

Boggabri Coal Operations Pty Ltd

Boggabri Coal Mine
2019 Annual Review

31 March 2020

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Revision Control Chart

Rev No	Original	1	2	3	4
Revision Date	31 March 2020	23 June 2020			
Prepared by	J Blane	S Torrance			
Reviewed by	H Russell	H Russell			
Approved by	A Margetts	A Margetts			
Signature					

Distribution Control

Company	Position
BCOPL	Environment Superintendent
Division of Resources and Geoscience	Regional Environment Officer
Department of Planning, Industry and Environment	Senior Planning Officer
Department of Primary Industry – Agriculture	Area Manager North West
Department of Planning, Industry and Environment – Water	Water Regulation Officer
Environment Protection Authority	Regional Operations Officer Armidale
Department of Primary Industry - Forestry	Forestry Occupancy Supervisor
Community Consultative Committee	Chairman
NRW Contracting (formerly BGC Contracting)	Project Manager

Annual Review Title Block	
Name of Operation	Boggabri Coal Mine
Name of Operator	Boggabri Coal Operations Pty Ltd
Development Consent/Project Approval #	09_0182
Name of Holder of Project Approval	Boggabri Coal Pty Limited (now trading as Boggabri Coal Operations Pty Limited)
Mining Lease #	CL 368
Name of holder of mining lease	Boggabri Coal Pty Limited (now trading as Boggabri Coal Operations Pty Limited)
Water Licence #	see Table 2-2 below for details
Name of holder of water access licences	Boggabri Coal Pty Limited (now trading as Boggabri Coal Operations Pty Limited)
MOP Commencement Date	1 January 2020
MOP Completion Date	31 December 2024
Annual Review Commencement Date	1 January 2019
Annual Review Completion Date	31 December 2019
I, Anthony Margetts, certify that this audit report is a true and accurate record of the compliance status of Boggabri Coal Mine for the period 1 January 2019 to 31 December 2019 and that I am authorised to make this statement on behalf of Boggabri Coal Operations Pty Limited.	
Name of authorised reporting officer	Anthony Margetts
Title of authorised reporting officer	General Manager
Signature of authorised reporting officer	
Date	23/6/2020

Contents

List of tables

List of figures

List of appendices

Acronyms

Abbreviations	Terms
AR	Annual Review
AEMR	Annual Environmental Management Report
AHCS	Aboriginal Heritage Conservation Strategy
AN	Ammonium Nitrate
ANFO	Ammonium Nitrate/ Fuel Oil
AQGHGMP	Air Quality and Greenhouse Gas Management Plan
AIA	Agricultural Impact Assessment
ASA	Agricultural Suitability Assessment
ASCF	Aboriginal Stakeholder Consultative Forum
BC Act	Biodiversity Conservation Act 2018 NSW
BCOPL	Boggabri Coal Operations Pty Limited
BCM	Boggabri Coal Mine
BCT	Boggabri Coal Terminal
BCSR	NSW Bureau of Crime Statistics and Research
BFMP	Blast Fume Management Protocol
BLMP	Blast Management Plan
BLMS	Blast Management Strategy
BMP	Biodiversity Management Plan
BOA	Biodiversity Offset Area
BOS	Biodiversity Offset Strategy
BTM Complex	Boggabri-Tarrawonga-Maules Creek Complex
CCC	Community Consultative Committee
CDFM	Cumulative Deviation From Mean Rainfall
CHMP	Cultural Heritage Management Plan
CHPP	Coal Handling and Preparation Plant
DAWE	Department of Agriculture, Water and the Environment (Cth)
DPIE	Department of Planning, Industry and Environment
DPI	Department of Primary Industries
DRE	NSW Division of Resources and Energy
EA	Environmental Assessment
EC	Electrical Conductivity
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	Environment Protection Licence
Forestry	NSW Forestry Corporation
GHG	Greenhouse Gas
GWMP	Groundwater Management Plan
HLM	Hunter Land Management
HVAS	High Volume Air Sampler
HTV	High Trigger Value
IAR	Idemitsu Australia Resources Group

Abbreviations	Terms
LOR	Limit of Reporting
LTV	Low Trigger Value
MCC	Maules Creek Coal Mine
MIA	Mine Infrastructure Area
MET Station	Meteorological Monitoring Station
MOP	Mining Operations Plan
Mt	Million tonnes
Mtpa	Million Tonnes Per Annum
MTV	Medium Trigger Value
MWD	Mine Water Dam
NGER	National Greenhouse and Energy Reporting
NGER Act	*National Greenhouse and Energy Reporting Act 2007* (Cth)
NMP	Noise Management Plan
NPI	National Pollutant Inventory
OEH	NSW Office of Environment and Heritage
PA	Project Approval 09_0182
PAC	NSW Planning and Assessment Commission
PAD	Potential Archaeological Deposit
PAF	Potential Acid Forming
PIRMP	Pollution Incident Response Management Plan
$PM_{2.5}$	Particulate matter < 2.5 µm
PM_{10}	Particulate matter < 10 µm
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
RAP	Registered Aboriginal Parties
RBS	Leard Forest Regional Strategy
RMP	Rehabilitation Management Plan
ROM	Run of Mine
SCMP	Spontaneous Combustion Management Plan
SIMP	Social Impact Management Plan
SMP	Soil Management Protocol
SPL	Sound Power Level
SWB	Site Water Balance
SWMP	Surface Water Management Plan
TCM	Tarrawonga Coal Mine
TEOM	Tapered Element Oscillating Microbalance
TLO	Train Load-out Facility
TMP	Traffic Management Plan
TSC Act	Threatened Species Conservation Act 1995 (NSW)
TSP	Total Suspended Particulates
ULSD	Ultra-Low Sulphur Diesel
WAL	Water Access Licence
WMP	Water Management Plan
WMS	BTM Complex Water Management Strategy

1 STATEMENT OF COMPLIANCE

In accordance with the requirements of the *Post-approval requirements for State significant mining developments – Annual Review Guideline* (NSW Government, 2015), a statement of compliance has been prepared to document the status of compliance with BCM's Project Approval 09_0182 (including Statement of Commitments), mining leases and other relevant approvals as at the end of the 2019 reporting period. Table 1-1 identifies whether or not non-compliances occurred during the reporting period for each statutory approval. Where non-compliances are identified, further details are provided in Table 1-2. Non-compliances have been colour-coded in that table, in accordance with the descriptions provided in the *Annual Review Guideline* (NSW Government, 2015).

Table 1-1 Statement of compliance

Approval	Were all conditions of the relevant approval(s) complied with during the reporting period?
Project Approval 09_0182 (incl. Statement of Commitments)	No
Coal Lease 368	Yes
Authorisation 355	Yes
Authorisation 339	Yes
EPL 12407	No
WAL 12691	Yes
WAL12767	Yes
WAL15037	Yes
WAL24103	Yes
WAL29473	Yes
WAL29562	Yes
WAL2571	Yes
WAL2572	Yes
WAL2595	Yes
WAL2596	Yes
WAL36547	Yes
WAL37519	Yes
WAL37067	Yes
WAL42243	Yes

Table 1-2 Non-compliances during the reporting period

Relevant approval	Ref.	Condition description	Compliance status*	Comment	BCOPL response	Where addressed in the Annual Review
Project Approval 09_0182 EPL 12407	Sch 3 C15 L4.1	The Proponent shall ensure that the blasting on the site does not cause exceedances of the criteria in Table 6 (airblast overpressure 120 dBL). However, these criteria do not apply if the Proponent has a written agreement with the relevant owner or infrastructure provider/owner, and the Proponent has advised the Department in writing of the terms of this agreement.	Non compliant-Low risk	A blast that was fired on 21 August 2019 recorded an airblast overpressure of 123dBL, exceeding the 120dBL criteria.	Analysis of meteorological data at BCM during the period of this blast event was conducted by Todoroski Air Sciences (2019). This exceedance was attributed to a short term fluctuation in the upper air wind conditions that could not have been reasonably foreseen.	**Section 4.4**
Project Approval 09_0182	Sch 5 C8	The Proponent shall notify, at the earliest opportunity, the Secretary and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. Within 7 days of the date of the incident, the Proponent shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.	Non compliant-Low	A blast that was fired on 21 August 2019 recorded an airblast overpressure of 123dBL, exceeding the 120dBL criteria. The exceedance of the performance criteria was not reported to DPIE within 7 days. A warning letter was issued by DPIE.	The exceedance was reported to DPIE on 28 August, 2019.	**Section 4.4**

Relevant approval	Ref.	Condition description	Compliance status*	Comment	BCOPL response	Where addressed in the Annual Review
Project Approval 09_0182	Sch 3 C9	(a) Ensure that: all new trucks, dozers, drills and excavators purchased for use on the site after the date of this approval are commissioned as noise suppressed (or attenuated) units; all equipment and noise control measures deliver sound power levels that are equal to or better than the sound power levels identified in the EA and that correspond to best practice or the application of best available technology economically achievable; where reasonable and feasible, improvements are made to existing noise suppression equipment as technologies become available.	Non compliant - Low risk	The 2019 sound power screening program indicated that there were 22 items of screened plant that recorded exceedances of 3dB or greater, consisting of Komatsu haul trucks (KOM 930E-4), one CAT excavator (CAT6030), one Hitachi excavator (EX2600-6), one CAT dozer (D11T), one Komatsu water cart (HD785-7) and a Reich drill (C700D). A total of 30 exceedances were recorded during the screening program period during various tests.	The SPL attenuation exhaust kit trial will continue during 2020. Key findings and recommendations will be reported following completion of the trial.	**Section 4.3**

Compliance Status Key for Table 1-2

Risk Level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-complaint	Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

2 INTRODUCTION

2.1 Mine Contacts

Table 2-1 BCM Mine Contacts

General Manager: Company: Address: Phone: Fax:	**Anthony Margetts** Boggabri Coal Operations Pty Limited 386 Leard Forest Rd, Boggabri, NSW, 2382 02 6749 6000 02 6743 4496
Health Safety and Environment Manager: Company: Address: Phone: Fax:	**Peter Forbes** Boggabri Coal Operations Pty Limited 386 Leard Forest Rd, Boggabri, NSW, 2382 02 6749 6000 02 6743 4496
Environmental Superintendent: Company: Address: Phone: Fax:	**Hamish Russell** Boggabri Coal Operations Pty Limited 386 Leard Forest Rd, Boggabri, NSW, 2382 02 6749 6000 02 6743 4496

2.2 Approvals, Licences and Mining Leases

Table 2-2 summarises the key mining leases and approvals currently held by Boggabri Coal Operations Pty Ltd (**BCOPL**) which are relevant to the operations at Boggabri Coal Mine (**BCM**).

Table 2-2 Key Approvals, Consents, Mining Leases and Licences

Description	Date granted/ commencement date	Expiry/duration
Project Approvals		
Project Approval 09_0182 (as modified)	18 July 2012	31 December 2033
EPBC Act Approval 2009/5256 (as varied)	11 February 2013	31 December 2053
Coal Leases		
Coal Lease CL 368	15 November 1990	14 November 2032
Mining Leases/Authorisations		
Authorisation A 355	19 July 1984	11 April 2018 (currently under renewal)
Authorisation A 339	11 April 1984	11 April 2022
Mining Lease ML1755	30 June 2017	30 June 2038
Environmental Protection Licences		
Environmental Protection Licence (EPL) 12407	11 January 2006	In perpetuity (Anniversary 11 January) until surrendered
Water Licences		
WAL 12691	27 July 2012	In perpetuity
WAL12767	8 April 2014	In perpetuity
WAL15037	12 December 2013	In perpetuity
WAL24103	1 September 2011	In perpetuity
WAL29473	26 July 2012	In perpetuity
WAL29562	26 July 2012	In perpetuity

Description	Date granted/ commencement date	Expiry/duration
WAL2571	12 December 2013	In perpetuity
WAL2572	25 December 2013	In perpetuity
WAL2595	12 December 2013	In perpetuity
WAL2596	25 September 2013	In perpetuity
WAL36547	6 February 2014	In perpetuity
WAL42234	9 January 2019	In perpetuity
90FW833717	21 September 2015	4 April 2020
90FW834023	21 September 2015	4 June 2029
Mining Operations Plans (MOP)		
Current MOP	1 January 2020	31 December 2024
Radiation Licences		
Licence No. 5083602	14 June 2017	14 June 2020
Council Approvals		
CC 04-04-2012 Mod1	22 October 2012	In perpetuity
CC 02-03-2012	6 June 2012	In perpetuity
CC 10-01-2012 Mod1	1 June 2012	In perpetuity
OC 09-10-2013	19 November 2013	In perpetuity
OC 02-04-2013	9 April 2013	In perpetuity
OC 01-03-2013	28 March 2013	In perpetuity
C6 – Approval to Operate a System of Sewage Management	20 February 2012	13 May 2024
Part 5 Determination –Goonbri Road Upgrade	28 March 2014	In perpetuity
Forestry Corporation Permits		
Forestry Compensation Agreement	23 January 2006	14 November 2032
Crown Lands Licences		
RI 507102	12 November 2012	14 November 2032
RI 533986	5 June 2014	14 November 2032

2.3 Mine Operation Introduction and History

Boggabri Coal Mine (BCM) is an open cut coal mine located 15 km north-east of the township of Boggabri in north-western New South Wales (NSW). BCM is managed by Boggabri Coal Operations Pty Ltd (BCOPL) which is majority owned by Idemitsu Australia Resources Group (IAR), a subsidiary of Japanese company, Idemitsu Kosan Pty Ltd.

Environmental assessments first commenced at BCM in 1976 followed by grant of approval for the project in 1989, and the commencement of operations in 2006. Truck and excavator operations produce a crushed and screened export quality thermal coal and pulverised coal injection product, which is transported from the mine via rail to the Port of Newcastle, for export to overseas markets. In the 2019 calendar year BCM produced 6.1 million tonnes (Mt) of product coal.

In 2009, BCOPL lodged a major project application under the now-repealed Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This project approval (Project Approval 09_0182) (PA), was granted by the NSW Planning Assessment Commission (PAC) in June 2012, allowing for extraction of up to 8.6 Mtpa of run of mine (ROM) coal from BCM until the end of year 2033 (the Project).

Under the PA, a new rail load-out facility and rail spur was constructed. Operation of this infrastructure commenced in December 2014. This has eliminated routine road transport of product coal between the mine infrastructure area (MIA) and the Boggabri Coal Terminal (BCT). All product coal is currently transported from site via rail. A new Coal Handling and Preparation Plant (CHPP) was commissioned in mid-2015, enabling further processing of ROM coal required for the mine to reach the full production rate. The PA also provides for the upgrade of the overburden and coal haulage fleet and other ancillary infrastructure, as well as the option of a dragline.

Seven modifications to the PA have been lodged since granting of the original PA. One of these modifications (Mod 1) was subsequently withdrawn. A request to modify (Mod 7) was lodged on 28 February 2018 for assessment under the EP&A Act and was approved on 27 May 2019 by the Independent Planning Commission. Mod 7 made amendments to the Boggabri Project Approval in relation to the following:

- Minor adjustment of the Common Boundary Lease Transfer Area.
- Use the product stockpile area, which has been approved for stockpiling Tarrawonga Product Coal, for BCM Product Coal.
- Modernisation of the long term security mechanisms for biodiversity offset areas.
- The inclusion of a range of exploration activities to support approved mining activities.
- The road transportation of coal samples required for marketing and analysis purposes.

In NSW, mining operations and certain mining purposes must be carried out in accordance with a Mining Operations Plan (MOP) that has been approved by the NSW Department of Planning, Industry and Environment –Resources Regulator. BCOPL is currently operating under an approved MOP that applies to activities at the BCM between 2020 and 2024.

2.4 Purpose and Scope of Report

This Annual Review discusses the environmental performance of BCOPL and its contractors, in relation to compliance with the conditions of the PA, and other relevant leases, licences and approvals. It provides a summary of operational and environmental management activities undertaken at the BCM during the reporting period (1 January to 31 December 2019) and provides a review against planned works, as described in the MOP, and predicted impacts documented in the Continuation of Boggabri Coal Mine Environmental Assessment (EA) (Hansen Bailey, 2010). The Annual Review also covers community relations and addresses mine development and rehabilitation undertaken during the reporting period.

The Annual Review has been prepared to satisfy the conditions of the PA (in particular Condition 4 of Schedule 5) and CL 368. Key requirements of these approvals are described in Table 2-3. A map illustrating the mine locality and project boundary is provided in Figure 2-1 while relevant monitoring points and land ownership are shown in **Appendix A**. Offset properties for BCM are identified on the figures provided in **Appendix B**.

This document has been prepared generally in accordance with the *Post-approval requirements for State significant mining developments – Annual Review Guideline* (NSW Government, 2015), (where relevant), as well as the relevant BCOPL reporting framework.

Table 2-3 Annual Review requirements

Licence, Approval or Guideline	Section Reference	Requirement	Reference in this report
CL 368	Condition 4	(a) The lease holder must lodge Environmental Management Reports (**EMRs**) with the Director-General annually or at dates otherwise directed by the Director-General. (b) The EMR must: i. Report against compliance with the MOP; ii. Report on progress in respect of rehabilitation completion criteria; iii. Report on the extent of compliance with regulatory requirements; and iv. Have regard to any relevant guidelines adopted by the Director-General	Whole document
Project Approval 09_0182	Schedule 5, Condition 4	Annual Review By the end of March each year, the Proponent shall review the environmental performance of the project for the previous calendar year to the satisfaction of the Secretary. This review must: (a) Describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;	Section 8
		(b) Include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against the: • Relevant statutory requirements, limits or performance measures/criteria; • Monitoring results of previous years; and • Relevant predictions in the EA	Section 4, Section 7.3
		(c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;	Section 4, Section 6
		(d) Identify any trends in the monitoring data over the life of the project;	Section 4
		(e) Identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and	Section 4
		(f) Describe what measures will be implemented over the next year to improve the environmental performance of the project.	Section 4
	Schedule 3, Condition 10	The Proponent shall: (a) Conduct an annual testing program of the attenuated plant on site to ensure that the attenuation remains effective; (b) Restore the effectiveness of any attenuation if it is found to be defective; and (c) Report on the results of any testing and/or attenuation work within the Annual Review.	Section 4.3
	Schedule 3, Condition 12	The proponent shall … (i) Use its best endeavours to achieve the long term intrusive noise goals for the project in Table 5, where this is reasonable and feasible, and report on the progress towards achieving these goals in the Annual Review;	Section 4.3.2

Licence, Approval or Guideline	Section Reference	Requirement	Reference in this report
	Schedule 3, Condition 68	The Proponent shall: (a) Implement all reasonable and feasible measures to minimise the waste (including coal reject) generated by the project; (b) Ensure that the waste generated by the project is appropriately stored, handled and disposed of; (c) Monitor and report on the effectiveness of the waste minimisation and management measures in the Annual Review.	Section 4.9
	Schedule 3, Condition 77	The proponent shall prepare and implement a Social Impact Management Plan (which will)… (h) Include a monitoring program, incorporating key performance indicators and a review and reporting protocol, including reporting in the Annual Review.	Section 7
Boggabri Coal Project EA	Section 8	BCOPL will prepare an Annual Review (which summarises monitoring results and reviews performance) and distribute it to the relevant regulatory authorities and the Boggabri CCC.	Whole document

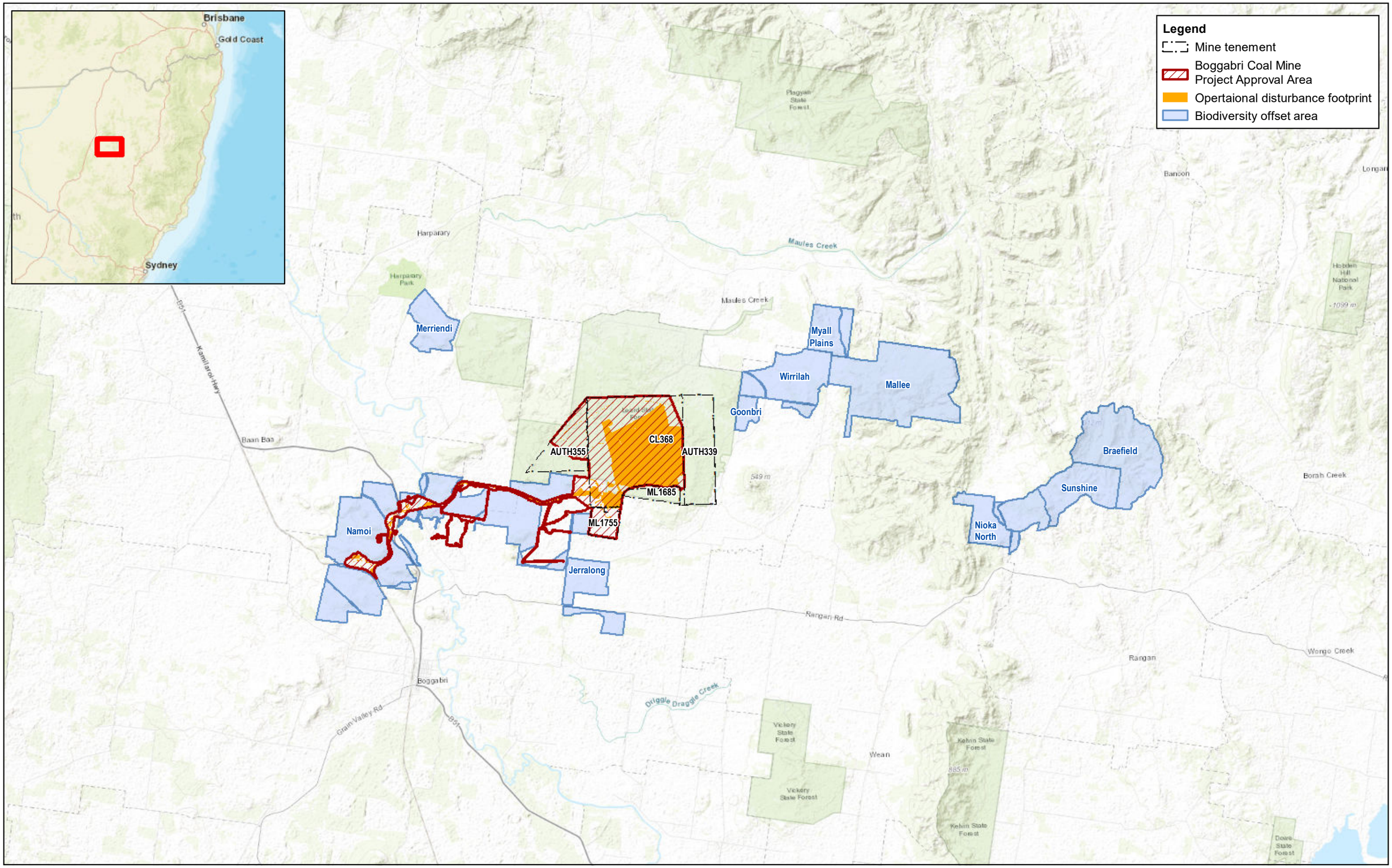
2.5 Actions from 2018 Annual Review

The 2018 Annual Review was provided to DRG, NSW Department of Primary Industries (DPI) – Land and Natural Resources, DPI – Water, NSW Environment Protection Authority (EPA) and Department of Planning, Industry and Environment (DPIE)(formerly Department of Planning and Environment (DPE)) and Forests NSW in March 2019.

BCOPL received confirmation on 22 July 2019 that the 2018 Annual Review generally satisfied DPIE's Annual Review requirements. Two comments were received from DPIE requiring amendment of the 2018 Annual Review as follows:

- Statement of Compliance was amended to include the non-compliance against Schedule 3 condition 9 of the PA in relation to the sound power level exceedances reported in Section 4.3.2.2 of the 2018 Annual Review.
- Water Licensing Summary – Water Take was amended to reflect the timeframe requirements of Annual Review Guideline that states that the Annual Review should report on the water taken by the operation in the previous water year (1 July 2017 – 30 June 2018).

No feedback was received in writing from any other regulatory agencies.
No comments were received from DPIE regarding actions to be addressed in the 2019 Annual Review.



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Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,

DOCUMENT	PS118825_AEMR_001_A1_locality
AUTHOR.	suansrir
REVIEWED BY.	N.Cooper
DATE.	19/02/2020

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FIGURE **2-1**

TITLE. **LOCALITY PLAN**

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3 SUMMARY OF OPERATIONS

3.1 Mining Preparation

Vegetation is cleared in advance of mining activities in accordance with the following documents:

- Clearing and Fauna Management Protocol, which forms Appendix B of the approved Biodiversity Management Plan (BMP)
- Cultural Heritage Management Plan (CHMP)

The adopted clearing protocol follows a two-stage clearing process to minimise impacts on native biodiversity. Prior to removal of vegetation, trained ecologists survey the areas proposed for clearing (refer to Section 4.7.2.3). Archaeological salvage is also undertaken as part of the clearing process to identify and potentially recover artefacts (refer to Section 4.11.2.1).

Sampling is undertaken prior to stripping of topsoils and subsoils to identify the soil resource, inform the preparation of a soil inventory to assist with rehabilitation planning, and to determine soil amelioration requirements.

Topsoil is then stripped in accordance with the approved Soil Management Protocol (SMP) and BMP, and where possible, hauled directly to re-profiled rehabilitation areas. Where re-profiled areas are not ready to receive topsoil, the topsoil is hauled to a temporary stockpile location where it is stored for future transport to rehabilitation locations.

BCOPL reports that 158,731 m^3 of topsoil recovery was undertaken during the 2019 reporting period. Of this, 59,367 m^3 of topsoil was spread over a 15.32 ha rehabilitation area in readiness for revegetation. At the end of December 2018, there was a total of 1,712,887 m^3 of topsoil material stockpiled across the BCM.

3.1.1 Saline or Potentially Acid Forming Materials

Most of the strata are devoid of acid producing pyrite. A small proportion of the potential coal reject materials located near the Braymont Seam have a relatively high total sulphur content and negligible buffering capacity and are classified as Potentially Acid Forming – High Capacity (**PAF**). However, most overburden materials are likely to be non-acid forming and have a high factor of safety with respect to potential acid generation. The overburden is therefore regarded as a non-acid forming unit.

Based on these outcomes, the risk of acid mine drainage at BCM is considered low. BCOPL has implemented an established process to manage PAF materials. The process involves annual sampling of reject material to identify any material that could be classified as PAF. If, following completion of sampling, material is identified as PAF, it is subject to deep in-pit burial.

No PAF material has been identified at the BCM to date.

3.2 Mining Operations

3.2.1 Equipment

Truck and excavator operations will continue to be undertaken as approved through the MOP term (2020-2024). The mining equipment fleet as at December 2019 is listed in Table 3-1.

Table 3-1 Equipment fleet as at December 2019

Equipment	Number in fleet
Haul trucks	48
Excavators	14
Front end loaders	5
Dozers	23
Graders	4
Water carts	7
Service trucks	5
Drills	5
Total	**111**

3.2.2 Activities

Mining activities undertaken at BCM during the reporting period included:

- Drilling and blasting of overburden
- Overburden removal by large hydraulic excavators, front-end loaders, shovels and dozers
- Haulage of waste to in-pit and out-of-pit emplacement areas
- Extraction of coal using large hydraulic excavators, front-end loaders, dozers and various Komatsu, Caterpillar and Hitachi rear dump trucks
- Movement of coal directly to a bypass crusher as product coal or stockpiled on ROM pads for further blending and crushing
- Coal processing through the CHPP

Mining activities were compliant with the requirements of the PA including not clearing within 250 m of Maules Creek Mine mining lease boundary.

3.2.3 Pit Progression

Coal is mined from eight coal seams including the Herndale, Onavale, Teston, Thornfield, Braymont, Bollol Creek, Jeralong and basal Merriown seams.

During the reporting period, pit development was primarily on Pits C and E (refer to Figure 8-1).

Jeralong Pit, Merriown Pit (Pit 1), Bollol Creek Pits, Pit B (5), and Pit A were completed in 2009, 2010, 2013, 2014 and 2017 respectively. The pits are being progressively backfilled with waste in accordance with the MOP final landform design.

3.2.3.1 Pit C

Pit C is a north progressing continuation of Bollol Creek Pit and Pit A. Operations commenced in June 2013. Progression is along the Merriown Seam in a northerly direction along 100 m wide east - west orientated mining strips, for the upper seams down to the Jeralong Seam and 50 m wide strips for the Merriown Seam. Pit C will be backfilled from the south to the north in line with pit progression.

3.2.3.2 Pit E

Pit E is a pit adjacent to the north eastern corner of Pit A. Progression is along the Merriown Seam in an easterly, then northerly direction along 100 m wide mining strips for the upper seams down to the Jeralong Seam and 50 m wide strips for the Merriown Seam. Pit E will be backfilled from the south to north in line with pit progression.

