Idemitsu Australia

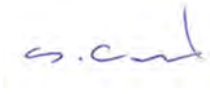
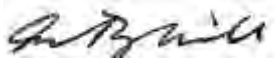
Boggabri Coal Mine - Project Approval Modification Environmental Assessment (MOD 5)

20 November 2015

PARSONS BRINCKERHOFF

Document information
Client: Idemitsu Australia Title: Boggabri Coal Mine - Project Approval Modification Environmental Assessment (MOD 5) Document No: 2200545A-ENV-REP-2 RevF Date: 20 November 2015

Rev	Date	Details
F	20/11/2015	Final

Author, Reviewer and Approver details			
Prepared by:	Steve Crick	Date: 20/11/2015	Signature: 
Reviewed by:	Delyth Toghill	Date: 20/11/2015	Signature: 
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Abbreviations

AEMR	Annual Environmental Management Report
ARI	Average Recurrence Interval
AWD	Available Water Determinations
AQGHG MP	Air Quality and Greenhouse Gas Management Plan
BCM	Boggabri Coal Mine
BCOPL	Boggabri Coal Operations Pty Limited
BCT	Boggabri Coal Terminal
BMP	Biodiversity Management Plan
Boggabri EA Offset Strategy	Biodiversity Offset Strategy (BOS) for the Boggabri Coal Project
BOS	Biodiversity Offset Strategy
CCC	Community Consultative Committee
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plan
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
DA	Development Approval
dB	Decibel
dB(A)	Decibel (A-weighted)
DEC	Department of Environment and Conservation
DMR	Department of Mineral Resources
DoE	Department of the Environment
DP&E	NSW Department of Planning and Environment
DP&I	Former NSW Department of Planning and Infrastructure
EA	Environmental Assessment
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environmental Protection Licence
ESD	Ecologically Sustainable Development
FM Act	*Fisheries Management Act 1994*
GDE's	Groundwater Dependent Ecosystems
GES	Groundwater Exploration Services Pty Ltd

GMP	Groundwater Management Plan
ha	Hectares
Heritage Act	*Heritage Act 1977*
HVAS	High Volume Air Sampler
Idemitsu	Idemitsu Australia Resources Pty Limited
km	Kilometres
km^2	Square kilometres
KTP	Key Threatening Process
kV	Kilovolt
LEP	Local Environment Plan
LGA	Local Government Area
m	Metres
MIA	Mine Infrastructure Area
Mining SEPP	Mining, petroleum production and Extractive Industries 2007
Ml	Megalitre
ML	Mining Lease
mm	Millimetres
MNES	Matters of National Environmental Significance
MOD	Modification
MOP	Mining Operations Plan
Mtpa	Million tonnes per annum
MWD	Mine Water Dam
Narrabri LEP	Narrabri Local Environment Plan 2012
NMP	Noise Management Plan
NOW	NSW Office of Water
NPW Act	*National Parks and Wildlife Act 1974*
NSW EPA	NSW Environmental Protection Authority
NV Act	*Native Vegetation Act 2003*
OEH	NSW Office of Environment and Heritage
PA 09_0182	Boggabri Coal Mine Project Approval
PAD	Potential Archaeological Deposit
PM_{10}	Particulate matter 10 micrometers or less in diameter
PoEO Act	*Protection of Environmental Operations Act 1997*
PVC	Polyvinyl
RAPs	Registered Aboriginal Parties
RMS	NSW Roads and Maritime Services

ROM	Run-of-mine
SD	Sediment Dam
SEPP 33	SEPP 33 - Hazardous and Offensive Development
SEPPs	State Environmental Planning Policies
SRLUP	New England North West Strategic Regional Land Use Plan
SWB	Site Water Balance
SWMP	Surface Water Management Plan
t	Tonne
TCM	Tarrawonga Coal Mine
the 2010 EA	*Continuation of Boggabri Coal Mine Environmental Assessment December 2010* (Hansen Bailey, 2010)
TSC Act	*Threatened Species Conservation Act 1995*
TSP	Total Suspended Particulate
µS/cm	Microsiemens per centimetre
WAL	Water Access Licence
WM Act	*Water Management Act 2000*
WMP	Water Management Plan
WSP	Water Sharing Plans

1. Introduction

1.1 Background

Boggabri Coal Operations Pty Limited (BCOPL) is majority owned (80%) by Idemitsu Australia Resources Pty Limited (Idemitsu), a subsidiary of Japanese company Idemitsu Kosan Pty Ltd which operate the Boggabri Coal Mine. The Boggabri Coal Mine (BCM) is located 15 kilometres (km) north-east of the township of Boggabri in the north-west Region of NSW (see Figure 1.1).

Full scale mining commenced at BCM in 2006. In 2009, BCOPL lodged an application for the continuation of BCM (the Boggabri Coal Project). This included an increase of production from five to seven million tonnes of product coal per annum. The Boggabri Coal Project was approved under PA 09_0182 (the project approval) on 18 July 2012 and activities have continued at the site since, including:

- construction of a new Coal Handling and Preparation Plant (CHPP)
- construction of a 17 km rail spur line and rail load-out facility
- construction of a high voltage power line (132kV) and associated substations
- upgrade of other ancillary infrastructure.

BCOPL also operates under an approval granted under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC Approval 2009/5256).

1.2 Purpose of this document

This Environmental Assessment (EA) has been prepared to support an application under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to modify PA 09_0182 to include additional activities and ancillary infrastructure that is required as part of ongoing operations at the BCM. These include conversion of existing test bores to operational production bores and the installation of ancillary infrastructure located on agricultural properties in areas adjacent to the mine (refer Section 3 for detail).

This EA has been prepared to consider the implications of the proposed modification in accordance with the requirements of the EP&A Act and Environmental Planning and Assessment Regulation 2000.

1.3 The proponent

The proponent for the proposed modification is Boggabri Coal Operations Pty Limited, for which the contact details are:

Boggabri Coal Operations Pty Limited
PO Box 12
Boggabri NSW 2382

Phone: (02) 6743 4775
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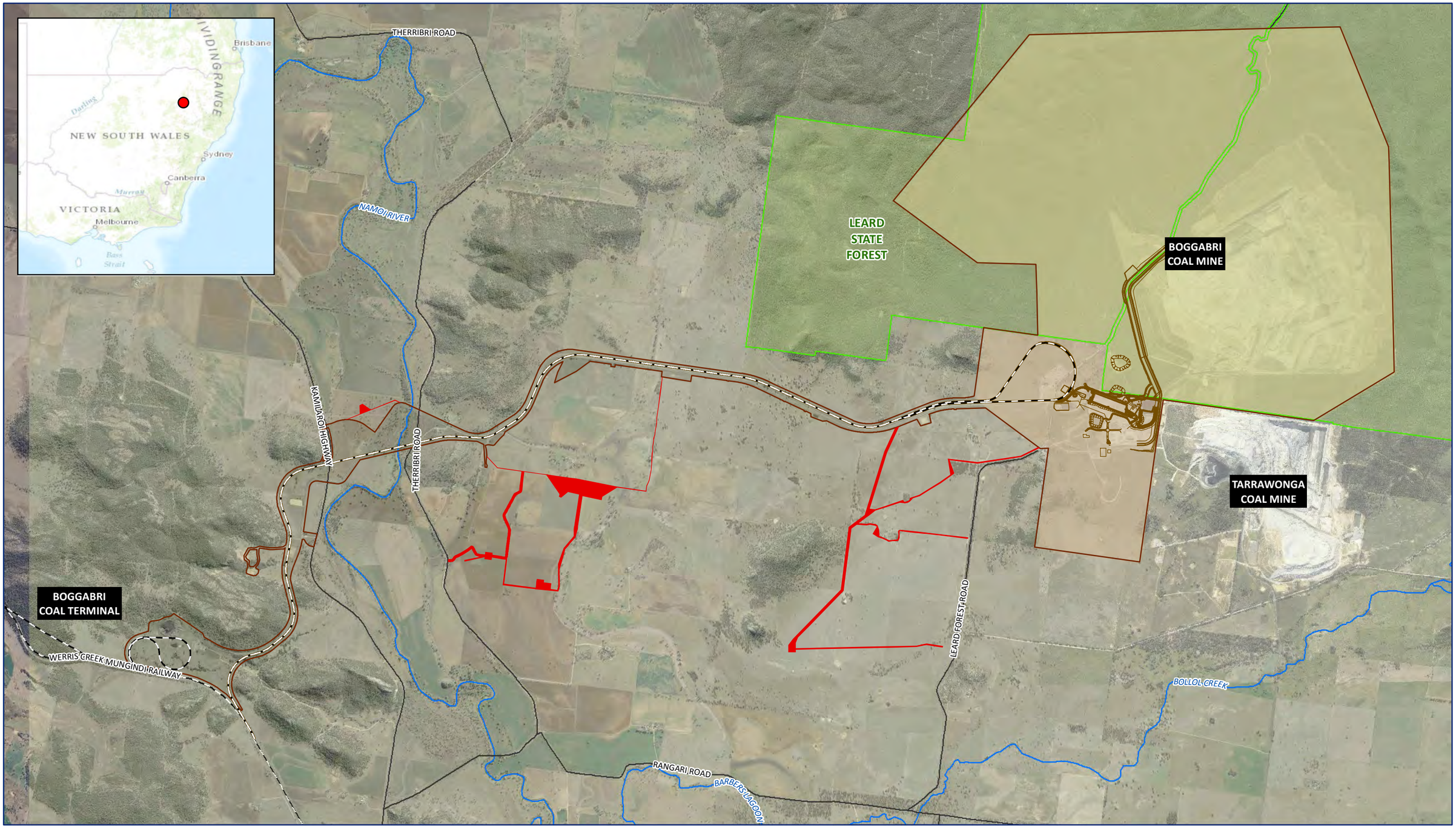


Existing mine infrastructure
Rail line
Road
River/creek
MOD 5 study area
Boggabri Project Approval Area
Boggabri Coal Mine
State Forest
Leard State Conservation Area

0 0.5 1 1.5 km

Figure 1.1
Project location

1.4 Need for the modification

The project approval in July 2012 allowed for the continuation of the BCM and associated infrastructure for a further 21 years with increased production. Detailed design of a number of components of the Boggabri Coal Project has progressed since the project approval was awarded. These ongoing development and design activities have identified a number of adjustments and additions to previously approved operations that are required to ensure its efficient continuous operation.

The proposed modification is sought to obtain approval for the establishment and operation of additional or altered project components required for the efficient operation of the BCM comprising

- two production bores to supply water for use in coal process and mining operations, these will complement the existing two production bores used for the BCM
- four contingency production bores, that will supply water for use at the mine when an existing water supply source is not available (such as when a production bore is offline for maintenance)
- ancillary infrastructure required for the bores, such as powerlines, access tracks and water transfer pipelines.

These are described in detail in Section 3.

1.5 Document structure

This document is structured as follows:

- **Section 1 (Introduction)** – discusses the background to the proposed modification, describes the proponent and outlines the need for the modification.
- **Section 2 (Existing operations)** – describes current and approved operations at BCM.
- **Section 3 (Proposed modification)** – describes the individual components of the proposed modification.
- **Section 4 (Regulatory framework)** – considers the legislative framework for the proposed modification, considers the applicability of Commonwealth and State legislation and relevant planning instruments.
- **Section 5 (Consultation)** – outlines the stakeholder consultation undertaken for the project.
- **Section 6 (Environmental impact assessment)** – identifies and assesses the potential environmental impacts of the proposed modification and describes the measures that will be implemented to mitigate these.
- **Section 7 (Conclusion)** – provides a conclusion to the findings of this EA, including a justification for the proposed modification.

2. Existing operations

2.1 Background

Exploration and development studies commenced in the vicinity of the BCM in 1976. Approval for mining operations was initially granted on 22 August 1989 under Part 4 of the EP&A Act. Major development of the site began in the mid-2000s, with coal mining commencing in 2006 using truck and shovel methods. Infrastructure constructed for the mine before production of coal included:

- 17 km bitumen sealed private coal haul road from the mine to the Boggabri Coal Terminal (BCT) rail loading facility, including bridges over the Namoi River and Kamilaroi Highway
- run of mine (ROM) and product coal stockpiles
- coal crushing plant
- conveyor and truck load out facility
- three km rail loop and turnout
- mine infrastructure area (MIA) including workshop and offices.

In 2009, BCOPL lodged a major project application under the now-repealed Part 3A of EP&A Act. This continuation is known as the Boggabri Coal Project and includes:

- production of up to seven million tonnes per annum (Mtpa) product coal
- construction of an additional CHPP
- a 17 km rail spur line and rail load-out facility running from the main line to the CHPP
- upgraded mining fleet
- upgrades of existing ancillary infrastructure.

Impacts associated with the Boggabri Coal Project were assessed through the *Continuation of Boggabri Coal Mine Environmental Assessment December 2010* (Hansen Bailey, 2010) (the 2010 EA). The Boggabri Coal Project was approved under project approval 09_0182 (the project approval) on 18 July 2012.

BCOPL subsequently applied for four modifications (MODs) of the project approval all of which have been approved, these are:

- **MOD 1** – to allow for emergency trucking operations and was subsequently withdrawn by BCOPL.
- **MOD 2** – to allow for the processing and associated transport of up to three Mtpa of ROM coal from the adjacent Tarrawonga Coal Mine.
- **MOD 3** – to allow for construction of a permanent mine access road, use of overburden as a base material for the rail spur embankment, use of an off-site lay-down area and use of in-pit fuel storage facilities.
- **MOD 4** – to allow for project boundary adjustments, alterations to existing infrastructure within the mine, construction of a security fence and firebreak and use of additional portable fuel storages within operational area.

2.2 Summary of mine operations

Key features of the BCM as approved under the project approval (as modified) are outlined in Figure 2.1 and shown on Table 2.1.

Table 2.1 Overview of the Boggabri Coal Mine

Major Project Components/Aspects	Proposed Operations
Limits on Extraction	▪ Up to 7 Mtpa product coal
ROM coal to be mined	▪ Approximately 145Mt
Mine Life	▪ 21 Years (exp. 2033)
Operating Hours	▪ 24 hours per day, 7 days per week
Number of Employees	▪ At least 500 full time equivalents (FTE)
Mining Methods	▪ Open cut mining using dragline and truck and shovel
Site Footprint	▪ Approximately 2,056 ha
Coal Processing	▪ ROM crushing plant located adjacent to ROM stockpile ▪ CHPP with 500 tonnes per hour capacity and associated ultra-fines plant
Infrastructure	▪ Mine Infrastructure Area (MIA) located to south-west of mine ▪ Power/water/communications systems ▪ Service roads
Product coal transport	▪ Rail spur from Werris Creek-Mungindi Railway Line to loading facility adjacent to the MIA
Water Management	▪ Clean water diversions to divert run-off from surrounding areas around disturbance areas ▪ Dirty water management system to capture and treat water from disturbed (non-mining) areas ▪ Contaminated water management system to capture water from coal mining and storage areas
Road Diversions	▪ Closure of a section of Leard Forest Road and widening of the existing private coal haulage road
Waste Management	▪ Coarse rejects and tailings co-disposed with overburden or within in-pit tailings emplacement areas

The following sections describe the mining and coal production methods employed at BCM.

2.2.1 Pre-mining operations

An annual vegetation clearing and topsoil salvage program is undertaken in areas to be mined in the following year. This involves pre-clearance surveys of vegetation, harvesting of commercial timber for firewood, seed collection and removal of habitat features such as logs for use in rehabilitated areas. All remaining vegetation is mulched for use in rehabilitation. Top soil is removed using tracked dozers and placed in topsoil stockpiles for use in rehabilitation.

2.2.2 Mining operations

Mining commenced in 2006 from the south of the open cut area shown on Figure 2.1 using large hydraulic excavators and rear dump trucks. The first two years of mining concentrated on two separate, progressively developed pits (the 'Merriown' and 'Jeralong' pits) which were then joined to form the 'Bollol Creek' pit, which is the current mine pit.

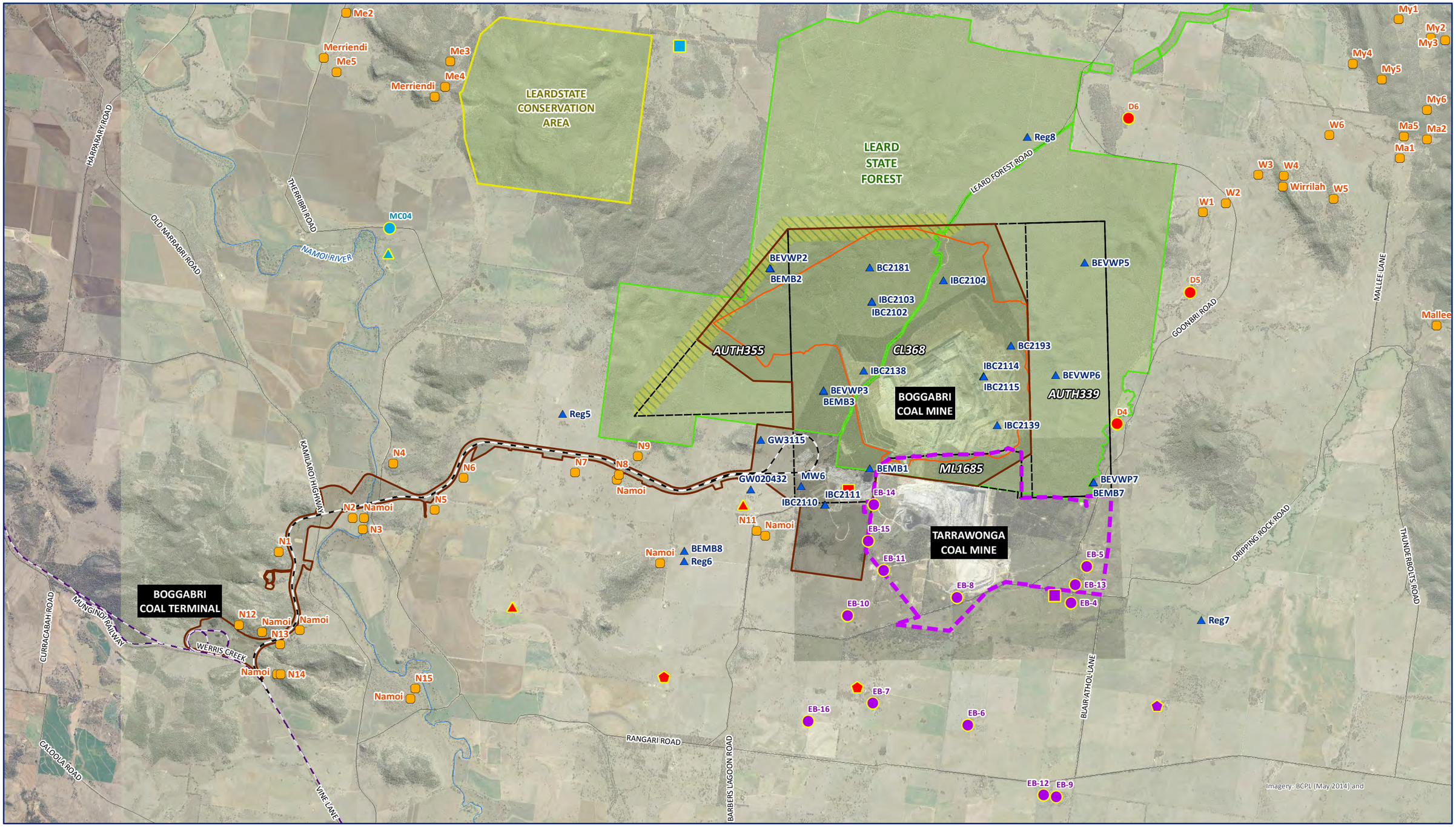
Coal is mined from eight seams in the Bollol Creek Pit: the Herndale, Onavale, Teston, Thornfield, Braymont, Bollol Creek, Jeralong and basal Merriown seams. Mining is currently undertaken using truck and shovel operations. However a dragline may be used for future operations.

