	t/yr	0.004	0.001	0.0001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	5	MC in %					0.25	silt content in %				
CL - Hauling ROM to ROM Pad	43,516	9,969	1,532	1,300,000	t/yr	0.165	0.036	0.004	kg/t	195	tonnes/load	10.0	km/return trip	3.2	0.7	0.1	kg/VKT	2.2	% silt c	249	Ave weight (t	80	% Control
CHPP - Unloading ROM to ROM Pad - Bloomfield	5,688	818	108	1,300,000	t/yr	0.004	0.001	0.0001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	5	MC in %					0.25	silt content in %				
CHPP - Unloading ROM to ROM Pad - Abel	26,688	3,838	507	6,100,000	t/yr	0.004	0.001	0.0001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	5	MC in %					0.25	silt content in %				
CHPP - Loading ROM to hopper	9,713	1,397	185	7,400,000	t/yr	0.004	0.001	0.0001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	5	MC in %					0.25	silt content in %			70	% Control
CHPP - Rehandle ROM at hopper	6,475	931	123	1,480,000	t/yr	0.004	0.001	0.0001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	5	MC in %					0.25	silt content in %				
CHPP - Plant feed conveyor	14	7	1	0.054	ha	850	425	64	kg/ha/yr													70	% Control
CHPP - Crushing	4,440	1,998	370	7,400,000	t/yr	0.0006	0.00027	0.00005	kg/t														
CHPP - Screening	11,100	4,440	259	7,400,000	t/yr	0.0015	0.0006	0.000035	kg/t														
CHPP - No. 2 Conveying to CHPP	8	4	1	0.031	ha	850	425	64	kg/ha/yr													70	% Control
CHPP - Transfer	8,339	3,944	597	7,400,000	t/yr	0.00376	0.00178	0.00027	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	0.631	MC in %									70	% Control
CHPP - Conveying to Product stockpile	17	8	1	0.067	ha	850	425	64	kg/ha/yr													70	% Control
CHPP - Unloading to Product stockpile	731	346	52	5,994,000	t/yr	0.00012	0.00006	0.00001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	7.3	MC in %										
CHPP - Conveying to train load out	33	16	2	0.128	ha	850	425	64	kg/ha/yr													70	% Control
CHPP - Transfer	219	104	16	5,994,000	t/yr	0.00012	0.00006	0.00001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	7.3	MC in %									70	% Control
CHPP - Loading coal to train	731	346	52	5,994,000	t/yr	0.00012	0.00006	0.00001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	7	MC in %										
CHPP - Dozers on Product stockpiles	1,926	252	42	1,100	hrs/yr	1.8	0.2	0.0	kg/h	0.7	silt content in %	7	MC in %										
OB - Loading Reject to haul truck	151	71	11	1,406,000	t/yr	0.00011	0.00005	0.00001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	8	MC in %										
OB - Hauling Reject to dump	38,114	8,363	895	1,406,000	t/yr	0.135	0.030	0.003	kg/t	195	tonnes/load	8.2	km/return trip	3.2	0.7	0.1	kg/VKT	2.2	% silt c	249	Ave weight (t	80	% Control
OB - Emplacing Reject at dump	151	71	11	1,406,000	t/yr	0.00011	0.00005	0.00001	kg/t	0.631	(WS/2.2)$^{1.3}$ in m/s	8	MC in %										
WE - Overburden emplacement areas	97,835	48,918	7,338	115.1	ha	850	425	64	kg/ha/yr														
WE - Open pit	43,775	21,888	3,283	51.5	ha	850	425	64	kg/ha/yr														
WE - ROM stockpiles	23	12	2	6.1	ha	8	4	1	kg/ha/yr	0.25	silt content (%)	73	No. of rain days (>0.25mm)					0.8	% of time wind speed >5.4m/s			50	% Control
WE - Product stockpiles	185	93	14	17.3	ha	21	11	2	kg/ha/yr	0.70	silt content (%)	73	No. of rain days (>0.25mm)					0.8	% of time wind speed >5.4m/s			50	% Control
OB - Grading roads	14,771	5,161	458	24,000	km	0.62	0.22	0.02	kg/VKT	8	speed of graders in km/h												
Locomotive idling	515	515	499	8,760	hrs/yr																		
Total TSP emissions (kg/yr.)	**582,386**	**188,690**	**29,225**																				
TSP/ROM Ratio	**0.448**																						

Table C-3: Emissions inventory – Diesel emissions

Plant Category	Plant Detail	Likely Total Yearly Hours	Number of Equip	Power (hp)	LF	Tier 2	Summary of $PM_{2.5}$ emissions (kg/year)	Summary of PM_{10} emissions (kg/year)
Excavator	Hitachi EX500-5	4100	1	3,001	0.45	0.1047	580	598
Shovel	P&H 5700	500	1	3,001	0.45	0.1047	71	73
Loader	994A	750	1	1,739	0.45	0.1047	61	63
Dozers (Open Cut)	D11N	1676	2	850	0.48	0.1047	72	74
Dozers (Open Cut)	D10T	2120	2	599	0.48	0.1047	64	66
Dozers (Open Cut)	D10N	320	1	599	0.48	0.1047	10	10
Dozers (Washed Coal)	D11R	1100	1	850	0.48	0.1047	47	48
Trucks (Open Cut)	793 C	10500	3	2,415	0.32	0.1047	850	876
Trucks (Open Cut)	789A	5013	3	1,451	0.32	0.1047	244	251
Trucks (Open Cut)	789A	1671	1	1,451	0.32	0.1047	81	84
Trucks (Open Cut)	789C	1671	1	1,451	0.32	0.1047	81	84
Water Carts	777B WC	2500	2	944	0.32	0.1046	79	81
Water Carts	773-B	100	1	944	0.32	0.1046	3	3
Graders	24H	2700	1	532	0.46	0.1047	69	71
Graders	16G	300	1	290	0.46	0.1047	4	4
Drills	Sk75	2500	1	801	0.52	0.0755	79	81
Drills	Sk50	750	1	801	0.52	0.0755	24	24
Loaders	992C	3084	4	814	0.45	0.1046	118	122

Appendix C

Isopleth Diagrams

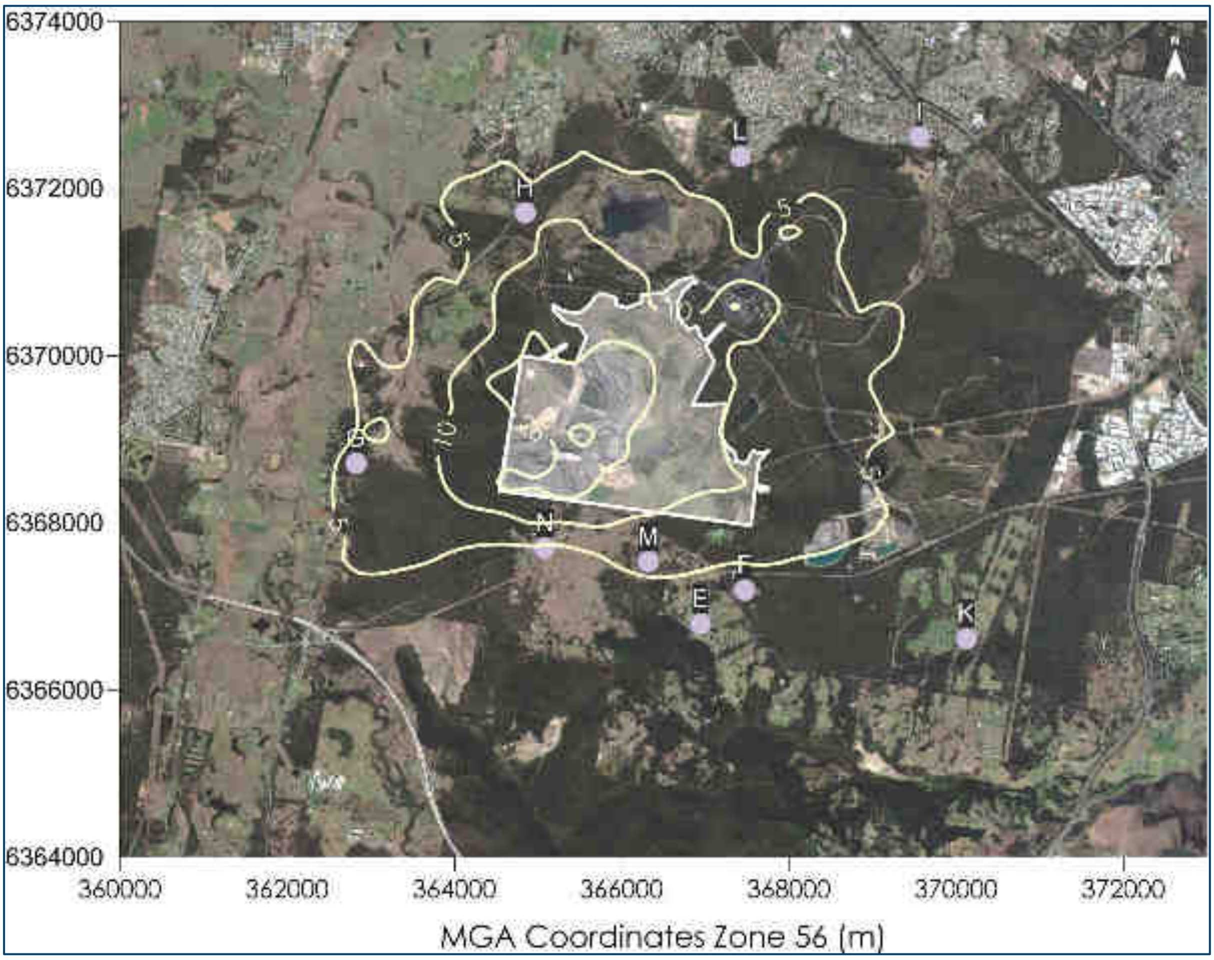

Figure C-1: Predicted maximum 24-hour average $PM_{2.5}$ concentrations due to emissions from the Project (µg/m³)

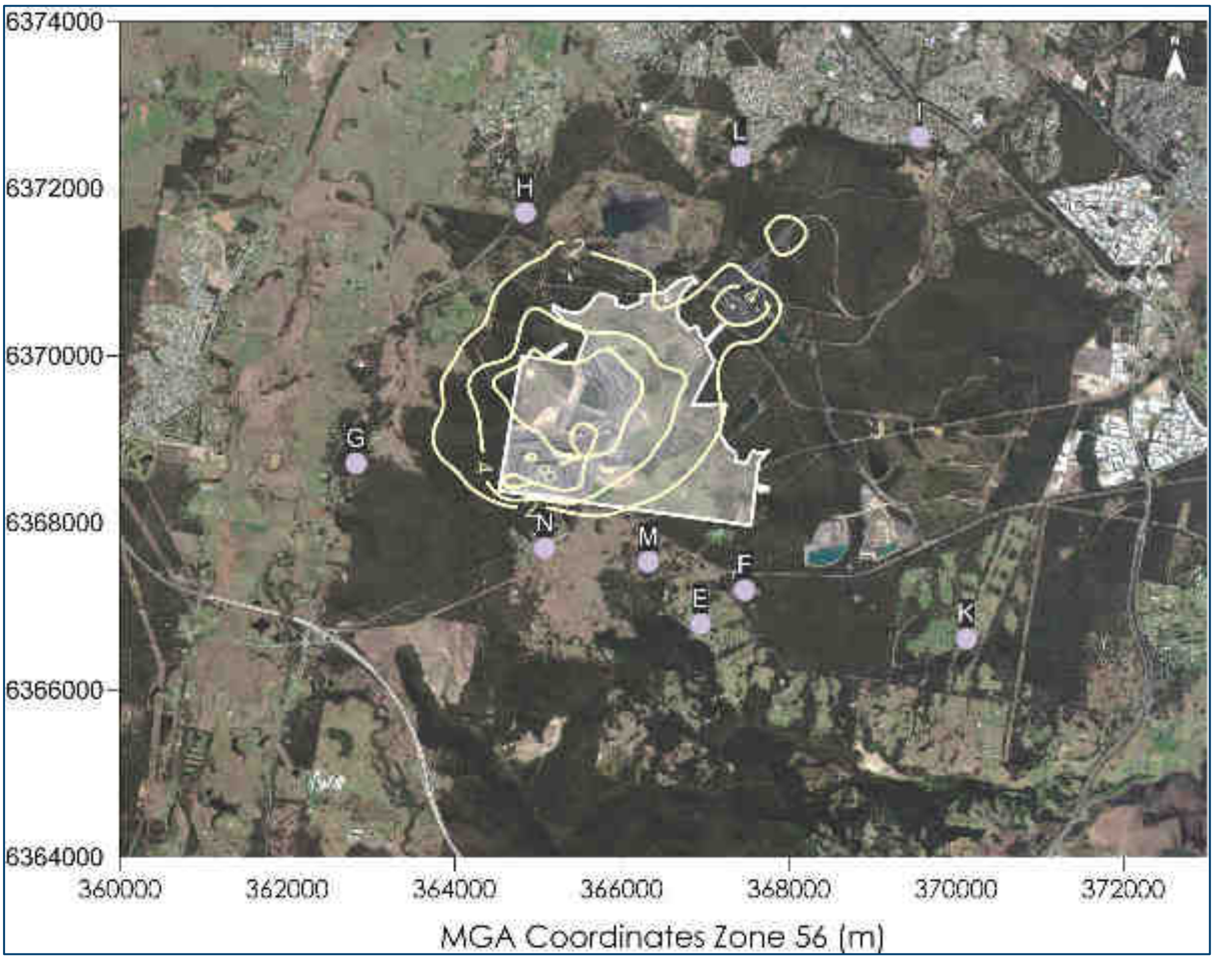

Figure C-2: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project (µg/m³)

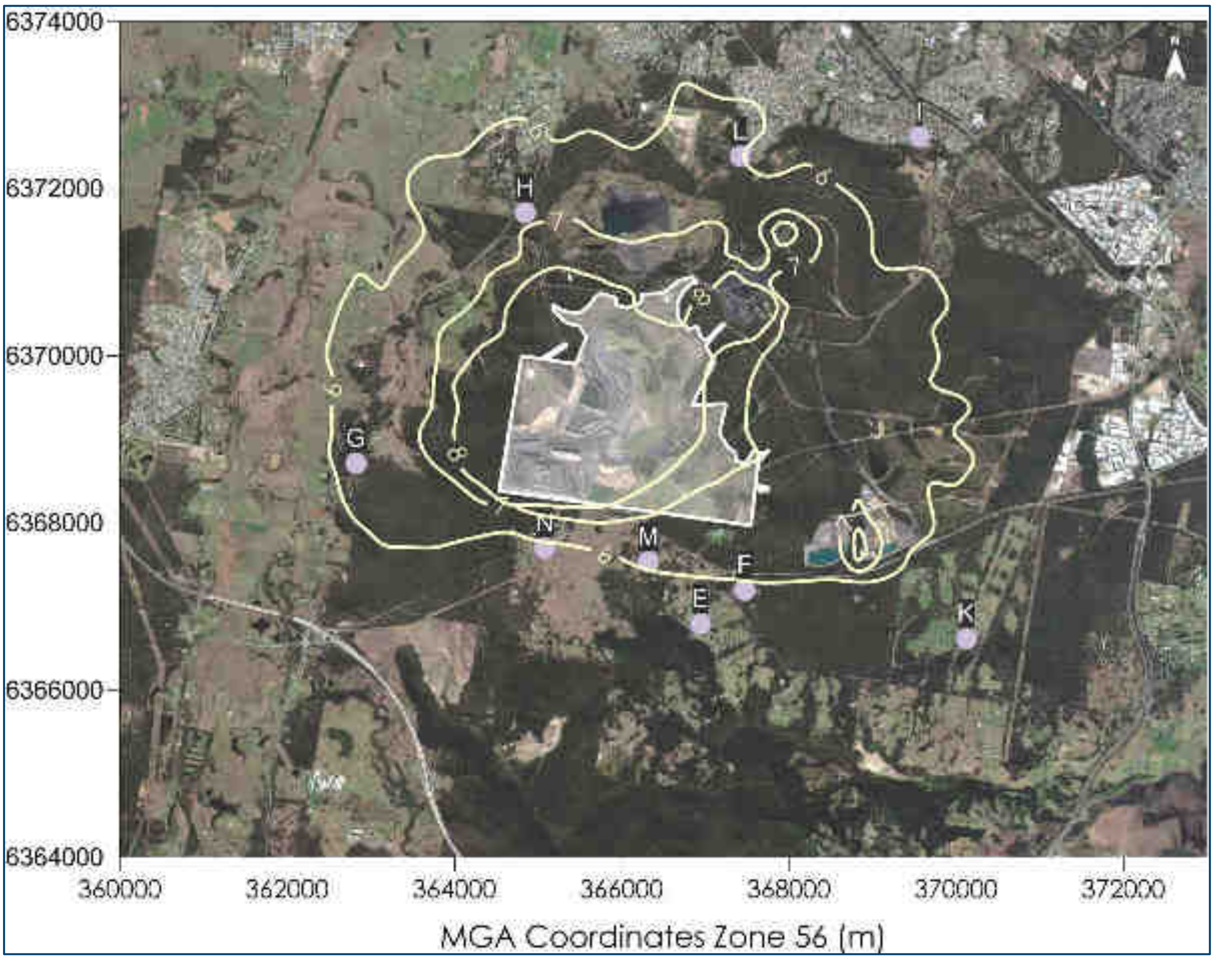

Figure C-3: Predicted annual average $PM_{2.5}$ concentrations due to emissions from the Project and other sources (µg/m³)

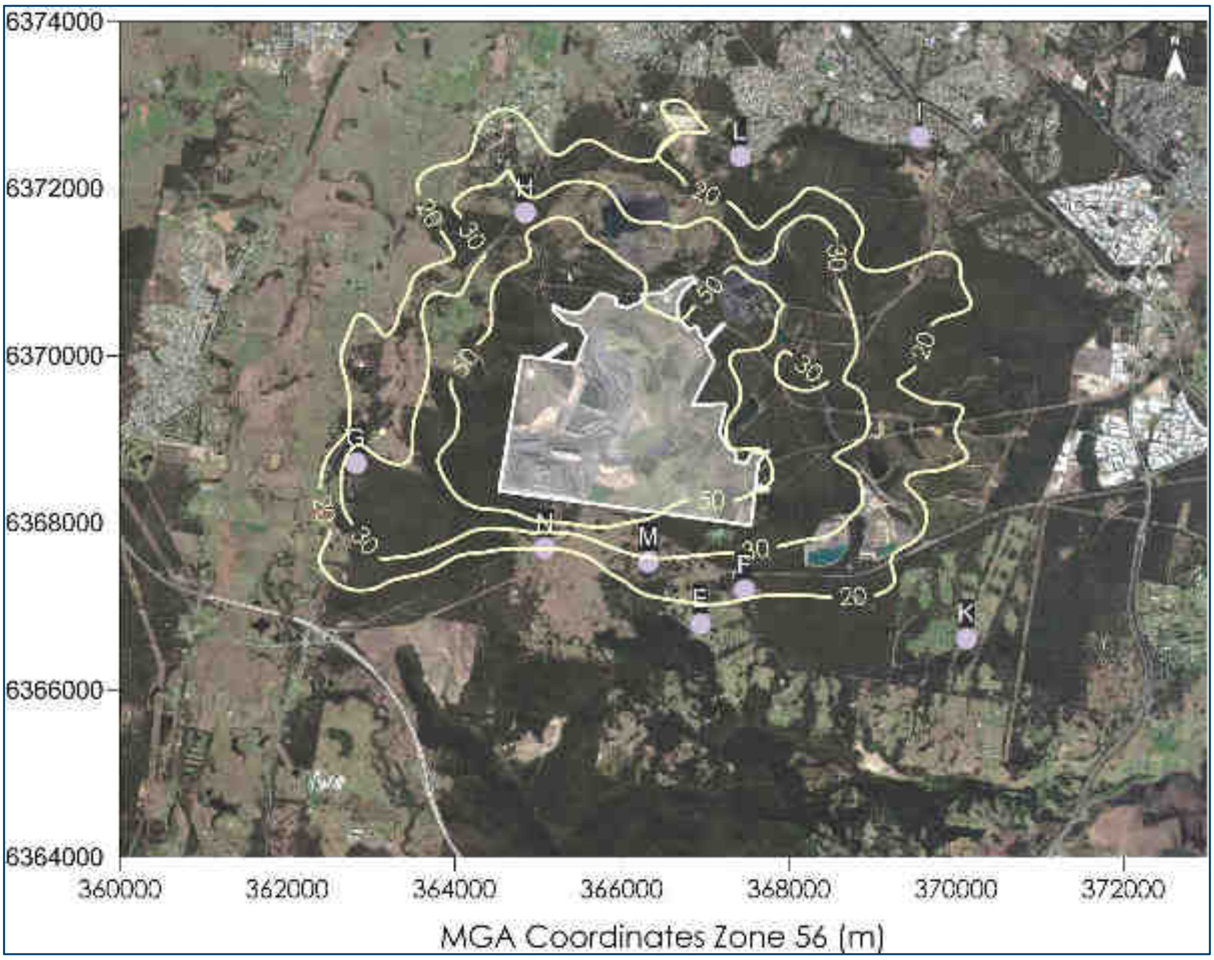

Figure C-4: Predicted maximum 24-hour average PM_{10} concentrations due to emissions from the Project (µg/m³)

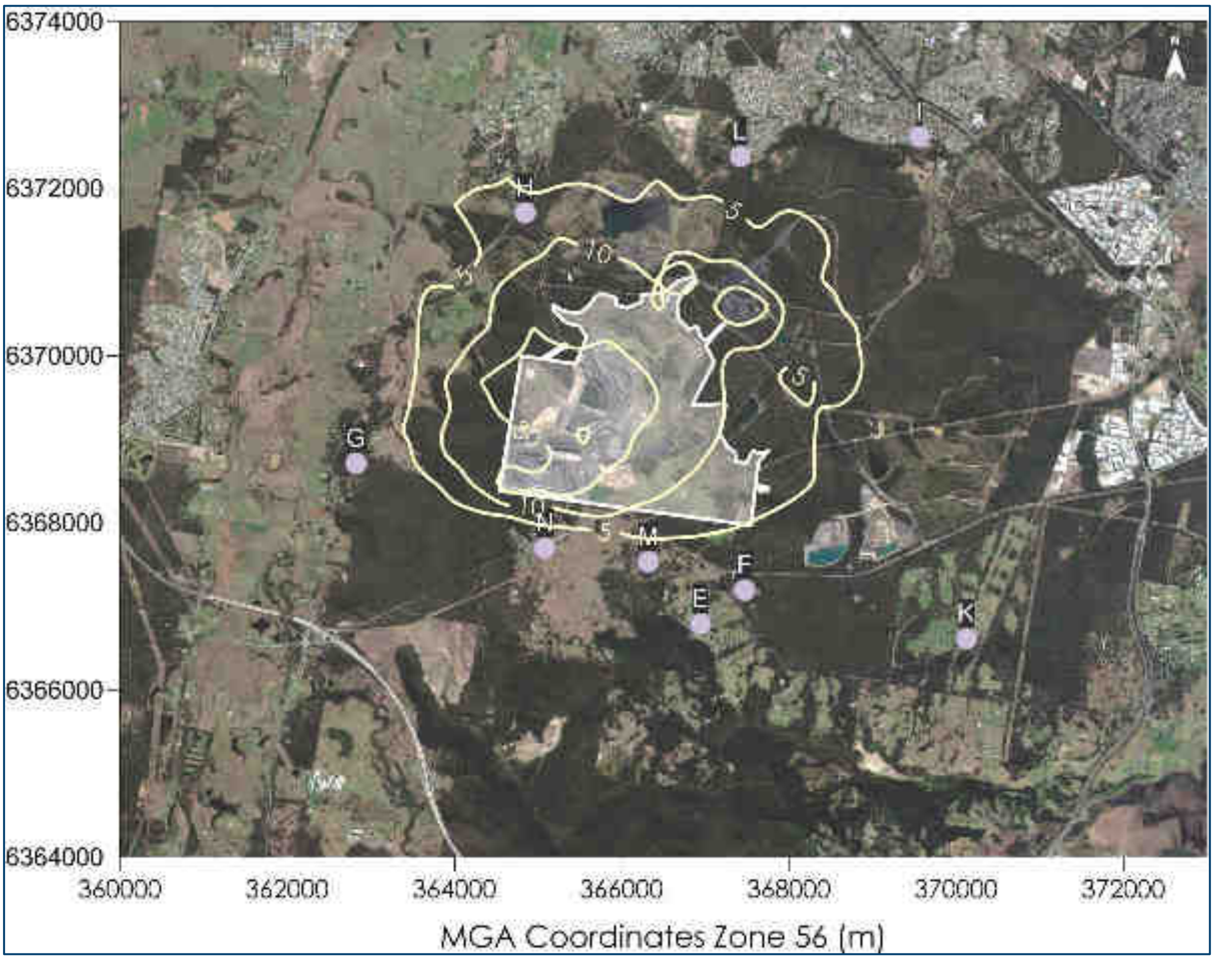

Figure C-5: Predicted annual average PM_{10} concentrations due to emissions from the Project (µg/m³)

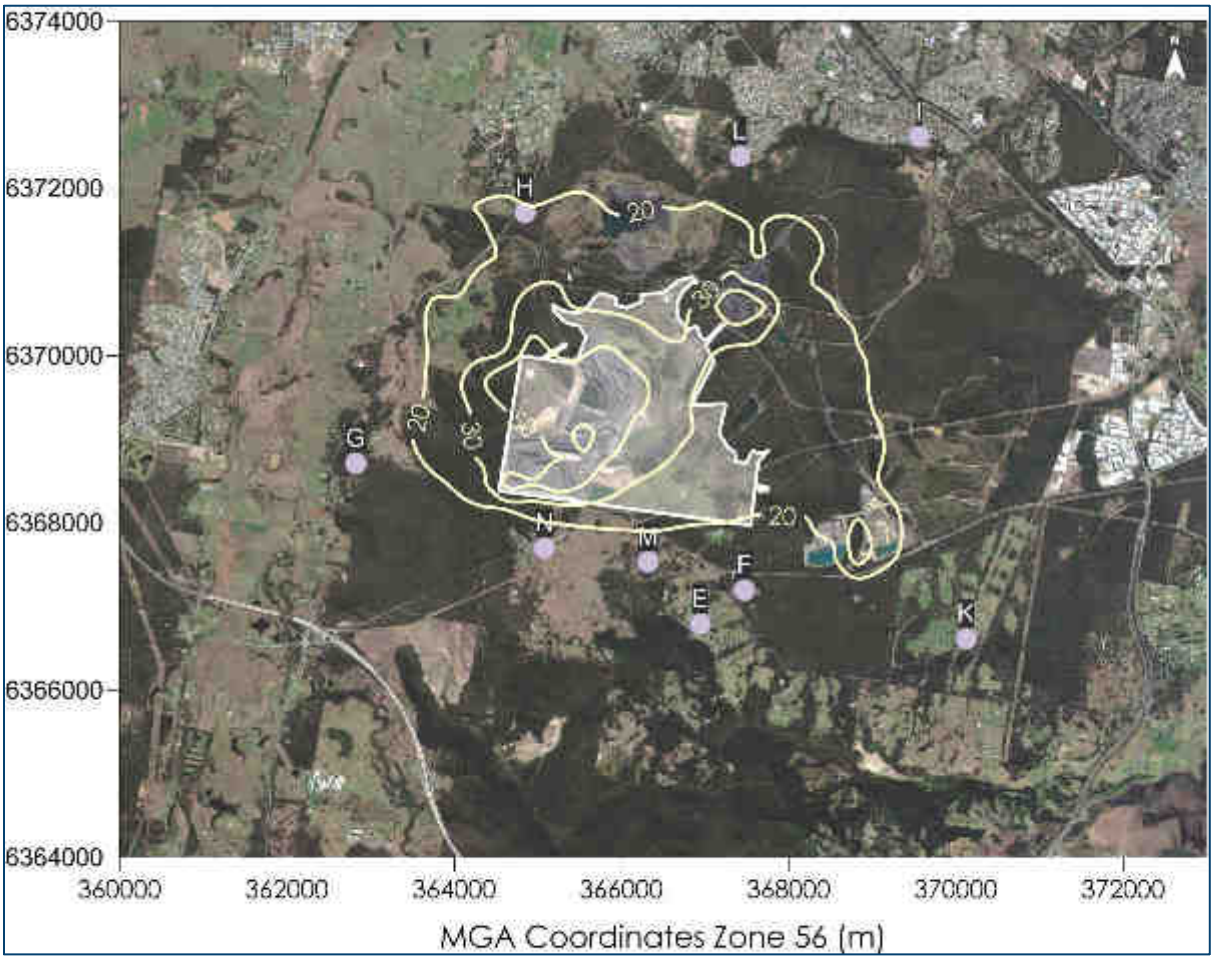

Figure C-6: Predicted annual average PM_{10} concentrations due to emissions from the Project and other sources (µg/m³)

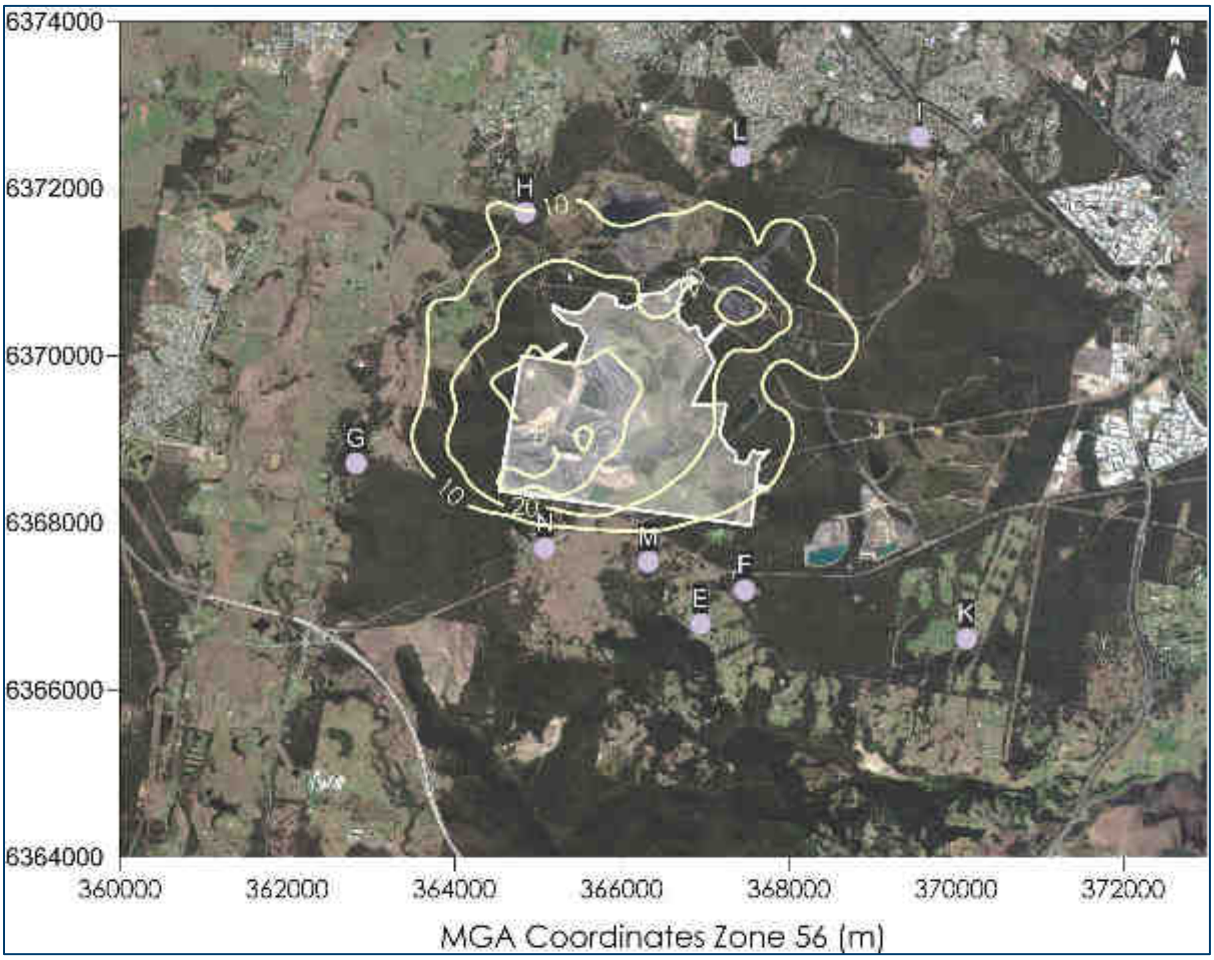

Figure C-7: Predicted annual average TSP concentrations due to emissions from the Project (µg/m³)

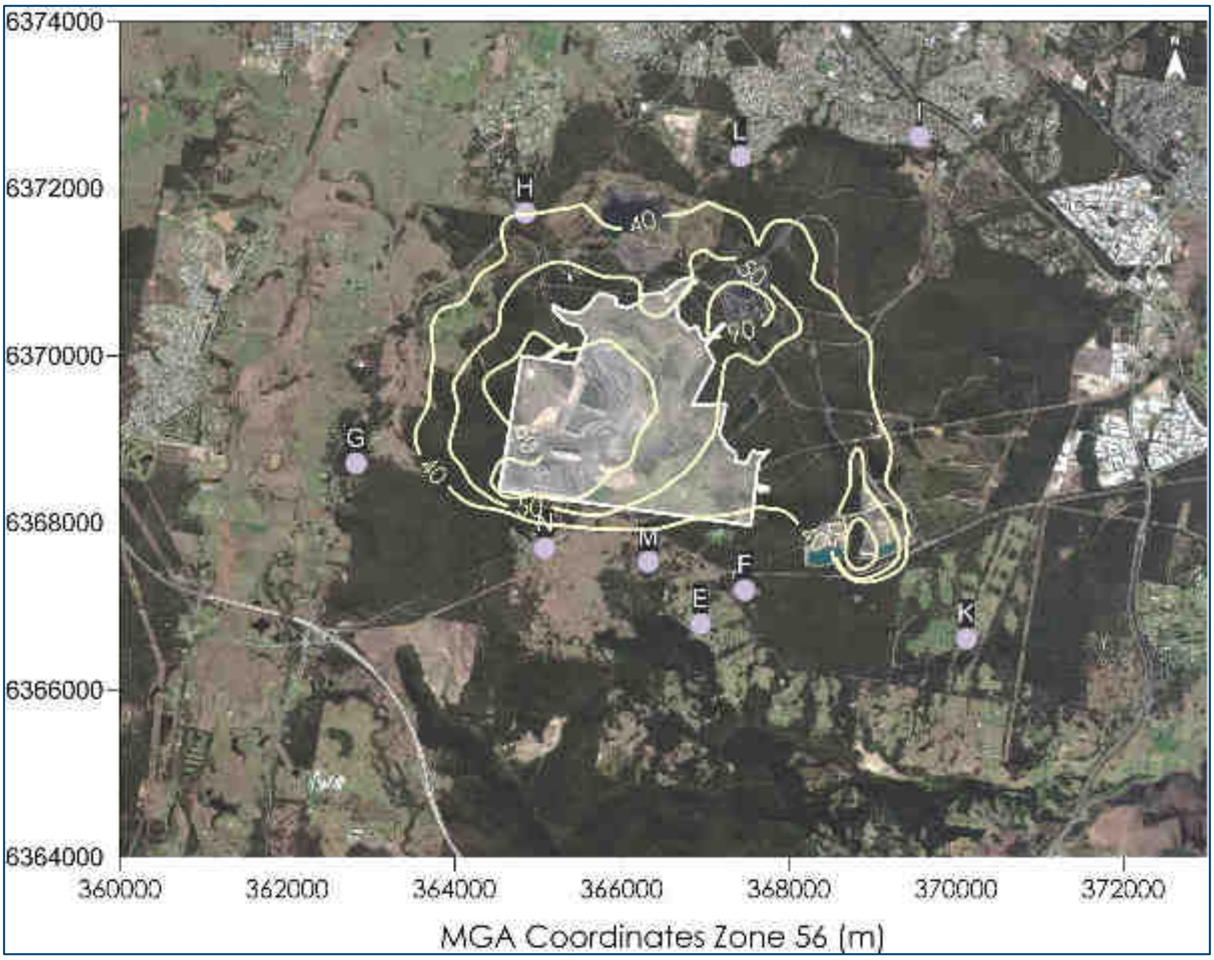

Figure C-8: Predicted annual average TSP concentrations due to emissions from the Project and other sources (µg/m³)

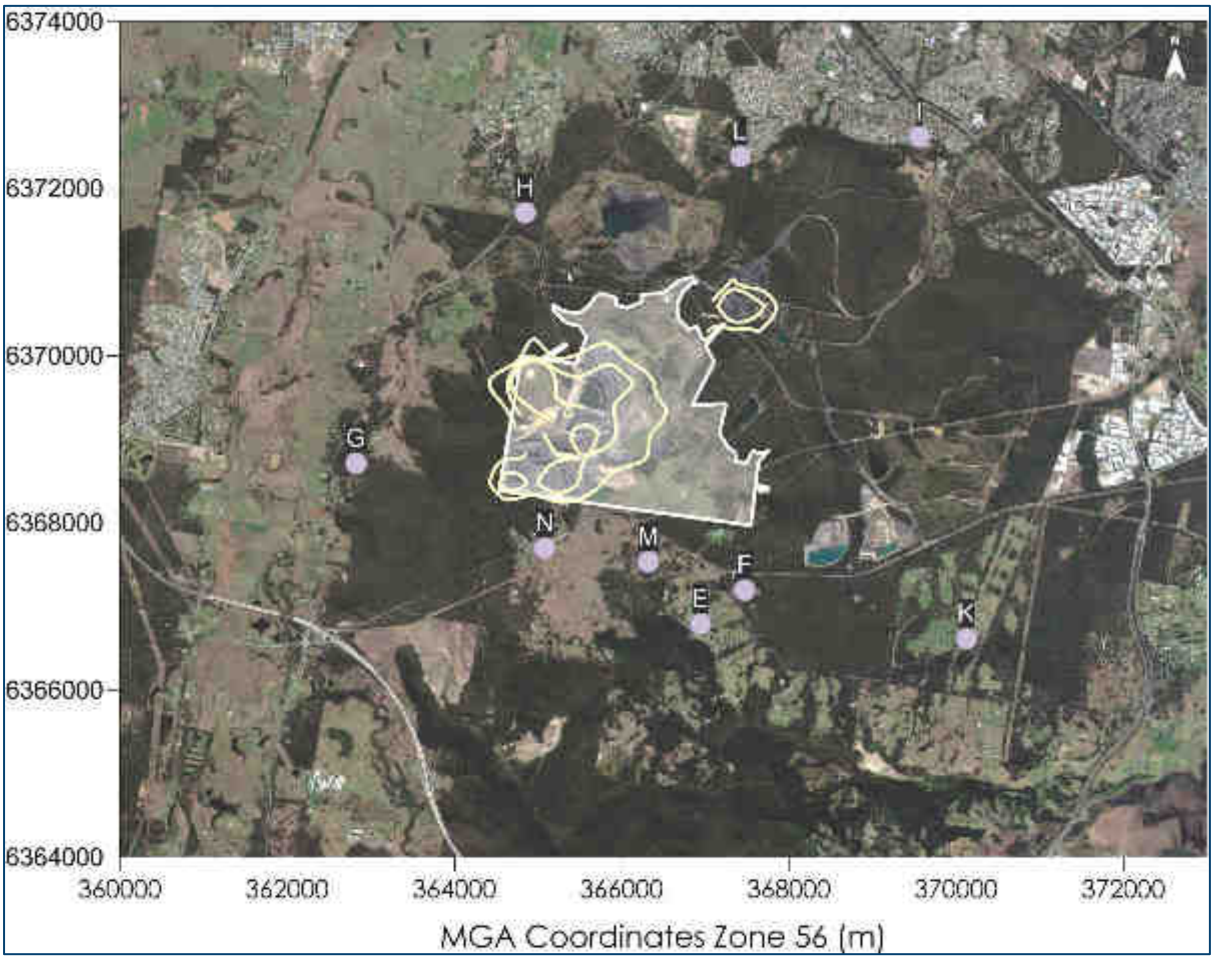

Figure C-9: Predicted annual average dust deposition levels due to emissions from the Project (g/m²/month)

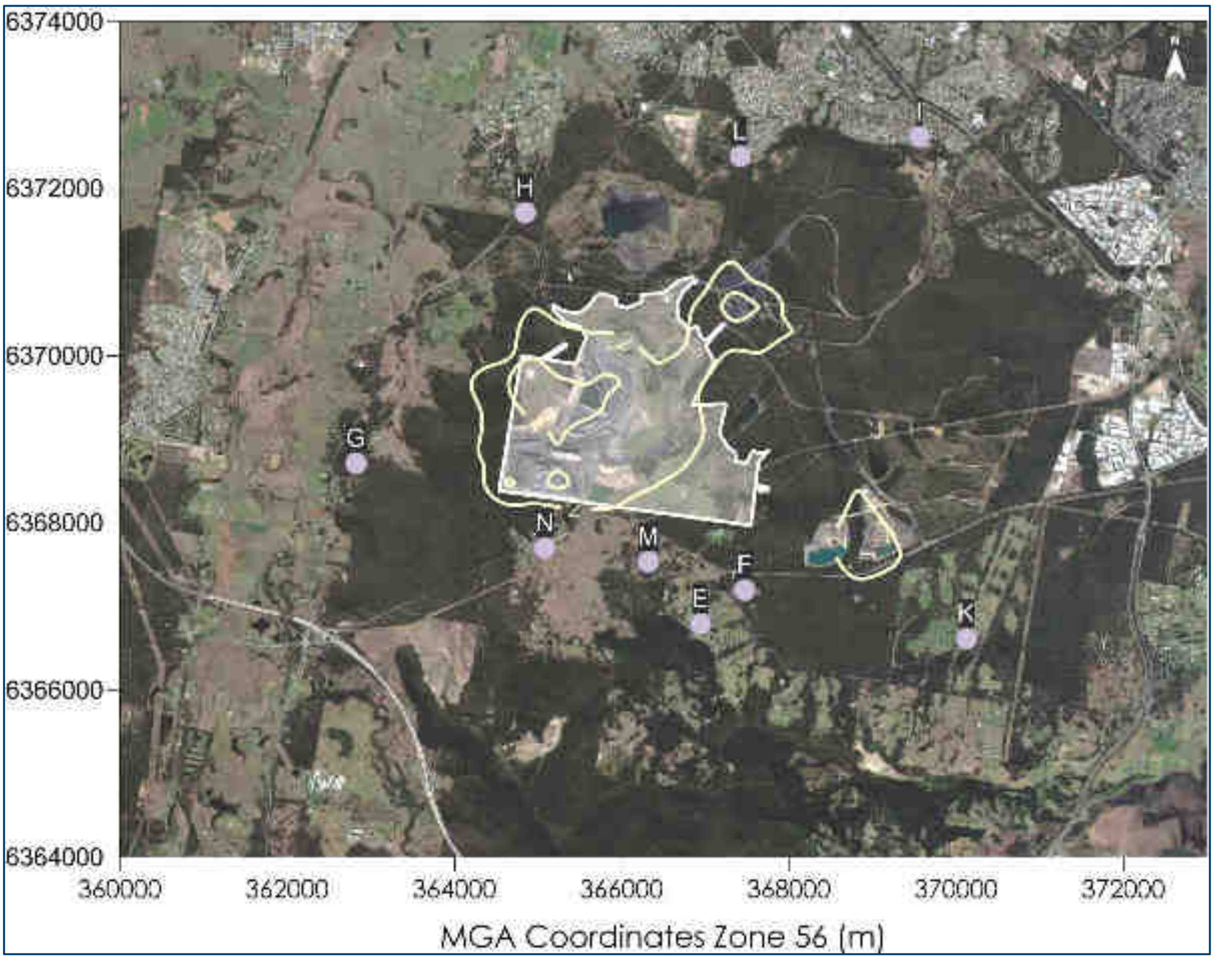

Figure C-10: Predicted annual average dust deposition levels due to emissions from the Project and other sources (g/m²/month)

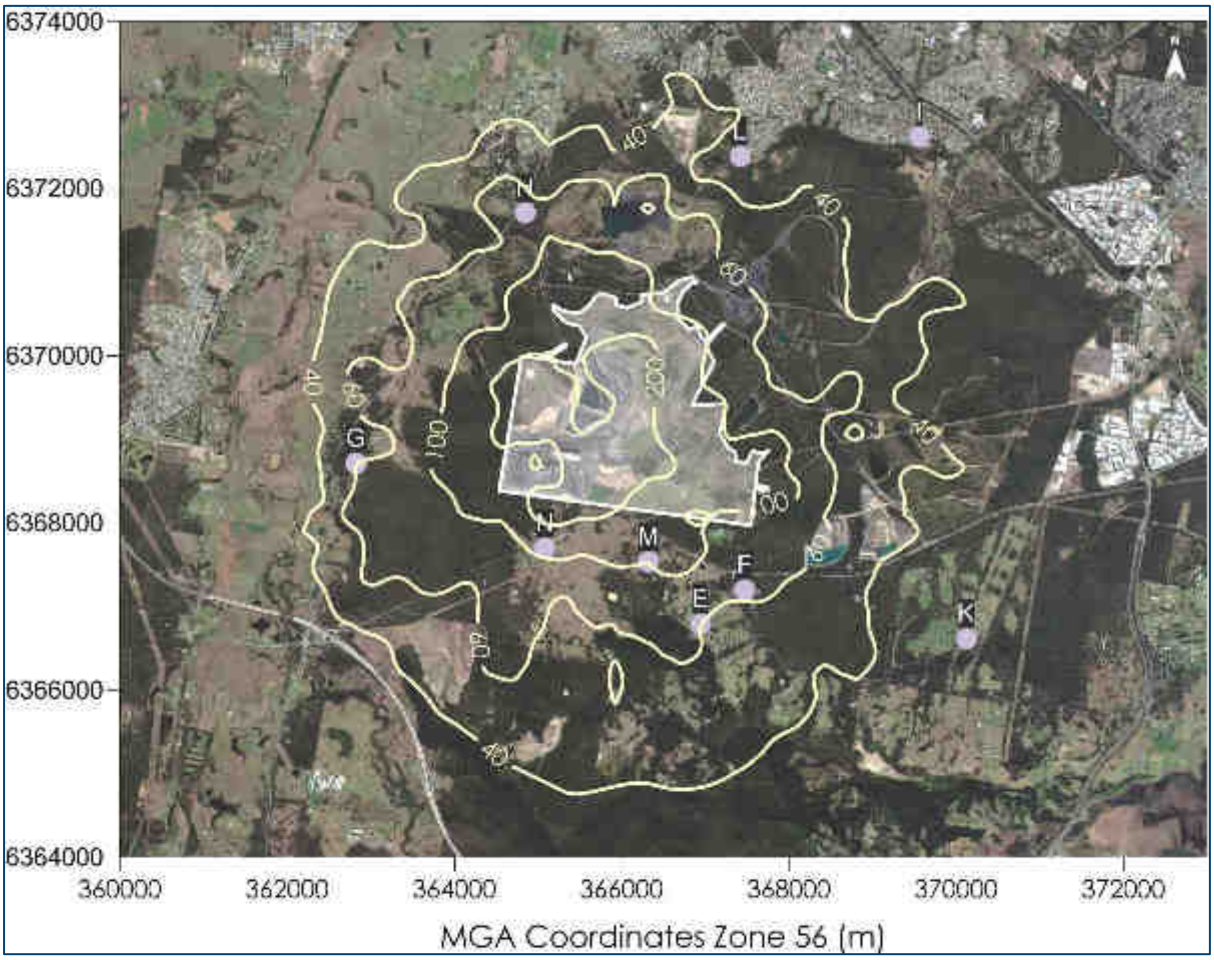

Figure C-11: Predicted 1-hour average NO_2 concentrations due to emissions from the Project (µg/m³)

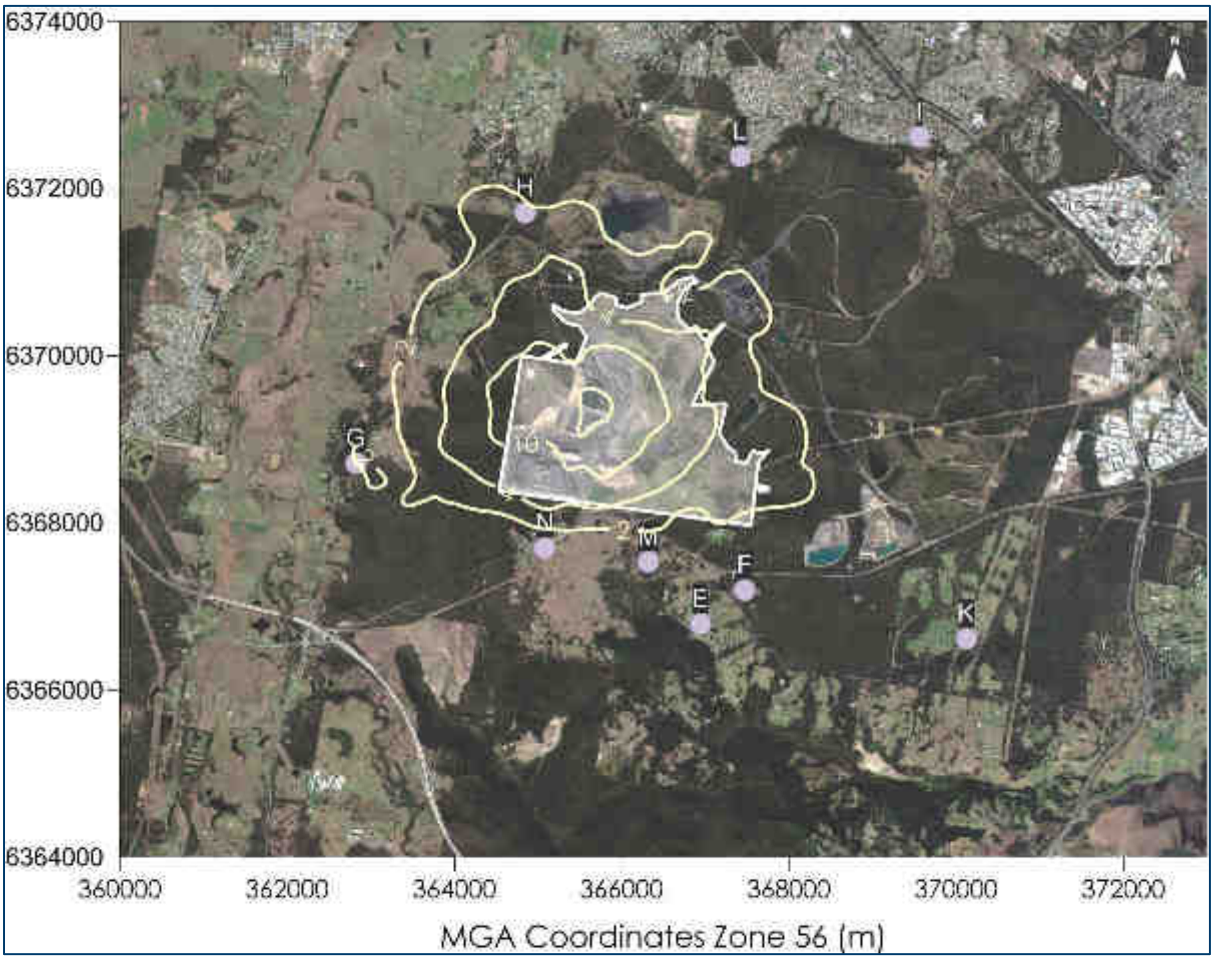

Figure C-12: Predicted annual average NO_2 concentrations due to emissions from the Project (µg/m³)

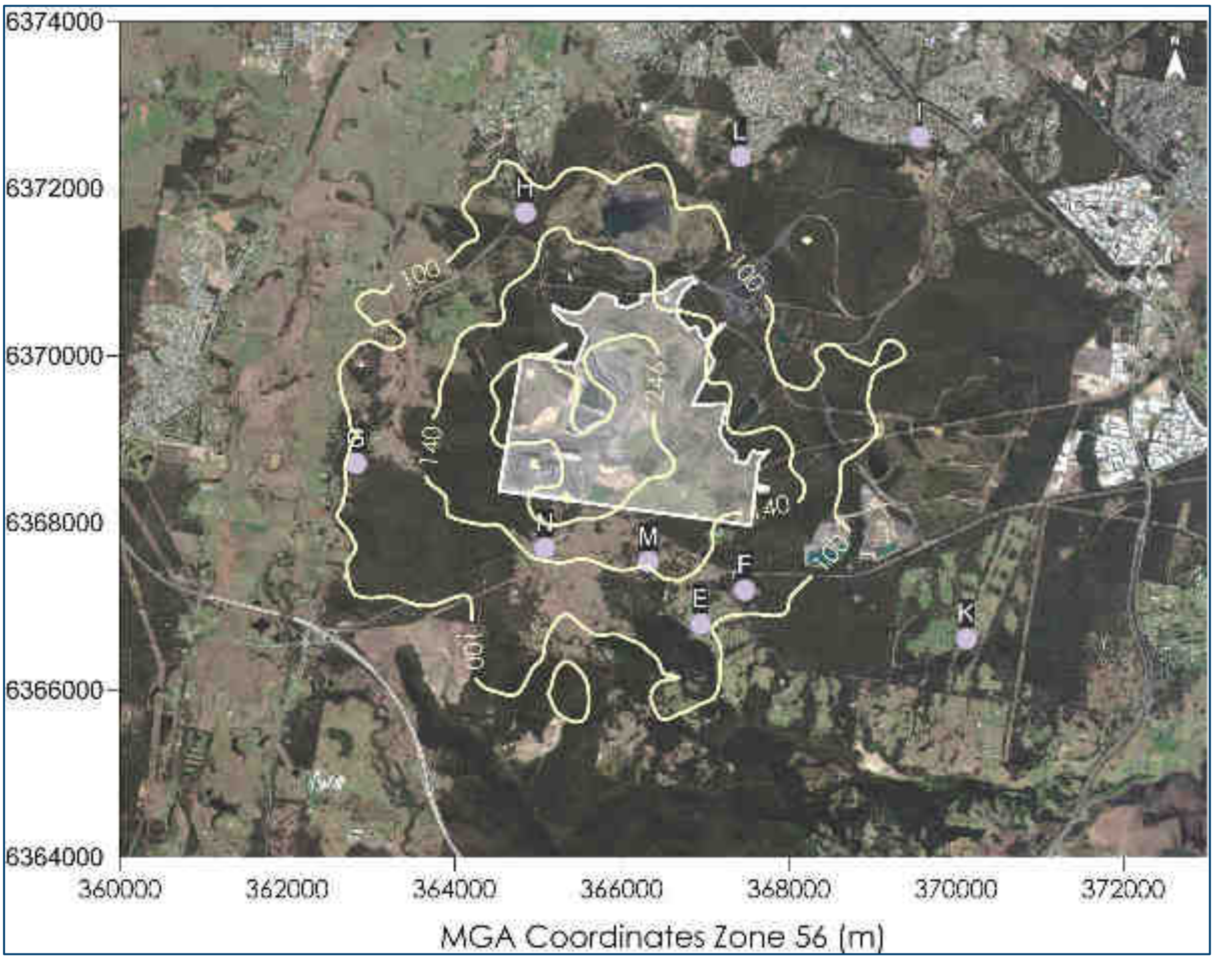

Figure C-13: Predicted 1-hour average NO_2 concentrations due to emissions from the Project and other sources (µg/m³)