3.2.4 Production Waste

Waste emplacement areas have been progressed by in–pit dumping to completed pits to a maximum Reduced Level (RL) of 395 m in accordance with the MOP. The main emplacement areas are immediately bounded by Merriown and Bollol Creek Pits to the east and south east, Jeralong and Bollol Creek Pits to the north and the surface mine limit to the West and South (refer Figure 8-1).

3.3 Production Statistics

From January to December 2019, mine production at BCM was carried out by Boggabri Coal Operations utilising BGC Contracting. Mining was undertaken in accordance with the approved MOP and site work standards and procedures, which have been developed to ensure ongoing compliance with the approved management plans and MOP.

A summary of production figures for the 2018 and 2019 calendar years is provided in Table 3-2 below. Also shown are the predicted production figures for the 2020 calendar year.

Table 3-2 Production and Waste Rock Summary

Material	Project Approval Limit	Reporting Period (Calendar Year)		
		2018 (actual)	2019 (actual)	2020 (predicted)
Waste Rock/ Overburden (Mbcm^3)	N/A	55.8	54.3	64.1
ROM Coal (Mt)	8.6	7.9	7.4	8.4
Reject Material (Mt)	N/A	1.6	1.4	1.6
Stripped Topsoil (kbcm^3)	N/A	364.85	116.48	355
Saleable Product (Mt)	8.6 (by rail)	6.6	6.1	7.2

Mining operations within the 2019 calendar year remained below the limits specified in the PA. Specific conditions from Schedule 2 of the PA are presented in Table 3-3 with responses on the compliance of each also provided.

Table 3-3 Compliance with Project Approval Conditions

Project Approval Condition No. and Description	Compliance Response
6. The Proponent may undertake mining operations 24 hours a day, 7 days a week.	Compliant
8 The Proponent shall not extract more than 3.5 million tonnes of ROM coal from the site in any calendar year (on a pro rata monthly basis) while ever coal is being transported along the private haul road to the coal loader, unless a road safety audit at the intersections of Leard Forest Road and Therribri Road has been completed in consultation with Council and RMS, and any recommended actions implemented to the satisfaction of the Secretary.	Compliant – coal was transported via the rail spur during 2019
9. The Proponent shall not extract more than 4.5 million tonnes of ROM coal from the site in any calendar year (on a pro rata monthly basis) or undertake mining operations outside the disturbance area approved under DA36/88 MOD 2, unless the Biodiversity Management Plan required under condition 49 of Schedule 3 has been approved by the Secretary.	Compliant –The BMP has been approved.
10. The Proponent shall not extract more than 8.6 million tonnes of ROM coal from the site in any calendar year.	Compliant – 7.4 Mt of ROM Coal was extracted in 2019
11. The Proponent may process up to 4.2 million tonnes of ROM coal in the CHPP in any calendar year.	Compliant– 3.7 Mt of ROM coal was processed in the CHPP during 2019
11A. The Proponent shall not process any coal from the Tarrawonga coal mine unless it has demonstrated that adequate water license are held to account for the required water use associated with processing this coal, to the satisfaction of the Secretary.	Compliant – no coal was processed for Tarrawonga Coal Mine in 2019
12. The Proponent may transport up to 10 million tonnes of product coal via the Boggabri Rail Spur Line in any calendar year; comprising: (a) 8.6 million tonnes of product coal from the Boggabri coal mine in any calendar year. (b) 3 million tonnes of product coal from the Tarrawonga coal mine in any calendar year.	Compliant – 6.1 Mt of product coal from the Boggabri coal mine was transported in 2019. No coal from the Tarrawonga coal mine was transported in 2019.
13. The Proponent may only transport coal from the site by road for 22 months following the date of this approval, or for such additional period as may result from delays in construction of the Boggabri Rail Spur Line as agreed by the Secretary. Following expiry of this period, all coal is to be transported from the site via the Boggabri Rail Spur Line unless in exceptional circumstances as agreed with RMS, the Council and approved by the Secretary.	Compliant – transport of coal by road was ceased following the completion of the Boggabri Rail Spur Line. The Rail Spur was operational throughout 2018

3.4 Exploration

Exploration drilling was undertaken in 2019 by BCOPL, for the purpose of determining coal quality and structure for modelling through the installation of infill drill holes.

A total of 87 infill holes were drilled by BCOPL during the reporting period, as detailed in Table 3-4. All infill drill holes were completed for the purpose of structure and coal quality testing. Figure 3-1 indicates the location of the infill drill holes drilled during the 2019 calendar year.

Table 3-4 BCM Infill Drilling

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2387	227663.44	6611826.08	311.53	111.11	8/01/2019	12/01/2019	Sealed	Structure and Quality
BC2388	227579.54	6611781.77	309.66	114.09	13/01/2019	15/01/2019	Sealed	Structure and Quality
BC2389	227497.72	6611732.82	309.47	117.04	16/01/2019	23/01/2019	Sealed	Structure and Quality
BC2390	227944.92	6612003.12	316.02	120.21	24/01/2019	28/01/2019	Sealed	Structure and Quality
BC2391	226579.90	6610943.89	308.35	113.06	29/01/2019	31/01/2019	Sealed	Structure and Quality
BC2392	226549.37	6610809.91	305.95	105.07	5/02/2019	7/02/2019	Sealed	Structure and Quality
BC2393	226443.01	6610979.61	310.97	37.95	8/02/2019	9/02/2019	Sealed	Structure and Quality
BC2394	226468.99	6611115.63	313.06	104.96	10/02/2019	11/02/2019	Sealed	Structure and Quality
BC2395	226304.22	6611010.82	314.24	88.17	12/02/2019	14/02/2019	Sealed	Structure and Quality
BC2396	226338.89	6611150.36	316.63	87.04	19/02/2019	20/02/2019	Sealed	Structure and Quality
BC2397	226320.22	6610896.50	310.14	93.14	21/02/2019	25/02/2019	Sealed	Structure and Quality
BC2398	226203.65	6611065.50	317.15	80.57	26/02/2019	27/02/2019	Sealed	Structure and Quality
BC2399	227888.71	6612060.42	317.73	131.17	5/03/2019	8/03/2019	Sealed	Structure and Quality
BC2400	228004.00	6612128.43	319.61	141.22	9/03/2019	12/03/2019	Sealed	Structure and Quality
BC2401	228188.55	6612238.73	328.06	163.62	12/03/2019	21/03/2019	Sealed	Structure and Quality
BC2402	228386.48	6612370.34	342.10	178.19	22/03/2019	27/03/2019	Sealed	Structure and Quality
BC2403	228290.96	6612302.20	336.89	172.86	2/04/2019	8/04/2019	Sealed	Structure and Quality
BC2404	228132.79	6612206.98	324.43	156.40	9/04/2019	18/04/2019	Sealed	Structure and Quality
BC2405	228499.56	6612405.29	337.23	132.35	19/04/2019	20/04/2019	Sealed	Structure
BC2406	226904.51	6611649.08	318.46	96.35	22/04/2019	23/04/2019	Sealed	Structure
BC2407	228872.65	6612689.90	350.67	198.49	23/04/2019	24/04/2019	Sealed	Structure
BC2408	227272.84	6611795.40	311.95	105.28	25/04/2019	30/04/2019	Sealed	Structure
BC2409	227406.63	6611914.11	313.58	114.23	30/04/2019	1/05/2019	Sealed	Structure

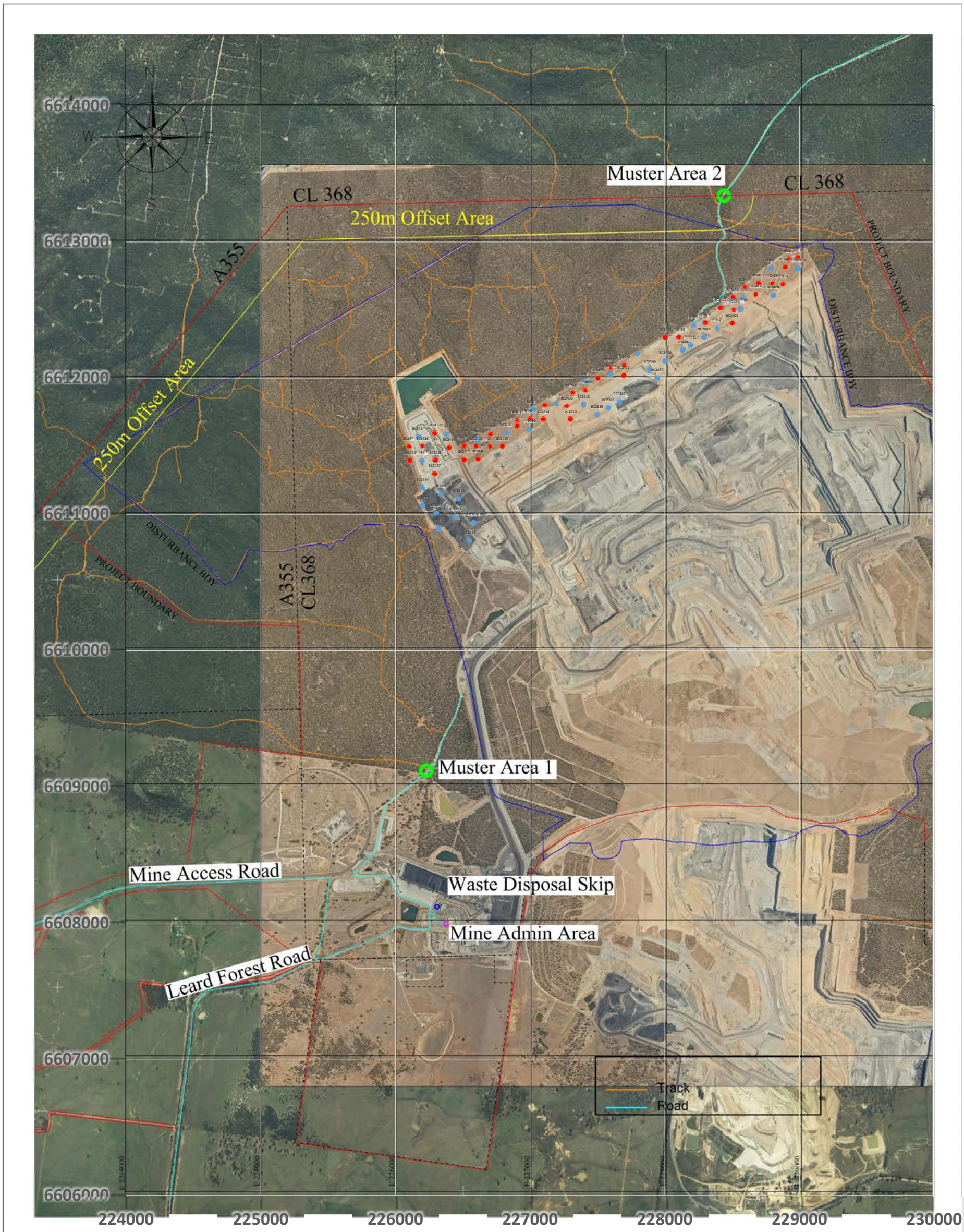
Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2410	227299.14	6611701.03	309.85	114.20	1/05/2019	2/05/2019	Sealed	Structure
BC2411	228672.18	6612616.73	342.72	186.30	2/05/2019	3/05/2019	Sealed	Structure
BC2412	227694.29	6612021.03	319.20	126.35	5/05/2019	6/05/2019	Sealed	Structure
BC2413	227397.41	6611804.24	311.76	114.28	6/05/2019	9/05/2019	Sealed	Structure and Quality
BC2414	226201.11	6611196.79	319.68	72.40	14/05/2019	15/05/2019	Sealed	Structure and Quality
BC2415	226200.07	6611393.27	324.84	81.38	16/05/2019	17/05/2019	Sealed	Structure and Quality
BC2416	226171.36	6611570.74	327.12	82.25	18/05/2019	20/05/2019	Sealed	Structure and Quality
BC2417	226605.46	6611547.22	320.77	87.99	20/05/2019	22/05/2019	Sealed	Structure and Quality
BC2418	226825.08	6611601.30	318.48	96.07	23/05/2019	30/05/2019	Sealed	Structure and Quality
BC2419	226993.89	6611626.67	315.99	95.99	30/05/2019	1/06/2019	Sealed	Structure and Quality
BC2420	228804.41	6612607.35	347.71	190.03	2/06/2019	13/06/2019	Sealed	Structure and Quality
BC2421	228989.49	6612806.21	359.19	206.74	14/06/2019	21/06/2019	Sealed	Structure and Quality
BC2421_R	228986.43	6612806.97	359.19	201.07	21/06/2019	25/06/2019	Sealed	Structure and Quality
BC2422	228554.60	6612506.94	340.24	183.72	4/07/2019	11/07/2019	Sealed	Structure and Quality
BC2422_R	228556.32	6612509.08	339.98	56.94	16/07/2019	16/07/2019	Sealed	Structure and Quality
BC2422RR	228559.05	6612511.05	340.14	57.07	24/07/2019	25/07/2019	Sealed	Structure and Quality
BC2423	228579.86	6612584.26	342.38	183.59	12/07/2019	26/07/2019	Sealed	Structure and Quality
BC2424	226106.45	6611397.11	326.19	78.00	4/07/2019	4/07/2019	Sealed	Structure
BC2425	226101.36	6611499.36	329.50	84.00	5/07/2019	5/07/2019	Sealed	Structure
BC2426	226200.50	6611501.45	326.55	84.17	5/07/2019	6/07/2019	Sealed	Structure
BC2427	226291.53	6611299.89	320.17	78.00	6/07/2019	6/07/2019	Sealed	Structure
BC2428	226297.79	6611398.30	321.73	84.00	7/07/2019	7/07/2019	Sealed	Structure
BC2429	227596.83	6612027.63	318.12	120.20	11/07/2019	13/07/2019	Sealed	Structure and Quality
BC2430	227190.88	6611812.92	313.38	96.02	13/07/2019	15/07/2019	Sealed	Structure and Quality

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2431	228213.97	6612390.09	336.96	180.06	25/07/2019	31/07/2019	Sealed	Structure and Quality
BC2432	227797.43	6612182.53	323.24	142.73	24/07/2019	30/07/2019	Sealed	Structure and Quality
BC2433	227413.90	6611975.37	314.57	111.14	30/07/2019	5/08/2019	Sealed	Structure and Quality
BC2434	228509.57	6612502.14	342.76	186.15	31/07/2019	1/08/2019	Sealed	Structure
BC2435	228103.14	6612302.01	326.45	166.00	1/08/2019	2/08/2019	Sealed	Structure
BC2436	228301.10	6612407.32	344.97	186.00	2/08/2019	3/08/2019	Sealed	Structure
BC2436C	228292.45	6612409.69	344.17	43.19	10/09/2019	12/09/2019	Sealed	Structure and Quality
BC2437	227020.00	6611769.59	317.45	93.14	4/08/2019	6/08/2019	Sealed	Structure and Quality
BC2438	228503.07	6612592.89	350.71	192.00	4/08/2019	5/08/2019	Sealed	Structure
BC2438C	228487.33	6612578.99	351.15	54.01	5/07/2019	7/07/2019	Sealed	Structure and Quality
BC2438R	228502.02	6612596.69	350.78	39.37	12/09/2019	13/09/2019	Sealed	Structure and Quality
BC2439	227502.10	6612002.01	315.25	117.00	6/08/2019	6/08/2019	Sealed	Structure
BC2440	227313.18	6611891.38	312.98	104.00	14/08/2019	14/08/2019	Sealed	Structure
BC2441	228414.15	6612517.88	352.87	216.00	14/08/2019	15/08/2019	Sealed	Structure
BC2441C	228416.07	6612522.14	352.84	57.04	8/09/2019	10/09/2019	Sealed	Structure and Quality
BC2441R	228411.86	6612521.19	352.93	25.50	4/10/2019	5/10/2019	Sealed	Structure and Quality
BC2442	227695.62	6612100.36	323.18	132.00	16/08/2019	16/08/2019	Sealed	Structure
BC2443	227595.55	6612080.60	320.69	126.14	17/08/2019	17/08/2019	Sealed	Structure
BC2444	226509.42	6611504.43	320.55	90.00	17/08/2019	18/08/2019	Sealed	Structure
BC2445	226509.74	6611402.61	318.36	84.00	19/08/2019	20/08/2019	Sealed	Structure
BC2446	226613.46	6611408.13	316.29	90.00	20/08/2019	21/08/2019	Sealed	Structure
BC2447	226700.03	6611502.00	316.85	90.00	21/08/2019	21/08/2019	Sealed	Structure
BC2448	226598.92	6611501.55	319.21	84.00	22/08/2019	22/08/2019	Sealed	Structure
BC2449	226706.28	6611590.17	317.98	90.00	22/08/2019	23/08/2019	Sealed	Structure

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2450	226793.58	6611501.22	314.15	96.00	23/08/2019	24/08/2019	Sealed	Structure
BC2451	226902.99	6611696.34	319.97	90.00	24/08/2019	25/08/2019	Sealed	Structure
BC2452	226998.91	6611701.30	317.90	96.00	25/08/2019	25/08/2019	Sealed	Structure
BC2453	227098.53	6611700.32	314.78	102.00	26/08/2019	26/08/2019	Sealed	Structure
BC2454	226398.37	6611491.22	321.39	84.00	27/08/2019	27/08/2019	Sealed	Structure
BC2455	227107.02	6611802.45	315.63	96.00	27/08/2019	27/08/2019	Sealed	Structure
BC2456	228793.86	6612694.50	344.26	192.00	28/08/2019	29/08/2019	Sealed	Structure
BC2457	226291.61	6611597.75	326.82	84.00	14/09/2019	14/09/2019	Sealed	Structure
BC2458	228003.55	6612300.24	324.47	156.00	15/09/2019	16/09/2019	Sealed	Structure
BC2459	228982.84	6612884.08	367.78	222.00	25/09/2019	27/09/2019	Sealed	Structure
BC2460	228592.06	6612668.96	345.57	192.00	28/09/2019	30/09/2019	Sealed	Structure
BC2461	228692.42	6612698.99	347.20	198.00	2/10/2019	3/10/2019	Sealed	Structure
BC2462	228920.93	6612873.94	367.05	224.00	7/10/2019	8/10/2019	Sealed	Structure
BC2463	228788.12	6612809.45	359.68	461.94	6/10/2019	9/11/2019	Open	Structure and Quality
BC2464	226378.55	6611587.30	325.15	249.03	10/11/2019	19/11/2019	Open	Structure and Quality
BC2465	228893.43	6612817.53	360.16	210.00	27/11/2019	28/11/2019	Open	Structure

Exploration January to December 2019

Printed Tuesday, 28 January 2020



REV	REVISIONS	DATE

Completion of the Quality Record is evidence that thedrawing has been verified conforming with the requirements of the Quality Plan. Where the Quality Record is incomplete all information on this drawing is intended for preliminary purposes only as it is unchecked.

QUALITY RECORD			
REVIEW	NAME	SIGNATURE	DATE
DRAWN	NIC GARDNER		13/1/20
DWG CHECKED by			

SCALE
See Grid

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BOGGABRI COAL

FILE REF.
2020 exploration GA plan base 130120.dwg

PLOT FILE:
2020 exploration GA plan base 130120.pdf

JOB REF:
0045

ORIG. FILE SIZE :
A1

Boggabri Coal Operations

General Arrangement Plan For Exploration works

DRAWING NO.:
130120e

REV

3.5 Construction Activities during 2019

A summary of construction activities undertaken during the reporting period and their completion status is provided in Table 3-5.

Table 3-5 Summary of Construction Activities during the Reporting Period

Infrastructure	Commencement Date	Completion Date
Construction of an awning for the heavy vehicle workshop	October 2018	May 2019
Construction of a new product stockpile expansion	July 2019	Ongoing

3.6 Construction Activities Proposed for 2020

Activities during the 2020 reporting period will involve the construction of a new topsoil stockpile area and replacement of the ROM stockpile bin.

4 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE

The Environment Management Strategy (EMS) provides the strategic framework for environmental management at BCM. The EMS:

- Outlines all relevant statutory leases, licences and approvals that apply to BCM.
- Details key plans, procedures, management plans and other documents that will be implemented to ensure compliance with all relevant leases, licences and approvals.
- Describes the key processes that will be implemented to:
  - Communicate with community and government stakeholders.
  - Manage community complaints.
  - Resolve disputes.
  - Respond to non-compliance incidents and emergencies.
- Outlines BCM's monitoring, reporting and auditing requirements.
- Outlines relevant roles, responsibilities and accountabilities relevant to environment management for all BCOPL employees and contractors.

A suite of environmental management plans (EMPs) have been developed to guide environmental management at BCM. They have been developed in accordance with the EMS, the PA and other statutory requirements. The revision status of approved key EMPs, as required by the PA, is summarised in Table 4-1.

Table 4-1 Key EMPs

Management Plan	Status
Mine Operations Plan (MOP)	January 2020 – 2020 to 2024
Blast Management Plan (BLMP)	Rev 5 November 2018 – Approved by DPIE
Blast Fume Management Protocol	Rev 3 July 2018 – Approved by DPIE
Air Quality and Greenhouse Gas Management Plan (AQGHGMP)	Rev 6 July 2018 – Approved by DPIE
Traffic Management Plan (TMP)	Rev 3 January 2015 – Approved by DPIE
Cultural Heritage Management Plan (CHMP)	Rev 7 November 2016 – Approved by DPIE
Environment Management Strategy (EMS)	January 2013 – Approved by DPIE
Noise Management Plan (NMP)	Rev 13 April 2019 – Approved by DPIE
Water Management Plan (WMP) Surface Water Management Plan (SWMP) Groundwater Management Plan (GWMP) Site Water Balance (SWB)	Rev 6 May 2017 – Approved by DPIE
Social Impact Management Plan (SIMP)	Rev 4 November 2013 – Approved by DPIE
Rehabilitation Management Plan (RMP)	Incorporated into the MOP for the project, at the request of DPIE. The current MOP was approved January 2020.
Biodiversity Management Plan (BMP)	October 2018 – Approved by DPIE
Biodiversity Offset Strategy	Rev G March 2019 – Approved by DPIE
Pollution Incident Response Management Plan (PIRMP)	August 2019

The PIRMP listed in Table 4-1 applies to all activities that have the potential to generate pollution incidents at BCM. These include, but are not limited to, water discharge events, hazardous spills resulting in land or water pollution, and fire hazards.

The PIRMP provides an overarching procedure to respond to pollution incidents at BCM including:

- Outlining the response and notification requirements in the event of a pollution incident at BCM.
- Providing clear definition of the roles and responsibilities for pollution incident responses at BCM.
- Facilitating compliance with the requirements of the POEO Act and associated regulations.

4.1 Meteorology

4.1.1 Environmental Management

The PA (Schedule 3, Condition 32) requires a permanent meteorological station to be installed and maintained for the life of the BCM. The station must comply with the requirements of the *Approved Methods for Sampling of Air Pollutants in New South Wales* (2007) Guideline and be capable of determining the temperature lapse rate.

As such, a meteorological monitoring station (MET) has been established to continuously measure and record wind speed, wind direction, temperature, solar radiation and rainfall at BCM. The location of the BCM MET station is shown on the Environmental Monitoring Location Plan in **Appendix A**.

The MET station provides real-time data to BCOPL employees and contractors. Meteorological data is used for assessing compliance, proactive dust and noise management, and for investigative and reporting requirements.

The parameters recorded by the BCM MET monitoring station and the method are outlined in Table 4-2.

Table 4-2 MET monitoring parameters

Parameter	Units	Frequency	Averaging period
Temperature at 2 m	ºC	Continuous	15 minute
Temperature at 10 m	ºC	Continuous	15 minute
Wind direction at 10 m	º	Continuous	15 minute
Sigma theta at 10 m	º	Continuous	15 minute
Rainfall	mm/hr.	Continuous	1 hour
Solar radiation	W/m2	Continuous	15 minute
Additional requirements: – Siting & Measurement	n/a	n/a	n/a

4.1.2 Environmental Performance

4.1.2.1 Temperature

Maximum, minimum and average temperatures are calculated daily from the 15 min recordings. Figure 4-1 shows average monthly temperature records for the reporting period (10m MET recordings). Compared to the previous reporting period, the average minimum and maximum temperatures are notably higher in summer.

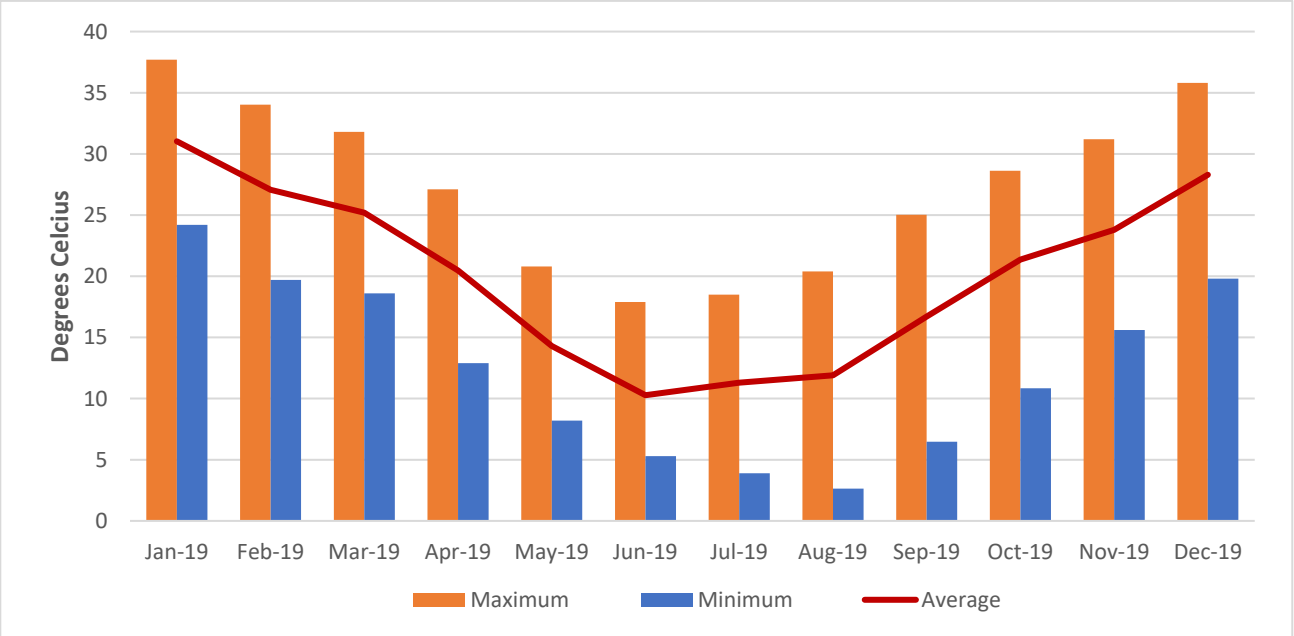


Figure 4-1 2019 Monthly Temperature Records

4.1.2.2 Rainfall

Rainfall is measured using an RG5 type flow-through monitor, with a 15-minute recording interval. Monthly rainfall totals for the reporting period are presented in Figure 4-2. A comparison of 2018-2019 rainfall is shown in Figure 4-3.