Overburden is blasted to allow for removal and is placed in either in-pit or out-of-pit emplacement areas (as shown on Figure 2.1). Under the project approval, blasting is permitted between 9.00am and 5.00pm Monday to Saturday.

2.2.3 Coal processing and transport

Once extracted, coal is transported to the ROM coal stockpile where it is fed into the CHPP. The CHPP is located adjacent to the ROM stockpile and comprises a 1,500 tonne per hour capacity bypass crusher and a 500 tonne per hour coal processing plant. Reject material from the CHPP includes coarse and fine tailings. Fines are processed through a belt press filter system to reduce moisture content before being added back to the coarse reject and transferred to a load out bin. Trucks take the reject material from the load out bin to the operational pit for co-disposal with overburden material in the mining void.

Product coal from the CHPP is stored in a product coal stockpile prior to being loaded onto trains at the rail load-out facility. Product coal is transported to the Port of Newcastle for shipping to international customers.



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- Boggabri AWS
- Boggabri Dust gauge
- Boggabri HVAS
- Boggabri TEOM
- Maules Creek AWS
- Maules Creek Dust gauge
- Maules Creek HVAS
- Tarrawonga AWS
- Tarrawonga Dust gauge
- Tarrawonga TEOM
- Groundwater bores
- Ecological monitoring location
- Existing/operational rail
- Proposed rail
- EPBC Approval boundary
- Boggabri Project Approval Area
- Biodiversity offset corridor
- Leard State Forest
- Leard State Conservation Area
- Mine tenement boundaries
- Tarrawonga Project Approval Area

0 1 2 3 km

Figure 2.1
Existing operations

2.3 Existing approvals

Table 2.2 summarises the current consents, authorisations and licences that apply to the BCM.

Table 2.2 Summary of current consents, authorisations and licences

Lease/licence/approval	Date granted	Expiry/duration
Exploration licences		
Exploration Permit Tender Area no. 1	22 December 1975	-
Coal leases (CL)		
CL368	15 November 1990	14 November 2032
Mining leases (ML)		
ML A355	19 July 1984	11 April 2018
ML A339	11 April 1984	11 April 2016
MLA 464	Application made 28 November 2013	-
Project approvals		
Project approval 09_0182 (as modified)	18 July 2012	31 December 2033
EPBC Act Approval	11 February 2013	31 December 2053
Other licences		
Environment Protection Licence 12407 (as currently modified)	5 September 2012	5 September 2017
EPL 20404	19 May 2014	19 May 2019
Approval of Controlled Works Part 8 of the Water Act 1912 – Floodplain construction works for rail loop	01 October 2013	-
Approval of Controlled Works Part 8 of the Water Act 1912 – Floodplain construction works for Kamilaroi Highway access road	5 June 2014	-
Water Access Licence (WAL) 12691	27 July 2012	Perpetuity
WAL 12767	8 April 2014	Perpetuity
WAL 14483	27July 2012	Perpetuity
WAL 15037	12 December 2013	Perpetuity
WAL 24103	1 September 2011	Perpetuity
WAL 29473	26 July 2012	Perpetuity
WAL 29562	26 July 2012	Perpetuity
WAL 2571	12 December 2013	Perpetuity
WAL 2572	25 September 2013	Perpetuity
WAL 2595	12 December 2013	Perpetuity
WAL 2596	25 September 2013	Perpetuity
WAL 31084	22 August 2013	Perpetuity
WAL 14495	3 February 2014	Perpetuity
WAL 36547	6 February 2014	Perpetuity
WAL 31096	25 November 2014	Perpetuity

2.4 Environmental management

BCOPL has implemented an Environmental Management Strategy that provides the framework to facilitate compliance with legal and other requirements (including statutory approval and stakeholder expectations). A component of the environmental management strategy is the development and implementation of a number of environmental management plans, strategies and procedures to cover specific aspects of the BCM including:

- water management
- air quality
- flora and fauna
- cultural heritage
- hydrocarbon
- noise and vibration
- waste
- rehabilitation and land management
- public safety
- irrigation area

BCOPL has also implemented an environmental monitoring program which allows effective quantitative measurement and management of its environmental performance. The BCM monitoring network is shown on Figure 2.1 and comprises:

- a meteorological monitoring station
- three depositional dust gauges
- 2 High Volume Air Samplers (HVAS)
- nine noise monitoring sites
- 14 groundwater monitoring bores
- seven surface water sampling points
- one tapered element oscillating monitor

The outcomes of the environmental monitoring program are published in the Annual Review (formerly Annual Environmental Management Report (AEMR)), and distributed to government agencies, employees, the Boggabri Community Consultative Committee (CCC) and other interested stakeholders.

2.5 Water management

The BCM water management system has been designed to segregate clean runoff, dirty runoff and contaminated water generated from rainfall events and mining operations. The following definitions have been adopted for the various runoff types:

- Clean water is defined as runoff from catchments that are not disturbed by mining operations.
- Dirty water is defined as runoff from disturbed areas within the mine site and includes runoff from overburden emplacements, haul roads and parts of the MIA. This water contains high levels of suspended solids.
- Contaminated water is defined as runoff generated from coal stockpiles, the CHPP, parts of the MIA and the mining void, as well as groundwater inflows to the mining void. This water contains high levels of suspended solids and is mildly saline.

Clean water runoff from undisturbed catchments is diverted around the mine working area wherever possible and into ‘Nagero’ Creek, an ephemeral waterway which drains to the Namoi River. In some instances as the mine pit footprint changes, remnant undisturbed catchments that cannot be feasibly diverted around the pit due to topographical limitations may remain. In these instances, where feasible, dams will be constructed

upslope of the pit to capture clean runoff and to minimise inflows to the mining void. They are designed to spill to the mining void during large storm events.

Dirty water runoff is captured in sediment dams to encourage the settling of suspended solids. Runoff from large storm events discharges to 'Nagero' Creek in accordance with Environmental Protection Licence requirements. Captured water is either released to the creek or pumped to mine water dams for storage and reuse. This will depend on stored water quality and the site water balance.

Contaminated water is captured in mine water dams for storage and reuse and is not released to 'Nagero' Creek. Contaminated water is used as much as possible on site for dust suppression.

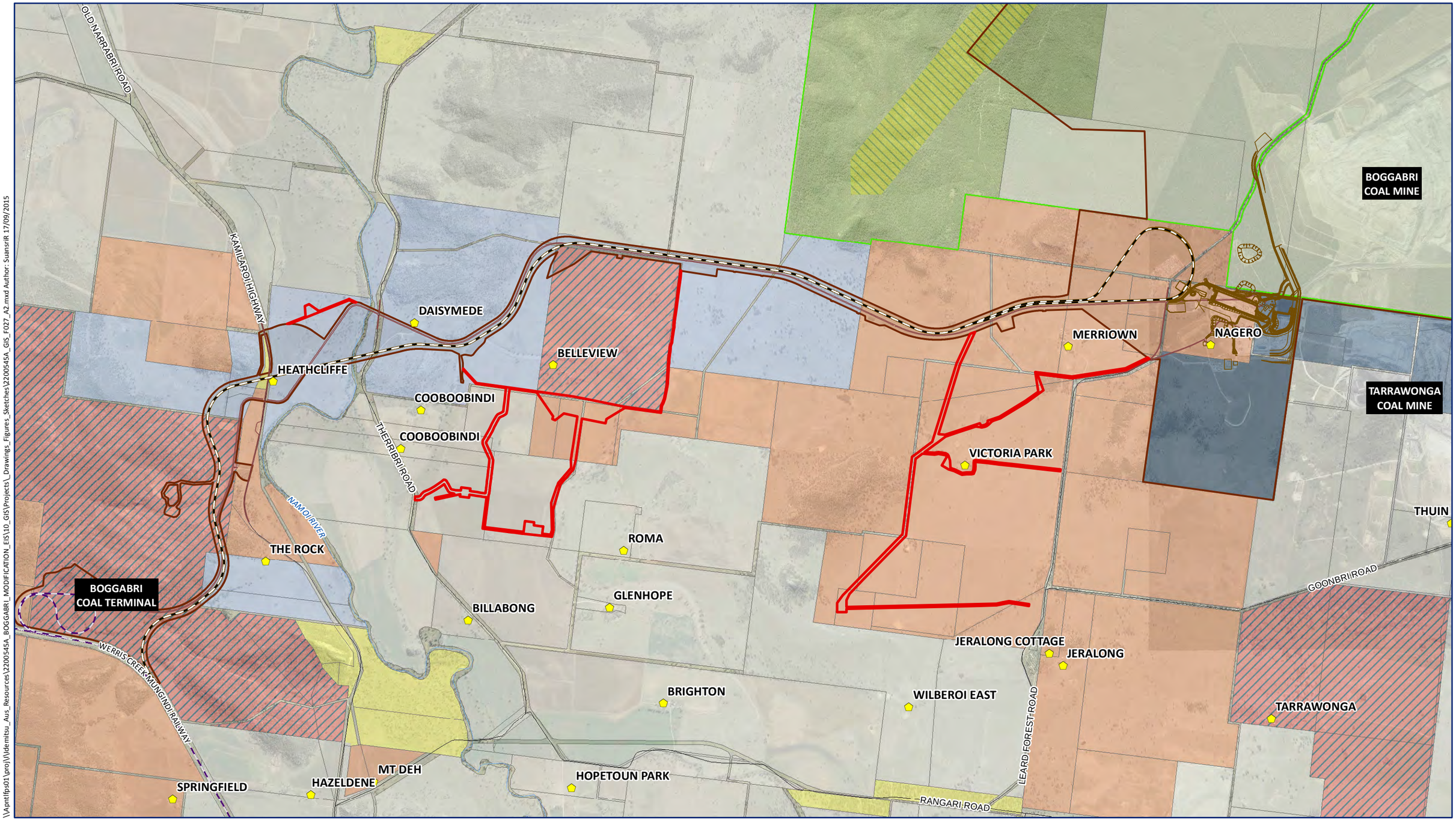
As approved under MOD 4 some of the existing mine water dams are currently being expanded to minimise the frequency and magnitude of in-pit flooding.

2.6 Land ownership

Land ownership for areas where project boundary adjustments are proposed under this modification is shown on Figure 2.2. Specific holdings that will be subject to boundary adjustments are described further in Table 2.3.

Table 2.3 Schedule of lands – proposed new project area

Lot	Deposited Plan (DP)	Ownership
44	DP754926	BCOPL
41	DP754926	RW & A Grover
40	DP754926	RW & A Grover
39	DP754926	RW & A Grover
161	DP754926	RW & A Grover
2	DP509312	RJ Heiler
59	DP754948	BCOPL
17	DP754940	BCOPL
1	DP622375	BCOPL/Tarrawonga Coal
105	DP755470	BCOPL
142	DP754926	BCOPL
43	DP754926	BCOPL



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- Surrounding residences
- Proposed security fence
- Mine infrastructure
- Road
- Existing/operational rail
- Proposed rail
- MOD 5 study area
- Boggabri Project Approval Area
- Mine infrastructure area
- Biodiversity offset corridor
- Leard State Forest
- Leard State Conservation Area
- Cadastre boundary
- <all other values>

Land ownership

- Boggabri Coal Pty Ltd
- Mine jointly owned
- Rail JV
- Tarrawonga Whitehaven Coal
- Crown
- Private

0 0.5 1 1.5 km

Figure 2.2
Property ownership

3. Proposed modification

3.1 Overview

As part of the ongoing development of the Boggabri Coal Project, BCOPL has identified the need for additional water supplies to provide for its mining and coal processing operations.

The Boggabri Coal Surface Water Assessment (Parsons Brinckerhoff 2010) predicated that under normal climactic conditions, the site would have an annual water surplus until its CHPP was established, but move to an annual water deficit when the CHPP became operational. Other changes to the site's water use and make have occurred since 2010, such as reduced catchment areas for on-site dams due to changes to mine plans and increased water requirements for dust suppression, as has been required by several pollution reduction programs that have been established at the site under the sites EPL. Requirements for dust suppression at the site were also increased in 2014 through the approval of MOD 4, under which BCOPL was made to minimise dust emissions on-site. Previous approval conditions required BCOPL to minimise emissions to off-site areas only.

BCOPL has sought to minimise its water requirements through adopting water efficient processes such as tailings dewatering processes and water recycling in the CHPP, use of dust suppressing substances in place of watering (where possible) and progressive rehabilitation of disturbed areas.

A detailed site water balance (SWB) was prepared for the BCM to assess the changes to the site's water demands and is provided in Appendix A. This study examined detailed climatic records relevant to the site against mine plans and infrastructure designs to determine water demands and management requirements. This study found that at full production the mine has a water demand of 9 megalitres per day (ML/day), excluding recycled water. In addition, evaporation accounts for losses of approximately 0.5 ML/day for average weather conditions, raising the total demand of the site to 9.5 ML/day (refer to Table 3.1). Water for BCM is currently sourced from direct rainfall and runoff, pit inflow, recycled water, extraction from the Namoi River and groundwater extraction from two existing bores. A summary of the site water balance is provided in Section 3.1.1 below.

The contribution of surface water flows is influenced by seasonal conditions. Under the existing system, during extended dry periods, runoff contribution reduces and the water is largely sourced from existing groundwater and river sources, with minor contribution from groundwater inflow into the pit.

The SWB found that for average weather conditions, the mine is predicted to require a daily average of 5.7 ML/day of imported water. BCOPL currently operates a production bore located on the adjacent 'Daisymede' property and a production bore located within the MIA that produce up to 1 ML/day (combined). Therefore an average deficit of 4.7 ML/day will occur during peak production under average weather conditions. Further analysis of water demands for the site under varying weather conditions is provided in Section 6.1.2.

The proposed modification (MOD 5) is required to ensure additional water supplies are available to the mine to meet the deficit in available water supplies via the establishment of additional groundwater bores.

3.1.1 Site water balance

As discussed in Section 3.1, a SWB has been prepared for the site to determine water uses, demands and management practices for the BCM (Parsons Brinckerhoff, 2015a). The SWB forms part of the Water Management Plan (BCOPL, 2014b) for the site and is reviewed and updated on an annual basis, or when

any significant changes are made to mining operations or to the site water management system. The SWB is provided in Appendix A.

As part of the latest revision of the SWB, the site water balance model was revised to reflect the latest mine plan and infrastructure layouts. The site water demands were also revised based on more detailed project design and engineering work that has occurred since the 2010 EA. A GoldSim site water balance model was used to predict water demands based on site water monitoring records, mine plans across the life of the mine and known demands for infrastructure such as the CHPP and activities such as dust suppression.

The model examined 108 rainfall and evaporation data scenarios, which were based historical rainfall and evaporation records relevant to the site for the period 1 January 1889 to 1 January 2013. A 'verification' simulation was undertaken to compare the water balance model results against site observations for the period November 2011 to February 2012.

A comparison of the key inputs for the SWB against those used for the 2010 EA is provided in Table 3.1.

Table 3.1 Average daily water demands

	Volume (Ml/day)	
Demand	2010 EA demands [1]	Revised (MOD 5) demands [2]
Haul road dust suppression	1.7	4.0
CHPP including stockpile dust suppression	1.7	4.0
MIA and potable supply	0.2	1.0
Allowance for evaporation of imported water (average weather conditions)	0.5	0.5
TOTAL	4.1	9.5

(1) Demands from 2010 EA for peak over life of project (CHPP washery feed 3.0 Mtpa)

(2) Demands from Parsons Brinckerhoff (2015a) for peak over life of project (CHPP washery feed 3.5 Mtpa)

The results show that the site currently has a water deficit under average climatic conditions, with up to 2,082 ML/yr of imported water required to meet demands. Table 3.2 provides the detailed SWB for years 2015, 2017, 2019, 2022 and 2033 of the mine. It is assumed that the 50th percentile result is generally representative of median climatic conditions

Table 3.2 Simulated annual mine site water balance – 50th percentile (median) results

	Annual volume (Ml/yr)				
Year	**2015**	**2017**	**2019**	**2022**	**2033**
Inflows (Ml/yr)					
Water management system runoff and direct rainfall:					
Clean water (highwall) dams	0	0	0	0	72
Dirty water sediment dams	359	362	374	708	698
Contaminated water dams, mine water dams and pit	639	670	640	469	539
Groundwater make (pit inflows)	205	250	287	342	410
Imported water requirement	1,933	2,082	2,070	2,065	1,930
Undisturbed catchment runoff and rehabilitated areas to 'Nagero' Creek	542	558	560	455	658
Dirty water from sediment dams reused onsite	100	266	279	423	415
Outflows (Ml/yr)					
Demands (mine water or raw water acceptable):					
Dust suppression - haul roads	1,461	1,461	1,461	1,461	1,461
CHPP	731	1,461	1,461	1,461	1,461
Demands (raw water only):					
MIA and potable water	365	365	365	365	365
Evaporation:					
Clean water (highwall) dams	0	0	0	0	3
Dirty water sediment dams	35	41	41	60	91
Contaminated water dams, mine water dams and pit	39	49	50	50	55
Site wide release to 'Nagero' Cree					
Clean water (highwall dam) controlled discharge to creek	0	0	0	0	69
Dirty water sediment dam overflows to creek	0	0	0	0	0
Dirty water sediment dam controlled discharge to creek	116	0	1	172	117

A summary of the estimated annual imported water requirements is provided in Table 3.3 for three of the climatic scenarios used in the SWB (dry, normal and wet). The values in Table 3.3 do not account for supply of water from existing entitlements held by BCOPL.

Table 3.3 Summary of annual imported water requirement

	Imported water requirement (Ml/yr)				
	2015	**2017**	**2019**	**2022**	**2033**
10th percentile result (wet)	1,171	1,116	1,134	1,371	1,208
50th percentile result (normal conditions)	1,933	2,082	2,070	2,065	1,930
90th percentile result (dry)	2,403	2,647	2,632	2,576	2,460

When the site is in a water deficit, water needs to be imported to the mine site to supplement dust suppression and CHPP process water demands. Even when the site is in a water surplus, high-quality imported water may still be required to meet MIA and potable water demands.

A total of 848 unit shares of groundwater is available to BCOPL from existing aquifer access licences and BCOPL is in the process of acquiring additional licences. The actual volume of groundwater available will depend on the available water determinations (AWD) made under the Water Sharing Plan. Assuming 100% allocation of aquifer licenses, approximately 848 Ml/yr will be available to BCOPL from its existing aquifer access licences.