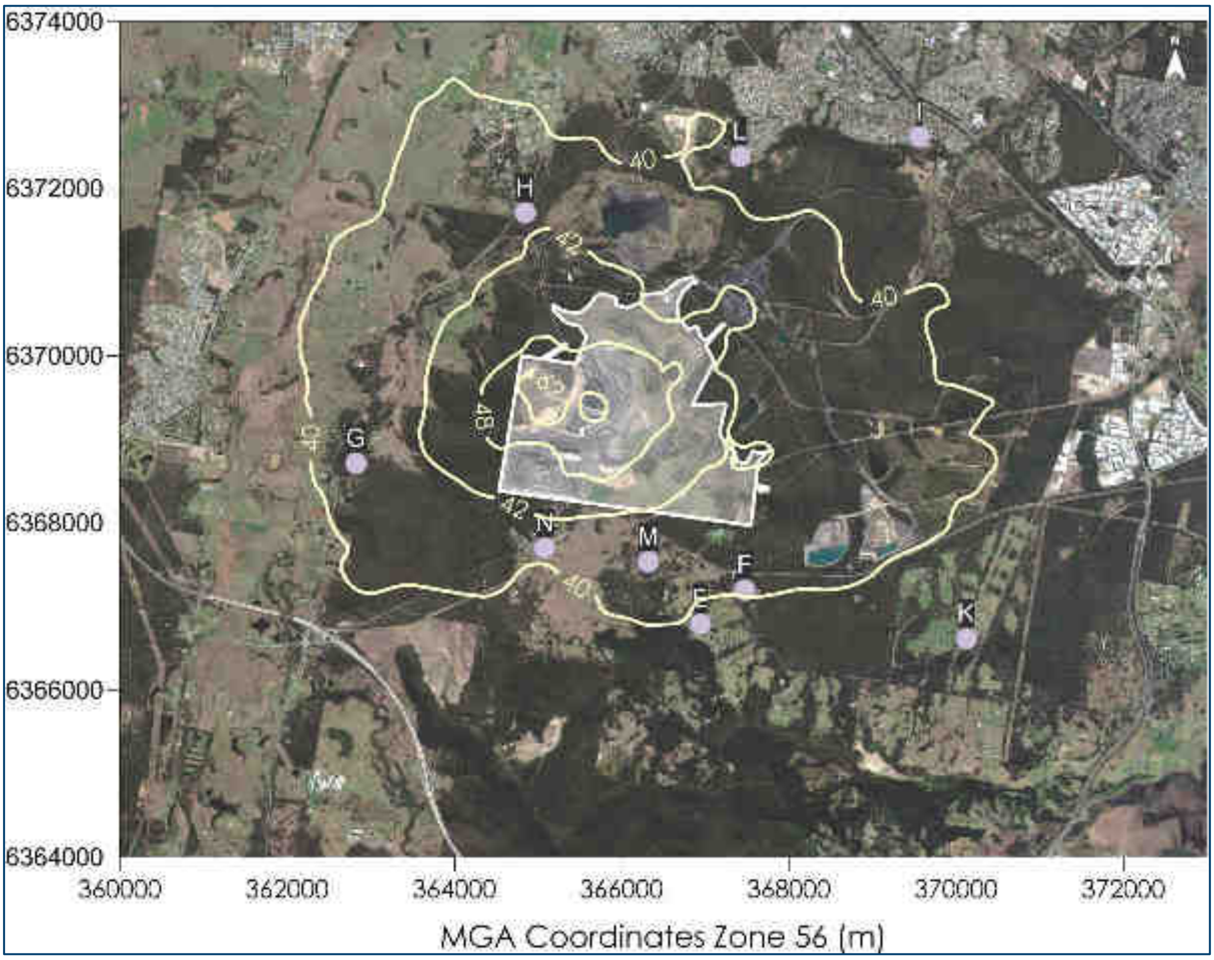

Figure C-14: Predicted annual average NO_2 concentrations due to emissions from the Project and other sources (µg/m³)

Appendix D

Further detail regarding 24-hour $PM_{2.5}$ and PM_{10} analysis

Table D-1: $PM_{2.5}$ 24-hr average concentration – Receptor location E

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	0.6	19.2	10/07/2015	8.1	3.2	11.3
20/08/2015	14.5	0.4	14.9	24/04/2015	ND	3.2	3.2
22/08/2015	14.1	2.4	16.6	7/06/2015	14.0	3.2	17.2
7/06/2015	14.0	3.2	17.2	20/11/2015	7.2	2.7	9.8
5/07/2015	12.8	0.1	12.8	8/06/2015	6.2	2.6	8.7
9/03/2015	12.1	0.2	12.3	22/08/2015	14.1	2.4	16.6
19/11/2015	12.0	0.2	12.2	4/05/2015	3.9	2.3	6.1
19/03/2015	11.1	0.0	11.2	28/05/2015	6.4	2.3	8.7
9/07/2015	10.9	0.2	11.1	27/06/2015	10.0	2.2	12.2
23/06/2015	10.8	0.4	11.2	4/06/2015	6.8	2.0	8.8

ND – No Data

Table D-2: $PM_{2.5}$ 24-hr average concentration – Receptor location F

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	0.7	19.3	7/06/2015	14.0	4.0	18.1
20/08/2015	14.5	0.3	14.8	11/07/2015	5.8	3.8	9.6
22/08/2015	14.1	3.0	17.2	4/06/2015	6.8	3.8	10.6
7/06/2015	14.0	4.0	18.1	30/05/2015	6.0	3.7	9.7
5/07/2015	12.8	1.1	13.9	10/07/2015	8.1	3.6	11.7
9/03/2015	12.1	0.2	12.3	8/06/2015	6.2	3.6	9.8
19/11/2015	12.0	0.2	12.2	24/04/2015	ND	3.6	3.6
19/03/2015	11.1	0.1	11.2	28/05/2015	6.4	3.3	9.8
9/07/2015	10.9	0.3	11.2	29/05/2015	5.6	3.3	8.9
23/06/2015	10.8	0.4	11.2	8/05/2015	5.1	3.1	8.2

ND – No Data

Table D-3: $PM_{2.5}$ 24-hr average concentration – Receptor location G

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	2.5	21.1	5/11/2015	1.3	7.2	8.5
20/08/2015	14.5	3.7	18.2	9/10/2015	4.4	5.5	9.9
22/08/2015	14.1	0.6	14.7	4/01/2015	3.9	5.1	9.0
7/06/2015	14.0	0.0	14.1	1/01/2015	4.7	5.0	9.8
5/07/2015	12.8	0.0	12.8	16/02/2015	3.9	4.9	8.7
9/03/2015	12.1	1.0	13.1	15/10/2015	4.0	4.8	8.8
19/11/2015	12.0	1.3	13.4	18/12/2015	3.2	4.5	7.7
19/03/2015	11.1	2.0	13.1	16/10/2015	5.6	4.5	10.1
9/07/2015	10.9	1.1	12.0	13/09/2015	7.5	4.4	11.8
23/06/2015	10.8	0.1	10.9	19/10/2015	5.4	4.4	9.7

Table D-4: $PM_{2.5}$ 24-hr average concentration – Receptor location H

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	0.6	19.1	30/04/2015	2.1	6.7	8.8
20/08/2015	14.5	0.7	15.2	26/06/2015	5.2	6.7	11.8
22/08/2015	14.1	0.1	14.2	11/06/2015	4.6	6.5	11.0
7/06/2015	14.0	0.1	14.2	3/05/2015	1.9	5.9	7.9
5/07/2015	12.8	0.0	12.8	17/09/2015	6.3	5.6	11.9
9/03/2015	12.1	2.8	14.9	16/03/2015	5.1	5.5	10.6
19/11/2015	12.0	2.9	14.9	18/09/2015	4.2	5.4	9.6
19/03/2015	11.1	0.9	12.0	17/04/2015	7.1	4.7	11.8
9/07/2015	10.9	2.1	13.0	26/02/2015	4.7	4.5	9.2
23/06/2015	10.8	0.1	10.9	9/11/2015	2.6	4.4	7.0

Table D-5: $PM_{2.5}$ 24-hr average concentration – Receptor location I

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	0.1	18.7	20/06/2015	4.4	1.8	6.2
20/08/2015	14.5	0.1	14.5	31/08/2015	4.2	1.8	6.0
22/08/2015	14.1	0.3	14.4	2/08/2015	6.4	1.8	8.2
7/06/2015	14.0	0.9	15.0	28/06/2015	9.3	1.7	11.1
5/07/2015	12.8	1.1	13.9	27/06/2015	10.0	1.7	11.6
9/03/2015	12.1	0.3	12.4	4/06/2015	6.8	1.7	8.5
19/11/2015	12.0	0.2	12.3	15/08/2015	7.9	1.6	9.5
19/03/2015	11.1	0.6	11.7	25/05/2015	8.2	1.4	9.6
9/07/2015	10.9	0.7	11.6	9/08/2015	9.2	1.4	10.6
23/06/2015	10.8	0.1	10.9	21/06/2015	7.6	1.4	9.0

Table D-6: $PM_{2.5}$ 24-hr average concentration – Receptor location K

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	0.2	18.8	12/07/2015	ND	2.4	2.4
20/08/2015	14.5	0.1	14.6	13/07/2015	5.8	1.9	7.7
22/08/2015	14.1	1.0	15.1	27/08/2015	1.9	1.6	3.5
7/06/2015	14.0	0.9	14.9	25/07/2015	4.1	1.6	5.7
5/07/2015	12.8	1.1	13.9	1/08/2015	8.0	1.6	9.7
9/03/2015	12.1	0.1	12.2	8/06/2015	6.2	1.6	7.8
19/11/2015	12.0	0.1	12.1	11/07/2015	5.8	1.6	7.4
19/03/2015	11.1	0.1	11.2	8/05/2015	5.1	1.4	6.5
9/07/2015	10.9	0.2	11.1	26/07/2015	2.6	1.4	4.0
23/06/2015	10.8	0.2	11.0	10/05/2015	2.9	1.4	4.3

ND – No Data

Table D-7: $PM_{2.5}$ 24-hr average concentration – Receptor location L

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	0.2	18.8	13/04/2015	5.6	2.7	8.3
20/08/2015	14.5	0.2	14.7	10/04/2015	3.4	2.6	6.1
22/08/2015	14.1	0.2	14.3	23/05/2015	3.2	2.6	5.8
7/06/2015	14.0	1.0	15.0	28/06/2015	9.3	2.3	11.6
5/07/2015	12.8	1.0	13.8	20/06/2015	4.4	2.2	6.6
9/03/2015	12.1	1.0	13.1	3/07/2015	ND	2.2	2.2
19/11/2015	12.0	0.7	12.7	10/09/2015	5.1	2.2	7.3
19/03/2015	11.1	1.2	12.3	20/07/2015	7.9	2.1	10.0
9/07/2015	10.9	1.4	12.3	15/08/2015	7.9	2.1	10.0
23/06/2015	10.8	0.1	11.0	11/06/2015	4.6	2.0	6.6

ND – No Data

Table D-8: $PM_{2.5}$ 24-hr average concentration – Receptor location M

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	1.4	19.9	10/07/2015	8.1	5.8	13.9
20/08/2015	14.5	0.9	15.4	7/06/2015	14.0	5.5	19.6
22/08/2015	14.1	4.7	18.8	24/04/2015	ND	5.1	5.1
7/06/2015	14.0	5.5	19.6	23/08/2015	8.9	4.7	13.6
5/07/2015	12.8	0.7	13.4	22/08/2015	14.1	4.7	18.8
9/03/2015	12.1	0.3	12.4	4/05/2015	3.9	4.6	8.5
19/11/2015	12.0	0.4	12.4	8/06/2015	6.2	4.4	10.6
19/03/2015	11.1	0.1	11.2	11/07/2015	5.8	4.2	10.0
9/07/2015	10.9	0.3	11.2	27/06/2015	10.0	4.2	14.1
23/06/2015	10.8	0.8	11.6	20/11/2015	7.2	4.0	11.1

ND – No Data

Table D-9: $PM_{2.5}$ 24-hr average concentration – Receptor location N

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
21/08/2015	18.6	2.6	21.2	18/04/2015	5.8	4.1	10.0
20/08/2015	14.5	1.8	16.3	10/07/2015	8.1	3.7	11.7
22/08/2015	14.1	2.4	16.5	22/06/2015	8.3	3.4	11.7
7/06/2015	14.0	0.7	14.8	26/12/2015	2.1	3.4	5.5
5/07/2015	12.8	0.0	12.8	13/06/2015	8.7	3.3	12.0
9/03/2015	12.1	0.3	12.4	26/11/2015	9.0	3.1	12.1
19/11/2015	12.0	0.4	12.5	11/07/2015	5.8	3.0	8.8
19/03/2015	11.1	0.3	11.4	5/10/2015	5.9	2.9	8.9
9/07/2015	10.9	0.5	11.4	30/03/2015	3.7	2.8	6.5
23/06/2015	10.8	1.0	11.9	21/08/2015	18.6	2.6	21.2

Table D-10: PM_{10} 24-hr average concentration – Receptor location E

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	2.8	**50.8**	24/04/2015	ND	16.6	16.6
6/05/2015	46.5	0.1	46.7	7/06/2015	16.4	16.0	32.4
26/11/2015	41.2	5.8	47.0	10/07/2015	13.0	15.6	28.6
21/08/2015	38.0	2.8	40.8	20/11/2015	28.2	15.0	43.2
6/10/2015	30.1	0.7	30.8	8/06/2015	11.9	14.6	26.5
19/11/2015	29.0	0.8	29.8	22/08/2015	23.2	12.7	35.9
7/10/2015	28.2	0.1	28.3	28/05/2015	13.8	12.3	26.0
20/11/2015	28.2	15.0	43.2	27/06/2015	15.8	10.3	26.1
9/03/2015	26.4	0.7	27.1	4/05/2015	8.8	10.1	18.9
19/12/2015	26.0	0.7	26.7	4/06/2015	13.0	9.8	22.8

ND – No Data

Table D-11: PM_{10} 24-hr average concentration – Receptor location F

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	2.6	**50.6**	7/06/2015	16.4	20.8	37.2
6/05/2015	46.5	0.6	47.1	8/06/2015	11.9	19.8	31.7
26/11/2015	41.2	6.8	48.0	11/07/2015	6.9	19.6	26.5
21/08/2015	38.0	3.3	41.3	28/05/2015	13.8	19.0	32.8
6/10/2015	30.1	0.7	30.8	4/06/2015	13.0	18.8	31.8
19/11/2015	29.0	0.9	29.9	30/05/2015	12.6	18.2	30.8
7/10/2015	28.2	0.1	28.3	24/04/2015	ND	18.1	18.1
20/11/2015	28.2	13.9	42.1	10/07/2015	13.0	18.1	31.1
9/03/2015	26.4	0.9	27.3	29/05/2015	11.0	16.7	27.7
19/12/2015	26.0	0.7	26.7	22/08/2015	23.2	16.2	39.4

ND – No Data

Table D-12: PM_{10} 24-hr average concentration – Receptor location G

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	0.1	48.1	5/11/2015	3.7	37.7	41.4
6/05/2015	46.5	0.0	46.5	9/10/2015	13.7	27.2	40.9
26/11/2015	41.2	0.2	41.4	4/01/2015	12.1	24.2	36.3
21/08/2015	38.0	11.9	49.9	1/01/2015	14.5	24.1	38.7
6/10/2015	30.1	0.7	30.8	16/02/2015	15.0	22.6	37.6
19/11/2015	29.0	6.1	35.1	15/10/2015	14.5	22.5	37.0
7/10/2015	28.2	0.0	28.3	18/12/2015	10.8	22.4	33.3
20/11/2015	28.2	0.3	28.6	16/10/2015	14.0	21.8	35.9
9/03/2015	26.4	4.3	30.7	19/12/2015	26.0	21.3	47.3
19/12/2015	26.0	21.3	47.3	14/02/2015	10.1	20.9	31.0

Table D-13: PM_{10} 24-hr average concentration – Receptor location H

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	0.9	48.9	3/05/2015	6.2	35.1	41.2
6/05/2015	46.5	0.1	46.6	26/06/2015	12.3	34.3	46.5
26/11/2015	41.2	2.5	43.7	11/06/2015	9.0	32.7	41.8
21/08/2015	38.0	2.6	40.6	30/04/2015	6.2	32.4	38.6
6/10/2015	30.1	0.3	30.4	17/09/2015	16.1	28.4	44.5
19/11/2015	29.0	14.3	43.3	18/09/2015	9.8	28.2	38.0
7/10/2015	28.2	3.4	31.7	16/03/2015	15.2	27.4	42.6
20/11/2015	28.2	2.2	30.5	21/04/2015	7.3	25.7	33.0
9/03/2015	26.4	13.7	40.1	17/04/2015	17.0	25.2	42.2
19/12/2015	26.0	3.8	29.8	26/09/2015	6.0	23.1	29.1

Table D-14: PM_{10} 24-hr average concentration – Receptor location I

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	0.2	48.2	2/08/2015	17.6	8.5	26.2
6/05/2015	46.5	0.3	46.8	28/06/2015	9.0	7.8	16.8
26/11/2015	41.2	0.1	41.3	31/08/2015	13.7	7.8	21.5
21/08/2015	38.0	0.6	38.6	9/08/2015	11.0	7.5	18.5
6/10/2015	30.1	1.6	31.7	4/06/2015	13.0	7.5	20.5
19/11/2015	29.0	1.0	30.0	27/06/2015	15.8	7.2	23.1
7/10/2015	28.2	1.9	30.2	20/06/2015	9.0	7.2	16.3
20/11/2015	28.2	3.6	31.8	15/08/2015	15.0	6.8	21.8
9/03/2015	26.4	1.4	27.8	14/06/2015	15.1	6.1	21.2
19/12/2015	26.0	0.1	26.1	25/05/2015	15.8	5.9	21.6

Table D-15 PM_{10} 24-hr average concentration – Receptor location K

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	0.9	48.9	12/07/2015	5.0	15.1	20.1
6/05/2015	46.5	0.5	47.0	13/07/2015	5.1	11.9	17.0
26/11/2015	41.2	1.9	43.1	25/07/2015	12.3	9.8	22.1
21/08/2015	38.0	1.2	39.2	27/08/2015	7.0	9.3	16.3
6/10/2015	30.1	0.3	30.4	8/06/2015	11.9	8.7	20.6
19/11/2015	29.0	0.3	29.3	1/08/2015	18.2	8.4	26.6
7/10/2015	28.2	0.0	28.3	26/07/2015	9.6	8.4	18.0
20/11/2015	28.2	3.6	31.8	10/05/2015	12.0	8.2	20.2
9/03/2015	26.4	0.4	26.8	11/07/2015	6.9	7.9	14.8
19/12/2015	26.0	0.3	26.3	30/07/2015	15.0	7.5	22.5

Table D-16: PM_{10} 24-hr average concentration – Receptor location L

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	0.4	48.4	23/05/2015	6.0	12.3	18.3
6/05/2015	46.5	0.1	46.6	10/04/2015	10.5	11.2	21.7
26/11/2015	41.2	0.5	41.7	13/04/2015	17.5	10.7	28.2
21/08/2015	38.0	0.8	38.8	26/06/2015	12.3	10.2	22.5
6/10/2015	30.1	0.6	30.7	11/06/2015	9.0	10.1	19.2
19/11/2015	29.0	3.2	32.2	4/09/2015	12.2	9.8	22.0
7/10/2015	28.2	2.0	30.3	28/06/2015	9.0	9.6	18.6
20/11/2015	28.2	5.6	33.8	10/09/2015	16.4	9.4	25.8
9/03/2015	26.4	4.4	30.9	20/06/2015	9.0	9.2	18.3
19/12/2015	26.0	0.5	26.5	3/07/2015	22.4	9.2	31.6

Table D-17: PM_{10} 24-hr average concentration – Receptor location M

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	5.4	**53.4**	10/07/2015	13.0	28.9	41.9
6/05/2015	46.5	0.4	46.9	7/06/2015	16.4	28.3	44.7
26/11/2015	41.2	13.7	**54.9**	24/04/2015	ND	26.6	26.6
21/08/2015	38.0	6.1	44.1	8/06/2015	11.9	25.0	36.9
6/10/2015	30.1	1.4	31.5	22/08/2015	23.2	24.4	47.6
19/11/2015	29.0	1.9	30.9	20/11/2015	28.2	22.9	**51.1**
7/10/2015	28.2	0.1	28.4	23/08/2015	10.7	22.0	32.7
20/11/2015	28.2	22.9	**51.1**	4/05/2015	8.8	21.7	30.5
9/03/2015	26.4	1.4	27.9	11/07/2015	6.9	20.8	27.7
19/12/2015	26.0	1.2	27.2	27/06/2015	15.8	19.3	35.1

ND – No Data

Table D-18: PM_{10} 24-hr average concentration – Receptor location N

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
1/12/2015	48.0	4.9	**52.9**	18/04/2015	10.0	18.2	28.2
6/05/2015	46.5	0.1	46.6	10/07/2015	13.0	15.8	28.8
26/11/2015	41.2	13.2	**54.4**	26/12/2015	7.2	14.6	21.8
21/08/2015	38.0	11.1	49.1	22/06/2015	8.0	14.6	22.6
6/10/2015	30.1	1.4	31.5	11/07/2015	6.9	14.5	21.3
19/11/2015	29.0	1.8	30.8	13/06/2015	12.1	13.6	25.7
7/10/2015	28.2	0.1	28.3	26/11/2015	41.2	13.2	**54.4**
20/11/2015	28.2	1.8	30.0	5/10/2015	25.7	13.0	38.6
9/03/2015	26.4	1.2	27.7	30/03/2015	10.0	12.6	22.6
19/12/2015	26.0	1.4	27.4	21/08/2015	38.0	11.1	49.1

Appendix H

Groundwater Impact Assessment

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Bloomfield Colliery Pty Ltd
17-Jan-2018

Groundwater Impact Assessment

Bloomfield Colliery - Life of Mine Extension

Groundwater Impact Assessment

Bloomfield Colliery - Life of Mine Extension

Client: Bloomfield Colliery Pty Ltd

ABN: 25 003 824 244

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HydroSimulations

17-Jan-2018

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Reviewed by	Graham Hawkes

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Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	21-Dec-2017	Draft	Simon Murphy Principal Environmental Planner	
0	17-Jan-2018	Final	Simon Murphy Project Manager	

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Glossary of Terms and Abbreviations

Term	Definition
AHD	Australian Height Datum
Alluvium	Sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains and alluvial fans.
Aquiclude	An aquiclude is a geological material through which zero flow occurs.
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding quantities of water.
Aquitard	A low permeability unit that can store groundwater and also transmit it slowly from one aquifer to another.
DI-CLW	NSW Department of Industry – Crown Lands and Water Division (formerly DPI-Water)
DLWC	NSW Department of Land and Water Conservation now DI-CLW
DoP	NSW Department of Planning. Predecessor agency to the NSW Department of Planning and Environment.
DPI-Water	NSW Department of Primary Industries – Water. State agency responsible for managing groundwater and surface water. now DI-CLW
Drawdown	A lowering of the water table in an unconfined aquifer or the potentiometric surface of a confined aquifer caused by the groundwater extraction from mining or pumping of groundwater from wells.
DWE	NSW Department of Water and Energy
Ecosystem	As defined in the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth), an ecosystem is a 'dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit'.
EC	Electrical Conductivity. A unit of measurement for water salinity. One EC equals one micro –Siemen per centimetre (µS/cm) measured at 25°C.
Environment	As defined within the *Environmental Planning and Assessment Act 1979* (NSW), all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings.
EP&A Act	*Environmental Planning and Assessment Act (1979)* (NSW)
Hydraulic conductivity	The rate at which water of a specified density and kinematic viscosity can move through a permeable medium (notionally equivalent to the permeability of an aquifer to fresh water).
Hydraulic gradient	The change in total groundwater head with a change in distance in a given direction, which yields a maximum rate of decrease in head.
Hydrogeology	The study of subsurface water in its geological context.
Hydrology	The study of rainfall and surface water runoff processes.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
LTAAEL	Long Term Average Annual Extraction Limit as outlined in the water sharing plan
MNES	matters of national environmental significance

Term	Definition
NoW	NSW Office of Water. now DI-CLW
NSW EPA	Environmental Protection Authority (NSW)
OEH	Office of Environment and Heritage (NSW)
ROM	Run-of-mine. Raw mined coal resource that includes waste material such as rocks and minerals
Salinity	The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS). The conversion factor between EC and mg/L is dependent on the chemical composition of the water, but a conversion factor of 0.6 mg/L TDS = 1EC unit is commonly used as an approximation.
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.
WM Act	*Water Management Act 2000* (NSW)

1.0 Introduction

1.1 Project Overview

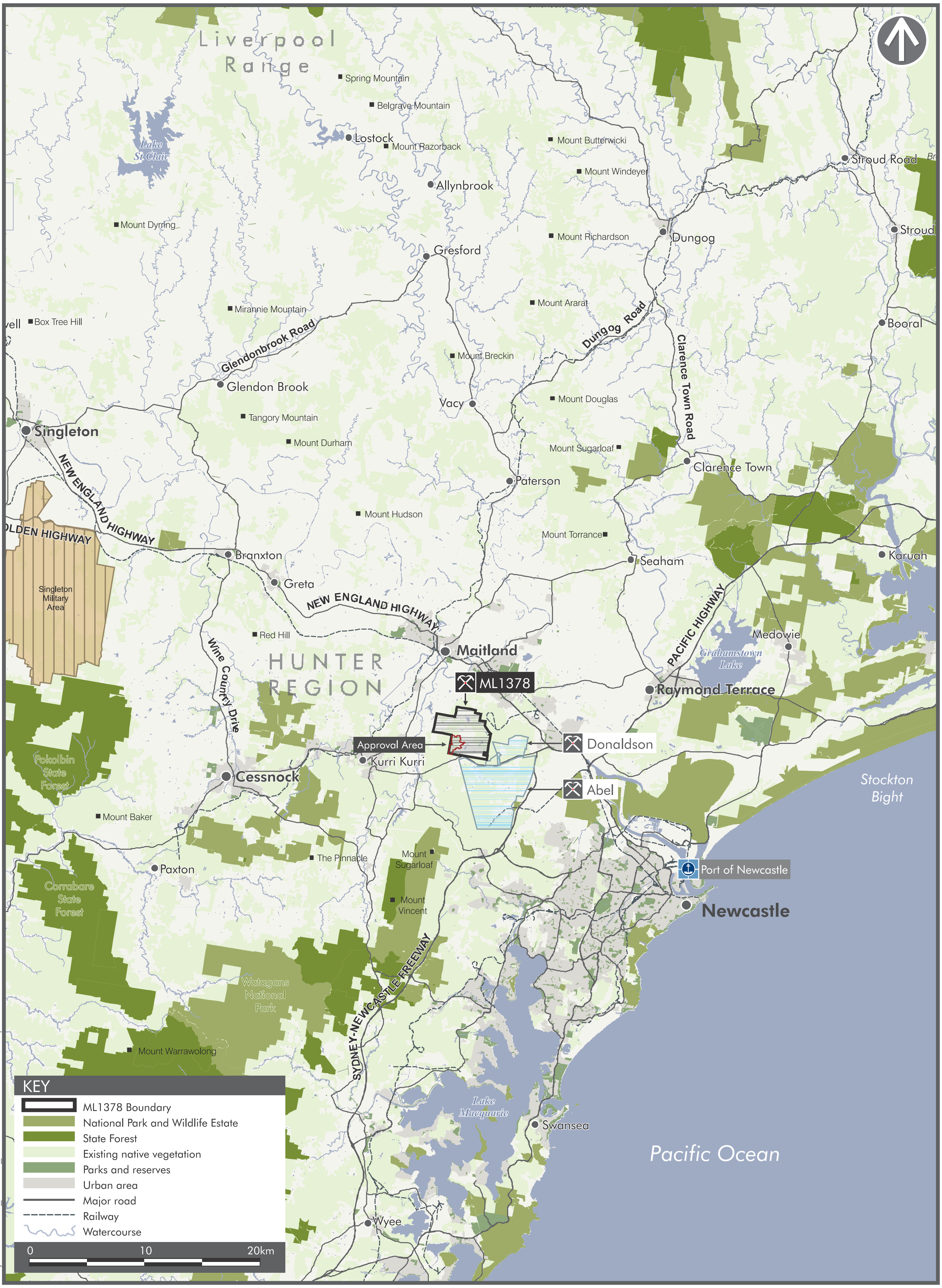
Bloomfield Colliery (the Colliery) is an open cut coal mine in the Hunter Valley, NSW, located approximately 25 kilometres (km) north-west of Newcastle and about 5 km south of Maitland. Open cut operations commenced in 1966. The Colliery currently operates in accordance with Project Approval 07_0087 under Part 3A (repealed) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), granted on 3 September 2009. The Project Approval has been subsequently modified on three separate occasions (May 2011, March 2012 and February 2013). Under this approval, mining operation may take place until 31 December 2021. Bloomfield now predicts mining to extend beyond the end of 2021, having identified up to 13 million tonnes of ROM (run-of mine) coal remaining inside the approval area. Bloomfield is therefore seeking a modification to the Project Approval to allow for the continuation of mining within the existing mining lease (Consolidated Coal Lease (CCL) 761) beyond the life of its current consent to 31 December 2030. The Project includes a modification of the previously approved final landform by moving the final void approximately 200m to the west. The mining will include extraction of the Donaldson and Big Ben Seams although some of the Big Ben seam has been previously mined by underground mining methods. The mine location is shown in **Figure 1** and **Figure 2**.

In order to support the modification application to DP&E, Bloomfield requires a supporting Environmental Assessment (EA) to describe the Project and assess potential environmental impacts and statutory approval requirements. Key technical assessment areas have been identified for assessment within the EA including modelling and assessment of the hydrogeological impacts of the Project. A predictive groundwater model has been developed independently by HydroSimulations. The purpose of this report is to assess the potential impacts the Project will have on groundwater resources and changes to the site’s water balance and water management within the framework of relevant legislation and guidelines. HydroSimulations Groundwater Modelling Report is attached in **Appendix A**.

1.2 Interaction with Neighbouring Mines

Bloomfield Colliery adjoins three other mines; Donaldson open cut mine (in care and maintenance), Abel underground mine (in care and maintenance) and Tasman underground mine (closed). The four mines all washed coal through the Bloomfield Coal Handling and Preparation Plant (CHPP). Tailings from the CHPP were deposited into former underground workings at Bloomfield until mid-2007 and are now deposited in former open cut workings on the site. Water from tailings is recovered and recycled through the CHPP.

Modelling by HydroSimulations included all neighbouring underground and open cut mines for assessment of cumulative effects. **Figure 1** shows the regional location of Bloomfield Colliery and the vicinity of the surrounding mines.



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REGIONAL CONTEXT
Bloomfield Project

FIGURE 1

1.3 SEARs

The Secretary's Environmental Assessment Requirements (SEARs) for the Bloomfield Colliery Life of Mine Extension were issued by the Department of Planning on 16 November 2015 and revised on 22 March 2017. The SEARs relating to hydrogeological impacts and where these requirements have been addressed in this report are summarised in **Table 1**.

Table 1 How SEARs have been addressed in this report

SEARs Requirement	Section where addressed in the report
General Requirements	
A description of the existing environment likely to be affected by the development, using sufficient baseline data.	**Section 4.0** – Existing environment
An assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice.	**Section 5.0** – Assessment of potential impacts
A description of the measures that would be implemented to mitigate and/or offset the likely impacts of the development.	**Section 6.0** – Monitoring and management of impacts
A description of any measures that would be implemented to monitor and report on the environmental performance of the development if it is approved.	**Section 6.0** – Monitoring and management of impacts
Groundwater	
The EA is required to assess whether the recovery of deeper coal seams would cause any changes to the groundwater resources intercepted by the development and any resultant changes to the site's water balance and water management system.	**Section 5.0** – Assessment of potential impacts

1.4 Structure of this Report

This report is structured as follows:

- **Chapter 1** – **Introduction.**
- **Chapter 2** – **The project** describes the project features and mining activities on the site.
- **Chapter 3** – **Assessment inputs** describes the regulatory context and key inputs and assumptions for the impact assessment.
- **Chapter 4** – **Existing environment** describes the existing environment (natural and built) prior to project commencement.
- **Chapter 5** – **Assessment of potential impacts** describes the potential impacts on groundwater inflow, groundwater drawdown and groundwater quality resulting from the proposed project, during the mining and recovery phase.
- **Chapter 6** – **Monitoring and management** describes the infrastructure and methods to be put in place to further monitor the groundwater environment and management steps to be implemented.
- **Chapter 7** – **Policy compliance** outlines the relevant policy and compliance measures.
- **Chapter 8** – **Conclusions** summarises the outcomes of the groundwater impact assessment.
- **Chapter 9** – **References.**
- **Chapter 10 – Limitations.**

2.0 The Project

2.1 Project Location

The Colliery is owned and operated by Bloomfield Collieries Pty Limited (Bloomfield). The Colliery is an open cut operation located in the Hunter Valley, NSW and 25 km north-west of Newcastle (refer to Figure 1 and Figure 2). The Colliery is located approximately 3 kilometres west of the Sydney-Newcastle Motorway and immediately north of John Renshaw Drive (B68 Freeway).

2.2 Previous Mining

Coal has been mined on the site by both underground and open cut means for approximately 170 years. Bloomfield purchased the operation in 1937, and commenced underground mining of the Donaldson, Big Ben and Rathluba seams. Underground mining on the site ceased in 1992.

Bloomfield's open cut mine commenced in 1966, using bulldozers and tractor scrapers. CCL761 was granted on 20 November 1991 and ML 1738 granted June 2017 form the boundary of the Colliery. The open cut has continued to expand and develop with the introduction of new machinery and technology.

Mining operations at the adjacent Abel Underground Mine (now in care and maintenance) required the use of certain Bloomfield infrastructure (the CHPP and rail loading facility). To enable this use, the Abel Project Approval granted on 7 June 2007 includes approval for the operation of Bloomfield CHPP and rail loading facility, including associated water management and process waste management. An Integrated Water Management System for the three adjoining mines of Bloomfield, Abel and Donaldson was approved on 5 May 2008.

Project Approval (MP 07_0087) for the Colliery was granted on 3 September 2009 for the staged completion of mining and progressive rehabilitation of the disturbed land. Prior to this, the Colliery had operated pursuant to existing use rights.

Mining operations are currently undertaken in open cut pits known as S Cut and Creek Cut. Mining in S Cut is progressively moving west, while extraction within Creek Cut is moving towards the south and west. These pits mine a range of coal seams within the Tomago Coal Measures.

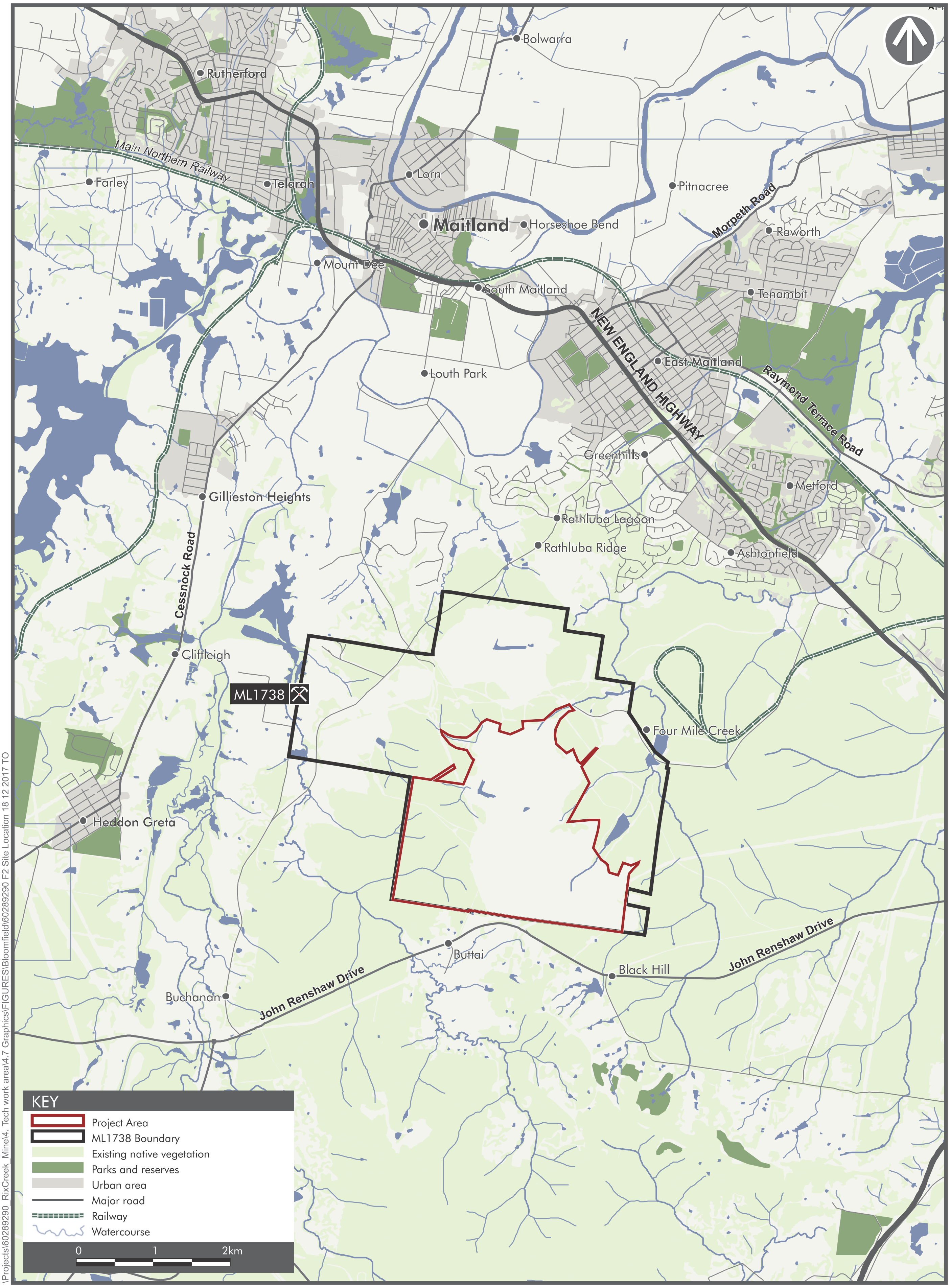
Areas within CCL 761 and ML 1738 where mining has been completed have been progressively stabilised and rehabilitated over time. To date, approximately 488 hectares of land within the Project Area has been rehabilitated. Areas of the rehabilitated land are being used for cattle grazing and for the control of surface runoff to water storage dams or natural watercourses.

2.3 Proposed Mining

Bloomfield Colliery currently operates in accordance with Project Approval 07_0087 under Part 3A (repealed) of the EP&A Act, granted on 3 September 2009. The project approval has been subsequently modified on three separate occasions (Modification No. 1 – 3). Pursuant to Schedule 5, Condition 2 of the Project Approval, mining operation under the existing consent may take place until 31 December 2021.

Changes to the mine fleet have allowed extraction of seams that were not previously considered to be a recoverable resource as part of the original 2008 EA. This has increased the amount of recoverable resource at the Mine and therefore the time required for extraction. Further exploration has been undertaken which has identified other previously unrecoverable resources that the new fleet can now access. As a result, Bloomfield has identified up to 13 million tonnes of ROM coal remaining inside the approval area. Mine planning has been undertaken for the extraction of this additional resource. The proposed change would result in a modification of the previously approved final landform by moving the final void approximately 200m to the west.

A consent modification is sought to align the Project Approval limit to coincide with the Abel consent limit of 31 December 2030. This would allow common infrastructure to be used by both mines until completion. Cumulative assessment of the potential groundwater impact has therefore been undertaken to incorporate the Project and operation of the Abel Underground Mine.



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SITE LOCATION
Bloomfield Project

FIGURE 2

3.0 Assessment Inputs

3.1 EPA Licence Conditions

Environmental management at the Colliery is undertaken in accordance with the Environment Protection Licence (EPL) No 396 issued by the Environment Protection Authority (EPA) under the *Protection of the Environment Operations Act 1997*. EPL No. 396 is attached in **Appendix B**.

The EPL conditions for the Colliery relevant to this assessment are summarised in **Table 2** and **Table 3**.

Table 2 EPL 396 Condition P1.2 - water monitoring and discharge points

EPL Monitoring Point	Type of Monitoring Point	Type of Discharge Point	Location Description
1	• Volume monitoring • Discharge quality monitoring	• Volume monitoring • Discharge quality monitoring	Lake Forster pipe outlet labelled As EPA ID1 on document dated Dec-14 and registered in the EPA Records System as DOC 17/425999 Volume must not exceed 40 kL/day.
2	• Ambient water quality monitoring	N/A	Four Mile Creek located 500m upstream of the current New England Highway culvert for Four Mile Creek.

Table 3 EPL 396 Condition L2.4 – surface water daily concentration and discharge limits

100th Percentile Concentration Limits				Volume
Electrical Conductivity (EC) (µS/cm)	pH	Total Suspended Solids (TSS) (mg/L)	Filterable Iron (mg/L)	Limit (ML/day)
6,000	6.5-8.5	30	1.0	40

3.2 Water Licence

Bloomfield Colliery operates in accordance with the Water Act 1912, and licence number 20BL172035. Under this licence, the Colliery has a maximum groundwater inflow volume of 500 ML/year into the void.

3.3 Relevant Legislation, Policy and Guidelines

This groundwater impact assessment has considered relevant guidelines, policies and both Commonwealth and State legislation.

3.3.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legal framework to protect and manage nationally important flora, fauna, ecological communities and water resources which are deemed to be matters of national environmental significance (MNES). An action that has, will have or is likely to have a significant impact upon MNES is declared a controlled action. Such actions require the approval of the Department of Environment and Energy (DoEE) as well as any requirements under NSW legislation.

Under the EPBC Act an expansion or modification to an existing facility may be within the definition of a large coal mining development if the activities are likely to have significant impact on a water resource (RPS, 2014)

The DoEE has provided the criteria for determining the significance of the impact that a large coal mining activity may have on a water resource. **Table 4** details the impact criteria and where these criteria have been discussed within this report.

Table 4 Impact Criteria

Assessment Criteria	Section(s) addressed
Valuation of the water resource	Section 4.0 – Existing Environment
Changes in water quantity, including the timing of variations in quantity	Section 5.0 – Assessment of potential impacts
Changes in the integrity of hydrological or hydrogeological connection, including substantial structure damage (e.g. large scale subsidence)	Section 5.0 – Assessment of potential impacts
Changes in the area or extent of a water resource	Section 5.0 – Assessment of potential impacts
The risk that the ability of relevant local or regional water quality objectives would be materially compromised	Section 5.0 – Assessment of potential impacts Section 7.0 – Policy compliance
A significant worsening of local water quality (where current local water quality is superior to local or regional quality objectives)	Section 5.0 – Assessment of potential impacts
Risk of high quality water being released into an ecosystem which is adapted to a lower quality of water.	Section 5.0 – Assessment of potential impacts
Cumulative impacts	Section 5.0 – Assessment of potential impacts

3.3.2 Environment Planning and Assessment Act 1979

The overarching environmental planning approval framework in NSW is provided by the EP&A Act. Supporting this primary piece of legislation is the *Environmental Planning and Assessment Regulation 2000* (the EP&A Regulation) and environmental planning instruments, including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).

The Colliery currently operates under Project Approval MP 07_0087, issued under Part 3A (repealed) of the EP&A Act. As it was for the purpose of coal mining, the original development was classified as a Major Project under the *State Environmental Planning Policy (Major Projects) 2005*, which triggered the former Part 3A approval pathway.

While Part 3A of the EP&A Act was repealed in 2011, transitional arrangements set out in Schedule 6A of the EP&A Act provide that Part 3A continues to apply to approved Part 3A projects, and that section 75W of the EP&A Act continues to apply for the purpose of modifications to Project Approvals. The current Project would therefore be undertaken as a modification to the existing Project Approval (MP 07_0087) under section 75W of the EP&A Act. The approval authority is the Minister for Planning.

3.3.3 Strategic Regional Land Use Policy

Residential and agricultural land across the state are protected from the impacts of mining and coal seam gas activities under the Strategic Regional Land Use Policy. The project is not located within the Upper Hunter Region of the Strategic Agricultural Land Map and is not on land classified as biophysical strategic agricultural land (NSW Government, 2012). The NSW Office of Environment and Heritage (OEH, 2012) indicate the project area is located on land that is classified as moderate to low capability in accordance with the Land and Soil Capability (LSC) assessment.

3.3.4 Water Management Act 2000

As part of the *Water Management Act 2000*, the Department of Primary Resources - Water (DPI Water) is in the process of developing Water Sharing Plans across the state for river and groundwater systems. At the time of writing water licencing is still administered under both the *Water Management Act 2000* and the *Water Act 1912*.

Surface water and alluvial licences are administered under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (DPI Water, 2016) via the *Water Management Act 2000*.

Hard rock licences are administered under the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* (DPI Water, 2016) via the *Water Management Act 2000*.

3.3.4.1 Aquifer Interference Policy

The Aquifer Interference Policy (AIP) (NoW 2012) explains the process of administering water policy under the WM Act for activities that interfere with the aquifer. The AIP outlines the assessment process and modelling criteria that DPI Water apply to assess aquifer interference projects. This assessment process and modelling criteria have been adopted for this hydrogeological assessment. Minimum impact considerations required under the AIP, for example, have been assessed for the project and are outlined in **Section 7.1** of this report.

The AIP adopts the following definition of an aquifer interference activity from the Water Management Act 2000:

- The penetration of an aquifer;
- The interference of an aquifer;
- The obstruction of the flow of water in an aquifer;
- The taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations;
- The disposal of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations;
- The policy specifies that the volume of water taken from a water source(s) as a result of an activity is required to be predicted prior to project approval and that approval will not be granted unless adequate arrangements are in force to ensure that no more than the minimum harm will be done to an aquifer or its dependent ecosystems;
- Where an activity results in the loss of water from the environment, a water access licence (WAL) is required under the WM Act to account for this water take;
- An activity must address minimal impact considerations in relation to the water table, groundwater pressure and groundwater quality; and
- Where the actual impacts of an activity are greater than predicted, planning measures must be put in place ensuring there is sufficient monitoring.

3.4 Groundwater Numerical Model Development

A numerical groundwater model was developed independently by HydroSimulations using MODFLOW-SURFACT software. MODFLOW-SURFACT is a three-dimensional model used to simulate variably saturated flow. Numerical modelling was carried out using Groundwater Vistas (Version 6.96) in conjunction with MODFLOW-SURFACT. The Groundwater Modelling Assessment Report is attached in **Appendix A**.

This model was based on a groundwater model completed by Aquaterra (2008) as part of the Groundwater Impact Assessment (Peter Dundon & Assoc., 2008) which supported the 2009 approval (07_0087). This model was subsequently built on for more detailed assessments of the Abel, Donaldson and Tasman Mines and a more extensive groundwater model was developed from this for the Abel mine by RPS Aquaterra (2013) and again by HydroSimulations (2015 and 2016).

The model area extends 23.0 km west to east and 16.6 km south to north covering an area of 380 km^2. Simulation time period runs from 1 January 2006 to 31 December 2031. The model consists of 20 layers based on the lithology and separating the coal seams and interburden zones. The model includes the Donaldson, Abel and Tasman Mines for cumulative impact assessment. The revised model includes:

- A re-build of the model geometry in the Bloomfield area;
- Inclusion of the old Big Ben underground workings;
- Inclusion of a dyke in the Bloomfield area; and
- Removal of cells in the southern part of the model to allow the model to run more efficiently, stabilise the model and to not reduce the quality of the model predictions.

Time series groundwater level data from 2006 – 2017 was used to calibrate the model in steady state and transient modes. Reference to the calibration statistics indicates the model has achieved a good calibration.

The groundwater model was developed and calibrated to simulate the existing hydrogeological regime within the Tomago Coal Measures and existing coal mining workings. The model objectives were to:

- Predict groundwater inflows to the new open cut coal mine;
- Predict groundwater drawdown due to groundwater extraction from the open pit;
- Predict groundwater drawdown at registered bores; and
- Predict the impacts the final void will have on long term groundwater levels.

Two predictive model scenarios were run to replicate the long term operations groundwater impacts of the project as follows:

1. **Scenario 1:** A 'No Mining' or 'Null' run (as per Barnett *et al* 2012), without the past or future Bloomfield mining but with all other surrounding mines active; and
2. **Scenario 2:** A run with the modified Bloomfield mine plan and all other mines active.

Comparison of scenarios 1 and 2 allows the net impact on the hydrogeological environment to be evaluated separately from the effects of Bloomfield alone.

4.0 Existing Environment

4.1 Rainfall and Climate

The nearest long term Bureau of Meteorology (BoM) station to the Bloomfield Colliery is Raymond Terrace 610341, located approximately seventeen kilometres to the east. Rainfall monitoring has been continuous since 1894, although since 1999 the data has become less reliable. Evapotranspiration data has been derived from the BoM Climatic Atlas of Australia. Mean monthly rainfall (1894 – 2017), monthly rainfall for 2016 and monthly evapotranspiration is summarised on **Table 5**.

Mean rainfall is highest during late summer and autumn peaking in March and April. The lowest average rainfall is in late winter and early spring. Evapotranspiration is highest in December and January and lowest in June, exceeding mean monthly rainfall for the months of January to March and August to December. Average monthly rainfall and recorded 2016 monthly rainfall from Raymond Terrace are shown in **Figure 3**.

Mean monthly rainfall (since 1894) has been compared to the recorded 2016 monthly rainfall. Overall 2016 was a drier year with the 991.4 millimetres recorded compared to the mean annual rainfall of 1046.7 millimetres, a difference of 55.3 millimetres. January was an exceptionally wet month with 408 millimetres being recorded which compares to a monthly mean of 98.3 millimetres, a difference of 310.5 millimetres. With the exception of June and August the remaining months were below the mean monthly rainfall.

Table 5 Summary of Monthly Rainfall and Evapotranspiration (Station 610341)

Month	Rainfall mean (mm)	Rainfall 2016 (mm)	Evapotranspiration* (mm)
January	98.3	408.8	182
February	105.7	19.2	143
March	118.1	39.2	127
April	108.1	52.8	96
May	91.7	8.6	68
June	105.5	129.6	57
July	71.0	53.0	67
August	62.6	68.8	93
September	63.1	63.0	120
October	68.9	56.8	149
November	71.8	36.8	167
December	87.0	54.8	200
Total	1046.7	991.4	1470

*Source: Bureau of Meteorology (2001)

The long term data has been collated to calculate a cumulative residual rainfall analysis to assist in the identification of rainfall trends. Time series graphs of cumulative residual rainfall allow long term rainfall patterns to be assessed, with periods of above average rainfall indicated by upward trends and periods of below average rainfall by downward trends. A plot of rainfall residual mass from the Raymond Terrace BoM station for the period 1894 to the end of 2016 is presented as **Figure 4**.

The rainfall residual mass curve shows the Bloomfield area was subjected to relatively dry years from the 1890's to the 1910 followed by a relatively wet period until the late 1940's. The period between the 1940's top the present was relatively wet but punctuated with dry periods, most recently the millennium drought (2001 – 2009). The period from 2009 to 2015 has approximated long term average conditions.