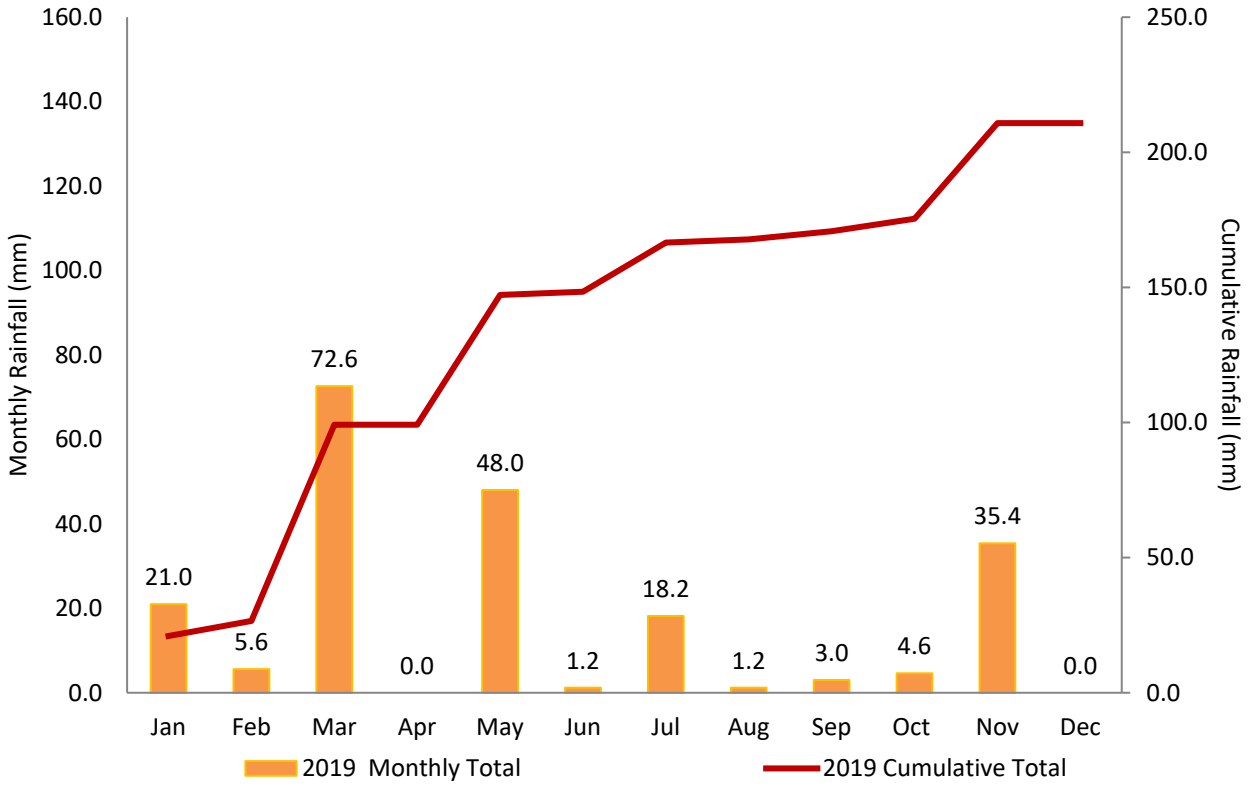


Figure 4-2 Monthly Rainfall

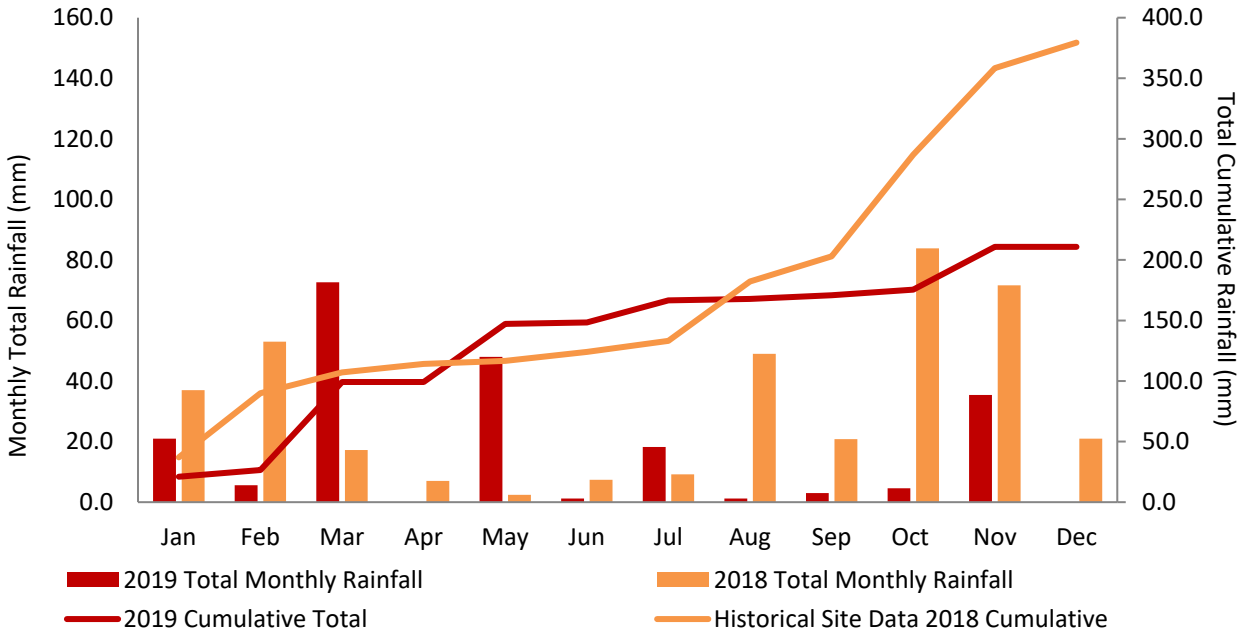


Figure 4-3 Comparison of 2018 and 2019 Rainfall

4.1.2.3 Wind

Wind speed and direction are important parameters for preparation of blasting activities, investigating noise and dust complaints, and assessing cumulative impacts as a result of other coal mines operating in the region. Wind data for 2019 are presented in the wind roses provided in Figure 4-4, Figure 4-5 and Figure 4-6. Wind speed values are displayed as metres per second.

Analysis of data reveals that prevailing winds during the 2019 reporting period were predominantly from the north and west in January, from the south-east from February through April and from the north-west and south-east from May through December.

The prevailing wind conditions during this reporting period were relatively consistent with the historical data as presented in the 2010 EA. Average wind speeds were lower in all months except February, March, April and June than the previous reporting period.

The MET data identified that average monthly wind speed generally did not exceed 3 m/s, except in February where the average monthly wind speed was 3.48 m/s.

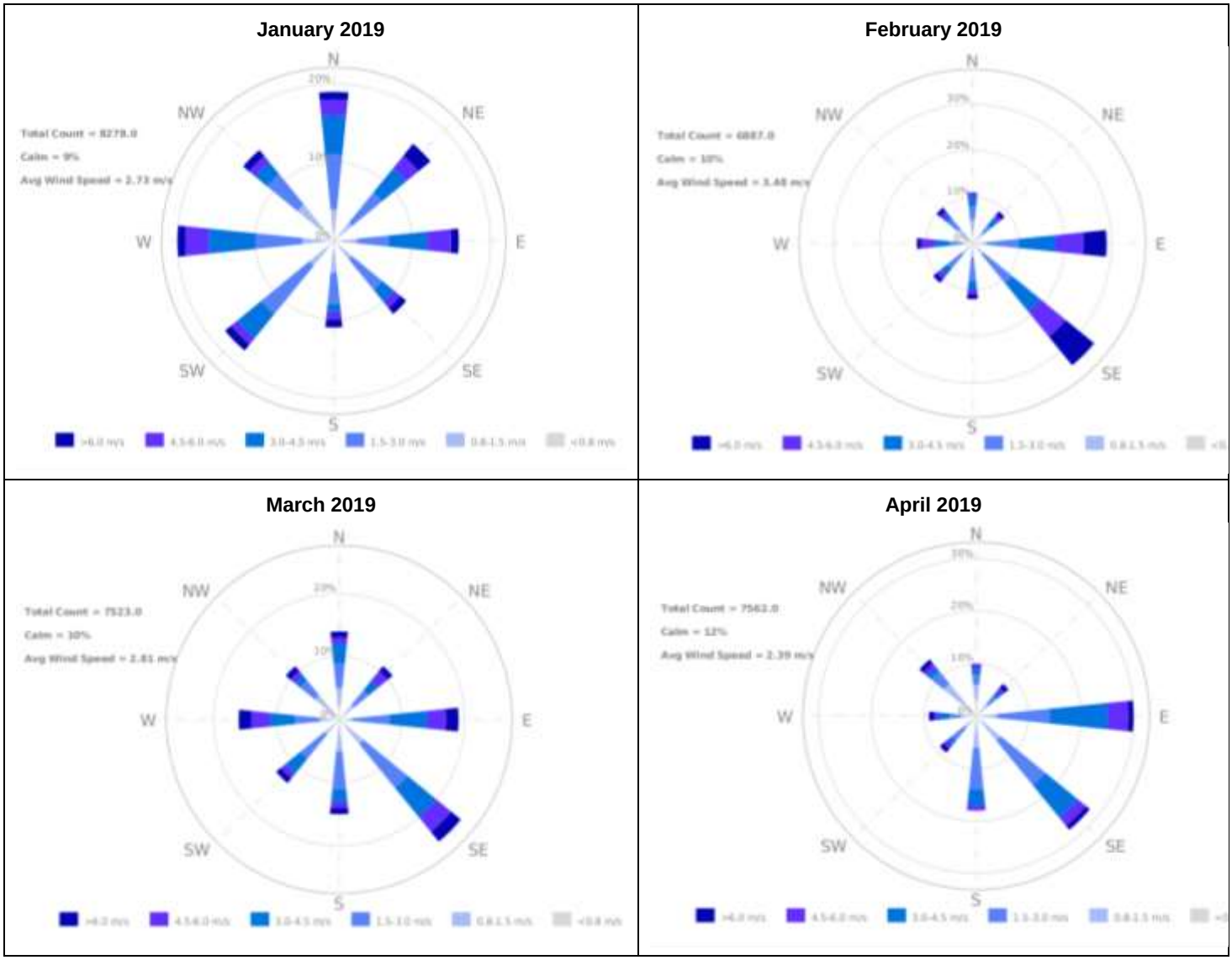


Figure 4-4 Monthly Wind Rose Summary January – April 2019

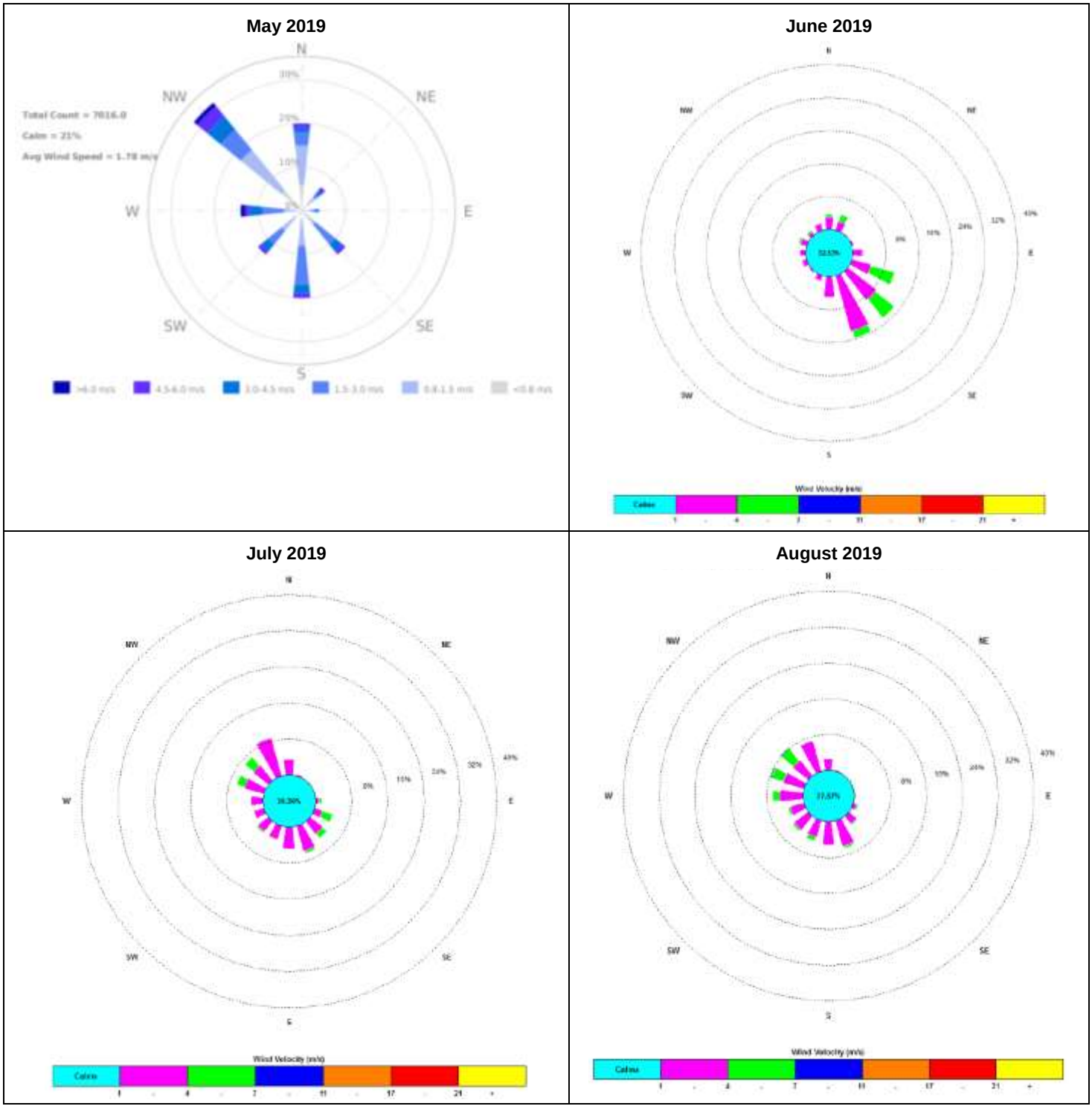


Figure 4-5 Monthly Wind Rose Summary May – August 2019

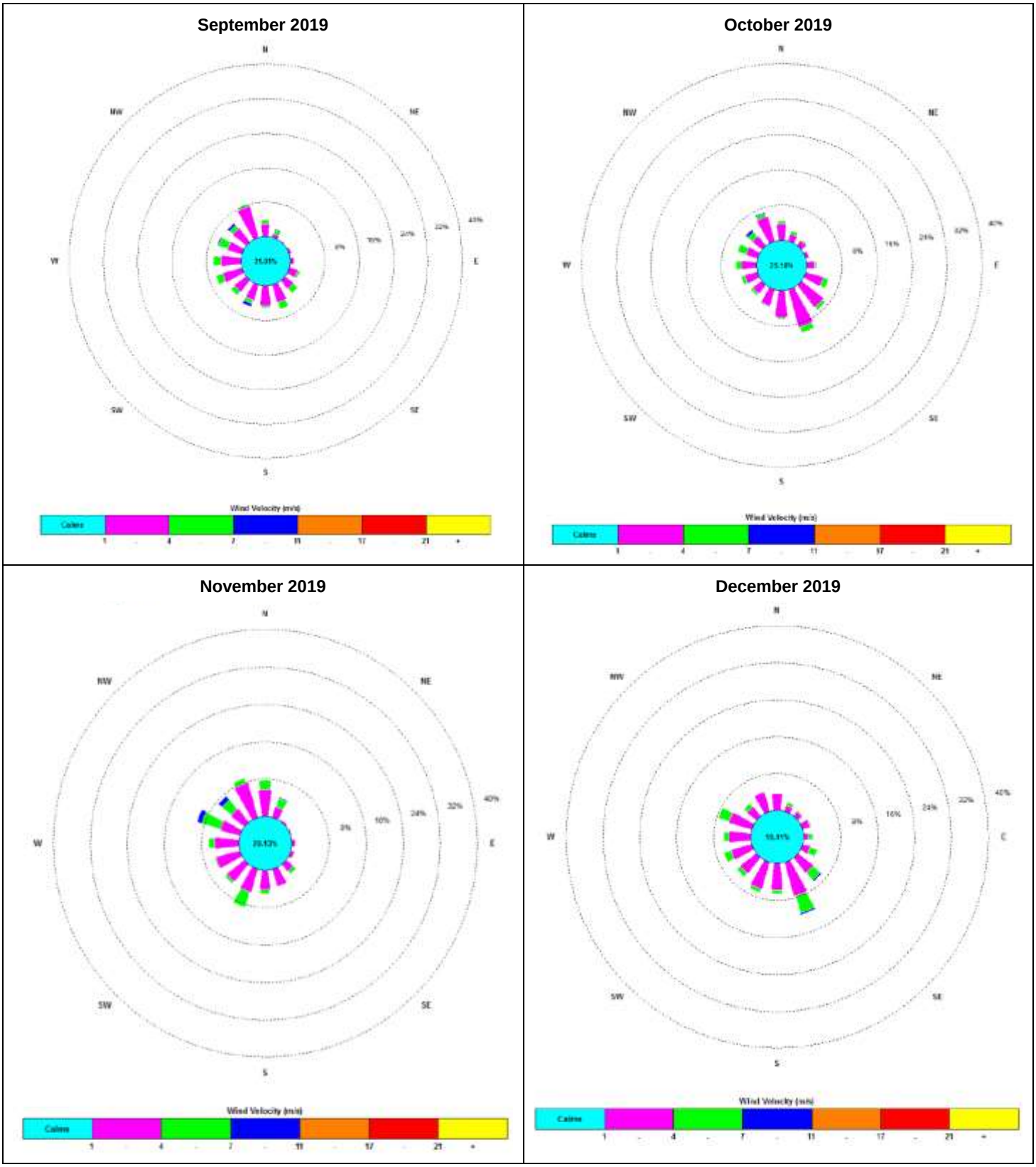


Figure 4-6 Monthly Wind Rose Summary September – December 2019

4.1.3 Improvements and Initiatives

Building on the work completed during the 2018 reporting period, BCOPL continued to implement and refine the real-time air quality management system at the BCM. This included ongoing utilisation of real-time meteorological data and weather forecasting software to guide the day-to-day implementation of reactive and proactive mitigation measures.

4.2 Air Quality

4.2.1 Environmental Management

Air quality management at BCM is undertaken in accordance with the AQGHGMP. Through implementation of the AQGHGMP, BCOPL execute a range of mitigation measures for air quality that have proved to be effective at managing dust impacts, demonstrated by maintaining compliance with criteria specified in the PA. During the reporting period, mitigation measures included the following:

- Dust suppression with bulk water trucks using dust suppression additives 'Avenger Coal' and 'Boost X' in mining areas, construction areas and haul roads during the 2019 reporting period.
- Visual assessments of mining and coal transport areas to identify dust sources and modify operations as required.
- Progressive rehabilitation of waste emplacements.
- Revegetating disturbed areas of the rail corridor.
- Implementation of product coal handling controls to minimise dust generation.
- Maintaining unsealed surfaces and trafficable areas in good condition.
- Installation and maintenance of dust suppression equipment on drill rigs.
- Implementing good practice blast design to minimise dust and plan blasting to suit meteorological conditions.
- Monitoring meteorological conditions to plan and modify operations as required.

These mitigation measures will continue to be employed throughout 2020.
BCOPL implements a dust monitoring program to measure concentrations of depositional dust, PM_{10} and $PM_{2.5}$ in the vicinity of the BCM. Depositional dust monitoring provides an indication of levels of dust in the atmosphere measured in g/m²/month of insoluble matter. PM_{10} measures the concentration of particulate matter less than 10 microns in diameter, whilst $PM_{2.5}$ monitoring measures the concentration of particulate matter less than 2.5 microns in diameter. PM_{10} monitoring utilises a High Volume Air Sampler (HVAS) and tapered element oscillating microbalance (TEOM), whilst $PM_{2.5}$ is measured only using a TEOM.

The current dust monitoring program includes 3 depositional dust gauges, two HVAS and four TEOMs, details of which are provided in Table 4-3. A figure showing the location of each air quality monitoring site is provided in **Appendix A**.

Table 4-3 Air quality monitoring sites

Site ID	To be used for compliance monitoring?	Type	Units	Frequency
D4-Greenhills	Yes	Deposited dust gauge	g/m^2/month	Monthly
D5-Goonbri	Yes	Deposited dust gauge	g/m^2/month	Monthly
D6-Onavale	Yes	Deposited dust gauge	g/m^2/month	Monthly
Roma/ Cooboobondi	Yes[1]	HVAS (PM_{10})	µg/m^3	Every 6 days
Merriown	No[2]	HVAS (PM_{10})	µg/m^3	Every 6 days
Velyama	No	TEOM (PM10)	µg/m3	Continuous
Goonbri	No	TEOM (PM10)	µg/m3	Continuous
Tarrawonga	No	TEOM (PM_{10})	µg/m^3	Continuous
Wilberoi East	Yes	TEOM (PM_{10} and $PM_{2.5}$)	µg/m^3	Continuous

[1] Roma HVAS unit moved to Cooboobindi following land owner request in February 2019

[2] Merriown HVAS unit removed from EPL12407 in November 2019

4.2.2 Environmental Performance

4.2.2.1 Depositional Dust

BCM's depositional dust monitoring is undertaken on a monthly basis at three monitoring sites: D4, D5 and D6 (refer to **Appendix A**). D5 is located on land owned by BCOPL, while D4 and D6 are located on land owned by Whitehaven Coal Pty Limited.

In accordance with the PA (Schedule 3, Condition 27), the annual average depositional dust must not exceed the limit of 4 g/m^2/month at any residence on privately owned land, or on more than 25 percent of any privately-owned land. Given that there are no criteria specified for non-privately owned land, the results have been assessed against these criteria for consistency, despite land being mine-owned.

Sampling and analysis is undertaken in accordance with *AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.*

4.2.2.1.1 Results

Depositional dust samples were subject to visual analysis by a NATA accredited laboratory to determine sample contamination by naturally occurring impurities. Table 4-4 presents the corrected results following visual analysis of the three dust monitors.

The results indicate that all depositional dust gauges remained below the criterion for the annual average during 2019.

Table 4-4 Depositional Dust – Annual Average Results

Monitoring Point	Annual average limit (g/m^2/month)	Corrected annual average* (g/m^2/month)
D4	4	2.3
D5	4	1.7
D6	4	2.9

* Total adjusted after visual analysis. Annual average applies to 2019 calendar year.

Depositional dust systems are often subject to contamination by naturally occurring impurities such as bird droppings, insects and vegetation. On fifteen occasions over the reporting period, samples were observed to be contaminated and were therefore not analysed by the laboratory. This included samples from January (D4 and D6), February (D4 and D6), March (D6), April (D6), May (D4 and D6), June (D4 and D6), July (D4 and D6), August (D4 and D6) and September (D6),

The result for D4 and D5 are above the predicted levels documented in the EA (0.5 and 0.6 g/m^2/month) for the closest corresponding year of operations (Year 10). D6 is located outside the area assessed in the EA and no predictions were provided. All dust gauge results remain below the criteria specified in the PA.

Depositional dust levels recorded during the 2019 reporting period remain within the range of historical results.

4.2.2.2 PM10

BCM monitors PM_{10} dust compliance through one HVAS unit and one TOEM (Wilberoi East). The BCM HVAS is located on the Cooboobindi property, approximately 8 km west of the BCM, and has been operational at this location from 15 March 2019. This HVAS unit was formerly located at the Roma property, however it was moved to Cooboobindi following a landowner request in February 2019. The BCM HVAS located on the Merriown property approximately 1 km west of the BCM was discontinued as a compliance monitoring location in 2018 as it was located on mine owned property and the PA and EPL criteria were not applicable at this location. Sampling is undertaken for a period of 24 hours every 6 days. PM_{10} monitoring is ongoing from previous reporting periods. Results for the HVAS located at Roma and Cooboobindi have been provided in this report and will continue to be monitored at Cooboobindi throughout 2020.

PM_{10} is also compliance monitored at one TEOM (Wilberoi East), which is located approximately 5km south-east of BCM. Sampling is undertaken continuously (5 minute intervals) and its results have been provided in this report and will continue to be monitored throughout 2020.

4.2.2.2.1 Results

The PM_{10} monitoring results over the reporting period for Roma HVAS (January and February only) and Cooboobindi are provided in Figure 4-7 and Figure 4-8 respectively. Both figures also include BCM's rolling average over the reporting period. The PM_{10} monitoring results of the Wilberoi East TEOM over the reporting period is provided in Figure 4-9, which also includes BCMs rolling average over the reporting period.

In accordance with the PA, the short-term concentration limit for PM_{10} over each 24-hour period is 50 µg/m^3 while the long-term concentration limit for the annual average is 30 µg/m^3.

The average PM_{10} concentrations at the Cooboobindi HVAS monitor over the reporting period was 23.2µg/m^3 per month. The Roma HVAS averaged 24.55µg/m^3 over the two months it was operational at this location. In comparison, the average concentration at the Roma HVAS in the 2018 reporting period was 27.2 µg/m^3. The annual average PM_{10} levels are above the PM_{10} levels (14µg/m^3) predicted in the EA. Elevated dust levels compared with those predicted in the EA are likely attributed to higher wind speeds and less rainfall during 2019 and several environmental events such as bushfires and dust generation related to drought conditions in the locality.

Exceedances of the short term PM_{10} criterion recorded at the Cooboobindi HVAS occurred three times in October, once in November and once in December. These exceedances of criteria are not considered non-compliances as they can be attributed to the regional air quality reported by the DPIE (formerly OEH) air quality monitoring network for North-west slopes being above the criteria (50µg/m^3) on these days. The long term annual PM^{10} criterion was not exceeded at Cooboobindi during the reporting period.

The short-term PM_{10} results for the 2019 reporting period are generally consistent with the 2018 and 2017 reporting periods. Cooboobindi HVAS was predicted to have an annual average of 15µg/m^3 in the EA. The short term PM_{10} levels at Cooboobindi were generally consistent with levels predicted in the EA, however, were regularly above in the latter parts of the reporting period. A similar trend is seen in regional air quality, where the amount of days where PM_{10} levels exceeded 50µg/m^3 increased between September and December due to regional dust events and bushfires, which is reflected in the PM_{10} monitoring results.

Short-term PM_{10} results for the Wilberoi East TEOM recorded a total of fifty three (53) exceedances of the short-term criteria over the reporting period. In 41 out of the 53 occasions the PM_{10} 24 hr average for the North-west slopes area exceeded 50ug/m^3, indicating that ambient air quality was above the assessment criteria irrespective of dust originating from the mine. Of the remaining 12 occasions, 11 were determined to be not mining related as the wind direction for the 24 hour periods prior to and during the exceedance were coming from directions away from BCM. The remaining exceedance on 21 September at Wilberoi East was attributed to localised dust generation as the Tarrawonga and Velyama TEOMs, which are located closer to BCM, recorded PM_{10} concentrations below the criteria. Paddocks to the north-east of the Wilberoi East TEOM were observed to contain large areas of exposed ground and were subject to wind speeds of greater than 5 m/s on this day, resulting in significant localised dust generation.

In accordance with note ‘d’ of Schedule 3 Condition 27 of the Boggari Coal PA, the above short-term PM10 exceedences were disregarded when calculating the average annual PM10 concentration at Wilberoi East TEOM. These exceedences were disregarded due to being caused by 'extraordinary events' (dust events and bush fires). The corrected average annual PM10 concentration at the Wilerboi East TEOM monitor over the reporting period was 24.38µg/m3.

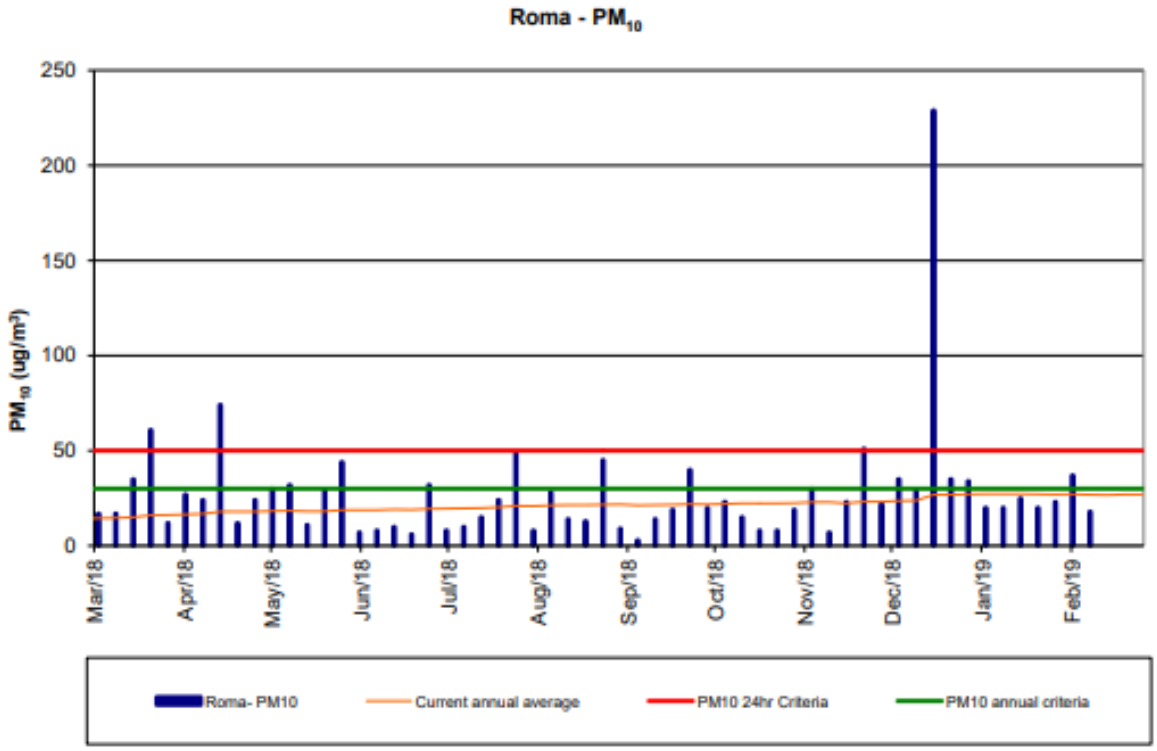


Figure 4-7 Roma PM_{10} Monitoring Annual Results[1]

1: Only data from January 2019 to February 2019 will be assessed in this report.