BCOPL also holds a total of 294 unit shares of general security surface water entitlements and 32.1 unit shares of supplementary water access licenses from the Namoi River. A reliability factor has been applied to the surface water entitlements based on a long-term extraction factor to reflect the actual available water for withdrawal from the river. Assuming reliability factors of 76% and 18% for general security and supplementary licenses respectively, approximately 229 Ml/yr will be available to BCOPL from its existing Namoi River water access licences.

Further details of water access licences held by BCOPL are provided in Appendix A. Table 3.4 provides a comparison of the site's worst case water demands against BCOPLs existing water entitlements.

Table 3.4 Water licence allocation

Scenario	Demand (2017) (Ml/year)	Existing licence allocation (Ml/year)	Difference (Ml/year)
50th percentile result (median)	2,082	1,077	1,015
90th percentile result (dry)	2,647	1,077	1,570

As shown in Table 3.4, the BCM has an operational water deficit of 1,015 Ml/year during normal weather conditions. The proposed modification would provide adequate water supply to meet this need and at the proposed pumping rate of up to 5.7 Ml/day, could supply sufficient water during dry conditions.

3.2 Proposed bore locations

The proposed modification is required to ensure additional water supplies are available to the mine to meet the deficit in available water supplies.

BCOPL proposes to develop a borefield that includes the existing Daisymede production bore and two new production bores that are located on adjacent agricultural properties. The production bores that would be included in the borefield are outlined in Table 3.5. The borefield would also include four separate contingency bores that would be used temporarily if one or more of the production bores failed.

Based on field tests (Parsons Brinckerhoff, 2015b), the two new production bores would provide a capacity of up to 10.9 ML/day and when combined with the existing approved production bore at the Daisymede property, could provide more than the entire required water supply for the mine during extended dry weather periods. This level of production would not be required under normal weather conditions.

Figure 3.1 provides an overview of the borefield and includes associated infrastructure such as powerlines, pipelines and access tracks. BCOPL engaged Groundwater Exploration Services Pty Ltd (GES) to undertake investigative drilling and groundwater testing on the Daisymede and Bellview properties located to the south-west of BCM in 2012 and 2013 (GES, 2013). Investigative drilling of 11 test bores identified potentially favourable geological conditions in parts of the properties and likely to be present in properties further to the south and west, closer to the Namoi River.

Two test bores were drilled on the Belleview property in December 2012 and January 2013 at depths of 40 and 41 metres (m) (GES, 2013). Mannion Drilling were engaged by BCOPL in 2014 to drill test bores on the adjacent Cooboobindi, Victoria Park, Roma and Heathcliffe properties.

Test pumping was undertaken on the production and contingency bores in 2014 and early 2015 (Parsons Brinckerhoff, 2015b). Further details of the groundwater system associated with the borefield are provided in Section 6.1.

Since the investigation studies for the proposed borefield were completed, BCOPL has negotiated agreements with the landholders responsible for the properties and developed concept plans for the borefield.

Details of each bore that would be included in the borefield are provided in Table 3.5. The existing bore at the Daisymede property is located approximately eight kilometres to the west of the mine and was originally established to provide water to the BCT. This bore was recently connected to the MIA via an overland pipeline that runs along the private haul road.

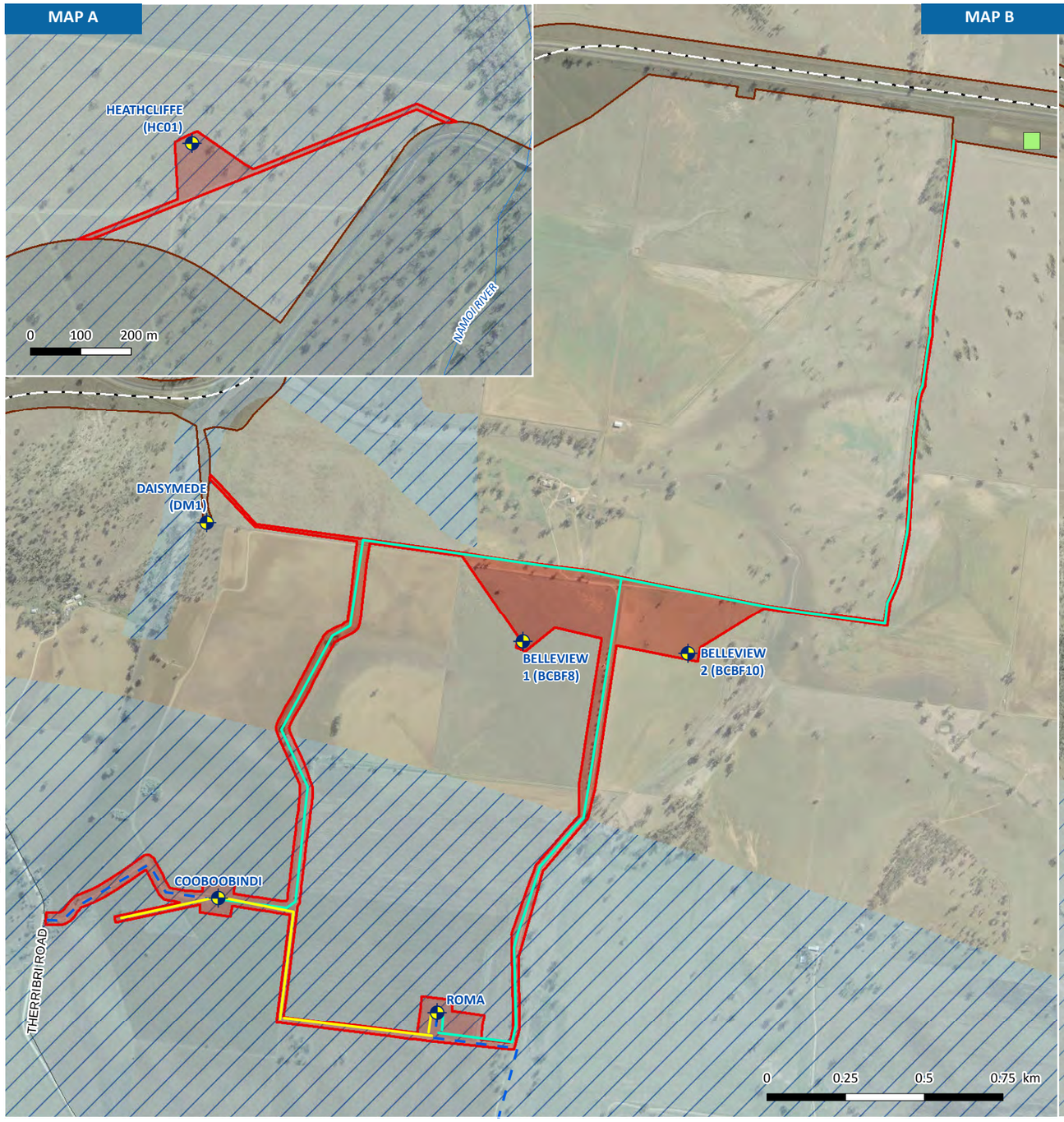
Table 3.5 Proposed borefield

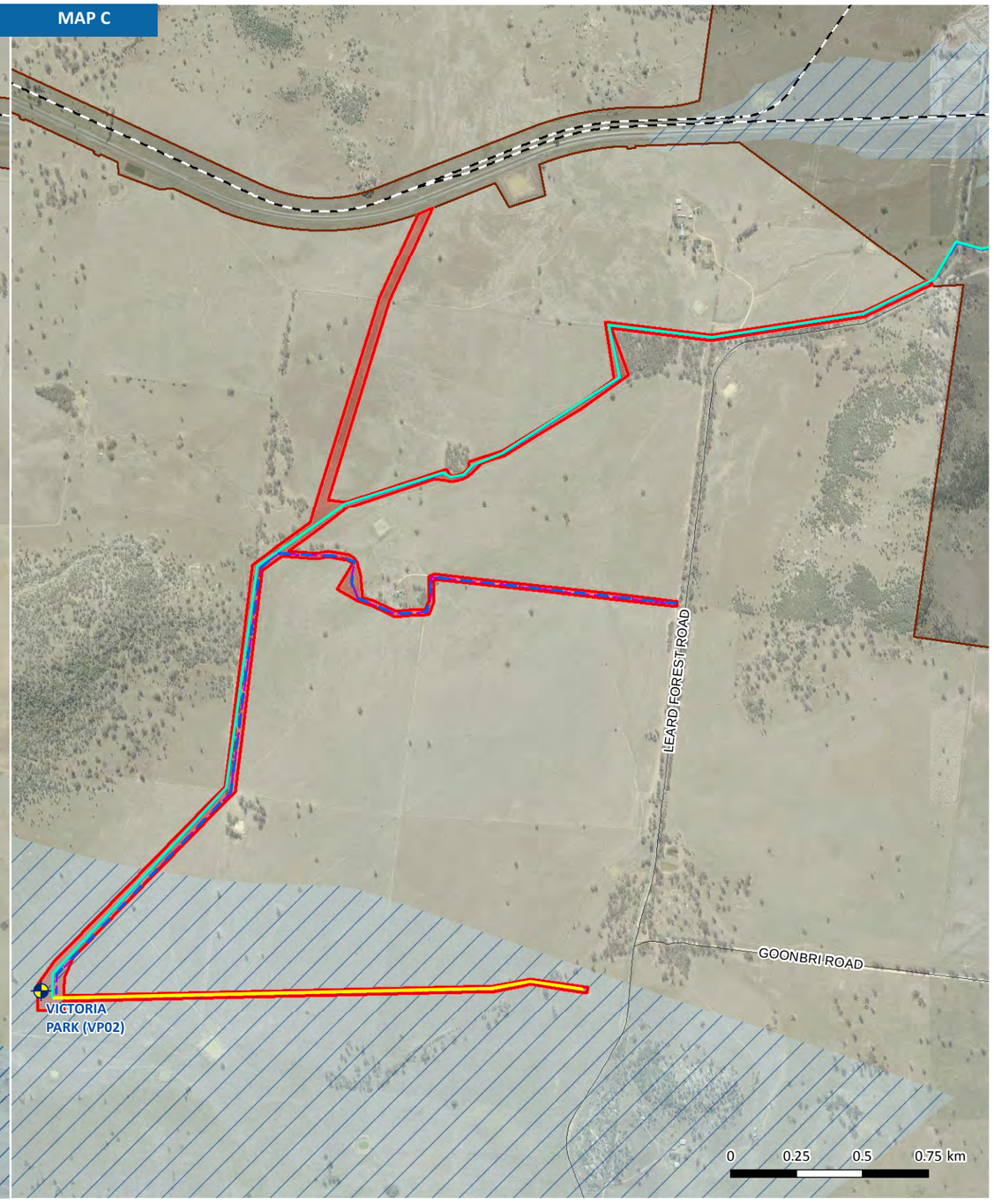
Bore	Operation Use	Status	Expected achievable maximum pumping rate[1] (ML/day)
Cooboobindi	Production	Test production bore	7-7.5
Victoria Park	Production	Test production bore	3.4
Daisymede	Production	Existing production bore	1
Roma	Contingency	Test production bore	4.5
Heathcliffe	Contingency	Test production bore	1.5
Belleview1	Contingency	Test production bore	1
Belleview 2	Contingency	Test production bore	0.5

(1) Based on field testing (Parsons Brinckerhoff, 2015b)

BCOPL has established agreements with landholders who would have bores or associated infrastructure constructed and operated on their property if the proposed modification is approved. BCOPL currently holds sufficient water access licences to use water drawn from the bores under normal conditions. BCOPL is currently reviewing water access licence availability to enable the borefield to operate at maximum capacity, as may be required during extended dry periods.

The locations of the bores under the modification are shown on Figure 3.1.





Groundwater bores
Tank farm
Proposed Power line
Proposed pipeline
Access road
Road
Drainage
Rail line
MOD 5 study area
Boggabri Project Approval Area
Flood prone land

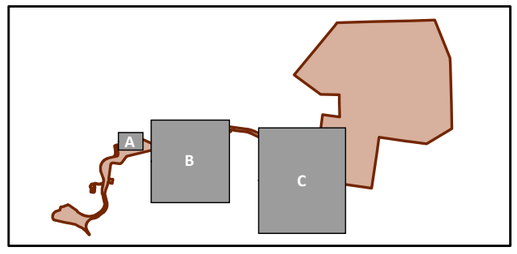


Figure 3.1
Modification study area and impacts

3.3 Borefield establishment

Establishment of the borefield is expected to take 2-3 months and will involve the following activities:

- Establishment of access tracks – access tracks will generally be located in existing farm access tracks, in some locations some grading or stabilisation works may be required to ensure the tracks are suitable for use by construction equipment and ongoing maintenance. Access track locations are shown on Figure 3.1.
- Conversion of test bores to production bores – the proposed production bores have already been installed as test bores at each of the sites shown on Figure 3.1. As part of converting these bores to production bores, the following activities would be undertaken:
  - Prior to any work occurring, permanent clean water diversion and sediment controls would be established around the sites and stock-proof fencing would be erected.
  - A site compound of about eight metres by eight metres would be constructed around each bore, this would include a concrete pad and a communications kiosk to provide for electricity switching and remote control of the bore. A typical production bore compound is shown in Photo 3.1.
  - In-bore pumps would be installed at each production bore.
- Installation of powerlines and water pipelines – overhead 11 kV powerlines will be installed to each bore from existing powerlines and water pipelines will be installed between each bore and the proposed tank farm or the MIA. Where the pipeline crosses an access track it would be buried. In all other areas the water transfer pipelines will be laid on the ground.
- Construction of the tank farm – the tank farm will be expanded at its existing site on the private haul road (refer to Figure 3.1) and will consist of several above ground water storage tanks and a water transfer pump that will pump water collected from the production bores to the MIA.

Photo 3.1 Typical production bore arrangement following installation

3.3.1 Power lines and pipelines

Above ground polyvinyl chloride (PVC) pipelines of 280 mm notional diameter will be installed between the bores and the existing water transfer pipeline running along the private haul road or direct to the MIA as shown on Figure 3.1. This will consist of laying the pipelines on the ground surface or excavating a trench of about 0.5 m wide and up to one metre deep in sections where the pipes are to be installed underground. The pipes would be installed underground where required to cross roads, access tracks and other services.

Overhead 11kV powerlines will be constructed on wooden support poles along each transfer pipeline to power the production bores and transfer pumps. The support poles will be installed into holes bored by a truck mounted auger, to depths of up to five metres. The poles will be erected be cranes and conductors strung by construction staff on elevated work platforms. The powerlines will connect to existing 11 kV powerlines.

3.3.2 Tank farm

The tank farm shown on Figure 3.1, previously built contains several tanks of up to 20,000 L that are used to store water pumped from the existing Daisymede bore. A new transfer pump will be installed at the tank farm to increase the transfer rate between the tanks and the MIA as part of the proposal. Several new water tanks will also be installed at this site as part of the proposal.

3.4 Operation and decommissioning

During operation, water will be pumped from each production bore by submersible pumps to above ground water storage tanks located within the tank farm and to MIA the as shown on Figure 3.1. An above ground 11 kV pumping station will be installed at the tank farm to transfer water to the mine.

The production bores will be operated and monitored remotely via telemetry. The pumps will not be operated continuously with pumping triggered remotely (manual activation and shutdown). The pumps are not expected to create any audible noise during operation, as they will be submerged within the bore.

Following completion of the overall mine, the bore sites and ancillary infrastructure will be decommissioned in consultation with affected landholders. If the relevant landholder requests that the bores are to be retained, the production bores and any relevant ancillary infrastructure will be transferred to their ownership. Otherwise, all equipment and structures will be removed and affected areas will be rehabilitated in consultation with the relevant landholder to return disturbed areas to agricultural production.

4. Regulatory framework

This Section of the EA provides a description of the regulatory framework under which BCOPL operates and statutory considerations applicable to the proposed modification.

4.1 Approval pathway

4.1.1 Development consent

The NSW Minister for Local Government and Minister for Planning granted development consent DA 36/88 to the Boggabri Coal Joint Venture on 22 August 1989 under Section 101 in Part 4 of the EP&A Act. This authorised the extraction of coal from the BCM for a period of 21 years following the date of the grant of a coal lease (CL) in respect of the development. CL 368 was granted by the Minister or Natural Resources in November 1990.

Modifications to DA 36/88 were granted in 2009, 2011 and 2012 for the alternation of mine plans. DA 36/88 was surrendered by BCOPL on 31 December 2013 following the approval of PA 09_0182.

4.1.2 Project Approval

As discussed in Section 1.1, a new project approval under Part 3A of the EP&A Act was granted for the Boggabri Coal Project on 18 July 2012. This approval (the project approval) superseded DA 36/88 as the planning approval for BCM. Pursuant to Condition 14 of PA 09_0182, BCOPL surrendered DA 36/88 on 31 December 2013. The project approval allows mining operations to be conducted in accordance with the Boggabri EA until the end of December 2033.

4.2 Commonwealth legislation

An approval under the EPBC Act is required for any action that is likely to have a significant impact on Matters of National Environmental Significance (MNES). Nine MNES are listed under Part 3 of the EPBC Act of which the following three are likely to be relevant to the BCM:

- listed threatened species and ecological communities
- migratory species
- protection of water resources from coal seam gas development and large coal mining development.

If a proposed action is likely to have a significant impact on MNES, the action is deemed to be a *controlled action*. A controlled action can only be carried out with the approval of the Minister under Section 133 of the EPBC Act.

On 22 December 2009, BCOPL submitted a referral under Section 68 of the EPBC Act to determine whether the Boggabri Coal Project was a controlled action. On 5 February 2010, the Department of the Environment (DoE) (formerly SEWPaC) declared the project to be a controlled action due to its impacts on listed threatened species and communities, and listed migratory species. DoE elected to assess the project through accreditation of the assessment process under the EPBC Act. On 11 February 2013, the project was granted approval under Section 133 of the EPBC Act (approval no. 2009/5256 – the EPBC approval).

On 22 June 2013, the EPBC Act was amended to include water resources as a MNES, in relation to coal seam gas and large coal mining developments. Under Section 3.5 of the 'Significant impact guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources' (Commonwealth

Department of the Environment December 2013, development of infrastructure associated with a coal mine that is *'not part of the extraction process'* or is *'not sufficiently proximate that it can be said to involve the extraction of CSG or coal'* does not need consideration of the water resources trigger under this act.

Section 4.2.1 of the guidelines go on to state *'If a referral for a proposed expansion or modification to a project does not involve extraction of CSG or coal, then it will not be within the definition of 'coal seam gas development' or 'large coal mining development' and the water trigger will not apply.*

Under guidelines actions approved under Part 9 of the EPBC Act prior to 22 June 2013 are exempt from the water resource triggers. The impacts to water resources from mining at the BCM were approved under Part 9 of the EPBC Act in February 2013 and are therefore exempt from the water triggers of the EPBC Act.

As the proposed modification does not involve the extraction of coal, it is not considered relevant to the water resource triggers of the EPBC Act.

4.3 State legislation

4.3.1 Environment Planning and Assessment Act 1979

The project approval was granted under the now repealed Part 3A of the EP&A Act. Consequently BCM constitutes as a "transitional Part 3A project" pursuant to the conditions and provisions in Schedule 6A of the EP&A Act.

Clause 3 of the Schedule 6A provides that Part 3A of the EP&A Act continues to apply to and in respect of "transitional Part 3A projects" following its repeal. That is, Part 3A of the EP&A Act continues to apply, notwithstanding its repeal.