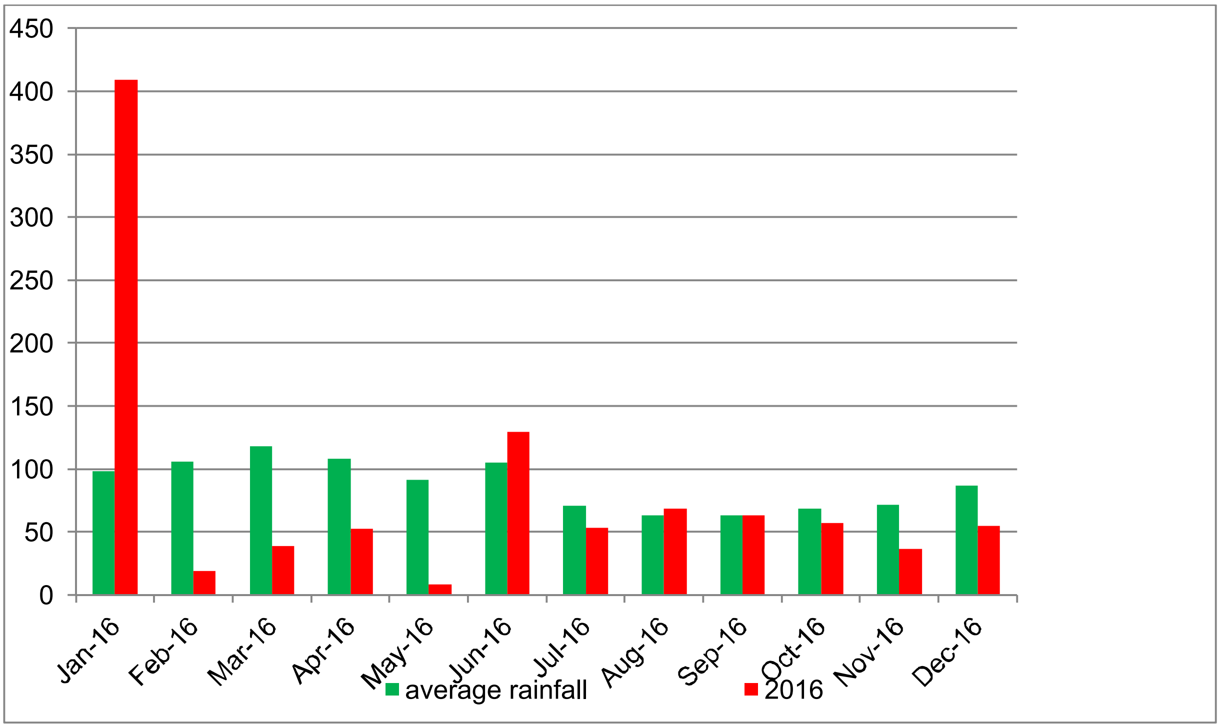

Figure 3 Average Monthly Rainfall compared to 2016 rainfall at Raymond Terrace

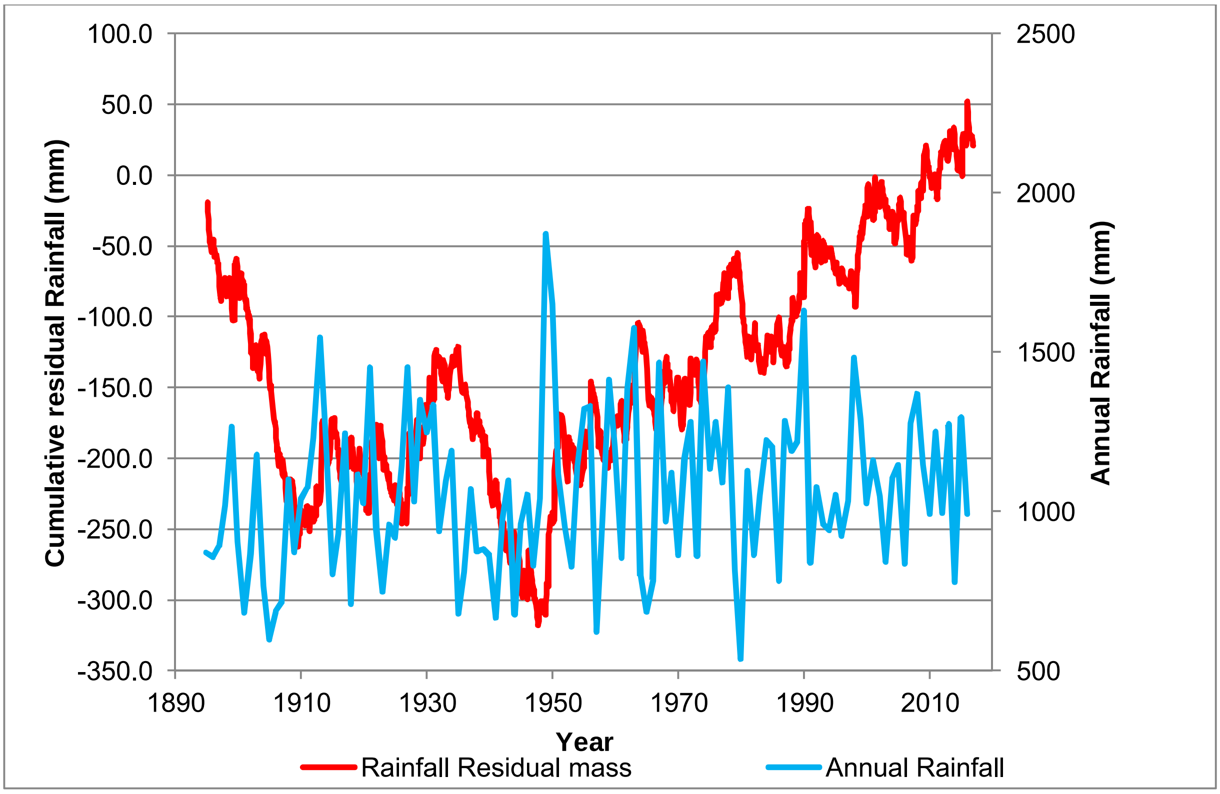

Figure 4 Rainfall Residual Mass – Raymond Terrace 1894 – 2016

The closest BOM station to Bloomfield is at the East Maitland Bowling Club (BOM Station 061034), located about 5 km north-east of the Site. The rainfall record for Raymond Terrace and the East Maitland Bowling Club are similar although Mean monthly rainfall at East Maitland is lower. The East Maitland rainfall record has been used to calculate rainfall recharge in the groundwater model as it is closer to the Mine.

4.2 Physiography

The topography surrounding the Colliery is dominated by gentle undulations to low hilly country. Surface drainage flows towards Whites Creek and Four Mile Creek that discharge into the Hunter River. Most of the operational mining areas at Bloomfield are located within the catchment of Four Mile Creek. Wallis Creek is located west of Bloomfield.

A series of drains and levees direct Four Mile Creek around Lake Foster (mine water storage) and into Possums Puddle (clean water storage). From Possums Puddle, clean water overflows, or is discharged, back into Four Mile Creek. The Colliery has two major mine water storage facilities, referred to as Lake Kennerson and Lake Foster.

The topography across the Colliery mine lease ranges from approximately 15 m AHD (Australian Height Datum) to more than 80m AHD.

4.3 Geology

The Colliery is located within the Permian Tomago Coal Measures of the Hunter Valley Coalfields within the Sydney Basin. The target coal seams are the Big Ben, Donaldson, Elwells Creek, Whites Creek and Upper and Lower Buttai seams (Aquaterra, 2008). Interburden between the coal seams consists of interbedded mudstone, siltstone and sandstone along with minor uneconomical coal seams. The overlying Newcastle coal measures do not outcrop at the site. The sediments dip to the south and south-west. Minor dykes and faults cross cut the strata.

To the west of the Colliery Quaternary alluvial deposits of gravel, sand, silt and clay are associated with Wallis Creek which in part forms a wetland system of disconnected ponds and swamps. To the east Quaternary sediments are associated with the Hunter River floodplain. Hexham Swamp has formed within the Quaternary sediments of the floodplain. Elsewhere across the site there are minor alluvial deposits associated with creeks such as Four Mile Creek and Buttai Creek.

4.4 Hydrogeology

4.4.1 Regional Hydrogeology

There are two aquifer groups that dominate the Upper Hunter Valley, the alluvial deposits of the Quaternary and consolidated sedimentary rocks of the Permian.

Alluvial deposits consisting of gravel, sand and clays where saturated can deliver reliable yields and good quality water which are used for domestic and agricultural purposes. These deposits are typically orders of magnitude more permeable than the Permian age coal seams.

Within the Permian age sedimentary rocks groundwater is typically of poor quality and of low yield. The coals seams represent the main water baring units of the Permian strata and can function as a semi-confined aquifer with vertical leakage from above and below interburden. Weathered zones near or at the surface can act as recharge zones and can form vertically and horizontally disconnected perched aquifers. Permeability’s within the coal seams range from 0.001 to 12 m/day and decrease exponentially with depth (AGE, 1984).

The sedimentary rock interburden has permeability’s in the range of 0.0013 m/ day to 0.4 m/day (AGE, 1984).

Regionally the potentiometric surface is a subdued reflection of the topography. At higher elevation features the potentiometric surface is typically deeper while at low lying features (e.g. valleys) it is typically closer to the ground surface. There is believed to be very limited hydraulic connectivity between the alluvium and Permian Coal Measures (Aquaterra, 2008).

4.4.2 Local Hydrogeology

The hard rock Permian coal measures are the main aquifer unit for the site, with the coal seams themselves representing the most permeable material within the formation. Groundwater typically is restricted to the cleat and fractures within the coal.

Groundwater is also present in the Quaternary alluvium, swamp, floodplain and estuarine sediments. The alluvial groundwater is shallow with groundwater levels being topographically controlled.

The Bloomfield groundwater monitoring network consists of five standpipe piezometers and five Vibrating Wire Piezometers. The potentiometric heads measured within the coal show a progressive decline with depth. There are stronger vertical gradients on the southern boundary and minimal gradients at the western sites (HydroSimulations, 2017). Piezometer logs are attached in **Appendix C**.

Groundwater in the region shows climatic trends where groundwater elevation drops in response to periods of decreased rainfall (Aquaterra, 2008). Long-term mining effects on the local groundwater system can be seen in the hydrographs prepared by HydroSimulations showing a decrease in groundwater elevation in piezometers monitoring the deeper coal seam aquifers, which isn't seen in the upper alluvial aquifer. This infers the alluvium/ weathered overburden and the deeper coal measures are not hydraulically connected.

The highest groundwater levels are in the northern part of the site where the coal measures outcrop. Pre mining the lateral hydraulic gradient would have been to the south and south east, however as a result of open cut mining, large sinks now exist and the natural gradient has been reversed (Aquaterra, 2008; HydroSimulations, 2017).

4.5 Recharge and Discharge

Recharge for the surficial alluvial aquifers and outcrop areas is dominated by rainfall. The alluvial aquifer is likely to be connected to Wallis Creek and Hexham Swamp, and would discharge to the streams. In wetter periods where the stream levels are higher than that of the water levels in the alluvium, they may contribute to stream flow or seepage from the streams into the aquifer may occur, although this would be short lived after rainfall events.

Coal seams are recharged by rainfall only at outcrop areas. At depth the coal seams are recharged by lateral flow down-gradient from outcrop areas and vertical flow through the overburden (HydroSimulations, 2017).

Groundwater discharge occurs by:

- Evapotranspiration in shallow water table areas;
- Spring flow;
- Baseflow contributions in wet periods;
- Evaporation from in-pit pools and seepage faces; and
- Direct pump out.

Due to naturally high salinity and low yields there is no other significant groundwater abstraction other than mining. There are only a few stock/ domestic bores registered in the government bore database (HydroSimulations, 2017). Bore logs for registered bores within a 4.5 km radius of the Mine are collated in **Appendix D**.

Average A Class pan evaporation for Cessnock (station 061242) and Paterson (061250) are presented below, and have a daily average of 4 mm/ day (1,460 mm/a).

Table 6 Mean Daily Evaporation Data for Cessnock and Paterson Stations (mm/d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cessnock (1966 – 2012)	5.7	4.9	3.9	2.8	1.9	1.5	1.7	2.5	3.5	4.3	5.0	5.7
Paterson (1967 – 2017)	6.2	5.3	4.2	3.2	2.4	2.1	2.4	3.3	4.4	5.2	5.8	6.6

The actual evapotranspiration (ET) in the district is approximately 800 mm/a according to BoM (2017). The definition for actual ET is "*the ET that actually takes place, under the conditions of existing water supply, from an area so large that the effects of any upwind boundary transitions are negligible and local variation are integrated to an area average. For example, this represents the ET which occur over a large area of land under existing (mean) rainfall conditions*" (HydroSimulations, 2017).

4.6 Existing Groundwater Usage

A review of the DI-CLW registered groundwater database showed there were 22 registered bores within 4.5 km of the Colliery most of which were monitoring bores.

4.7 Groundwater Dependent Ecosystems

The *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* (DPI Water, 2016) does not list any high priority groundwater dependent ecosystems (GDE's) in the vicinity of the site.

Similarly within the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources* (DWE, 2009) there are no high priority GDE's in the vicinity of the site.

4.8 Groundwater Quality

Groundwater in the vicinity of the mine is generally:

- Saline and of negligible beneficial use. Total Dissolved Solids (TDS) concentrations ranged from 1000 mg/L to 13,000 mg/L (Aquaterra, 2008); and
- pH is generally close to neutral (Aquaterra, 2008; Business Environment, 2008).

4.9 Groundwater Surface Water Interaction

The shallow alluvial aquifer, which is associated with Wallis Creek and the Hunter River floodplain, is inferred to be in direct hydraulic connection with the lower reaches of the major tributary streams in the area. This is based on a close correlation between the surface water and groundwater levels (Aquaterra, 2008) and groundwater baseflow in the ephemeral water courses, which is likely to reverse direction during periods of heavy surface water flow.

Groundwater in the localised surficial weathered bedrock is inferred to be in hydraulic connection with the high-level streams. These limited occurrences of surficial groundwater do not represent a significant or regionally extensive aquifer system, and are not considered to be part of the surface water flow system.

There is no evidence of connectivity between surface waters and the deeper aquifers of the coal measures (Aquaterra, 2008).

Modelling of the groundwater and surface water interactions for surface water systems surrounding Bloomfield found that all watercourses were inferred to be gaining systems with the exception of Buttai Creek and Hexham Swamp. The Surface Water Assessment conducted by AECOM (2017) found the final proposed landform will result in a reduction in the catchment area draining towards the final void to approximately 52 Ha, a decrease from the 103 Ha under the currently approved final landscape design. This increases the catchment to Buttai Creek by 41 hectares.

Figure 5 and **Figure 6** show the local and regional surface water system relative to the Colliery.

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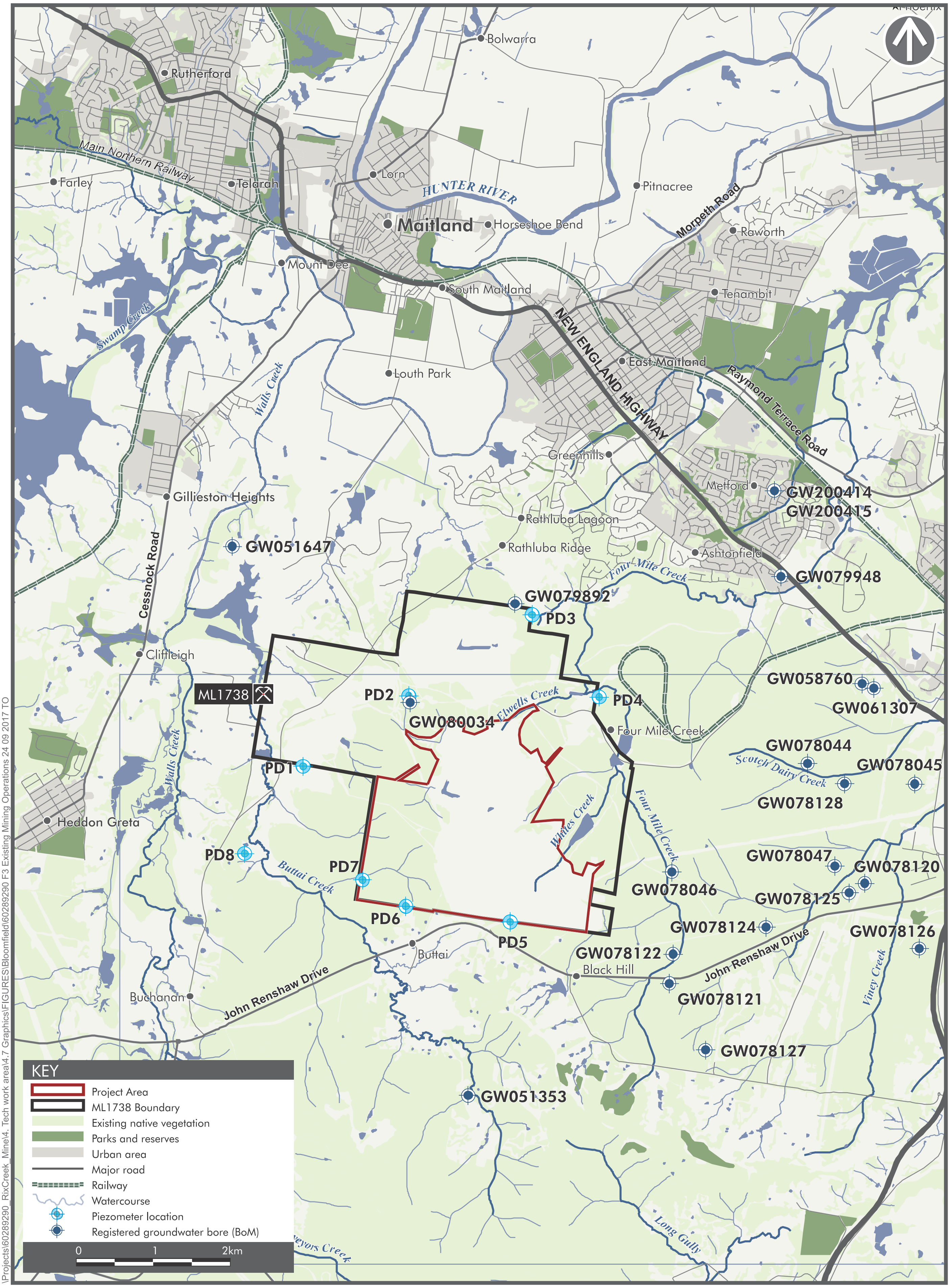
AECOM

EXISTING MINING OPERATIONS
Bloomfield Project

FIGURE 5



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GROUNDWATER MONITORING BORES AND SURROUNDING REGISTERED BORES

Bloomfield Project

FIGURE 6

5.0 Assessment of Potential Impacts

5.1 Groundwater Extraction

5.1.1 Predicted Mine Inflows

Predicted groundwater extractions via mine inflows are presented in **Table 7.** Inflows in 2006 are predicted to be 0.9 ML/d at the start of open cut mining and will peak around 1.6 ML/d (year 2013) in the calibration period and a peak of 1.5 ML/d in the prediction period. These rates do not incorporate evaporation losses that will occur when the groundwater is exposed to the atmosphere. In 2025 at the cessation of mining inflows are predicted to be approximately 1.0 ML/d.

Table 7 Bloomfield Mine inflow rates (2006 - 2132)

Mine year		Stress Period	Mine inflow (ML/d)	Mine inflow (ML/year)
Calibration	2006	2	0.88	322
	2007	4	0.82	300
	2008	6	0.85	312
	2009	8	0.87	318
	2010	10	0.92	336
	2011	11	1.18	430
	2012	12	1.4	513
	2013	13	1.57	572
	2014	14	1.51	551
	2015	15	1.4	511
	2016	16	1.2	440
	2017	17	1.24	455
Prediction	2018	18	1.42	520
	2019	19	1.42	520
	2020	20	1.54	561
	2021	21	1.53	559
	2022	22	1.16	423
	2023	23	0.69	253
	2024	24	1	367
	2025	25	1	367
	2026	26	0	0
	2027	27	0	0
	2028	28	0	0
	2029	29	0	0
	2030	30	0	0
	2031	31	0	0
Recovery	2032 - 2132	32	0	0

5.1.1.1 Mine Inflow Prediction Refinement

The groundwater model is conservative and applies higher rainfall recharge to the model at various locations across the model domain, resulting in higher predicted mine flows. Two areas of increased modelled recharge are as follows:

1. Mine spoil area; and

2. Catchments of surface water run-off diversions[1]

The mine spoil area (43.3 ha) and the hardstand workshop area (7.5 ha) west of the mine spoil area will receive no rainfall recharge as runoff is captured from these areas and discharged off-site. A recharge rate of 5% of annual rainfall was applied to these areas to keep the model stable. Removal of this water from the model will reduce the mine inflows by 22.61 ML/year.

Clean water catchments across the site divert clean surface water runoff to storage dams which are part of the natural surface water system limiting rainfall recharge. There are four clean water sub-catchments with a total surface area of 623 ha as follows:

1. Buttai Creek – 269 ha;
2. Four Mile Creek – 141 ha;
3. Possum Puddle west 135 ha; and
4. Possum Puddle east 78ha.

A reduction in groundwater recharge from 5% (modelled) to 4% across these catchments is considered realistic to account for the enhanced rainfall runoff. Removal of this water from the model will reduce the mine inflows by 55.4 ML/year.

Thus in total the mine inflow refinements which include a reduction in rainfall recharge from the mine spoil area and clean water sub-catchments would reduce mine inflows by a total of 78.0 ML/year.

The estimated annual water requirements for licensing is summarised in **Table 8** based on the revised mine inflows for the water year. The water year is assumed to be from July through to June.

Table 8 Modelled Mine and Refined Inflows for the Water Year

Water Year	Licence Requirement (ML/year)	
	Modelled	Refined inflow
2016/17	447.5	369.5
2017/18	487.5	409.5
2018/19	520	442
2019/20	540.5	462.5
2020/21	560	482
2021/22	491	413
2022/23	338	260
2023/24	310	232
2024/25	367	289
2025/26	183.5	105.5
2026/27	0	0

The predicted licence requirements from the refined inflows vary from 369.5 ML/year in 2016/17, reaching a maximum of 482 ML/year in 2020/21 and declining to zero in 2026/27. These predicted mine inflows are within the existing mine licence discharge licence of 500ML/year.

[1] The clean water catchment boundaries are defined by the contours, clean and dirty water drawings provided by Bloomfield. The mine lease boundary forms the edge of the catchment areas, where in some instances the actual catchment extends beyond the mine lease boundary. Further detail on the diversion works would assist in refining these catchments.

5.1.2 Alluvial Takes

The alluvial takes from the Wallis Creek Water Source and the Newcastle Water Source are presented in **Table 9**. These takes are only as a result of Bloomfield mining operations and have been considered in the overall mine inflow rates (HydroSimulations, 2017).

Table 9 Modelled Alluvial Takes

	Wallis Creek Water Source Take Extra Leakage (ML/ year)		Newcastle Water Source Take Less Upflow (ML/ year)	
	Calibration Period (2006 – 2017)	Prediction and Recovery Period (2018 – 2132)	Calibration Period (2006 – 2017)	Prediction and Recovery Period (2018 – 2132)
Maximum	8	26	0.2	8
Mean	4	12	0.0	2

5.1.3 Final Void

The final void will remain a sink and will have a wide spread effect of lowering water levels in the vicinity of the mine in the long term. A hypothetical monitoring point within the final void is predicted to only recover 15 m after 100 years, with a void water surface of -40 m AHD (HydroSimulations, 2017).

5.2 Groundwater Drawdown

Predicted groundwater heads have been modelled to show groundwater level and drawdown at the completion of mining in 2025.

Drawdown as a result of mining activities at the Colliery are expected to reach a maximum in the Mine Year 20 or 2025, at which time mining activities are scheduled to cease in the southern end of the approved extraction area and the groundwater levels would start to recover (HydroSimulations, 2017).

Drawdown of 100 m is predicted in the surficial aquifer layer 1 in the Bloomfield extraction area and final mine void (alluvial and regolith) although it is limited in extent. Significant drawdown is also evident within the lease area to the north-west of approved extraction area corresponding with historical open cut and underground mining. Drawdown from the open cut is propagating into the high permeability underground voids, although there is some spatial confinement with the north-westerly trending dyke.

Drawdown is generally less than 0.5 m outside the Bloomfield lease area apart from the south-west corner where the 2 m drawdown contour extends outside the lease approximately 600 m beneath Buttai Creek (HydroSimulations, 2017).

The predicted drawdowns are not expected to negatively impact GDE's as historical mining in the area has previously lowered water levels far below the ground surface.

The Donaldson open cut and final void are predicted to experience significant drawdown, however there is no overlap of the water table drawdowns produced by the various mines (HydroSimulations, 2017).

Predicted drawdowns at the end of mining in nearby registered bores (within 5 km) are shown in **Table 10**. All values are cumulative.

Most of the drawdown are predicted to be less than 1 m, however drawdowns between 1-2 m are predicted for three bores (GW078047, GW078128 and GW078044), which is within the Aquifer Interference Policy threshold of 2 m.

Larger drawdowns are predicted for GW078124 and GW078124 with 20 m and 17 m drawdown respectively due to the final void at the Donaldson mine.

Table 10 Predicted Drawdown in Registered Alluvial Bores at End of Mining 2025

Bore name	Easting (MGA)	Northing (MGA)	Bore depth (m)	Drilled year	Predicted drawdown (m)
GW200415	369986	6373738	20.1	2004	<1
GW078120	371176	6368590	24	1997	<1
GW080034	365222	6370959	NA	NA	<1
GW078125	370970	6368464	30	1997	<1
GW058760	371142	6371207	33	1983	<1
GW061307	371299	6371148	30	1984	<1
GW200414	369960	6373761	10	2004	<1
GW078123	369309	6386165	33	1997	17
GW051647	362896	6373006	12	1980	<1
GW078047	370784	6368800	54.3	1997	1.5
GW078122	368666	6367663	35.4	1997	<1
GW078124	369883	6368018	40	1997	20
GW078045	371836	6369892	30.5	1997	<1
GW078128	370912	6369893	30	1997	2
GW051353	365986	6365810	49.7	1997	<1
GW079892	366598	6372257	6.69	1980	<1
GW078046	368651	6368741	30.4	NA	<1
GW079948	370081	6372613	NA	1997	<1
GW078044	370428	6370151	30.1	NA	1.4
GW078127	369073	6366406	30	1997	<1
GW078126	371890	6367736	30	1997	<1
GW078121	368619	6367262	43	1997	<1

5.3 Groundwater Quality Impacts

Groundwater within the Bloomfield mine lease is saline and of negligible beneficial use. The potential impacts of Bloomfield's current and future operations relate to the risks of contamination from disturbed catchments, mine water, and process water being released off site to natural waterbodies.

Discharges to Four Mile Creek from Bloomfield occur from Lake Foster discharge pipe outlet and are monitored and reported in accordance with EPL 396. Since the approval of the Project there have been four unplanned discharges as a result of large rainfall events or pipe failure which resulted in water overflowing from storage dams and leaving the site. These incidents were reported to the EPA in accordance with Project Approval and EPL requirements.

The proposed modification being sought by Bloomfield will not increase or decrease the probability of unplanned discharges, or water quality risks, from Bloomfield's operations. However these risks will continue to exist up until the end of extraction (2030) and until such time as the site is rehabilitated noting that risks would decrease with the progressive rehabilitation of post mining areas across the life of the project. As part of the management measures described in Section 6.0 Bloomfield will update the environmental management systems as part of the project to further minimise the risk of unplanned discharges.

5.4 Baseflow Impacts

The model was set up to accept baseflow if groundwater levels exceeded riverbed elevations, but not to allow leakage as most streams in the area are ephemeral. The model was able to predict reduction to baseflow but was unable to predict increases in leakage from losing streams. Baseflow simulations were run for both mining and null simulations.

The predictions are:

- Four Mile Creek is predicted to be converted to a losing stream around 2011, therefore its average baseflow of 0.24kL/ day would be lost;
- The difference between mining and null runs for all other water courses was negligible, indicating that Bloomfield mining is having an insignificant effect on baseflow capture; and
- Leakages for Hexham Swamp differed by no more than 1 kL/ day between both mining and null. This would be within numerical error bounds.

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6.0 Monitoring and Management of Impacts

6.1 Monitoring

In order to monitor the drawdown effects from depressurisation of the regional aquifer ongoing quarterly monitoring of the onsite piezometer network and monthly surface water monitoring is recommended. In addition the installation of additional monitoring points will be considered if areas of predicted drawdown are significantly different to actual drawdown.

The frequency of water level measurements within the pit should be compatible with evaporation rates obtained from the site's weather station which will allow refinement of model calibration and inflow predictions.

6.2 Management

Bloomfield has an existing Water Management Plan (WMP) which details the monitoring and management measures which are currently in place for the management of groundwater (and surface water) at the Colliery. The WMP will be reviewed and updated in accordance with the conditions of consent to monitor groundwater levels in monitoring wells and in the pit. Groundwater discharge will be monitored to quantify pit inflows to ensure the discharge licence conditions are satisfied.

The monitoring data collected from groundwater and surface water systems enables management of groundwater impacts through the following recommendations:

- Establishment of groundwater and surface water trigger levels based on the beneficial use of each water body;
- Mitigation measures may include the provision of 'make good' measures in bores where excessive drawdown may be experienced. This could involve deepening a water supply bore or providing an alternative water supply. No surface water mitigation measures are proposed due to the minimal predicted impacts;
- Groundwater level data will be plotted as hydrographs and compared to rainfall; and
- The results of the groundwater monitoring program will be collated on an annual basis and presented in an annual report as required under the conditions of consent.

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7.0 Policy Compliance

7.1 Aquifer Interference Policy

The *Water Act 1912* (NSW) has been replaced by the WM Act and does not apply to areas of the state where water sharing plans are in place. Groundwater and surface water within the project footprint are covered by the *Water Sharing Plan for the Hunter Regulated River Water Source* and the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*.

The AIP explains the requirements of the WM Act. It clarifies the requirements for licences for aquifer interference activities and establishes the considerations required for assessing potential impacts on key water dependent assets. Any potential impact on local aquifers would be assessed under this policy.

A controlled activity approval (such as a water access licence or aquifer access licence) and/or an aquifer interference approval is required under the WM Act for any activity that results in interference to an aquifer. Under section 91F of the WM Act, approval is required for aquifer interference activities. These activities include the taking of groundwater. The policy applies to all aquifer interference activities, but has been developed to address a range of high risk activities.

7.2 Minimal Impact Assessment

The AIP outlines minimal impact considerations that must be met as a result of the proposal. The minimal impact considerations are dependent upon the impacted aquifer type (alluvial, coastal, fractured rock or special cases such as the Great Artesian Basin) and whether the aquifer is ‘highly productive’ or ‘less productive groundwater’. The impacts to be considered are to groundwater levels (or water pressure in artesian basins) and water quality as follows:

- **Water table** (drawdown) – impact is considered to be minimal where there is less than a cumulative two metre decline at any water supply work. If the impact is greater than two metres than make good provisions apply;
- **Water table** (receptors) – impact is considered to be minimal where the water table change is less than 10 percent of the cumulative variation in the water table 40 metres from any high priority GDE or high priority culturally significant site listed in the water sharing plan;
- **Water pressure** – impact is considered to be minimal where the cumulative decline in head is less than two metres at any water supply work; and
- **Water quality** – impact is considered to be minimal where the change in groundwater quality is within the current beneficial use category of the groundwater beyond the 40 metres of the activity.

If the predicted impacts are less than Level 1 minimal impact considerations (as defined in the AIP) then these impacts are considered acceptable. If, however, the impacts are assessed as greater than Level 1 but these predicted impacts exceed the Level 1 thresholds by no more than the accuracy of a robust model, the project would be accepted as suitable with appropriate monitoring during operation. To reduce the impacts, mitigation measures such as make good provisions may be required to protect a resource or receptors. Where the groundwater impacts are deemed not acceptable the project may have to be modified to reduce the groundwater impacts on an acceptable level.

The majority of the project footprint is considered to be within a ‘Less Productive Groundwater Source’ within fractured rock, based on the low number of registered bores in the area. In outlining the Minimal Impact Considerations (Table 1, AIP) the policy considers porous and fractured rock water resources together.

A minimal impact assessment has been conducted for the groundwater potentially impacted by the project in accordance with the *NSW Aquifer Interference Policy Step by Step Guide* (NoW, 2013b). The minimal impact considerations for ‘highly productive groundwater’ in a fractured rock aquifer and for ‘less productive groundwater’ in a coastal aquifer are presented in **Table 11** and **Table 12** respectively.

Table 11 Minimal Impact Considerations for a 'highly productive groundwater alluvial aquifer"

Minimal Impact Considerations	Response
Water Table – Level 1 Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post water sharing plan' variations, 40 m from any: High priority groundwater dependent ecosystem; or High priority culturally significant site listed in the schedule of the relevant water sharing plan, or A maximum of a 2 m decline cumulatively at any water supply work.	There are no high priority groundwater dependent ecosystems listed under the *North Coast Fractured and Porous Rock Groundwater Sources* No culturally significant sites were identified within the *North Coast Fractured and Porous Rock Groundwater Sources* Groundwater modelling indicates that drawdown effects on the surficial aquifer are not expected to have any adverse impact on groundwater dependent ecosystems because the groundwater levels are already well below ground surface.
Water Table – Level 2 If more than 10% cumulative variation in the water table, allowing for typical climatic 'post water sharing plan' variations, 40 m from any: High priority groundwater dependent ecosystem; or High priority culturally significant site; listed in the schedule of the relevant water sharing plan, if appropriate studies demonstrate to the Minister's satisfaction that the variation will not prevent the long term viability of the dependent ecosystem or significant site. If more than a 2 m decline cumulatively at any water supply work then make good provisions should apply.	The alluvium of both the Wallis Creek Water Source and the Newcastle Water Source (along the lower Hunter) are classified as 'Highly Productive' by DPI Water. The calculated alluvial takes (rounded to the nearest ML/a) for separate simulation phases are recorded in **Table 9**. These takes are due only to Bloomfield mining. The standpipe SP4-2 is located near Four Mile Creek. It is more likely that the water level in this bore is influenced by water level in the creek, when it flows. The simulated hydrograph shows a rising trend for some years, followed by stabilisation. SP7-1 is located at the western border of the Bloomfield mine. The prediction and recovery stages of the simulated hydrograph suggest that the water level will decline due to mining and not recover significantly. This bore would remain within the zone of influence of the final void. Most of the drawdown for registered bores calculated by the model are much less than 1 m, while drawdown greater than 1 m and up to 2 m are predicted at three bores (GW078047, GW078128 and GW078044), which is within the AIP's 2 m threshold. Large predicted drawdowns of 20 m and 17 m at bores GW078124 and GW078123 are due to the final void at the Donaldson mine. Mitigation measures have been recommended for GW078124 and GW078123 located near the Donaldson Mine where it has been predicted that the drawdown exceeds a water level decline of more than 2 m. The predicted groundwater level decline will not prevent the long term viability of the bore and make good provisions will be covered by the Donaldson Mine groundwater management plan.

Minimal Impact Considerations	Response
Water Quality – Level 1 Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	Not applicable
Water Quality – Level 2 If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long term viability of the dependent ecosystem, significant site or affected water supply works.	Not applicable

Table 12 Minimal Impact Considerations for a 'Less Productive Fractured Rock Aquifer'

Minimal Impact Considerations	Response
Water Pressure – Level 1 A cumulative pressure head decline of not more than a two metre decline, at any water supply work.	Significant drawdown is also evident within the lease area to the north-west of the approved extraction area, coincident with historical open cut and underground mining. Drawdown from open cut mining is propagating into the high-permeability underground voids, with some spatial confinement offered by a north-westerly trending dyke. The drawdown is generally less than 0.5 m outside the Bloomfield lease boundary except for the south-west corner where a 2-m drawdown contour extends off-lease. The 2 m of drawdown extends beneath Buttai Creek for a distance of about 600 m.
Water Pressure – Level 2 If the predicted pressure head decline is greater than condition 1 above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long term viability of the affected water supply works unless make good provisions apply.	Whites Creek Seam: All three vibrating wire piezometers (VWP) lie along the southern boundary of the Bloomfield lease. All simulated hydrographs show significant mining effects, with the degree of recovery being minimal but increasing from east to west, due to the effects of adjacent underground mining. Donaldson Seam: Four out of seven bores (SP2-1, VW1(35m), VW6(114m) and VW7(95m)) in this layer show slow water level recovery post-mining. Water levels at bores SP3-1 and VW5(71m) show no sign of recovery. Most bores are influenced by adjacent underground mining. Big Ben Seam: All simulated hydrographs show significant declines due to mining, with slow or negligible recovery in some cases. Most bores are influenced by adjacent or historical underground mining.
Water Quality – Level 1 Any change in the groundwater quality should not lower the beneficial use category of the	Not applicable

Minimal Impact Considerations	Response
groundwater source beyond 40 m from the activity.	
Water Quality – Level 2 If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long term viability of the dependent ecosystem, significant site or affected water supply works.	Not applicable

7.3 Compliance with the Water Sharing Plan

The project is covered by the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*, which applies to 13 groundwater sources. The Water Sharing Plan outlines a series of rules for granting access licences (Part 7), managing access licences (Part 8), water supply works approvals (Part 9), access licence dealings (Part 10) and mandatory conditions (Part 11). A summary of relevant rules and an assessment of project compliance are provided in **Table 13**, it was found that all rules are complied with.

Table 13 Project Compliance with the Water Sharing Plan

Rule	Assessment
Rules for granting access licences	Groundwater access is managed under Licence 20BL172035. There are no surface water licences.
Rules for managing access licences	The EPL and Water Management Plan detail the process in which water access is managed and discharged.
Distance restrictions to minimise interference between supply works	There are no supply works within the area of the Colliery.
Distance restriction from the property boundary is 50 m	Property boundary is outside the 50 m restriction.
Distance restriction from an approved water supply work is 100 m	No bores registered to property outside the Mine have been identified within 100 m of the project.
Distance restriction from a Department observation bore is 200 metres	There are no DPI Water observation bores within 200 m of the project footprint.
Distance restriction from an approved work nominated by another access license is 400 m.	There are no water supply works nominated by another access licence within 400 m of the project footprint.
Distance restriction from an approved water supply work nominated by a local water utility or major utility access licence is 1000 m	There are no local or major water utilities within 1000 m of the project footprint.
Part 9 – 40 Rules for water supply works located near contaminated sources	There are no identified contamination sources located near the project area.
Part 9 – 41 Rules for water supply works located near sensitive environmental	The project footprint is located outside the required distance for the following sensitive environmental areas:

Rule	Assessment
areas	• 200 m of a high priority groundwater dependent ecosystem; • 500 m of a karst groundwater dependent ecosystem; and • 40 m from a lagoon or escarpment. The project footprint is not located outside the required distance of the following sensitive environmental areas: • 40 m from third order streams or above. The non-compliance of the third order streams is considered acceptable as the creeks form part of the surface water discharge system under the Mines EPL.
Part 9 – 42 Rules for water supply works located near groundwater dependent culturally significant sites	The project footprint is not located near a groundwater dependent culturally significant site.
Part 9 – 44 Rules for water supply works located within distance restrictions	There are no water supply works that are located within restricted distances along the project footprint.
Part 10 – Access dealing rules	Groundwater access is managed under Licence 19027. There are no surface water licences.

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8.0 Conclusions and Recommendations

Bloomfield is seeking approval for modifications to Project Approval 07_0087, for the extension of mining operations up until 31 December 2030 and a revised final landform.

Mine scheduling to support the Project Approval identified that the resource would be exhausted by the end of 2021. However, Bloomfield now predicts mining to extend beyond 2021 due to:

- Actual run of mine (ROM) production levels have been lower than the predicted ROM production rates of 1.3 Mtpa, over the life of the project to-date;
- Changes to the mine fleet have allowed access to, and extraction of seams that were not previously considered to be a recoverable resource as part of the original 2008 EA; and
- Further exploration has identified other previously unrecoverable resources that the new fleet can now access.

Bloomfield has identified up to 13 million tonnes of ROM coal remaining inside the approval area. Based on current annual mining rates of approximately 1 million tonnes of ROM per year, mining will extend beyond 2021. The intention of this consent modification is to align the Bloomfield mining operations consent limit to coincide with the adjoining Abel Underground Mine consent limit of 31 December 2030. Maximum annual production levels will continue at 1.3 Mtpa ROM per year.

For licencing purposes the maximum inflow predicted by the model across the life of the proposed Project is 561 ML/a in 2020. However the groundwater model is conservative and applies higher recharge across parts of the model domain. The mine inflows have been recalculated reducing recharge to these areas and the resultant mine inflows are within the licence conditions of 500ML/a. The final void will remain a sink and will have a wide spread effect of lowering water levels in the vicinity of the mine in the long term. A hypothetical monitoring point within the final void is predicted to only recover 15 m after 100 years.

Groundwater drawdown as a result of mining activities are expected to reach a maximum in 2025, at which time mining activities are scheduled to cease in the southern end of the approved extraction area and groundwater levels would start to recover. A drawdown of 100 m is predicted in the surficial aquifer in the Bloomfield approved extraction area and final mine void. Drawdown is generally less than 0.5 m outside the Bloomfield lease area apart from the south-west corner where the 2 m drawdown contour extends outside the lease approximately 600 m beneath Buttai Creek. The predicted drawdowns are not expected to negatively impact GDE’s as historical mining in the area has lowered water levels far below the ground surface.

Discharges to Four Mile Creek from Bloomfield occur from Lake Foster discharge pipe outlet and are monitored and reported in accordance with EPL 396. The proposed modification will not increase or decrease the probability of unplanned discharges, or water quality risks from Bloomfield’s operations.

Predicted surface water impacts were considered negligible, indicating that Bloomfield mining is having an insignificant effect on stream baseflow. Four Mile Creek is predicted to have been converted to a losing stream around 2011, losing an average baseflow of 0.24kL/ day.

A minimal impact assessment has been conducted for the groundwater potentially impacted by the project in accordance with the AIP. All predicted impacts are less than Level 1 minimal impact considerations (as defined in the AIP) and are therefore considered acceptable with appropriate monitoring during operation.

The project is covered by the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*. An assessment of project compliance found that all rules are complied with.

Monitoring and Management Recommendations

In order to monitor the drawdown effects from depressurisation of the regional aquifer ongoing quarterly monitoring of the onsite piezometer network and surface water monitoring is recommended. In addition the installation of additional monitoring points will be considered where areas of predicted drawdown are significantly different to that of the actual drawdown.

The frequency of water level measurements within the pit should be compatible with evaporation rates obtained from the site's weather station which will allow refinement of model calibration and inflow predictions.

The monitoring data collected from groundwater and surface water systems enables management of groundwater impacts through the following recommendations:

- Establishment of groundwater and surface water trigger levels which require an assessment of the ongoing impact at each location;
- Mitigation measures may include the provision of 'make good' measures in bores where excessive drawdown may be experienced. This could involve deepening a water supply bore or providing an alternative water supply. No surface water mitigation measures are proposed due to the minimal predicted impacts; and
- Groundwater monitoring is to be undertaken in accordance with a groundwater monitoring plan developed in accordance with the approval consent conditions.

9.0 References

AECOM (2013); Preliminary Environmental Assessment, Rix's Creek Continuation of Mining Project, dated 21 November.

Australasian Groundwater and Environmental Consultants Pty Ltd (1984) Effects of Mining on Groundwater Resources in the Upper Hunter Valley, NSW Coal Association.

Aquaterra (2008): Bloomfield Colliery Completion of Mining and Rehabilitation Groundwater Impact Assessment. Re: S05/R02g, dated September.

DPI Water (2012): NSW Aquifer Interference Policy. State of NSW, Department of Trade and Investment, Regional Infrastructure Services NSW Office of Water. NSW Department of Primary Industries.

DPI Water (2016): Water Sharing plan for the North Coast Fractured and Porous Rock Groundwater Sources. Background document for amended plan 2016. dated August. NSW Department of Primary Industries.

DPI Water (2016): Water Sharing plan for the Hunter Unregulated and Alluvial Water Sources. Background document for amended plan 2016. dated August. NSW Department of Primary Industries.

DPI Water (2017): Water Sharing plan for the Hunter Regulated River Water Source. Background document, dated March. NSW Department of Primary Industries.

DWE (2009): Hunter unregulated and alluvial water sources. Guide, dated August. . NSW Department of Water and Energy.

HydroSimulations (2017). Bloomfield Colliery Extension Groundwater Modelling Assessment.

NSW Government, 2012. Strategic Regional Land Use Policy.

NSW Office of Environment and Heritage (2015). Hunter Wetlands National Park Draft Plan of Management

RPS (2014): Rix's Creek continuation of mining project, Groundwater Impact Assessment, dated 30 September.

Appendix A

Groundwater Modelling Report

HydroSimulations

Appendix A Groundwater Modelling Report HydroSimulations

Bloomfield Colliery Extension

Groundwater Modelling Assessment

FOR

AECOM and

The Bloomfield Group

BY

NPM Technical Pty Ltd

trading as

HydroSimulations

Project number: BLO001

Report: HC2017/39

Date: October 2017

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Role	Persons
Modeller	Ms N. Akhter
Authors	Ms N. Akhter, Dr N. Merrick
Reviewer	Dr N. Merrick

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1 INTRODUCTION

The Bloomfield Colliery (Bloomfield) is an existing open cut mining operation located near Buttai in the Hunter Valley of New South Wales (NSW), about 25 kilometres (km) north-west of Newcastle, and about 5 km south of Maitland. The project site is located a few kilometres west of the M1 Motorway and immediately North of John Renshaw Drive (B68 Freeway) (**Figure 1).**

Bloomfield is one of two open cut coal mines owned by its parent company, Big Ben Holdings Pty Limited. It produces approximately 0.6 million tonnes of product coal per annum (Mtpa) by open cut methods. Coal has been mined on the site for approximately 170 years. Underground mining commenced in 1937 to the west and north-west of current open cut mining (**Figure 2**), and the last coal extracted from underground operations was in 1992. Bloomfield produces mainly thermal coal with some semi-soft coking coal, principally for the Asian export market.

The current operation consists of open cut mining, a Coal Handling and Preparation Plant (CHPP) and a rail loading facility that transports processed coal to the Port of Newcastle. The open cut commenced operations in 1964 and has continued to the present day. Part 3A approval was granted in September 2009, with three Modification approvals since then (May 2011, March 2012, February 2013). The 2009 approval (07_0087) was supported by a Groundwater Impact Assessment conducted by Peter Dundon & Associates Pty Ltd with groundwater modelling conducted by Aquaterra Consulting Pty Ltd (Aquaterra, 2008).

The continued use of the coal washery and rail loading facility (including the management of water associated with the washery, coarse reject and tailings disposal, and coal handling) was approved in June 2007 as part of the Abel Underground Mine project. Bloomfield is currently progressing its approved open cut mining program and is actively rehabilitating former mining areas on the site.

This Modification seeks extension of open cut mining operations approximately 200 metres (m) to the west, to the boundary of the lease (**Figure 3**). Over this interval, the deepest mining of the Big Ben Seam will step up to the Donaldson Seam to allow for the Big Ben Seam having been mined previously by underground mining methods.

This report is limited to the *Groundwater Modelling Assessment* of open cut mining, taking into account the cumulative effects of neighbouring underground mines. The focus of the modelling is on cumulative and incremental impacts to the baseflow/leakage interactions with Hexham Swamp and key watercourses, with quantification of likely mine inflow, groundwater heads generally and drawdowns at registered bores. The groundwater takes from each designated water source are quantified and provided as an input for assessment of licensing requirements in the *Groundwater Impact Assessment* prepared by AECOM. Similarly, quantification of other groundwater impacts is passed to AECOM for assessment in accordance with the Aquifer Interference Policy (NSW Government, 2012).

1.1 Interaction of Bloomfield with District Mines

Other mines in the vicinity of Bloomfield are located on **Figure 1**. Coal from the Bloomfield Colliery, together with coal from the Donaldson open cut mine, the Abel underground mine and the Tasman underground mine, is processed through the Bloomfield CHPP.

The tailings from the CHPP are disposed at the Bloomfield site. Until mid-2007, tailings were deposited predominantly underground in former workings, but are now deposited in abandoned open cuts on the Bloomfield site. Water is recovered from the tailings and recycled through the CHPP.

For assessment of cumulative effects, all neighbouring underground and open cut mines are included in the numerical groundwater model.

1.2 Scope of Work

The tasks to be addressed to achieve the objectives of the groundwater modelling study are:

- Modification of the existing numerical groundwater model used for previous investigations at Abel Mine.
- Contraction of the southern extent of the model from northing 6350000 to 6357425 (to reduce prohibitive model size).
- A re-build of the model geometry in the Bloomfield area using the latest geological model in that area.
- Inclusion of historical Big Ben underground works (not in the current Abel model).
- Inclusion of a dyke in the Bloomfield area (not in the current Abel model).
- Retention of MODFLOW-SURFACT software for consistency with previous assessments, with use of the TMP facility for time-varying changes in permeability and storage to represent open cut infill (and underground fracturing);
- Extension of model calibration from December 2015 to April 2017.
- Construction of prediction models for all mines, with and without Bloomfield operations.
- Prediction model for the proposed extension at Bloomfield plus the approved operations at Abel and Donaldson.
- Construction of a recovery model for the Bloomfield extension and neighbouring mines.

2 HYDROGEOLOGICAL ANALYSIS

2.1 Geology

The Bloomfield Colliery is located in the Newcastle Coalfield where the Permian Tomago Coal Measures are dominant (**Figure 4**). The target seams at Bloomfield are the Big Ben, Donaldson, Elwells Creek (EC), Whites Creek (WC) and Upper and Lower Buttai Coal Seams (C, B, A seams) (Aquaterra, 2008). The strata of the coal measures dip towards the south and south-west.

Quaternary alluvial deposits of gravel, sand, silt and clay are most pronounced to the west of Bloomfield along Wallis Creek, and far to the east associated with the Hunter River (**Figure 1**). The underlying interburden sediments consist of mudstone, siltstone and sandstone (Aquaterra, 2008).

Surface topography in the Bloomfield project area ranges from less than 20 mAHD (Australian Height Datum) to more than 80 mAHD.

2.2 Hydrology

Lake Kennerson and Lake Foster (**Figure 3**) are the major mine water storage facilities on site. Water is pumped from the open cut pits through open drains to Lake Kennerson. Runoff from disturbed areas is also transferred to Lake Kennerson, where suspended solids are allowed to settle. From there, water feeds to Lake Foster by controlled release. Lake Foster also receives decant water from the tailings dam (**Figure 3**). From there, water is pumped to the CHPP for use in coal processing and dust suppression.

Mine water is discharged under Environmental Protection Licence (EPL 396) into Four Mile Creek via an open drain (**Figure 5**).

Four Mile Creek, the main stream near the site, has been diverted around Lake Foster by a series of drains and levees. Diversion banks and channels have been constructed to direct runoff from undisturbed and rehabilitated areas away from operational areas and mine water storages. This clean water is directed into clean water dams or natural watercourses. The major clean water storage dam is Possums Puddle which overflows into a natural drainage system. No clean water is used for operational purposes.

Other watercourses in the vicinity of Bloomfield and the district mines are located on **Figure 5**. Creeks are generally ephemeral and are sustained by runoff and occasional baseflow contributed by groundwater discharge during wet conditions.

The Bloomfield area consists of low undulating hills and is bordered by Buttai Creek and Four Mile Creek catchments to the west and east, respectively. Buttai Creek drains westwards into Wallis Creek and then into Hunter River east of Maitland. Four Mile Creek drains eastwards into the Hunter River floodplain east of Morpeth.

2.3 Hydrogeology

Shallow groundwater is present in alluvial, swamp, floodplain and estuarine sediments. Groundwater also appears locally in the shallow weathered Permian, which extends to depths of 10-20 m (Aquaterra, 2008). Shallow groundwater levels are topographically controlled. Deeper groundwater is present in the coal measures, with relatively higher permeability in the coal seams.

The Bloomfield groundwater monitoring network consists of five standpipe piezometers (measured quarterly) and five bores instrumented with datalogged vibrating wire piezometers (VWPs). Their locations are shown in **Figure 6**. The potentiometric heads within the coal measures show a progressive decline with depth, with stronger vertical gradients on the southern boundary of the lease (at VW5 and VW6, close to Abel workings) and minimal gradients at the western sites.

Many monitoring bores show evidence of depressurisation due to mining (**Appendix B**). Drawdowns due to mining range from 10 m to about 60 m. Shallow alluvium and regolith bores do not show mining effects. This indicates limited hydraulic connectivity between the alluvium/weathered overburden and the deeper coal measures.

Aquaterra (2008) reported representative properties for the main hydrogeological units based on hydraulic testing on the Bloomfield site, supplemented by previous investigations for the

Abel and Donaldson projects, and experience in other parts of the Hunter Valley coalfields. Representative values are summarised in **Table 1**.

Table 1
Representative Properties of Hydrogeological Units

Units	Horizontal Hydraulic Conductivity (m/d)	Storage Coefficient [-]	Specific Yield [%]
Coal Seams	0.01 to 0.1	0.0001	1
Interburden (Undisturbed)	0.001	0.00001	0.5
Interburden (Disturbed by subsidence from underground mining)	0.1 to 10	0.0001	1 to 5
Alluvium	1 to 5	0.0001	10

Note: Vertical hydraulic conductivity for coal measure units are generally less than one tenth of the value of horizontal hydraulic conductivity

Groundwater within the coal measures is controlled by recharge-discharge processes, with the highest groundwater levels in the northern parts of the lease where the coal measures outcrop. Under pre-mining conditions, the lateral hydraulic gradient would have been to the south and south-east. Open cut mining has created groundwater sinks which have reversed the natural groundwater flow directions.

2.4 Recharge

The surficial alluvial aquifers and outcrop areas are recharged from rainfall. Most likely the alluvial aquifers are in hydraulic continuity with Wallis Creek to the west and Hexham Swamp to the east. The shallow aquifer system normally discharges to the streams, although during wet periods stream flow may contribute some recharge to these alluvial aquifers for short periods while stream water levels are temporarily higher than the adjacent alluvium groundwater levels. Stream flows from runoff are generally short-lived after rainfall events.

Coal seams are recharged directly from rainfall only where they are outcropping or subcropping on the north-eastern side of the lease. At depth, coal seams are recharged by lateral flow down-gradient from the outcrop areas, and vertical flow through the overburden. Rainfall recharge rates within the hard rock outcrop area are expected to be relatively low (1-10 mm/a).

Long term records of rainfall data are available for several nearby stations, the closest being the East Maitland Bowling Club (station 061034) about 5 km north-east of Bloomfield. **Table 2** lists the mean monthly and annual rainfall, based on more than 90 years of daily rainfall data from 1902 to closure of the station in 1994.

Table 2
Mean Monthly Rainfall at East Maitland Bowling Club (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean (mm)	89.0	94.1	96.5	87.4	70.3	84.2	58.1	52.2	54.8	65.5	61.6	81.3	889.9

2.5 Groundwater Discharge

Groundwater discharge can occur by evapotranspiration in areas of shallow water table, or spring flow where the water table intersects the land surface, or through baseflow contributions to watercourses. Open cut mining facilitates groundwater losses by evaporation from in-pit pools or seepage faces on excavation walls, or direct pump-out.

Due to naturally high groundwater salinity and low bore yields, there is no significant groundwater abstraction other than coal mine dewatering. Only a few stock/domestic bores are registered in the government bore database.

Average A Class pan evaporation data are available for Cessnock (station 061242) and Paterson (station 061250). **Table 3** summarises mean monthly evaporation rates, giving an average of about 4 mm/day (1,460 mm/a).