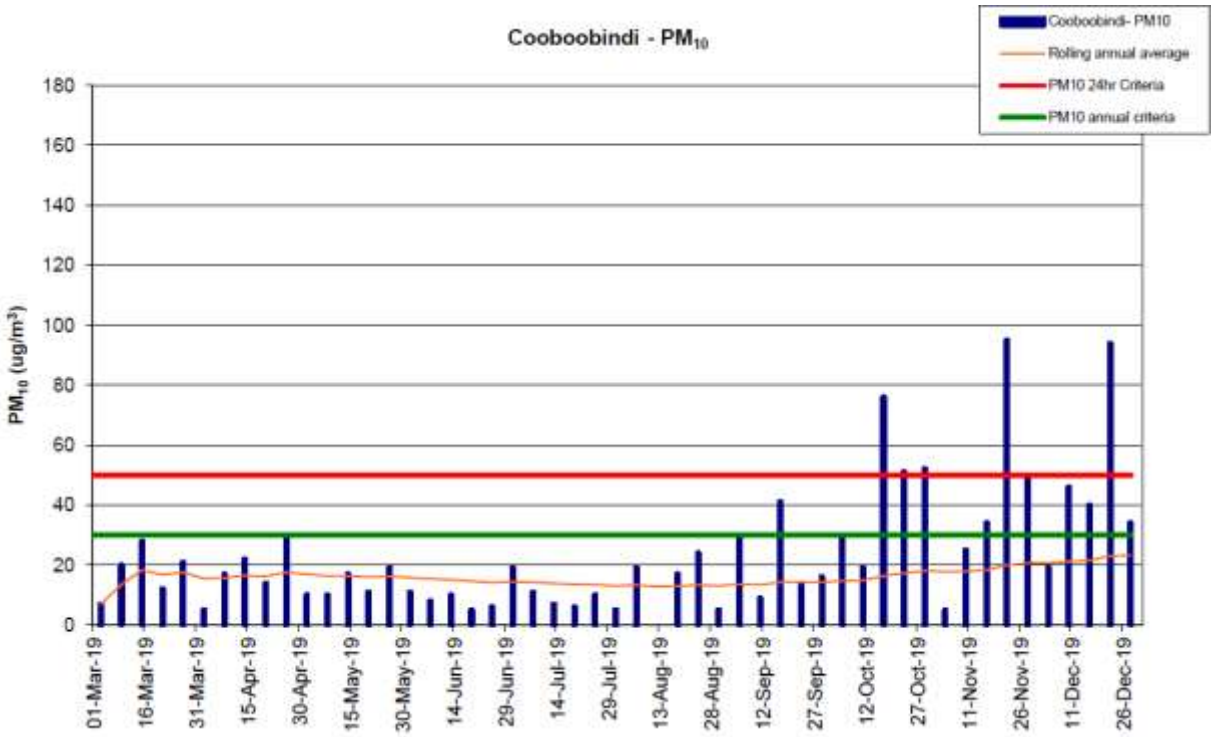


Figure 4-8 Cooboobindi PM_{10} Monitoring 2019 Results

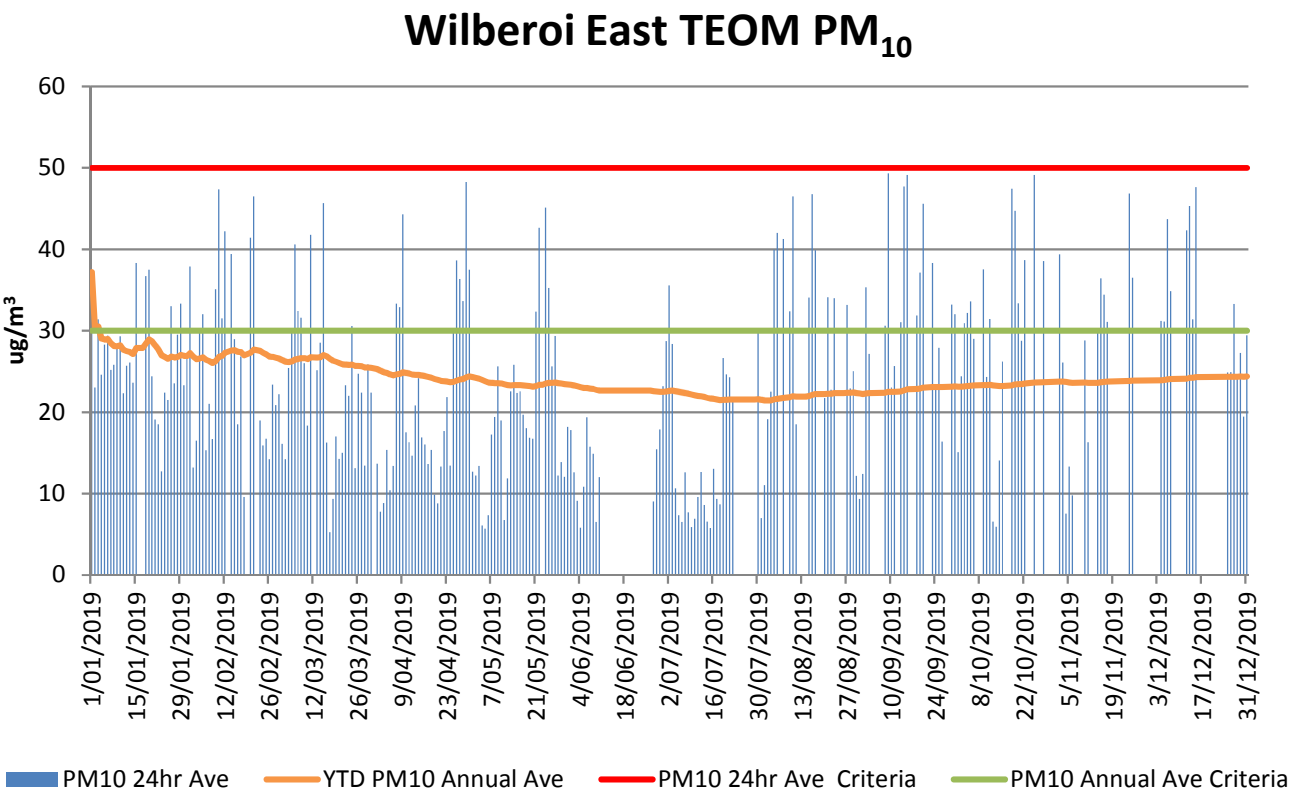


Figure 4-9 Wilberoi East PM_{10} Monitoring 2019 Results

4.2.2.3 Total Suspended Particulates

The ambient air quality criterion for Total Suspended Particulates (TSP) quoted in Table 9 of the PA (annual average 90µg/m³) is based on a value derived by the National Health and Medical Research Council in 1996. There is an established relationship between TSP concentration and the concentration of PM_{10}. In areas where coal mining is a significant component of the local particulate emission inventory, PM_{10} typically comprises ~40% of the TSP (SPCC, 1986 and others).

As prior studies have confirmed that the long-term average PM_{10} to TSP ratio is close to 0.4:1, that is, 40% of TSP is comprised of PM_{10}, inversely, the relationship between TSP and PM_{10} can be written as: TSP = PM_{10} x 2.5. Due to the nature of the relationship between TSP and PM_{10} levels, the TSP criterion of 90 µg/m³ (annual average) will always be satisfied when the long-term PM_{10} criterion of 30 µg/m³ is satisfied.

As discussed above in Section 4.2.2.2, Boggabri Coal currently monitor PM_{10} at Cooboobindi.

In consideration of the historical PM_{10} monitoring undertaken for the BCM (i.e. results have historically been significantly below the PM_{10} annual average criteria) and the above relationship between PM_{10} and TSP, BCOPL consider that compliance with the long-term TSP criteria can be demonstrated via the application of the known relationship between PM_{10} and TSP. This can be achieved by calculating annual average TSP results from the PM_{10} monitoring using the above calculation for the locations in the vicinity of the operation. The calculation of TSP is based on the available data at the Cooboobindi HVAS monitoring location.

The results indicate the annual averageTSP at Cooboobindi (50.8 µg/m³) is below the air quality criterion in the PA for the reporting period.

4.2.3 Improvements and Initiatives

BCOPL moved the Roma PM_{10} HVAS to Cooboobindi on request of the land holder. The Roma PM_{10} HVAS was decommissioned in February 2019 and the Cooboobindi PM_{10} HVAS was commissioned in March 2019.

BCOPL installed an additional two management tool TEOMs during the 2019 reporting period. The two new sites Velyama and Goonbri TEOMs recorded data between April and December 2019. The Tarrowonga TEOM recorded data for all of 2019. All four TEOMs remain operational (Compliance unit - Wilberoi East; Management tool units - Tarrawonga, Goonbri and Velyama).

4.3 Operational Noise

4.3.1 Environmental Management

Operational noise is managed by BCOPL in accordance with the approved NMP and EPL12407. Revision 13 of the NMP was approved by the DPIE in April 2019.

The NMP covers all operational activities with the potential to generate noise at the BCM. It details specific noise management and mitigation measures, outlines monitoring and reporting requirements and provides clear definition of the roles and responsibilities for noise management. Blasting is addressed in Section 4.4.

BCOPL proactively implements a range of noise mitigation measures for operational activities at BCM. During the reporting period, these included the following:

- Implementing an annual monitoring plan to ensure the effectiveness of attenuated plant is maintained.
- Enforcing speed limits for product trucks in accordance with the NMP.
- Progressive replacement of components of the existing fleet found to be generating excessive noise.
- Maintaining plant and equipment to manufacturer's standards.
- Placement of spoil in strategic locations to enhance noise screening.
- Scheduling noisy activities between 7 am and 6 pm where possible.
- Selecting alarms, horns and warning devices such as reverse squawkers which produce the lowest possible noise level within safety requirements.
- Monitoring weather conditions on a daily basis.
- Screening or partially enclosing conveyor belt motors at the coal handling area.
- Ensuring train loading chute and bins are closed.
- Conducting train speed noise testing to optimise train speed for minimum noise.

BCOPL engaged acoustic specialists to undertake attended noise monitoring in 2019 on a monthly basis at locations defined in the NMP to adequately assess the noise impacts related to BCM. Prior to 2016, this was undertaken quarterly.

In addition, sound power level monitoring is undertaken annually, in accordance with the PA, to assess the performance of mine plant against the sound power levels predicted in the EA. Sound power level monitoring for 2019 was conducted over six events in January, June and July. Results of this monitoring is presented in Section 4.3.2.2.

4.3.2 Environmental Performance

4.3.2.1 Attended Noise Monitoring

Monthly attended noise monitoring surveys were carried out during 2019. Each monthly survey was undertaken during the night-time period only. Prior to 2016, three measurements were undertaken at each location during each time period (day, evening and night) on a quarterly basis. Due to the uniformity of noise limits across day, evening and night periods, an alternative monitoring methodology involving one fifteen minute measurement at each location during the night period, on a monthly basis, was agreed to by DPIE and the EPA. This alternative method was adopted from January 2016 onwards.

The monthly monitoring locations included the properties documented in Table 4-5, which was based upon the locations as documented in the updated NMP and a modification to EPL12407. Monitoring was undertaken at three locations during the 2019 noise monitoring surveys. The results are presented in the following sections.

Table 4-5 Current Attended Noise Monitoring Locations

Noise Monitoring Site ID	Current Monitoring Location
N2	Sylvania, Dripping Rock Road
N3	Picton, Dripping Rock Road
N4	Barbers Lagoon, Boggabri-Manilla Road

The conditions of the PA specify that BCM's operational noise limits apply to all nominated private residences except for those that are either subject to a noise agreement with BCM, or subject to acquisition or noise mitigation on request.

BCM's operational noise limits are 35 dB(A) $L_{eq\ (15\ minutes)}$ for day, evening and night time periods which are defined as follows:

- Day – 7 am to 10 pm Monday to Saturday and 8am to 6pm on Sunday and public holidays
- Evening – 6 pm to 10 pm
- Night – all other times

In addition to the above, the noise level at night must not exceed the sleep disturbance level specified as 45dB(A) $L_{1\ (1\ min)}$, at any residence. Operational noise limits are specified in Table 4-6.

Table 4-6 Noise Limits

	Operational Noise Impact Criteria			Sleep Disturbance Criteria	Cumulative Noise Criteria (BTM complex)
	Day $L_{Aeq\ (15\ min)}$	Evening $L_{Aeq\ (15\ min)}$	Night L_{Aeq} (15 min)	Night $L_{Aeq\ (1\ min)}$	Day, Evening, Night, L_{Aeq} (15 min)
All privately-owned residences	35 dB(A)	35 dB(A)	35 dB(A)	45 dB(A)	40 dB(A)

Table 5 in Schedule 3 of the PA also specifies long-term intrusive noise goals at all privately owned existing residences, which concur with the limits specified in Table 4-6.

4.3.2.1.1 Results

A summary of the attended noise monitoring results is provided in Table 4-7. This includes all monthly monitoring conducted in 2019.

Noise levels assessed as part of the monitoring program were within all operational noise criteria. They were also lower than the noise levels predicted in the EA (Hansen Bailey, 2010), and did not exceed the sleep disturbance limit at night. BCM was successful in achieving the long-term intrusive noise goals during the 2019 reporting period.

All attended noise monitoring results were undertaken to assess cumulative noise from the Boggabri-Tarrawonga-Maules Creek Complex (BTM Complex) and confirmed the noise levels were within the cumulative noise criteria for the PA (refer to Table 4-6).

Table 4-7 Summary of attended noise monitoring results - dB(A) $L_{Aeq\ (15\ minutes)}$ & L1 (1 min)

Location	@Criteria dB(A) $L_{eq\ (15\ min)}$	#Criteria dB(A) $L_{1\ (1\ min)}$	14 Jan	06 Feb		27 Mar		16 Apr		2 May		5 Jun		8 Jul		7 Aug		23 Sep		10 Oct		14 Nov		2 Dec	
Sylvania	35	45	^	^	^	^	^	^	^	<20	25	^	^	^	^	^	^	^	^	^	^	^	^	^	^
Picton	35	45	^	^	^	^	^	^	^	^	^	^	^	^	^	<30	<30	^	^	^	^	^	^	^	^
Barbers Lagoon	35	45	^	<30	31	^	^	<25	<25	<25	<25	^	^	^	^	^	^	^	^	~	~	^	^	^	^

Notes: N/A in the 'Criteria' column denotes properties that are either mine-owned or are subject to acquisition rights as per the PA.

^ BCM Inaudible.

~ Not measureable

@ Operational noise impact criteria.

Sleep disturbance noise criteria.

* Cumulative noise impact criteria.

4.3.2.2 Sound Power Screening

Schedule 3, Condition 10 of the PA requires BCOPL to:

'(a) Conduct an annual testing program of the attenuated plant on site to ensure that the attenuation remains effective;
(b) Restore the effectiveness of any attenuation if it is found to be defective; and
(c) Report on the results of any testing and/or attenuation work within the Annual Review.'

The annual sound power screening and additional monitoring events were undertaken on 9 January, 3 June, 4 June, 1 July, 15 July and 16 July, 2019. The results have been compared against criteria used in modelling for the EA (Hansen Bailey, 2010). The plant assessed for sound power screening during both rounds consisted of the following:

- CAT6030 (EX257) excavator
- CAT6060 (EX124) excavator
- Hitachi EX2600-6 (EX259) excavator
- Hitachi ZX870 (EX261) excavator
- Komatsu WA1200-3 (WL188) excavator
- Komatsu WA320PZ-6 (WL189) excavator
- Komatsu 930E-4 (DT263, DT264, DT265, DT291, DT292, DT720, DT721,DT722, DT724, DT725, DT748, DT749, DT750, DT751, DT752, DT754) haul trucks
- Komatsu D375A-5EO (TD078, TD079, TD080, TD082) dozer
- CAT D11T (TD06, TD07), dozer
- CAT 16M (GR060,GR061) graders
- Komatsu HD785-7 (WC029, WC031) water cart
- Reich Drill C700D (653, 658) drills

A total of 34 items of plant were screened during the 2019 program.

Results that exceeded the relevant criteria by 3 dB or more were considered potentially significant. Sound power results have been assessed against sound powers used in modelling for the EA (Hansen Bailey, 2010). Dozers were assessed against the specified limits for 1st gear operation only. Any difference in screen results for the same plant between consecutive years of +3 dB or more would also trigger a more detailed analysis of the item in question.

4.3.2.2.1 Methodology

The measurement and calculation methodology adopted for the 2019 sound power screening was undertaking using the following standard methods:

- AS 2012.1-1990 'Acoustics – Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors – Stationary test condition – Determination of Compliance With Limits for External Noise'
- AS 2012.2-1990 'Acoustics –Measurement of airborne noise emitted by earth-moving machinery and agricultural tractors –Stationary test condition – Operator's Position'
- AS 1269.1-2005 'Occupational Noise Measurement – Part 1 Measurement and assessment of noise emission and exposure'
- ISO 3744-2010 'Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane'
- ISO 6393:2008(E) 'Earth-moving machinery – Determination of sound power level – Stationary test conditions'
- ISO 6395:2008(E) 'Earth-moving machinery – Determination of sound power level noise emissions – Dynamic test conditions'

4.3.2.2.2 Results

The results of the 2019 sound power screening program indicated that there were 22 items of screened plant that recorded exceedances of 3dB or greater, consisting of Komatsu haul trucks (KOM 930E-4), one CAT excavator (CAT6030), one Hitachi excavator (EX2600-6), one CAT dozer (D11T), one Komatsu water cart (HD785-7) and a Reich drill (C700D). A summary of the sound power level monitoring results is provided in Table 4-8.

Table 4-8 Summary of 2019 sound power screening results

Plant type	Criteria (dB)	Number of exceedances of 3dB or more during testing	Comment/Recommendation
Excavators/loaders	117-120	2	Further action will be determined and reported following completion of the trial.
Komatsu 930E-4 haul trucks	117-119	24	The SPL attenuation exhaust kit trial will continue during 2020. Key findings and recommendations will be reported following completion of the trial.
Other Haul Trucks	117	1	Further action will be determined and reported following completion of the trial.
Dozers	116	1	Further action will be determined and reported following completion of the trial.
Graders	115	0	No further action required.
Water Trucks	117	1	Further action will be determined and reported following completion of the trial.
Drills	117	1	Further action will be determined and reported following completion of the trial.

4.3.2.3 Noise Model Validation

In accordance with PA Schedule 3, Condition 13 (f), BCOPL annually commissions an independent acoustic consultant to complete a validation of the noise model used in the Continuation of Boggabri Coal Mine Acoustic Impact Assessment (Bridges Acoustics, 2010). This involved comparing 2019 attended noise monitoring results with modelled noise impacts for the 2010 Acoustic Impact Assessment. Predictions from Year 5[1] of the Acoustics Impact Assessment were utilised, as that stage best aligns with 2019, which is Year 7 of the project.

During the 2019 reporting period, attended environmental noise monitoring was conducted at three locations. Attended monitoring results were filtered to extract those that were taken during meteorological conditions that were similar to meteorological conditions included in the Acoustics Impact Assessment.

Seven of the 36 attended monitoring events undertaken in 2019 occurred during meteorological conditions that coincided with modelled meteorological conditions. During periods when these conditions did occur, measured levels from BCM were inaudible or not measurable.

[1] *Predictions were made for Year 5, Year 10, Year 15 and Year 20 of operations.*

4.3.3 Improvements and Initiatives

The sound power level (SPL) attenuation trial continued during the reporting period. The three suppliers installed attenuation kits on the six Komatsu 930E trucks during the first half of 2019. Each supplier installed an exhaust kit on one truck and a grid box retarder and exhaust kit on another truck. SPL noise testing was conducted on all six trucks 3 months after installation. The trial is currently ongoing as two of the kits have shown reliability issues. The results from the monitoring will be reported in future annual reports once the trial has been finalised.

4.4 Blasting

4.4.1 Environmental Management

Blast operations at BCM are managed in accordance with the approved Blast Management Plan (BLMP), which covers blasting activities associated with mining. The BLMP and Blast Fume Management Protocol was updated and approved in November 2018. Drill and blast design at BCM focuses on the following objectives:

- Control of air blast and ground vibration
- Minimising fly-rock
- Optimising fragmentation
- Reducing coal seam damage
- Reducing blast fume

Blast fume is managed in accordance with BCM's Blast Fume Management Protocol (BFMP). The BFMP was prepared to satisfy the PA in order to establish management measures for control of fume-related emissions from blasting operations. The BFMP is based on the Australian Explosive Industry and Safety Group's *Code of Good Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting, Edition 2*. It describes site specific monitoring and rating/recording for blast fume events as well as incident response procedures.

4.4.2 Environmental Performance

4.4.2.1 Blast Peak Vibration

Monitoring of peak vibration was conducted at Goonbri (MP1) and Wilberoi East (MP3) during the entire 2019 reporting period (refer to **Appendix A**). Monitoring of peak vibration at Jeralong (MP2) was ceased in April as this location was removed from EPL 12407. A total of 119 blast events occurred during the reporting period.

The applicable PA and CL368 limits for peak vibration are 10 mm/sec at any noise sensitive location, and 5 mm/sec at any noise sensitive location for up to 5 percent of all blast events occurring within the reporting period. Additionally, blasting may only be undertaken between 9:00 am and 5:00 pm Monday to Saturday, at a rate of no more than once per day or four times per week (averaged across the calendar year), unless otherwise exempted.

4.4.2.1.1 Results

Monitoring results indicate all blasts complied with both the 10 mm/sec peak vibration limit and the 5 mm/sec limit at all locations monitored (refer to Figure 4-10). The results are lower than those of the 2018 reporting period. Blasting for the past few years has consistently remained well below the limits.

Blasting was not undertaken more than once a day at any time during the reporting period and all blast operations were conducted between the approved times of 9:00 am – 5:00 pm Monday to Saturday.

No temporary road closures were required due to proximity of blasting.

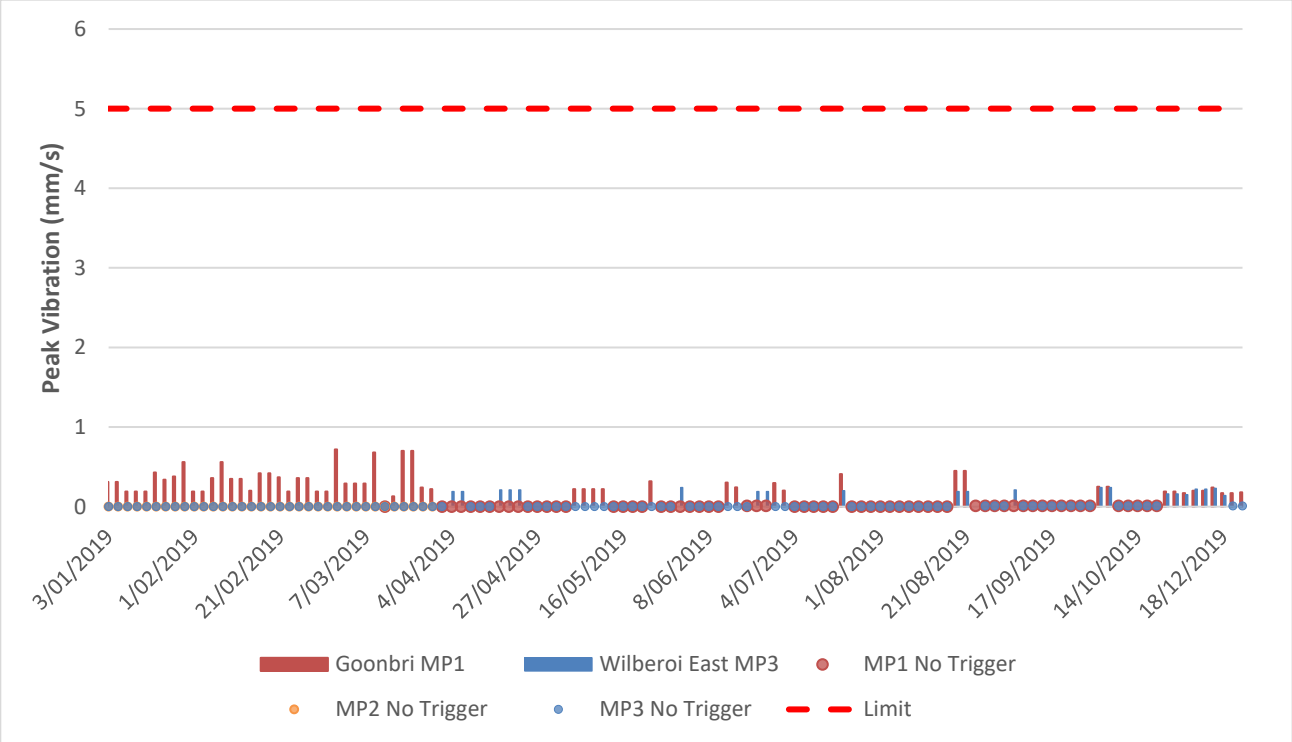


Figure 4-10 Summary of Peak Vibration Monitoring Results

4.4.2.2 Blast Overpressure

Monitoring of blast overpressure was conducted at Goonbri (MP1) and Wilberoi East (MP3) during the entire 2019 reporting period. Monitoring of blast overpressure at Jeralong (MP2) was ceased in April. A total of 119 blast events occurred during the reporting period.

The applicable PA criteria for airblast overpressure are 120 dB(A) at any noise sensitive location (residence on privately owned land), and 115 dB(A) for up to 5 percent of all blast events conducted during the reporting period.

4.4.2.2.1 Results

Figure 4-11 illustrates the blast overpressure monitoring results for the 2019 reporting period.

The monitoring results indicate that one blast exceeded 115 dB(A) overpressure limits (5% allowable exceedance applies) at mine owned property, which did not trigger a non-compliance with the PA as they occurred within the 5% allowable exceedance. One blast exceeded 120 dB(A) overpressure limit at Wilberoi East on 21 August. Analysis of meteorological data at BCM during the period of this blast event was conducted by Todoroski Air Sciences (2019). This exceedance was attributed to a short term fluctuation in the upper air wind conditions that could not have been reasonably foreseen. The exceedance was reported to DPIE on 28 August. BCOPL was issued with a warning letter from DPIE on 18 October 2019 for not reporting the blast overpressure exceedance within seven days of the incident.

Boggabri Coal complied with all its blast overpressure criteria during the 2015, 2016, 2017 and 2018 reporting periods.

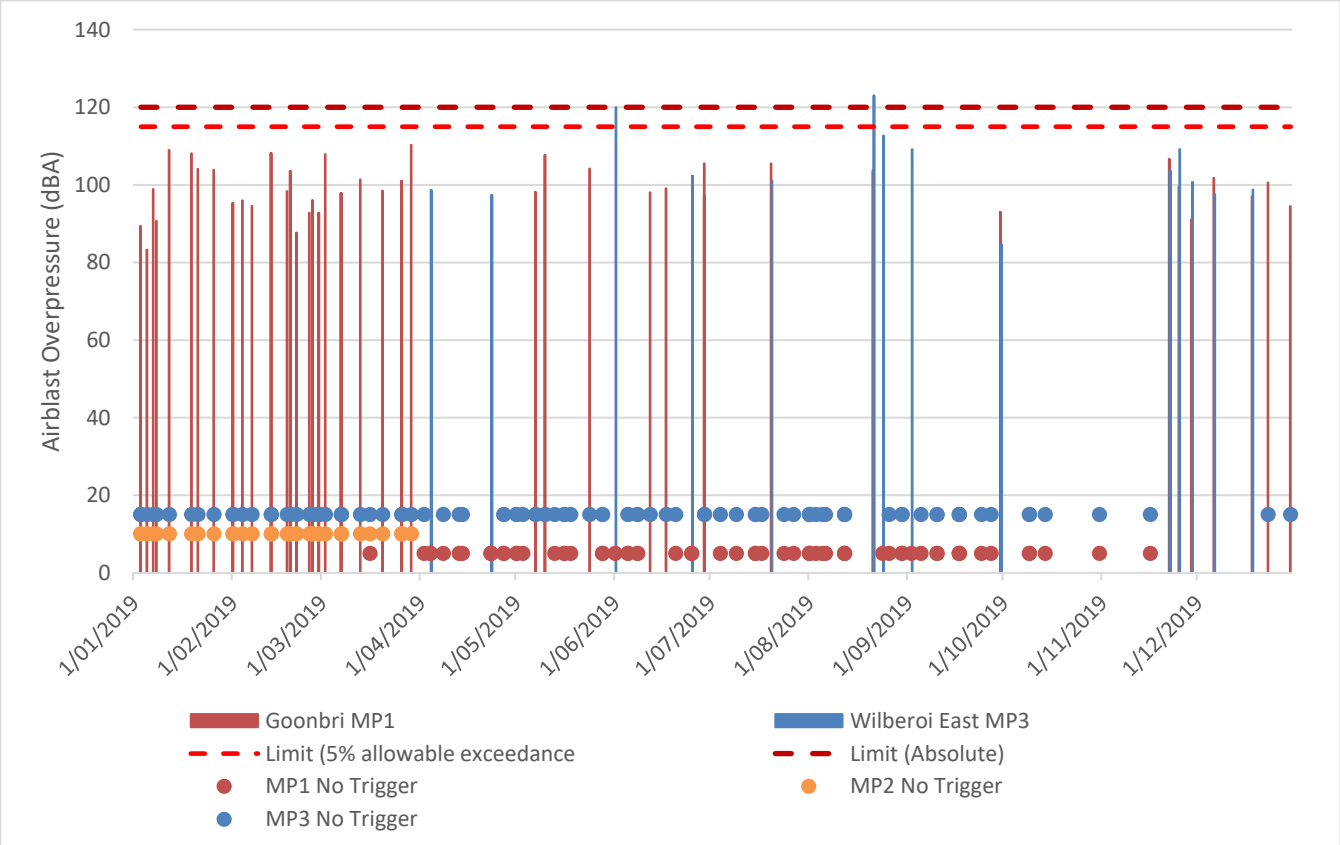


Figure 4-11 Blast Overpressure Results

4.4.2.1 Blast fume

Blast fume was monitored by BCOPL for all blast events that occurred during the reporting period.