Approval for the proposed modification is therefore sought under Section 75W of the EP&A Act, which states:

75W Modification of Minister's Approval:

> *"1. The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under the Part.*
>
> *2. The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.*
>
> *3. The Minister may modify the approval (with or without conditions) or disapprove of the modification."*

Section 75W(2) states that the Minister's approval is not required where the modified project will be consistent with the approved project. BCOPL does not consider the proposed modification to be entirely consistent with the project approval. Accordingly, BCOPL is seeking a modification to PA 09_0182 under Section 75W of the EP&A Act.

The proposed modification does not represent a radical departure from the existing project approval, consequently it is considered that the Minister is able to modify the approval under Section 75W of the EP&A Act.

As a transitional Part 3A project, Section 75U of the EP&A Act (now repealed) continues to apply to the BCM. Section 75U specifies a number of authorisations and approvals that are not required for projects

approved under art 3A of the EP&A act. Pursuant to Section 75U, the following authorisations are not required for the Modification:

- a permit under Section 20, 205 or 2019 of the *Fisheries Management Act 1994* (FM Act)
- an approval under Part 4, or an excavation permit under Section 139, of the *Heritage Act 1977* (Heritage Act)
- an Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974* (NPW Act)
- an authorisation referred to in Section 12 of the *Native Vegetation Act 2003* (NV Act) (or under any Act to be repealed by that Act) to clear native vegetation or State protected land
- a bushfire safety authority under Section 100B of the *Rural Fires Act 1997*
- a water use approval under Section 89, a water management work approval under Section 90 or an activity approved under Section 91 of the *Water Management Act 2000* (WM Act).

The matters that will ordinarily be considered in these applications for these authorities have been addressed in this EA and the 2010 EA.

4.3.2 Other NSW legislation

Consideration of other legislation that may be applicable to the proposed modification is outlined in Table 4.1.

Table 4.1 NSW Legislation

Legislation	Key requirements	Relevance to the project
Mining Act 1992	▪ This act establishes a framework for the regulation of exploration and mineral extraction, including: ▸ Compensation of landholders for loss or damage ▸ Means for an appropriate return to the state from mineral resources ▸ Measures to ensure the appropriate rehabilitation of mine sites. ▪ Under this act, exploration and mining must be undertaken under an authorisation or lease. ▪ Under Section 6 of this act, an authorisation is also required for '*the construction, maintenance or use of any reservoir, dam (including a tailings dam), drain or water race*'	▪ BCM operates under CL 368 awarded under this act. ▪ BCM operates under a Mining Operations Plan (MOP) developed in accordance with CL 368 and this act.
Noxious Weeds Act 1993	▪ The *Noxious Weeds Act 1993* provides for a coordinated approach to the removal and control of scheduled noxious weeds across the NSW.	▪ No permits or approvals are required under this Act, but it is the responsibility of BCOPL to provide for the removal and proper disposal of any listed weeds found within the project area. Noxious weeds are discussed and management measures proposed in Section 6.3.

Legislation	Key requirements	Relevance to the project
Protection of the Environment Operations Act 1997 (PoEO Act)	■ This act establishes a regime for the prevention of pollution and a regulatory framework for environmental protection. ■ EPLs are required from the NSW Office of Environment and Heritage (OEH) under this Act for 'scheduled activities' and 'scheduled development work'.	■ The NSW Environmental Protection Authority (EPA) licences the operation of the BCM. ■ EPL covers the following scheduled activities: ▸ Coal works ▸ Crushing, grinding or separating ▸ Mining for coal ■ The proposed modification does not cover or modify any scheduled activity undertaken at the site. ■ The EPA will determine any requirements for modification of the BCM EPL as part of the approval process for the proposed modification.
Roads Act 1993	■ Development that affects a public road, Crown road, highway, main road, freeway or tollway requires approval from the NSW Roads and Maritime Services (RMS) or the local council under this Act.	■ The proposed modification does not involve any activities that will affect a public road or highway, therefore approval is not required under this act.
Threatened Species Conservation Act 1995 (TSC Act)	Approval is required to: a) harm any animal that is of, or is part of, a threatened species, population or ecological community b) pick any plant that is of, or is part of, a threatened species, population or ecological community c) damage critical habitat, or d) damage habitat of a threatened species, population or ecological community.	■ The proposed modification will not involve a significant impact to any threatened species, population or endangered community and therefore approval is not required under this act.

Legislation	Key requirements	Relevance to the project
Water Management Act 2000 (WM Act)	■ This Act governs access to, and the use of, water in NSW where water sharing plans (WSP) have commenced. ■ The following WSPs apply to water sources in the vicinity of the BCM: ▸ Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources 2012 ▸ Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2003 ▸ Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003 ▸ Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Source 2011. ■ Under these WSPs, several approvals may be applicable, including: ▸ Water Access Licence (WAL), which approves access to a share of a water source. ▸ Works Approval, which applies to water supply drainage or flood mitigation works. ▸ Water Use Approval, which applies to specific uses of extracted water. ▸ Controlled Activity Approval, which applies to works in, on or under waterfront land (40 m from the upper bank). ■ If groundwater extraction is required for the project, an Aquifer Interference Approval may be required for the work under clause 91F of the WM Act. ■ A Flood Work Approval is required under this Act for 'flood works' located on a floodplain that may have an effect on the flow of water during a flood event.	■ The proposed bores will require a Water Access Licence(s) to account for water taken. ■ A Works Approval is not required for water supply pipelines associated with the production bores as activities subject to approval under Part 3A of EP&A Act are exempt. ■ A Water Use Approval is not required for the proposed modification as activities subject to approval under Part 3A of EP&A Act are exempt. ■ Under Clause 36 of the Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003, a new water supply works is not permitted within 200 m of a property boundary. The proposed Victoria Park bore is located 190 m from a property boundary, however; as the proposed modification is being assessed under Part 3A of the EP&A Act, Section 90 of the WM Act does not apply and therefore Clause 36 of the Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003 does not apply. ■ The proposed modification does not involve work within 40 m of the upper bank of a creek, therefore a controlled activity approval under the WM Act is not required. ■ An Aquifer Interference Approval is not required for the proposed modification as activities subject to approval under Part 3A of EP&A Act are exempt. ■ Groundwater users who are impacted by the modification are subject to the 'make good' provisions of the Aquifer Interference Policy, which requires BCOPL to provide access to an equivalent supply of water through enhanced infrastructure or other means, such as deepening existing bores, funding extra pumping costs or constructing new pipelines or bores. ■ As the proposed modification will not result in the construction of any large structures that may impede water flow on the Namoi River flood plain, it is not considered to be a flood work. The largest structures to be constructed on the flood plain would be the production bores and associated communications kiosks and powerlines. Water pipelines would be laid on the ground surface in these areas, but would not be of sufficient height to impede water flow during a flood event. The proposed tank farm is located outside the mapped flood prone area. Flood prone areas relevant to the modification are shown on Figure 3.1.

Legislation	Key requirements	Relevance to the project
Water Act 1912	■ If an activity is being undertaken in an area where a gazetted WSP is not in place, a licence or permit is required to extract water from a surface or groundwater system, including dewatering of excavations.	■ The project area is covered by a number of WSPs and therefore this Act does not apply.

4.4 State environmental planning policies

Under Section 75R(2)(b) of the EP&A Act, State Environmental Planning Policies (SEPPs) apply to projects which Part 3A applies.

Given this, various SEPPs potentially of relevance to BCM have been identified and discussed.

4.4.1 Mining, petroleum production and Extractive Industries 2007 (Mining SEPP)

The aims of the Mining SEPP include providing for the proper management and development for mineral, petroleum and extractive mineral resources for the social and economic welfare of the State and to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive mineral resources and to establish appropriate planning controls to encourage ecologically sustainable development (ESD) and establishes relevant matters for consideration by a consent authority.

The considerations set out by clauses 12 to 17 of the Mining SEPP (which sets out matters for consideration in development applications) are examined and reported upon throughout this EA. This EA undertakes the assessments required by clause 12 of the Mining SEPP.

4.4.2 SEPP 33 – Hazardous and Offensive Development

SEPP 33 – Hazardous and Offensive Development (SEPP33) requires the consent authority to consider the merits of proposed activities including the location of the development and the way in which it is to be carried out. A review of the relevant components of this modification has confirmed that the development is not considered to be potentially hazardous or offensive. As such, a detailed preliminary hazardous analysis is not required.

Further, as per SEPP 33 applies only to proposals that are potentially dangerous or offensive and the proposed development does not constitute a potentially hazardous or offensive industry under clause 3, SEPP 33 does not apply to the proposed modification.

4.5 Local environmental plans

BCM is located entirely within the Narrabri Local Government Area (LGA). The Narrabri Local Environment Plan 2012 (Narrabri LEP) applies to all land within the Narrabri LEP.

The BCM is located on land zoned as RU1 (Primary Production) and RU3 (Forestry) under the Narrabri LEP. All infrastructure associated with BCM is located on land zoned RU1.

The proposed modification will be carried out in lands zoned within RU1. Open cut mining and water supply systems are permissible with development consent within zone RU1 and therefore the proposed modification is considered to be consistent with the Narrabri LEP.

4.6 Other considerations

4.6.1 New England North West Strategic Regional Land Use Plan

The New England North West Strategic Regional Land Use Plan (SRLUP) was published by the NSW DP&I in 2012 covering a number of LGAs including the Liverpool Plains, Gunnedah, Moree Plains and Narrabri LGAs (DP&I, 2012). The Plan represents one component of the Government's broader Strategic Regional Land Use Policy which has been developed to address land use conflicts in regional areas.

An integral component of the England North West Strategic Regional Land Use Plan is the introduction of a new decision making framework, referred to as the 'gateway process'. This process involves an early stringent assessment of the potential impacts of mining and coal seam gas development on agricultural land and water resources.

The gateway process does not apply to the proposed modification, as it will not involve any additional mining activities in addition to those approved under the project approval.

5. Consultation

5.1 Consultation for the modification

Table 5.1 outlines the stakeholder consultation activities undertaken for the modification.

Table 5.1 Stakeholder consultation

Stakeholder	Summary of consultation	Issues raised	How addressed in this EA
NSW Department of Planning and Environment (DP&E)	▪ Briefing of proposed modification in October 2014 ▪ Phone conversations between October 2014 and September 2015.	▪ Potential for impacts to biodiversity ▪ Potential for impacts to cultural heritage ▪ Assessment methodology for groundwater impacts ▪ Landholder consent.	▪ Section 6
NSW Office of Water (NOW)	▪ Phone briefing of proposed modification in November 2014 ▪ Meeting to discuss proposed modification on 24 February 2015.	▪ Construction activities on Namoi River floodplain ▪ Assessment methodology for groundwater impacts	▪ Section 6.1 and 6.2
Registered Aboriginal Parties	▪ Meetings with BCM RAPs to discuss proposed modification on 16 October 2014, 18 November 2014 and 15 April 2015 ▪ A meeting was held with the Gomeroi Traditional Custodians on 17 November 2014, the elders of this group are also RAPs ▪ A letter was sent to RAPs who did not attend the meetings held in November 2014 or provided comments previously ▪ Provision of the Draft Aboriginal Cultural Heritage Assessment to RAPs on 15 June 2015 for comment.	▪ Potential impacts to cultural heritage	▪ Section 6.4 and Appendix D
Landholders	▪ Meetings to negotiate access agreements ▪ Meetings, emails, phone calls and letters throughout 2015 to discuss groundwater drawdown impacts and impacts to agricultural production with landholders with bores that may be impacted by groundwater drawdown of greater than 2m.	▪ Construction and operation of bores ▪ Groundwater impacts.	▪ Section 3.3 ▪ Section 6.1
Community Consultative Committee	▪ Proposed modification discussed at meetings on the 3rd of March 2015, 19th of May 2015 and 11th August 2015	▪ Members queried: the level of water demand and how much additional Water Access Licence BCOPL requires	▪ Section 3.1.1 ▪ Section 6.1

5.2 Ongoing stakeholder engagement

BCOPL undertakes a range of ongoing stakeholder engagement activities as part of its ongoing operations, including:

- regular meetings of the Boggabri CCC
- quarterly Aboriginal Stakeholder Consultative Forums
- quarterly meetings with Gomeroi Traditional Custodians
- updates to the BCOPL website
- distribution of regular community newsletters
- recurring meetings with neighbouring land owners and mining operations
- consultation with landholders who's bores or wells may be impacted by the modification
- preparation of regular reports, such as the AEMR, which is distributed to a range of stakeholders.

6. Environmental impact assessment

6.1 Groundwater

A groundwater impact assessment has been prepared by Parsons Brinckerhoff for the operation of the proposed borefield (Parsons Brinckerhoff, 2015b).

The groundwater impact assessment includes the development of a numerical groundwater model to predict the extent of drawdown from borefield operations. This includes consideration of impacts to the aquifer resource and sensitive receptors, such as private landholder groundwater works (bores and wells) in the region. The groundwater impact assessment is included as Appendix B.

6.1.1 Existing environment

Groundwater systems

The proposed borefield extends over an area of approximately 7.5 km long by 2.5 km wide and is located on a relatively flat alluvial valley on the eastern side of the Namoi River, approximately 15 km north east of the township of Boggabri, NSW.

The proposed borefield is located in an area with a geology that is predominantly comprised of Permian Age metasediments and volcanics which are overlain by Quaternary alluvial deposits within valley areas. The Permian metasediments in the region include the Maules Creek Formation which is mined for coal at Boggabri, Tarrawonga and Maules Creek mines. In the area of the proposed borefield, the Boggabri Volcanics form the basement rock underlying the alluvium and bordering the alluvial plain. The geology of the area is shown on Figure 6.1.

The alluvial deposits in the proposed borefield area are associated with the Namoi River and the lower reaches of ‘Nagero’ and Bollol Creeks. The thickness of alluvium in this area has been recorded as exceeding 125 m deep in places but is typically between 25 to 75m thick. Alluvial aquifers in the area are shallow, with typical aquifers occurring at varying depths, typically several metres from the surface and in some areas being recorded at less than one metre from the ground surface.

Alluvial sediments in this area are recognised as belonging to the following formations:

- Narrabri Formation – the uppermost formation, which predominantly consists of clay with minor sands and gravels.
- Gunnedah Formation – underlying the Narrabri Formation, which consists predominantly of gravel and sand with minor clay beds.

The regional hydrogeology is divided into two main units comprising:

- Bedrock aquitard – low permeability, with groundwater being contained within rock fractures and joints.
- Alluvium aquifer – groundwater contained within the alluvial sediments described above, these aquifers are highly permeable and contain substantial quantities of water.

The thickness of the alluvial aquifer increases towards the centre of the Namoi Valley and this corresponds with higher sustainable bore yields. The Cooboobindi and Roma bores have the greatest aquifer thickness and sustainable pumping rates (refer to Appendix B). The bores with lowest sustainable pumping rates are located closer to the margin of the alluvium and have the least available aquifer thickness and include Daisymede and Belleview 1 and 2 bores.

Groundwater in the Upper Namoi Alluvium has a pH close to neutral and generally fresh to marginal shown by electrical conductivity (EC) values less than 1500 µs/cm, with areas of slightly saline groundwater with EC readings of up to 7000 µs/cm (Barrett, 2012).

Groundwater users

The proposed borefield is located in an area with agricultural production (cotton and grazing) being the main land use. Water supply for agricultural land uses is sourced from surface water (runoff and the Namoi River), storage in dams and groundwater from bores accessing the alluvial aquifers.

A survey of registered groundwater works (bores and wells) was undertaken in early 2015 on land holdings within 4 to 5 km of the borefield region (Parsons Brinckerhoff, 2015c). Information of aquifer source, groundwater levels and quality, usage and bore construction details were identified for 55 registered bores in the area of which 52 bores were in alluvium and 3 bores in fractured bedrock.

Of the 55 registered groundwater works in the borefield area: 24 were found to be currently active, 10 are not currently used, nine are abandoned or entitlements have been sold to BCOPL, and no information on usage for 12 bores (the landholders unavailable to comment). Groundwater works located in the area are shown on Figure 6.2.

Groundwater dependent ecosystems

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms that depend on groundwater for survival (Department of Land and Water Conservation, 2002). A GDE may be either entirely dependent on groundwater for survival, or may use groundwater opportunistically or for a supplementary source of water (Hatton and Evans, 1998).

The Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources (NSW Government, 2003) notes that ‘there are no high priority groundwater dependent ecosystems identified and scheduled at the commencement of this Plan’ in Upper Namoi Groundwater Source. The water table of the alluvial plain is typically greater than 2m depth and therefore unlikely to support stands of groundwater dependant vegetation (CSIRO, 2007).

The GDE Atlas (Bureau of Meteorology, 2015) desktop assessment shows some areas on the alluvium plain and along the Namoi River which have low to moderate potential for vegetation reliant on subsurface groundwater. These areas would comprise River Red Gum open forest, Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland and Plains Grassland communities (Parsons Brinckerhoff, 2009). The Pilliga box – Poplar Box – White Cypress Pine grassy open woodland and Plains Grassland communities are considered to be primarily associated with perched water tables not likely to be dependent on sub surface groundwater and are thus not included within the GDE classification (Eamus et al., 2006).

The River Red Gum open forest is likely to be directly associated with the Namoi River. A characteristic of river red gums is the rapid development of an extensive and deep taproot system. The dense surface root system of a mature river red gum extends at least 20 m in the horizontal direction and greater than 10 metres vertically (Davies, 1953). River red gums can therefore have a water uptake area of greater than 4,000 cubic metres, with potential for element uptake via their roots from the adjacent stream sediments, the shallow ground water aquifers within the alluvial sediments and buried bedrock. Therefore this community will have proportional dependence upon the subsurface groundwater. It is unlikely that this GDE would be a high

priority groundwater dependent ecosystem due to the proportional use of the groundwater as opposed to being entirely dependent upon the groundwater.