Table 3
Mean Daily Evaporation Data for Cessnock and Paterson Stations (mm/day)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cessnock [1966-2012]	5.7	4.9	3.9	2.8	1.9	1.5	1.7	2.5	3.5	4.3	5.0	5.7
Paterson [1967-2017]	6.2	5.3	4.2	3.2	2.4	2.1	2.4	3.3	4.4	5.2	5.8	6.6

The actual evapotranspiration (ET) in the district is approximately 800 mm/a according to BoM (2017). The definition for actual ET is: "... the ET that actually takes place, under the condition of existing water supply, from an area so large that the effects of any upwind boundary transitions are negligible and local variations are integrated to an areal average. For example, this represents the ET which would occur over a large area of land under existing (mean) rainfall conditions."

3 GROUNDWATER SIMULATION MODEL

3.1 Existing Groundwater Models

The 2009 approval (07_0087) was supported by a Groundwater Impact Assessment conducted by Peter Dundon & Associates Pty Ltd with groundwater modelling conducted by Aquaterra (2008). Key features of the original Bloomfield groundwater model were:

- MODFLOW-SURFACT software
- Extent 14 km x 14.5 km
- Cell size 25 m x 25 m to 100 m x 100 m
- 276 rows, 277 columns, 8 layers; 612,000 model cells
- Boundary set at deepest coal seam outcrop limits
- Boundary set at Wallis Creek and Hexham Swamp
- Inclusion of Donaldson and Abel mines.

The original Bloomfield model was developed from an earlier model for the Abel Mine. Subsequently, there have been various modifications (in lateral and vertical extent) to this model for more detailed assessments of the Abel, Donaldson and Tasman Mines.

A more extensive groundwater model with 20 layers was developed by RPS Aquaterra (2013) for the Abel Underground Mine MOD3 (known as the ‘A33’ model). HydroSimulations (2015) modified and partially recalibrated this model for a modified mine plan with different sequencing at Abel and Tasman. For approved mining, changes were made to the height of continuous fracturing above Abel underground panels.

3.2 Current Model

The current regional model that includes Bloomfield, Donaldson, Abel and Tasman Mines was modified and partially recalibrated by HydroSimulations in 2016, with emphasis on the Abel Mine.

The model domain is discretised into about 1.9 million cells comprising 347 rows, 332 columns and 20 layers. The dimensions of the model cells are varied from 50 m in the Abel mining area to 112.5 m near the boundaries. The cell sizes at Bloomfield range from 50 m x 50 m to 100 m x 100 m.

The model layers represent the following lithologies:

- Layer 1: Alluvium and regolith
- Layer 2: Overburden and coal seams above Fassifern Seam
- Layer 3: Fassifern Seam
- Layers 4 to 6: Fassifern – West Borehole interburden
- Layer 7: West Borehole Seam
- Layer 8: West Borehole – Sandgate interburden
- Layer 9: Sandgate Seam
- Layer 10 to 12: Sandgate – Donaldson interburden
- Layer 13: Upper Donaldson Seam
- Layer 14: Upper Donaldson – Lower Donaldson interburden
- Layer 15: Lower Donaldson Seam
- Layer 16: Donaldson – Big Ben interburden
- Layer 17: Big Ben Seam
- Layer 18: Big Ben – Ashtonfield interburden
- Layer 19: Ashtonfield Seam
- Layer 20: Basal Layer

The current model extends to northing 6374000 which is 2km north of the Bloomfield mining lease and about 4 km north of active mining.

3.3 Modified Model

Several modifications have been made to the current model to improve its suitability for assessing the effects of mining at Bloomfield. The following changes were made:

- A re-build of the model geometry in the Bloomfield area only.

- Inclusion of old Big Ben underground works (not in the current Abel model).

- Inclusion of a dyke in the Bloomfield area (not in the current Abel model).

- Contraction of the southern extent of the model from northing 6350000 to 6357420. This reduced the very large number of model cells which exceed the industry benchmark of 1 million cells[1]. Models with more than this limit are prone to numerical instability, longer runtimes, excessive memory requirements and more difficult post-processing. This contraction does not affect the results of interest.

- Extension of model calibration from December 2015 to April 2017.

No changes were considered necessary for the following features:

- Position of the northern boundary at northing 6374000.

- Cell sizes (maximum 100 m x 100 m at Bloomfield).

- Inclusion of Donaldson, Abel and Tasman mines for cumulative impact assessment.

Given the differences in coal seam nomenclature between the district collieries, a comparison was made between Bloomfield floor levels for the "Donaldson" seam and the "Big Ben" seam to infer the corresponding seams to the south. This process uncovered a very poor representation of the Bloomfield seams in the current Abel groundwater model. As a result, it has not been possible to definitively correlate northern and southern seams. The Bloomfield "Big Ben" seam is considered to match the Ashtonfield seam in the Abel mode. Model layer floor levels have been modified to match actual Bloomfield levels.

The lithologies in the new Bloomfield model are designated as follows at the Bloomfield Colliery, with typical coal thicknesses (in parentheses):

- Layer 1: Alluvium and regolith
- Layer 2: Overburden and above coal seams
- Layer 3: C seams (1.0 m)
- Layers 4 to 6: C – B interburden
- Layer 7: B seams (1.0 m)
- Layer 8: B – A interburden
- Layer 9: A seam (0.5 m)
- Layer 10 to 12: A – C Interburden
- Layer 13: WC seams (2.0 m)
- Layer 14: WC – EC Interburden
- Layer 15: EC seams (1.5 m)
- Layer 16: EC - Donaldson interburden
- Layer 17: Donaldson seams (1.5 m)
- Layer 18: Donaldson - Big Ben interburden
- Layer 19: Big Ben seams (3.0 m)
- Layer 20: Basement – Wallis Creek Subgroup.

3.4 Methodology

Groundwater modelling has been conducted in accordance with the Australian Groundwater Modelling Guidelines (Barnett *et al.*, 2012) and the Murray-Darling Basin Commission

[1] However, the number of active cells remains high at 1.46 million.

(MDBC) Groundwater Flow Modelling Guideline (MDBC, 2001). Under the earlier MDBC modelling guidelines, the model is best categorised as an Impact Assessment Model of medium complexity. That guide describes this model type as follows:

> "*Impact Assessment model - a moderate complexity model, requiring more data and a better understanding of the groundwater system dynamics, and suitable for predicting the impacts of proposed developments or management policies.*"

The more recent guidelines do not classify complexity as such, but focus on 'confidence'. This model has a reasonable amount of groundwater level data but it is not calibrated against stream baseflow or mine inflow[2]. The model is complex due to the large number of mines in the area and the low permeability strata of the Newcastle Coal Measures.

Four model variants were developed:

1. Transient calibration model from January 2006 to April 2017.
2. Prediction model for the proposed extension at Bloomfield plus the approved operations at Abel, Donaldson and Tasman.
3. Recovery model for the Bloomfield extension and neighbouring mines (based on the final heads of model #2).
4. Null model, consisting of models #1, #2 and #3 in sequence with the exclusion of all Bloomfield operations since 2006.

For model #1, particular attention was paid to good calibration at the bores in the Bloomfield monitoring network.

Differencing the results from models #2 and #3, with model #4, allowed isolation of the impacts due to the Bloomfield extension alone.

3.5 Software

MODFLOW-SURFACT software has been retained for consistency with previous assessments, with use of the TMP facility for time-varying changes in permeability and storage to represent open cut infill (and district underground fracturing).

Numerical modelling has been undertaken using the Groundwater Vistas (Version 6.96) software interface (Environmental Simulations Inc, 2011) in conjunction with MODFLOW-SURFACT (Version 4), distributed by HydroGeoLogic Inc (Virginia, USA). MODFLOW-SURFACT is an advanced version of the popular MODFLOW code developed by the United States Geological Survey (USGS). MODFLOW is the most widely used code for groundwater modelling and is considered an industry standard.

MODFLOW-SURFACT is a three-dimensional model able to simulate variably saturated flow and can handle desaturation and resaturation of multiple hydrogeological layers without the "dry cell" problems of 'standard' MODFLOW. This is pertinent to the depressurisation associated with longwall mining and the desaturation that occurs within and along the edge of open cut mines. 'Standard' versions of MODFLOW can handle depressurisation and desaturation to some extent, but model cells that are dewatered (reduced below atmospheric

[2] See Section 6 for the assigned model class

pressure) are replaced by "dry" cells, which can interfere with the simulation of various processes and also cause model instability.

3.6 Model Layers and Geometry

The new Bloomfield model covers an area of about 380 km^2 and extends 23.0 km from west to east and 16.6 km from south to north (**Figure 1**, **Figure 7**). The model has a total of 1,812,720 cells across 20 layers (**Table 4**), with 1,459,120 cells active (**Figure 8**). Model cells are not uniform, varying from 50 m to 112.5 m. The model grid consists of 273 rows and 332 columns, without any rotation.

Table 4
Model Layers and Formations

LAYER	FORMATION
1	Alluvium and regolith
2	Overburden and above coal seams
3	C seams
4	C – B interburden
5	
6	
7	B seams
8	B - A interburden
9	A seam
10	A – WC Interburden
11	
12	
13	Whites Creek Seam
14	WC – EC interburden
15	Elwells Creek
16	EC - Donaldson interburden
17	Donaldson seams
18	Donaldson - Big Ben interburden
19	Big Ben seams
20	Basal Layer (Wallis Creek Subgroup)

3.7 Model Simulation Period and Timing

Simulation commences at 1 January 2006 and ends at 31 December 2031 (**Table 5**). The first 17 stress periods (SP1 to SP17) are used for transient calibration (to the end of 2017), initially in six-monthly steps and then in annual steps (from 2011).

The model prediction assumes that Bloomfield mining would continue until December 2025 - stress period (SP) 25. District mines are assumed to continue until December 2031 (SP31). During the prediction period, all stress periods are annual.

Post-mining recovery is simulated at SP32 (until 2132) with a single 100-year stress period. During this time, final voids are simulated at Bloomfield and Donaldson.

Table 5 shows the assumed schedules of the various mines and model stress period definition.

Table 5
Mine Evolution and Model Stress Period Definition

	Stress Period	From	To	Days	Mine Sequencing
CALIBRATION		-	31/12/2005	-	
	1	1/01/2006	30/06/2006	181	Donaldson OC; Bloomfield OC
	2	1/07/2006	31/12/2006	184	
	3	1/01/2007	30/06/2007	181	Tasman Fassifern UG
	4	1/07/2007	31/12/2007	184	
	5	1/01/2008	30/06/2008	182	Abel UG
	6	1/07/2008	31/12/2008	184	
	7	1/01/2009	30/06/2009	181	
	8	1/07/2009	31/12/2009	184	
	9	1/01/2010	30/06/2010	181	
	10	1/07/2010	31/12/2010	184	
	11	1/01/2011	31/12/2011	365	Abel Upper/ Donaldson UG
	12	1/01/2012	31/12/2012	366	
	13	1/01/2013	31/12/2013	365	
	14	1/01/2014	31/12/2014	365	Final Void
	15	1/01/2015	31/12/2015	365	Abel Lower/Donaldson UG
	16	1/01/2016	31/12/2016	366	
	17	1/01/2017	31/12/2017	365	
PREDICTION	18	1/01/2018	31/12/2018	365	Tasman Extension West Borehole UG
	19	1/01/2019	31/12/2019	365	
	20	1/01/2020	31/12/2020	366	
	21	1/01/2021	31/12/2021	365	
	22	1/01/2022	31/12/2022	365	
	23	1/01/2023	31/12/2023	365	
	24	1/01/2024	31/12/2024	366	
	25	1/01/2025	31/12/2025	365	
	26	1/01/2026	31/12/2026	365	Final Void
	27	1/01/2027	31/12/2027	365	
	28	1/01/2028	31/12/2028	366	
	29	1/01/2029	31/12/2029	365	
	30	1/01/2030	31/12/2030	365	
	31	1/01/2031	31/12/2031	365	
	32	1/01/2032	31/12/2032	36525	Post-mining Recovery

3.8 Model Stresses and Boundary Conditions

3.8.1 Inactive Areas

Inactive areas are defined to the east of Hunter River and to the west of Wallis Creek (**Figure 7**).

3.8.2 Watercourses

The numerical model incorporates river/aquifer interactions, to enable quantification of the impacts of mining on surface water features. This is important to assess whether mining is likely to lower water levels and reduce baseflow to permanent streams.

MODFLOW River (RIV) cells are applied along the various watercourses in this area, as well as to represent Hexham Swamp. Bed conductance for all watercourses and the swamp are set to 25 m^2/d. The river stage heights are set generally at riverbed elevations except for the swamp which is given 0.5 m water depth. This practice means that “river” boundaries act in the same way as MODFLOW “drains”, and allow baseflow (groundwater discharge) but do not allow leakage from the watercourse to the aquifer (unless stage is greater than bed elevation).

All River cells are within Layer 1.

3.8.3 Rainfall Recharge and Evapotranspiration

For all model variants, rainfall recharge is applied to each active model cell as a percentage of long-term average rainfall using the MODFLOW Recharge (RCH) package. No changes were made to the recharge rates adopted in the previous A33 model, which had 11 distinct recharge zones with a median rate of 0.7% of annual rainfall.

Evapotranspiration (ET) from shallow water tables has been simulated using the MODFLOW EVT package. Two conceptual zones have been set based on geological outcrop. Maximum extinction depths, that is the depths to which MODFLOW-SURFACT will attempt to take ET from the water table, are assumed to be 3 m for the alluvium and 1.8 m for hard rock outcrop (regolith) areas. The corresponding maximum ET rates are 248 and 274 mm/a, unchanged from those adopted in the A33 model.

New recharge zones are set up in the Bloomfield mine area during mine progression to negate recharge during active mining, and to enhance recharge to spoil after a delay of five years. Spoil recharge is applied as 5% of mean annual rainfall.

3.8.4 Open Cut Mining

MODFLOW Drain (DRN) cells are used to simulate both open cut and underground mining, with the drain invert at the base of the relevant coal seam for each mine in the area. The Bloomfield open cut mine is set from regolith (layer 1) to the Big Ben seam (layer 19) as the maximum vertical extent. Underground mining is applied in layers 3 (Tasman), 7 (Tasman), 13 (Abel) and 15 (Abel).

MODFLOW Drains are progressed in accordance with mine progression plans. Open cut drain cell conductance was set to 1000 m^2/d to allow free drainage into pits. Generally, these drains remain active up to eight years from the beginning of their activation. After that time, spoil is emplaced in the void. The TMP package is used to allocate enhanced transmissive and storage properties to the spoil.

The temporal progression of Bloomfield open cut mining is illustrated in **Appendix A**.

3.8.5 Hydraulic Properties

While the hydraulic conductivities of the A33 model have been retained as much as possible, some changes were necessary to improve model calibration at Bloomfield. Also, several local features were not present in the A33 model:

- Historical open cut areas (**Figure 2**) (given hydraulic conductivity 1 m/day).
- Historical underground Big Ben mining areas (**Figure 2**) (given hydraulic conductivity 10 m/day).
- A north-westerly trending dyke (**Figure 7**) (given leakage coefficient 10^{-5} d^{-1}).

Spoil hydraulic conductivity is set at 1 m/day in both horizontal and vertical directions.

4 MODEL CALIBRATION

4.1 Current Abel Model

Steady state (or baseline 'long-term') calibration as the first stage of the calibration process was carried out against 60 targets, using a combination of auto-sensitivity analysis and manual modification of model zones and parameters. The steady state calibrated model yielded a 'scaled root mean squared error'(SRMS) value of 4.5% which is below the target 10% SRMS suggested in the MDBC flow model guideline (MDBC, 2001).

Transient model calibration was carried out in order to achieve a history match to the reported observed groundwater levels during the period January 2006 to June 2012 inclusive (RPS Aquaterra, 2013). The calibration was done against 2,606 target water levels, using a combination of auto-sensitivity analysis and manual modification of zones and model parameters. These targets were distributed throughout the model layers in the form of 88 groundwater hydrographs.

The SRMS value for the RPS Aquaterra (2013) six-year transient calibration period was 4.3% (within the target range of 0-10%).

4.2 New Bloomfield Model

Calibration of the modified groundwater model has focused on 'history matching' of model outputs against the following Bloomfield-specific data:

- Groundwater levels for standpipes: SP2-1, SP2-2, SP3-1, SP4-2 and SP7-1.

- Groundwater levels for vibrating wire piezometers: VW1, VW5, VW6, VW7 and VW8.

Standpipe and bore VWP locations are presented in **Figure 6**. There is no reliable baseflow data from around the site against which to calibrate the model for fluxes. Nor is there a reliable mine inflow time series for calibration.

To get a sensible initial head for the Bloomfield transient model, steady state calibration was carried out by a manual method.

Transient model calibration was designed to match recorded groundwater levels during the period January 2006 to April 2017 against 18 target water levels, using manual modification of zones and model parameters. These targets were distributed through four of the model layers:

- Alluvium and regolith (Layer 1): 2 targets
- WC seams (Layer 13): 3 targets
- Donaldson seams (Layer 17): 7 targets
- Big Ben seams (Layer 19): 6 targets

All horizontal and vertical hydraulic conductivities were allowed to vary during the calibration process. The final hydraulic conductivities in the model are presented in **Table 4.**

Table 6
Hydraulic Conductivities for Initial and Calibrated Models

ZONE	DESCRIPTION	**Initial [m/d]**		**Calibrated [m/d]**	
		K_H	K_V	K_H	K_V
1	Alluvium	1.00E-02	1.00E-03	1.00E-03	1.00E-04
20	River bank Alluvium	2.00E-01	1.00E-02	1.00E-01	1.00E-01
55	Whites Creek Seam	5.00E-02	1.00E-03	5.00E-02	5.00E-03
56	Whites Creek Seam	1.00E-02	5.00E-03	1.00E-04	1.00E-05
7	Interburden	2.00E-04	2.00E-05	1.00E-04	1.00E-05
14	Donaldson Seam	5.00E-02	5.00E-03	5.00E-03	5.00E-05
29	Donaldson Seam	5.00E-03	3.00E-04	5.00E-03	5.00E-04
15	Interburden	1.00E-04	5.00E-05	5.00E-03	5.00E-05
17	Big Ben Seam	5.00E-02	8.00E-03	1.00E-02	8.00E-04

K_H = horizontal hydraulic conductivity; K_V = vertical hydraulic conductivity

4.3 Model Performance

4.3.1 Statistics

The Bloomfield model takes approximately 4.5 hours to run, covering both the historical phase (2006-2017) and the predictive phase (out to the year 2031). The 100-year recovery phase takes an extra 2 hours.

During the historical phase (2006-2017), the model has a mass balance error of 0.2%, which is well below the accepted threshold of 1-2% (Barnett *et al.*, 2012).

The statistical performance for the 12-year calibration period is 10.4 %RMS and 9.8 mRMS (with 18 water level targets, 611 observations) for the local Bloomfield area. For all 3,983 observations across the full model area, the calibration performance statistics are 4.1 %RMS and 12.7 mRMS.

Scattergrams are displayed in **Figure 9.**

4.3.2 Mine Inflow

A graph of the modelled inflows to the Bloomfield open cut mine is presented in **Figure 10**. During the 2006 – 2017 calibration period, simulated inflow is predicted to have averaged 1.1 ML/d (420 ML/a) with a peak of about 1.6 ML/d (570 ML/a).

The pattern of inflow agrees with the previous Bloomfield model (Aquaterra, 2008) from 2007 to 2017, where the average was 1.4 ML/d (510 ML/d) and the peak was predicted to be about 2.0 ML/d (730 ML/a).

These rates do not account for evaporative losses from the floor and walls of the pits.

4.3.3 Groundwater Levels

Appendix B (**Figures B1** to **B7**) presents hydrographs for the relevant monitoring bores in the Bloomfield monitoring network (bore locations are shown on **Figure 6**):

- Standpipes SP4-2 and SP7-1 : for Alluvium and Regolith
- Bores VW5(62m), VW6(96m) and VW7(70m) : for Whites Creek Seam
- Standpipes SP2-1, SP3-1, bores VW1(35m), VW5(71m), VW6(114m), VW7(95m) and VW8(83m): for Donaldson Seam
- Standpipe SP2-2, bores VW1(46m), VW5(89m), VW6(128m), VW7(107m) and VW8(97m): for Big Ben Seam

These charts include both simulated and measured responses. As modelled groundwater levels are calculated on an annual basis, they cannot simulate the short-term climate variations seen in the measured hydrographs.

The overall trends of the simulated groundwater levels at the bores in alluvium and regolith match well with those measured. Standpipe SP4-2 (depth 9 m) near Four Mile creek shows a rising trend for groundwater level which probably correlates with river stage. The simulated water level matches very well with this trend. SP7-1 (depth 11 m) is positioned on the western border of the open cut operations. Its simulated water level indicates the westward progression of mining.

The overall magnitudes and trends of simulated groundwater levels at VW6(96m) and VW7(70m) in the Whites Creek Seam are perfectly matched with the measured levels. The water level patterns are showing a clear mining effect in both simulated and measured cases. An exception is bore VW5(62m) where the simulated level is showing a mining effect but the measured level is not affected.

Five of the seven bores in the Donaldson Seam are well-matched with the measured groundwater levels. Mining effects are undoubtedly visible for VW1(35m), VW5(71m), VW6(114m) and VW7(95m). Exceptions are standpipe SP2-1 (depth 65 m) and VW8(83m). SP2-1 is surrounded by historical open-cut and underground mining. Considering the position of SP2-1, the simulated water level reasonably shows drawdown but the lack of any measured drawdown suggests that recovery from historical mining might already have occurred.

In the Big Ben seam the simulated water levels at VW1(46m), VW5(89m), VW6(128m) and VW7(107m) match very well with the measured levels. As in the Donaldson seam, the bore water levels in the Big Ben seam show clear mining effects. The poor agreement at SP2-2 (depth 85 m) suggests that recovery might already have occurred from past mining in this seam at this location. VW8 responses, however, indicate residual effects from previous Buchanan mining of the Big Ben seam.

4.3.4 Groundwater Surface Water Interaction

With all district mines active during the calibration period, simulated groundwater-surface water interactions with watercourses in the Bloomfield area are presented in **Table 7.**

Table 7
Modelled Groundwater-Surface Water Interaction (2006-2017)

WATERCOURSE	MODELLED RIVER AQUIFER INTERACTION [kL/d]	COMMENT
	AVERAGE (2006-2017)	
BUTTAI CREEK	0.01	Losing stream
FOUR MILE CREEK	-0.24	Gaining stream
WALLIS CREEK	-0.02	Gaining Stream
WEAKLEYS FLAT CREEK	-20	Gaining Stream
VINEY CREEK	-0.02	Gaining Stream
BLUEGUM CREEK	-0.26	Gaining Stream
MINMI CREEK	-2.6	Gaining Stream
HEXHAM SWAMP	7,080	Losing system

These results suggest that all watercourses other than Buttai Creek and Hexham Swamp are simulated as gaining systems, at least as an ‘average’ condition across the 6-12 months model stress periods. However, the baseflow magnitudes are very low.

The locations of the creeks are presented in **Figure 5**.

4.3.5 Water Balance

A water budget for the entire model domain, averaged over the calibration period, is presented in the **Table 8**.

The water balance suggests that rainfall recharge is a small component (17%) of the water balance, and that leakage from the water bodies are the more substantial sources of groundwater replenishment (66%). Mine inflow of 15% (to all mines, not just Bloomfield) and evapotranspiration (57%) are the main discharge processes. The loss from storage (about 1.3 ML/d) is about half of the total mine inflow.

Table 8
Calibrated Model Water Balance (2006-2017)

COMPONENT	IN [ML/d]	OUT [ML/d]	NET [ML/d]
Drains (Mine inflow)	-	2.66	
Recharge (Direct Rainfall)	2.96	-	
Rejected Recharge	-	0.92	
Evapotranspiration (ET)	-	10.35	
River (Leakage / Baseflow)	11.23	4.21	
Constant Head (CHD)	2.87	0.16	
Regional Groundwater Flow (GHB)	-	0.02	
Storage			1.26 LOSS
TOTAL	17.06	18.31	1.25

5 PREDICTIVE MODELLING

5.1 Mining Schedule

A summary of the mining schedule that has been used for the Bloomfield mine and all other nearby mines is provided in **Table 5**Error! Reference source not found.. This outlines the sequencing of cumulative stresses and the transient simulation setup for calibration, prediction and recovery phases of the model. The predictive model simulates the period from January 2018 to December 2031, with completion of Bloomfield mining assumed at December 2025.

5.1.1 Prediction

Transient stress periods 18-31 are set for the predictive period from 2018 to 2031 to allow representation of the extraction and dewatering of the open cut extension. These stress periods are annual.

5.1.2 Recovery

Post-mining recovery is simulated at stress period 32 (2032-2132) with a single 100-year stress period.

Snapshots of Bloomfield open-cut mine progression are presented in **Appendix A**.

5.2 Modelling Approach

Two main predictive model scenarios were run:

1. a run with the modified Bloomfield mine plan and all other active mines; and
2. a ‘No-mining’ or ‘Null’ run without the past or future Bloomfield mining but with all other surrounding mines active.

Comparison of scenarios 1 and 2 allows the net impact on the hydrogeological environment to be evaluated separately from the effects of Bloomfield alone.

5.3 Model Implementation

As in the calibration model (**Section** 4), active mine areas were simulated in the model using MODFLOW drain cells with the invert elevation set at the floor of the relevant coal seam layer and drain cell conductance was set to 1000 m^2/d to allow a free-draining condition.

5.4 Water Balance

Shown in **Table 9** is the water balance averaged over the 2006-2025 period, when Bloomfield mining is assumed to end. The water balance reports the inflows, outflows and change in storage over the entire model domain.

The total inflow to the groundwater system within the model extent is approximately 17 ML/day, of which rainfall recharge is about 17% and leakage from water bodies provides around 66%. Groundwater discharge is dominated by evapotranspiration which is about 52% of total outflow. Mine inflow is around 22% of the total water balance. The loss from storage (about 2.8 ML/d) is about two-thirds of the total mine inflow and about twice the loss during the calibration period (to 2017).

Table 9
Predictive Model Water Balance (2006-2031)

COMPONENT	IN [ML/d]	OUT [ML/d]	NET [ML/d]
Drains (Mine inflow)	-	4.39	
Recharge (Direct Rainfall)	2.96	-	
Rejected Recharge	-	0.92	
Evapotranspiration (ET)	-	10.36	
River (Leakage / Baseflow)	11.23	4.21	
Constant Head (CHD)	2.87	0.16	
Regional GW flow (GHB)	-	0.01	
Storage			2.84 LOSS
TOTAL	17.06	20.06	2.94

Apart from mine inflow, which has increased from about 2.7 to about 4.4 ML/day, there is very little difference in other water balance components from those in the calibration period. This indicates that district mining is not having any significant effect overall on other components of the water balance.

5.5 Predicted Drawdowns

Predicted groundwater heads have been extracted from the model to show groundwater level and drawdown contour maps at the completion of Bloomfield mining (December 2025).

Water level maps are presented in **Appendix C** (**Figures C1** to **C8**) for model layers 1, 3, 7, 9, 13, 15, 17 and 19.

Drawdown maps, relative to the model-predicted levels at 2006, are presented in **Appendix D** (**Figures D1** to **D8**) for model layers 1, 3, 7, 9, 13, 15, 17 and 19.

Appendix B shows groundwater level hydrographs for the standpipes and vibrating wire piezometers in the Bloomfield monitoring network.

Drawdowns due to Bloomfield mining are expected to reach a maximum at Mine Year 20 (year 2025), at which time mining from the southern end of the extension area is scheduled to cease, and groundwater levels would start to recover.

The drawdown map (**Figure D1**) for the surficial aquifer Layer 1 (alluvium and regolith) shows a limited area of drawdown in the Bloomfield extension area and the location of the final void where the drawdown is about 100 m. Significant drawdown is also evident within the lease area to the north-west of extension mining, coincident with historical open cut and underground mining. Drawdown from open cut mining is propagating into the high-permeability underground voids, with some spatial confinement offered by a north-westerly trending dyke. The drawdown is generally less than 0.5 m outside the Bloomfield lease boundary except for the south-west corner where a 2-m drawdown contour extends off-lease. The 2 m of drawdown extends beneath Buttai Creek for a distance of about 600 m. As this creek is simulated as a losing system, no additional leakage loss is anticipated from the stream. However, alluvial take is likely and this is quantified in **Section 5.10**.

The predicted drawdown effects on the surficial aquifer are not expected to have any adverse impact on groundwater dependent ecosystems because the groundwater levels are already well below ground surface. Close to Buttai Creek, the water table depth at the site of VW8 was 9 m in 2007, and the depth to water at SP7-1 was 10 m in 2015.

Another area of significant drawdown (**Figure D1**) is associated with the Donaldson open cut and final void. There is no overlap of the water table drawdowns produced by the various mines.

5.6 Predicted Drawdowns at Registered Bores

Predicted drawdowns at the end of mining at registered bores within 5 km of Bloomfield are listed in **Table 10** and posted on the map at **Figure 11**. These values are cumulative drawdowns from all mining activities. As there is no overlap of water table effects between the various mines, the cause of the drawdown is clear from an inspection of **Figure 11** in terms of proximity to the nearest mine.

Most of the drawdowns calculated by the model are much less than 1 m, while drawdowns greater than 1 m and up to 2 m are predicted at three bores (GW078047, GW078128 and GW078044), which is within the Aquifer Inference Policy's 2 m threshold.

Large predicted drawdowns of 20 m and 17 m at bores GW078124 and GW078123 are due to the final void at the Donaldson mine.

Table 10
Predicted Drawdown [m] at Registered Bores at the End of Bloomfield mining

REGISTERED BORE NAME	AQUIFER	EASTING [MGA]	NORTHING [MGA]	BORE DEPTH (m)	DRILLED YEAR	PREDICTED DRAWDOWN (m) [Year 2025]
GW200415	Alluvium	369986	6373738	20.1	10/09/2004	< 1
GW078120	Alluvium	371176	6368590	24	14/11/1997	< 1
GW080034	Alluvium	365222	6370959	*	*	< 1
GW078125	Alluvium	370970	6368464	30	14/11/1997	< 1
GW058760	Alluvium	371142	6371207	33	1/10/1983	< 1
GW061307	Alluvium	371299	6371148	30	1/10/1984	< 1
GW200414	Alluvium	369960	6373761	10	9/09/2004	< 1
GW078123	Alluvium	369309	6368165	33	14/11/1997	17
GW051647	Alluvium	362896	6373006	12	1/09/1980	< 1
GW078047	Alluvium	370784	6368800	54.3	14/11/1997	1.5
GW078122	Alluvium	368666	6367663	35.4	14/11/1997	< 1
GW078124	Alluvium	369883	6368018	40	14/11/1997	20
GW078045	Alluvium	371836	6369892	30.5	14/11/1997	< 1
GW078128	Alluvium	370912	6366923	30	14/11/1997	2
GW051353	Alluvium	365986	6365810	49.7	1/11/1980	< 1
GW079892	Alluvium	366598	6372257	6.69	1800-01-01	< 1
GW078046	Alluvium	368651	6368741	30.4	14/11/1997	< 1
GW079948	Alluvium	370081	6372613	*	*	< 1
GW078044	Alluvium	370428	6370151	30.1	14/11/1997	1.4
GW078127	Alluvium	369073	6366406	30	14/11/1997	< 1
GW078126	Alluvium	371890	6367736	30	14/11/1997	< 1
GW078121	Alluvium	368619	6367262	43	14/11/1997	< 1

* Not available

5.7 Groundwater Hydrographs

Predicted groundwater hydrographs at Bloomfield monitoring bores are shown in **Appendix B** (**Figures B1-B7)**. These figures show groundwater levels in the alluvium and regolith (Layer 1), Whites Creek seam (Layer 13), Elwells Creek seams (Layer 15), Donaldson seams (Layer 17) and Big Ben seam (Layer 19). Bore locations are on **Figure 6**.

Alluvium and Regolith (Layer 1) [**Figure B1**]

The standpipe SP4-2 is located near Four Mile creek. It is more likely that the water level in this bore is influenced by water level in the creek, when it flows. The simulated hydrograph shows a rising trend for some years, followed by stabilisation.

SP7-1 is located at the western border of the Bloomfield mine. The prediction and recovery stages of the simulated hydrograph suggest that the water level will decline due to mining and not recover significantly. This bore would remain within the zone of influence of the final void.

Whites Creek Seam (Layer 13) [**Figure B2**]

All three VWP sites lie along the southern boundary of the Bloomfield lease. All simulated hydrographs show significant mining effects, with the degree of recovery being minimal but increasing from east to west, due to the effects of adjacent underground mining.

Donaldson Seam (Layer 17) [**Figures B3-B5**]

Four out of seven bores (SP2-1, VW1(35m), VW6(114m) and VW7(95m)) in this layer show slow water level recovery post-mining. Water levels at bores SP3-1 and VW5(71m) show no sign of recovery. Most bores are influenced by adjacent underground mining.

Big Ben Seam (Layer 19) [**Figures B6-B7**]

All simulated hydrographs show significant declines due to mining, with slow or negligible recovery in some cases. Most bores are influenced by adjacent or historical underground mining.

5.8 Baseflow Capture

Watercourses have been set up in the model to accept baseflow if groundwater levels exceed riverbed elevations, but not to allow leakage given that most streams are ephemeral. The model can predict reductions to baseflow for gaining streams, but cannot predict increases in leakage from losing streams. Where the water table is disconnected from a losing stream, mining cannot induce any additional leakage. **Table 7** has noted that the only simulated losing systems are Buttai Creek and Hexham Swamp.

Baseflows have been extracted from the model for both the mining and the null simulations, for cumulative stresses imposed by all mines.

The status of Four Mile Creek is predicted to have converted from gaining to losing status around 2011. This means that its average baseflow of 0.24 kL/day (**Table 7)** would have been lost at that time. This is equivalent to only 0.1 ML/a.

All other watercourses had negligible differences between the null and mining runs, indicating that Bloomfield mining is having an insignificant effect on baseflow capture. The strongest effect was observed at Weakleys Flat Creek where the loss was only 0.12 kL/day (0.04 ML/a).

The leakages from Hexham Swamp differed by no more than 1 kL/day (from 7,080 kL/day in **Table 10**) between null and mining simulations. This would be within numerical error bounds.

5.9 Predicted Mine Inflow

The predicted groundwater inflows[3] to the Bloomfield Mine are listed in **Table 11** and are graphed in **Figure 10**.

The simulated inflows are predicted to increase from about 0.9 ML/d at the start of open cut mining activities in year 2006 to peak about 1.6 ML/d (year 2013) during the calibration period, with a peak of about 1.5 ML/d in the prediction period. These rates do not take into account the evaporative losses that would occur when the groundwater discharges are exposed to the atmosphere. At the end of mining at year 2025 the inflow is predicted to be about 1.0 ML/d.

[3] Time-weighted averages

There is expected to be a slight drop (by about 2%) in the future peak inflow compared to what should already have occurred. The expected maximum for licensing purposes is 561 ML/a.

Aquaterra (2008) conducted a sensitivity analysis which found that peak inflow could increase by about 10% for higher horizontal hydraulic conductivity and by about 5% for higher vertical hydraulic conductivity.

Table 11
Bloomfield Mine Inflow Rates
[2006-2132]

	MINE YEAR	STRESS PERIOD	MINE-INFLOW [ML/d]	MINE-INFLOW [ML/year]
CALIBRATION	2006	2	0.88	322
	2007	4	0.82	300
	2008	6	0.85	312
	2009	8	0.87	318
	2010	10	0.92	336
	2011	11	1.18	430
	2012	12	1.40	513
	2013	13	**1.57**	**572 max**
	2014	14	1.51	551
	2015	15	1.40	511
	2016	16	1.20	440
	2017	17	1.24	455
PREDICTION	2018	18	1.42	520
	2019	19	1.42	520
	2020	20	**1.54**	**561 max**
	2021	21	1.53	559
	2022	22	1.16	423
	2023	23	0.69	253
	2024	24	1.00	367
	2025	25	1.00	367
	2026	26	0	0
	2027	27	0	0
	2028	28	0	0
	2029	29	0	0
	2030	30	0	0
	2031	31	0	0
RECOVERY	2032-2132	32	0	0

5.10 Alluvial Takes

The alluvium of both the Wallis Creek Water Source and the Newcastle Water Source (along the lower Hunter) are classified as 'Highly Productive' by DPI Water (**Figure 12)**. The calculated alluvial takes (rounded to the nearest ML/a) for separate simulation phases are recorded in **Table 12** and graphed in **Figure 13** and **Figure 14**. These takes are due only to Bloomfield mining.

For licensing purposes, the additional maximum take from the Wallis Creek Water Source is predicted to be about 18 ML/a (26-8 ML/a) after 2017, and the additional maximum take from the Newcastle Water Source is predicted to be about 8 ML/a (8-0.2 ML/a).

Table 12
Modelled Alluvial Takes

	WALLIS CREEK WATER SOURCE TAKE EXTRA LEAKAGE [ML/YEAR]		NEWCASTLE WATER SOURCE TAKE LESS UPFLOW [ML/YEAR]	
	CALIBRATION PERIOD [2006-2017]	**PREDICTION AND RECOVERY PERIOD [2018-2132]**	**CALIBRATION PERIOD [2006-2017]**	**PREDICTION AND RECOVERY PERIOD [2018-2132]**
MAXIMUM	**8**	**26**	**0.2**	**8**
MEAN	**4**	**12**	**0.0**	**2**

5.11 Final Void

The final void at Bloomfield is certain to remain a sink. It would have the effect of a long-term and widespread lowering of the water table, as indicated in **Figure C9** in **Appendix C**.

The hydrograph for a hypothetical monitoring point within the final void is shown in **Figure 15**. This shows recovery of only about 15 m after 100 years, with a void lake water surface around -40 mAHD.

6 LIMITATIONS

Model confidence has been assessed in terms of the attributes of Class 1, 2 and 3 models in the model classification system of Barnett *et al.* (2012). A self-assessment is offered at **Table 13**.

As all models would have elements of Class 1, Class 2 and/or Class3 attributes, it is not possible to assign a model uniquely to a particular class. For the Bloomfield model, the occurrences of performance indicators are quantified here:

- Class 1 : 4 items [25%]
- Class 2 : 5 items [31%]
- Class 3 : 7 items [44%]

Although the classification system points to Class 3, subjective assessment would rate the model more as Class 1-2 for the following reasons:

- Mine inflow rates are not readily available for calibration purposes.
- Baseflow estimates are not ground-truthed.
- No seasonality has been attempted in replicating the detail observed in monitoring bore hydrographs.
- There is uncertainty as to the details for historical mining.
- The groundwater system is complex as the result of a large number of previous and current simultaneous mining operations.

Table 13 Model Confidence Classification

CLASS	DATA	CALIBRATION	PREDICTION	INDICATORS
1 [count 4]	Not much. Sparse. No metered usage. Remote climate data.	Not possible. Large error statistic. Inadequate data spread. Targets incompatible with model purpose. [No inflow record]	Timeframe >> calibration Long stress periods. Transient prediction but steady-state calibration. Bad verification.	Timeframe > 10x Stresses > 5x Mass balance > 1% (or single 5%) Properties <> field. Bad discretisation. No review.
2 [count 5]	Some. Poor coverage. Some usage info. Baseflow estimates.	Partial performance. Long-term trends wrong. Short time record. Weak seasonal replication. No use of targets compatible with model purpose.	Timeframe > calibration. Long stress periods. New stresses not in calibration. Poor verification.	Timeframe = 3-10x Stresses = 2-5x Mass balance < 1% Some properties <> field measurements. Some key coarse discretisation. Review by hydrogeo.
3 [count 7]	Lots. Good aquifer geometry. Good usage info. Local climate info. K measurements. Hi-res DEM.	Good performance stats. Long-term trends replicated. Seasonal fluctuations OK. Present day data targets. Head and flux targets.	Timeframe ~ calibration. Similar stress periods. Similar stresses to those in calibration. Steady-state prediction consistent with steady-state calibration. Good verification.	Timeframe < 3x Stresses < 2x Mass balance < 0.5% Properties ~ field measurements. Some key coarse discretisation. Review by modeller.

7 REFERENCES

Aquaterra, 2008. Bloomfield Colliery Completion of Mining and Rehabilitation Groundwater Impact Assessment. Report S05/R02g, September 2008.

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A., 2012. *Australian Groundwater Modelling Guidelines*. Waterlines Report Series No. 82, National Water Commission, Canberra. June 2012.

Bloomfield Collieries Pty Ltd, 2015. Annual Environmental Management Report 2015. 17 March 2016.

BoM (Bureau of Meteorology), 2017, Climate Data Online. Available at: http://www.bom.gov.au/climate/data/

Environmental Simulations Inc, 2011. *Groundwater Vistas 6*. (Graphical User Interface for MODFLOW and other models). Available at: http://www.groundwatermodels.com/

Hydrosimulations, 2015. Abel Mine Modification (MOD4) Groundwater Modelling Assessment. Report HC2015/18, December 2015.

MDBC, 2001. Groundwater flow modelling guideline. Murray-Darling Basin Commission. URL: www.mdbc.gov.au/nrm/water_management/groundwater/groundwater_guides

NSW Government, 2012. *Aquifer Interference Policy*. September 2012.

RPS Aquaterra, 2013. *Abel Upgrade Modification – Groundwater Assessment*. Report for Donaldson Coal. Ref: 1S64DD/021f, 13 February 2013.

FIGURES

Figures 1 to 15

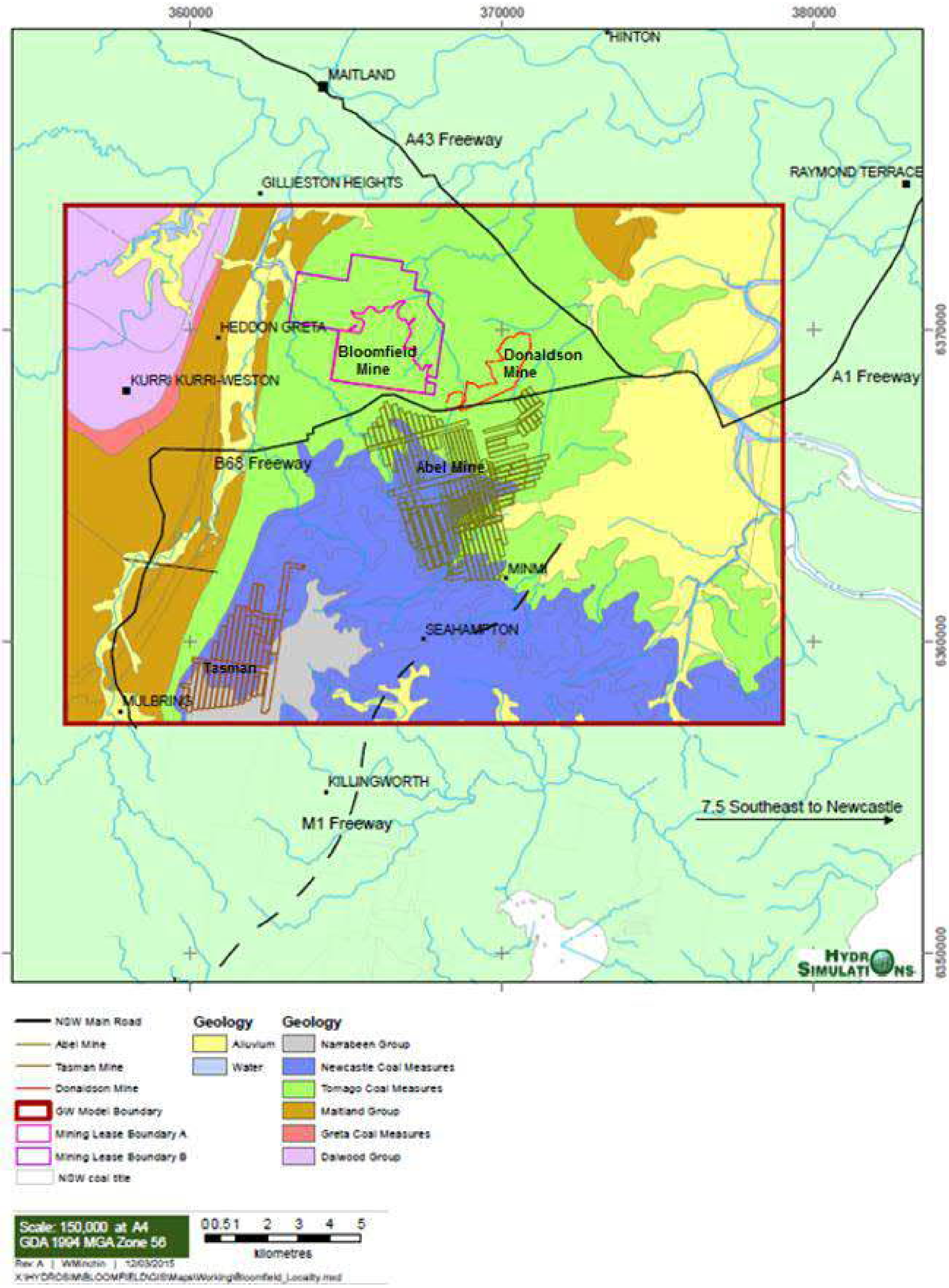


Figure 1. Location Plan

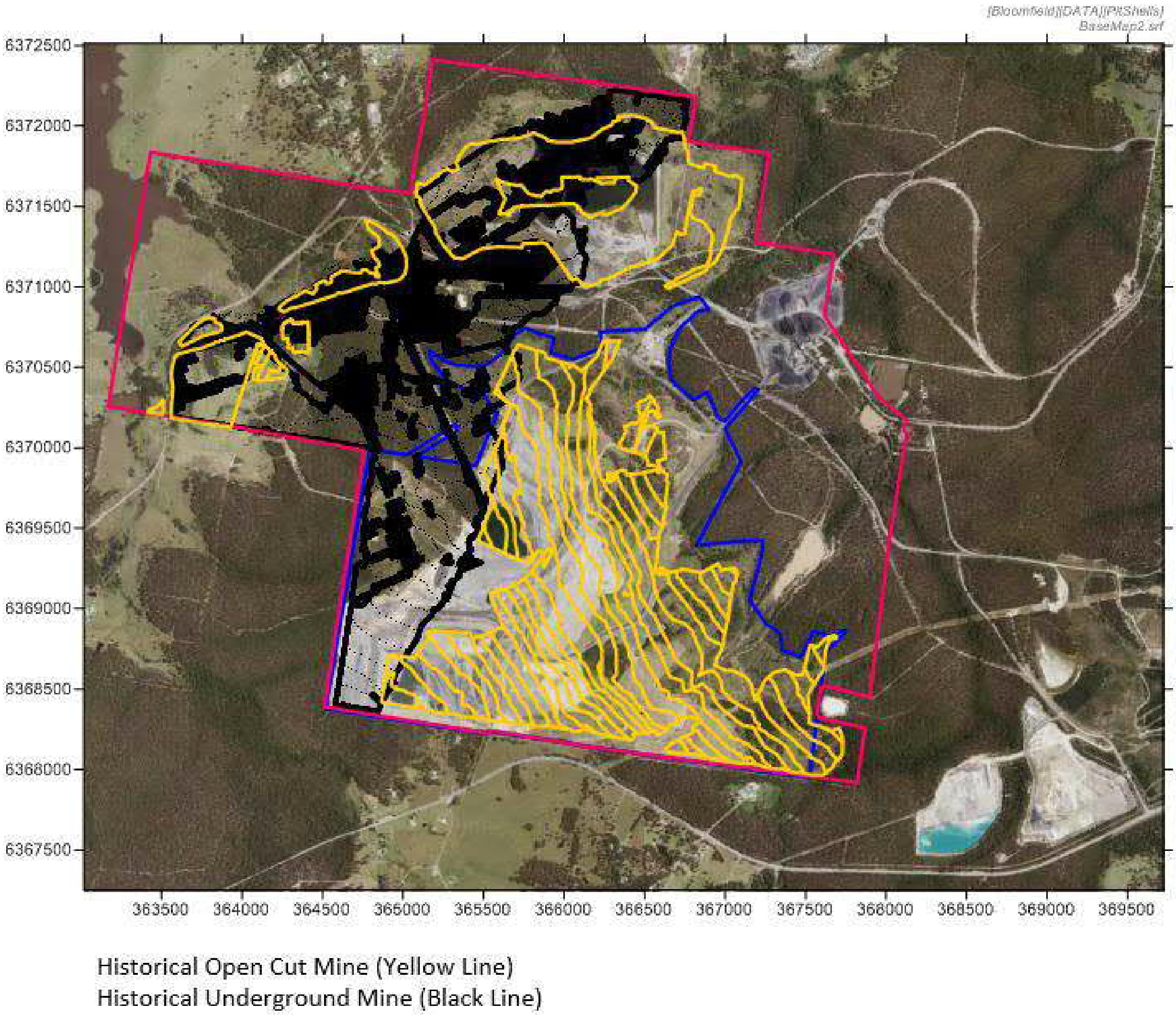


Figure 2. Historical Bloomfield Mining

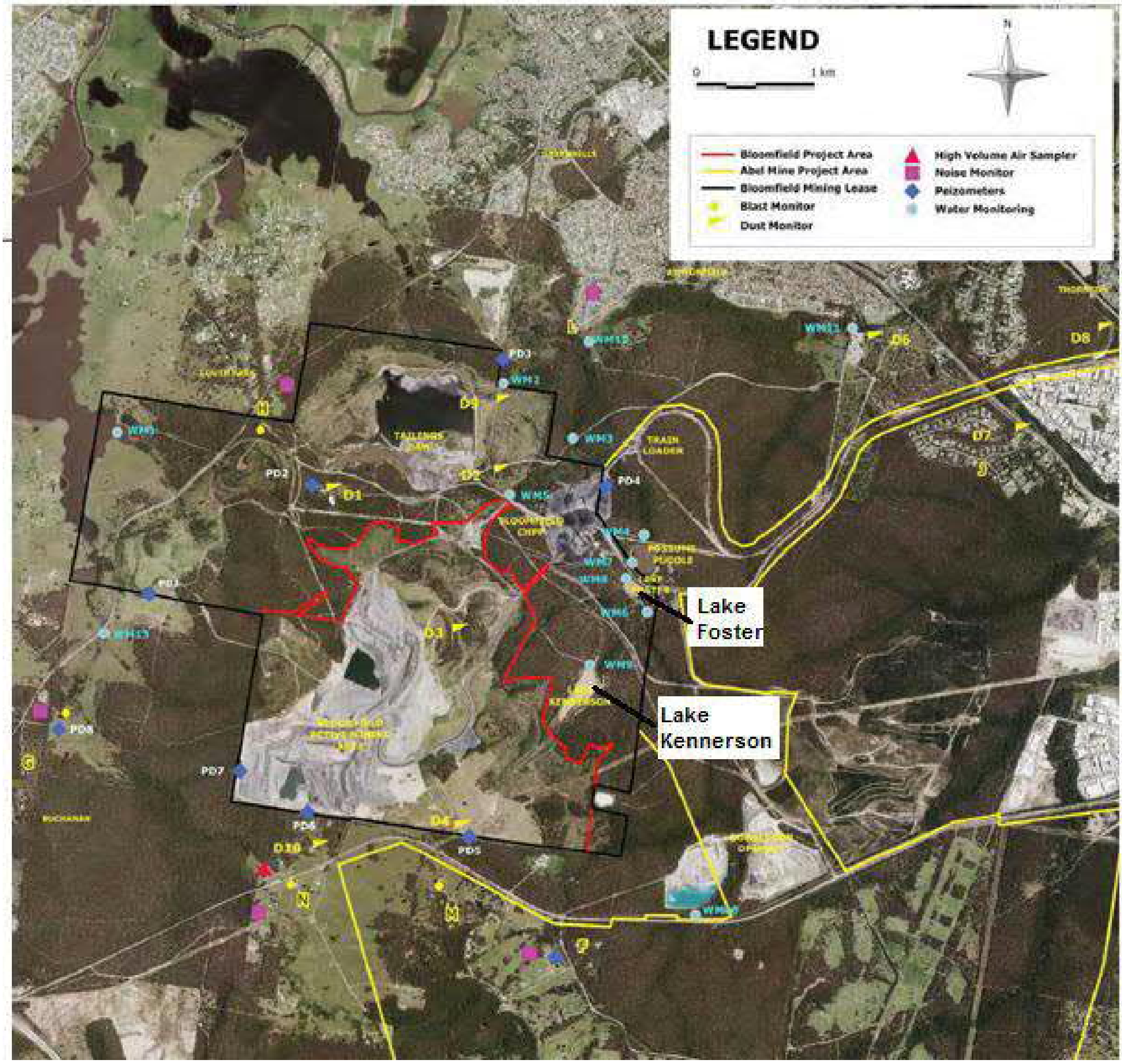


Figure 3. Lease Boundaries and Environmental Monitoring Sites [Bloomfield, 2015]