A fume risk rating system is utilised at BCM to categorise fume events. This is based on the fume rating system detailed in the *Code of Good Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting, Edition 2* (AEISG 2011).

4.4.2.1.1 Results

Nine fume events occurred during the reporting period. None of the fume events were categorised as a Level 3c fume event or higher requiring notification. All blast fume events were compliant during the 2019 reporting period.

4.4.3 Improvements and Initiatives

During 2019 the following improvements and initiatives were used in drill and blast methods:

- Misfire mitigation – using electronic ignition in high risk areas
- Develop processes for managing blasthole conditions
- Adjusted blast patterns
- Using electronics for remote firing

A cumulative Blast Management Strategy (BLMS) has been prepared and approved to document the approach that will be taken to monitor and collectively manage cumulative blasting impacts. The BLMS details the relevant cumulative blasting impact assessment criteria for each mine and outlines the cumulative blast management protocols that will be implemented within the BTM Complex.
Mitigation measures detailed in the BLMS, BLMP and other relevant documents are considered to be effective and will continue to be implemented in future blast events.

4.5 Surface Water

4.5.1 Environmental Management

Water management at BCM is undertaken in accordance with the approved water management plans, prepared in accordance with the PA. The Water Management Plan (WMP) acts as the overarching document governing water management at BCM. Approved subordinate plans supporting water management include:

- Surface Water Management Plan (SWMP)
- Groundwater Management Plan (GWMP)
- Site Water Balance (SWB) report
- BTM Complex Water Management Strategy (WMS)

The water management system operates across four key elements as defined below:

- **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 spoil dumps, haul roads and parts of the mine infrastructure area. 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.
- **Erosion and sediment control** is defined as the suite of management and physical measures available to minimise the generation of soil erosion and to prevent soil and sediment entering the receiving water systems (i.e. 'Nagero Creek' and the Namoi River).

Surface water is managed in accordance with BCM's SWMP and associated water management plans which conform to the approvals, licences and other regulatory requirements of BCM. The key objectives of the surface water management system are to:

- Segregate clean runoff, dirty runoff, and contaminated water generated from rainfall events and mining operations.
- Minimise the volume of contaminated mine water (surface runoff draining to the pit and groundwater seepage) generated by the BCM.
- Preferentially reuse contaminated water for dust suppression and coal washing.
- Provide sufficient on-site storage to avoid releases of contaminated water that could affect the quality of downstream watercourses.
- Treat all dirty runoff from un-rehabilitated overburden areas to settle coarse suspended solids
- Where practicable, divert 'clean' runoff to downstream creeks.

Erosion and sediment control at BCM is guided by the WMP and the SMP, and is consistent with the "Blue Book" - *Managing Urban Stormwater, Soils and Construction, Volume 1* (Landcom, 2004) and Managing Urban Stormwater, Volume 2E: Mines and Quarries (DECC, 2008).

Erosion and sediment control measures employed at BCM include:

- Minimising ground disturbance where possible.
- Amelioration of dispersive soil to minimise the risk of rill, gully and tunnel erosion and to allow the infiltration of surface water.
- Contour scarification of compacted surfaces to encourage infiltration and surface roughness.
- Placing removed soils in areas where they are less likely to be affected by rainfall.
- Stockpiling in a stable manner by ensuring that topsoil is not dispersed and the height of stockpiles is restricted to 3 m.
- Long term (greater than six months) stockpiles are stabilised by appropriate seeding or mulched vegetation where possible.

- Disturbed areas are rehabilitated as soon as possible following disturbance, including regrading where required.
- Where feasible, understorey and ground cover vegetation are retained in and around drainage lines.
- Preventing vehicles from entering topsoiled rehabilitation areas to prevent damage to vegetation and soil structure.
- Erosion and sediment control measures are installed before commencement of any works.
- All erosion control measures are maintained until all earthworks and mining activities are completed and site rehabilitation is complete.
- All erosion and sediment control measures employed are appropriately designed, sized, located and installed. Erosion and sediment control measures include the use of:
    - Sediment fencing
    - Channel bed and bank protection
    - Earth bunds and diversion drains
    - Geotextile sediment fencing
    - Sediment retention basins

In accordance with the PA, BCM maintains a SWB for effective management of water resources. The SWB details water use, water demand and water management at BCM, as well as the sources and security of water supply, including contingency for future reporting periods. The SWB is regularly revised in order to reflect modifications to the mine plan.

4.5.1.1 Surface Water Quality Monitoring

In order to track surface water quality within and around the site and to determine environmental compliance and performance, BCOPL undertakes ‘ambient’, ‘event’ and ‘frequency’ based water quality monitoring in accordance with the SWMP.

Ambient monitoring measures the surface water quality of the receiving environment surrounding BCM i.e. outside the site water management system. Ambient monitoring is triggered by an event such as a ‘wet weather discharge’ rather than according to a set sampling regime.

Mine site event based monitoring is undertaken within the site water management system and includes monitoring of sediment dams and mine water dams (MWD) in response to controlled discharges (i.e. release from a sediment dam), uncontrolled discharges (i.e. spillage from a dam during wet weather) or emergency discharges (i.e. an emergency discharge due to wet weather).

Frequency based monitoring is undertaken within the site water management system on a quarterly basis to assess the condition of site water quality and inform ongoing management.

Details of BCM’s surface water quality monitoring program including monitoring locations, trigger events and sampling methods, are outlined in Table 4-9.

Table 4-9 Surface Water Quality Monitoring Regime

EPL ID	Location	Location description	*Trigger event/ Type of monitoring	Frequency	Sampling method
Ambient and Event Based Monitoring					
1	SD6	Nagero Dam	Wet weather discharge Controlled discharge water quality	As soon as practicable at the commencement of a wet weather discharge	Grab sample with conductivity and pH in situ
3	SD3	South west corner of spoil dump	Wet weather discharge Controlled discharge water quality	As soon as practicable at the commencement of a wet weather discharge	Grab sample with conductivity and pH in situ
4	SD4	Sediment dam at rail load out area, west of mine site	Wet weather discharge Controlled discharge water quality	As soon as practicable at the commencement of a wet weather discharge	Grab sample with conductivity and pH in situ
5	SW1 'Nagero Creek'	Downstream of mining	Rainfall event sufficient to generate flow in 'Nagero Creek' OR Controlled discharge water quality	As soon as practicable during or following a rainfall event sufficient to generate flow in 'Nagero Creek' OR As soon as practicable during a discharge event from EPL discharge points 1, 3 & 4	Grab sample with conductivity and pH in situ
6	SW2 'Nagero Creek'	Upstream of mining	Rainfall event sufficient to generate flow in 'Nagero Creek' OR Controlled discharge water quality	As soon as practicable during or following a rainfall event sufficient to generate flow in 'Nagero Creek' OR As soon as practicable during a discharge event from EPL discharge points 1, 3 & 4	Grab sample with conductivity and pH in situ
Frequency Based Monitoring					
36	SD6	Nagero Dam	Surface water quality	Quarterly	In situ
	SD10 SD12	CHPP stockpiles	Surface water quality	Quarterly	In situ
38	SD3	South west corner of spoil dump	Surface water quality	Quarterly	In situ
39	SD4	Rail loop 15 km west of mine site	Surface water quality	Quarterly	In situ
41	MW3	South of MIA	Surface water quality	Quarterly	In situ

Notes:
* Wet weather discharge: an uncontrolled spill event from a dam as a result of excessive rainfall (i.e. typically via emergency spillways
Controlled discharge water quality: a controlled discharge event from a dam (i.e. drawdown of a dam after adequate sediment settlement has occurred).

Surface water quality testing parameters from the SWMP are specified in Table 4-10.

Table 4-10 Surface Water Quality Testing Parameters

Monitoring type	Determinants
Ambient and event based	Conductivity, nitrate, nitrogen (total), oil and grease, pH, phosphorus (total), reactive phosphorus, total suspended solids
Frequency based (quarterly)	Conductivity, pH

BCOPL uses a handheld multi-parameter water quality probe (pH, EC, temperature). All water quality samples requiring lab analysis are sent to a NATA-accredited laboratory for processing.

4.5.1.2 Water Storage and Usage Monitoring

Water storage levels of all active sediment dams and mine water dams are monitored and recorded on a weekly basis. This allows for effective management of stored supplies in terms of consumption, potential discharges and infrastructure planning.

4.5.2 Environmental Performance

4.5.2.1 Surface Water Quality Criteria

4.5.2.1.1 Interim Trigger Levels

The SWMP specifies interim trigger levels for ambient monitoring, i.e. water quality of Nagero Creek when a discharge event occurs at BCM. Sufficient baseline data for the formation of statistically sound trigger levels is not available for Nagero Creek and the ANZECC (2000) default guidelines are considered to be unsuitable, as the ambient water quality has historically exceeded some of the criteria. The SWMP therefore assigns interim trigger levels based on the ANZECC guideline values for the protection of Environmental Values (2010) and the 80th percentile value of the limited ambient monitoring results historically collected from SW2.

4.5.2.2 Results of Ambient and Event Based Monitoring

As outlined in the SWMP, BCOPL is required to undertake monitoring upstream (SW2) and downstream (SW1) of the BCM following rainfall that is sufficient to generate flow within Nagero Creek. There were no rainfall events that generated flow within Nagero Creek during the 2019 reporting period. There were no surface water discharges from the BCM during the 2019 reporting period. There have therefore been no run-off related impacts from BCM into surface water systems during 2019.

4.5.2.3 Results of Frequency Based Monitoring

Frequency based monitoring was undertaken on the following dates:

- Quarter 1 – 11 March 2019
- Quarter 2 – 12 June 2019
- Quarter 3 – 16 September 2019
- Quarter 4 – 4 December 2019

Due to a lack of water, monitoring samples were unable to be obtained at all at MW3 and SD6 during the third and fourth quarter and SD4 during the first, third and fourth quarters of 2019. The in-situ results for quarterly monitoring are provided in Table 4-11, with the laboratory results indicated in brackets.

Table 4-11 Summary of Frequency Based Monitoring Results

	MW3	SD6	SD10	SD12	SD3	SD4	SD23
pH							
Q1	DRY	8.94	7.74	8	8.82	DRY	7.93
Q2	DRY	9.21	7.59	8.41	8.31	8.39	8.19
		(8.35)	**(7.8)**	**(8.18)**	**(8.46)**	**(7.62)**	**(8.31)**
Q3	DRY	DRY	7.69	8.97	8.45	DRY	8.62
Q4	DRY	DRY	7.99	8.56	9.06	DRY	8.5
			(7.93)	**(7.56)**	**(8.99)**		**(7.87)**
Avg	N/A	9.08	7.75	8.49	8.66	8.39	8.31
Conductivity (µS/cm)							
Q1	DRY	1576	1216	1886	886	DRY	1872
Q2	DRY	1105	1403	1820	466	189	1692
		(1110)	**(1390)**	**(1760)**	**(457)**	**(167)**	**(1640)**
Q3	DRY	DRY	1446	2258	595	DRY	1721
Q4	DRY	DRY	1869	1922	905	DRY	1895
			(1780)	**(1880)**	**(856)**		**(1760)**
Avg	N/A	1340	1483	1971	713	189	1795

Results show pH measured in-situ ranged from 7.59 to 9.21, with an average of 8.39 across all sediment dams included in quarterly monitoring. This is a slightly higher average than recorded in the 2018 AR where the average overall pH was 8.30. The in-situ pH results were generally similar to the lab analysis results.

Conductivity measured in-situ ranged from 189 µS/cm to 2258 µS/cm with an average of 1406 µS/cm across all surface water monitoring locations. This is a slightly higher average than recorded in the 2018 AR where the average overall conductivity was 1389 µS/cm. The in-situ conductivity results were generally similar to the lab analysis results.

4.5.2.4 Demand, Take and Usage

In accordance with its surface water licences and PA, BCOPL accesses surface water from the Namoi River from time to time. BCOPL also holds water entitlements for groundwater extraction. Furthermore, BCOPL can trade additional water to make up shortfalls. Where necessary, BCM uses existing water entitlements to supplement demand. The water taken from the existing licenses as at the end of the water year (1 July 2018 to 30 June 2019) is detailed in Table 4-12. A Water Access Licence (WAL42234) was purchased in the reporting period in Upper Namoi Zone 11 Maules Creek Groundwater Source.

Table 4-12 Water Take

Water Access Licence No.	Water Source and Water Sharing Plan (WSP)	Allocation (ML)	Carryover from Previous Water Year	Temporary Transfers (ML)	Passive Take / Inflows (ML)	Active Pumping (ML)	TOTAL (ML)
15037 12767 24103 12691 36547 37519	Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gin's Leap), Upper and Lower Namoi Groundwater Sources WSP	1028	1518	1310	0	2188.1	2188.1
29473 29562	Gunnedah Oxley Basin Murray Darling Basin Groundwater Source, NSW Murray Darling Basin Porous Rock Groundwater Sources WSP	842	210.5	0	182.5	16.62	199.12
2571 2572 2595 2596	Lower Namoi Regulated River, Upper Namoi and Lower Namoi Regulated River WSP	26.5	n/a	128	0	259.8	259.8
37067	Upper Namoi Regulated River, Upper Namoi and Lower Namoi Regulated River WSP	128	0	-128	0	0	0
42234	Upper Namoi Zone 11 Maules Creek Groundwater source. Purchased 9/1/2019	0	60	0	0	0	0

**Total water extracted is able to exceed the sum of allocation and temporary transfers due to water being in the account at the start of the accounting period.*

4.5.2.4.1 Water Demand

Core water demands during the 'water year' reporting period (1 July 2018 to 30 June 2019) were for coal processing in the CHPP and dust suppression. Quantities of water were also required for vehicle washdown and potable water uses.
Table 4-13 outlines future estimated water volumes for key water demands as described in the Site Water Balance (SWB).

Water demand predictions were initially provided in the EA; however, these have been updated a number of times since to account for actual changes to water demand and usage.

Table 4-13 Predicted Water Demand

	Dust suppression (haul roads)	CHPP	MIA and Potable water
Period	Jan 2017 to 2033	Jan 2017 to 2033	Jan 2017 to 2033
Demand	1460 ML/yr	1460 ML/yr	365 ML/yr

4.5.2.4.2 Water Usage

Dust suppression accounts for the majority of water usage at BCM and involves application by water cart to unsealed roads, trafficable areas, windrows, stockpiles and batters.

During the reporting period 1,252.74 ML's of water was used for mining operation dust suppression. This represents a reduction in water use from the previous reporting period, when 1,307 ML of water was used. This is attributed to the major transition that occurred in late 2017 and increased efforts at BCM to minimise water use. The moisture content of coal that was output from the CHPP in 2019 has been measured as 640.2 ML. This represents 10.49% of the 6,100,000 tonnes of coal leaving the CHPP being measured as water.

In addition, a total of 235.825 ML of water was used in the CHPP & MIA during the reporting period. This includes water used for both the coal bypass and the processing plant. The total water usage for dust suppression and the CHPP is below the predicted demand as detailed in Table 4-13.

During the reporting period BCM responded to a request from Whitehaven Coal to supply Maules Creek Mine with water, by conveying 410 ML's to the Mine via a purpose built pipeline.

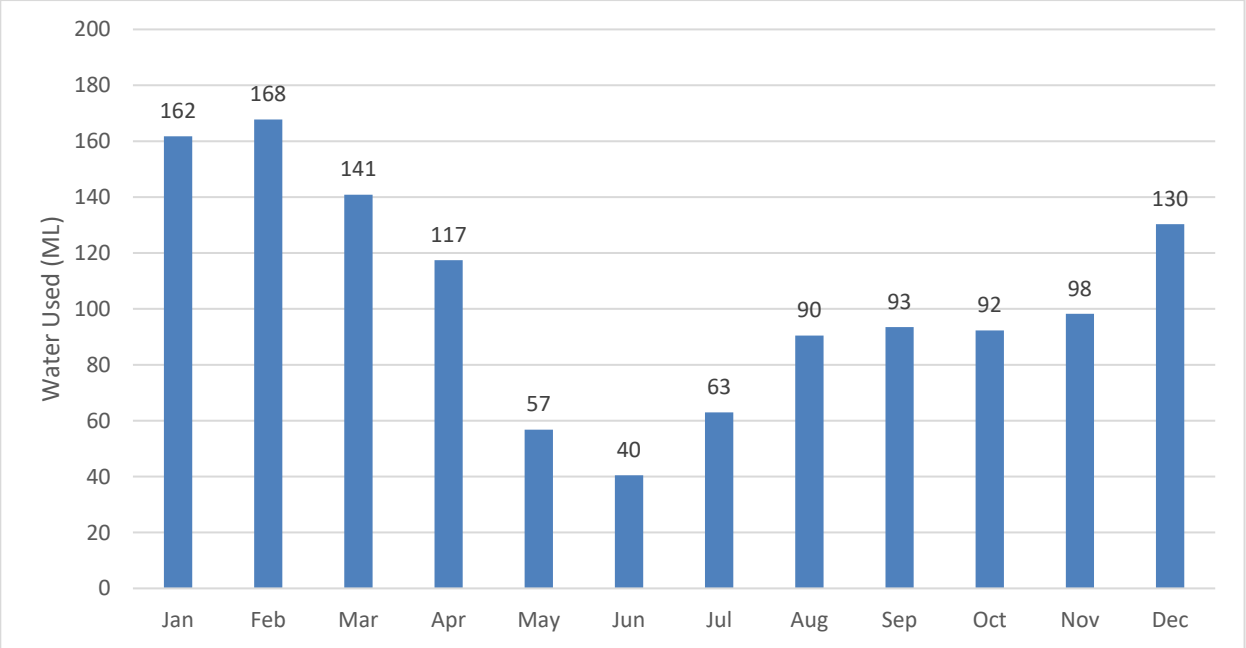


Figure 4-12 Monthly Dust Suppression Water Usage (ML)

4.5.2.4.3 Water Storage

Details of BCM's water storage dams including their design capacity and storage at the beginning (as at 3 January 2019) and end of the reporting period (as at 24 December 2019), are outlined in Table 4-14.

Table 4-14 Water Storage Summary

Storage	Location/ description	Stored water	Catchment area (ha)	Required minimum capacity (ML)	Design capacity (ML)	Water stored start of period (ML)	Water stored end of period (ML)
Dirty water							
SD3	West of spoil dump	Dirty Water: runoff from partially rehabilitated spoil dump	140	99.6	102.3	33.6	16.63
SD6	Downstream of MIA (referred to as Nagero Dam)	Dirty Water: Runoff from grassed areas near MIA, and overflows from SD10 and SD8	64	13.4	52.2	37.4	3.52
SD7	Eastern spoil dump	Dirty Water: runoff from spoil dump and clean runoff from undisturbed catchment	159	81.0 Note: overflow drains to pit	95.1	56.5	57.1
SD8	In MIA	Dirty Water: runoff from MIA	13	5.6	9.8	1.8	0.23
SD23	Near topsoil stockpile	Dirty Water: runoff from topsoil stockpile	20	0.6	15.2	16.4	15.66
Dirty water total			**396**	**200.2**	**274.6**	**145.7**	**93.14**
Contaminated water							
SD10	CHPP	Contaminated Water: runoff from product coal stockpile	27	77.9	116.4	56.7	50.66
SD11	At rail loop	Contaminated Water: runoff from rail loop	4	9.5	16.4	3.1	0.92
SD12	CHPP	Contaminated Water: runoff from ROM coal stockpile	64	200.7	206.6	61	30.45
SD28	Train load out facility (**TLO**)	Contaminated Water: Runoff from TLO	1	2.5	3.5	0.4	0.24
SD29*	CHPP	Contaminated Water: Runoff from coal stockpile area south	4	8.6	10.5	0.4	-

Storage	Location/ description	Stored water	Catchment area (ha)	Required minimum capacity (ML)	Design capacity (ML)	Water stored start of period (ML)	Water stored end of period (ML)
MW3	South of MIA	Contaminated Water: surplus pumped from SD2 and clean runoff from small grassed catchment	22	26.8	153.5	122.5	0
MW5	In-pit	Contaminated Water Storage Dam	38	1000	2000	48.4	621.12
MW7**	In pit	Contaminated Water: surplus mine water from pit	-	-	102	65.8	-
Strip 9***	In pit	Contaminated Water: Surplus mine water from pit	22	1000	3,426.0	404.6	-
Contaminated water total			**182**	**2326**	**6034.9**	**762.9**	**703.39**

Notes:
* SD29 was decommissioned during the reporting period
**MW7 was decommissioned in the reporting period
***Strip 9 was decommissioned in the reporting period

4.5.3 Improvements and Initiatives

Control strategies implemented under relevant management plans and strategies are considered to be adequate to manage and mitigate impacts to surface water downstream of the BCM. These will continue to be implemented throughout future reporting periods and updated where deemed necessary. Impacts to the downstream environment during the current reporting period are considered negligible.

During 2019 BCM undertook a dam maintenance program that removed accumulated sediment from a number of its dams. This program improved the capacity of these dams and will continue beyond the 2019 reporting period. BCM also installed a series of water level meters in dams in 2019, the installation of these meters will also continue beyond the 2019 reporting period. In addition to these improvements, a filtration pump was installed on SD6.

4.6 Groundwater

4.6.1 Environmental Management

Groundwater is managed in accordance with BCM's approved water management plans, specifically the GWMP. A general overview of water management at BCM is provided in Section 4.5.1.

The GWMP provides a framework defining how BCOPL will assess, manage and mitigate impacts to the groundwater system. This particularly focuses on impacts to the shallow alluvial aquifer as a result of mining activities such as dewatering the open pit void. The GWMP specifies impact assessment criteria and trigger levels to identify groundwater level and quality changes, and outlines BCOPL's monitoring and reporting requirements for groundwater management.

BCOPL holds licences for extraction from a number of groundwater bores. The amount of water extracted from groundwater sources and corresponding entitlements are identified in Table 4-12.

4.6.1.1 Groundwater Monitoring Program

BCOPL's groundwater monitoring program aims to identify any changes to the natural groundwater system as a result of mining operations and ensure compliance with the PA. It focuses on potential impacts to environmental assets and groundwater users in the area surrounding BCM.

The monitoring program undertaken during the reporting period included:

- Quarterly monitoring of groundwater levels (March, June, September and December 2019)
- Quarterly monitoring of physiochemical parameters
- Six-monthly laboratory groundwater quality analysis of major ions, metals and nutrients

During the reporting period the active groundwater monitoring network comprised 14 monitoring bores screened across different geological units, including nine within the Maules Creek Formation aquifer (Merriown, Jeralong, Bollol Creek and Braymont coal seams), three in the colluvial aquifer (Boggabri Volcanics) and one in the alluvial aquifer associated with Nagero Creek (Alluvium). Construction details of these bores are listed in Table 4-15 and their respective locations are shown in Appendix A.

Table 4-15 Construction Details of Monitoring Bores

Monitoring bore	Approx. collar (mAHD)	Screen interval (mbtoc)	Mean sample depth (mbtoc)	Depth (mBGL)	Screened geology	Notes for reporting period
IBC2102	321	76-82	-	85	Merriown Coal Seam	No access
IBC2103	321	53-56	-	59	Jeralong Coal Seam	No access
IBC2104	330	79-85	-	87	Braymont Coal Seam	No access
IBC2105	330	151-157	-	160	Merriown Coal Seam	No access
IBC2110	273	91-97	9.51	100	Boggabri Volcanics	Water level and quality
IBC2111	272.5	36-42	9.45	45	Boggabri Volcanics (weathered)	Water level and quality
IBC2114	325	77-80	-	86	Bollol Creek Coal Seam	Dry
IBC2115	325	102.5-108.5	-	111	Merriown Coal Seam	Decommissioned
IBC2138	294.4	57.5-63.5	-	66	Merriown Coal Seam	Dry
IBC2139	319.3	86.8-89.8	-	92	Merriown Coal Seam	Inaccessible
GW3115	280	0-42	22.88	N/A	Boggabri Volcanics (weathered)	Water level and quality
MW6	268	18-22	-	N/A	Alluvium	Bore blocked
BC2181*	335.2	105-111	91.05	114	Merriown Coal Seam	Water level and quality
BC2193*	340	87.3-93.3	-	96.3	Braymont Coal Seam	Decommissioned

Note:

*denotes not in EPL

m bgl: metres below ground level

m btoc: metres below top of casing

- indicated no data available

N/A denotes not available

Five groundwater monitoring bores (IBC2114, IBC2115, IBC2138, IBC2139 and IBC2193) have been removed from the groundwater monitoring network due to encroachment by mining activities or dry conditions from dewatering. A further two bores (IBC 2102 and 2103) were also removed from the groundwater monitoring network during 2017 due to damaged bore casings. Water depth was monitored at these bores during 2017, however these bores were not accessible for much of 2018 and 2019. Monitoring bores IBC2104 and IBC2105 were not able to be accessed in 2019 and monitoring bore MW6 was blocked and not able to be sampled in 2019.

Three additional locations (Belleview 3, Victoria Park MB and Cooboobindi) were monitored for groundwater level and quality from 2017. These additional monitoring bores are not listed on EPL 12407 and therefore monitoring results at these additional bores have not been included in this report.

Groundwater quality testing parameters as outlined in the GWMP are listed in Table 4-16.

Table 4-16 Groundwater Quality Testing Parameters

Monitoring type	Determinants
Six-monthly laboratory analysis	Sulphate as SO_4^{2-} , chloride, calcium, magnesium, sodium, potassium, dissolved arsenic, dissolved cadmium, dissolved chromium, dissolved copper, dissolved lead, dissolved manganese, dissolved nickel, dissolved zinc, dissolved iron, ammonia as N, nitrite as N, nitrate as N, nitrite + nitrate as N, total nitrogen as N, total phosphorus as P, reactive phosphorus as P, hydroxide alkalinity, carbonate alkalinity, bicarbonate alkalinity and total alkalinity.
Quarterly field parameters	Conductivity (EC), pH, temperature, groundwater level

4.6.1.2 Annual Groundwater Monitoring Review

BCOPL commissioned GHD to undertake an Annual Groundwater Monitoring Review (2020) in accordance with the GWMP. The review assesses BCM's groundwater monitoring data and provides analyses on groundwater levels and groundwater quality during the 2019 reporting period. Findings from the review are summarised in the following sections.

4.6.2 Environmental Performance

Groundwater monitoring during 2019 at BCM consisted of monitoring of groundwater levels and sampling of groundwater quality. Groundwater monitoring was undertaken in accordance with the requirements of EPL 12407 and the GWMP. Groundwater levels were monitored manually on a quarterly basis (March, June, September and November/December 2019).

Groundwater quality field parameters (EC, pH and temperature) were measured quarterly, while sampling for major ions, dissolved metals and nutrients was undertaken in June and November 2018. Bores IBC2102 and IBC2103 were not monitored throughout 2019 due to being damaged. Bores IBC2104 and IBC2105 were not monitored throughout 2019 as they were not accessible. Bore MW6 was not monitored throughout 2019 as the bore was blocked.