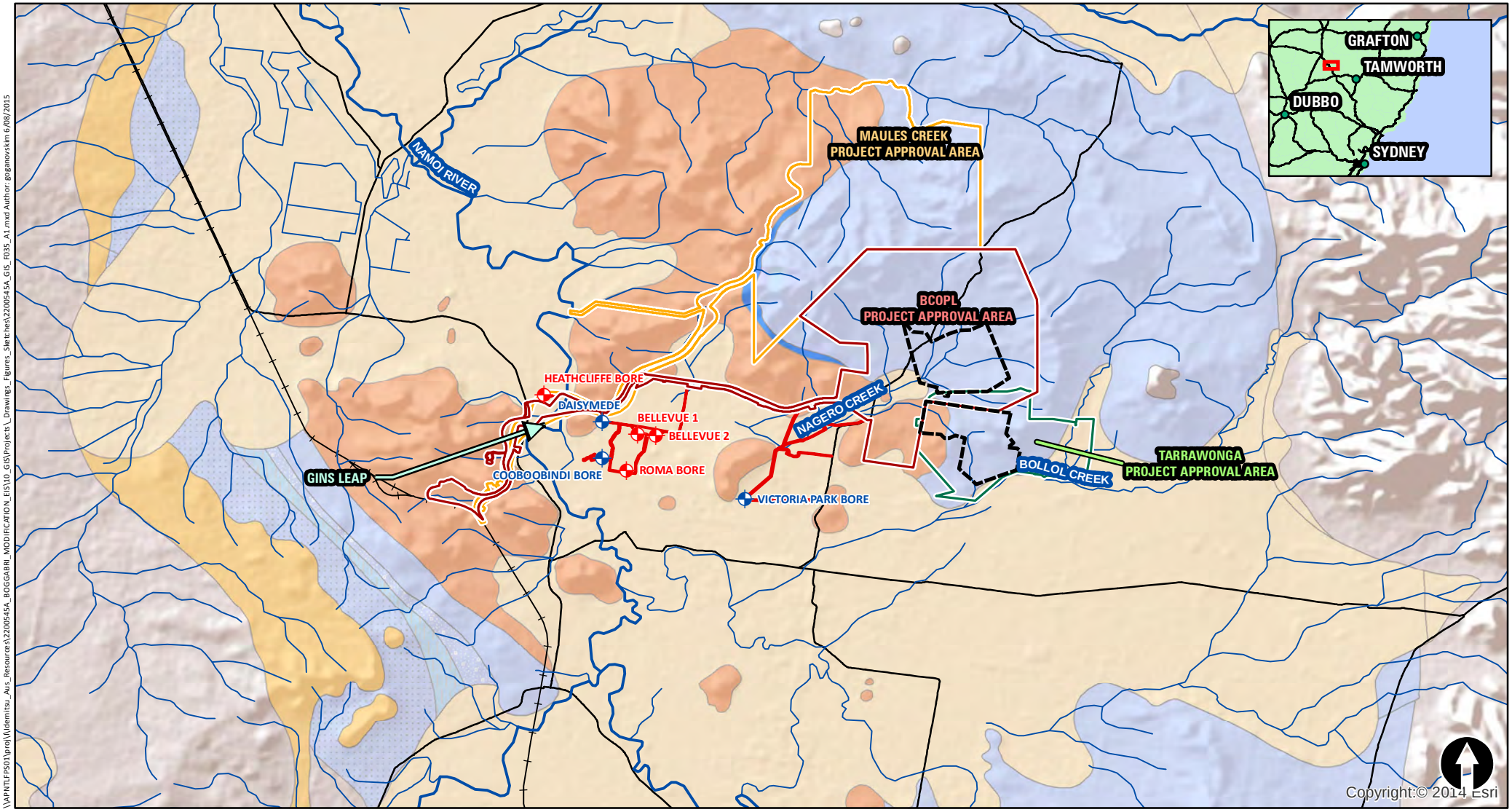
Like many Australian trees, *Eucalyptus* spp. have a dual (dimorphic) root system, with lateral roots that are close to the surface, and a taproot or 'sinker' that penetrates deep into the soil (up to 9m for River red Gum (*E. camaldulensis*)) (Holloway, Biggs, Marshall, & McGregor, 2013). *Eucalypt* spp. are therefore able to source water from multiple sources (i.e. surface water, soil moisture after flooding and rainfall, and/or groundwater). Their reliance and use on groundwater is therefore facultative (optional) (DSITIA, 2013). In addition most *Eucalypt* spp. rely on flooding for regeneration, not base flow (Holloway, Biggs, Marshall, & McGregor, 2013).

As long as surface flows and flooding do not vary significantly, indirect impacts to these potential GDEs are unlikely to be significant. In summary, none of the vegetation communities within the vicinity of the borefield are considered to be high priority GDEs as they are not entirely dependent on subsurface groundwater for their water requirements.

Groundwater monitoring

BCOPL operates a groundwater monitoring program that involves the quarterly monitoring of groundwater levels and field parameters such as pH and electrical conductivity, and six-monthly detailed laboratory analysis of groundwater quality.

Monitoring is undertaken at nine monitoring bores that cover bedrock and alluvial aquifers described above. BCOPL also shares groundwater monitoring data and responsibilities with surrounding mines such as Maules Creek and Tarrawonga. Groundwater monitoring sites associated with BCM are shown on Figure 6.3.



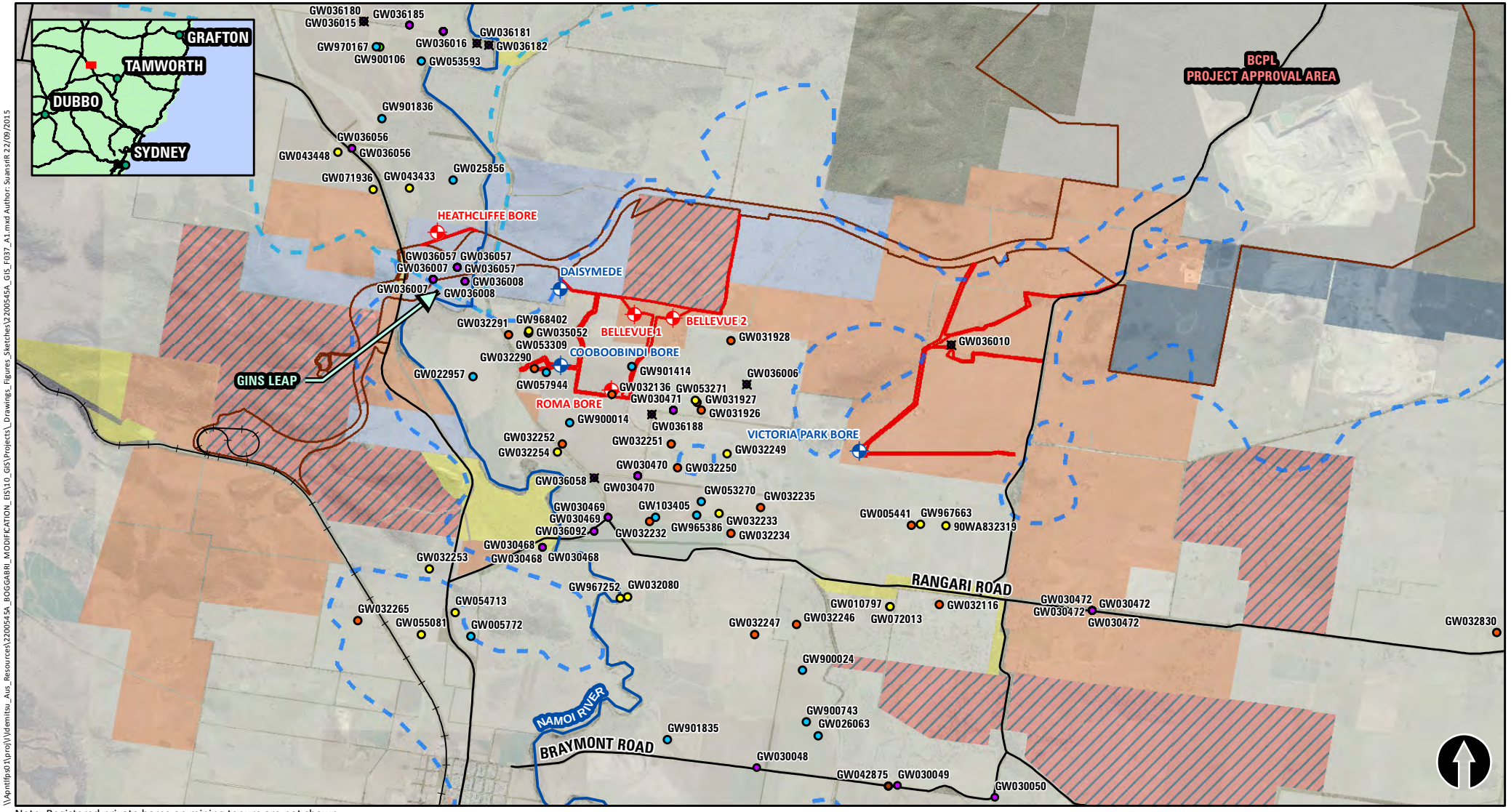
0 2 4 6 km

Contingency production bore
Production bore
Active mining area
BCOPL Project Approval Area
Maules Creek Project Approval Area
Tarrawonga Project Approval Area
MOD 5 study area

Gunnedah Coalfield (North) regional geology

Qx Alluvium
Rdc Digby Formation
Pb Brothers Subgroup
Pwf Watermark Formation
Pps Porcupine Formation
Pmx Maules Creek Formation
Plf Leard Formation
Pbr Boggabri Volcanics

Figure 6.1
Regional geology



Note: Registered private bores on mining tenure are not shown

0 2 4 6 km

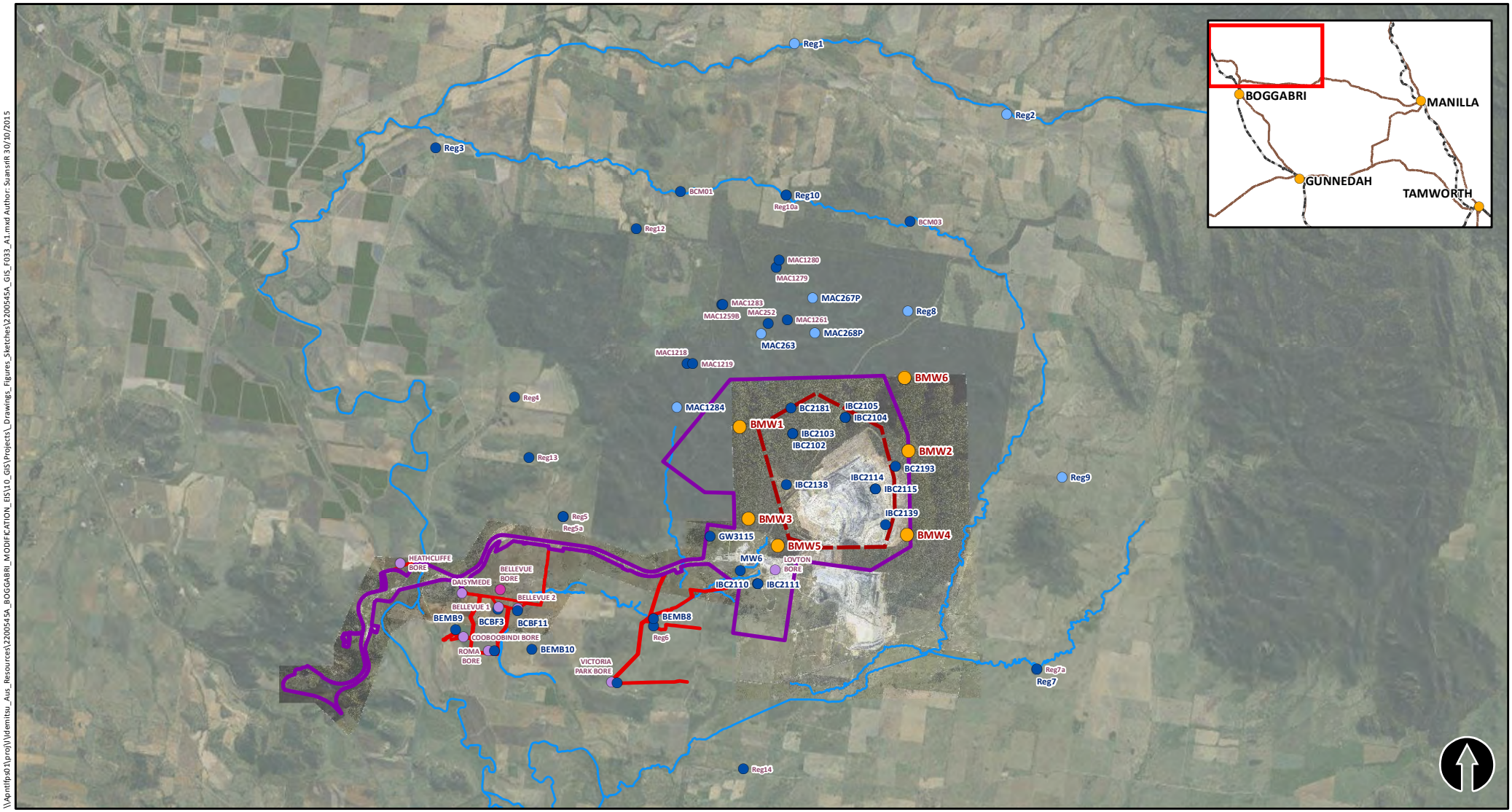
Bores
- Boggabri town water supply
- NSW Office of Water - Abandoned
- NSW Office of Water
- Stock/Domestic
- Unknown
- Irrigation
- Stock/Domestic/Irrigation
- Contingency production bore
- Production bore

- Roads
- Railway
- Major
- Boggabri Project Approval Area
- MOD 5 study area

Namoi Valley Groundwater Source
- Zone 4
- Zone 5

Property ownership
- Boggabri Coal Pty Ltd
- Mine jointly owned
- Rail JV
- Tarrawonga Whitehaven Coal
- Crown
- Private

Figure 6.2
Registered landholder works in borefield region



Source: Imagery from BCPL (2015) and ESRI

0 2 4 6 km

Proposed Boggabri monitoring bores
- Monitoring site

BTM Complex monitoring bores
- Monitoring bore
- VMP monitoring

BTM Complex production bores
- Domestic bore
- Production bore

- Mine disturbance area
- Project boundary
- MOD 5 study area
- Drainage line

Figure 6.3
Proposed & existing operational groundwater monitoring network

6.1.2 Assessment methodology

A three-dimensional groundwater model was prepared as part of the groundwater impact assessment (Parsons Brinckerhoff 2015b) to assess the potential impacts of the proposed modification to groundwater resources and users (refer to Appendix B). The model was verified using pump test data from the Cooboobindi test production bore (refer to Appendix B). A sensitivity analysis was also undertaken to assess the model predictions to variations in input parameters. The model assessed the following operational scenarios for the proposed bores:

- Base case (scenario 1A) – average weather conditions with normal water demands for the Daisymede (existing), Victoria Park and Cooboobindi production bores (proposed production bores) over a 17 year period (representing the anticipated life of the mine)
- Base case, extended dry weather (scenario 1B) – average weather conditions, except during years 11-14 of the 17 year bore operation period, during which time all mine water is required to come from the proposed borefield due to extended dry conditions (operation of: Daisymede (existing), Victoria Park and Cooboobindi production bores (proposed production bores))
- Contingency bore operation (scenarios 2A, 3A and 4A) – average weather conditions for 17 years, with use of a contingency bore for a period of three months instead of one of the proposed production during a simulated production bore failure
- Contingency bore operation, extended dry weather (scenarios 2B, 3B and 4B) – dry weather conditions during years 11-14, with use of a contingency bore for a period of 3 months during a production bore failure (this occurs during the dry period).

Table 6.1 provides pumping rates used for each scenario.

Table 6.1 Model scenarios (pumping rates in ML/day)

Scenario	1A	1B	2A	2B	3A	3B	4A	4B
Bore(1)	Base Case	Base Case dry weather	CB fails	CB fails, dry weather	VP bore fails	VP bore fails, dry weather	DM fails	DM fails, dry weather
Daisymede(2)	0.8	0.9	0.8	0.9	0.8	0.9		
Victoria Park(3)	1.9	3	1.9	3			1.9	3
Cooboobindi(3)	3	5.5			3.5	7	3	5.5
Roma(4)			3	5.5				
Heathcliffe(4)					1.4	1.5		
Bellevue BCBG8(4)							0.4	0.5
Bellevue BCBF10(4)							0.4	0.4

(1) DM = Daisymede; VP is Victoria Park, CB is Cooboobindi
(2) Existing production bore
(3) Proposed production bore
(4) Proposed contingency bore

6.1.3 Potential impacts

The groundwater model was based on continuous pumping from the active bores over the life of the mine. The groundwater model determined that the proposed modification has the potential to interfere with groundwater aquifers through drawdown of the alluvial aquifers in the vicinity of the production bores. These impacts include the following predicted drawdown impacts:

- For the A-scenarios the maximum drawdown can be observed at the end of pumping in year 17 (when mining ceases).
- For the B-scenarios the maximum drawdown can generally be observed at the end of year 13 (driest modelled period).
- For A-scenarios of average weather conditions, the number of active landholder bores, predicted to be more than two metres drawdown, is limited to two bores on the Cooboobindi and Roma properties (this does not include unused or abandoned bores and those owned by, or leased to BCOPL). This number would be expected to reduce further during wetter than average conditions.
- The B-scenarios, which are considered worst case scenarios due to increased pumping and dry conditions, six active landholder bores or wells would experience a drawdown between two and five metres (this does not include unused or abandoned bores and those owned by, or leased to BCOPL).
- Five shallow, active concrete lined landholder wells would potentially become dry or be subject to reduced supply under all scenarios. These groundwater works are located on the Brighton, Glenhope, Billabong and Nardeeneen properties and use very shallow groundwater that would be drawn down by less than two metres.

Predicted maximum drawdown contours for the 1A and 1B scenarios are shown on Figures 6.4 and 6.5. Drawdown due to extraction of groundwater is predicted to extend as far as the Namoi River for all scenarios, with drawdown of at least one metre occurring over a 3.8 km section of the river for Scenario 1A, and drawdown of over two metres occurring the same section under Scenario 1B. This will reduce the volume of groundwater discharging into Namoi River and increase river loss into the groundwater within the zone of influence, assuming that the river is hydraulically well-connected to the aquifer.

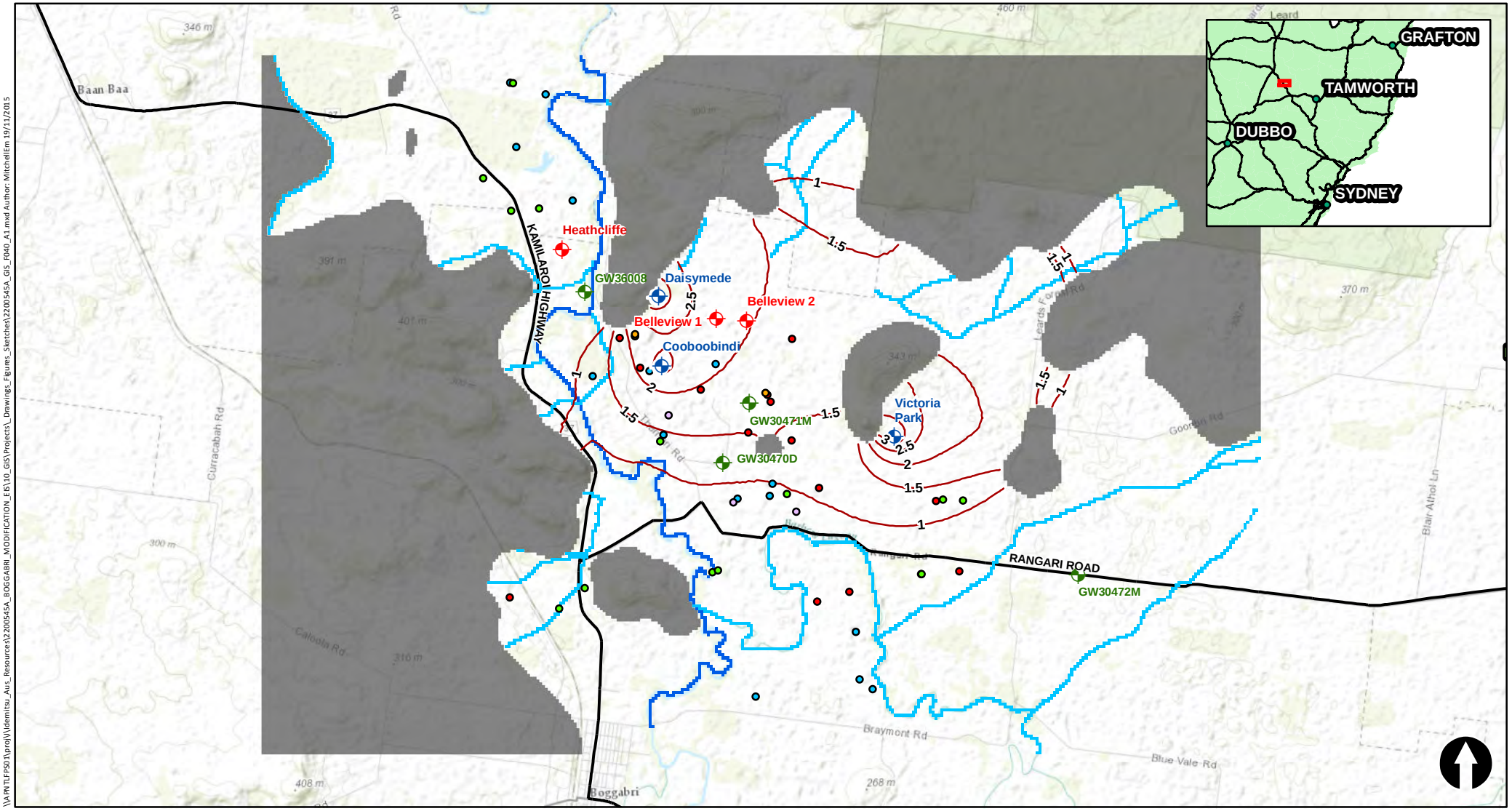
The Boggabri flow gauging station (419012) records from 1980 to 2014 provide an average yearly flow of 611 GL. The estimated loss of water from the Namoi River due to operation of the proposed borefield represents less than 0.2% of the average annual flow for Scenarios 1A and 1B as shown in Table 6.2. The 10th percentile annual river flow (132.5 GL) reflects an extended dry period. Under these conditions, the loss of river flow from pumping represents 0.6% to 0.9% of annual river flow.