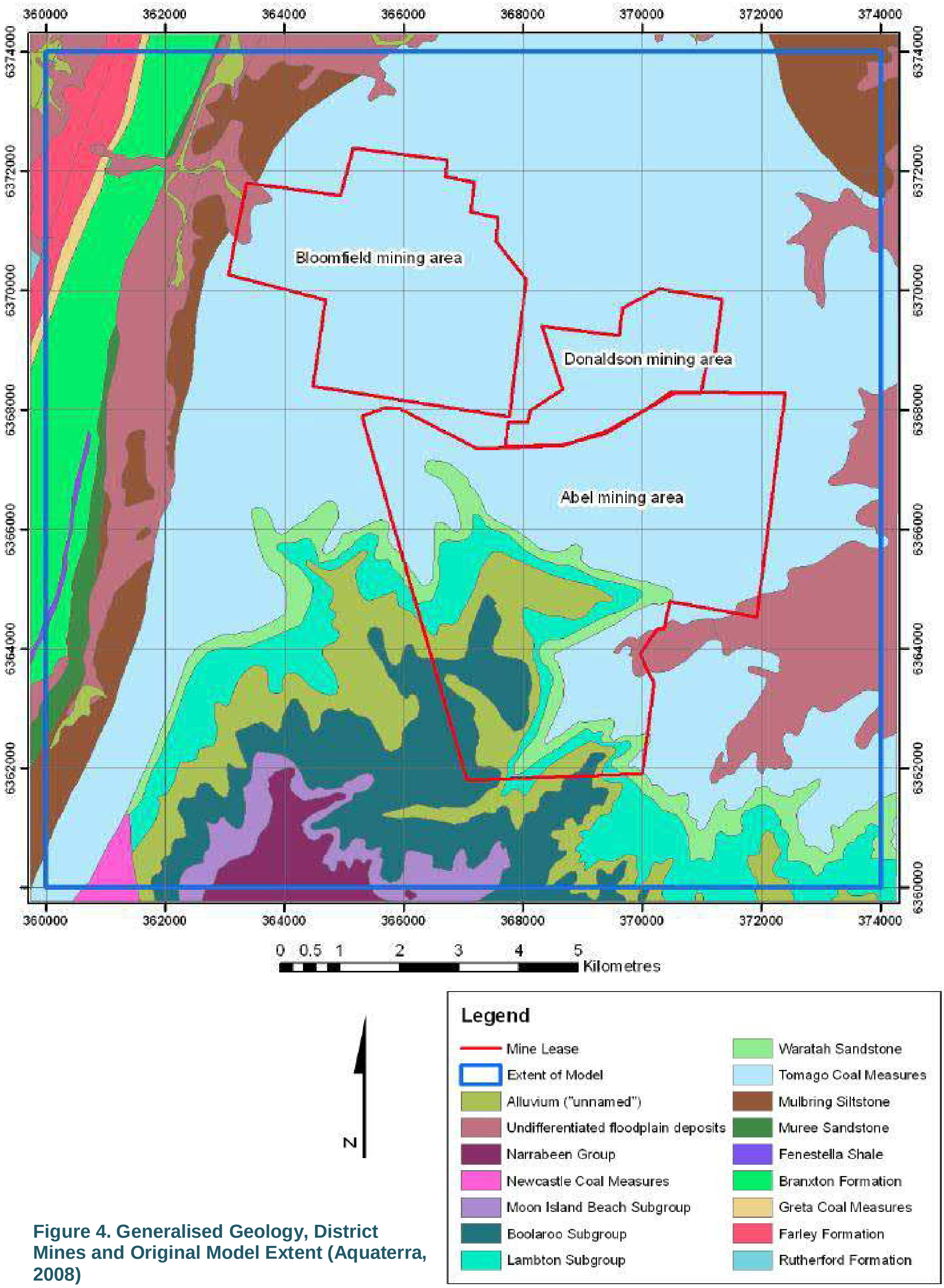


Figure 4. Generalised Geology, District Mines and Original Model Extent (Aquaterra, 2008)

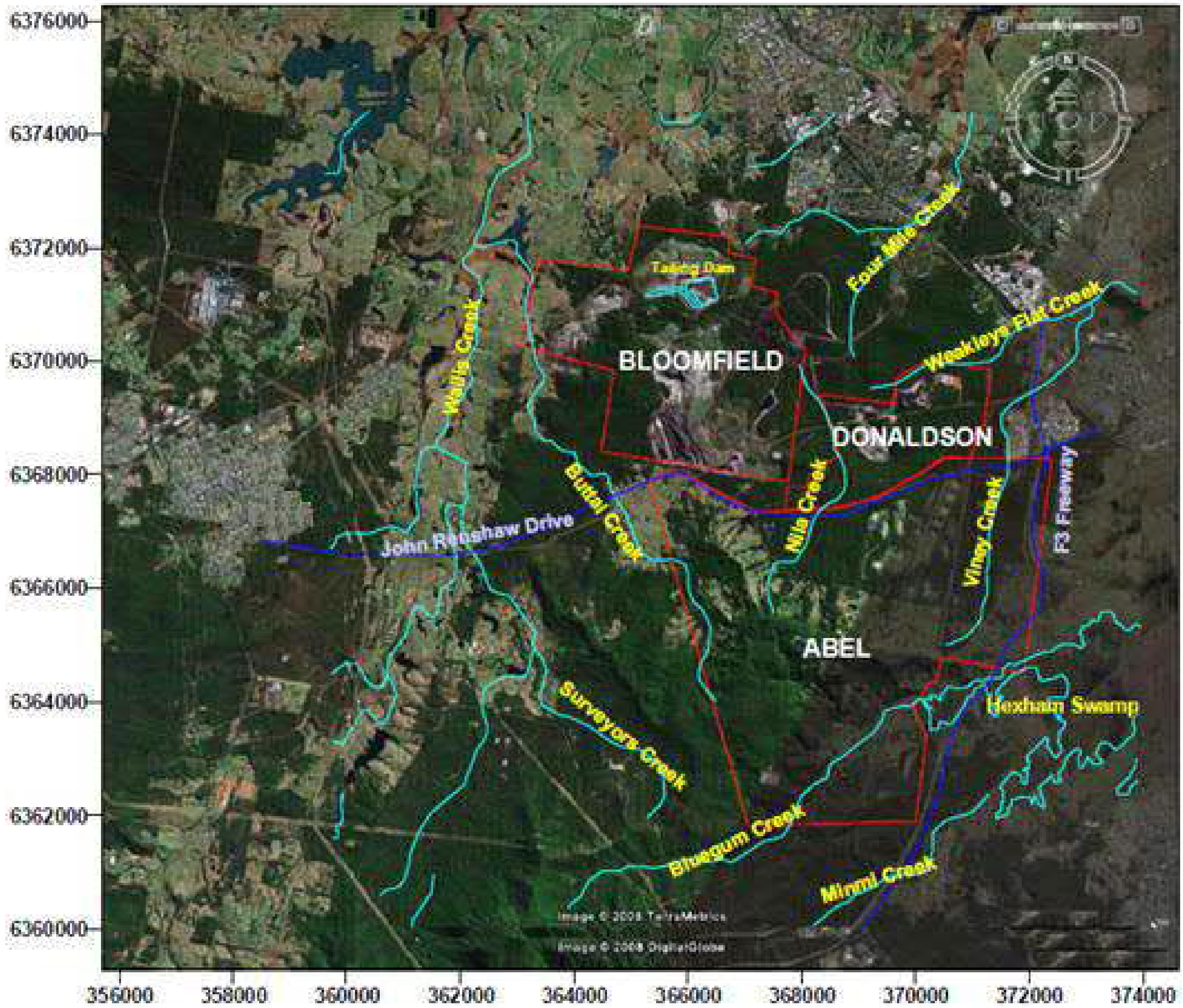


Figure 5. Watercourses (Aquaterra, 2008)

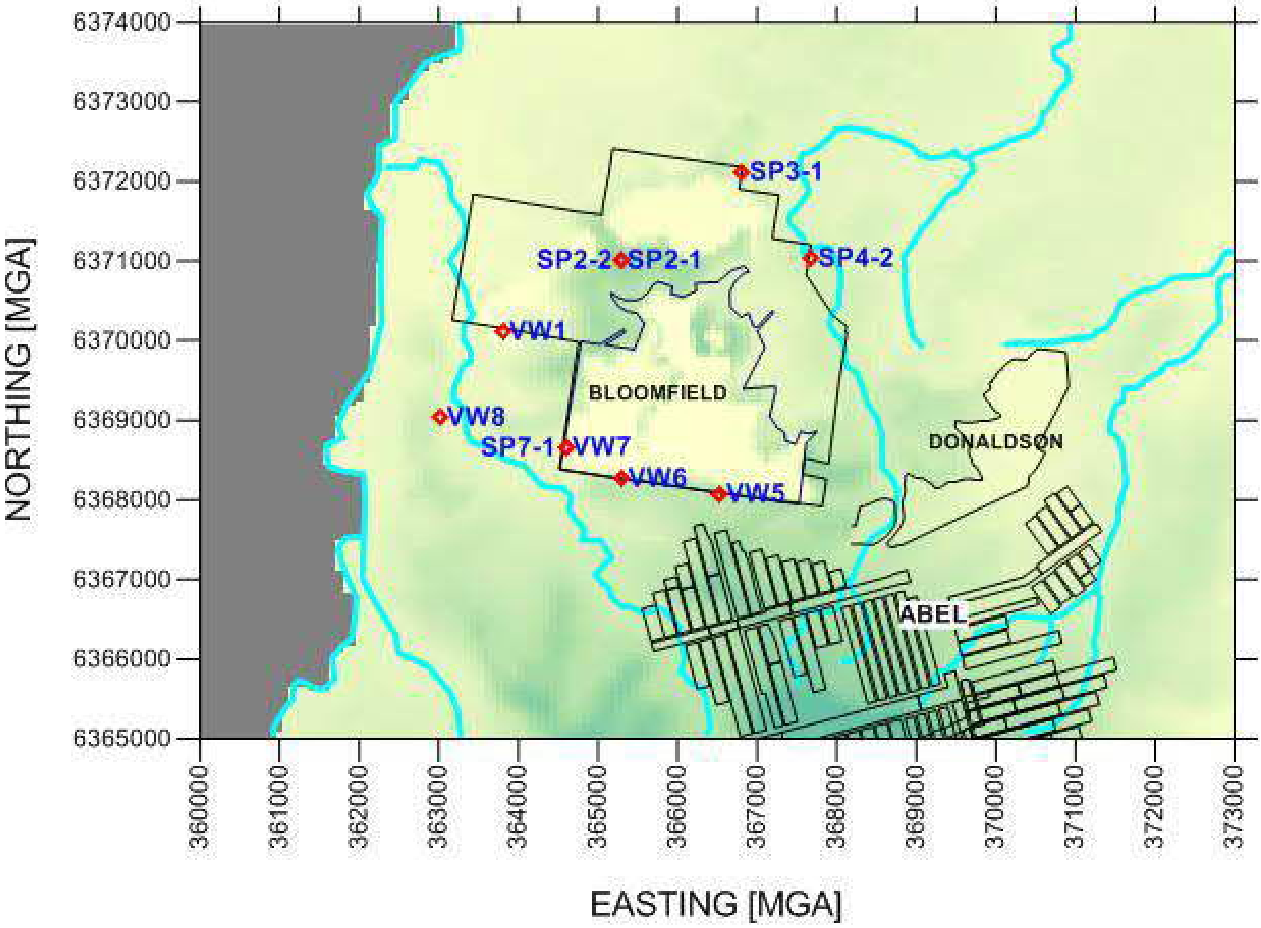


Figure 6. Bloomfield Groundwater Monitoring Network

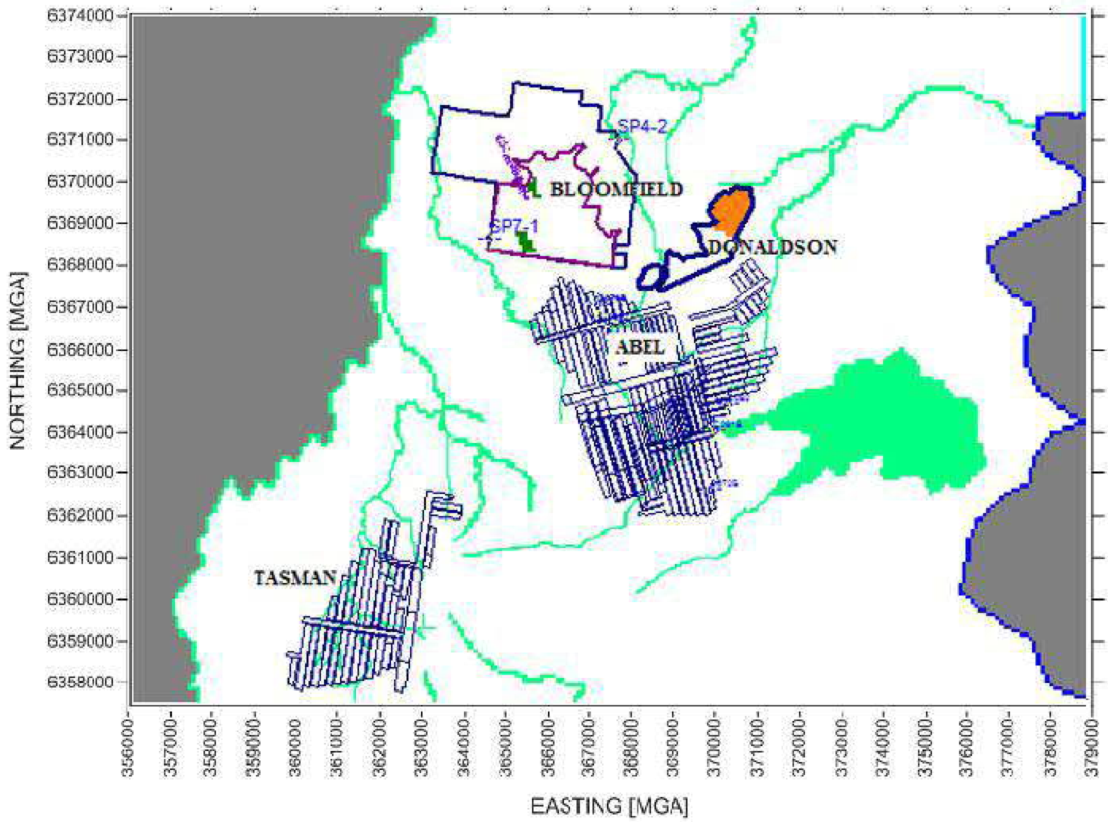


Figure 7. Bloomfield Groundwater Model Extent

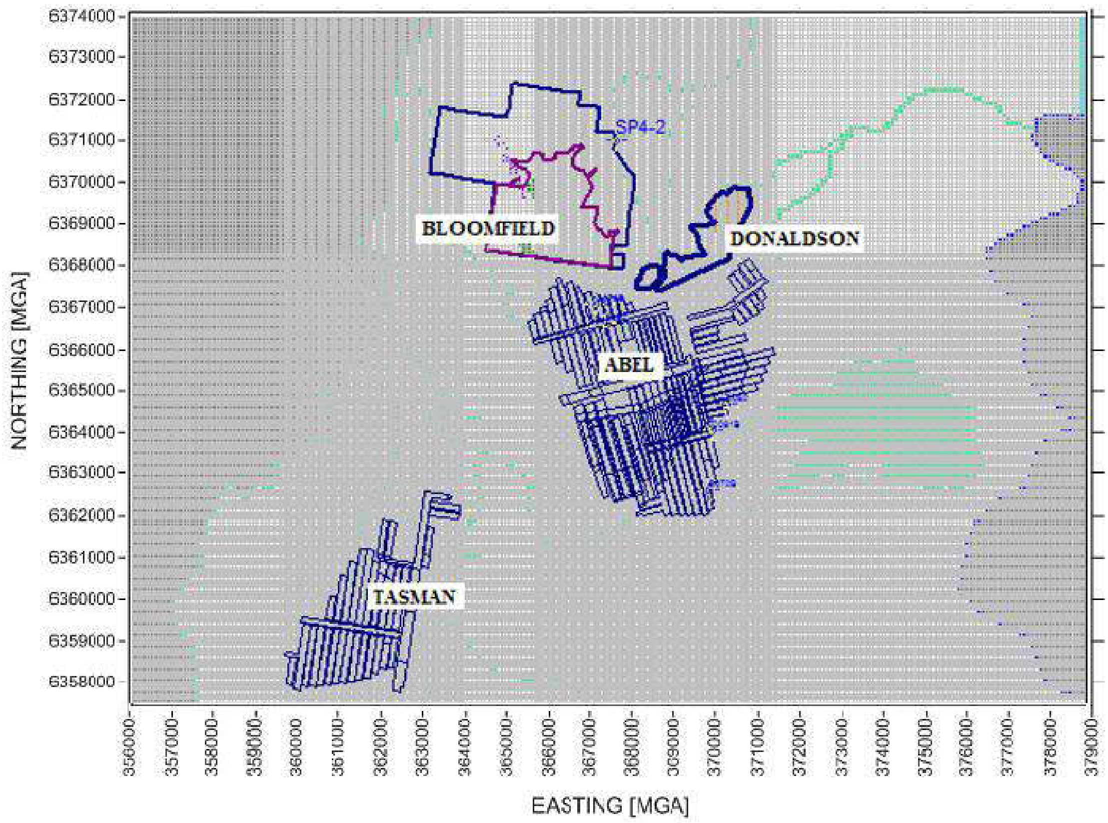


Figure 8. Bloomfield Groundwater Model Grid

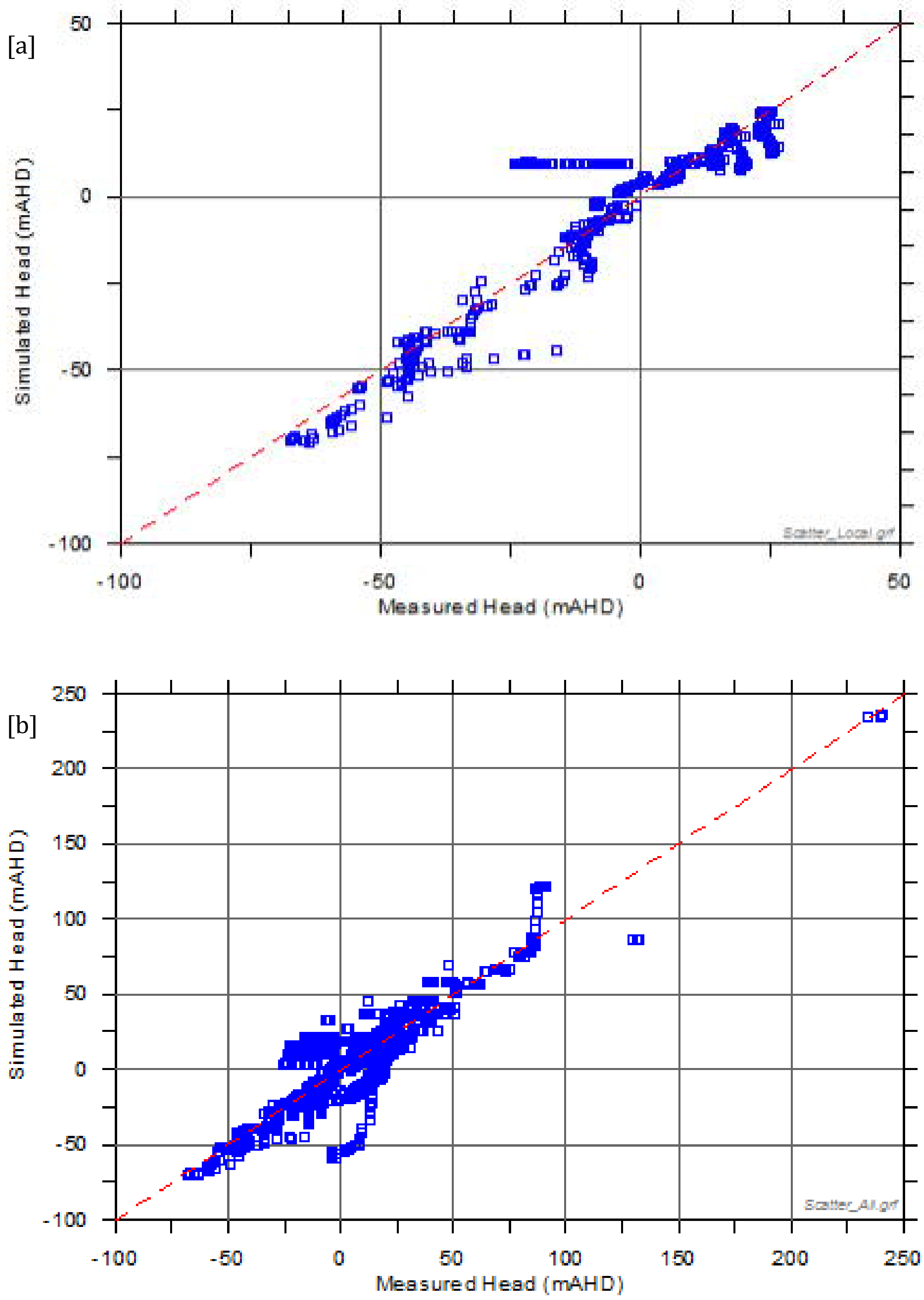


Figure 9. Calibration Scattergrams [a] Bloomfield Bores; [b] Regional Bores

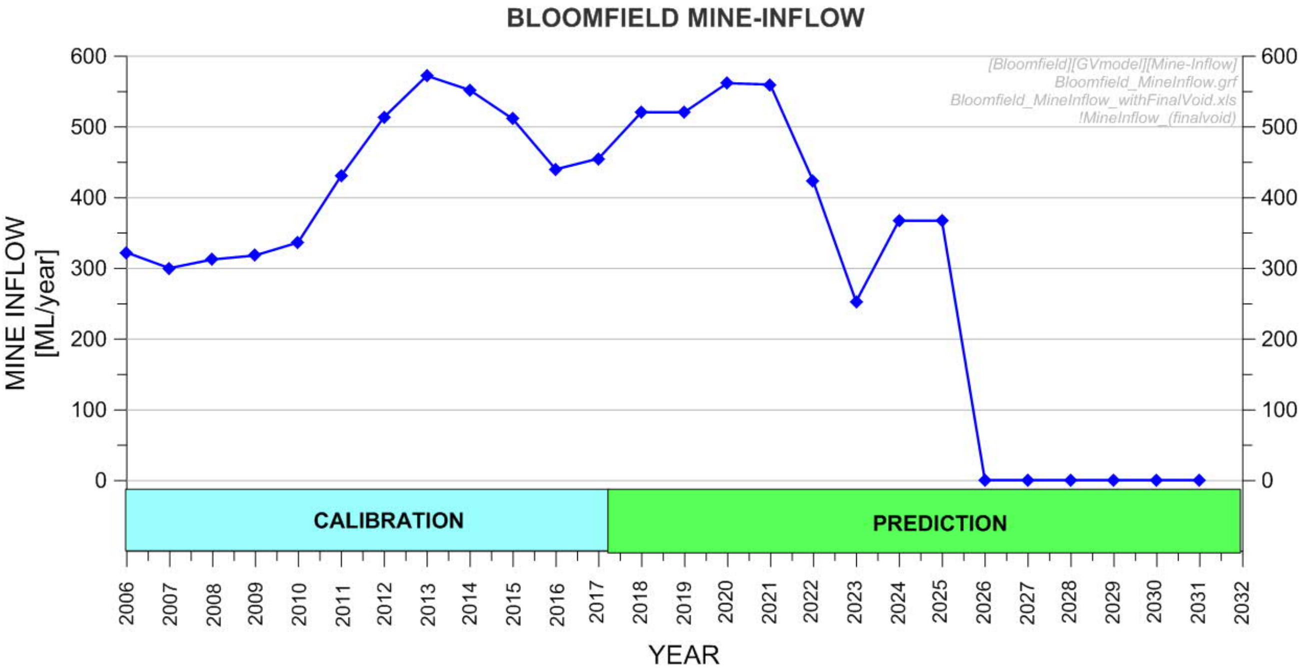


Figure 10. Modelled Mine Inflows for the Bloomfield Mine

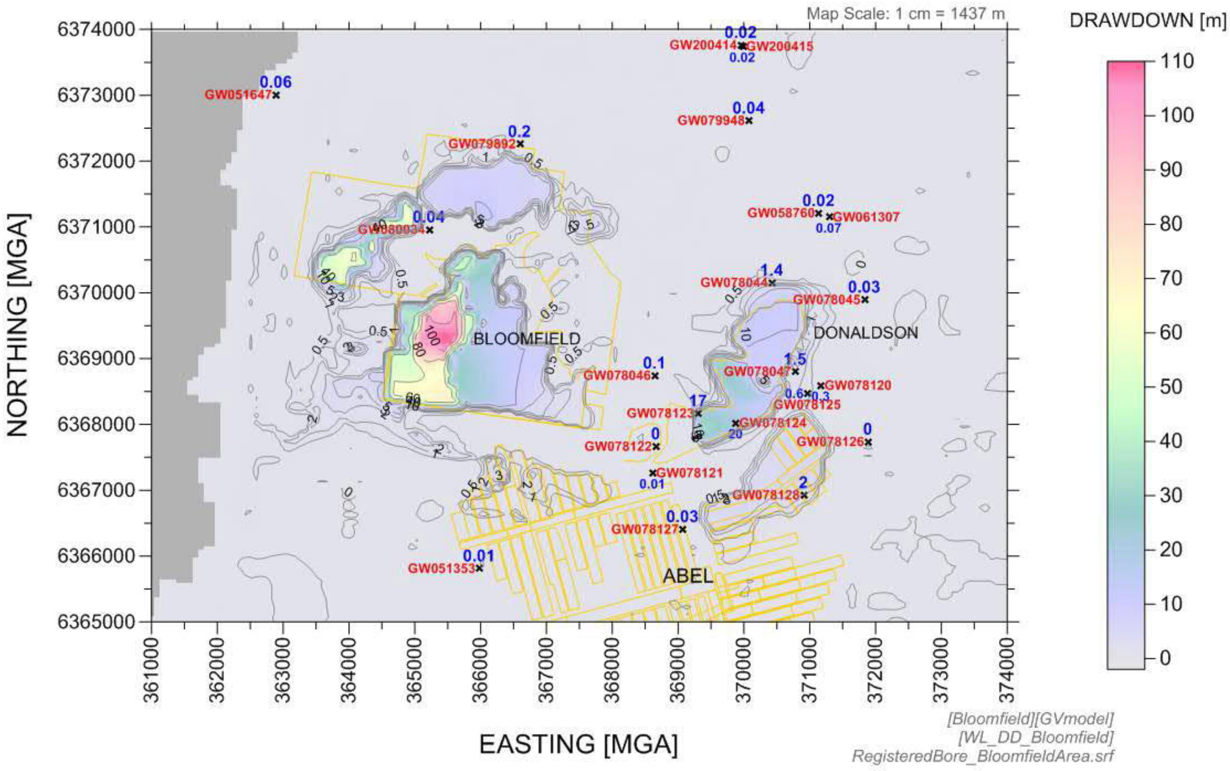


Figure 11. Predicted Drawdown at Registered Bores [in Alluvium and Regolith, Layer 1] at the End of Mining (Year 2025)

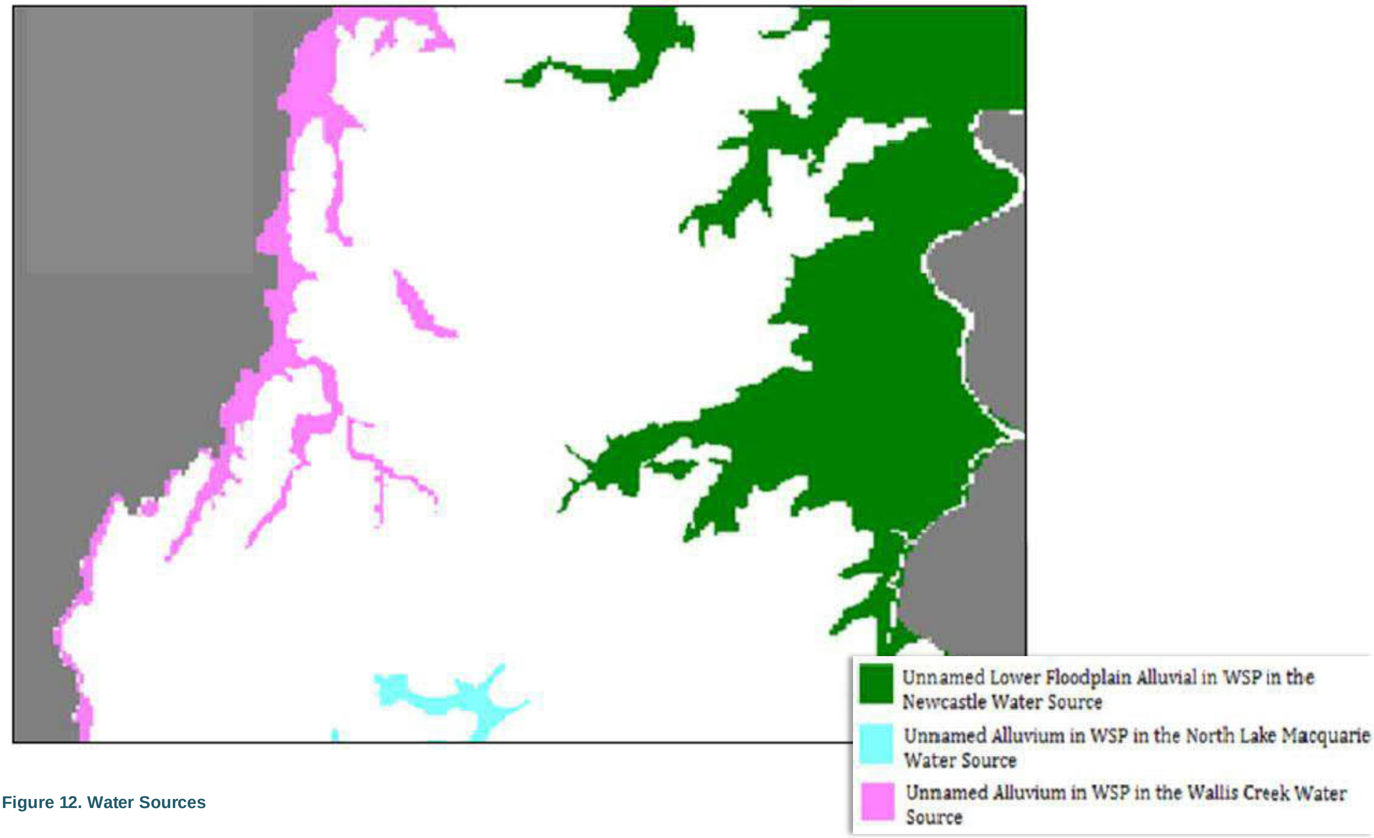


Figure 12. Water Sources

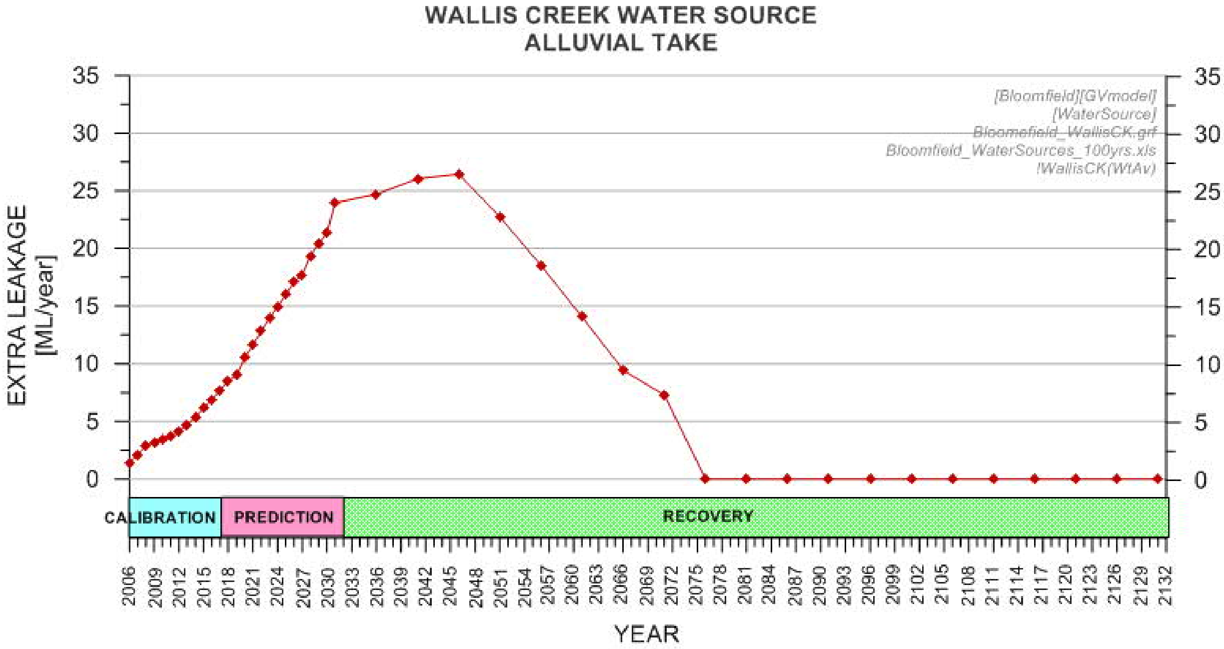


Figure 13. Wallis Creek Water Source Alluvial Take

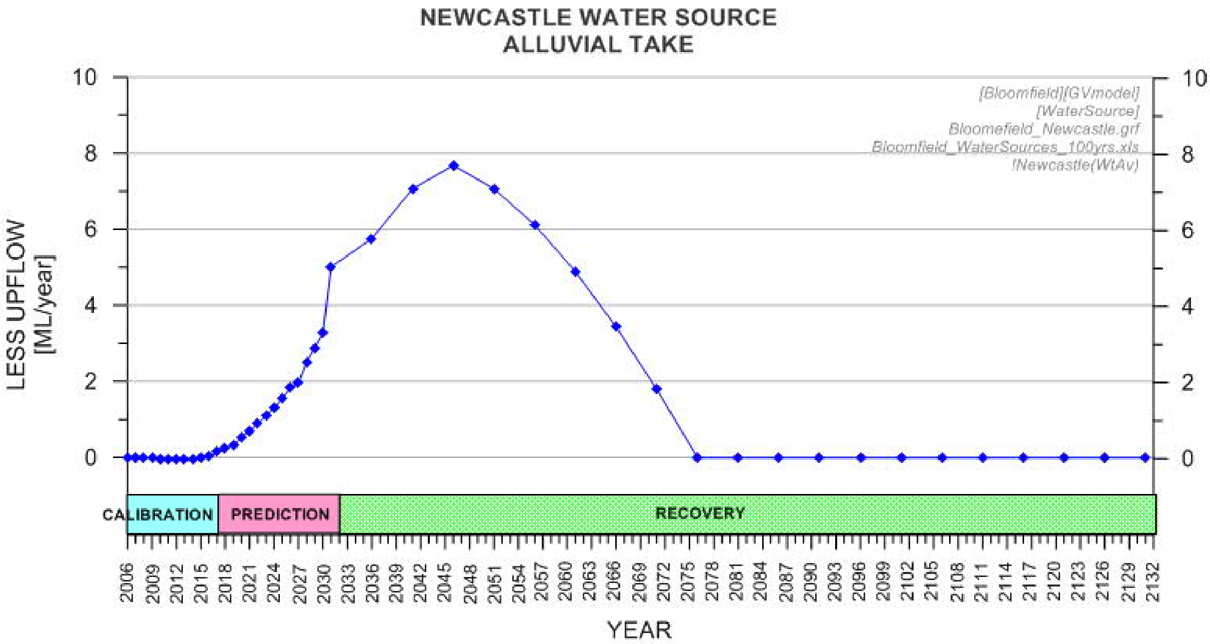
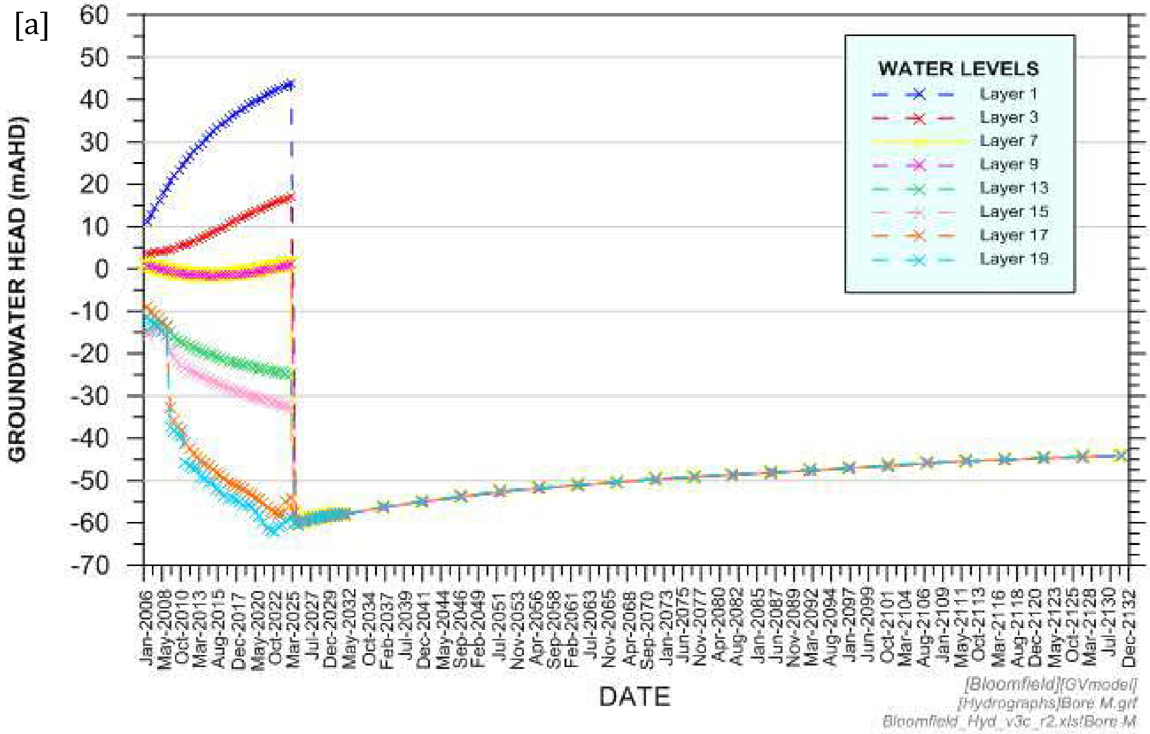


Figure 14. Newcastle Water Source Alluvial Take

[a]



[b]

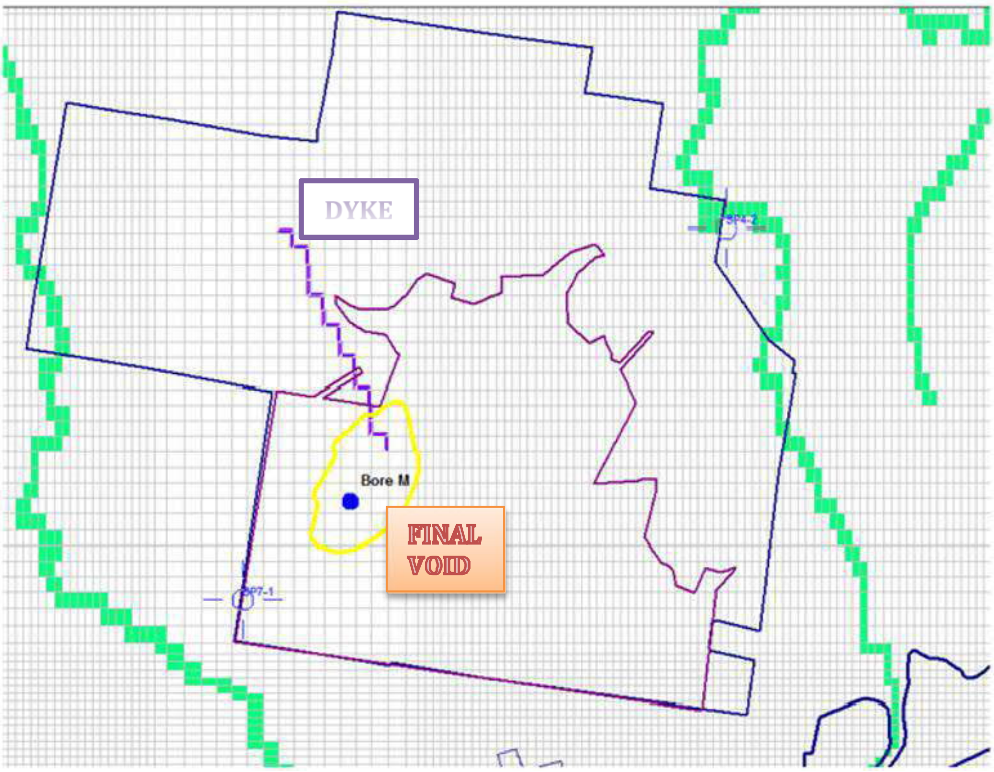


Figure 15. Simulated Recovery Hydrograph at Site M [a] within the Final Void [b]

APPENDIX A

Mining Progression

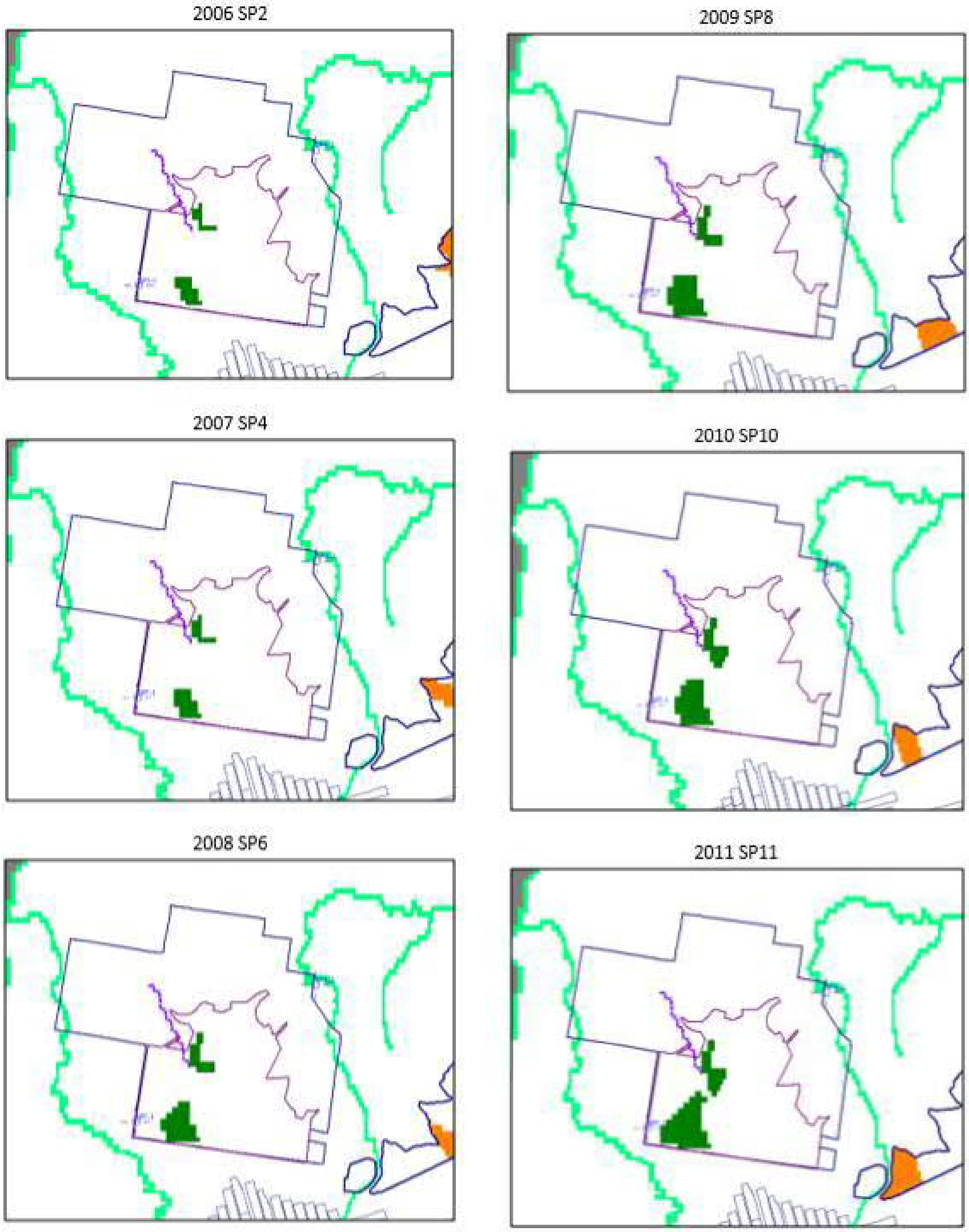


Figure A1. Mining Progression 2006 to 2011

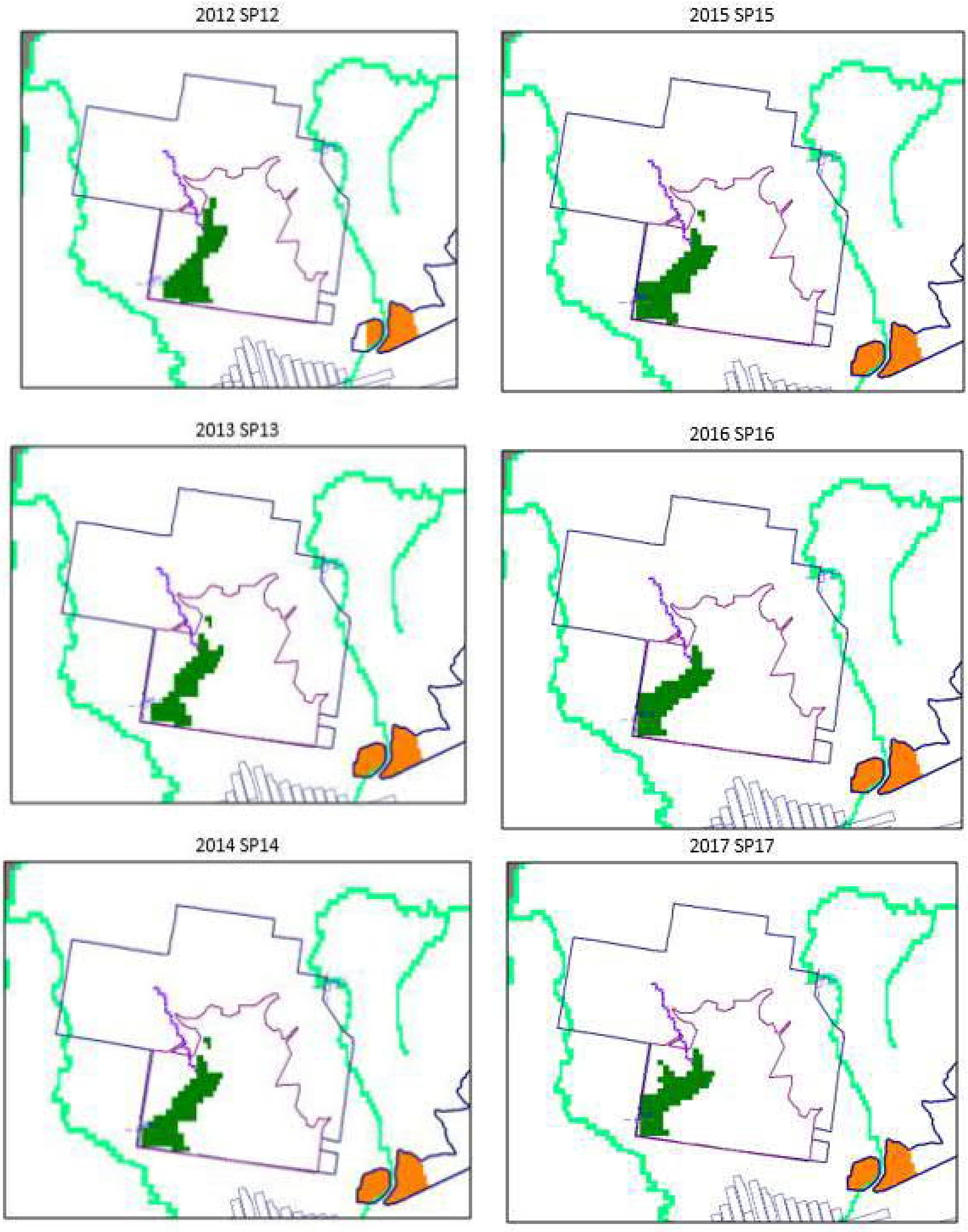


Figure A2. Mining Progression 2012 to 2017

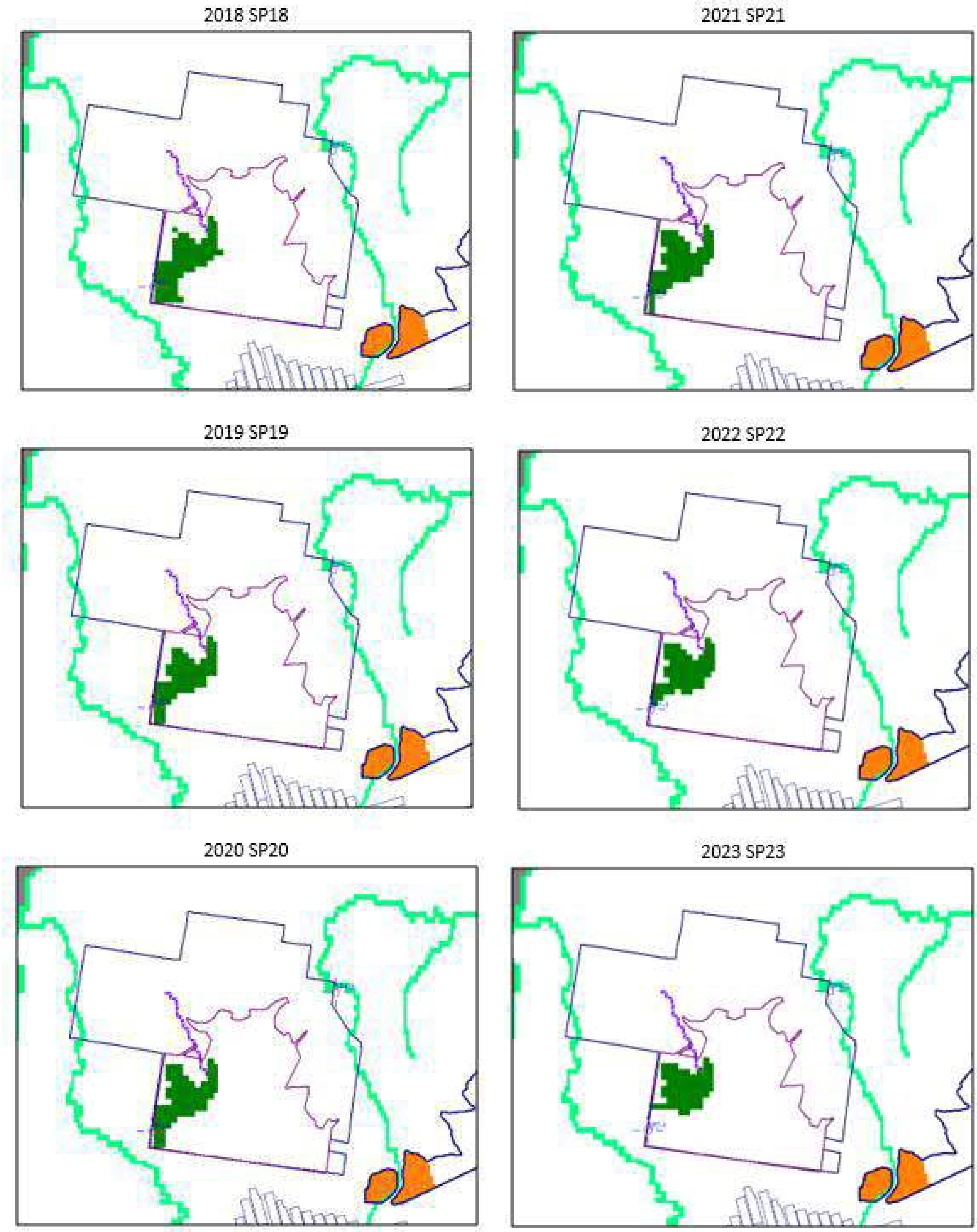


Figure A3. Mining Progression 2018 to 2023

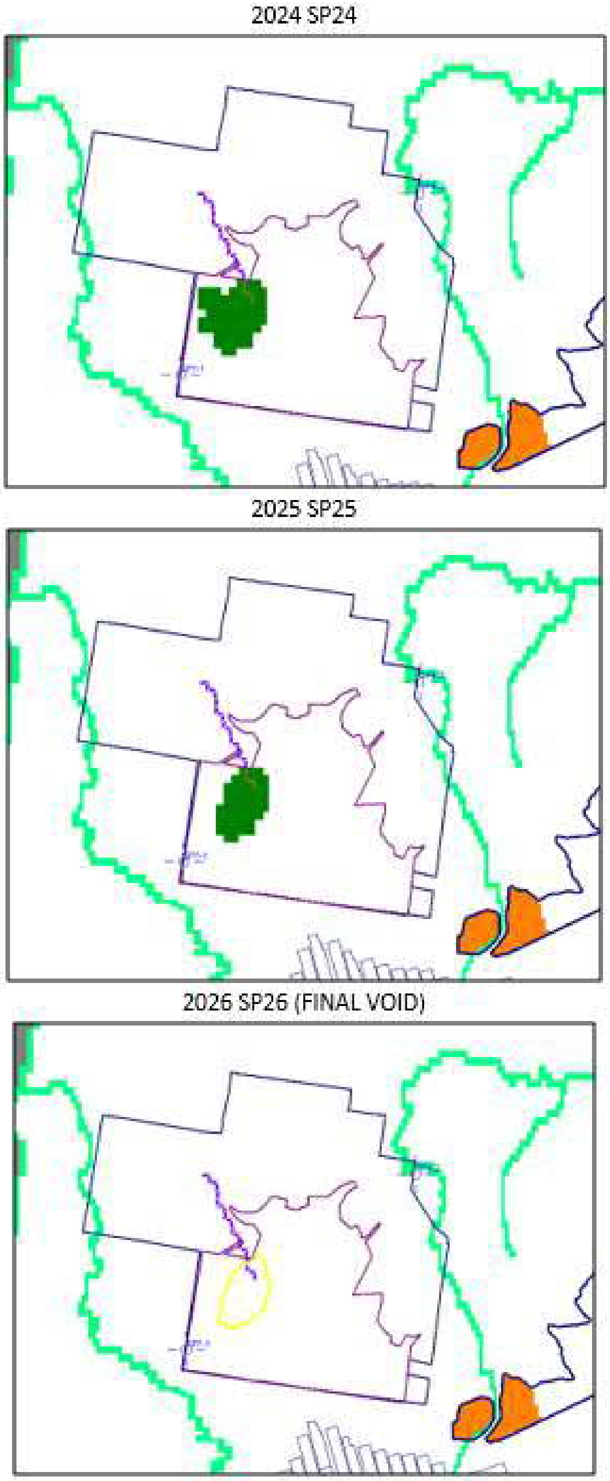
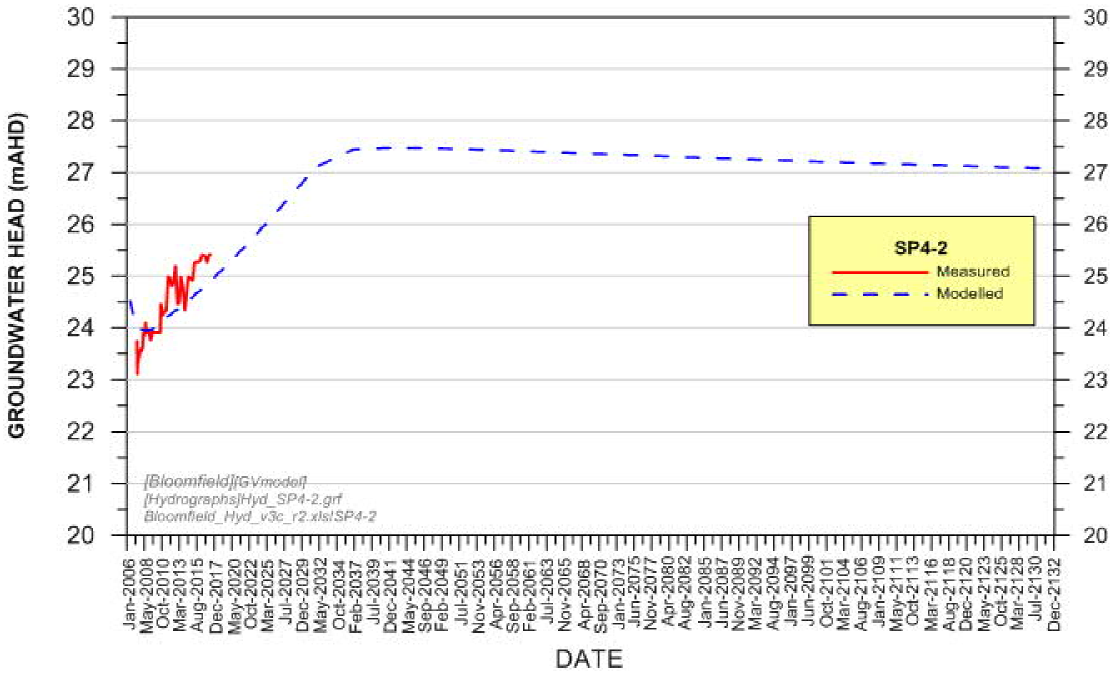