Groundwater sampling was undertaken using a groundwater pump and a minimum of three well volumes were purged or until the field parameters stabilised prior to sample collection. Samples were filtered onsite for the dissolved metal suite.
As reported in the 2018 annual review, five groundwater monitoring bores (IBC2114, IBC2115, IBC2138, IBC2139 and IBC2193) have been removed from the groundwater monitoring network due to encroachment by mining activities or dry conditions from dewatering. A further two bores, IBC 2102 and 2103, have also been removed from the network due to damaged bore casings.

All these bores have been removed from the groundwater monitoring network in the approved GWMP, and the NSW EPA approved an application to vary EPL 12407 to remove these bores from the licence in 2018.

4.6.2.1 Groundwater Level Results

The minimum recorded water levels recorded in 2019 have been compared with the trigger levels defined in the GWMP are provided in Table 4-17. MW6 was not monitored during 2019. Groundwater levels remained within the trigger thresholds throughout the reporting period.

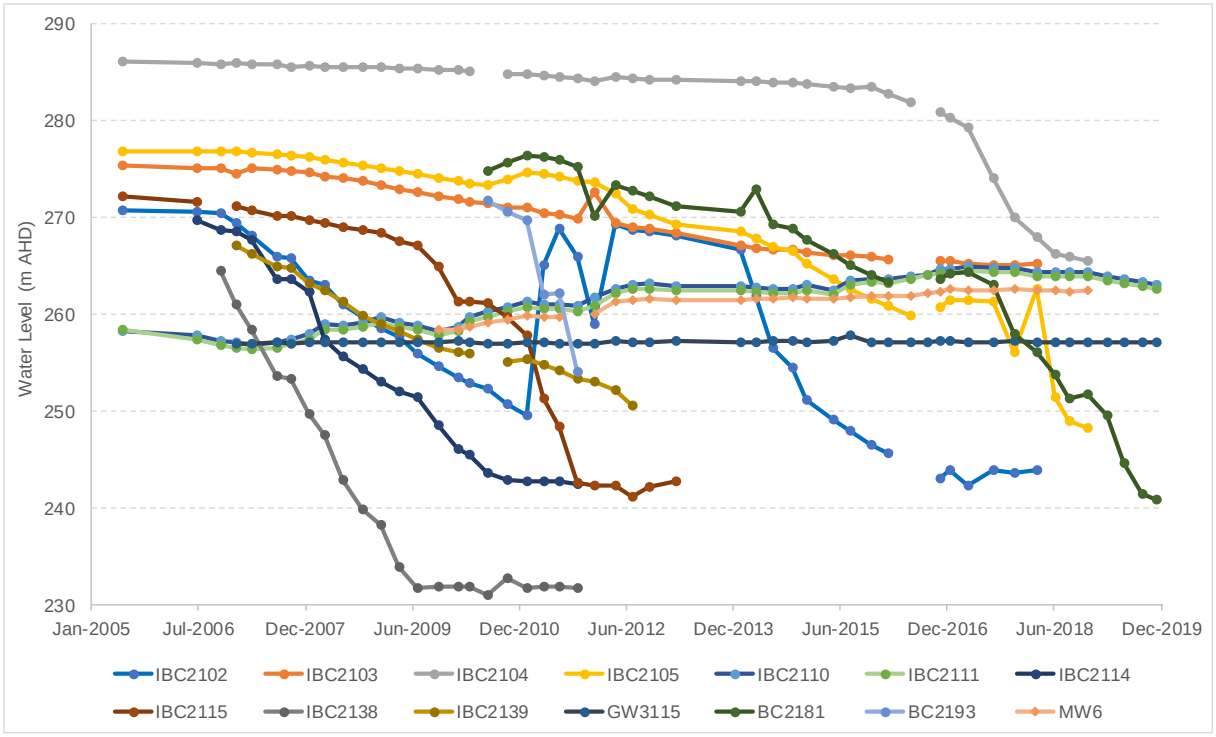
Table 4-17 Minimum Measured Groundwater Levels

Monitoring bore	Trigger value (minimum) (mAHD)	Minimum water level 2018 reporting period
GW3115	256.98	257.09
IBC2110	257.11	263.02
IBC2111	256.62	262.6
MW6	258.48	-

The groundwater level monitoring results obtained during the reporting period have been added to the long term hydrographs presented annually for BCM, as shown in Figure 4-13.
Data collection from bores IBC2114, IBC2115, IBC2138 and BC2193 ceased between 2011 and early 2013. This has been reported in previous Annual Reviews.

During the monitoring period, bores screened in the Boggabri Volcanics remained within trigger values defined in the GWMP. The bore (MW6) within the alluvium aquifer was not monitored during 2019. Bores within these locations are further discussed in subsequent sections, including trends observed within the aquifers.

Monitoring of groundwater levels during 2019 was undertaken at three bores within the Boggabri Volcanics (IBC2110, IBC2111 and GW3115) and one bore within the Maules Creek Formation (BC2181).



Source: GHD, 2020

Figure 4-13 Long Term Groundwater Levels for all Bores

4.6.2.1.1 Quaternary Alluvium

Monitoring bore MW6 is the only bore screened in the alluvium. MW6 was not monitored in 2019 as the bore was blocked. Throughout 2018 groundwater levels displayed a very slight decreasing trend with levels decreasing 0.13 m.

The cumulative deviation from mean rainfall (CDFM) curve (based on data from Boggabri Post Office weather station (station number 055007)) has been plotted with the hydrograph for MW6 as shown in Figure 4-14.

The CDFM curve indicates the monthly accumulation of the difference between the observed monthly rainfall and long term average monthly rainfall. Any increase in the CDFM curve reflects above average rainfall while a decrease in the CDFM reflects below average rainfall.

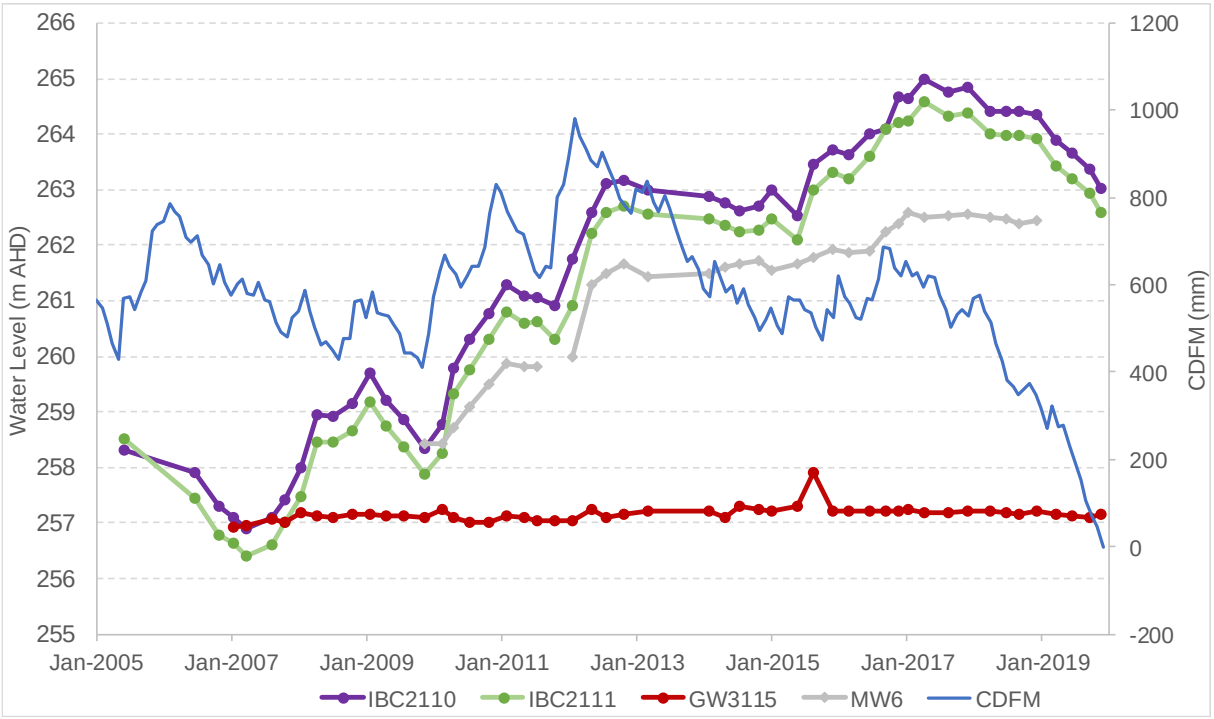
Visual comparison of the MW6 hydrograph and the CDFM curve indicates that groundwater levels in the alluvium historically have responded to periods of above average rainfall. Between 2012 and 2015, groundwater levels have increased even though the CDFM curve was falling. The increasing trend at MW6 in 2016 may be attributable to generally above average rainfall (indicated by the increasing CDFM curve). The relatively stable groundwater level in MW6 in 2017 may be attributable to the generally average rainfall (indicated by a relatively flat CDFM curve). Between January 2018 and September 2018, groundwater levels at MW6 were relatively constant despite significantly decreasing CDFM curve. This trend indicates that there may be factors other than rainfall that may be influencing the historically high groundwater level at MW6. For the remainder of 2018, groundwater levels at MW6 were constant while the CDFM curve was constant.

4.6.2.1.2 Boggabri Volcanics

Monitoring bore IBC2110 is installed deeper within the Boggabri Volcanics while IBC2111 and GW3115 are installed in the shallow weathered Boggabri Volcanics.

Groundwater levels at GW3115 were stable at approximately 257.1 m AHD throughout 2019, which is generally consistent with levels across the historical monitoring period. Groundwater levels at IBC2110 and IBC2111 both decreased slightly throughout 2019 by 1.33 m. This is a continuation of the decreasing trend that commenced in late 2018. This decreasing trend may be attributable to significantly below average rainfall over this period as shown by the sharply decreasing CDFM curve.

This decreasing trend is a change from the increasing trend observed from 2012 to 2017 when groundwater levels at monitoring bores in the Boggabri Volcanics generally remained steady or increasing even though the CDFM curve was falling. Similar historical trends have been observed at MW6. This indicates that there are factors in addition to rainfall that are influencing groundwater levels at MW6 and monitoring locations in the Boggabri Volcanics.



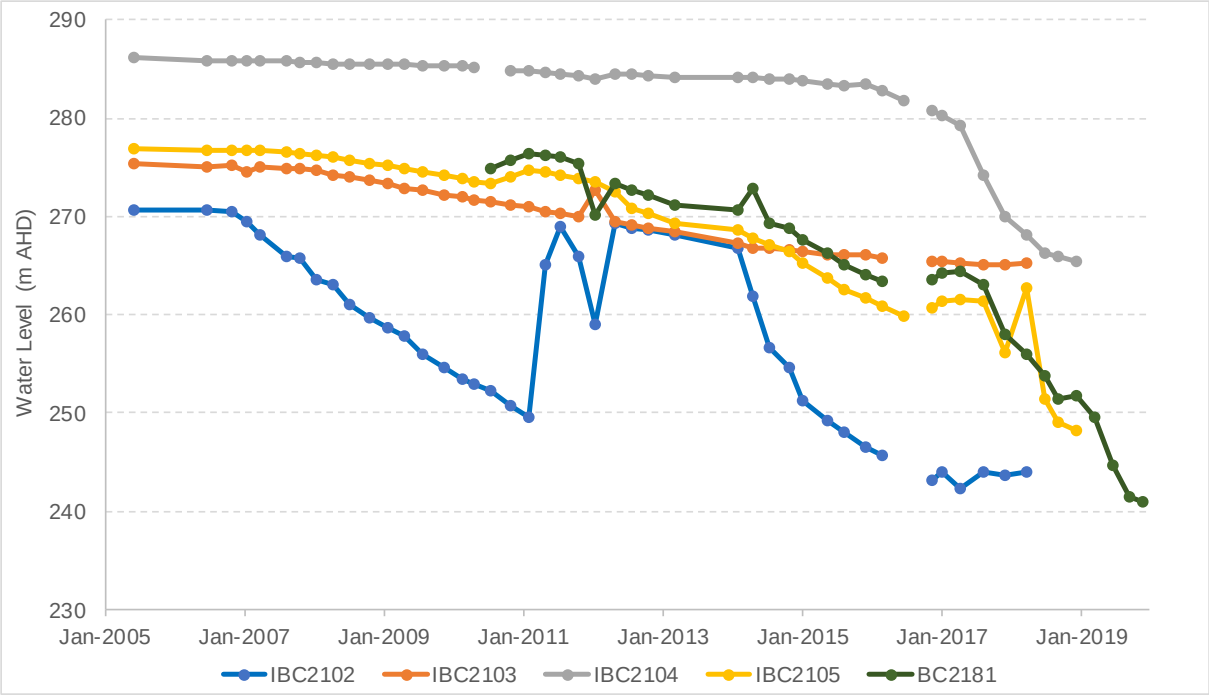
Source: GHD, 2020

Figure 4-14 Alluvium and Boggabri Volcanics Hydrograph and CDFM Curve

4.6.2.1.3 Maules Creek Formation

The groundwater monitoring network at Boggabri Coal Mine includes three bores in the Merriown Seam: IBC2102, IBC2105 and BC2181. The groundwater monitoring network also includes a bore installed in the Jeralong Seam at IBC2103 and within the Braymont Seam at IBC2104. Monitoring at IBC2102, IBC2103, IBC2104 and IBC2105 was not possible in 2019 as the bores were not accessible.

Visual inspection of the hydrographs presented in Source: GHD, 2020
Figure 4-15 indicate a historical decreasing trend in groundwater level for monitoring bores screened in the Maules Creek Formation. This decreasing trend has continued in 2019 at BC2181. Groundwater levels at BC2181 decreased by 10.86 m in 2019.



Source: GHD, 2020

Figure 4-15 Maules Creek Formation Hydrographs - 2019 Levels

4.6.2.2 Comparison of predicted and annual water levels

AGE (2010) developed and calibrated a groundwater model in order to predict possible void inflows and drawdown caused by the coal extraction activities.

Modelled water levels were predicted to decrease over the life of the mine (AGE, 2010). Drawdown has been observed in Maules Creek Formation, which is consistent with the predicted decrease in water levels. In contrast, observed water levels increased within the Boggabri Volcanics and the alluvium south-west of the mine. It is noted that the model developed by AGE (2010) does not include cumulative impacts from adjacent operations within the BTM Complex.

4.6.2.3 Groundwater Quality Trigger Values

For certain parameters, the groundwater quality data collected to date has been reviewed and used to develop revised site trigger values for groundwater quality, which are documented in the latest version of the GWMP (May 2017).

Criteria to develop the trigger values have followed the percentiles approach instead of the standard deviation, as recommended for skewed data, which applies to the BCM. The following assessment criteria are defined in the GWMP:

- One data point greater than the High Trigger Value (HTV), defined as the 99.87th percentile
- Two consecutive data points greater than the Medium Trigger Value (MTV), defined as the 97.73rd percentile
- Five successive data points greater than the Low Trigger Value (LTV), defined as the 84.13th percentile

Following this method, the trigger values derived in the GMP are presented in Table 4-18.

4.6.2.4 Compensatory groundwater

In accordance with Schedule 3 condition 34 of the Project Approval, BCOPL is required to provide a compensatory water supply to any landowner of privately-owned land whose water supply is adversely and directly impacted as a result of the project. Although the 2017 Independent Environmental Audit report found this condition not triggered; BCOPL is required to provide a commentary on the compliance status of this condition in each annual review. No complaints were received by private landholders regarding adverse impacts to water supply during the reporting period, therefore no compensatory water supply was required.

In 2019 Boggabri Coal received feedback from landholder about a reduction in the standing water level in a well that supplies their residences tanks. In response Boggabri Coal offered to drill a new replacement bore. The drilling works were undertaken in 2019.

Table 4-18 Groundwater Quality Trigger Values

Parameter	Trigger values	Exceedance criteria	Coal Measures			Alluvium	Boggabri Volcanics		
			IBC2104	IBC2105	BC2181	MW6	IBC2110	IBC2111	GW3115
pH	Median		7.0	7.3	7.0	7.4	7.8	6.9	7.5
	LTV (84.13th %ile)	5 consecutive data points	7.3	7.6	7.3	7.5	8.0	7.1	7.8
	LTV (15.87th %ile)	5 consecutive data points	6.8	7.1	6.9	7.3	7.3	6.6	7.2
	MTV (97.73rd %ile)	2 consecutive data points	7.9	7.9	8.0	7.6	8.3	8.2	9.4
	MTV (2.27th %ile)	2 consecutive data points	6.6	6.9	6.8	7.2	7.0	6.5	6.9
	HTV (99.87th %ile)	1 data point	8.1	8.0	8.2	7.6	8.4	8.6	9.6
	HTV (0.13th %ile)	1 data point	6.5	6.9	6.8	7.2	6.9	6.4	6.5
EC (µS/cm)	Median		426	736	748	1995	1735	2230	3450
	LTV (84.13th %ile)	5 consecutive data points	501	768	813	2029	2053	2326	3656
	MTV (97.73rd %ile)	2 consecutive data points	565	1013	1164	2080	2146	2385	3808
	HTV (99.87th %ile)	1 data point	584	1137	1273	2089	2150	2399	3848
Sulphate (mg/L)	Median		16	12	25	44	12	54	188
	LTV (84.13th %ile)	5 consecutive data points	33	19	31	49	66	63	203
	MTV (97.73rd %ile)	2 consecutive data points	49	61	47	57	81	74	212
	HTV (99.87th %ile)	1 data point	53	81	52	59	83	76	212
Chloride (mg/L)	Median		29	24	65	251	121	298	654
	LTV (84.13th %ile)	5 consecutive data points	33	33	83	275	313	350	694
	MTV (97.73rd %ile)	2 consecutive data points	55	49	126	275	384	388	753
	HTV (99.87th %ile)	1 data point	68	52	139	275	396	389	767
Sodium (mg/L)	Median		83	168	79	371	436	352	733
	LTV (84.13th %ile)	5 consecutive data points	109	180	90	393	469	371	781
	MTV (97.73rd %ile)	2 consecutive data points	146	221	152	408	495	382	803

4.6.2.5 Groundwater Quality Results – Field Parameters

Time series plots of temperature, pH and Electrical Conductivity (EC) are presented in Figure 4-16, Figure 4-17 and Figure 4-18 respectively. Water quality field parameters for EC and pH have also been compared to the trigger values, with results presented in Table 4-19.

EC was within trigger values throughout 2019 at all monitoring locations except for IBC2110 and IBC2111 installed in the Boggabri Volcanics.

The exceedance of the EC trigger values at IBC2110 in September 2019 is considered to be an outlier. EC at IBC2110 returned to within the range of historical values (pre-2019) in the following monitoring round in November 2019. However, there is a gradual increasing trend in EC at IBC2110. This increasing trend may be related to the observed historical trends in groundwater level in alluvium and Boggabri Volcanics monitoring bores.

The exceedance of EC trigger values at IBC2111 is associated with an increasing trend in EC at this monitoring location. This increasing trend may be related to the observed historical trends in groundwater level in alluvium and Boggabri Volcanics monitoring bores.

There were was one exceedance of the pH trigger values in 2019. The lower bound HTV was exceeded in September 2019 at BC2181. Despite exceeding trigger values, pH at BC2181 remained within the historical (pre-2019) range of values in 2019.

Seasonal temperature variations were observed at all bores in 2019 and temperatures recorded were similar to previous years' results. There were some significantly high temperatures recorded in March 2019 particularly at IBC2110 and IBC2111. These results may be due to a faulty water quality meter or an error in transcribing the results from the field notes.

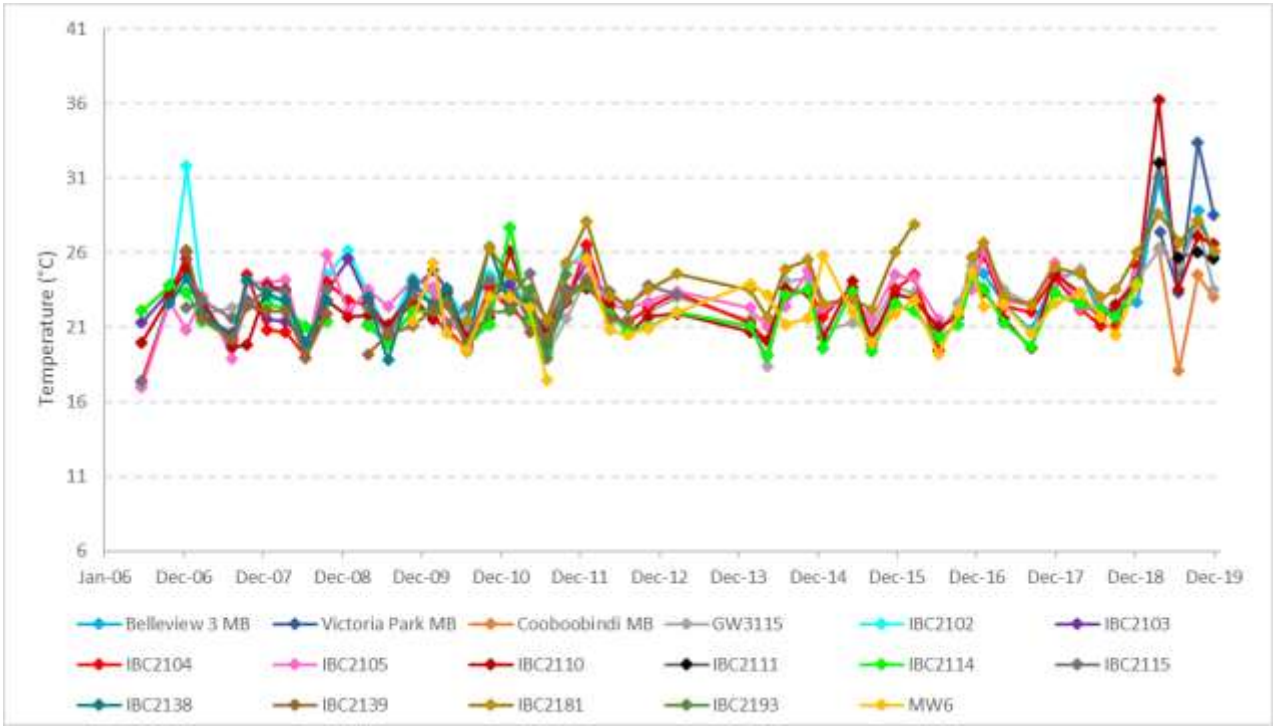


Figure 4-16 Groundwater Trends in Temperature

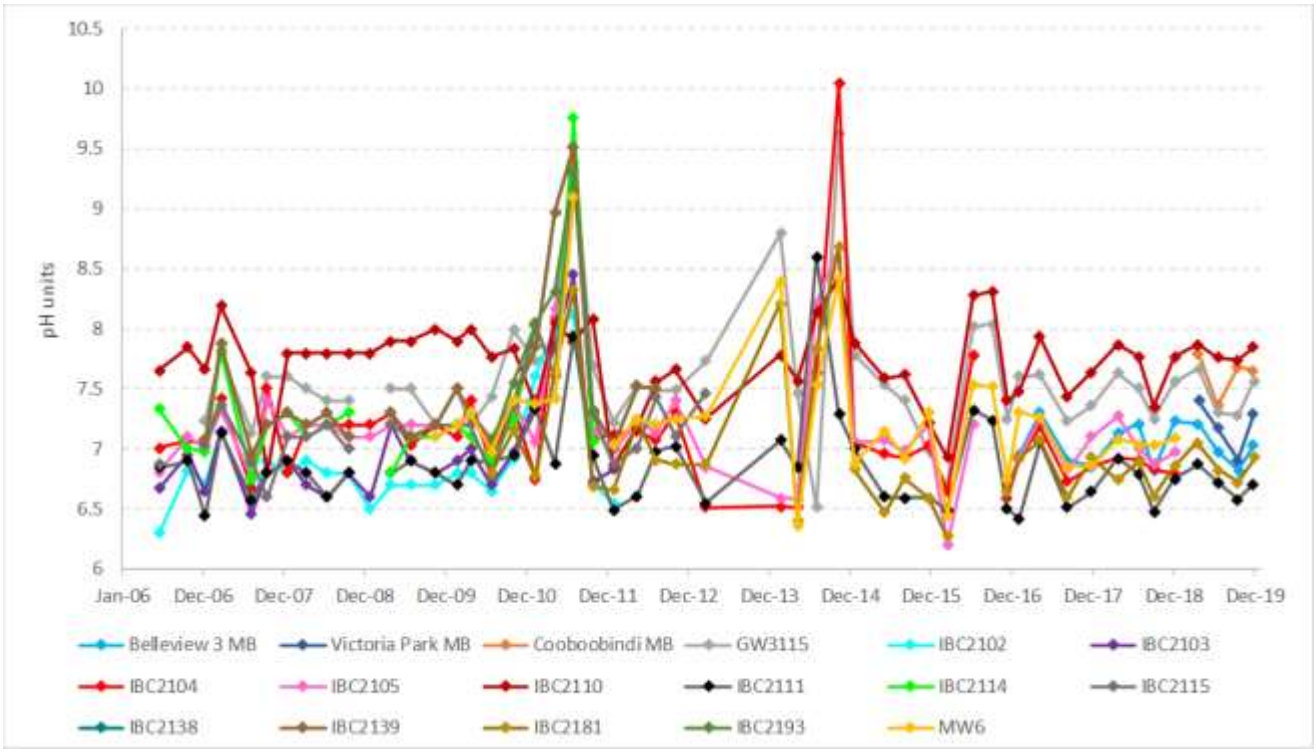


Figure 4-17 Groundwater Trends in pH

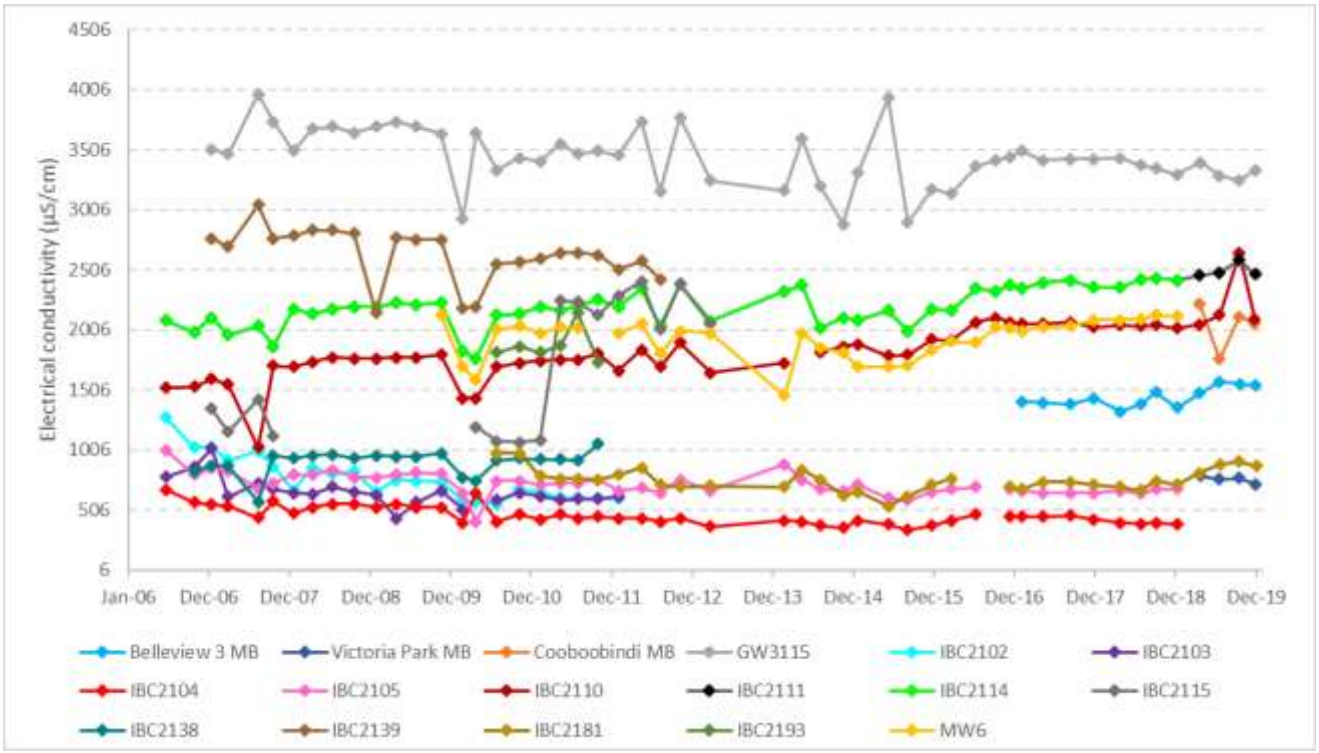


Figure 4-18 Groundwater Trends in Electrical Conductivity

Table 4-19 Results Summary for In Situ Water Quality Measurements

Bore and date sample	Standing Water Level (m AHD)	pH (pH units)	Electrical Conductivity (µS/cm)
GW3115 (Boggabri Volcanics)			
27/03/2019	257.14	7.67	3400
20/06/2019	257.12	7.30	3290
16/09/2019	257.09	7.28	3250
28/11/2019	257.14	7.56	3340
IBC2110 (Boggabri Volcanics)			
22/03/2019	263.90	7.87	2051
19/06/2019	263.65	7.76	2129
17/09/2019	263.38	7.74	2647***
25/11/2019	263.02	7.85	2097
IBC2111 (Boggabri Volcanics)			
22/03/2019	263.44	6.87	2462***
19/06/2019	263.20	6.72	2483***
17/09/2019	262.95	6.58	2589***
27/11/2019	262.60	6.71	2469***
BC2181 (Merriown Seam)			
19/03/2019	249.61	7.05	814
24/06/2019	244.72	6.82	886
16/09/2019	241.46	6.72***	909
4/12/2019	240.93	6.93	874

Notes:

a denotes an exceedance of the LTV (but less than 5 consecutive readings that would constitute a breach of the trigger).

b five consecutive exceedances of the LTV including previous data

******* indicates exceedance of the HTV (as defined in section Table 4-18)

****** indicates two consecutive exceedances of the MTV (as defined in Table 4-18)

***** indicates five consecutive exceedances of the LTV (as defined in Table 4-18).

4.6.2.5.1 Groundwater - Major Ions

Major ion compositions were analysed as part of the analytical suite. Results for major ions are presented in Table 4-20.