Inflows to the river are predicted to gradually recover following completion of the mine (when it is expected that the borefield will cease operation), with 88.2% of the existing flow rate restored after 10 years for A Scenarios and 83.3% for B Scenarios. Furthermore, the assessed marginal reduction of inflows to the Namoi River is likely to be minimal under normal climatic conditions, as BCOPL dependence on extraction of river water will reduce when the operation of the borefield supplies water to BCM.

Table 6-2 Estimated loss of baseflow to the Namoi River as a result of borefield operation

Years of operation	Scenario 1A		Scenario 1B	
	Reduction in net flux to river (ML/y)	Percentage of average annual flow	Reduction in net flux to river (ML/y)	Percentage of average annual flow
1 to 10	860	0.14 %	860	0.14 %
11 to 14	965	0.16 %	1,133	0.19 %
15 to 17	975	0.16 %	769	0.13 %
18 to 27	232	0.04 %	314	0.05 %

Note: 18 to 27 years net river flux estimates are during recovery of groundwater levels following borefield pumps ceasing operations.



Source: Imagery from ESRI

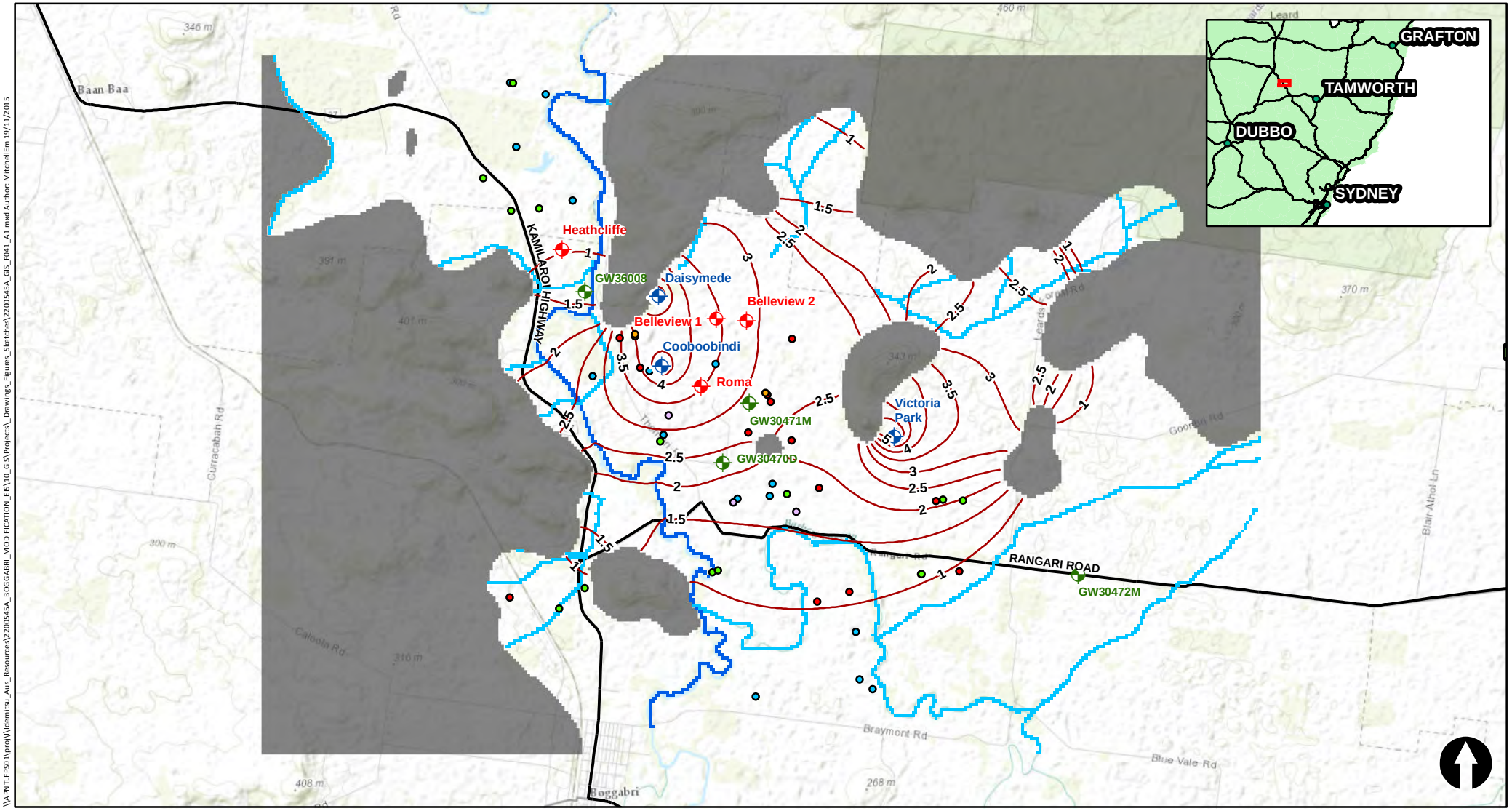
0 2 4 6 km

- Contingency production bore
- Production Bore
- NOW long term monitoring bores

Landholder Bores

- Group 1: Active Irrigation bores
- Group 2: Active Stock and Domestic bores
- Group 3: unknown
- Group 4: not used
- Group 5: license cancelled
- Max DD Contours 1A
- Main Roads
- Drain cells (creeks)
- River cells (Namoi River)
- No Flow Cells - Layers 1 & 2

Figure 6.4
Maximum drawdown contours - Scenario 1A



Source: Imagery from ESRI

0 2 4 6 km

- Contingency production bore; Roma
- Production Bore
- NOW long term monitoring bores

Landholder Bores

- Group 1: Active Irrigation bores
- Group 2: Active Stock and Domestic bores
- Group 3: unknown
- Group 4: not used
- Group 5: license cancelled
- Max DD Contours 1B
- Main Roads
- Drain cells (creeks)
- River cells (Namoi River)
- No Flow Cells - Layers 1 & 2

Figure 6.5
Maximum drawdown contours - Scenario 1B

Groundwater users who are impacted by the modification are subject to the 'make good' provisions of the Aquifer Interference Policy, which requires BCOPL to provide access to an equivalent supply of water through enhanced infrastructure or other means, such as deepening existing bores, funding extra pumping costs or constructing new pipelines or bores.

The groundwater users who may be subject to drawdown impacts use their bores for stock watering, with one bore being used intermittently for irrigation. As these users are be subject to the make good provisions of the aquifer interference policy and will be provided with alternative water supply if drawdown impacts occur, no impacts to their operations are anticipated.

6.1.3.1 Cumulative impacts

The operation of the borefield in conjunction with mining operations at the nearby Boggabri, Tarrawonga and Maules Creek mines has the potential to cause cumulative drawdown of groundwater.

Cumulative drawdown impact assessments have previously been undertaken for these operations by Heritage Computing (2012) and AGE (2010). These studies show drawdown extending into the alluvium at the base of the foothills east to northeast of the borefield (refer to Appendix B for further details).

Worst case cumulative drawdown impacts predicted by AGE (2011) show one metre of groundwater drawdown extending to within 500 m of the Victoria Park, Belleview and Daisymede bores. These production bores may be affected by minor drawdown from mining operations, although this is not expected to affect water availability for the proposed borefield.

The proposed borefield will contribute to regional cumulative groundwater drawdown associated with the adjacent mining operations. This is estimated to be an additional groundwater drawdown of 1-2 metres under A Scenarios and 1-3 metres under B Scenarios in the alluvium to the east and northeast of the borefield where mine cumulative drawdown is experienced (refer to Appendix B for further details).

6.1.4 Mitigation measures

Groundwater monitoring

BCOPL will operate an expanded groundwater monitoring program designed to monitor the effects of the proposed borefield. This will be developed in consultation with DPI Water as part of revising the BCM Groundwater Management Plan (BCOPL, 2014c), should the proposed borefield be approved. The expanded groundwater monitoring program will measure groundwater levels in the proposed borefield area and identify any drawdown impacts.

The data collected from the monitoring program will be used to validate modelling predictions, assess consistency with the Aquifer Interference Policy and be used to determine if water supply from landholder bores has been adversely affected.

If during operation, the borefield indicates possible impacts to the groundwater resource, an independent review of the impact will be undertaken. This will include an investigation of aquifer groundwater level and quality trends in conjunction with rainfall data and BCOPL/neighbouring landholder pumping activities. Where neighbouring landholders show concern that their water supply maybe adversely affected by the operation of the borefield then the review will also assess the condition of the landholders groundwater works and historic usage.

If impacts to a groundwater resource are identified then the following mitigation measures will be developed.

- BCOPL would revise the Groundwater Management Plan to reduce the identified impact in consultation and agreement with NOW (or relevant regulator). This may include changes to pumping regime of the BCOPL borefield and modification to the groundwater monitoring program.
- If required, BCOPL would provide a compensatory water supply to any landowner whose water supply is shown to be adversely and directly impacted by operation of the borefield.

6.2 Surface water

6.2.1 Existing environment

BCM is largely contained within the catchment of an unnamed ephemeral waterway, locally called 'Nagero' Creek. A small area to the south of the MIA is located within the catchment of Bollol Creek. 'Nagero' Creek and Bollol Creek are both small tributaries of the Namoi River, which is part of the Barwon-Darling River system.

The Namoi River catchment is bounded by the Great Dividing Range in the east, the Liverpool Ranges and Warrumbungle Ranges in the south, and the Nandewar Ranges and Mount Kaputar to the north. Major tributaries of the Namoi River include Coxs Creek, Mooki River, Peel River, Cockburn River, Manilla River and Macdonald River, all of which join the Namoi River upstream of Boggabri.

The Namoi River catchment has an area of approximately 42,000 km^2. The catchment extends over 350 km in an east-west direction between the Great Dividing Range and the Barwon River. The Namoi River catchment area to Boggabri is approximately 22,600 km^2.

As shown on Figure 3.1, the nearest watercourse to any works associated with the proposed modification is the Namoi River, located approximately 700 m to the south of the Roma bore access road. The Namoi Valley is subject to regular flooding. The existing mining area and MIA are not located within the floodplain. However, parts of the proposed borefield will be, as shown on Figure 3.1.

A surface water management system is implemented throughout the BCM to manage surface water flows and contain water that has come in contact with disturbed areas and coal. The surface water management system is guided by a Water Management Plan that incorporates Surface and Groundwater Management Plans. The proposed modification occurs outside the existing BCM project area and outside the area of the existing surface water management system.

6.2.2 Potential impacts

Establishment of the borefield and associated infrastructure such as power lines, pipelines and access tracks has the potential to result in erosion and sedimentation impacts to local watercourses. During the establishment phase, erosion and sediment controls will be implemented in accordance with the existing approved Construction Environmental Management Plan (CEMP) (BCOPL, 2013b). The proposed modification is not expected to have any impacts on flood behaviour on the flood plain areas shown on Figure 3.1 as it would not result in any structures or landforms being constructed that could impede flood flows. The bores and access roads are at ground level, the pipelines are only 280mm high and ancillary power lines do not have the potential to affect flood flows due to their small footprint.

Flood waters may impact the infrastructure constructed on the floodplain through inundation, restricting access to the bores for maintenance, and flood flows, which could cause direct damage to infrastructure. During a flood event, the borefield would not be expected to be operating and any damage to the borefield infrastructure would be unlikely to result in secondary flooding from damage to the groundwater distribution pipes.

6.2.3 Proposed management measures

During the operational phase, surface water impacts will be mitigated through the implementation of the existing approved WMP (BCOPL, 2014b) and SWMP (BCOPL, 2014a). The WMP will be revised to include the works associated with the proposed modification.

During the establishment phase, erosion and sediment controls will be implemented in accordance with the existing approved CEMP (BCOPL, 2013b).

6.3 Biodiversity

A detailed Biodiversity Assessment was prepared for the proposed modification and is included as Appendix C. This section provides a summary of that assessment.

The assessment included significance assessments for threatened species, populations or communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) or *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* that were known or predicted to occur within a 10 km radius of the modification area, with a moderate to high likelihood of occurring in the area, based on suitable habitat and that were likely to be impacted by the proposed modification.

6.3.1 Existing environment

BCM is located in the Brigalow Belt South bioregion. This region covers an area of approximately 27,196,933 ha encompassing the towns of Baradine, Binnaway, Coonabarabran, Dubbo, Gunnedah, Merriwa, Moree and Narrabri (NSW National Parks and Wildlife Service, 2003).

The biodiversity values of the project area have been extensively documented. Ecological surveys were completed within the locality for the following studies:

- Boggabri Coal – Biodiversity Monitoring, February 2006 – August 2012 (Parsons Brinckerhoff, 2011a).
- Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff, 2010a).
- Preliminary vegetation mapping and survey report for Boggabri Coal lease (Parsons Brinckerhoff, 2009).
- Flora and Fauna Summary of the Boggabri Coal Project (Parsons Brinckerhoff, 2005).
- Results of Fauna survey work undertaken by the NSW National Parks and Wildlife Service within Leard State Forest (Pennay, 2001).
- Report on the botany, wildlife and ecology of the Leard State Forest. Draft Environmental Impact Statement for Amax-BHP Joint Venture Boggabri Coal Project (James B. Croft and Associates, 1983).

Vegetation communities that occur within the proposed borefield area are shown on Figure 6.6. Biodiversity values including the flora, fauna and vegetation communities that occur within the BCM area are described in detail in Appendix C.

MAP A

MAP B

MAP C

HEATHCLIFFE (HC01)

Q2

NAMOI RIVER

DAISYMEDE (DM1)

BELLEVIEW 1 (BCBF8)

Q14

BELLEVIEW 2 (BCBF10)

Q15

Q11

Q12

COOBOOBINDI

Q13

Q18

THERRIBRI ROAD

Q19

ROMA

Q20

0 0.25 0.5 0.75 km

Q8

Q9

LEARD FOREST ROAD

Q10

GOONBRI ROAD

VICTORIA PARK (VP02)

\\APNTLFPS01\proj\\Idemitsu_Aus_Resources\2200545A_BOGGABRI_MODIFICATION_EIS\10_GIS\Projects_Drawings_Figures_Sketches\2200545A_GIS_F031_A3.mxd Author: MitchellEm 19/11/2015

- Hollow-bearing tree
- Quadrat
- Groundwater bores
- Road
- Drainage
- Rail line
- MOD 5 study area
- Boggabri Project Approval Area
- Derived grassland
- Exotic grassland
- Pilliga Box - Poplar Box - White Cypress Pine grassy open woodland
- Plains Grassland
- River Red Gum riparian woodlands and forests (Low Condition) (FM Act)
- River Red Gum riparian woodlands and forests (Moderate Condition) (FM Act)
- Weeping Myall Woodland (TSC Act & EPBC Act)

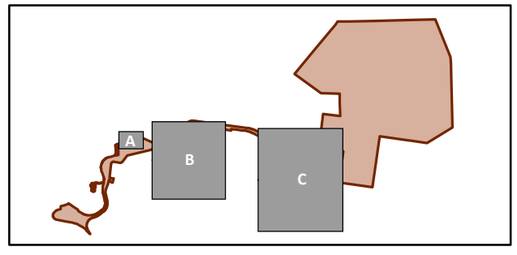


Figure 6.6
Vegetation communities

6.3.2 Potential impacts

6.3.2.1 Vegetation impacts

Clearing of native vegetation is listed as a key threatening process (KTP) under both the NSW TSC Act and the Commonwealth EPBC Act. The proposed modification will require additional impacts to native vegetation, beyond that previously approved under PA 09_0182.

This will involve the removal 18.8 ha of native vegetation and approximately 1.4 ha of communities listed as endangered ecological communities (EECs) under the TSC Act, EPBC Act and *Fisheries Management Act 1994* (FM Act)(refer to Table 6.3). An area of 8.6 ha of predominately disturbed and exotic vegetation will be impacted within the biodiversity offsets as described in the BCM Biodiversity Offsets Strategy. These vegetation communities are shown on Figure 6.6.

Table 6.3 Potential loss of native vegetation within the proposed modification area

Vegetation community	TSC Act[1]	EPBC Act[2]	FM Act[3]	Total modification area (ha)[4]		Area within offsets (ha)[7]	
				Ground Disturbance (ha)[5]	Above Ground Water pipeline (ha)[6]	Ground Disturbance (ha)[5]	Above Ground Water pipeline (ha)[6]
Exotic grassland with scattered trees	–	-	-	3.8	46.6	-	1.0
Derived native grassland[8]	-	-	-	-	11.2	-	2.9
Plains Grassland	-	-	-	-	0.1	-	0.1
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	-	-	0.2	5.9	-	3.4
Weeping Myall Woodland[9]	E	E	-	-	0.1	-	-
River Red Gum riparian woodlands and forests	-	-	E	-	1.3	-	1.3
Total clearing for modification				**4.0**	**65.2**	**-**	**8.6**
Total Native Vegetation clearing for modification				**0.2**	**18.6**	**-**	**7.7**
Total FM Act EEC clearing for modification				**-**	**1.4**	**-**	**1.3**
Total TSC Act EEC clearing for modification				**-**	**0.1**	**-**	**-**
Total EPBC Act EEC clearing for modification				**-**	**0.1**	**-**	**-**

(1) TSC Act, E = Endangered.
(2) EPBC Act, E = Endangered, CE = Critically Endangered.
(3) FM Act, E = Endangered.
(4) For the purpose of this report, Total modification area (ha) = all sites assessed within this report that have not previously been assessed.
(5) Disturbance from underground pipeline and installation of power lines and associated infrastructure
(6) Area includes where the pipeline will be placed above ground and no ground disturbance will take place.
(7) For the purpose of this report, Area within offsets = Area (ha) within Namoi River Offsets associated with the proposed modification.
(8) This community generally occurred as native grassland derived from the Pilliga Box – Poplar Box White Cyperus Pine grassy open forest.
(9) This community meets both the EPBC Act criteria and the TSC Act criteria for Weeping Myall Woodlands.