Figure A4. Mining Progression 2024 to 2025 and Final Void Location (SP26-SP32)

APPENDIX B

Groundwater Level Hydrographs



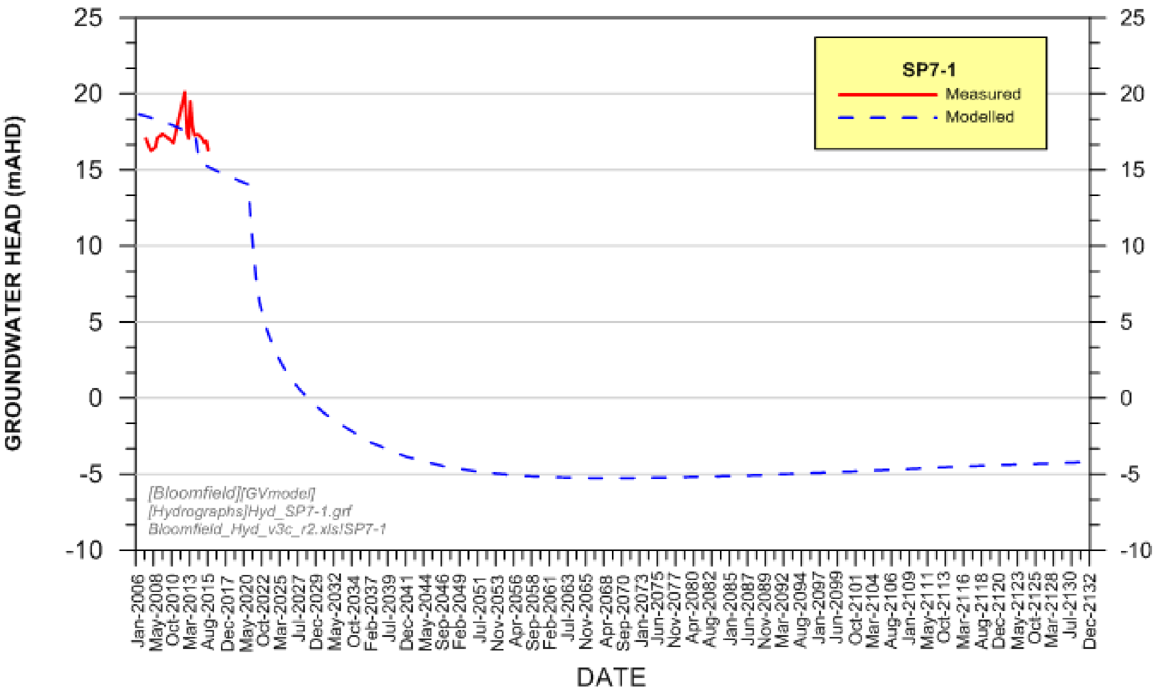


Figure B1. Measured and Simulated Hydrographs for Standpipes SP4-2 and SP7-1 in Alluvium and Regolith [Layer1]

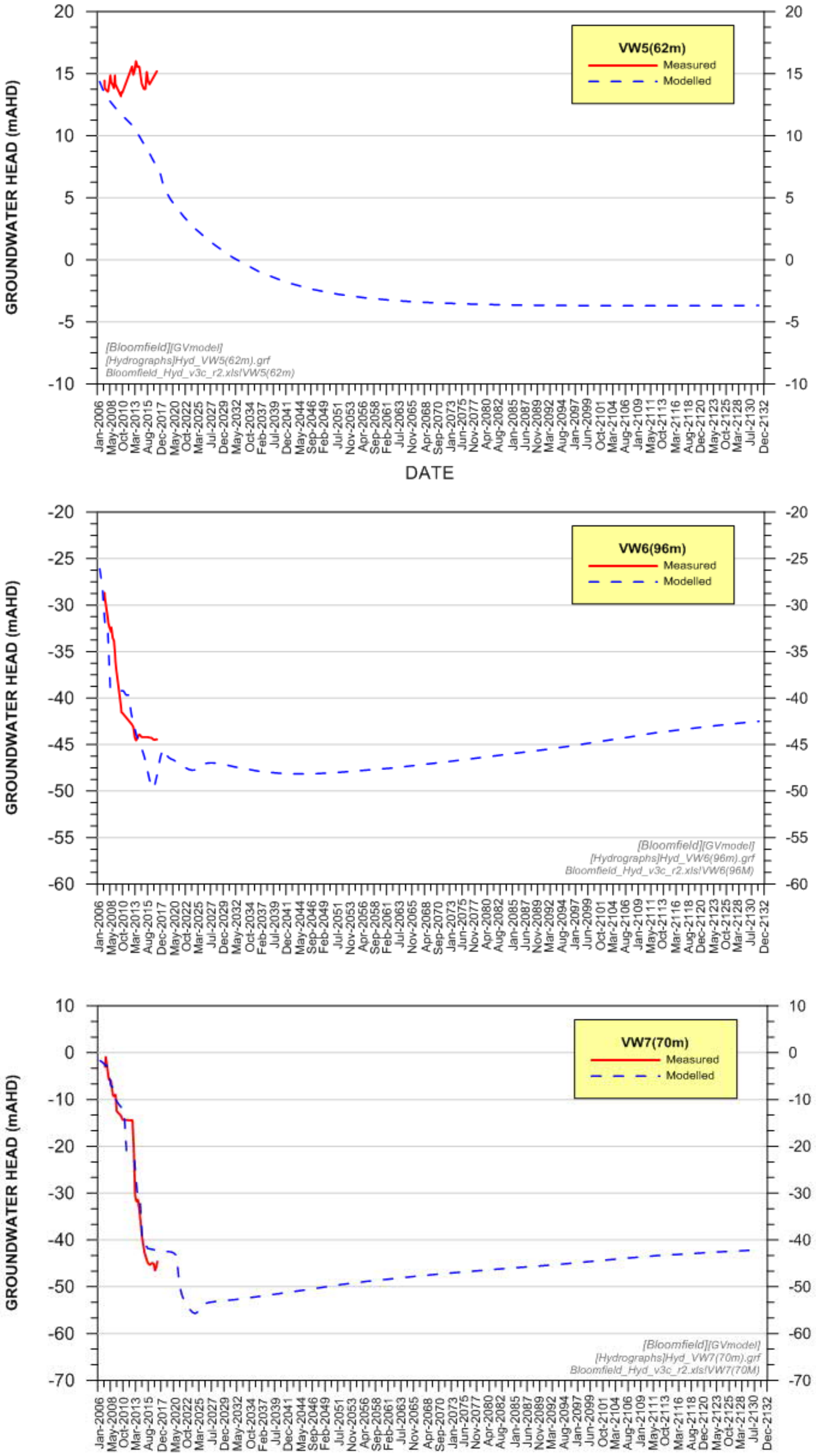


Figure B2. Measured and Simulated Hydrographs for VW5(62m), VW6(96m) and VW7(70m) at Whites Creek Seam [Layer13]

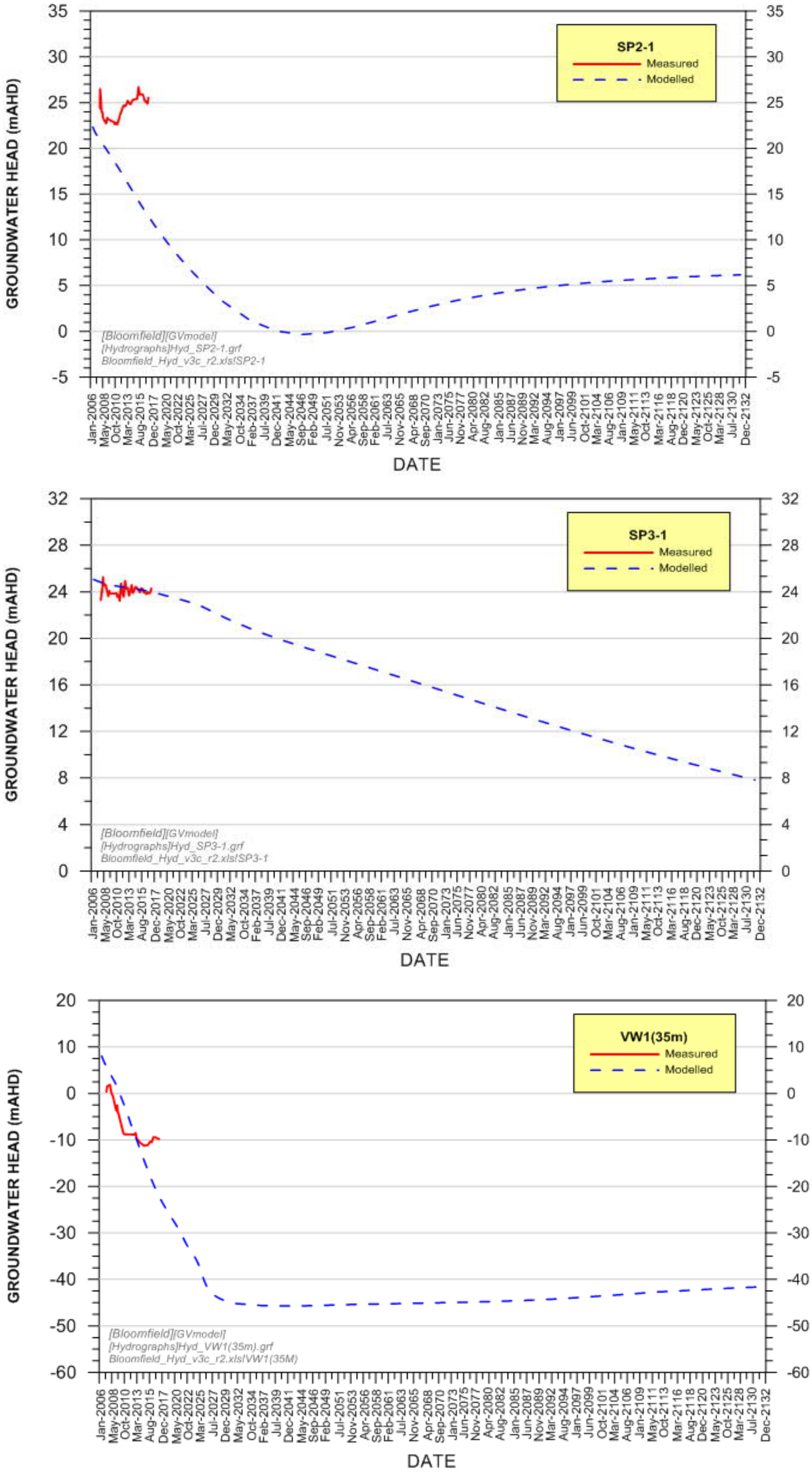
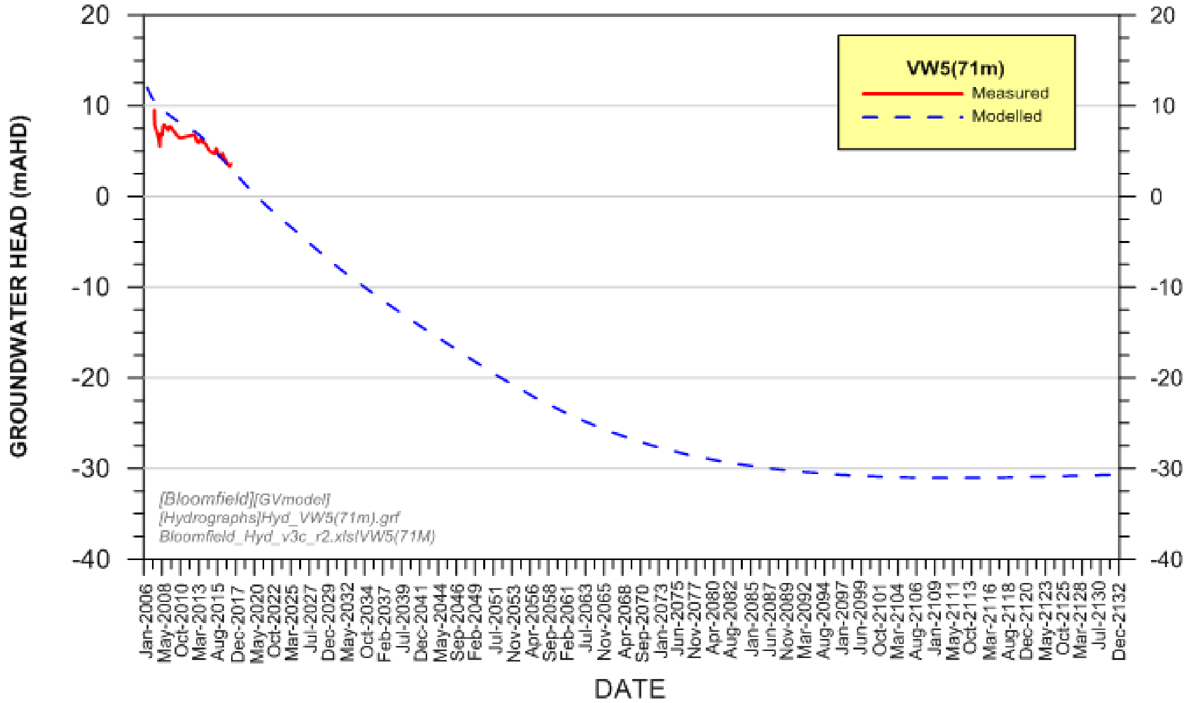


Figure B3. Measured and Simulated Hydrographs for Standpipes SP2-1 and SP3-1, and VW1(35m) at Donaldson Seam [Layer17]



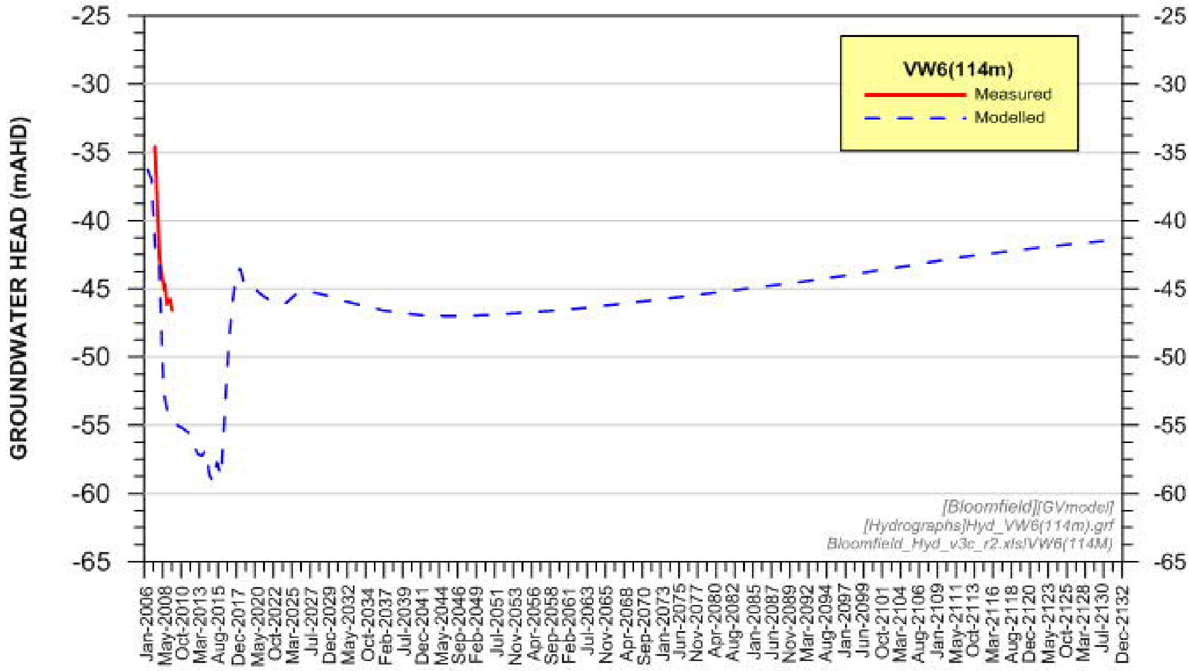
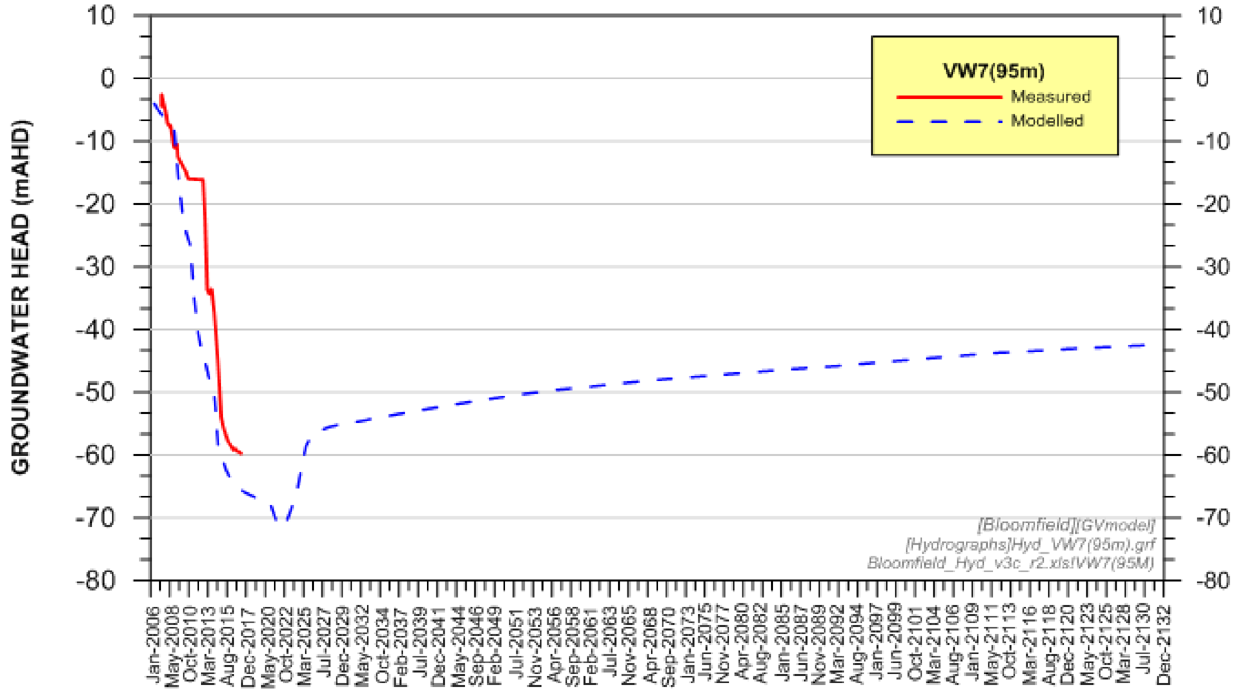


Figure B4. Measured and Simulated Hydrographs for VW5(71m) and VW6(114m) at Donaldson Seam [Layer17]



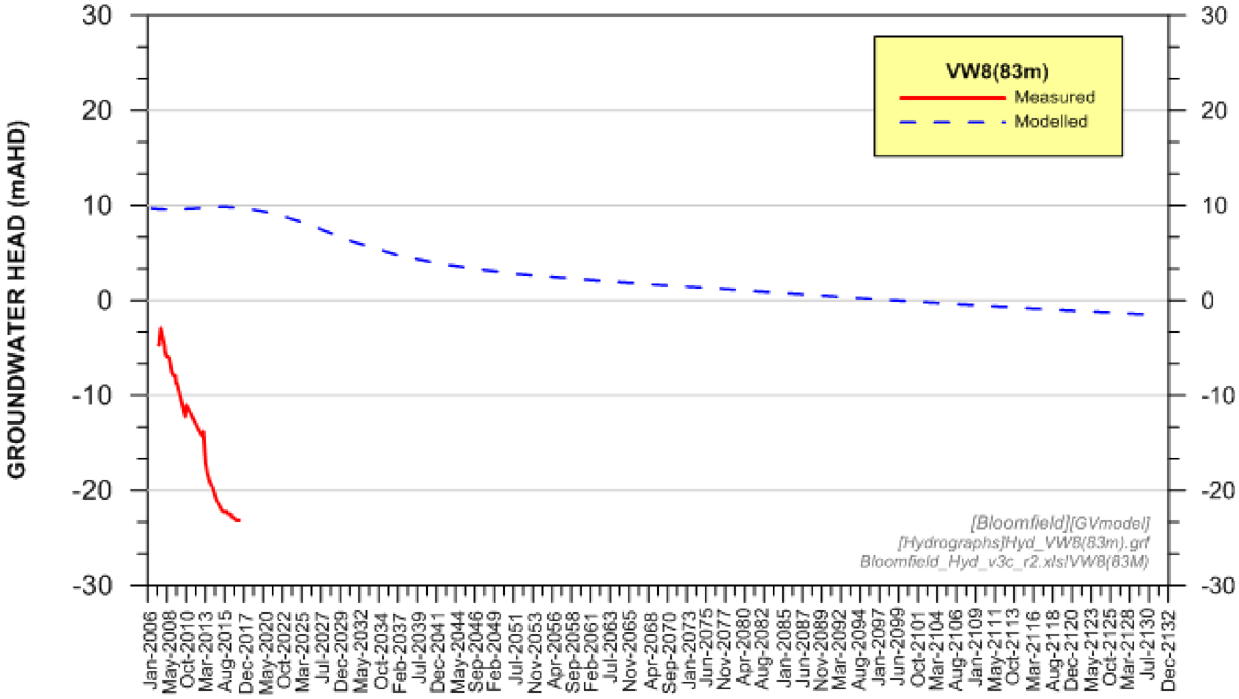


Figure B5. Measured and Simulated Hydrographs for VW7(95m) and VW8(83m) at Donaldson Seam [Layer17]

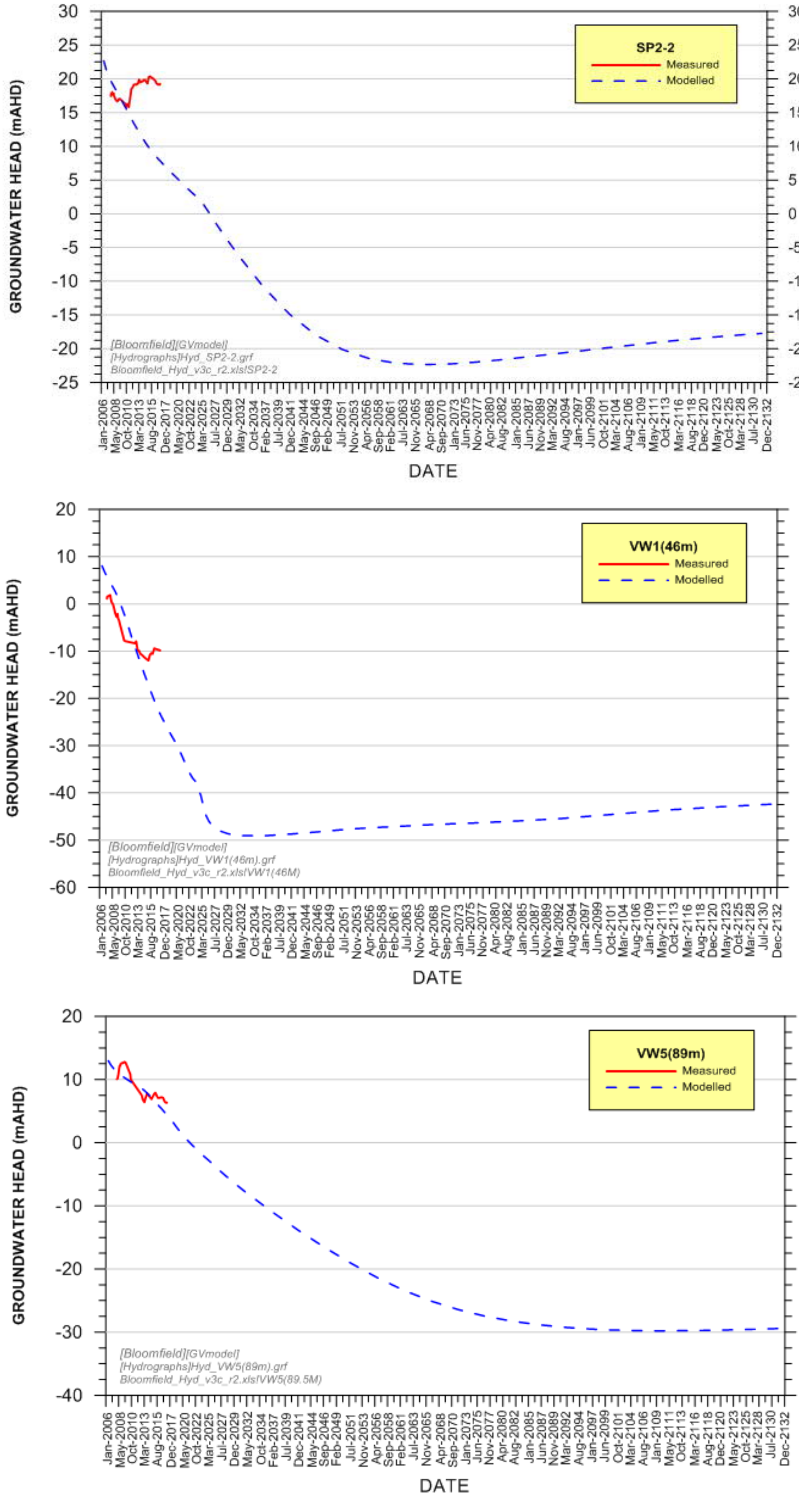
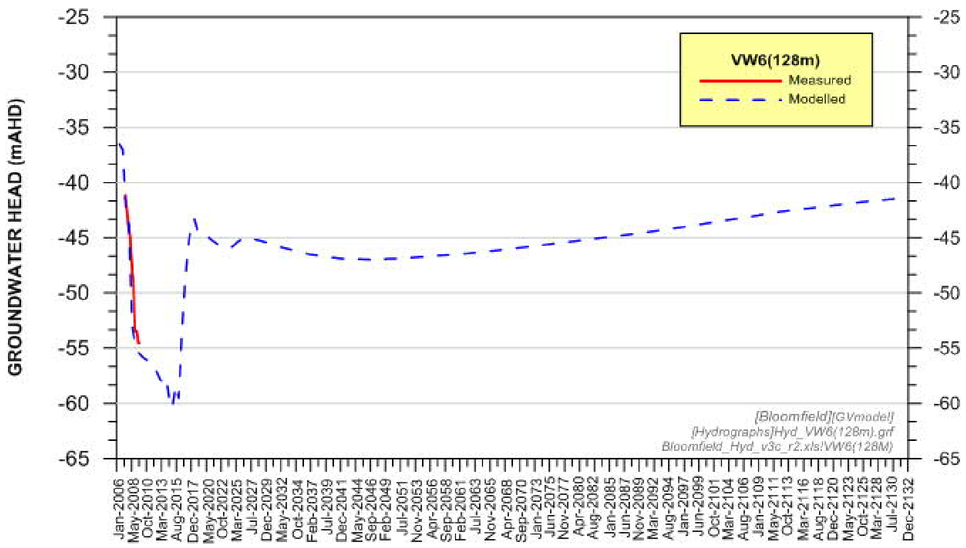
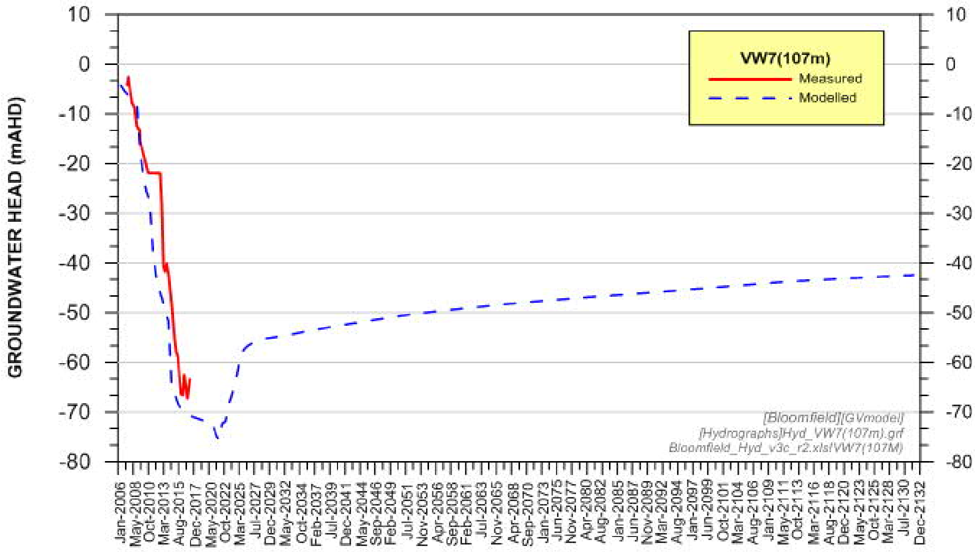


Figure B6. Measured and Simulated Hydrographs for Standpipe SP2-2, VW1(46m) and VW5(89m) at Big Ben Seam [Layer19]





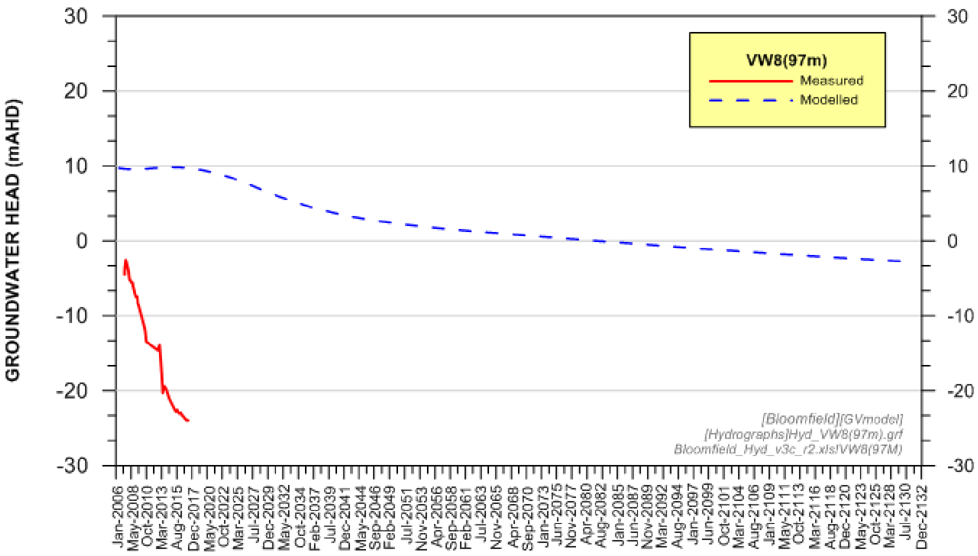


Figure B7. Measured and Simulated Hydrographs for VW6(128m), VW7(107m) and VW8(97m) at Big Ben Seam [Layer19]

APPENDIX C

Simulated Groundwater Level Maps

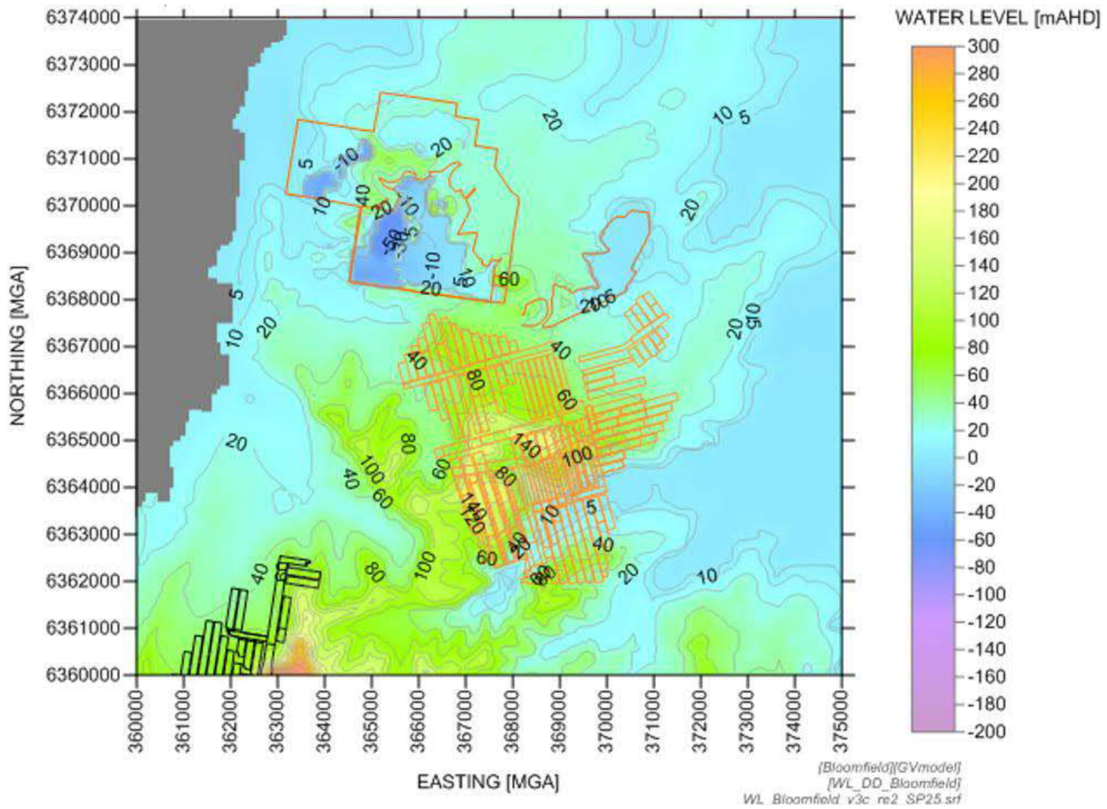


Figure C2. Predicted Water Levels in Alluvium and Regolith [Layer 1] at the End of Mining (Year2025)

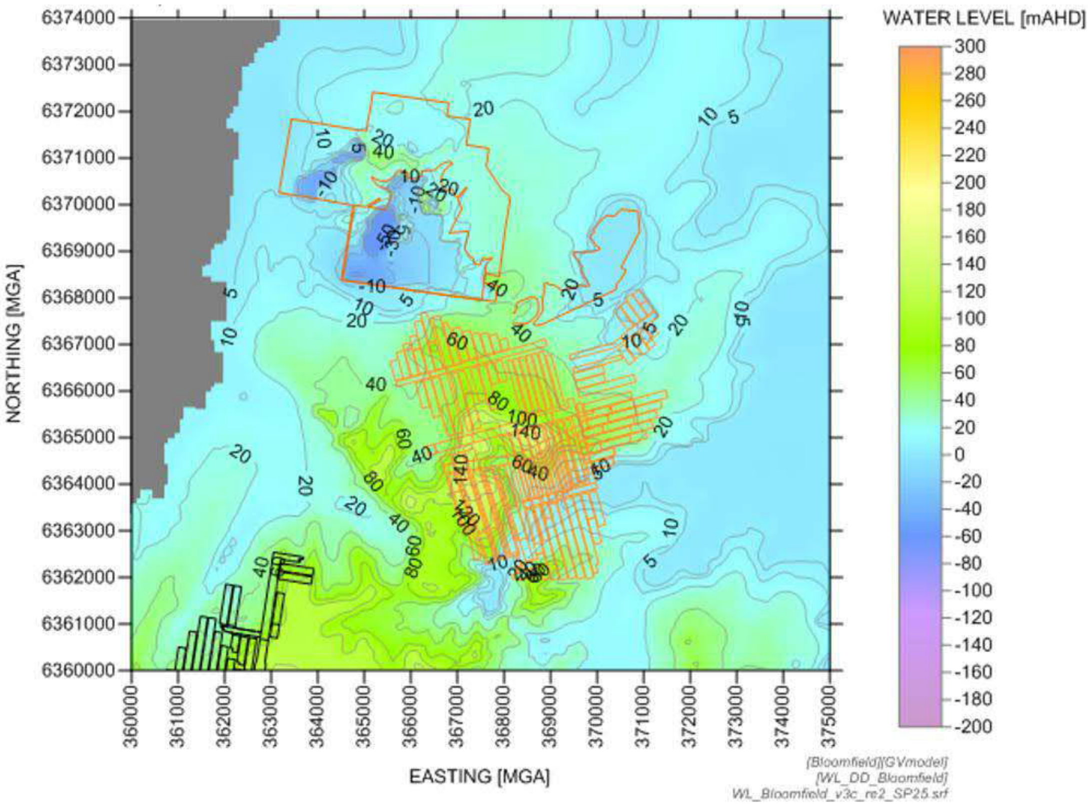


Figure C2. Predicted Water Levels in C Seam [Layer 3] at the End of Mining (Year2025)

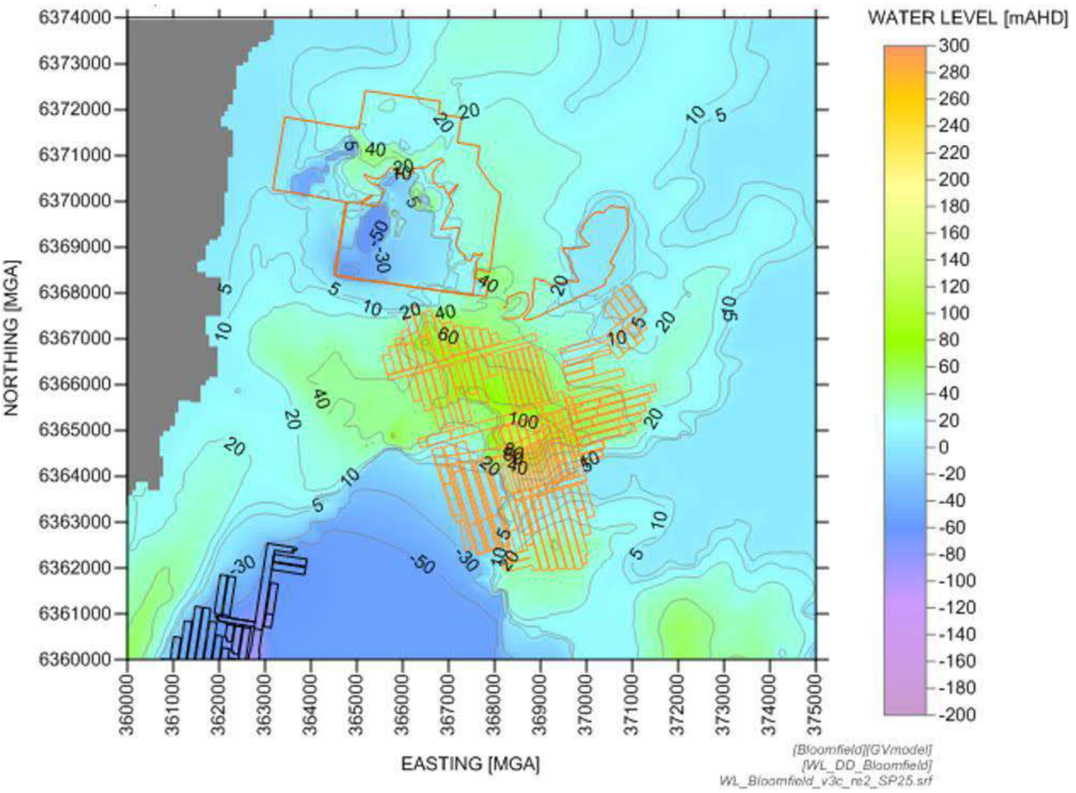


Figure C3. Predicted Water Levels in B Seam [Layer 7] at the End of Mining (Year2025)

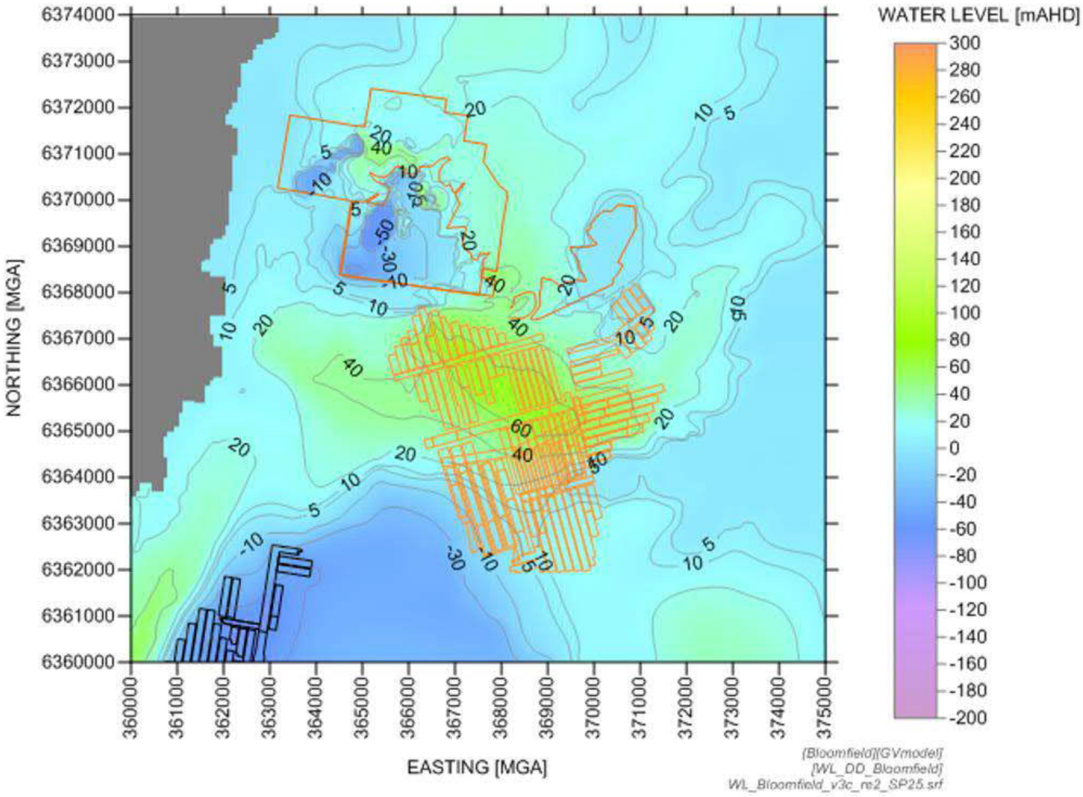


Figure C4. Predicted Water Levels in A Seam [Layer 9] at the End of Mining (Year2025)

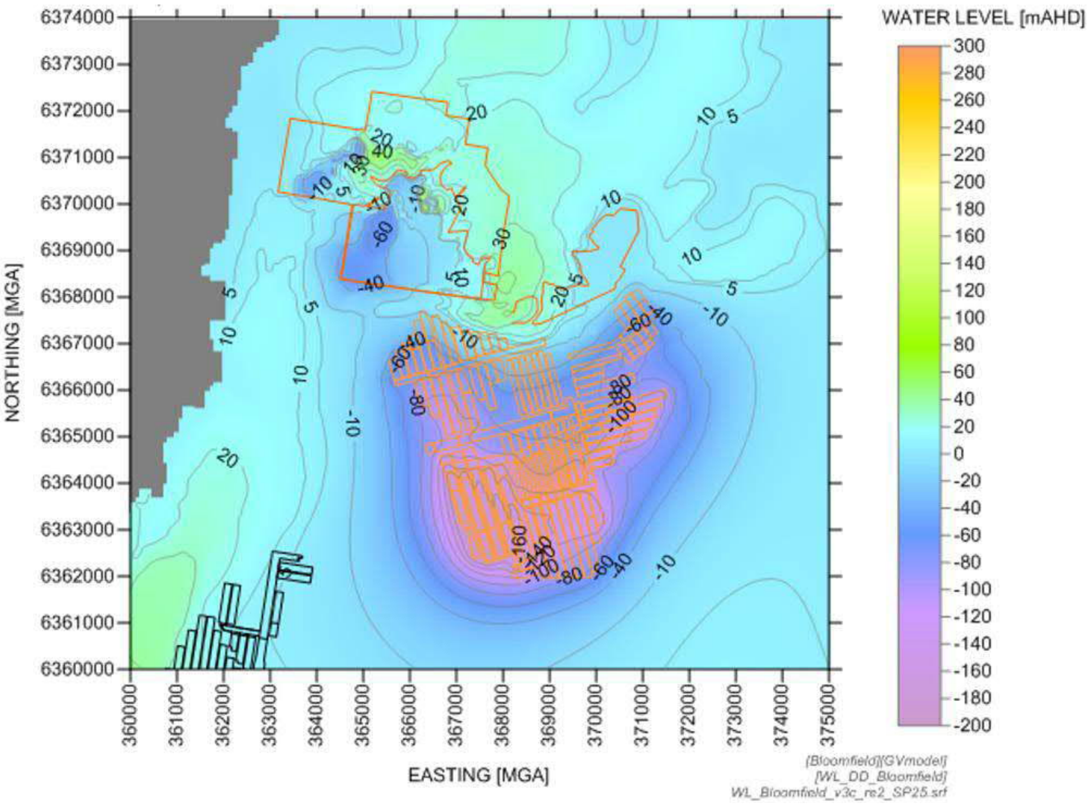


Figure C5. Predicted Water Levels in Whites Creek Seam [Layer 13] at the End of Mining (Year2025)

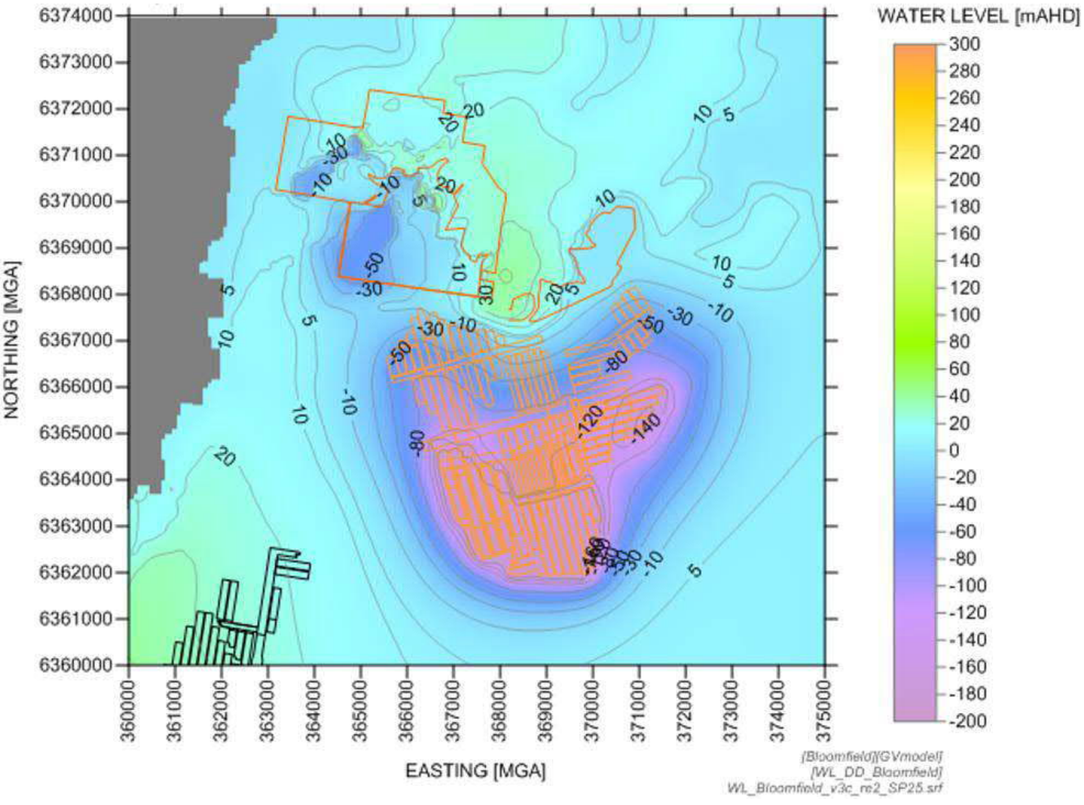


Figure C6. **Predicted Water Levels in EC Seam [Layer 15] at the End of Mining (Year2025)**

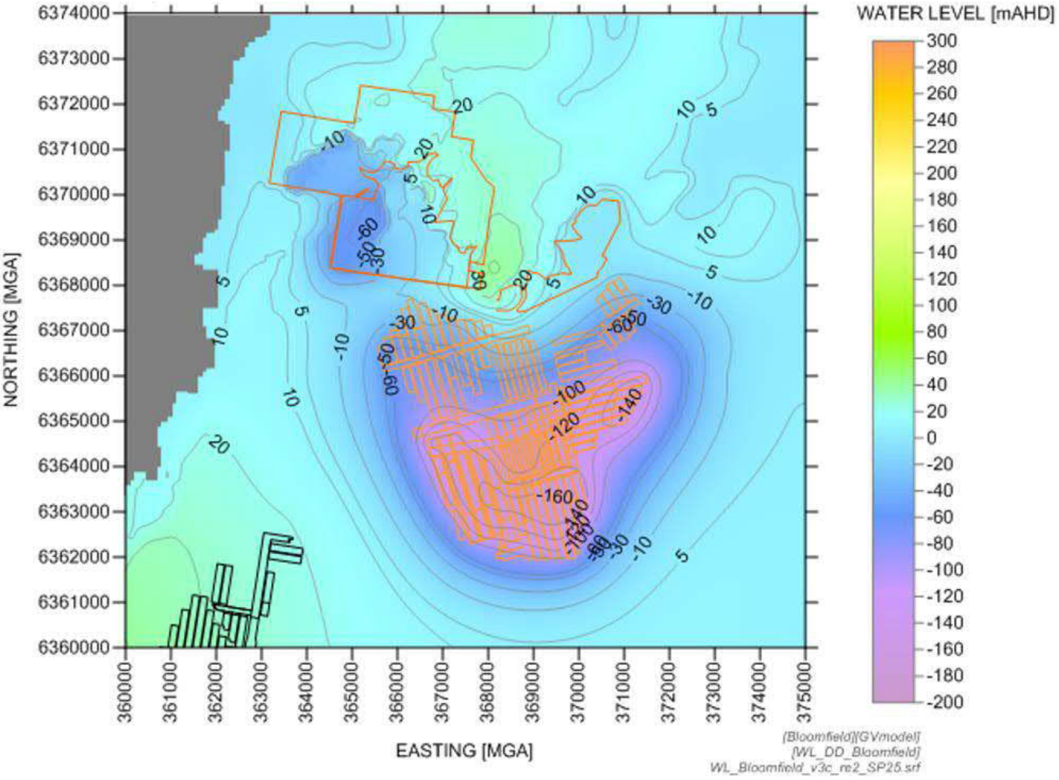


Figure C7. Predicted Water Levels in Donaldson Seam [Layer 17] at the End of Mining (Year2025)

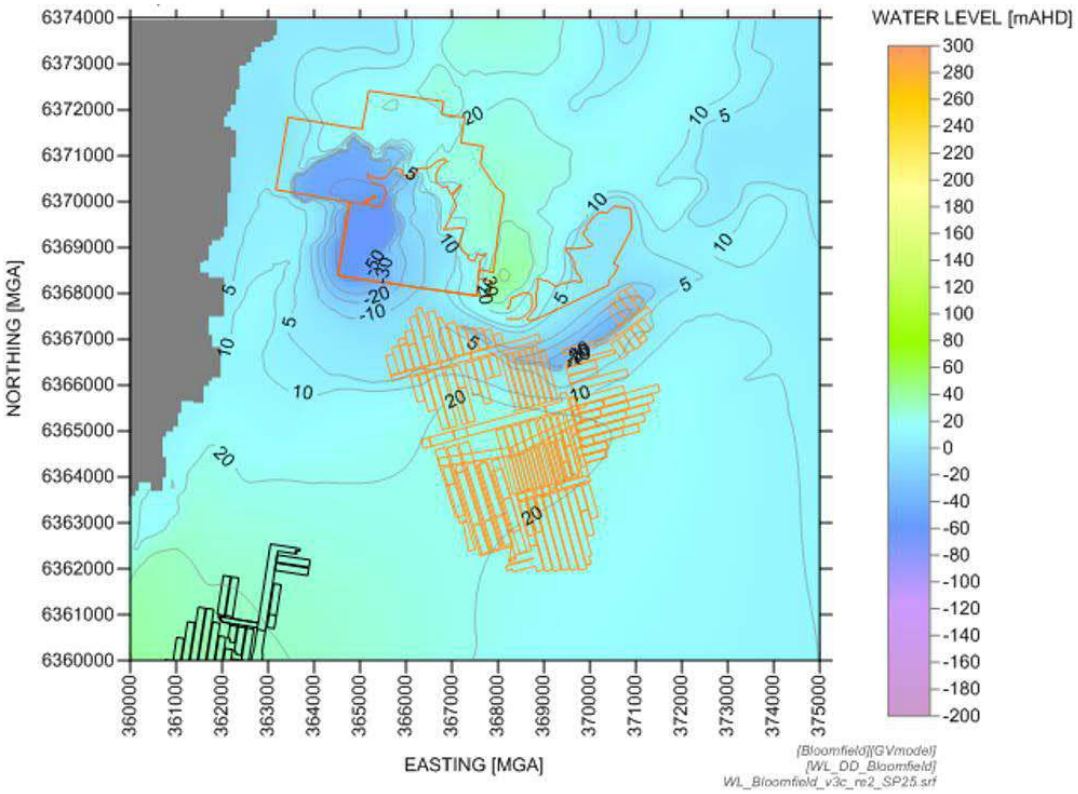


Figure C8. Predicted Water Levels in Big Ben Seam [Layer 19] at the End of Mining (Year2025)