All major ions at sites sampled were compliant with the trigger values with the exception of exceedances for chloride and sulfate. The LTV for chloride was exceeded in June 2019 at IBC2110. The HTV for chloride was exceeded at IBC2110 in November 2019 and at IBC2111 in June 2019 and November 2019. The HTV for sulfate was exceeded at IBC2111 in June 2019 and November 2019.

Statistically significant increasing trends in chloride and sulfate have been identified in bores installed in the alluvium and the Boggabri Volcanics. The exceedance of trigger values for chloride and sulfate commenced in 2016. The trend in sulfate and chloride is associated with the increasing trend in EC in monitoring bores installed in the Boggabri Volcanics. Continued monitoring of major ions is recommended.

Based on the Piper plots, the groundwater sampled in 2019 was predominantly sodium and bicarbonate dominant. IBC2110, IBC2111 and GW3115 within the Boggabri Volcanics show chloride and bicarbonate dominance. BC2181 within the Merriown Seam shows less sodium dominance, which is consistent with previous monitoring results (GHD, 2016; GHD, 2017 and GHD, 2018).

Table 4-20 Results Summary for Analysis of Major Ions

Bore and date sample	Bicarbonate as CaCO3 (mg/L)	Sulfate as SO4 (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)
GW3115 (Boggabri Volcanics)							
20/06/2019	623	167	583	62	16	644	4
28/11/2019	651	175	703	60	16	624	4
IBC2110 (Boggabri Volcanics)							
19/06/2019	384	82	367*	16	5	436	3
25/11/2019	419	80	447***	15	5	431	3
IBC2111 (Boggabri Volcanics)							
19/06/2019	525	83***	400***	135	42	343	5
27/11/2019	631	85***	492***	131	43	352	5
BC2181 (Merriown Seam)							
24/06/2019	361	14	38	73	23	71	10
4/12/2019	353	18	44	74	25	70	10

Note:
a Denotes an exceedance of the LTV (but less than 5 consecutive readings that would constitute a breach of the trigger).
b Denotes an exceedance of the MTV (but less than 2 consecutive readings that would constitute a breach of the trigger).
******* indicates exceedance of the HTV (as defined in Table 4-18)
****** indicates two consecutive exceedances of the MTV (as defined in Table 4-18)
***** indicates five consecutive exceedances of the LTV (as defined in Table 4-18)

4.6.2.5.2 Groundwater - Metals

Analytical results indicated that dissolved metal concentrations for the majority of monitoring locations were below laboratory limit of reporting (LOR).

All dissolved metal concentrations were similar to historical data. Iron concentrations have historically been elevated at GW3115 and remained elevated during 2019. Based on historical data, it is likely that iron is naturally elevated at GW3115.

A summary of the metal concentrations recorded during the reporting period is presented in Table 4-21.

Table 4-21 Results Summary for Analysis of Metals

Bore and date sample	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Zinc (mg/L)	Iron (mg/L)
GW3115 (Boggabri Volcanics)									
20/06/2019	<0.001	<0.0001	<0.001	<0.001	<0.001	0.088	<0.001	1.8	<0.05
25/11/2019	<0.001	<0.0001	<0.001	<0.001	<0.001	0.088	<0.001	0.007	0.05
IBC2110 (Boggabri Volcanics)									
19/06/2019	<0.001	<0.0001	<0.001	<0.001	<0.001	0.105	0.005	<0.005	<0.05
25/11/2019	<0.001	<0.0001	<0.001	<0.001	<0.001	0.069	0.006	<0.005	<0.05
IBC2111 (Boggabri Volcanics)									
19/06/2019	<0.001	<0.0001	<0.001	0.01	<0.001	0.031	0.003	0.37	0.12
27/11/2019	<0.001	<0.0001	<0.001	0.018	<0.001	0.01	0.002	0.133	<0.05
BC2181 (Merriown Seam)									
24/06/2019	<0.001	<0.0001	<0.001	<0.001	<0.001	0.062	0.004	0.053	<0.05
4/12/2019	<0.001	<0.0001	<0.001	0.002	<0.001	0.096	0.002	0.02	<0.05

4.6.2.5.3 Groundwater - Nutrients

Nutrient concentrations during 2019 were generally similar to historical concentrations.

Mann Kendall trend analysis identified statistically significant increasing trends in nitrate at IBC2111. Total phosphorus concentrations were also very slightly elevated in November 2019 at IBC2110.

Table 4-22 Results Summary for Analysis of Nutrients

Bore and date sample	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Nitrite + Nitrate (mg/L)	Total Kjedahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Reactive Phosphorus (mg/L)
GW3115 (Boggabri Volcanics)								
20/06/2019	0.1	<0.01	<0.01	<0.01	-	<0.1	<0.01	<0.01
28/11/2019	0.1	<0.01	<0.01	<0.01	0.4	0.4	<0.01	<0.01
IBC2110 (Boggabri Volcanics)								
19/06/2019	0.19	<0.01	0.01	0.01	-	0.2	0.09	0.05
25/11/2019	0.22	<0.01	<0.01	<0.01	0.4	0.4	0.37	<0.01
IBC2111 (Boggabri Volcanics)								
19/06/2019	<0.01	<0.01	4.23	4.23	-	5.3	0.02	0.01
27/11/2019	<0.01	<0.01	4.12	4.12	0.5	4.6	0.02	<0.01
BC2181 (Merriown Seam)								
24/06/2019	0.02	<0.01	0.08	0.08	-	1.8	0.23	<0.01
4/12/2019	0.09	<0.01	0.04	0.04	0.4	0.4	0.04	<0.01

Note: '-' denotes not analysed

4.6.2.5.4 Long-Term Water Quality Trend Analysis

Statistical trend analysis of groundwater quality data was undertaken using the Mann-Kendall test. Mann-Kendall analysis is a non-parametric statistical method that accounts for complexity in the dataset such as non-normal distributions, seasonality, missing values and values below the limit of reporting. The Mann-Kendall analysis will identify if a statistically significant increasing or decreasing trend is occurring, but will not identify the source or cause of any identified trend. The Mann-Kendall analysis was carried out using all historical water quality data for each location, including results reported in 2019. All statistical testing was undertaken at a 95% confidence level using pyMannKendall python package (Hussain et al., 2019). It should be noted the Mann-Kendall analysis can be affected by changes in rainfall and changes in the LOR.

Increasing trends were evident for the following parameters:

- EC at IBC2110, IBC2111 and BC2181
- Sulfate at IBC2110 and IBC2111
- Chloride at IBC2110, IBC2111
- Calcium at IBC2111 and BC2181
- Magnesium at IBC2111 and BC2181
- Sodium at IBC2110
- Nitrate at IBC2111

Decreasing trends were evident for the following parameters:

- pH at BC2181
- EC at GW3115
- Sodium at GW3115 and BC2181
- Ammonia at BC2181

Decreasing trends in arsenic, cadmium and chromium are likely due to a trend of values equal to or below the LOR.

Where increasing trends are evident, concentrations of these parameters generally were within the adopted trigger values for 2019 monitoring with the exception of chloride at IBC2110 and IBC2111, sulfate at IBC2111, and EC at IBC2110 and IBC2111. Decreasing trends in pH were identified at BC2181 that correspond with exceedances of adopted trigger values in 2019.

The majority of statistically significant trends are evident for bores within the Boggabri Volcanics (particularly IBC2110 and IBC2111) and may be associated with the historical trends in groundwater levels at these locations (which may be attributable to changes in irrigation). It should be noted that the trends that have been identified are not necessarily attributable to the operation of Boggabri Coal Mine. Other contributing factors may be the local effects of rainfall, natural geochemical processes or even the installation of the bore itself.

4.6.2.5.5 Groundwater Quality Summary

Groundwater quality was generally within trigger values except for a number of exceedances for pH and EC at Boggabri Volcanics, Merriown Seam and Alluvium sites, and a number of exceedances for sulfate and chloride.

4.6.2.6 Mine Void Groundwater Inflow

4.6.2.6.1 Inflow Volumes

The groundwater make reported by BCOPL for the reporting period is 199.1 ML. This reported volume includes water that entered to pit via intercepted coal seams and was pumped from the pit or subject to evaporation. The total licenced water take for the Gunnedah – Oxley Basin groundwater source (WAL 29562 and WAL 29473) is 842 ML/year, which is over four times the reported groundwater make.

4.6.2.6.2 Inflow Water Quality

Pit water storage facilities include MW2 and MW3. A water quality sample was taken from MW3 in June and December 2018 however no sample was taken in 2019. No sample was taken from MW2 in 2017, 2018 or 2019 but samples had previously been taken in 2016. The water quality analysis undertaken in 2014 and reported by Parsons Brinckerhoff (2015) indicated that the water type at MW3 was somewhat similar water type to bores screened in the alluvium or Boggabri Volcanics, while MW2 was somewhat similar to water type of bores screened in the coal seams.

The water type at MW3 had changed during 2018. Results from 2018 indicate a slightly increased magnesium/calcium influence compared to sodium bicarbonate/sodium chloride dominated water from 2017 (GHD, 2018).
It should be noted that the assessment is affected due to:

- The proportion of rainwater is relatively high at MW2 and MW3 (reported to be 85% of total water volume).
- Processes such as evaporation and oxidation alter the water quality of pit water.
- Sampling of MW3 in January 2017, April 2017, June 2018 and November 2018 was undertaken after a number of days with no rainfall. November 2017 sampling of MW3 was undertaken after a small rainfall event of 2 mm. Sampling of MW2 and MW3 in 2016 was undertaken after a small rainfall event of 1.8 mm at BCM.

It is considered unlikely that significant volumes of groundwater from the alluvium is drawn in to the pit because:

- The low permeability Boggabri Volcanics acts as a hydraulic barrier between the void and the alluvium.
- No drawdown in bores screened in the alluvium and the Boggabri Volcanics is evident indicating only limited or no water is taken from storage in these formations.

4.6.3 Improvements and Initiatives

In 2019 Boggabri Coal responded to a request by its industry neighbours Maules Creek Coal Mine, by supplying them with 410 megalitres of water. This water was sourced from Boggabri Coal's bore field and conveyed to Maules Creek Coal Mine via an existing transfer tank and piping infrastructure installed specifically for this purpose.

In 2020 Boggabri Coal proposes to upgrade groundwater bore metering so that it meets the *NSW Non-Urban Water Metering Policy.*

4.7 Biodiversity

4.7.1 Environmental Management

Biodiversity issues at BCM are managed in accordance with the approved BMP. The BMP provides a framework for managing biodiversity values within the project boundary, Biodiversity Offset Areas (BOAs), and wider locality.

The BMP guides the management of potential risks to biodiversity as a result of BCM. Specifically, the BMP aims to:

- Provide details of the parties responsible for monitoring, reviewing, and implementing the BMP
- Ensure compliance with all legislative requirements, statutory approvals/licences and corporate responsibilities of BCOPL
- Describe the measures (short, medium and long-term) to be implemented to manage remnant vegetation and habitat within the Project boundary and BOAs, including detailed performance and completion criteria
- Describe the practical management strategies (including procedures) to be implemented to manage impacts on flora and fauna, maximising salvage and beneficial use of resources in areas to be impacted for habitat enhancement, rehabilitate creeks, drainage lines and disturbed areas, control weeds and pests
- Describe biodiversity monitoring and reporting requirements

No impacts outside those predicted in the EA have occurred during the reporting period indicating the management strategies specified by the BMP and implemented across the site are adequate to address potential impacts.

BCM's biodiversity offset requirements are outlined in the Boggabri Coal Mine Biodiversity Offset Strategy (WSP, 2018) (BOS). The BOS guides the implementation of BOAs. It identifies potential suitable offsets to adequately compensate the Project's impacts on local biodiversity, ensuring the Project complies with legislative and PA offset requirements.

The BOS was revised in 2018 in accordance with Schedule 3, Condition 43 of the PA to incorporate an additional 1000 ha of offsets. The revised strategy also included additional offset requirements identified in Condition 39, Table 15 of the PA. This BOS was prepared to accurately reflect the final offset areas to be subject to formal in perpetuity conservation in accordance with Schedule 3 Condition 47 of the PA. In 2019, BCM commenced formal negotiations with the NSW Biodiversity Conservation Trust regarding formal in perpetuity conservation agreements for 8,076.8 ha committed as biodiversity offset to meet the PA.

BCOPL has implemented a range of biodiversity monitoring activities since the commencement of operations, in addition to those studies completed for the EA. Biodiversity monitoring has included the following programs or studies undertaken by WSP:

- Vegetation clearing monitoring (undertaken in conjunction with the annual tree clearing program)
- Leard State Forest annual biodiversity monitoring (an annual program of comprehensive flora and fauna surveys)
- Leard State Forest corridor monitoring (a program to monitor biodiversity within a vegetation corridor between BCM and Maules Creek Mine)
- Biodiversity offset area monitoring (an annual program to assess the progress of the BOAs in achieving biodiversity targets)
- Targeted seasonal threatened species surveys for Regent Honeyeater, Swift Parrot and Corben's Long-eared Bat

- Mine rehabilitation biodiversity monitoring (an annual program based on flora and fauna surveys to assess the progress of mine rehabilitation areas in achieving rehabilitation targets)
- Stream and riparian vegetation health assessment (an annual program monitoring riparian vegetation health in accordance with BCM Surface Water and Groundwater Management Plans)

The following sections summarise activities related to biodiversity management, provide updates on key biodiversity studies undertaken during the reporting period, and summarises the performance of BCOPL in meeting requirements of the PA and internal management plans.

4.7.2 Environmental Performance

4.7.2.1 BTM Complex 2018 Annual Biodiversity Summary Report

The Leard Forest Regional Strategy (RBS) was prepared to provide a strategic framework for the management and implementation of the Boggabri Coal Project, Tarrawonga Coal Project and Maules Creek Coal Project (the BTM Complex) biodiversity offset programs and to provide guidance for co-ordinated management with other land managers within the region. To achieve coordinated and successful biodiversity management within the region, the RBS specified that the BTM Complex must prepare an 'Annual Summary Report' detailing the overall biodiversity performance and outcomes of biodiversity offsets.

In 2019, BCOPL collaborated with Whitehaven Coal Pty Limited (Maules Creek Coal Mine and Tarrawonga Coal Mine) to prepare the inaugural BTM (Boggabri, Tarrawonga and Maules Creek) 2018 Annual Biodiversity Summary Report. This report summarised activities completed across the BTM Complex as they pertained to natural regeneration, seed collection and propagation, active revegetation, pest management, mine rehabilitation, biodiversity management consultation, biodiversity offset monitoring methodologies and 2018 biodiversity offset performance and outcomes (vegetation community attributes, key weed attributes, fauna monitoring results, threatened flora and fauna monitoring results).

4.7.2.2 Commonwealth Consent Fauna Surveys

In accordance with the Commonwealth's Department of Agriculture, Water and the Environment Conditions of Approval 13c and 14, BCOPL have commissioned annual surveys across BCM biodiversity offset lands for *Nyctophilus corbeni* (Corben's Long-eared Bat), *Anthochaera (Xanthomyza) phrygia* (Regent Honeyeater) and *Lathamus discolor* (Swift Parrot). Targeted surveys for Regent Honeyeater and Swift Parrot were undertaken during June and August 2019, whilst surveys for Corben's Long-eared Bat were undertaken in December 2019, and January 2020.

Annual targeted threatened species surveys were undertaken for Regent Honeyeater and Swift Parrot with consideration of the *Commonwealth Survey Guidelines for Australia's Threatened Birds* (Department of Environment Water Heritage and the Arts 2010). Surveys were completed across the BOAs, extending from the Western offset (Merriendi BOA), through the Namoi offset, Central offsets (Goonbri BOA, Wirrilah BOA, Myall Plains BOA, Mallee BOA) and Eastern offsets (Nioka North BOA, Sunshine BOA, Braefield BOA). The key objective of which, is to determine if the threatened species are using winter blossom resources. *Eucalyptus albens* (White Box) is an important source of winter blossom resources in the western slopes region of NSW and it occurs widely across the BOAs and throughout Leard State Forest surrounding BCM. During June and August 2019 survey period there was again an overall lull in the appearance of blossom resources across the BOAs. The region again continued to experience a sustained dry period, which may, to some extent, account for the relatively low percentages of trees exhibiting blossom or new growth. The low numbers of nectarivorous birds encountered during this survey period were a strong indication of the relatively low blossom values observed across the entirety of the BOAs and canopies throughout Leard State Forest. The Regent Honeyeater and Swift Parrot were not detected during these targeted searches.

Targeted surveys for Corben's Long-eared Bat were also undertaken within the BOAs, encompassing the Western, Namoi, Central and Eastern Offset Areas. Corben's Long-eared Bat was recorded for the first time in the Merriendi BOA during the monitoring period (recorded January 2020). However, Corben's Long-eared Bat was not detected during this survey period at locations from which it has previously been recorded, including the Namoi and Central Offset Areas. Additionally, the Large-eared Pied Bat (*Chalinolobus dwyeri*), which is listed as Vulnerable under the both the NSW BC Act and Commonwealth EPBC Act, was recorded for the second time in the Nioka North BOA in December 2019.

In addition, the Border Thick-tailed Gecko (*Uvidicolus sphyrurus*), which is listed as Vulnerable under the EPBC Act and BC Act, was recorded for the first time in the Nioka North BOA in December 2019 during targeted Corben's Long-eared Bat surveys.

4.7.2.3 Vegetation Clearing

Vegetation clearing for the reporting period commenced on 4 February 2019 and ended 17 March 2019, inclusive of pre-clearing surveys, and Stage 1 and Stage 2 clearing operations. The extent of clearing totalled 64.75 ha of vegetation, encompassing four vegetation communities.

One vegetation community corresponded with PCT1383 - *White Box Grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion*, which is listed as Critically Endangered under the EPBC Act and Endangered under the BC Act. The extent of each vegetation community cleared during the 2019 clearing period is illustrated in Table 4-23.

Table 4-23 Vegetation communities identified in 2019 tree clearing

Vegetation Community	Threatened Ecological Community		Total 2019 Clearing Community Extent (ha)
	BC Act	EPBC Act	
PCT1381 – Narrowleaved Ironbark shrubby woodland	N/A	N/A	10.49
PCT1383 – White box grassy woodland[1]	Endangered	Critically Endangered	48.53
PCT1313 – White Cypress – Narrow leaved Ironbark Shrub/grass open forest	N/A	N/A	4.92
Blue-leaved Ironbark heathy woodland	N/A	N/A	0.81
		Total	**64.75**

1. This community was commensurate with the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland community, listed as Endangered and Critically Endangered under the BC Act and EPBC Act respectively.

4.7.2.4 Vegetation Clearing Ecological Monitoring

As with previous years, the 2019 tree-clearing program was undertaken in conjunction with a team of qualified ecologists to ensure, as far as practicable, the safe removal and relocation of native fauna.

Pre-clearing fauna trapping and relocation was completed prior to the commencement of clearing activities. This included 240 Elliott A (terrestrial) trap nights, 120 Elliott B (arboreal) trap nights and 36 cage trap nights. The following species were captured and relocated to the designated fauna relocation sites prior to the commencement of clearing operations:

- Burn's dragon
- Yellow-footed Antechinus
- Tree Skink
- Lace Monitor

During stage 1 and stage 2 clearing operations, 324 animals were successfully relocated, 381 animals were observed from habitat trees and evaded capture, and 35 animals were killed or euthanised as a result of clearing operations (Table 4-24). The most abundant groups of animals encountered during 2019 clearing operations were reptiles (423 individuals) and microchiropteran bats (microbats) (303 individuals).

To minimise stress to displaced native animals, all individuals were appropriately retained and released into designated fauna relocations sites at the earliest practicable time following capture. It is anticipated that the number of microchiropteran bats, either relocated or evading capture, is likely to be higher, with numerous microbats observed within existing hollow-bearing trees or being present in broken hollow branches that were safely relocated to the designated fauna relocation sites.

Table 4-24 Animal groups encountered during clearing operations

Fauna Group	Number of individuals recorded			
	Relocated	Observed	Deceased/ Euthanised	Total
Reptiles	225	150	18	423
Microchiropteran bats	168	218	17	303
Mammals	1	13	0	14
Total	**324**	**381**	**35**	**740**

The attendance of the ecologist's supervising tree clearing greatly enhanced the likelihood of survival for the above listed species.
In addition to the above mentioned animals, nine threatened species were encountered during the 2019 clearing operations (refer to Table 4-25).

Table 4-25 Threatened Species Encountered during Clearing Operations

Common Name	Scientific Name	EPBC Act Status	BC Act Status[1]
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	–	V
Pale-headed Snake	*Hoplocephalus bitorquatus*	–	V
Dusky Woodswallow	*Artamus cyanopterus*	–	V
Speckled Warbler	*Chthonicola sagittata*	–	V
Varied Sitella	*Daphoenositta chrysoptera*	–	V
Little Lorrikeet	*Glossopsitta pusilla*	–	V
Little Eagle	*Hieraaetus morphnoides*	–	V
Turquoise Parrot	*Neophema pulchella*	–	V
Brown Treecreeper	*Climacteris picumnus*	–	V

[1] Listed as Vulnerable (V) under the NSW *Biodiversity Conservation Act 2016*.

The rigorous fauna surveys undertaken as part of the BCM tree clearing program are regarded as a key practice in minimising harm to fauna prior to clearing activities, and reducing the mine's impact on biodiversity. Furthermore, the tree shaking methodology implemented during Stage 2 clearing proved to be an effective way of flushing Yellow-bellied Sheathtail-bats from roost trees, thus minimising further harm to this species.

The tree clearing program involved the salvage of woody debris including fallen timber, felled hollow trees, and bush rock for later use in restoration areas in the BOAs and mine rehabilitation areas. A total of 976 lineal metres of woody debris and 10m2 of bush rock was retained and stockpiled.

4.7.2.4.1 Stygofauna Surveys

Commencing in late 2018 and 2019, a pilot survey of stygofauna in aquifers situated within and around the BCM lease area were undertaken. A selection of groundwater bores that met the known water quality requirements for stygofauna were surveyed to gather baseline data regarding the potential presence, distribution and diversity of stygofauna species in alluvial aquifers surrounding the BCM. It was envisaged that such information may facilitate the management of future risks to subsurface groundwater dependent ecosystems (SGDE), biodiversity and aquifer water quality.

A total of ten bores were surveyed in association with BCM. The surveyed bores included deep monitoring bores and alluvial harvesting bores (Table 4-26). Two field surveys were undertaken, the first survey was undertaken between the 13 – 15 November 2018, with all 10 groundwater bores sampled. Based on the results obtained from the first survey, four alluvial bores were scheduled for resampling in July 2019.

Table 4-26 Groundwater Bores Sampled

Site Name	Eastings	Northings	Depth (m)	Survey Period
IBC – 2104	228336	6612213	52	November 2018
IBC – 2105	228325	6612215	52	November 2018
IBC – 2110	225935	6607685	52	November 2018
IBC – 2111	225948	6607685	52	November 2018
IBC – 2181	226848	6612477	52	November 2018
GW 3115	224752	6609186	138	November 2018
Victoria Park MB	221966	6604988	224	November 2018, July 2019
Bellview 3 MB	218887	6607064	200	November 2018, July 2019
Cooboobindi MB	217939	6696232	55	November 2018, July 2019
MW6	225386	6607868	52	November 2018

The groundwater bores sampled in November 2018 resulted in only one bore (MW6) yielding stygofauna typical of the aquifers. Some bores contained aquatic invertebrates and microcrustacean such as mites, copepods and cladocera, but these are unlikely to be representative of the aquifer and instead have been introduced through bores being left uncapped or introduced via equipment contamination. Terrestrial invertebrates identified, such as collembola, aphids and parts of ants and spiders, also support this conclusion.

The second sampling event completed in July 2019 targeted the four alluvial bores only. Only three of the bores were surveyed as MW6 had been damaged and could not be resampled. No stygofauna were identified during the 2019 survey.

Bore MW6 was the only bore that contained stygofauna, which included three specimens of obligate groundwater crustaceans belonging to the order Syncaridi, and genus Notobathynella (*Parabathynellidae*). This species is known from the region and has been identified in Tasmania, NSW, Victoria and New Zealand. The *Parabathynellidae* are an important component of Australia's groundwater fauna as they are have an ancient lineage, occupy specialised habitats such as caves, the hyporheic zones of sand and gravel bed rivers and groundwaters, have no part of their life cycle that can resist desiccation, are highly endemic, and play an important role in groundwater carbon/energy cycles and water purification.

As stygofauna was only identified from a single bore and limited to a single species, it is difficult to draw conclusions about the connectivity of the alluvial aquifer to support this and other stygofauna species. The absence of stygofauna from the remaining nine groundwater bores sampled does not necessarily mean that stygofauna are not present in these aquifers. The most likely bores to support stygofauna are the shallower alluvial bores within the BCM lease. The remaining deep coal seam bores are less likely to support stygofauna.

4.7.2.5 Annual Leard State Forest Biological Monitoring

A tailored biological monitoring program for BCM was established in 2006, prior to mining. The monitoring program aims to identify and assess potential impacts to biodiversity within the Leard State Forest as a result of mining activities. It focuses on native vegetation, fauna habitat, invertebrates, birds and microbats within the forest. Monitoring is undertaken on an annual basis by qualified ecologists. As at March 2020, 15 monitoring surveys have been undertaken.

The monitoring program is based on the 'Beyond BACI' monitoring design, incorporating four replicate survey sites within the Leard State Forest (the potential impact location) and four survey sites in each of two reference locations (Central Offset Area (previously referred to as Eastern Offset) and the Rocklea property – refer to Appendix B.

As discussed in previous Annual Reviews/AEMRs, reference locations prior to 2012 included the Vickery State Forest and Rocklea property. Due to increasing pressures of mining activities, including encroachment of open cut operations on long term biodiversity monitoring sites, the Central Offset Area of the BCM BMP was substituted as a reference location for the Vickery State Forest, on the basis it contains homogenous vegetation considered to be analogous with that of the Leard State Forest, and its relative absence of impacts associated with BCM. The Central Offset Area is located between Leard State Forest and the Nandewar Range, and at its furthest extent, approximately 10 km east of the Leard State Forest.

Survey sites within Leard State Forest were selected where possible to represent each of the two main vegetation types likely to be impacted by mining – Ironbark Woodland and White Box Woodland. These sites were located at varying distances around the area of mining as illustrated in Appendix B. Likewise, survey sites at the reference locations/control sites were selected, where possible, within vegetation types like those found in Leard State Forest, or at a minimum, with similar vegetation structures. Surveys at each site included:

- Two 100 m transects for vegetation cover abundance
- Two 100 m transects for invertebrates each containing 10 pitfall traps
- Two nights of microbat recordings using AnaBat SD1/SD2 or Anabat Express Bat Detector units
- Two 20-minute area searches within 80 m (approximately 2 ha) of fixed monitoring sites on non-consecutive mornings
- A reference photograph for each transect

4.7.2.5.1 Results

Data acquired during the 2019 monitoring event should be considered with respect to the extended and severe drought conditions from which biological variables were sampled.