Vegetation impacts associated with the proposed modification will be limited to the disturbance and clearing of groundcover vegetation only. No hollow bearing trees and or canopy cover clearing will be required as part of the modification. The native groundcover vegetation to be disturbed and/or removed currently occurs within highly disturbed agricultural land surrounded by exotic vegetation.

The proposed modification will involve the disturbance and/or removal of groundcover vegetation only and have a minimal impact on fauna habitats. The impact assessments undertaken for the Biodiversity Assessment (refer to Appendix C) confirm that the disturbance and/or removal of 18.9 ha of native understorey vegetation, which is predominantly comprised of derived native grassland, is unlikely to have a significant impact upon any threatened species, populations or communities.

6.3.2.2 Impacts to offset areas

BCOPL has developed a Biodiversity Offset Strategy for the Boggabri Coal Project (Boggabri EA Offset Strategy) (Parsons Brinckerhoff 2010b, 2011b).

The proposed modification will impact 7.7 ha of native understorey vegetation within the offset areas described in the Biodiversity Offset Strategy. These areas will require an alternative replacement. The extent of the proposed adjustments to the offsets is presented in Table 6.4.

Table 6.4 Vegetation impacts within existing offsets

Vegetation community	TSC Act listing[1]	EPBC Act listing[2]	FM Act listing[3]	Area within offsets (ha)[4]
Exotic grassland with scattered trees	–	–	–	1.0
Plains Grassland	E	CE	-	0.1
Derived Native Grassland[5]	–	–	–	2.9
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	–	–	3.4
Weeping Myall Woodland[1,2]	E	E	–	–
River Red Gum riparian woodlands and forests[3]	–	–	E	1.3
Total area of modification within offsets				**8.7**
Total Native Vegetation within offsets				**7.7**
Total area of FM Act CEEC within modification offsets				**1.3**
Total area of TSC Act CEEC within modification offsets				**-**
Total area of EPBC Act CEEC within modification offsets				**-**

(1) TSC Act, E = Endangered.
(2) EPBC Act, E = Endangered, CE = Endangered.
(3) FM Act, E = Endangered.
(4) For the purpose of this report, Area within offsets = Total modification area (ha) within Namoi River Offsets associated with the proposed modification.
(5) Represents Pilliga Box – Poplar box White Cypress Pine grassy open forest derived native grassland.

6.3.2.3 Other impacts

Fauna injury or death could occur as a result of the proposed activities during the construction phase, particularly when vegetation and habitats are being cleared. Vehicle strike during construction, operation and maintenance works is not likely to significantly increase as a result of the proposed modification. Consequently the impact is assessed as low.

The construction phase of the proposed modification has the potential to disperse weeds into areas where weed species do not currently occur. The most likely causes of weed dispersal will include earthworks, movement of soil and attachment of seed and other propagules to vehicles and machinery. This may in turn reduce the habitat quality of the sites for threatened species. Dispersal of weeds during the operation phase will relate generally to maintenance activities.

The profuse invasion of exotic perennial grasses, such as *Chloris gayana* and *Lolium perenne* was recorded within the areas to be affected by the proposed modification. This is recognised as a Key Threatening Process (KTP) under the TSC Act. The proposed modification has the potential to result in further spread of these species.

6.3.2.4 Summary of impacts

KTP's are listed under Schedule 3 of the NSW TSC Act and Commonwealth EPBC Act. A process is defined as a KTP if it threatens or may threaten the survival, abundance, or evolutionary development of a native species or ecological community. A process can be listed as a KTP if it could cause a native species or ecological community to become eligible for adding to a threatened list (other than conservation dependant), or cause an already listed threatened species or community to become more endangered, or if it adversely affects two or more listed threatened species or ecological communities.

The proposed modification will result in the loss of native vegetation and will thus contribute to one KTP - clearing of native vegetation and land clearance. The proposed modification is not likely to significantly increase the introduction or spread of exotic weed species, if undertaken in accordance with mitigation measures discussed in Section 6.3.3.

6.3.3 Mitigation measures

6.3.3.1 Biodiversity management plan

Impacts associated with biodiversity will be managed through the implementation of the BCOPL Biodiversity Management Plan (BMP) (BCOPL, 2012). These are detailed in Appendix C.

6.3.3.2 Proposed biodiversity offsets

BCOPL is currently refining its BOS in accordance with Condition 43 of PA 09_0182, in consultation with the DoE. The final offset package including refined vegetation mapping resulting from the proposed modification, independent field validation and baseline ecological monitoring will be incorporated into a revised BOS and Biodiversity Management Plan.

BCOPL is committed to the approved BOS development in accordance with the consolidated PA 09_0182. This commitment includes revisions to the BOS resulting from the refined vegetation mapping identified after the development of the BOS.

Offsets will be provided for the proposed modification in accordance with the quantum (ratio) and principles of the existing BOS. The BOS will be amended to ensure the lands previously identified within the Namoi River Offset Area and subsequently excised for the proposed new project area will be replaced by an

alternative offset. The quantum of this transfer will comprise up to 7.7 ha of native vegetation and threatened species habitat.

The BOS is currently undergoing revisions following the implementation of the regional offset strategy and the identification and provision of an additional 1,103 ha residual offset requirements (as per Condition 39 of PA 09_0182).

The relatively minor changes to the Namoi River Offset Area resulting from the proposed modification and associated refined vegetation mapping will be incorporated into the final amended BOS and BMP.

A summary of the total offset requirements for the new impacts associated with the proposed modification is provided below in Table 6.5.

Table 6.5 Offset requirements for impacts associated within the modification

Vegetation community	TSC Act listing[1]	EPBC Act listing[2]	FM Act [3]	Area not previously assessed (ha)[4]	Offsets requirement (ha)[5]
Derived native grassland[6]	-	-	-	11.2	62.7
Plains Grassland	E	CE	-	0.1	0.6
Pilliga Box – Poplar Box White Cypress Pine grassy open forest	–	-	-	6.1	34.2
Weeping Myall Woodland	E	E	-	0.1	0.6
River Red Gum riparian woodlands and forests	-	-	E	1.3	7.3
Total Native Vegetation clearing for modification				**18.8**	**105.4**
Total FM Act EEC clearing for modification				**1.3**	**7.3**
Total TSC Act EEC clearing for modification				**0.1**	**0.6**
Total EPBC Act EEC clearing for modification				**0.1**	**0.6**

(1) TSC Act, E = Endangered.
(2) EPBC Act, CE = Critically Endangered.
(3) FM Act, E = Endangered.
(4) For the purpose of this report, Area not previously assessed (ha) = all sites for which new impacts to biodiversity has not yet been assessed within the existing EA (PA 09_0182) (impact assessments in Appendix E of Appendix C).
(5) For the purpose of this report, Offset requirements = Application of the final ratio of 5.6:1 specified in the approved BOS to all Area not previously assessed.
(6) The derived grassland generally occurred as native grassland derived from the Pilliga Box – Poplar Box White Cyperus Pine grassy open forest.

The proposed additional offset for the modification impacts will therefore incorporate a minimum of 105.8 ha of native understorey vegetation and threatened species habitat.

6.4 Aboriginal and non-Aboriginal heritage

A Cultural Heritage Assessment for the proposed modification was undertaken by Insite Heritage Pty Ltd and is provided in Appendix D. This section provides a summary of that assessment.

The assessment was prepared in consultation with representatives of the BCOPL Registered Aboriginal Parties (RAPs), who participated in field surveys and were consulted regarding the findings of the assessment and its recommendations.

BCOPL has developed a comprehensive Cultural Heritage Management Plan (CHMP) (BCOPL, 2013a) to manage heritage matters within its approved project area. The Cultural Heritage Assessment was based on field inspections undertaken in accordance with the CHMP, as part of the due diligence process required for all potentially ground disturbing works. Where possible, the location of any proposed activities was adjusted to avoid impacts to identified archaeological or cultural heritage sites. The CHMP includes measures for the excavation, recording and retrieval of sites and artefacts for which impacts cannot be avoided.

6.4.1 Potential impacts

The Cultural Heritage Assessment identified the following potential impacts associated with the proposed modification, which will be managed in accordance with the CHMP:

- **Roma bore and infrastructure** – one open site (containing eight artefacts) in a disturbed area and an area of potential archaeological deposit (PAD) may be disturbed during ground disturbing activities at this site.
- **Cooboobindi bore and infrastructure** – one site containing five artefacts located on the access road to this site and two artefacts located in an adjacent ploughed field. Disturbance of these artefacts may be required during ground disturbing activities.
- **Victoria Park bore ancillary infrastructure** – installation of ancillary infrastructure at this site will disturb a site consisting of a scatter of seven artefacts.
- **Bellevue bore ancillary infrastructure –** installation of ancillary infrastructure at this site will disturb a site consisting of 100 scattered artefacts in an area heavily disturbed by ploughing. Another three isolated artefacts are located in an adjacent paddock and access track at this site, but impacts to these areas can be avoided.

Impacts to all identified sites will be avoided as far as possible during ground disturbing activities. Measures to manage impacts will be implemented as specified in the CHMP. Where impacts cannot be avoided, the artefacts will be salvaged in consultation with the RAPs and procedures specified in the CHMP.

Aboriginal heritage sites identified as part of the Cultural Heritage Assessment and previous assessments are shown on Figure 6.7. This figure shows:

- In-situ sites – which still remain in place and have not been salvaged or impacted
- Changed sites – which have been salvaged or impacted in accordance with PA 09_0182 or previous approvals.

Consultation with the RAPs identified no specific sites of cultural heritage significance associated with the proposed modification. A concern was expressed by one RAP group regarding the potential for the proposed activities to impact on megafauna remains. This concern is addressed in detail in Appendix D.

MAP A

MAP B

MAP C

HEATHCLIFFE (HC01)

NAMOI RIVER

NV76

NV22

DAISYMEDE (DM1)

PL1/14

PL4/14

BELLEVIEW 1 (BCBF8)

BELLEVIEW 2 (BCBF10)

pl5/14

PL3/14

PL2/14

PL8/14

PL9/14

COOBOOBINDI

THERRIBRI ROAD

ROMA

Velyama NV74

IA4

Velyama IA3

NV 73

NV 72

Velyama AS6

NV 71

BCHR7

NV 66

NV 67

NV 68

NV 64

NV 69

NV 70

BCHR6

NV 78

NV 77

BCHR5

BCHR4

BCHR3

BCHR1

NV 53

NV 52

BCHR2

NV79

NV24

NV58

NV59

NV57

NV60

NV61

NV54

NV63

NV55

NV51

NV56

PL6/14

BCD1

LEARD FOREST ROAD

GOONBRI ROAD

VICTORIA PARK (VP02)

0 0.25 0.5 0.75 km

Heritage site - insitu
Heritage site - changed
Groundwater bores
Tank farm
Proposed above ground power line
Proposed underground power line
Proposed above ground pipeline
Proposed underground pipeline
Access road
Road
Drainage
Existing railway
MOD 5 study area
Boggabri Project Approval Area

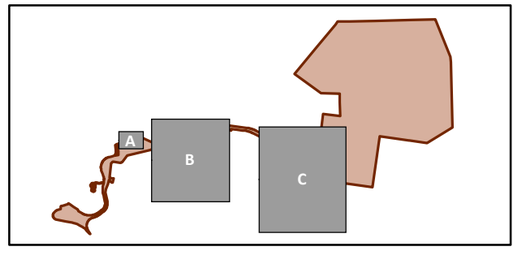


Figure 6.7
Heritage sites

The term megafauna relates to animals that evolved following the extinction of dinosaurs and exist in present day species such as the Red Kangaroo, Saltwater Crocodile and Emu. This group consisted of mammals, birds and reptiles with a body mass of over 40 kilograms. The extinction of a number of Australian megafauna species occurred prior to the last glacial maximum period (commencing approximately 26,500 years ago). Two sites containing evidence of archaeological deposits and megafauna remains have been found within north-western NSW. These sites (Lime Springs and Trinkey) are located approximately 50 km to the south-west of Gunnedah, NSW.

The landscape contexts associated with megafauna finds are not consistent with the area of the proposed modification. Megafauna sites are generally associated with cave sites and wet areas such as the base of springs or Paleo-lakes. It was determined that, as the disturbance activities associated with the proposed modification are generally minimal in nature, any impacts to sites potentially containing megafauna would be unlikely. If any megafauna remains are found during activities associated with the proposed modification, procedures for unexpected finds of heritage and archaeological items will be implemented as described in the CHMP.

6.4.2 Proposed mitigation activities

BCOPL will revise its CHMP in consultation with the RAPs and the OEH to include any new project areas and activities associated with the proposed modification.

Sites impacted by the proposed modification will be salvaged prior to disturbance in accordance with the salvage procedure outlined in Section 5 of BCOPL's CHMP.

6.5 Noise

6.5.1 Receiving environment

Noise is managed by BCOPL in accordance with its Noise Management Plan (BCOPL, 2015), which covers all operational activities with the potential to generate noise at the mine.

BCM is located in a quiet rural area, generally away from major roads or other major industry. The key noise generating activities occurring in the surrounding area are associated with the mine and surrounding mines.

Monitoring demonstrated that background noise levels in the surrounding area regularly fall to 30 dBA or below.

Receptors sensitive to noise impacts from bore establishment and operational activities associated with the BCM were identified in the 2010 EA. A background noise level of 30 dBA was adopted for all receivers and time periods in accordance with the NSW Industrial Noise Policy (EPA, 2000).

The nearest potentially sensitive receivers to the proposed bores and associated infrastructure are shown on Figure 2.2 and are summarised in Table 6.6.

Table 6.6 Nearest potentially sensitive receivers (1)

Name	Ownership	Status	Use	Distance to nearest modification activity
Victoria Park	BCOPL	Occupied	Temporary residence	50m from bore access track
Heathcliffe	BCOPL	Unoccupied	n/a	50 m from bore access road
Merriown	BCOPL	Occupied	Residential	250m from bore water pipeline
Bellview	BCOPL	Unoccupied	n/a	250m from production bore
Cooboobindi north	Private	Unoccupied	n/a	500m from bore access road
Daisymede	BCOPL	Unoccupied	n/a	500 m from bore access, power and water pipeline
'Nagero'	BCOPL	BCOPL head office	Commercial	N/A
Cooboobindi south	Private	Occupied	Residential	600m from bore access, power and water pipeline
Roma	Private	Occupied	Residential	1km from production bore
Glenhope	Private	Occupied	Residential	1.2km from production bore
Billabong	Private	Occupied	Residential	1.2km from production bore
Wilberoi East	Private	Occupied	Residential	1.2km from production bore
Jerralong Cottage	BCOPL	Unoccupied	n/a	2km from bore access road
Jerralong	BCOPL	Occupied	Residential	2.2 km from bore access road
The Rock	BCOPL	Occupied	Residential	2.2km from bore access road
Thuin	Whitehaven Coal	Unoccupied	Historic site	3.5km from bore water pipeline
Brighton	Private	Unoccupied	n/a	2.5km from production bore

(1) Privately owned and occupied residences are highlighted in light blue as it is considered these are the only nearby receivers with potential to be affected by the proposed modification. Other receivers are either owned by BCOPL or unoccupied.

6.5.2 Potential impacts

The proposed modification includes the operation of groundwater production bores and associated infrastructure on adjacent properties to supplement the mine's water supply.

As shown in Table 6.6, the nearest sensitive receivers that may be affected by noise generated by the proposed modification is a residence located on the Cooboobindi south property. This property contains a residence that is located up to 600 m from proposed bore infrastructure. Noise associated with this infrastructure will consist of:

Construction noise:

- Installation of ancillary infrastructure such as power lines, pipelines and access tracks will occur progressively along each infrastructure corridor. Noise generating activities associated with these works will also occur intermittently and will aim to occur for no longer than one day at any one location.
- Construction of the tank farm will occur over a period of up to three weeks and will involve the intermittent use of construction machinery and hand tools.

Operational noise:

- The production bores are not expected to generate any operational noise as they will be powered by submersible pumps installed in the bore, under the water table. Audible above ground noise will not be expected to be emitted by the bores.
- No operational noise is expected to be generated by the ancillary bore infrastructure. Some noise generation may occur during periodic maintenance activities, although this will be brief and will occur infrequently.
- The operation of the water transfer pump within the tank farm has the potential to generate operational noise impacts. A quantitative assessment of these impacts has been undertaken as is discussed in the following section.

Operational noise assessment – water transfer pump

Under PA 09_0182 and the EPL applicable to BCM (EPL 12407), operational noise from the site should not exceed 35 dB(A) $L_{Aeq\ (15\ min)}$ at any privately owned residence, unless BCOPL has established an agreement with the owner of that residence regarding noise impacts.