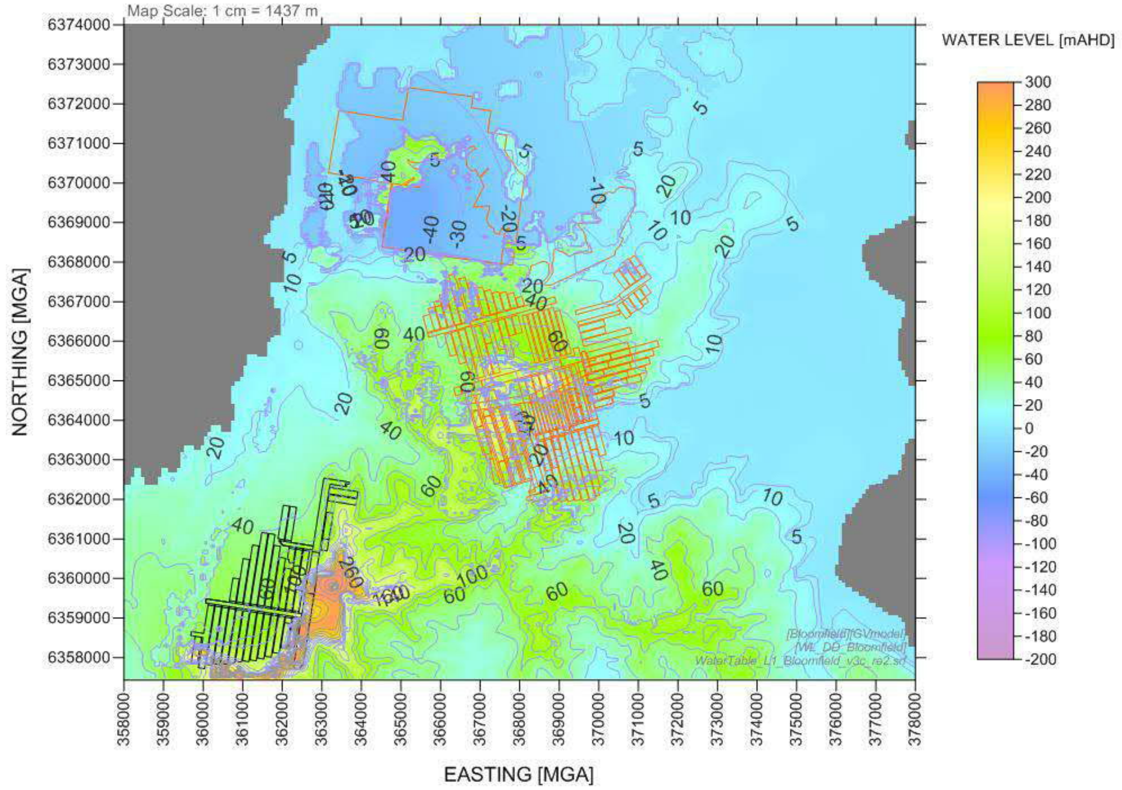


Figure C9. Predicted Water Table at the End of Recovery (100 years)

APPENDIX D

Predicted Groundwater Drawdown Maps

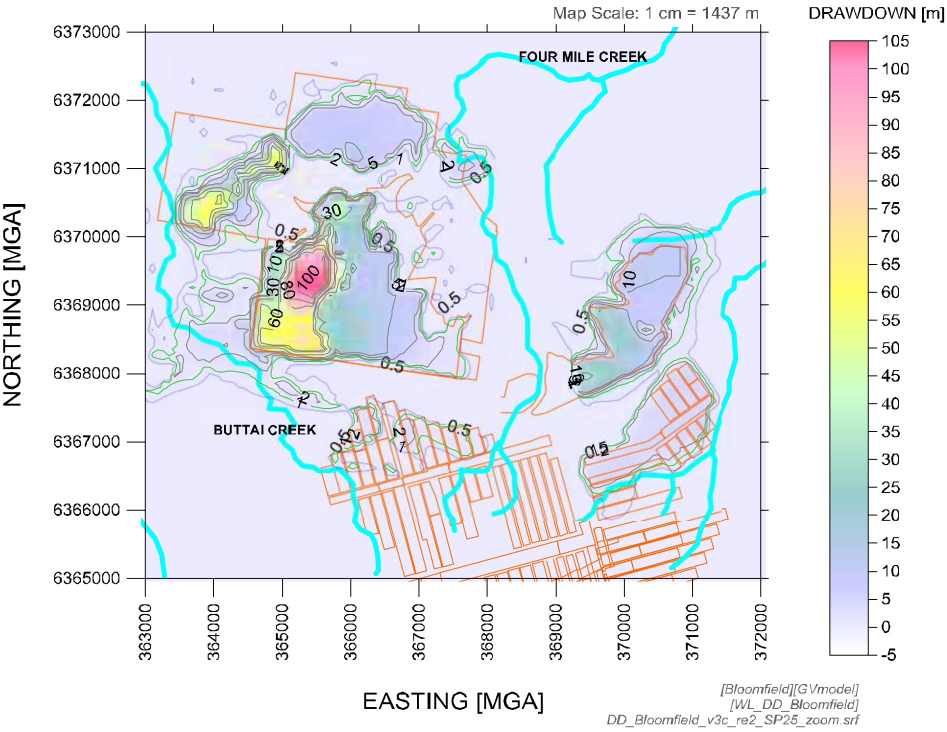


Figure D3. Predicted Drawdowns in Alluvium and Regolith [Layer 1] at the End of Mining (Year2025)

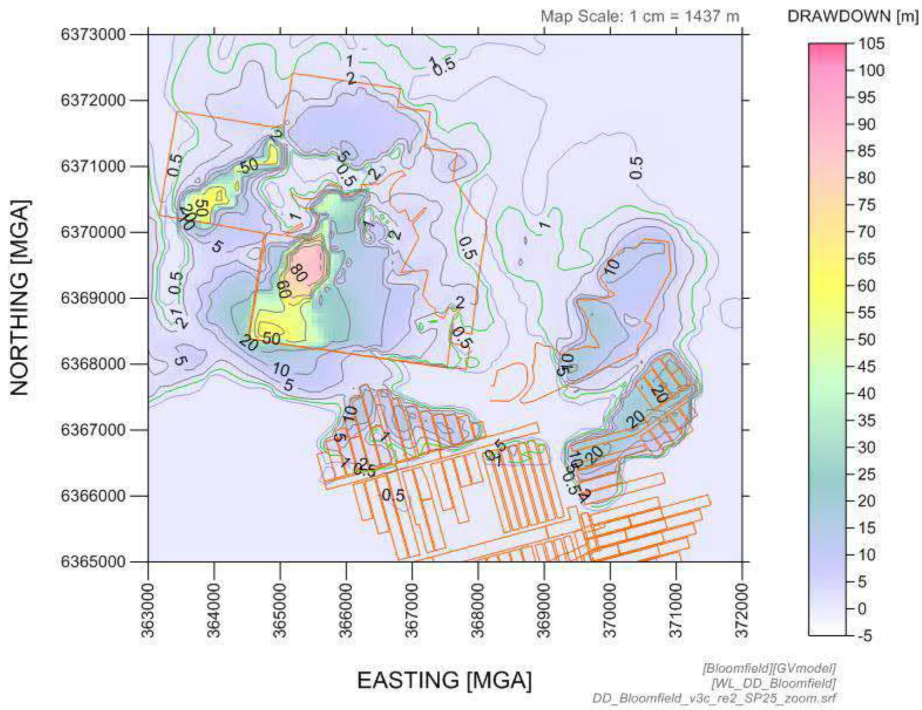


Figure D2. Predicted Drawdowns in C Seam [Layer 3] at the End of Mining (Year2025)

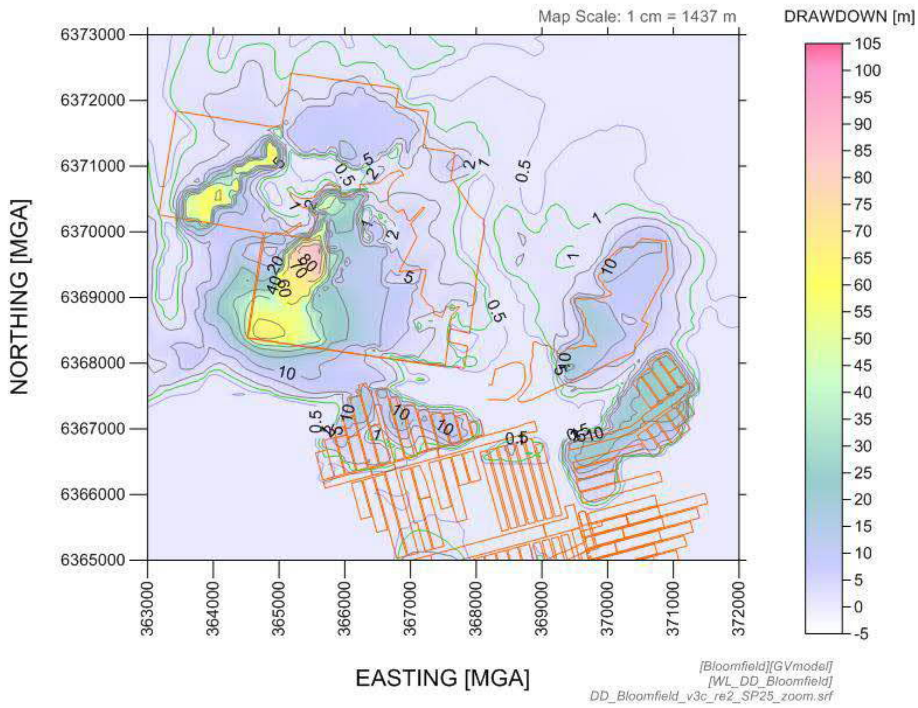


Figure D3. Predicted Drawdowns in B Seam [Layer 7] at the End of Mining (Year2025)

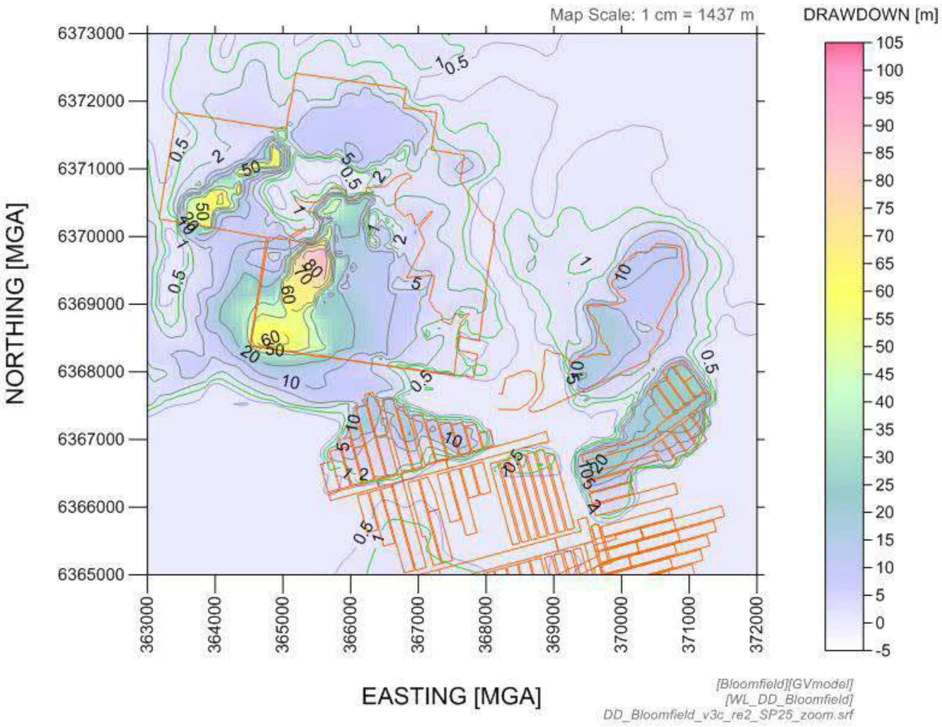


Figure D4. Predicted Drawdowns in A Seam [Layer 9] at the End of Mining (Year2025)

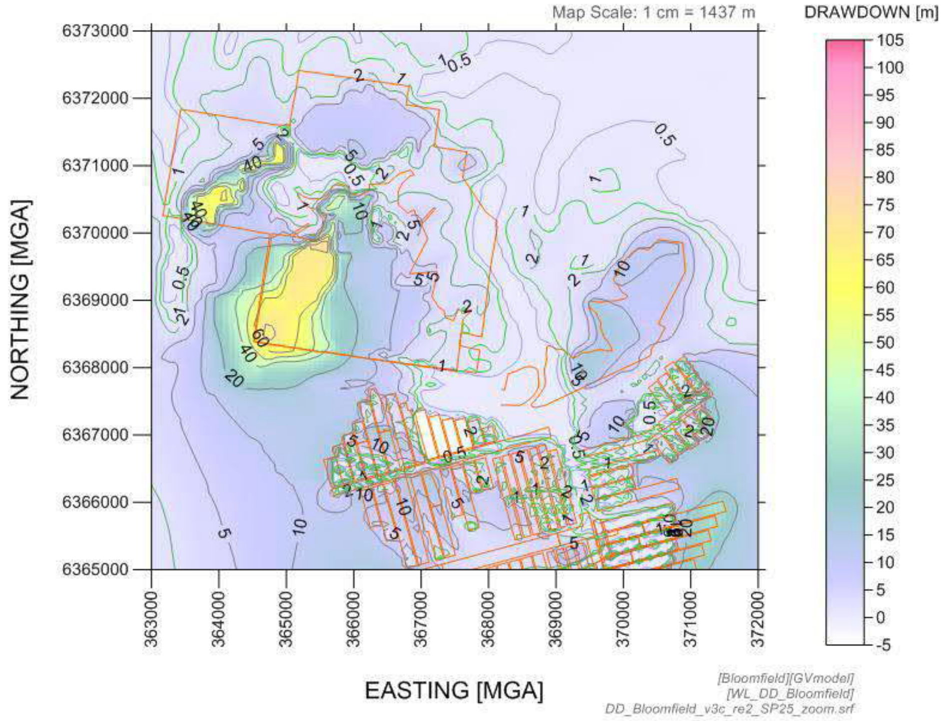


Figure D5. Predicted Drawdowns in Whites Creek Seam [Layer 13] at the End of Mining (Year2025)

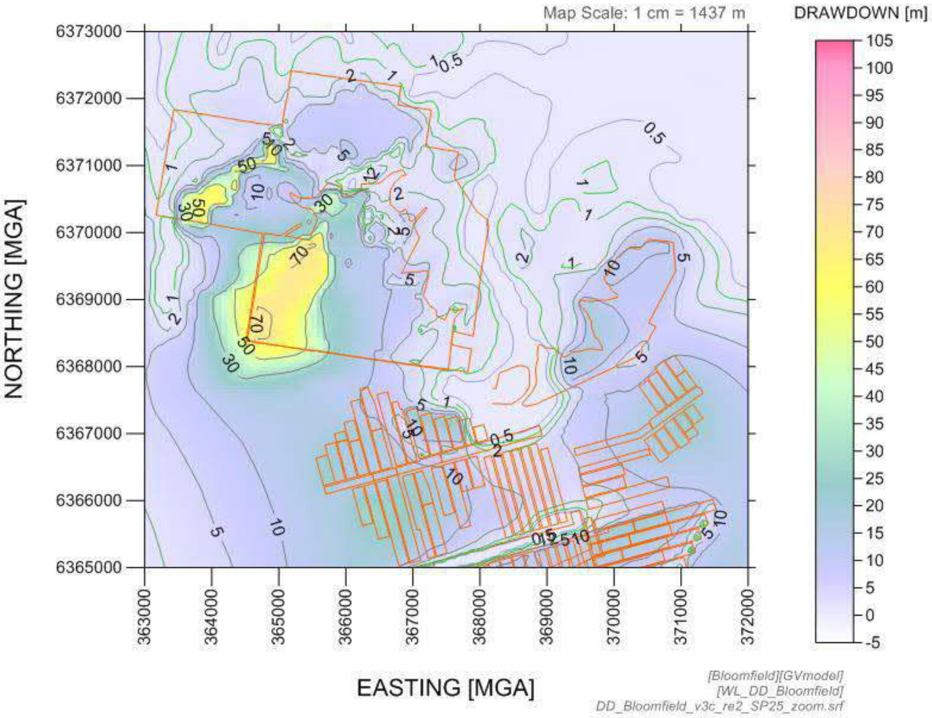


Figure D6. Predicted Drawdowns in EC Seam [Layer 15] at the End of Mining (Year2025)

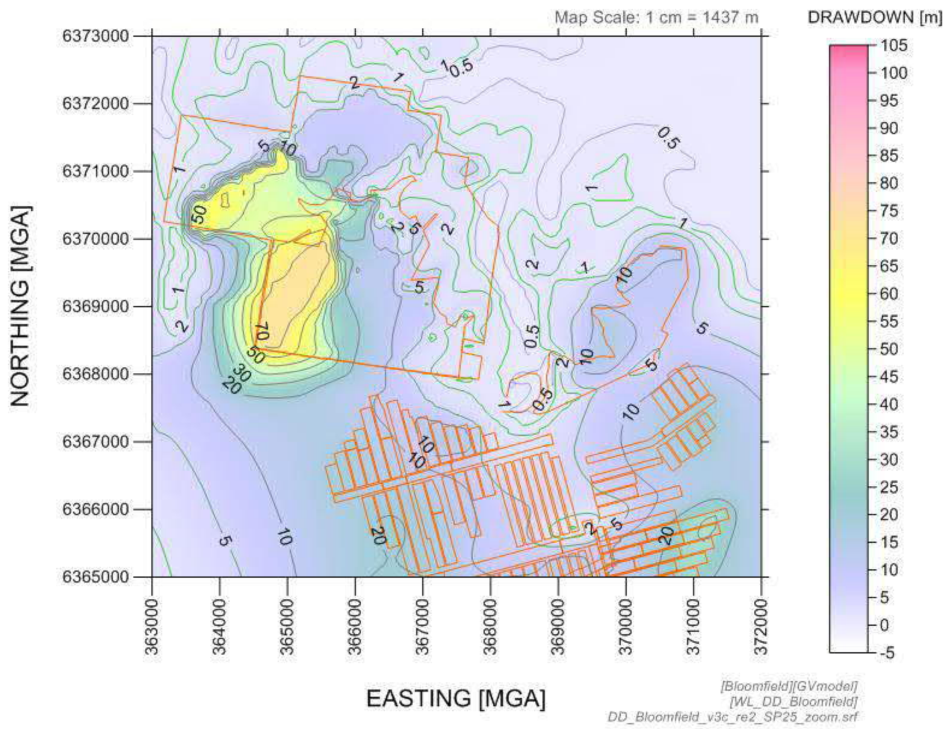


Figure D7. Predicted Drawdowns in Donaldson Seam [Layer 17] at the End of Mining (Year2025)

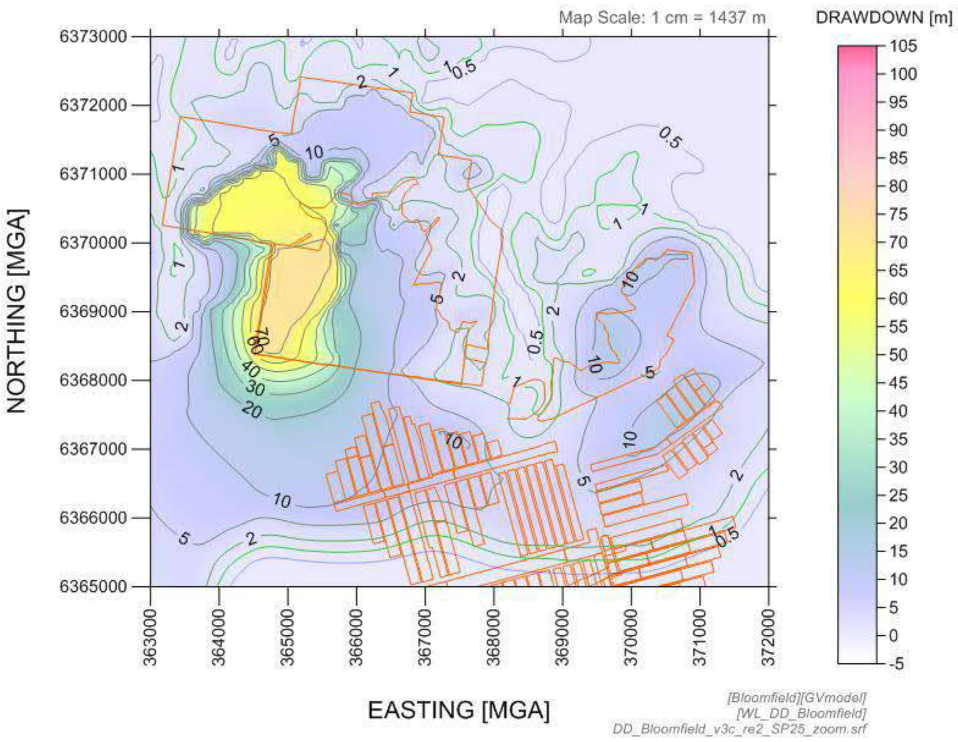


Figure D8. Predicted Drawdowns in Big Ben Seam [Layer 19] at the End of Mining (Year2025)

Appendix B

EPL No. 396

Appendix B EPL No. 396

Environment Protection Licence

Licence Details	
Number:	396
Anniversary Date:	31-December

Licensee
BLOOMFIELD COLLIERIES PTY LTD
PO BOX 4
EAST MAITLAND NSW 2323

Premises
BLOOMFIELD COLLIERY
FOUR MILE CREEK ROAD
ASHTONFIELD NSW 2323

Scheduled Activity
Coal works
Mining for coal

Fee Based Activity	**Scale**
Coal works	> 2000000-5000000 T annual handing capacity
Mining for coal	> 500000-2000000 T annual production capacity

Region
North - Hunter
Ground Floor, NSW Govt Offices, 117 Bull Street NEWCASTLE WEST NSW 2302
Phone: (02) 4908 6800
Fax: (02) 4908 6810
PO Box 488G NEWCASTLE NSW 2300

Environment Protection Licence

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

BLOOMFIELD COLLIERIES PTY LTD
PO BOX 4
EAST MAITLAND NSW 2323

subject to the conditions which follow.

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Coal works	Coal works	> 2000000 - 5000000 T annual handing capacity
Mining for coal	Mining for coal	> 500000 - 2000000 T annual production capacity

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
BLOOMFIELD COLLIERY
FOUR MILE CREEK ROAD
ASHTONFIELD
NSW 2323
AS DESCRIBED BY COORDINATES AND MAP ON DOCUMENT DATED DEC-14 AND REGISTERED IN THE EPA RECORDS SYSTEM AS DOC17/425999

A3 Information supplied to the EPA

A3.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identi-fication no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters under wet weather conditions Volume monitoring Discharge quality monitoring	Discharge to waters under wet weather conditions Volume monitoring Discharge quality monitoring	Lake Forster pipe labelled as EPA ID 1 on document dated Dec-14 and registered in the EPA Records System as DOC17/425999
2	Ambient water quality monitoring.		Four Mile Creek located 500m upstream of the current New England Highway culvert for Four Mile Creek and identified as EPA ID 2 on document dated Dec-14 and registered in the EPA Records System as DOC17/425999

P1.3 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi-fication no.	Type of monitoring point	Location description
3	Air blast overpressure & ground vibration peak particle velocity monitoring	Monitoring location identified as "Mt Vincent Road" in the document titled "Bloomfield Collieries Pty Ltd, EPL 396, Blast Monitoring Site Location Plan, 12 January 2015"
4	Air blast overpressure & ground vibration peak particle velocity monitoring	Monitoring location identified as "McNaughtons" in the document titled "Bloomfield Collieries Pty Ltd, EPL 396, Blast Monitoring Site Location Plan, 12 January 2015"
5	Air blast overpressure & ground vibration peak particle velocity monitoring	Monitoring location identified as "Elliots" in the document titled "Bloomfield Collieries Pty Ltd, EPL 396, Blast Monitoring Site Location Plan, 12 January 2015"

6	Air blast overpressure & ground vibration peak particle velocity monitoring	Monitoring location identified as "Richards" in the document titled "Bloomfield Collieries Pty Ltd, EPL 396, Blast Monitoring Site Location Plan, 12 January 2015"

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L2.4 Water and/or Land Concentration Limits

POINT 1

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Conductivity	microsiemens per centimetre				6000
Filterable iron	milligrams per litre				1.0
pH	pH				6.5-8.5
Total suspended solids	milligrams per litre				30

L3 Volume and mass limits

L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
a) liquids discharged to water; or;
b) solids or liquids applied to the area;
must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	40000

L3.2 Discharge from Point 1 as referred to in Condition L3.1 is only permitted under the following conditions:

- in wet weather conditions following 10mm or greater 24 hours rainfall event in the catchment in the first 24 hour period following the rainfall event; and

- in wet weather conditions following a 15mm or greater 24 hours rainfall event in the catchment in the second 24 hour period following the rainfall event; and

- in wet weather conditions following a 20mm or greater 24 hours rainfall event in the catchment in the third 24 hour period following the rainfall event.

L4 Blasting

L4.1 Blasting in or on the premises must only be carried out between 9:00 hours and 17:00 hours, Monday to Saturday. Blasting in or on the premises must not take place on Sundays or Public Holidays without the prior approval of the EPA.

L4.2 The airblast overpressure level from blasting operations in or on the premises must not exceed:
115 dB (Lin Peak) for more than 5% of the total number of blasts during each reporting period;
at either monitoring point 3, 4, 5 or 6 in Condition P1.3.

L4.3 The airblast overpressure level from blasting operations in or on the premises must not exceed:
120 dB (Lin Peak) at any time;
at either monitoring point 3, 4, 5 or 6 in Condition P1.3.

L4.4 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:
5 mm/second for more than 5% of the total number of blasts during each reporting period;
at either monitoring point 3, 4, 5 or 6 in Condition P1.3.

L4.5 The ground vibration peak particle velocity from blasting operations carried out in or on the premises must not exceed:
10 mm/second at any time;
at either monitoring point 3, 4, 5 or 6 in Condition P1.3.

L4.6 Offensive blast fume must not be emitted from the premises.

Definition:

Offensive blast fume means post-blast gases from the detonation of explosives at the premises that by reason of their nature, duration, character or quality, or the time at which they are emitted, or any other circumstances:
1. *are harmful to (or likely to be harmful to) a person that is outside the premises from which it is emitted, or*
2. *interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted.*

4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.

5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
a) in a legible form, or in a form that can readily be reduced to a legible form;

b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and
d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Water and/ or Land Monitoring Requirements

POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Daily during any discharge	Grab sample
Filterable iron	milligrams per litre	Daily during any discharge	Grab sample
pH	pH	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

POINT 2

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	microsiemens per centimetre	Continuous during discharge	In line instrumentation
pH	pH	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

M3 Testing methods - concentration limits

M3.1 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Recording of pollution complaints

M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M4.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M5.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.

M6 Requirement to monitor volume or mass

M6.1 For each discharge point or utilisation area specified below, the licensee must monitor:
a) the volume of liquids discharged to water or applied to the area;
b) the mass of solids applied to the area;
c) the mass of pollutants emitted to the air;
at the frequency and using the method and units of measure, specified below.

POINT 1

Frequency	Unit of Measure	Sampling Method

Daily during any discharge	kilolitres per day	By Calculation (volume flow rate or pump capacity multiplied by operating time)

POINT 2

Frequency	Unit of Measure	Sampling Method
Daily during any discharge	kilolitres per day	In line instrumentation

M7 Blasting

M7.1 To determine compliance with conditions L4.2 and L4.3:
a) Airblast overpressure and ground vibration levels must be measured and electronically recorded for monitoring points 3, 4, 5 and 6 for the parameters specified in Column 1 of the table below; and
b) The licensee must use the units of measure, sampling method, and sample at the frequency specified opposite in the other columns.

Parameter	Units of Measure	Frequency	Sampling Method
Airblast Overpressure	Decibels (Linear Peak)	All blasts	Australian Standard AS 2187.2-2006
Ground Vibration Peak Particle Velocity	millimetres/second	All blasts	Australian Standard AS 2187.2-2006

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
1. a Statement of Compliance,
2. a Monitoring and Complaints Summary,
3. a Statement of Compliance - Licence Conditions,
4. a Statement of Compliance - Load based Fee,
5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,
6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and
7. a Statement of Compliance - Environmental Management Systems and Practices.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of

the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

R4.1 Reporting blasting limit exceedence

The licensee must report any exceedence of the licence blasting limits to the regional office of the EPA as soon as practicable after the exceedence becomes known to the licensee or to one of the licensee's employees or agents.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

8 Pollution Studies and Reduction Programs

U1 Coal Mine Wind Erosion of Exposed Land Assessment

U1.1 The licensee must undertake the following steps:

1. Calculate the wind erosion exposed surface area (in hectares) within the premises as of 31 December 2014.
2. Determine the wind erosion exposed surface area (in hectares) predicted as at 31 December 2014 within the licensee's Environmental Assessment for the premises.
3. Compare the areas calculated in steps 1 and 2.
4. Submit a written report to the EPA at hunter.region@epa.nsw.gov.au containing the analysis required in steps 1 to 3, by 29 May 2015.

The report submitted to the EPA must be accompanied by spatial data to confirm the wind erosion exposed surface area calculations. The following data is required:

- Shapefiles showing the premises boundary.
- Shapefiles showing the wind erosion exposed area within the premises as of 31 December 2014.
- Shapefiles showing areas classified as stabilised surface as of 31 December 2014.
- Details of any studies undertaken to verify that the areas of stabilised surface meet the definition.

Note: *Environmental Assessment* means any environmental assessment document prepared in order to gain approval or consent under the Environmental Planning and Assessment Act (1979) under which the licensee currently operates at the premises. If the predictions made in this document do not correspond to the current year of mine operation, the licensee should extrapolate between predictions.

Stabilised Surface means any previously disturbed surface area which shows visual or other evidence of surface crusting and is resistant to wind-driven fugitive dust and is demonstrated to be stabilised. Stabilisation can be determined in accordance with one or more of the applicable test methods contained in the Rule 403 Implementation Handbook located at: www.capcoa.org/Docs/SCAQMD%20r403%20handbook.doc.

Wind Erosion Exposed Surface Area means the portion of the premises surface which has been physically moved, uncovered, destabilised or otherwise modified from its natural state, thereby increasing the potential for fugitive particulate matter emissions, but excluding areas which have been:

- paved or covered by a permanent building or structure;
- maintained with a vegetative ground cover of at least 50% of ground cover for particular areas.

Vegetative ground cover can be determined in accordance with the standardised procedure for revegetation assessment contained in Atyeo C. & Thackway R. (2009) located at: http://data.daff.gov.au/data/warehouse/pe_brs90000004196/revegetationManual200906_20100410_ap14.pdf or

- classified as a stabilised surface.

Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder describe d at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non - putrescible), special waste or hazardous waste

Ms Debbie Maddison

Environment Protection Authority

(By Delegation)

Date of this edition: 05-April-2000

End Notes

1	Licence varied by notice V/M upgrade, issued on 07-Jul-2000, which came into effect on 07-Jul-2000.
2	Licence varied by notice 1005836, issued on 21-Nov-2001, which came into effect on 21-Nov-2001.
3	Licence varied by notice 1032965, issued on 09-Dec-2003, which came into effect on 03-Jan-2004.
4	Licence varied by notice 1042169, issued on 22-Dec-2004, which came into effect on 16-Jan-2005.
5	Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
6	Licence varied by notice 1104182, issued on 18-Nov-2009, which came into effect on 18-Nov-2009.
7	Licence varied by notice 1501185 issued on 02-Dec-2011
8	Licence varied by notice 1506512 issued on 21-Mar-2013
9	Licence varied by notice 1516491 issued on 08-Oct-2013
10	Licence varied by notice 1522189 issued on 16-Oct-2014
11	Licence varied by notice 1527795 issued on 05-Feb-2015
12	Licence varied by notice 1530063 issued on 27-Apr-2015
13	Licence varied by notice 1547417 issued on 17-Aug-2017

Appendix C

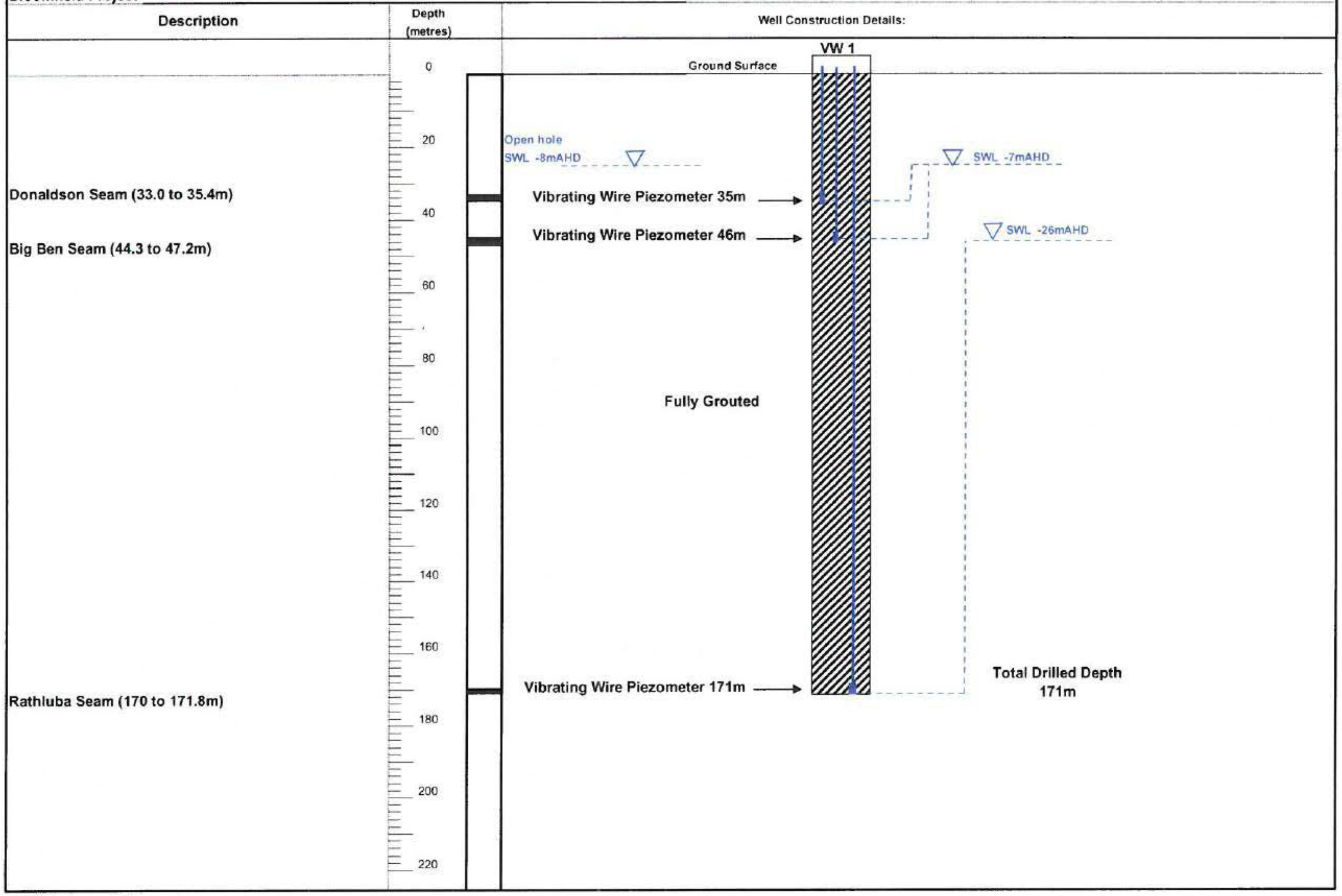
Bloomfield Piezometer Logs

Appendix C Bloomfield Piezometer Logs

Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 1

Client: Bloomfield Collieries Pty Ltd	Bore: VW 1	Elevation (GL): 17.4 mAHD	Elevation (TOC):	Stickup:	Drilling Contractor: Hunter Drilling Services	Project No:	S05
						Date Started: 27-Mar-07	Date Finished: 12-Apr-07
Location: Bloomfield Project			Hole depths: As shown			Supervised By: R McCallum	



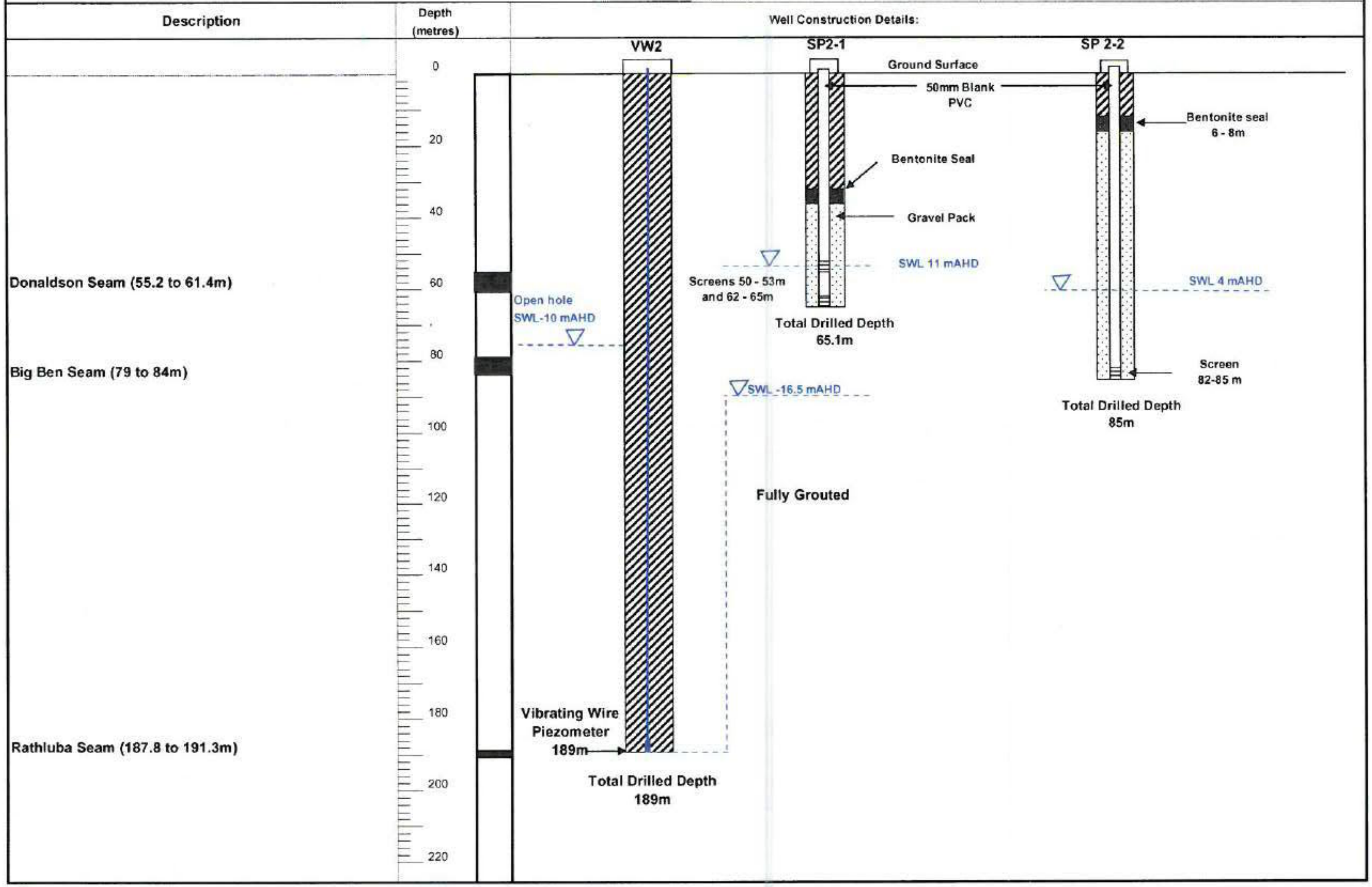
Appendix B-1: Bore Logs - Site 1

Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 2

Client:	Bore:	Elevation (GL):	Elevation (TOC):	Stickup:	Drilling Contractor:	Date Started:	Date Finished:
Bloomfield Collieries Pty Ltd	VW2	65.2 mAHD			Hunter Drilling Services	20-Mar-07	27-Mar-07
Location:	SP2-1	65.2 mAHD			Hunter Drilling Services	20-Mar-07	27-Mar-07
Bloomfield Project	SP2-2	65.2 mAHD			Hunter Drilling Services	20-Mar-07	27-Mar-07
			Hole depths: As shown			Supervised By: R McCallum	

Project No: S05



Appendix B-2: Bore Logs - Site 2

Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 3

Client:	Bore:	Elevation (GL):	Elevation (TOC):	Stickup:	Drilling Contractor:	Date Started:	Date Finished:
Bloomfield Collieries Pty Ltd	VW3	38.8 mAHD			Hunter Drilling Services	11-May-07	14-May-07
Location: Bloomfield Project	SP3-1	38.8 mAHD			Hunter Drilling Services	11-May-07	14-May-07

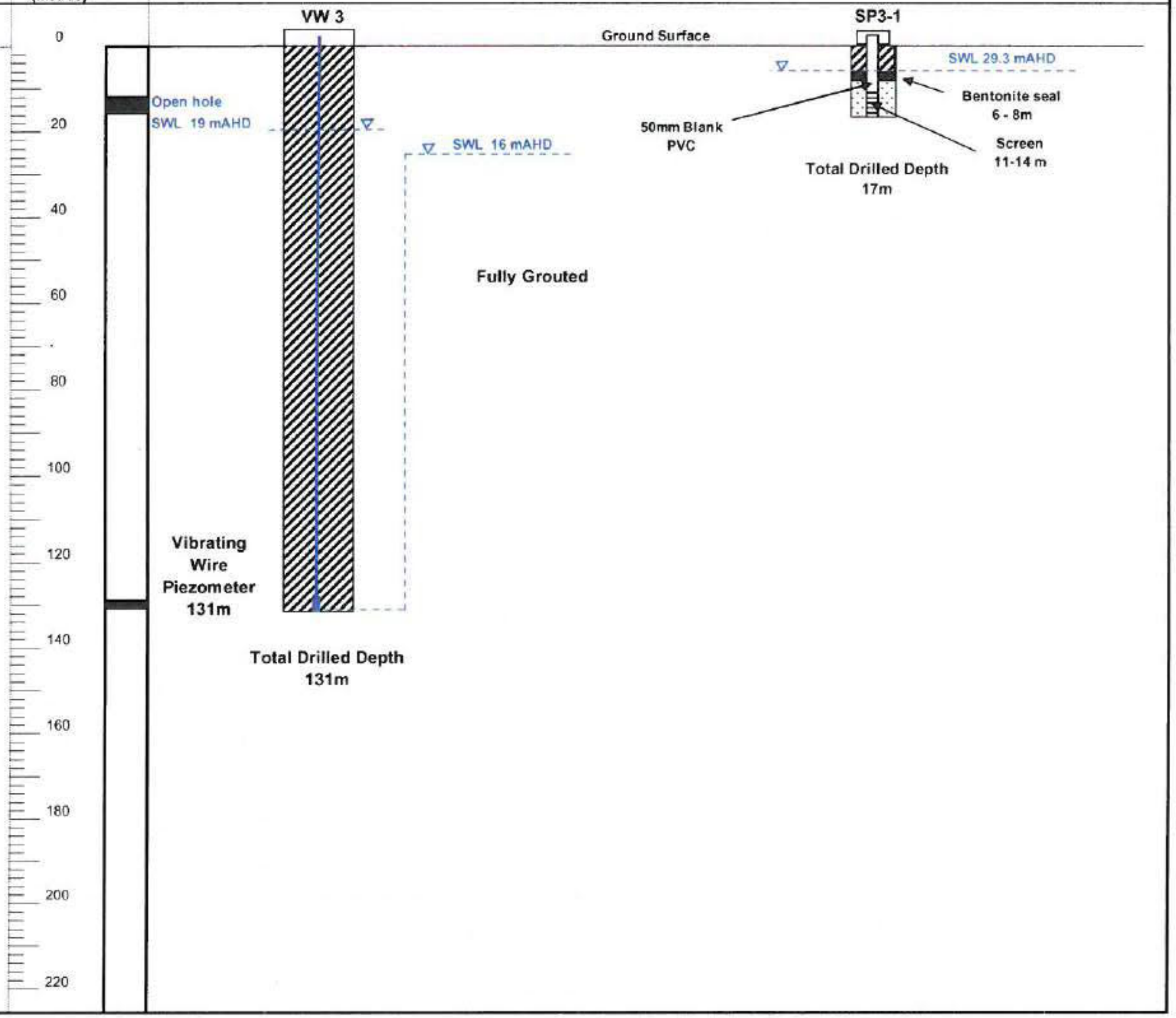
Project No: S05

Hole depths: As shown

Supervised By: R McCallum

Description	Depth (metres)
Donaldson Seam (12 to 15.2m)	
Rathluba Seam (129.7 to 131.5m)	

Well Construction Details:



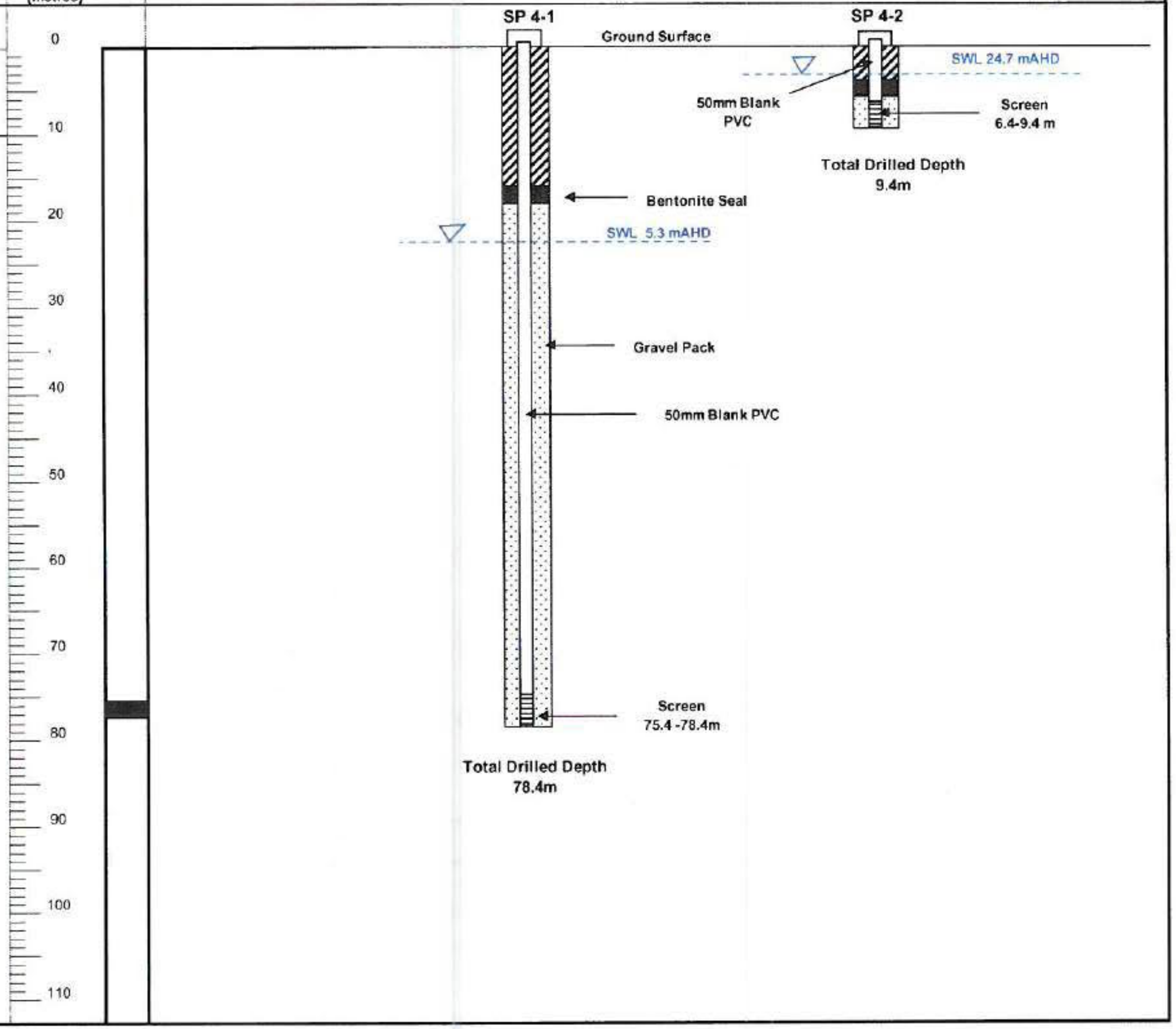
Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 4

Project No:	S05

Client:	Bore:	Elevation (GL):	Elevation (TOC):	Stickup:	Drilling Contractor:	Date Started:	Date Finished:
Bloomfield Collieries Pty Ltd	SP4-1	27.8 mAHD			Hunter Drilling Services	16-Mar-07	17-Mar-07
Location:	SP4-2	27.8 mAHD		0.25 m	Hunter Drilling Services	16-Mar-07	17-Mar-07
Bloomfield Project							
			Hole depths: As shown			Supervised By: R McCallum	

Description	Depth (metres)	Well Construction Details:
Alluvium / weathered Permian		
Rathluba Seam (75.4 to 77.4m)		



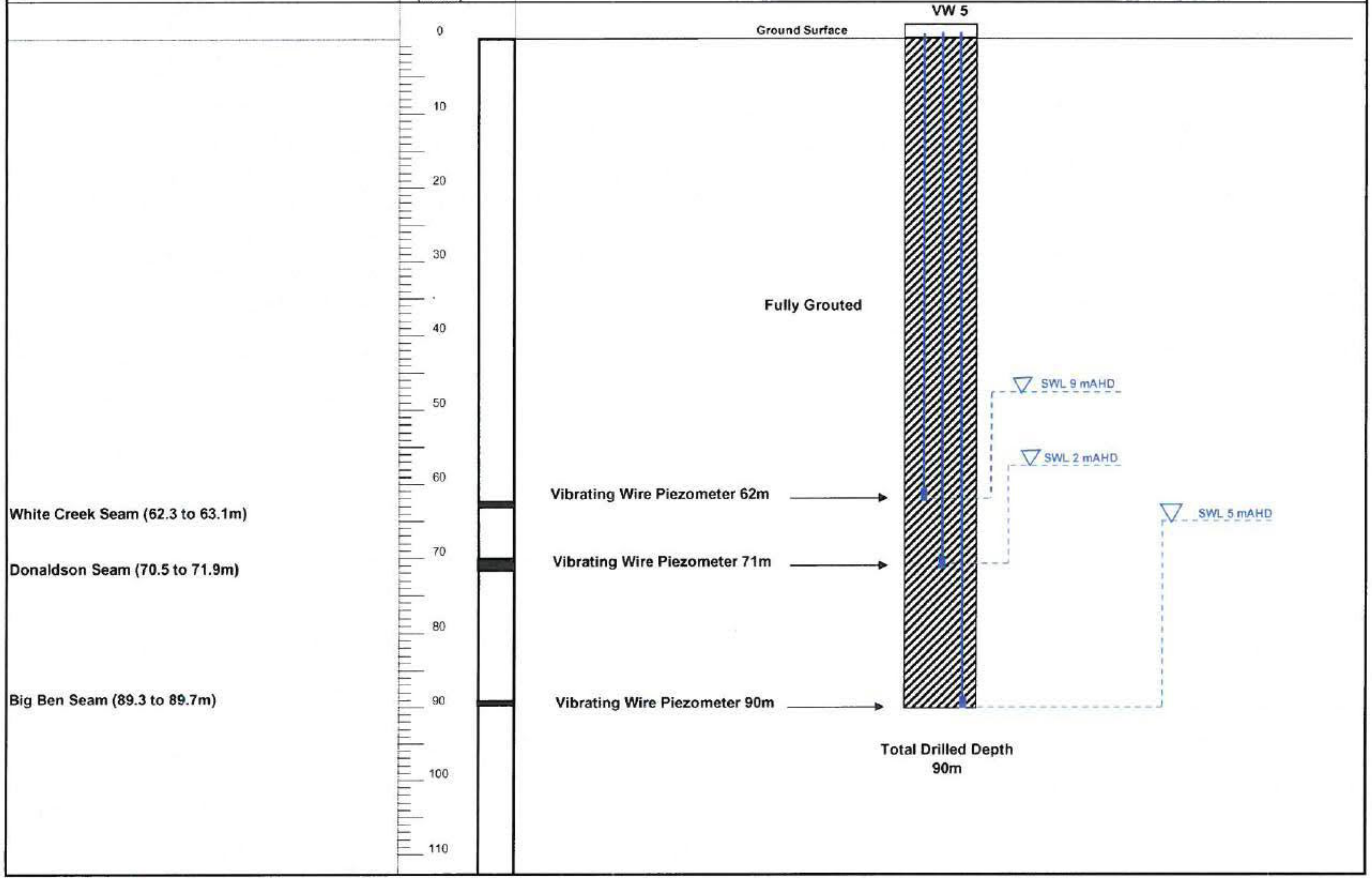
Appendix B-4: Bore Logs - Site 4

Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 5

Client: Bloomfield Collieries Pty Ltd	Bore: VW5	Elevation (GL): 55.7 mAHD	Elevation (TOC):	Stickup:	Drilling Contractor: Hunter Drilling Services	Project No: S05
Location: Bloomfield Project			As shown			Date Started: 05-Apr-07 / Date Finished: 27-Apr-07
						Supervised By: R McCallum