Figure 6.8 shows the predicted operational noise levels for the water transfer pump, based on a sound pressure level of 85 dB(A) L_{Aeq} (at one metre distance) supplied by the pump manufacturer. Figure 6.8 utilised the following equation (Equation 0.1) to predict worst case noise levels that do not take into account noise attenuation from receiver buildings, vegetation or surrounding terrain. The equation includes a -8 dB(A) correction for the loss of acoustic energy from hemispherical radiation from noise sources:

$$SPL\ received = SWL\ source - 20\log(r) - 8$$

Where: SPL received = construction noise level at the receiver
SWL source = sound power level for construction plant

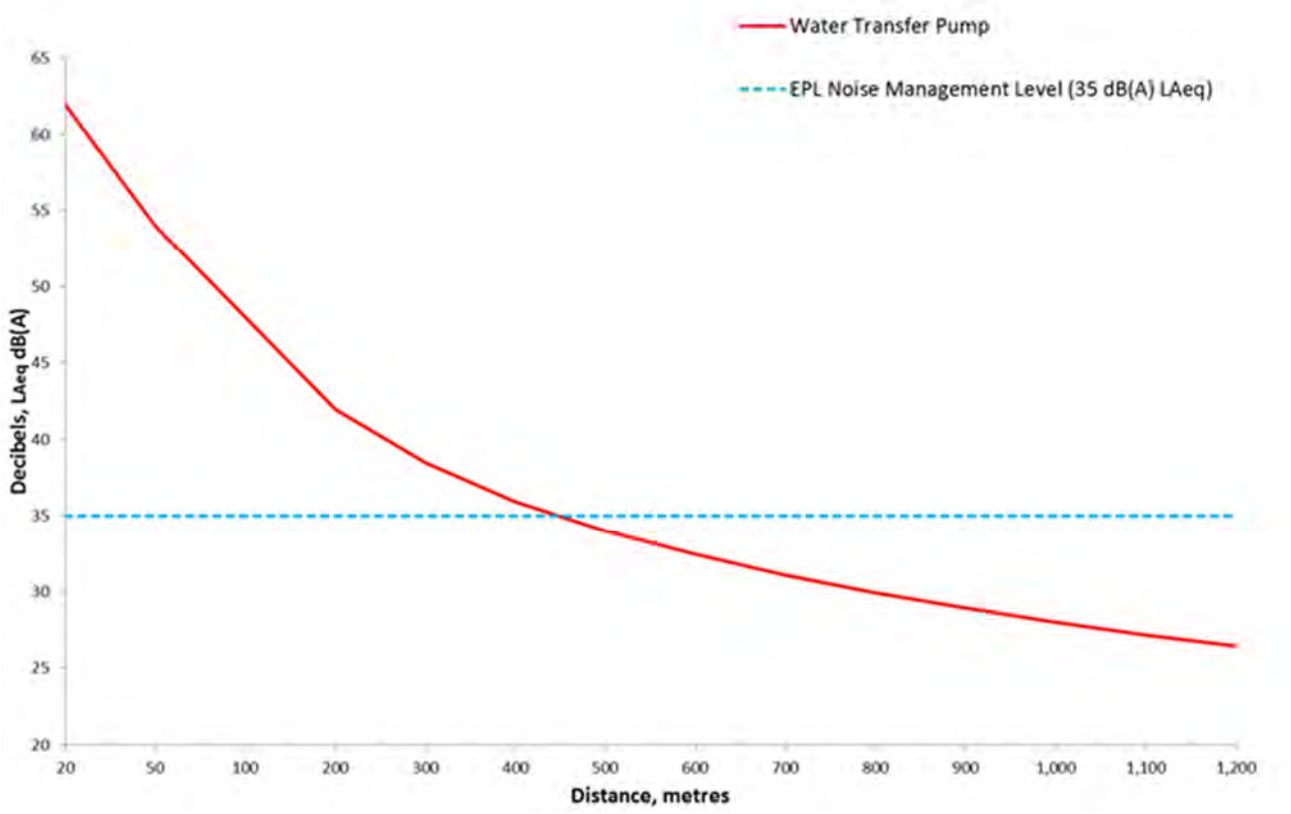


Figure 6.8 Estimated noise levels at increasing separation distance from the pump

In a worst case scenario, compliance with the EPL noise management level of 35 dB(A) L_{Aeq} will be achieved at approximately 450 m. Given the estimated distance of 1500 m to the nearest identified sensitive receiver, operational noise from the proposed water transfer pump is not expected to cause any noise impacts or exceedance of the operational noise limits that apply to BCM.

BCOPL undertake routine noise monitoring at the nearest sensitive receivers as part of its NMP. If an increase in noise did occur at a sensitive receiver, BCOPL's noise management system will identify and manage it to avoid or mitigate impacts.

6.5.3 Mitigation measures

The following measures will be implemented to ensure any noise issues associated with the proposed modification are mitigated:

- Construction and operational activities associated with the proposed modification will be undertaken in accordance with BCOPL's established Noise Management Plan (BCOPL, 2015) and the CEMP (BCOPL, 2013b).
- Construction activities will be undertaken during standard construction hours:
  - Monday to Friday – 7.00am to 6.00pm
  - Saturdays – 8.00am to 1.00pm
  - Sundays and Public Holidays – none.

6.6 Air quality

6.6.1 Existing environment

A detailed air quality assessment was prepared for BCM as part of the 2010 EA. An air quality dispersion model was developed for this assessment based on the *Approved Methods for the modelling and Assessment of Air Pollutants in New South Wales* (DEC, 2005). This assessment determined that construction and operation of the overall mine may cause air quality impacts to two privately-owned receivers. These residences have since been acquired by BCOPL or adjoining mining operators.

BCOPL has developed an Air Quality and Greenhouse Gas Management Plan (AQGHGMP) (BCOPL, 2013c) to manage its air quality impacts, as specified under PA 08_0182. The AQGHGMP identifies the nearest sensitive air quality receivers to the mine, activities that have the potential to impact on air quality at these receivers and actions required to monitor and manage particulate and greenhouse gas emissions from the mine. Sensitive receivers relevant to the proposed modification are described in Section 6.5.1 of this EA.

Summer months at the BCM are mostly hot and winter periods are relatively short with frequent frosts. January is typically the hottest month, reaching an average maximum temperature of 34°C. July is typically the coolest month, reaching an average maximum temperature of 16.9°C.

Temperature inversions are most common in winter months, forming in later afternoon and reaching maximum resistance at dawn. Summer months have higher mean rainfall (approx. 80 mm) compared to winter months (50 mm). There is potential for poor dispersion during inversion conditions.

The mine generally receives wind from the south-east in summer and the north-west in winter. Winds in autumn and spring months are more variable. Autumn is typically the windiest season. Air quality risk is heightened during high winds that could affect sensitive receptors in the South and South East.

6.6.2 Potential impacts

The proposed modification has minimum potential to generate air quality impacts during the construction phase from the generation of dust from disturbed areas and exhaust emissions from vehicles and equipment.

The construction activities associated with the proposed modification may cause a relatively low level of disturbance and intensity when compared to adjacent mining, coal processing and transport operations. Due to this and the distance to the nearest sensitive receiver (refer to Section 6.5.1) the potential for construction activities associated with the proposed modification is considered negligible.

6.6.3 Mitigation measures

The following measures will be implemented to ensure any air quality impacts associated with the proposed modification are mitigated:

- bore establishment and operational activities associated with the proposed modification will be undertaken in accordance with BCOPL's established AQGHGMP (BCOPL, 2013c) and the CEMP (BCOPL, 2013b)

6.7 Other impacts

The 2010 EA provided a comprehensive assessment of the socio-economic and environmental impacts of the BCM. Following the 2010 EA, subsequent EAs were prepared for modifications of PA 09_0182 as follows:

- Modification 2 – Environmental Assessment: Modification to Development Consent for Boggabri Coal Mine August 2011 (Hansen Bailey, 2011).
- Modification 3 – Boggabri Coal Mine Project Approval Modification Environmental Assessment October 2013 (Hansen Bailey, 2013).
- Modification 4 – Boggabri Coal Mine – Project Approval Modification Environmental Assessment (MOD 4) 16 December 2014 (Parsons Brinckerhoff, 2014)
- Note – Modification 1 applied to the previous development consent for BCM.

The impacts identified in the previous EAs prepared for BCM were reviewed for this assessment and the modification was shown to not result in any additional impacts to those previously considered.

BCOPL operates under a number of environmental management plans and procedures that have been designed and implemented to manage, monitor and minimise the potential impacts of its operations on the surrounding environment. These plans and strategies provide the framework for ongoing management of environmental impacts and specify management practices to minimise these through design, operation and ongoing monitoring of operations at BCM.

An integral part of BCOPL's environmental management system is its environmental monitoring network, which is described in further detail in Section 2.4. Supporting the environmental monitoring network, is the site's suite of environmental management plans, procedures and strategies which have been developed to address specific aspects of the operation. This suite includes:

- Air Quality and Greenhouse Gas Management Plan
- Blast Fume Management Protocol
- Blast Management Plan
- Cultural Heritage Management Plan
- Environmental Management Strategy
- Forestry Plantation Offset Strategy
- Groundwater Management Plan
- Noise Management Plan
- Rehabilitation Management Plan
- Site Water Balance
- Surface Water Management Plan
- Traffic Management Plan
- Construction Environmental Management Plan
- Water Management Plan.

On approval of the proposed modification, each of these plans will be reviewed and updated to reflect the changes to the project associated with the modification and any additional mitigation measures that have been developed as part of this EA.

7. Conclusion

7.1 Alternatives considered

Alternatives to each activity included under the proposed modification were considered during the design process to take into account potential environmental impacts and conflicts with other land uses. This resulted in a number of adjustments being made to some of the proposed activities, such as:

- relocation of ancillary infrastructure to avoid cultural heritage impacts
- co-location of ancillary infrastructure to minimise vegetation disturbance
- use of existing access tracks and infrastructure wherever possible
- minimisation of track width and infrastructure areas.

The only key alternative to the proposed modification was the 'do nothing' option. As described in Section 3, the proposed modification is required to provide a reliable water supply to BCM as it currently has a substantial predicted water deficit. The 'do nothing option' would result in increasing water restrictions to the mine, particularly during dry weather. This would result in increasing limitations to production and potentially, mine closure. Therefore, the 'do nothing' option was not considered further.

Overall, the activities included under the proposed modification were identified as having the least environmental and social impacts of all viable options considered.

7.2 Ecologically sustainable development

The four principles of ESD are outlined in Section 6(2) of the Protection of Environmental Operations Act 1979 (PoEO Act), and in Schedule 2 of the EP&A Regulations. In summary, the principles are:

- **The precautionary principle** – if there are threats of serious or irreversible damage, a lack of full scientific uncertainty should not be used as a reason for postponing measures to prevent environmental degradation.
- **Intergenerational equity** – the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
- **Conservation of biological diversity and ecological integrity** – the diversity of genes, species, populations and their communities, as well, as the ecosystems and habitats they belong to, should be maintained or improved to ensure their survival.
- **Improved valuation, pricing and incentive mechanisms** – environmental factors should be included in the valuation of assets and services.

Table 7.1 provides an assessment of how these principles apply to the proposed modification.

Table 7.1 Adherence of the proposed modification to the principles of ESD

Principle	How addressed by the project
The precautionary principal	■ The project is not anticipated to cause serious or irreversible environmental damage that will result in impacts of a permanent nature. ■ Detailed impact assessments have been undertaken for this EA, to predict as far as possible, potential impacts associated with the proposed modification. ■ All measures considered to be necessary to safeguard environmental values have been identified and included in preparation of this assessment.
Intergenerational equity	■ Environmental investigations have been undertaken for the proposed modification during the preparation of this EA and mitigation measures have been developed where necessary to minimise the impacts on the health, diversity and productivity of the environment and therefore maintain benefits for future generations. ■ The proposed modification will contribute towards the ongoing employment of staff of BCM, providing benefits for local, regional and state wide communities through direct and indirect employment, expenditure and royalties. ■ The proposed modification will not sterilise any land from future development or affect the beneficial uses of the area following completion of the BCM.
Conservation of biological diversity and ecological integrity	■ Potential impacts to flora and fauna species and vegetation communities of local, regional, state and national significance were assessed as part of this EA and the proposed modification was determined not to cause any significant impacts to any threatened or endangered species or communities. Any impacts to biodiversity would be countered through the extension of the Boggabri Coal Project biodiversity offset strategy.
Improved valuation, pricing and incentive mechanisms	■ The proposed modification will use existing equipment; infrastructure and staff associated with BCM and will therefore provide for efficient resource use. ■ The proposed modification will result in improved operational efficiencies for BCM, increasing the long-term productivity of the site.

7.3 Conclusion

The proposed modification consists of a number of small additions and modifications to the Boggabri Coal Project, none of which are predicted to cause substantial additional impacts to those previously approved under the project approval.

The proposed modification is likely to result in environmental impacts, including drawdown of alluvial aquifers in the vicinity of proposed production bores, causing groundwater drawdown of over two metres at one active irrigation bore and drawdown impacts to two active shallow wells used for domestic uses and stock water during normal climactic conditions. To manage these impacts, BCOPL will expand its existing groundwater monitoring program and if impacts are observed may change the pumping regime, provide rectification works or compensatory water supply to the landowner.

The proposed modification is predicted to marginally reduce inflows to a small section of the Namoi River during operation and this would recover following cessation of pumping. This marginal reduction of inflows will be offset during normal climactic conditions by BCOPL reducing its approved extraction of river water, as the borefield will provide the required water.

The clearing of 18.8 ha of native vegetation, including approximately 1.3 ha of vegetation listed under the FM Act and 0.1 ha listed under the TSC Act and EPBC Act, will be mitigated by providing biodiversity offsets in accordance with the quantum (ratio) and principles of the existing BOS. The BOS will be amended to ensure the lands previously identified within the Namoi River Offset Area and subsequently excised for the proposed new project area will be replaced by an alternative offset.

Impacts are predicted to several Aboriginal heritage sites, although disturbance to these sites would be avoided where possible during construction. Where impacts cannot be avoided, the artefacts will be salvaged in consultation with the site's RAPs and procedures specified in the CHMP.

The proposed modification will provide a number of benefits as it will provide a secure water supply for BCM and resolve its current water deficit. BCM provides benefits to local, regional and statewide communities through employment, expenditure and royalties.

This EA has considered all aspects of the proposed modification considered to have the potential to cause additional environmental and social impacts to those previously assessed for BCM as part of PA 09_0182 (as modified). Through this EA, BCOPL is committing to implementing further management measures to mitigate any identified impacts that may occur above those for which it has previously developed management measures.

These commitments include:

- expansion of the site's existing groundwater monitoring program
- revision of the site's surface and groundwater management plans to include the borefield and associated works
- revision of the BOS to include an additional of 105.4 ha of suitable native vegetation for the modifications impacts
- amendment of the site's environmental management plans, procedures and strategies to incorporate changes associated with the proposed modification
- salvage of impacted cultural heritage sites in consultation with the Boggabri RAPs.

BCOPL has approval to develop a significant coal resource. The proposed modification to this approval will improve its operational efficiency and long-term operational security, and thereby assist with maximising the economic benefits associated with development of this coal resource. The proposed modification is not predicted to generate significant changes to the overall environmental impacts of BCM and is therefore considered to be justified.

8. References

AGE (Australasian Groundwater and Environmental Consultants), 2010, *Report on Continuation of Boggabri Coal Mine: Groundwater Assessment*, Parts 1 and 2, prepared for Boggabri Coal Pty Ltd, October 2010.

Barrett, C, 2012, *Upper Namoi groundwater source – status report 2011*. NSW Department of Primary Industries, Office of Water, Sydney.

Boggabri Coal Pty Ltd (BCOPL), 2012, *Biodiversity Management Plan*. October 2012. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd.

Boggabri Coal Pty Ltd (BCOPL), 2013a, Boggabri Coal Part 3A *Cultural Heritage Management Plan (CHMP).* December 2013.

Boggabri Coal Pty Ltd (BCOPL), 2013b, *Construction Environmental Management Plan.*

Boggabri Coal Pty Ltd (BCOPL), 2013c, *Air Quality and Greenhouse Gas Management Plan.*

Boggabri Coal Pty Ltd (BCOPL), 2014a, *Surface Water Management Plan*. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. February 2014.

Boggabri Coal Pty Ltd (BCOPL), 2014b, *Water Management Plan*. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. February 2014.

Boggabri Coal Pty Ltd (BCOPL), 2014c, Groundwater *Management Plan*. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. February 2014.

Boggabri Coal Pty Ltd (BCOPL), 2015, *Noise Management Plan*. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. February 2014.

Bureau of Meteorology, 2015, *The Atlas of Groundwater Dependent Ecosystems.* http://www.bom.gov.au/water/groundwater/gde/map.shtml/

CSIRO, 2007. *Water Availability in the Namoi – A Report to the Australian Government from the CSIRO Murray Darling Commission Sustainable Yields Project.*

Davies,N., 1953, *Investigations on the soil and water relations of the river red gum forests*. Final Report Murray Management Survey. Forestry Commission of New South Wales, Resources Branch ReportNo. R.124.

Department of Environment and Conservation, 2005, *Approved Methods for the modelling and Assessment of Air Pollutants in New South Wales*.

Department of Land and Water Conservation, 2002, *The NSW State Groundwater Dependent ecosystems Policy – A Component Policy of the NSW State Groundwater Policy Framework Document*

Department of Planning and Infrastructure (DP&I), 2012, *New England North West Strategic Regional Land Use Plan (SRLUP).*

Eamus, et.al, 2006, *A functional methodology for determining the groundwater regime needed to maintain health of groundwater dependent ecosystems*. Australian Journal of Botany 54 97-114. www.publish.csiro.au/journals/ajb

Environmental Protection Authority (EPA), 2000, *NSW Industrial Noise Policy.*

Groundwater Exploration Services (GES), 2013, *Boggabri Coal Groundwater Supply Investigation*. March 2013.

Heritage Computing Pty Ltd, 2012, *Cumulative Groundwater Management Protocol for Boggabri Coal Mine, Tarrawonga Coal Mine and Maules Creek Coal Project,* Report HC2011/15, draft prepared for Boggabri Coal Pty Ltd, Tarrawonga Coal Pty Ltd, Aston Resources Ltd, September 2012.

National Parks and Wildlife Service, 2003, *The Bioregions of New South Wales: their biodiversity, conservation and history*, NSW National Parks and Wildlife Service, Hurstville.

Hansen Bailey, 2010, *Continuation of Boggabri Coal Mine Environmental Assessment*, Prepared for Boggabri Coal Mine.

Hansen Bailey, 2011, Modification 2 – *Environmental Assessment: Modification to Development Consent for Boggabri Coal Mine*.

Hansen Bailey, 2013, Modification 3 – *Boggabri Coal Mine Project Approval Modification Environmental Assessment.*

Hatton, T. & Evans, R., 1998, *Dependence of ecosystems on groundwater and its significance to Australia. Canberra: CSIRO (Land and Water).*

James B. Croft and Associates, 1983, *Report on the botany, wildlife and ecology of the Leard State Forest. Draft Environmental Impact Statement for Amax-BHP Joint Venture Boggabri Coal Project, Appendix 1.*

NSW Government, 2003, *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources 2003,* http://www.legislation.nsw.gov.au/viewtop/inforce/subordleg+1035+2002+FIRST+0+N/

Parsons Brinckerhoff, 2005, *Flora and Fauna Summary of the Boggabri Coal Project*, Parsons Brinckerhoff, Sydney.

Parsons Brinckerhoff, 2009, *Preliminary vegetation mapping and survey report for Boggabri Coal lease.*

Parsons Brinckerhoff, 2010a, *Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment*, A report prepared by Parsons Brinckerhoff for Hanson Bailey Pty Ltd, Newcastle, NSW.

Parsons Brinckerhoff, 2010b, *Continuation of Boggabri Coal Mine – Biodiversity Offset Strategy*, A report prepared by Parsons Brinckerhoff for Hanson Bailey Pty Ltd, Newcastle, NSW.

Parsons Brinckerhoff, 2011a, *Boggabri Coal – Biodiversity Monitoring, February 2006 – August 2012.*

Parsons Brinckerhoff, 2011b, *Continuation of Boggabri Coal Mine – Matters of National Environmental Significance*. A report prepared by Parsons Brinckerhoff for Hanson Bailey Pty Ltd, Newcastle, NSW, April 2011.

Parsons Brinckerhoff, 2014, *Modification 4 – Boggabri Coal Mine – Project Approval Modification Environmental Assessment (MOD 4).* A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. 2014.

Parsons Brinckerhoff, 2015a, *Site Water Balance*. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. September 2015.

Parsons Brinckerhoff, 2015b, *Groundwater Impact Assessment*. A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd. June 2015.

Parsons Brinckerhoff, 2015c, *Landholder Bore Hydrocensus at Boggabri Coal Operations.* A report prepared by Parsons Brinckerhoff for Boggabri Coal Pty Ltd, July 2015.

Pennay, M., 2001, *Results of Fauna survey work undertaken by the NSW National Parks and Wildlife Service within Leard State Forest*, WRA Biodiversity Survey Coordinator NSW National Parks and Wildlife Service, Sydney NSW.