Description	Depth (metres)	Well Construction Details:

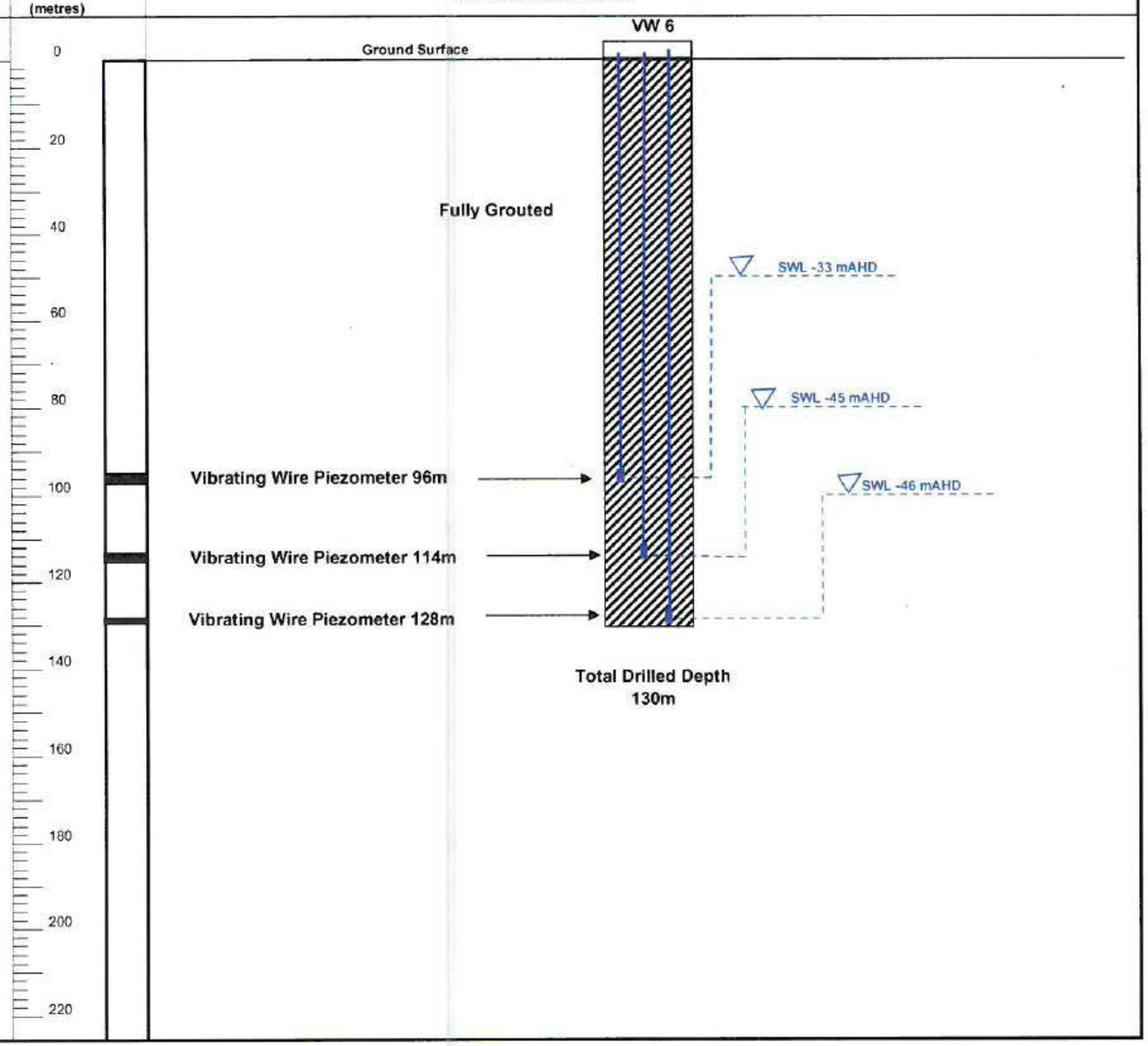


Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 6

						Project No:	S05
Client:	Bore:	Elevation (GL):	Elevation (TOC):	Stickup:	Drilling Contractor:	Date Started:	Date Finished:
Bloomfield Collieries Pty Ltd	VW6	52.5 mAHD	52.75 mAHD	0.25 m	Hunter Drilling Services	24-Apr-07	27-Apr-07
Location:							
Bloomfield Project			Hole depths: As shown			Supervised By: R McCallum	

Description	Depth (metres)	Well Construction Details:
White Creek Seam (95.1 to 96.7m)		
Donaldson Seam (113.2 to 114.7m)		
Big Ben Seam (128 to 129.3m)		

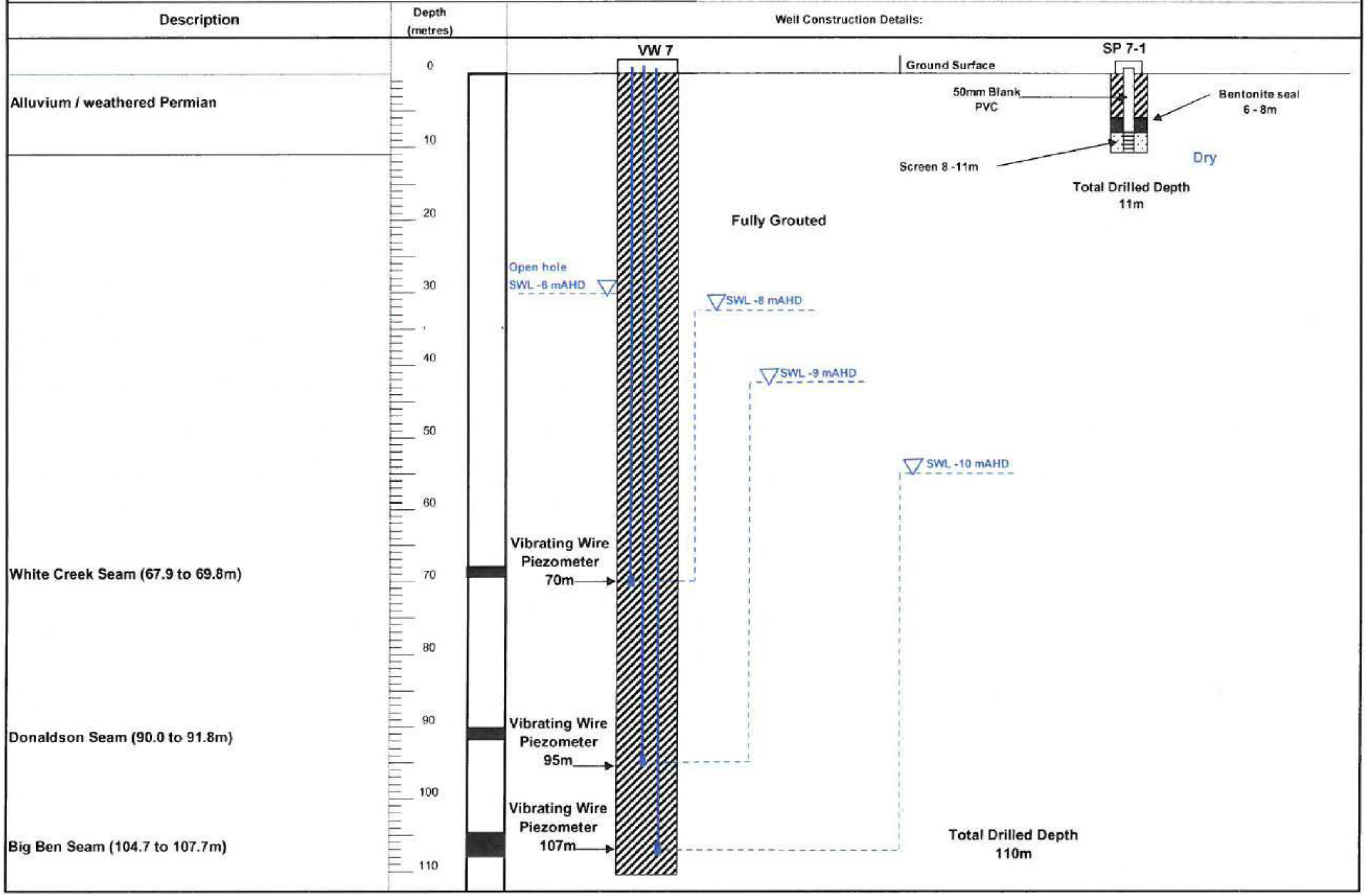


Appendix B-6: Bore Logs - Site 6

Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 7

Client:	Bore:	Depth:	Elevation (GL):	Elevation (TOC):	Stickup:	Drilling Contractor:	Project No:	S05
Bloomfield Collieries Pty Ltd	VW7		24.9 mAHD			Hunter Drilling Services	Date Started: 18-Apr-07	Date Finished: 24-Apr-07
Location: Bloomfield Project	SP7-1		24.9 mAHD	As shown		Hunter Drilling Services	Supervised By: R McCallum	

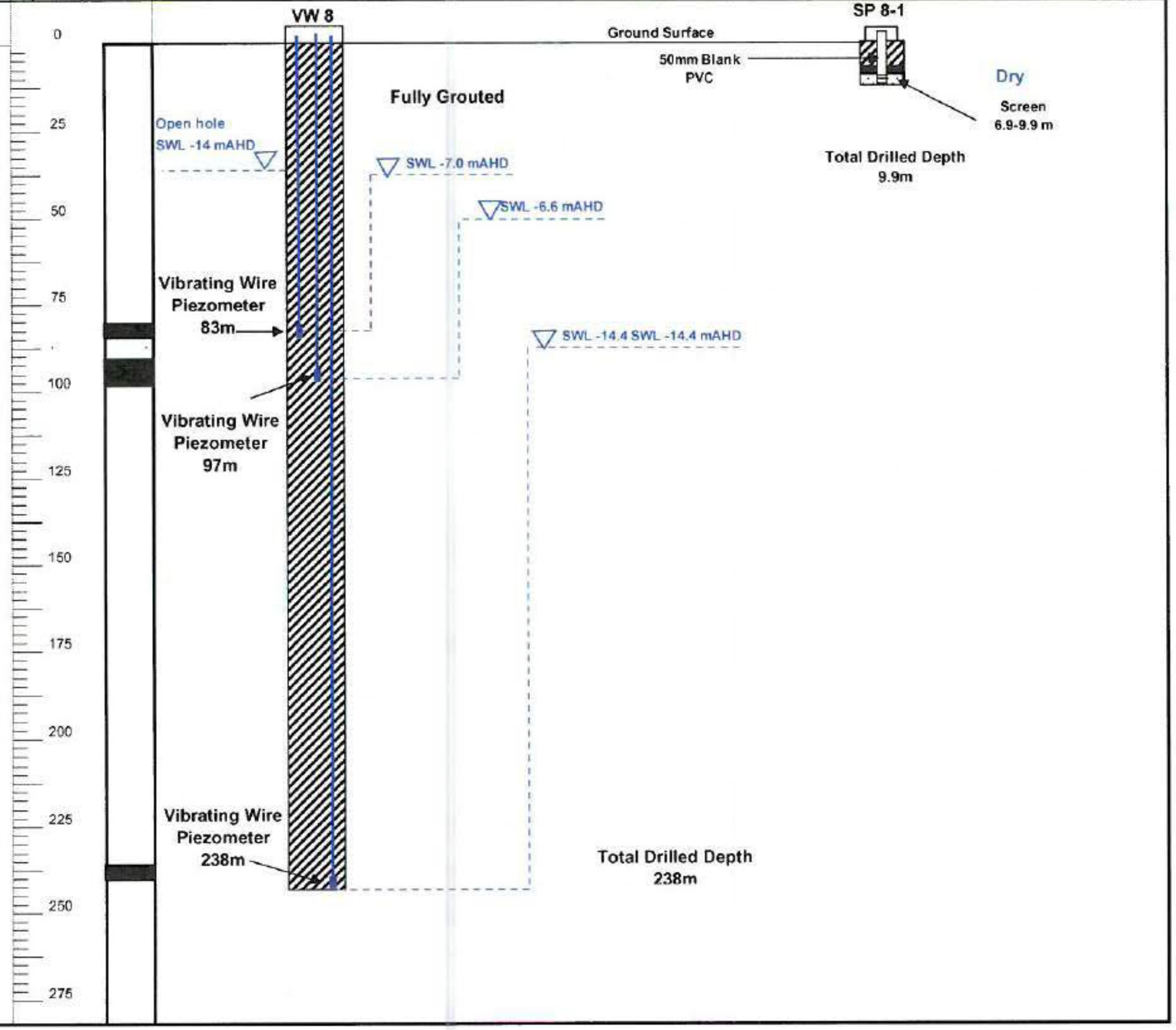


Aquaterra Consulting Pty Ltd
Logging Sheet

BORES: Site 8

Client:	Bore:	Depth:	Elevation (GL):	Elevation (TOC):	Stickup:	Drilling Contractor:	Project No:	S05
Bloomfield Collieries Pty Ltd	VW8		22.5 mAHD			Hunter Drilling Services	Date Started: 29-Mar-07	Date Finished: 18-Apr-07
Location: Bloomfield Project	SP8-1		22.5 mAHD	As shown			Supervised By: R McCallum	

Description	Depth (metres)	Well Construction Details:
Alluvium		
Donaldson Seam (80.4 to 84m)		
Big Ben Seam (91.5 to 98.5m)		
Rathluba Seam (237.2 to 240.2m)		



Appendix B-8: Bore Logs - Site 8

Appendix D

DPI-Water Registered Bores

Appendix D DPI-Water Registered Bores

NSW Office of Water
Work Summary

GW051353

Licence:	20BL114994	**Licence Status:**	ACTIVE
		Authorised Purpose (s):	STOCK,DOMESTIC
		Intended Purpose(s):	STOCK, DOMESTIC

Work Type: Bore open thru rock
Work Status:
Construct.Method: Rotary
Owner Type: Private

Commenced Date:		**Final Depth:**	49.70 m
Completion Date:	01/11/1980	**Drilled Depth:**	49.70 m

Contractor Name:
Driller:
Assistant Driller:

Property:	ROBIN HILL	**Standing Water Level (m):**	
GWMA:	-	**Salinity Description:**	3001-7000 ppm
GW Zone:	-	**Yield (L/s):**	

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	99
Licensed:	NORTHUMBERLAND	STOCKRINGTON	Whole Lot //

Region:	20 - Hunter	**CMA Map:**	9232-3N		
River Basin:	210 - HUNTER RIVER	**Grid Zone:**		**Scale:**	
Area/District:					
Elevation:	0.00 m (A.H.D.)	**Northing:**	6365810.0	**Latitude:**	32°50'15.3"S
Elevation Source:	(Unknown)	**Easting:**	365986.0	**Longitude:**	151°34'05.1"E
GS Map:	-	**MGA Zone:**	0	**Coordinate Source:**	GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	P.V.C.	-0.30	1.50	114			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.60	23.10	0.50	Fractured	15.20		0.12			
24.90	25.20	0.30	Fractured	15.20		0.20			

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	Soil Clay	Soil	
0.50	3.60	3.10	Sandstone Yellow	Sandstone	
3.60	3.90	0.30	Ironstone Shale	Ironstone	
3.90	10.70	6.80	Sandstone White	Sandstone	
10.70	11.90	1.20	Coal	Coal	
11.90	14.00	2.10	Sandstone Hard	Sandstone	
14.00	15.80	1.80	Shale	Shale	
15.80	22.60	6.80	Sandstone White	Sandstone	
22.60	25.60	3.00	Shale Water Supply	Shale	
25.60	49.70	24.10	Shale Black	Shale	
3.90	10.70	6.80	Shale Seams	Shale	

Remarks

***** End of GW051353 *****

NSW Office of Water
Work Summary

GW051647

Licence: 20BL112319

Licence Status: ACTIVE

Authorised Purpose (s): STOCK
Intended Purpose(s): STOCK

Work Type: Bore
Work Status:
Construct.Method: Rotary
Owner Type: Private

Commenced Date:
Completion Date: 01/09/1980

Final Depth:
Drilled Depth:

Contractor Name:
Driller: Alan Francis Ryan
Assistant Driller:

Property: KARINYA
GWMA: -
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.034	L9 (1)
Licensed:	NORTHUMBERLAND	MAITLAND	Whole Lot //

Region: 20 - Hunter
CMA Map: 9232-3N

River Basin: 210 - HUNTER RIVER
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6373006.0
Easting: 362896.0
Latitude: 32°46'20.3"S
Longitude: 151°32'10.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

			Drillers Description	Geological Material	Comments

From (m)	To (m)	Thickness (m)			
0.00	0.15	0.15	Topsoil	Topsoil	
0.15	3.00	2.85	Clay	Clay	
3.00	3.81	0.81	Sand Yellow	Sand	
3.81	4.57	0.76	Sand White	Sand	
4.57	6.10	1.53	Clay Sand	Clay	
6.10	12.00	5.90	Sandstone Hard	Sandstone	

Remarks

***** End of GW051647 *****

NSW Office of Water
Work Summary

GW058760

Licence: 20BL130469

Licence Status: ACTIVE

Authorised Purpose (s): FARMING
Intended Purpose(s): FARMING

Work Type: Bore
Work Status:
Construct.Method: Rotary
Owner Type: Private

Commenced Date:
Completion Date: 01/10/1983

Final Depth: 33.00 m
Drilled Depth:

Contractor Name:
Driller:
Assistant Driller:

Property: N/A NSW
GWMA: -
GW Zone: -

Standing Water Level (m):
Salinity Description: 0-500 ppm
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.003	L13 DP225727 (46)
Licensed:	NORTHUMBERLAND	ALNWICK	Whole Lot 13//225727

Region: 20 - Hunter
CMA Map: 9232-3N

River Basin: Area/District: 210 - HUNTER RIVER
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6371207.0
Easting: 371142.0
Latitude: 32°47'22.3"S
Longitude: 151°37'26.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	33.00	900			Seated on Bottom
1	1	Opening	Slots - Horizontal	27.00	33.00	900		1	Mechanically Slotted, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
27.00	33.00	6.00	(Unknown)	27.00		0.10			

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

17/01/1985: TDS = 162 MG/L

***** End of GW058760 *****

NSW Office of Water
Work Summary

GW061307

Licence: 20BL133448

Licence Status: ACTIVE

Authorised Purpose (s): DOMESTIC
Intended Purpose(s): DOMESTIC

Work Type: Bore
Work Status:
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date: 01/10/1984

Final Depth: 30.00 m
Drilled Depth: 30.00 m

Contractor Name:
Driller:
Assistant Driller:

Property: N/A NSW
GWMA: -
GW Zone: -

Standing Water Level (m):
Salinity Description: 501-1000 ppm
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.003	L10 DP225727 (46)
Licensed:	NORTHUMBERLAND	ALNWICK	Whole Lot 10//225727

Region: 20 - Hunter
CMA Map: 9232-3N

River Basin: Area/District: 210 - HUNTER RIVER
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)

Northing: 6371148.0
Easting: 371299.0

Latitude: 32°47'24.3"S
Longitude: 151°37'32.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	Threaded Steel	-0.20	30.00	150			Seated on Bottom
1	1	Opening	Slots - Vertical	25.00	30.00	150		1	Mechanically Slotted, A: 6.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
25.00	25.50	0.50	(Unknown)						

28.00	28.50	0.50	(Unknown)	25.00		0.40		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.80	1.80	Clay	Clay	
1.80	30.00	28.20	Rock White Shale, Sandstone Water Bearing	Rock	

Remarks

***** End of GW061307 *****

NSW Office of Water
Work Summary

GW078044

Licence: 20BL166662
Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method: Backhoe
Owner Type:

Commenced Date:
Completion Date: 14/11/1997
Final Depth: 30.10 m
Drilled Depth: 30.10 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: NOT KNOWN
GWMA: 017 - HUNTER
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.003	LOT 102 DP 616161
Licensed:	NORTHUMBERLAND	ALNWICK	Whole Lot 12//1007491

Region: 20 - Hunter
CMA Map:
River Basin: - Unknown
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6370151.0
Easting: 370428.0
Latitude: 32°47'56.3"S
Longitude: 151°36'58.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction
Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.10	96			Other
1		Annulus	Waterworn/Rounded	8.40	30.10				Ungraded
1	1	Opening	Screen	16.50	26.90			1	
1	1	Opening	Slots - Horizontal	16.50	26.90	55		1	PVC, SL: 10.4mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)		Duration (hr)	Salinity (mg/L)

							Hole Depth (m)		
13.70	30.10	16.40	Unknown	13.70			30.10		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	6.00	6.00	SILTSTONE	Siltstone	
6.00	8.70	2.70	SANDSTONE	Sandstone	
8.70	10.60	1.90	COAL	Invalid Code	
10.60	12.00	1.40	MUDSTONE	Unknown	
12.00	14.80	2.80	SILTSTONE/SANDSTONE	Siltstone	
14.80	15.50	0.70	COAL	Invalid Code	
15.50	17.90	2.40	SILTSTONE	Siltstone	
17.90	18.30	0.40	COAL	Invalid Code	
18.30	19.50	1.20	SILTSTONE	Siltstone	
19.50	20.30	0.80	COAL	Invalid Code	
20.30	21.50	1.20	CLAYSTONE	Claystone	
21.50	26.60	5.10	COAL	Invalid Code	
26.60	30.10	3.50	SILTSTONE	Siltstone	

Remarks

***** End of GW078044 *****

NSW Office of Water
Work Summary

GW078045

Licence: 20BL166663

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method: Backhoe
Owner Type:

Commenced Date:
Completion Date: 14/11/1997

Final Depth: 30.50 m
Drilled Depth: 30.50 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: N/A
GWMA: 017 - HUNTER
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.003	LOT 23 DP 532814
Licensed:	NORTHUMBERLAND	ALNWICK	Whole Lot 23//532814

Region: 20 - Hunter
CMA Map:
River Basin: - Unknown
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6369892.0
Easting: 371836.0
Latitude: 32°48'05.3"S
Longitude: 151°37'52.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.50	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	5.00	30.50				Ungraded
1	1	Opening	Screen	15.80	27.80			1	
1	1	Opening	Slots - Horizontal	15.80	27.80	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)		Duration (hr)	Salinity (mg/L)

							Hole Depth (m)		
17.30	30.50	13.20	Unknown	17.30			30.50		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	SANDSTONE	Sandstone	
2.00	16.00	14.00	SILTSTONE/MUDSTONE	Siltstone	
16.00	16.50	0.50	COAL	Invalid Code	
16.50	20.40	3.90	SILTSTONE/MUDSTONE	Siltstone	
20.40	20.90	0.50	COAL	Invalid Code	
20.90	25.00	4.10	MUDSTONE	Mudstone	
25.00	30.50	5.50	SILTSTONE	Siltstone	

Remarks

***** End of GW078045 *****

NSW Office of Water
Work Summary

GW078046

Licence: 20BL166664

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method: Backhoe
Owner Type:

Commenced Date:
Completion Date: 14/11/1997

Final Depth: 30.40 m
Drilled Depth: 30.40 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: N/A
GWMA: 017 - HUNTER
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	LOT 92 DP 755260
Licensed:	NORTHUMBERLAND	STOCKRINGTON	Whole Lot 92//755260

Region: 20 - Hunter
CMA Map:

River Basin: Area/District: - Unknown
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown

Northing: 6368741.0
Easting: 368651.0

Latitude: 32°48'41.3"S
Longitude: 151°35'49.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.40	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	6.00	30.40				Ungraded
1	1	Opening	Screen	6.80	18.80			1	
1	1	Opening	Slots - Horizontal	6.80	18.80	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

13.60	30.40	16.80	Unknown	13.60			30.40		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	9.20	9.20	SILTSTONE/MUDSTONE	Siltstone	
9.20	9.40	0.20	COAL	Invalid Code	
9.40	11.20	1.80	SILTSTONE	Siltstone	
11.20	11.60	0.40	COAL	Invalid Code	
11.60	30.40	18.80	SILTSTONE/SANDSTONE	Siltstone	

Remarks

***** End of GW078046 *****

NSW Office of Water
Work Summary

GW078047

Licence:	20BL166665	**Licence Status:**	ACTIVE
		Authorised Purpose (s):	MONITORING BORE
		Intended Purpose(s):	MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:		**Final Depth:**	54.30 m
Completion Date:	14/11/1997	**Drilled Depth:**	54.30 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property:	N/A	**Standing Water Level (m):**	
GWMA:	017 - HUNTER	**Salinity Description:**	
GW Zone:	-	**Yield (L/s):**	

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	PT LOT 13 DP 755260
Licensed:	NORTHUMBERLAND	STOCKRINGTON	PART LOT 13//755260

Region:	20 - Hunter	**CMA Map:**			
River Basin: Area/District:	- Unknown	**Grid Zone:**		**Scale:**	
Elevation:	0.00 m (A.H.D.)	**Northing:**	6368800.0	**Latitude:**	32°48'40.3"S
Elevation Source:	Unknown	**Easting:**	370784.0	**Longitude:**	151°37'11.1"E
GS Map:	-	**MGA Zone:**	0	**Coordinate Source:**	Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	54.30	96			Unknown
1		Annulus	Waterworn/Rounded	24.90	49.20				Ungraded
1	1	Opening	Screen	25.20	49.20			1	
1	1	Opening	Slots - Horizontal	25.20	49.20	55		1	PVC, SL: 24.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

22.80	54.30	31.50	Unknown	22.80			54.30		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	6.50	6.50	SILTSTONE	Siltstone	
6.50	12.00	5.50	SANDSTONE	Sandstone	
12.00	14.60	2.60	SILTSTONE/MUDSTONE	Siltstone	
14.60	15.40	0.80	COAL	Invalid Code	
15.40	24.90	9.50	SILTSTONE	Siltstone	
24.90	27.70	2.80	COAL	Invalid Code	
27.70	32.30	4.60	SILTSTONE/SANDSTONE	Siltstone	
32.30	33.40	1.10	COAL	Invalid Code	
33.40	39.30	5.90	SANDSTONE	Sandstone	
39.30	39.90	0.60	COAL	Invalid Code	
39.90	41.10	1.20	SILTSTONE/SANDSTONE	Siltstone	
41.10	43.50	2.40	COAL	Invalid Code	
43.50	45.10	1.60	CLAYSTONE	Claystone	
45.10	49.40	4.30	COAL	Invalid Code	
49.40	54.30	4.90	SILTSTONE	Siltstone	

Remarks

***** End of GW078047 *****

NSW Office of Water
Work Summary

GW078120

Licence: 20BL166666

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 14/11/1997

Final Depth: 24.00 m
Drilled Depth: 24.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: N/A

GWMA: 017 - HUNTER
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.029	LOT 115 DP 240782
Licensed:	NORTHUMBERLAND	HEXHAM	Whole Lot 115//240782

Region: 20 - Hunter
River Basin: - Unknown
Area/District:

CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown

Northing: 6368590.0
Easting: 371176.0

Latitude: 32°48'47.3"S
Longitude: 151°37'26.1"E

GS Map: -

MGA Zone: 0

Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	24.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	2.00	24.00				Ungraded
1	1	Opening	Screen	6.00	18.00			1	
1	1	Opening	Slots - Horizontal	6.00	18.00	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)		Duration (hr)	Salinity (mg/L)

							Hole Depth (m)		
6.10	24.00	17.90	Unknown	6.10			24.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	14.00	14.00	SILTSTONE/MUDSTONE	Siltstone	
14.00	16.00	2.00	SANDSTONE	Sandstone	
16.00	24.00	8.00	MUDSTONE/SHALE	Mudstone	

Remarks

***** End of GW078120 *****

NSW Office of Water
Work Summary

GW078121

Licence: 20BL166667
Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 14/11/1997
Final Depth: 43.00 m
Drilled Depth: 43.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: N/A
GWMA: 017 - HUNTER
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	LOT 10 DP 11875
Licensed:	NORTHUMBERLAND	STOCKRINGTON	Whole Lot 10//11875

Region: 20 - Hunter
CMA Map:
River Basin: - Unknown
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6367262.0
Easting: 368619.0
Latitude: 32°49'29.3"S
Longitude: 151°35'47.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	43.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	2.00	43.00				Ungraded
1	1	Opening	Screen	26.70	42.50			1	
1	1	Opening	Slots	26.70	42.50	55		1	PVC, SL: 15.8mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.30	43.00	20.70	Unknown	22.30			43.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	14.00	14.00	SILTSTONE/SHALE	Siltstone	
14.00	16.00	2.00	SANDSTONE	Sandstone	
16.00	20.00	4.00	SILTSTONE/SHALE	Siltstone	
20.00	22.00	2.00	SANDSTONE	Sandstone	
22.00	25.40	3.40	SILTSTONE/SHALE	Siltstone	
25.40	25.90	0.50	COAL	Invalid Code	
25.90	32.10	6.20	SANDSTONE	Sandstone	
32.10	32.60	0.50	COAL	Invalid Code	
32.60	33.90	1.30	SANDSTONE	Sandstone	
33.90	35.60	1.70	COAL	Invalid Code	
35.60	36.20	0.60	SANDSTONE	Sandstone	
36.20	37.00	0.80	COAL	Invalid Code	
37.00	38.20	1.20	SANDSTONE/SILTSTONE	Sandstone	
38.20	38.60	0.40	COAL	Invalid Code	
38.60	43.00	4.40	SILTSTONE	Siltstone	

Remarks

***** End of GW078121 *****

NSW Office of Water
Work Summary

GW078122

Licence: 20BL166668

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE

Intended Purpose(s): MONITORING BORE

Work Type: Bore

Work Status:

Construct.Method:

Owner Type:

Commenced Date:

Completion Date: 14/11/1997

Final Depth: 35.40 m

Drilled Depth: 35.40 m

Contractor Name: MCDERMOTT DRILLING PTY LTD

Driller:

Assistant Driller:

Property: N/A

GWMA: 017 - HUNTER

GW Zone: -

Standing Water Level (m):

Salinity Description:

Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	LOT 10 DP 11875
Licensed:	NORTHUMBERLAND	STOCKRINGTON	Whole Lot 10//11875

Region: 20 - Hunter

CMA Map:

River Basin: Area/District: - Unknown

Grid Zone:

Scale:

Elevation: 0.00 m (A.H.D.)

Elevation Source: Unknown

Northing: 6367663.0

Easting: 368666.0

Latitude: 32°49'16.3"S

Longitude: 151°35'49.1"E

GS Map: -

MGA Zone: 0

Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	35.40	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	19.20	35.40				Ungraded
1	1	Opening	Screen	19.50	35.00			1	
1	1	Opening	Slots - Horizontal	19.50	35.00	55		1	PVC, SL: 15.5mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
23.10	51.30	28.20	Unknown	23.10			35.40		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	12.00	12.00	SANDSTONE/SILTSTONE	Sandstone	
12.00	12.40	0.40	COAL	Invalid Code	
12.40	16.00	3.60	SILTSTONE	Siltstone	
16.00	19.50	3.50	SANDSTONE	Sandstone	
19.50	20.90	1.40	COAL	Invalid Code	
20.90	22.00	1.10	SANDSTONE	Sandstone	
22.00	23.60	1.60	COAL	Invalid Code	
23.60	24.40	0.80	SANDSTONE	Sandstone	
24.40	26.60	2.20	COAL	Invalid Code	
26.60	28.00	1.40	SILTSTONE/CLAYSTONE	Siltstone	
28.00	31.70	3.70	COAL	Invalid Code	
31.70	35.40	3.70	SANDSTONE	Sandstone	

Remarks

***** End of GW078122 *****

NSW Office of Water
Work Summary

GW078123

Licence: 20BL166669

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE

Intended Purpose(s):

Work Type: Bore

Work Status:

Construct.Method:

Owner Type:

Commenced Date:

Completion Date: 14/11/1997

Final Depth: 33.00 m

Drilled Depth: 33.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD

Driller:

Assistant Driller:

Property: N/A

GWMA: 017 - HUNTER

GW Zone: -

Standing Water Level (m):

Salinity Description:

Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	LOT 92 DP 755260
Licensed:	NORTHUMBERLAND	STOCKRINGTON	Whole Lot 92//755260

Region: 20 - Hunter

CMA Map:

River Basin: - Unknown

Area/District:

Grid Zone:

Scale:

Elevation: 0.00 m (A.H.D.)

Elevation Source: Unknown

Northing: 6368165.0

Easting: 369309.0

Latitude: 32°49'00.3"S

Longitude: 151°36'14.1"E

GS Map: -

MGA Zone: 0

Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	33.00	96			Other
1		Annulus	Waterworn/Rounded	12.50	32.20				Ungraded
1	1	Opening	Screen	20.20	32.20			1	
1	1	Opening	Slots - Horizontal	20.20	32.20	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

24.40	33.00	8.60	Unknown	24.40			33.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	13.20	13.20	SANDSTONE/SILTSTONE	Sandstone	
13.20	15.30	2.10	COAL	Invalid Code	
15.30	17.00	1.70	SILTSTONE	Siltstone	
17.00	17.90	0.90	COAL/SANDSTONE	Invalid Code	
17.90	19.00	1.10	SILTSTONE	Siltstone	
19.00	19.70	0.70	COAL/SANDSTONE	Invalid Code	
19.70	20.80	1.10	SANDSTONE	Sandstone	
20.80	23.20	2.40	COAL	Invalid Code	
23.20	25.50	2.30	SANDSTONE/CLAYSTONE	Sandstone	
25.50	29.70	4.20	COAL	Invalid Code	
29.70	33.00	3.30	SANDSTONE/SILTSTONE	Sandstone	

Remarks

***** End of GW078123 *****

NSW Office of Water
Work Summary

GW078124

Licence:	20BL166670	**Licence Status:**	ACTIVE
		Authorised Purpose (s):	MONITORING BORE
		Intended Purpose(s):	MONITORING BORE
Work Type:	Bore		
Work Status:			
Construct.Method:			
Owner Type:			
Commenced Date:		**Final Depth:**	40.00 m
Completion Date:	14/11/1997	**Drilled Depth:**	40.00 m
Contractor Name:	MCDERMOTT DRILLING PTY LTD		
Driller:			
Assistant Driller:			
Property:	N/A	**Standing Water Level (m):**	
GWMA:	017 - HUNTER	**Salinity Description:**	
GW Zone:	-	**Yield (L/s):**	

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	PT LOT 13 DP755260
Licensed:	NORTHUMBERLAND	STOCKRINGTON	PART LOT 13//755260

Region:	20 - Hunter	**CMA Map:**			
River Basin: Area/District:	- Unknown	**Grid Zone:**		**Scale:**	
Elevation:	0.00 m (A.H.D.)	**Northing:**	6368018.0	**Latitude:**	32°49'05.3"S
Elevation Source:	Unknown	**Easting:**	369883.0	**Longitude:**	151°36'36.1"E
GS Map:	-	**MGA Zone:**	0	**Coordinate Source:**	Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	40.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	11.10	40.00				Ungraded
1	1	Opening	Screen	12.50	36.50			1	
1	1	Opening	Slots - Horizontal	12.50	36.50	55		1	PVC, SL: 30.0mm, A: 2.40mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

18.60	40.00	21.40	Unknown	18.60			40.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	8.10	8.10	sandstone	Sandstone	
8.10	8.60	0.50	coal	Invalid Code	
8.60	10.00	1.40	siltstone	Siltstone	
10.00	15.50	5.50	sandstone	Sandstone	
15.50	17.20	1.70	coal	Invalid Code	
17.20	18.30	1.10	sandstone	Sandstone	
18.30	19.20	0.90	coal	Invalid Code	
19.20	20.00	0.80	mudstone	Mudstone	
20.00	24.50	4.50	siltstone	Siltstone	
24.50	27.70	3.20	coal	Invalid Code	
27.70	29.90	2.20	sandstone/claystone	Sandstone	
29.90	33.30	3.40	coal	Invalid Code	
33.30	37.00	3.70	mudstone	Mudstone	

Remarks

23/09/2011: Slot Length and Width adjusted due to data entry errors with advice from Madhwan Keshwan. GDS Data Cleanup project 2011.

***** End of GW078124 *****

NSW Office of Water
Work Summary

GW078125

Licence:	20BL166671	**Licence Status:**	ACTIVE
		Authorised Purpose (s):	MONITORING BORE
		Intended Purpose(s):	MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:		**Final Depth:**	30.00 m
Completion Date:	14/11/1997	**Drilled Depth:**	30.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property:	N/A	**Standing Water Level (m):**	
GWMA:	017 - HUNTER	**Salinity Description:**	
GW Zone:	-	**Yield (L/s):**	

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	PT LOT 13 DP755260
Licensed:	NORTHUMBERLAND	STOCKRINGTON	PART LOT 13//755260

Region:	20 - Hunter	**CMA Map:**			
River Basin:	- Unknown	**Grid Zone:**		**Scale:**	
Area/District:					
Elevation:	0.00 m (A.H.D.)	**Northing:**	6368464.0	**Latitude:**	32°48'51.3"S
Elevation Source:	Unknown	**Easting:**	370970.0	**Longitude:**	151°37'18.1"E
GS Map:	-	**MGA Zone:**	0	**Coordinate Source:**	Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	5.00	30.00				Ungraded
1	1	Opening	Screen	11.80	29.80			1	
1	1	Opening	Slots - Horizontal	11.80	29.80	55		1	PVC, SL: 18.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

10.20	30.00	19.80	Unknown	10.20			30.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	19.00	19.00	siltstone/sandstone	Siltstone	
19.00	24.00	5.00	sandstone	Sandstone	
24.00	26.50	2.50	siltstone/sandstone	Siltstone	
26.50	26.90	0.40	coal	Invalid Code	
26.90	30.00	3.10	siltstone/sandstone	Siltstone	

Remarks

***** End of GW078125 *****

NSW Office of Water
Work Summary

GW078126

Licence: 20BL166672

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 14/11/1997

Final Depth: 30.00 m
Drilled Depth: 30.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: BERESFIELD BORAL-BERESFIELD
GWMA: 017 - HUNTER
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.029	LOT 117 DP 568625
Licensed:	NORTHUMBERLAND	HEXHAM	Whole Lot 30//870411

Region: 20 - Hunter
CMA Map:
River Basin: - Unknown
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6367736.0
Easting: 371890.0
Latitude: 32°49'15.3"S
Longitude: 151°37'53.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	2.00	30.00				Ungraded
1	1	Opening	Screen	17.50	29.50			1	
1	1	Opening	Slots - Horizontal	17.50	29.50	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)		Duration (hr)	Salinity (mg/L)

							Hole Depth (m)		
9.00	30.00	21.00	Unknown	9.00			30.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	7.00	7.00	sandstone	Sandstone	
7.00	17.10	10.10	siltstone/mudstone	Siltstone	
17.10	17.80	0.70	coal	Invalid Code	
17.80	19.50	1.70	siltstone/claystone	Siltstone	
19.50	19.90	0.40	coal	Invalid Code	
19.90	30.00	10.10	siltstone/mudstone	Siltstone	

Remarks

***** End of GW078126 *****

NSW Office of Water
Work Summary

GW078127

Licence: 20BL166673

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 14/11/1997

Final Depth: 30.00 m
Drilled Depth: 30.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: NOT KNOWN
GWMA: 017 - HUNTER
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.057	LOT 82 DP 627798
Licensed:	NORTHUMBERLAND	STOCKRINGTON	Whole Lot 82//627799

Region: 20 - Hunter
River Basin: Area/District: - Unknown

CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown

Northing: 6366406.0
Easting: 369073.0

Latitude: 32°49'57.3"S
Longitude: 151°36'04.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	1.00	30.00				Ungraded
1	1	Opening	Screen	14.30	26.30			1	
1	1	Opening	Slots - Horizontal	14.30	26.30	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

16.60	30.00	13.40	Unknown	16.60			30.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	13.00	13.00	siltstone/mudstone	Siltstone	
13.00	17.00	4.00	mudstone	Mudstone	
17.00	30.00	13.00	siltstone/mudstone	Siltstone	

Remarks

***** End of GW078127 *****

NSW Office of Water
Work Summary

GW078128

Licence: 20BL166674

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 14/11/1997

Final Depth: 30.00 m
Drilled Depth: 30.00 m

Contractor Name: MCDERMOTT DRILLING PTY LTD
Driller:
Assistant Driller:

Property: BERESFIELD BORAL BERESFIELD
GWMA: 017 - HUNTER
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.029	LOT 117 DP 568625
Licensed:	NORTHUMBERLAND	HEXHAM	Whole Lot 30//870411

Region: 20 - Hunter
River Basin: Area/District: - Unknown

CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown

Northing: 6366923.0
Easting: 370912.0

Latitude: 32°49'41.3"S
Longitude: 151°37'15.1"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	30.00	96			Open Hole - Water
1		Annulus	Waterworn/Rounded	1.70	8.00				Ungraded
1	1	Opening	Screen	18.00	30.00			1	
1	1	Opening	Slots - Horizontal	18.00	30.00	55		1	PVC, SL: 12.0mm, A: 5.00mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)		Duration (hr)	Salinity (mg/L)

							Hole Depth (m)		
7.80	30.00	22.20	Unknown	7.80			30.00		

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	8.00	8.00	siltstone	Siltstone	
8.00	9.00	1.00	shale	Shale	
9.00	12.00	3.00	siltstone	Siltstone	
12.00	12.80	0.80	shale	Shale	
12.80	13.40	0.60	coal	Invalid Code	
13.40	30.00	16.60	siltstone/mudstone	Siltstone	

Remarks

***** End of GW078128 *****

NSW Office of Water
Work Summary

GW079892

Licence:

Licence Status:

Authorised Purpose(s):
Intended Purpose(s):

Work Type: Bore

Work Status:

Construct.Method:

Owner Type:

Commenced Date:
Completion Date:

Final Depth:
Drilled Depth:

Contractor Name:

Driller:

Assistant Driller:

Property:

GWMA:
GW Zone:

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	GLOUC	GLOUC.049	
Licensed:			

Region: 20 - Hunter

CMA Map:

River Basin: - Unknown
Area/District:

Grid Zone:

Scale:

Elevation: 6.69 m (A.H.D.)
Elevation Source: Unknown

Northing: 6372257.0
Easting: 366598.0

Latitude: 32°46'46.3"S
Longitude: 151°34'32.0"E

GS Map: -

MGA Zone: 0

Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

15/02/2000: Form A Remarks:
RZM monitoring bore SK 6560
30/11/2009: Reviewed data - nothing to update.

***** End of GW079892 *****

NSW Office of Water
Work Summary

GW079948

Licence:

Licence Status:

Authorised Purpose(s):
Intended Purpose(s):

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date:

Final Depth:
Drilled Depth:

Contractor Name:
Driller:
Assistant Driller:

Property:
GWMA:
GW Zone:

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	GLOUC	GLOUC.049	
Licensed:			

Region: 20 - Hunter
River Basin: - Unknown
Area/District:

CMA Map:
Grid Zone:
Scale:

Elevation: 9.87 m (A.H.D.)
Elevation Source: Unknown

Northing: 6372613.0
Easting: 370081.0

Latitude: 32°46'36.2"S
Longitude: 151°36'46.0"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

15/02/2000: Form A Remarks:
RZM MONITORING BORE SK 7653
01/12/2009: Reviewed data - nothing to update.

***** End of GW079948 *****

NSW Office of Water
Work Summary

GW080034

Licence:

Licence Status:

Authorised Purpose(s):
Intended Purpose(s):

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date:

Final Depth:
Drilled Depth:

Contractor Name:
Driller:
Assistant Driller:

Property:
GWMA:
GW Zone:

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	GLOUC	GLOUC.049	
Licensed:			

Region: 20 - Hunter
CMA Map:
River Basin: - Unknown
Area/District:
Grid Zone:
Scale:

Elevation: 5.94 m (A.H.D.)
Elevation Source: Unknown
Northing: 6370959.0
Easting: 365222.0
Latitude: 32°47'27.8"S
Longitude: 151°33'38.4"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

15/02/2000: Form A Remarks:
RZM MONITORING BORE SK 8368
01/12/2009: Reviewed data - nothing to update.

***** End of GW080034 *****

NSW Office of Water
Work Summary

GW200414

Licence: 20BL169475

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE

Intended Purpose(s):

Work Type: Bore

Work Status:

Construct.Method:

Owner Type:

Commenced Date:

Completion Date: 09/09/2004

Final Depth: 10.00 m

Drilled Depth: 10.00 m

Contractor Name:

Driller:

Assistant Driller:

Property: N/A 114 CHELMSFORD DRIVE METFORD 2323

GWMA: -

GW Zone: -

Standing Water Level:

Salinity:

Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.34	1/1001539
Licensed:	NORTHUMBERLAND	MAITLAND	Whole Lot 1//1001539

Region: 20 - Hunter

CMA Map:

River Basin: - Unknown

Area/District:

Grid Zone:

Scale:

Elevation: 0.00 m (A.H.D.)

Elevation Source: Unknown

Northing: 6373761.0

Easting: 369960.0

Latitude: 32°45'58.9"S

Longitude: 151°36'41.9"E

GS Map: -

MGA Zone: 0

Coordinate Source: Map Interpretation

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	10.00	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	fill (silty sand, dark brown, medium grained sand, minor medium plasticity clay inclusions without)	Fill	
0.30	0.50	0.20	fill (clayey sand, light brown medium grained sand, medium plasticity clay fines)	Fill	
0.50	1.30	0.80	clay (silty, light grey, orange mottling, low plasticity fines)	Clay	
1.30	2.50	1.20	sandstone (extremely weathered, fine grained, red and grey mottled)	Clay	
2.50	4.00	1.50	sandstone (very weathered, brown orange, fine to very fine grained, trends to siltstone)	Sandstone	
4.00	6.00	2.00	sandstone (moderately weathered, orange brown, fine grained)	Sandstone	
6.00	6.50	0.50	sandstone (fine grained, minor weathering, light grey)	Sandstone	
6.50	8.00	1.50	siltstone (grey, minor unweathered carbonaceous fragments, iron stained bands throughtout)	Siltstone	
8.00	8.20	0.20	coal (black, minor carbonaceous mudstone bands, moderately hard, 90-100% dull, fresh)	Invalid Code	
8.20	10.00	1.80	sandstone (light grey, fine to medium grey, moderately hard)	Sandstone	

Remarks

***** End of GW200414 *****

NSW Office of Water
Work Summary

GW200415

Licence: 20BL169475

Licence Status: ACTIVE

Authorised Purpose (s): MONITORING BORE
Intended Purpose(s):

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 10/09/2004

Final Depth: 20.10 m
Drilled Depth: 20.10 m

Contractor Name:
Driller:
Assistant Driller:

Property: N/A 114 CHELMSFORD DRIVE METFORD 2323
GWMA: -
GW Zone: -

Standing Water Level:
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.34	1/1001539
Licensed:	NORTHUMBERLAND	MAITLAND	Whole Lot 1//1001539

Region: 20 - Hunter
CMA Map:
River Basin: Area/District: - Unknown
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6373738.0
Easting: 369986.0
Latitude: 32°45'59.7"S
Longitude: 151°36'42.9"E

GS Map: -
MGA Zone: 0
Coordinate Source: Map Interpretation

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	20.10	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.30	1.30	clay (silty, sandy, light to dark brown, low plasicity, fine to medium grained sand. Some grey orange mottling)	Clay	
1.30	1.50	0.20	clay (sandy silty, orange grey mottled)	Clay	
1.50	4.00	2.50	sandstone (medium grained, light grey, moderately weathered with orange brown mottling near top)	Sandstone	
4.00	6.50	2.50	sandstone (fine to very fine grained, tends to siltstone, orange, moderately weathered)	Sandstone	
6.50	7.00	0.50	coal (black, tends to claystone in part, minor weathering)	Invalid Code	
7.00	9.00	2.00	siltstone (grey, tends to fine sandstone, minor carbonaceous traces)	Siltstone	
9.00	15.00	6.00	sandstone (light grey, white, fine to medium grained, moderately hard, not weathered, minor siltstone bands)	Sandstone	
15.00	17.00	2.00	sandstone (with siltstone, interbedded, light grey, fine to medium grained sandstone, grey siltstone, minor carbonacous)	Sandstone	
17.00	20.10	3.10	sandstone (fine to medium grained, light grey/white, fresh, hard)	Sandstone	

Remarks

***** End of GW200415 *****

Appendix I

Heritage Searches

Appendix I Heritage Searches

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : Bloomfield EA

Client Service ID : 290952

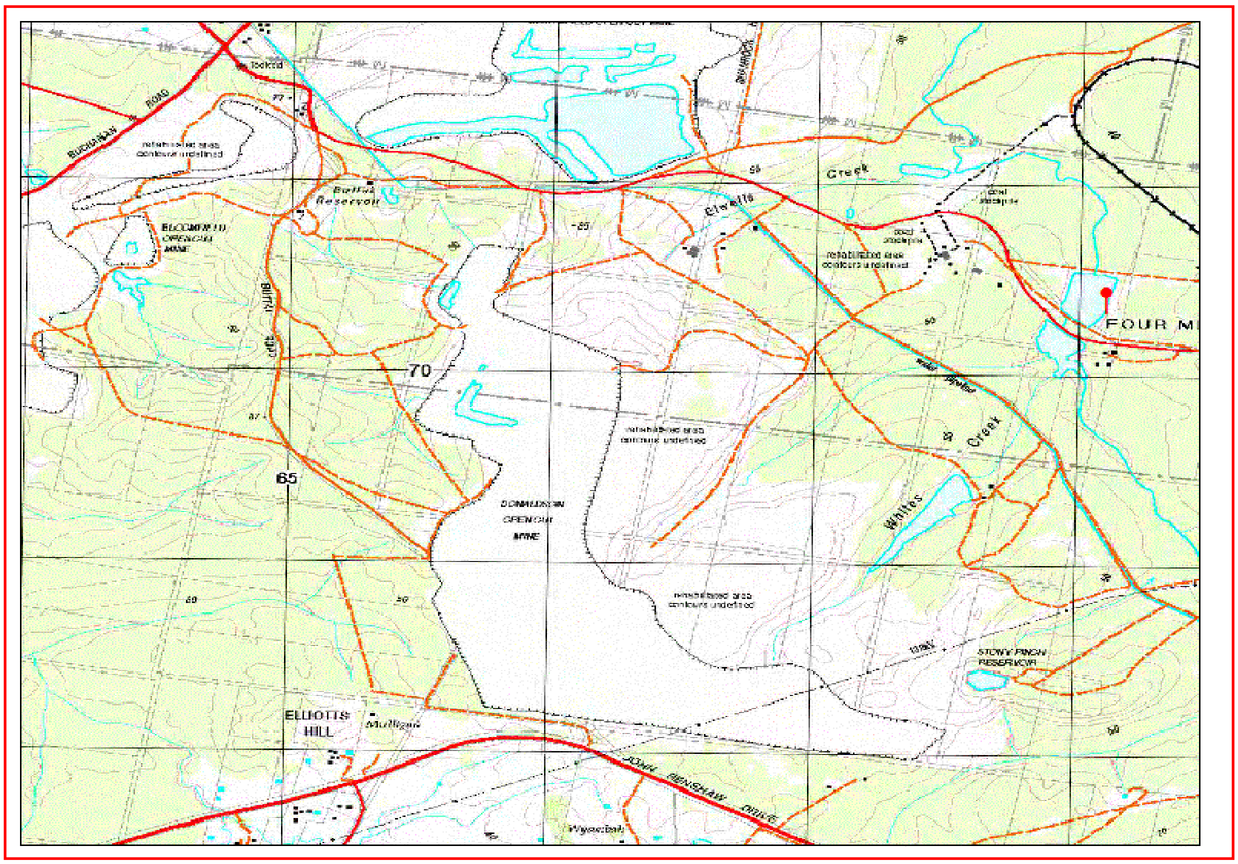
Alison O'Neill
17 Warabrook Bvde
Warabrook New South Wales 2304
Attention: Alison O'Neill
Email: alison.o'neill@aecom.com

Date: 13 July 2017

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -32.8174, 151.5478 - Lat, Long To : -32.788, 151.5945 with a Buffer of 50 meters, conducted by Alison O'Neill on 13 July 2017.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

15	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Office of Environment & Heritage

Search for NSW heritage

Return to search page where you can refine/broaden your search.

Statutory listed items

Information and items listed in the State Heritage Inventory come from a number of sources. This means that there may be several entries for the same heritage item in the database. For clarity, the search results have been divided into three sections.

- Section 1 - contains Aboriginal Places declared by the Minister for the Environment under the National Parks and Wildlife Act. This information is provided by the Heritage Division.
- Section 2 - contains heritage items listed by the Heritage Council of NSW under the NSW Heritage Act. This includes listing on the State Heritage Register, an Interim Heritage Order or protected under section 136 of the NSW Heritage Act. This information is provided by the Heritage Division.
- Section 3 - contains items listed by local councils on Local Environmental Plans under the Environmental Planning and Assessment Act, 1979 and State government agencies under s.170 of the Heritage Act. This information is provided by local councils and State government agencies.

Section 1. Aboriginal Places listed under the National Parks and Wildlife Act.

Your search did not return any matching results.

Section 2. Items listed under the NSW Heritage Act.

Your search did not return any matching results.

Section 3. Items listed by Local Government and State Agencies.

Your search returned 3 records.

Item name	Address	Suburb	LGA	Information source
Buttai Cemetery/Elliott Family Graves	659 John Renshaw Drive	Buttai	Cessnock	LGOV
Buttai No. 1 Reservoir	Lot 1 Buttai Rd	Four Mile Creek	Cessnock	SGOV
Buttai No. 2 Reservoir	Lot 1 Buttai Rd	Four Mile Creek	Cessnock	SGOV

There was a total of 3 records matching your search criteria.

Key:
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.
Note: While the Heritage Division seeks to keep the Inventory up to date, it is reliant on State agencies and local councils to provide their data. Always check with the relevant State agency or local council for the most up-to-date information.