Vegetation across the three monitoring locations retained a moderate to high diversity of native plant species and a low diversity of exotic species. Comparatively, replicate monitoring sites associated with Leard State Forest retained a mean native plant species richness slightly greater than the two reference locations. Exotic plant species richness however, was largely comparable between Leard State Forest, Central Offset Area and the Rocklea property.

One threatened flora species (Tylophora linearis) was recorded during the survey at three replicate monitoring sites associated with Leard State Forest, including LSF2, LSF3 and LSF4; and at replicate monitoring site Roc2 associated with the Rocklea property. Tylophora linearis is listed as Endangered under both the NSW BC Act and Commonwealth EPBC Act.

Dry woodland habitat associated with Leard State Forest and the two reference locations provide important habitat for a variety of woodland specialist and generalist species of bird. A total of 64 species of diurnal bird were recorded during replicate monitoring surveys with the Fuscous Honeyeater, Rufous Whistler, Striated Pardalote, Grey Fantail, and Weebill, commonly recorded. Mean diurnal bird species richness and abundance was lower within the potential impact location compared to the two control locations during the 2019 monitoring event.

Seven threatened species of bird listed as Vulnerable under the NSW BC Act were recorded during duplicate surveys at replicate monitoring sites, including Little Lorikeet, Turquoise Parrot, Brown Treecreeper, Speckled Warbler, Varied Sittella, Dusky Woodswallow and Grey-crowned Babbler.

Microchiropteran bat data for the Leard State Forest Biological Monitoring Program is currently under detailed analysis.

4.7.2.6 Annual Leard State Forest Corridor Biodiversity Monitoring

The Leard State Forest corridor refers to a vegetated, boundary corridor that is predominately within Leard State Forest between BCM and Maules Creek Mine. This corridor forms a part of the larger East-West Corridor (as detailed in the BMP) representing the vegetation corridor between the Nandewar Range, BCM BOAs, Leard State Forest and the Namoi River.

The purpose of the corridor monitoring is to gain an understanding of biodiversity values within the Leard State Forest corridor and to identify any potential changes to these values as a result of the works being undertaken at BCM.

General biodiversity survey methodologies for the 2019 monitoring was undertaken in September 2019, at four replicate monitoring sites positioned within BCMs legislated 250 m wide portion of the corridor. Monitoring targeted native vegetation, birds and microbats. Data collected during the reporting period includes fifth year data for site 2, and seventh year data for sites 3-5. Site 1 was discontinued in 2017 due to its location outside of the legislated corridor area. Nevertheless, site 1 is still monitored as part of the Annual Leard State Forest Biological Monitoring program.

The following general survey methodologies were completed at each replicate monitoring site (direction randomly selected within each location):

- Two 100 m vegetation survey transects for cover and abundance
- One BioBanking plot (including photo point monitoring)
- Two nights of passive microbat recordings
- Two 20-minute area searches within 80 m (approximately 2 ha) of fixed monitoring sites on separate mornings
- Two consecutive nights of passive infra-red/motion sensor camera detection

In addition, targeted seasonal survey methodologies were apportioned to Swift Parrot and Regent Honeyeater in June and August 2019, and Corben's Long-eared Bat in January 2020.

4.7.2.6.1 Results

In summary, the results from the seventh year of corridor monitoring indicate that whilst some biodiversity values remained largely comparable with those established during baseline surveys (2013), others were suppressed. For example, some attributes, such as plant species richness/cover, fluctuate naturally in response to rainfall. Nevertheless, to date the data collected suggests that activities associated with the Boggabri Coal Mine are not likely to have substantially impacted biological values within the corridor. Importantly, data acquired during the 2019 monitoring event should be considered with respect to the extended and severe drought conditions from which biological variables were sampled.

- A total of 93 species of plant were recorded collectively across the replicate monitoring sites, which included two exotic species, both of which are classified as Priority Weeds under the NSW Biosecurity Act 2015 and Weeds of National Significance (Opuntia stricta* and Opuntia tomentosa*). Although 2019 vegetation attributes were largely comparable between monitoring years (2014 to 2019), stresses on vegetation attributes associated with the drought were evident. It is likely that the prolonged extreme dryness experienced over the past couple of years rather than below average rainfall this season is the contributing factor to this response. Continual annual monitoring will aid in determining the resilience and response of the vegetation within the corridor over time as conditions improve.
- Diurnal bird species richness at each replicate monitoring site was similar during the 2019 monitoring event. However, mean diurnal bird species richness (as averaged from four replicate monitoring sites) was suppressed during the 2019 monitoring event. Mean species richness occurred below that recorded during baseline monitoring surveys (2013) and the Leard State Forest analogue benchmark. It is likely that bird activity and population dynamics has been impacted to some degree by the prolonged drought experienced over much of eastern Australia over the last few years. A total of 34 species of bird were recorded collectively across the replicate monitoring sites, the composition of which suggest vegetation retains structural complexity capable of providing habitat to woodland and generalist species of bird. Two threatened species of bird listed as Vulnerable under the BC Act were recorded from replicate monitoring sites during surveys; Speckled Warbler and Varied Sittella.
- Microchiropteran bat data for the Leard State Forest Biological Corridor Monitoring program is currently under detailed analysis.
- Targeted Swift Parrot and Regent Honeyeater surveys were conducted in the corridor over two discrete sampling periods in June and August 2019. The Swift Parrot and Regent Honeyeater were not recorded during these targeted surveys with blossom values in the corridor and wider Boggabri locality generally suggesting that these species were not likely to be present. The very low occurrences of namely Eucalyptus albens blossom resources within the corridor and larger Leard State Forest remnant was not of significant proportions and this was evident in the generally subdued presence of nomadic nectarivorous birds in the Boggabri locality.
- A total of four harp trap nights targeting Corben's Long-eared Bat was completed from three locations within the corridor. A total of five species of microchiropteran bat were recorded from the corridor, with Corben's Long-eared Bat captured from one location.
- No pest species were recorded in the corridor during the survey period either through direct observation or remote sensing camera traps. Only one species, Australian Raven, was recorded from replicate monitoring LC4 via remote sensing camera trap.

Further ongoing monitoring of the corridor will allow for long-term comparison of biological data to assist in assessing the functioning of the area as a biodiversity corridor. Similarly, ongoing monitoring will allow for potential quantification of the successfulness of any processes implemented to minimise operational impacts on the corridor.

4.7.2.7 Annual Stream and riparian vegetation health Monitoring

The Boggabri Coal Mine is largely contained within the catchment of an unnamed ephemeral drainage line commonly known as 'Nagero Creek'. A small area to the south of the project is also located within the catchment of Bollol Creek. Nagero Creek and Bollol Creek are both small tributaries of the Namoi River, with the former flowing approximately 8 km to the Namoi River.

The Namoi River is the main watershed for the region and is part of the Murray Darling Basin system and managed under two Water Sharing Plans. BCOPL holds existing licences under the Water Management Act 2000 for the extraction of both surface water and groundwater associated with this watershed.

The purpose of this program is to monitor stream and riparian vegetation health due to the potential for impacts on surface water and groundwater systems. Survey methodologies for the 2019 monitoring program were completed between 5 – 9 November 2019, at five replicate monitoring sites, incorporating:

- Quantitative transect/plots (one BioBanking plot)
- Stream characteristics (channel size, composition, flow category and clarity, et cetera)
- Photographic monitoring

Data collected during the reporting period includes second year data for all replicate monitoring sites.

4.7.2.7.1 Results

In November 2019, 99.5% of New South Wales was experiencing extended and severe drought conditions. These drought conditions had led to very low soil moisture levels and the drying out of most ephemeral and perennial watercourses within the region including the Namoi River, which was reduced to isolated stagnant pools.

Furthermore, in 2019 dams within the region where at critical levels and the portion of the Namoi River which flows in proximity to the project was categorised as being in a drought Stage 4 (Critical Drought).

The results from the 2019 monitoring program confirmed that the condition of riparian vegetation health had remained relatively consistent since the 2018 baseline monitoring program. More specifically, vegetation attributes associated with floristic composition, structure and functionality monitored were consistent with or only showed slight increases/decreases in values compared to the 2018 baseline.

A large proportion of vegetation attributes across all sites failed to meet the BBAM benchmark values for their respective vegetation type however this is similar to the results of the 2018 baseline data. This was largely attributed to past land uses (predominantly agriculture) that have cleared canopy and midstorey components and heavily disturbed the soil profile leading to the dominance of exotic species in the groundcover.

Similarly, stream characteristics of Nagero Creek and the Namoi River were relatively consistent with the 2018 baseline monitoring results. Exceptions to this included changes in attributes which are affected by drought conditions such as water height, flow and where water was present turbidity. The large reduction of water within the Namoi River is likely attributable to drought conditions associated with low rainfall received over an extended period of time, no releases of water from Lake Keepit Dam since December 2018 and water extractions associated with surrounding land uses.

Overall, the structure and health of Nagero Creek was in moderate condition. The stream is an ephemeral waterway with intermittent flow which is heavily dependent on high rainfall (no water was recorded within this creek during the 2019 survey period). The substrate was comprised of clay-based soils and appeared to be stable in nature given no evidence of erosion was observed. Disturbances on this stream are likely attributed to past agricultural pressures rather than impacts associated with the project.

Overall, the structure and health of the Namoi River was in poor to moderate condition. Although the river is a permanent waterway with many habitat features (such as fallen timber, hollow bearing trees, debris etc.) the river banks appeared to be partially unstable as substantial undercutting and scourging was recorded at all sites. This erosion is likely attributed to low vegetation cover and the high velocity of water the river receives during high rainfall or during scheduled water releases from Lake Keepit. It is unlikely that this erosion is due to impacts associated with the project.

4.7.2.8 Annual Biodiversity Offset Area Monitoring

Biodiversity offset area monitoring comprises annual surveys of vegetation, diurnal birds, microchiropteran bats, terrestrial mammals and vertebrate pest and biennial surveys of nocturnal mammals and birds. In addition, targeted annual seasonal surveys are undertaken for Regent Honeyeater, Swift Parrot and Corben's Long-eared Bat.

The 2019 biodiversity offset monitoring represents the fifth year of biodiversity monitoring completed on all ten BOAs for the Project. The 10 BOAs contain large patches of remnant vegetation and high-quality habitats adjoining existing vegetated lands and create direct linkages or key stepping stones for a regional east-west wildlife corridor. Boggabri Coal's ten Biodiversity Offset Areas are separated in to four management areas, which includes:

- Eastern Offset Area (Braefield BOA, Sunshine BOA, Nioka North BOA)
- Central Offset Area (Mallee BOA, Myall Plains BOA, Wirrilah BOA, Goonbri BOA)
- Namoi Offset Area (Namoi BOA, Jerralong BOA)
- Western Offset Area (Merriendi BOA)

The aims of the 2019 biodiversity offset monitoring were to:

- Outline the monitoring results for the 10 BOAs that form part of the BOS
- Provide results of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Community against plant community types and the State and Transition Model
- Provide a comparison of 2019 monitoring results against biodiversity benchmark data collected during the 2015 baseline monitoring event and against Leard State Forest analogue benchmark data (fauna) and BBAM vegetation community benchmarks
- Recommend potential mitigation or management actions that may be required based on the results of the 2018 biodiversity offset monitoring event.

Importantly, data acquired during the 2019 monitoring event should be considered with respect to the extended and severe drought conditions from which biological variables were sampled.

4.7.2.8.1 Habitat Management Zone

Vegetation data collected as part of the 2019 monitoring session suggests that the vegetation types within habitat management zone across the four management areas are in good condition overall and typical of large relatively undisturbed patches of native vegetation in the locality. Ecosystem health and ecosystem structure were good.

Although still higher than the 2015 baseline monitoring some vegetation attributes showed a decrease in value compared to the 2016 and 2017 monitoring periods. This is likely attributed to the higher than average rainfall received prior to the 2016 monitoring survey and severe drought conditions experienced preceding the 2018 and 2019 monitoring events. Vegetation attributes most affected by these conditions included:

- Moderate to severe canopy dieback of Eucalypt species, and in some locations *Callitris glaucophylla,* observed in various BOAs which may have resulted in lower overstorey cover and lower Cypress Pine densities recorded during 2019 monitoring session at some locations
- Shrub and groundcover species desiccation which may have resulted in the lower native/exotic species richness and cover recorded during the 2019 monitoring session at some locations.

Despite these climatic seasonal variations, the monitoring sites established in the habitat management zones provide good analogue sites for which to compare the progress of habitat restoration zones against. Key findings identified within the habitat management zones in 2019 included:

- One threatened flora species, Tylophora linearis, was recorded during the 2019 monitoring session from monitoring site My3 (Myall Plains BOA) (habitat management zone). It is suspected that the species still occurs at monitoring site W1 (Wirrilah BOA), however this site was not surveyed during the 2019 monitoring program due to severe weather conditions.
- Native species richness, overstorey projected foliage cover and native other groundcover were generally slightly lower than previous years. This is likely due to the drought conditions experienced during 2019.
- Exotic species richness and cover was generally lower than previous years, likely attributed to the drought conditions experienced during 2019.
- Livestock grazing still occurs within the Eastern Offset BOAs, however has removed from other management areas.
- Some monitoring locations contained Cypress Pine densities that exceed the 650 stems/per hectare threshold (M4, My3 and W4 – over double the threshold). Although, they exceeded this threshold most vegetation attributes meet, are within or exceed the BBAM benchmark values for their corresponding vegetation type. It is possible that the germination and recruitment of canopy and midstorey species at these locations may be prohibited by the high density of Cypress Pine present given the lack of recruitment and low cover of midstorey species recorded. Further investigations into the management of Cypress Pine at these locations should be considered. Continual monitoring of all other locations where Cypress Pine density is above the threshold is recommended in subsequent years to confirm whether Cypress Pine is inhibiting canopy recruitment etc. prior to undertaking Cypress Pine thinning.
- Most Box Gum Woodland monitoring sites within habitat management zones meet or are considered likely to meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands (exception to this is S3).
- Box Gum Woodland monitoring sites within habitat management zones largely meet, are within or exceed BBAM benchmarks. Exceptions to this include some sites which largely did not meet fallen timber or hollow bearing tree benchmarks.
- *Alternanthera pungens** recorded at two habitat management zone sites (S3 and S5) – although not a priority weed under the Biosecurity Act this species is highly invasive (the species was recorded at only one monitoring sites in 2018, suggesting that the species has spread since last year's monitoring program) and control of this species should be considered. Furthermore, it is recommended that biosecurity measures should be introduced to avoid the spread of this weed into other BOA properties. For example, vehicles should remain on tracks and avoid driving in paddocks where this species occurs and brush down of tyres should be completed when leaving and entering any other BOAs.
- *Phyla canescens** recorded at two habitat management zone sites (N3 and N15) – although not a priority weed under the Biosecurity Act this species is highly invasive and control of this species should be considered. It poses a high threat to riparian ecosystems, predominantly those along watercourses and terraces such as the 'River Red Gum riverine woodlands and forests' vegetation community. At these locations, *Phyla canescens** is highly prolific and is forming dense mats which are likely to be preventing the recruitment of native species.

Habitat management zones across the BOAs provide habitat for a range of threatened species and, apart from the effects of a sustained dry period, the intact and semi-intact habitats remain in good condition. The association of habitat management zones with areas of high-quality extant vegetation with a diversity of woodland structural forms are key to the diversity this zone supports; as illustrated by the presence of 12 threatened species and one Endangered Population recorded in areas of suitable habitat. Key findings identified in habitat management zones during the 2019 monitoring event included:

- The presence of 13 threatened fauna species, including Speckled Warbler, Dusky Woodswallow, Brown Treecreeper, Diamond Firetail, Varied Sittella, Hooded Robin, Turquoise Parrot, Grey-crowned Babbler, Painted Honeyeater, Border Thick-tailed Gecko, Corben's Long-eared Bat, Eastern Cave Bat and Yellow-bellied Sheathtail-bat (additional threatened species of microchiropteran bat may be identified from bat call sequence data that is currently under detailed analysis).
- The Border Thick-tailed Gecko was recorded for the first time in BOAs in 2019. This species was recorded opportunistically during targeted Corben's Long-eared Bat trapping in the Nioka North BOA.
- The Australian Brush-turkey was recorded for the time in the BOAs in November 2019. This species was recorded opportunistically in the Mallee BOA during biodiversity offset area monitoring. Under the BC Act, the Australian Brush-turkey is listed as an Endangered Population in the Nandewar and Brigalow Belt South Bioregions.
- Diurnal bird species richness was typical of relatively undisturbed woodland and open forest habitats in the region. Comparatively, mean diurnal bird species richness in 2019 was below previous sets of monitoring data. This is likely due to the prolonged and severe drought conditions experienced during 2019 sampling period. Mean diurnal bird species richness in habitat management zones achieved between 53 % and 80 % of the Leard State Forest analogue benchmark. It should be noted that the analogue monitoring sites returned a diurnal bird species richness at 55 % of the analogue benchmark in 2019.
- Call playback and spotlight methodologies for nocturnal birds and mammals were employed during the 2019 monitoring event. Call playback techniques did not elicit a response from targeted threatened nocturnal bird or mammal species. The following species were recorded during night work:
    - Four nocturnal birds, including Southern Boobook, White-throated Nightjar, Australian Owlet-nightjar and Tawny Frogmouth were recorded via call recognition and/or observed
    - Seven mammals, including Common Brush-tailed Possum, Common Ringtail Possum, Eastern Grey Kangaroo, Swamp Wallaby, Red-necked Wallaby, Common Wallaroo and Brown Hare were observed
    - Five reptiles, including Barking Gecko, Robust Velvet Gecko, Dubious Dtella, Bandy and Australian Coral Snake
- The perceived lack of large forest owls (particularly Barking Owl) or arboreal mammals (Koala and Squirrel Glider) from the BOAs are likely an artefact of survey effort rather than actual absence from the BOAs. Indeed, suitable habitat in the form of high quality and contiguous wooded areas containing old growth forms with numerous tree hollows interspersed with clearings and ecotones, provide suitable breeding substrates and adequate foraging areas.
- Several introduced species were recorded during the 2019 monitoring period, including Fox, Cat, Brown Hare, Rabbit, Goat, Pig, Cattle and Sheep.

4.7.2.8.2 Habitat Restoration Zone

The habitat restoration zone is predominantly comprised of derived native grassland communities. Ecosystem health and ecosystem structure are generally poor. As such, the monitoring sites generally fall below the BBAM vegetation type benchmarks for a range of attributes. However, due to the general lack of canopy, midstorey, fallen logs and the presence of grazing pressure (limited to discrete properties), native grass cover is generally high and exceeds benchmark conditions. To date, restoration works are limited to revegetation activities within the Namoi and Wirrilah BOAs. The restoration works planned for the habitat restoration zones will result in an overall improvement in the attributes over time.

Key vegetation findings identified within the habitat restoration zones in 2019 included:

- Native species richness, overstorey projected foliage cover and native other groundcover were generally slightly lower than previous years. This is likely due to the drought conditions experienced during 2019.
- Exotic species richness and cover was generally lower than previous years, likely attributed to the drought conditions experienced during 2019.
- Livestock grazing still occurs within the Eastern Offsets and Jerralong BOAs, removed from other restoration areas.
- One monitoring location contained Cypress Pine densities which exceeded the 650 stems/per hectare threshold (W3 – over double the threshold and double the density recorded in 2018). Although, it exceeded this threshold most vegetation attributes meet, are within or exceed the BBAM benchmark values for its corresponding vegetation type. Recommended that this site be monitored in subsequent years to confirm whether Cypress Pine is inhibiting canopy recruitment etc. prior to undertaking Cypress Pine thinning.
- Most Box Gum Woodland monitoring sites within habitat restoration zones do not meet or are considered unlikely to meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands (exceptions to this were sites S2, B4, B6, W3, W6, N16 and M2).
- Box Gum Woodland monitoring sites within habitat restoration zones largely fail to meet BBAM benchmark values especially for attributes relating to the number of hollow bearing trees, length of fallen timber and native overstorey percentage cover. Furthermore, most sites showed no or limited evidence of regeneration of canopy species.
- Due to the above, management within habitat restoration zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.
- *Alternanthera pungens* recorded in proximity to one habitat restoration zone site (S2) – although not a priority weed under the Biosecurity Act 2015 this species is highly invasive and control of this species should be considered. Furthermore, it is recommended that biosecurity measures should be introduced to avoid the spread of this weed into other BOA properties.
- *Phyla canescens** recorded at habitat restoration zone site (Na2) - although not a priority weed under the Biosecurity Act this species is highly invasive and control of this species should be considered. It poses a high threat to riparian ecosystems, predominantly those along watercourses and terraces such as Pilliga Box - Poplar Box- White Cypress Pine grassy open woodland on alluvial loams associated with the floodplain of Bollol Creek which occurs at Na2. At this location, *Phyla canescens** only occurred in low abundance and cover, however, it has potential to become highly prolific and form dense mats which could prevent the recruitment of native species.

Generally, habitat restoration zones possessed a low diurnal bird species richness. This can be expected as these areas are typically disturbed areas that have long been dedicated to grazing of cattle. Such areas are structurally simplified, contain few habitat features and are generally devoid of canopy and understorey cover; attributes that may otherwise encourage a diverse woodland fauna. Bird species common to habitat restoration zones included disturbance tolerant species and common open country species, including Galah, Sulphur-crested Cockatoo, Australian Magpie, Australian Raven, Magpie-lark, Crested Pigeon, Australian Pipit, Rufous Songlark and Eastern Rosella.

Introduced species commonly observed opportunistically within habitat restoration zones included Pig, Brown Hare and Cattle.

4.7.2.8.3 Corridor Enhancement Zone

The corridor enhancement zone has been significantly disturbed by past land use practices, including clearing, cropping, pasture improvement and heavy grazing. The lack of canopy, midstorey and altered groundlayer composition recorded during baseline monitoring supports this assertion. Likewise, the paucity of fauna species supports this history of disturbance. Restoration works planned for corridor enhancement zones will result in an overall improvement in ecological attributes over time and build on adjoining existing wildlife corridors. A considerable improvement in habitat value should be seen in this area over the coming years.

Key findings identified within the habitat management zones in 2019 included:

- Native species richness, overstorey projected foliage cover and native other groundcover were generally slightly lower than previous years. This is likely due to the drought conditions experienced during 2019.
- Exotic species richness and cover was generally lower than previous years, likely attributed to the drought conditions experienced during 2019.
- Livestock grazing still occurs within the Eastern Offset BOAs, removed from other management areas.
- Box Gum Woodland monitoring sites within corridor enhancement zones do not meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands.
- Box Gum Woodland monitoring sites within corridor enhancement zones largely fail to meet BBAM benchmark values especially for attributes relating to the number of hollow bearing trees, length of fallen timber and native overstorey percentage cover. Furthermore, most sites showed no or limited evidence of regeneration of canopy species aside from restoration tube stock planting.
- Due to the above, management within habitat restoration zones should focus on tube stock planting of canopy species which will lead to the eventual increase in canopy cover and formation of habitat resources such as hollow bearing trees, fallen timber, leaf litter etc. to increase connectivity. As these resources take over 50 years to form, it is recommended that in the interim fauna habitat resources such as salvaged fallen timber and nest boxes should be introduced, where possible, to encourage fauna usage. These measures will also aid in increasing other BBAM vegetation attributes which do not currently meet benchmark values.
- *Alternanthera pungens* recorded at two corridor zone sites (S4 and S5) – although not a priority weed under the Biosecurity Act this species is highly invasive (the species was recorded at only one monitoring sites in 2018, suggesting that the species has spread since last year's monitoring program) and control of this species should be considered.

4.7.2.9 Weed and Pest Management

Weed and pest management at BCM is guided by the Weed and Pest Management Strategy (Appendix C of the BMP).

Weed infestations and pest animals are identified and reported by all BCM personnel as part of daily surveillance. BCM's Monitoring, Inspection and Reporting Program (as detailed in the BMP and RMP) reduces the potential for weed introduction and spread, and assists weed monitoring and control. This program ensures both a proactive and reactive approach to weed and pest animal management.

All priority weeds within the Project boundary and BCOPL's BOAs are managed in accordance with the requirements of the *Biosecurity Act 2015*. Routine weed spraying is undertaken as required at BCM by suitably qualified persons. Records of herbicide application are filed for all spraying events. Targeted spraying for Prickly Pear and Tiger Pear was completed during the reporting period, primarily within the Namoi BOA. Garlon Fallowmaster herbicide and Spreadwet wetting agent were deployed via spray trailer.

Compliance with the Clearing and Fauna Management Procedure contained within the BMP has increased avoidance of weed introduction and spread across the site through restricting access to areas of native vegetation and communicating responsibilities to all personnel at site inductions and during regular toolbox meetings.

The vertebrate pest control and monitoring program within BCOPL's BOAs continued during the reporting period. Hunter Land Management (HLM), on behalf of BCOPL, completed the program. It included sand pad monitoring, 1080 baiting, and trapping to manage foxes, wild dogs, wild pigs and other vertebrate pests.

4.7.2.10 Management of Agricultural Land

In 2013, as part of the development of the BMP, BCOPL commissioned an independent consultant (URS) to prepare an Agricultural Suitability Assessment (ASA) for BCOPL's then BOAs. The ASA identified areas of high, medium and low agricultural suitability within the BOAs and made recommendations for their continued use as agricultural land through implementation of the BMP. Cropping and grazing within BOAs was undertaken during the reporting period in accordance with the recommendations made in the ASA, under private lease agreements with local landholders. The land management practices implemented in those areas, such as fencing, weed management, cattle grazing, sowing, harvesting, and crop rotation, were generally consistent with those being implemented on the same parcels of land prior to approval of BCOPL's BMP.

In 2018, BCOPL commissioned an independent consultant (WSP) to prepare an Agricultural Impact Assessment (AIA), to assess the annual financial impact of removing Agricultural Zones and Corridor Enhancement Zones from agricultural production within the five additional BOAs required to fulfil PA under the Project's revised BOS; including Jerralong, Goonbri, Nioka North, Sunshine and Braefield properties. All BOAs assessed by this AIA are in part committed to biodiversity offsets. Apart from Jerralong, all properties were considered of moderate to low agricultural value, and as such, the provision of biodiversity offsets as assigned by the BOS, is of minimal economic impact to the agricultural industry and local community. Furthermore, the area of high agricultural value in the Jerralong property, remains as other land for agriculture in the BOS.

Furthermore, additional properties owned by BCOPL that are not within BOAs, continued to be managed for agricultural purposes under private lease agreements within local landholders during the reporting period. A combination of cropping and grazing was undertaken on those properties.

4.7.2.11 Environmental Management Correspondence

Correspondence with Maules Creek Mine and TCPL has been undertaken on a regular basis to discuss cooperative management and protection of the vegetated corridor, Leard Forest Regional Biodiversity Strategy, and engagement of independent consultants to prepare a joint "Annual Biodiversity Summary Report" and "Leard Forest Regional Biodiversity Strategy Stage 3 – Preliminary Strategy Review", as discussed below.

In addition, BCOPL and Maules Creek Mine-engaged ecologists held several phone conferences relating to standardising biodiversity survey methodologies and to advise of threatened species identified during biodiversity monitoring programs.

The Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report) (RBS) (Umwelt, 2017) was prepared to provide a strategic framework for the management and implementation of the Boggabri Coal Mine, Tarrawonga Coal Mine and Maules Creek Coal Mine (collectively referred to as the BTM Complex) biodiversity offset programs and to provide guidance for co-ordinated management with other land managers within the region. To achieve coordinated and successful biodiversity management within the region, the RBS specifies that the BTM Complex must prepare an 'Annual Summary Report' detailing the overall biodiversity performance and outcomes of biodiversity offsets. In 2019, BCOPL collaborated with Whitehaven Coal Pty Limited (Maules Creek Coal Mine and Tarrawonga Coal Mine) to prepare the inaugural BTM (Boggabri, Tarrawonga and Maules Creek) 2018 Annual Biodiversity Summary Report.

4.7.3 Improvements and Initiatives

Biodiversity management initiatives implemented during the reporting period continued to include ongoing biodiversity monitoring and management in accordance with the approved BMP and revegetation activities within BCOPL's BOAs. Revegetation activities involved weed management, site preparation and hikos planting with species determined in the BMP.

4.8 Hazardous Materials

4.8.1 Environmental Management

The management of hazardous materials at BCM is undertaken in accordance with the following BCOPL documents:

- Waste Management Plan
- Pollution Incident Response Management Plan
- Hazardous Material, Dangerous Goods Risk Assessment

Contractors operating at the BCM also implement a range of company-specific standards and procedures to ensure alignment with BCOPL requirements and legal obligations for the management of hazardous materials.

Collectively the hazardous materials management documents:

- Set out the minimum requirements for contractors for the use, storage and control of hazardous materials.
- Provide protocols for hazardous material use, storage and clean-up response.
- Provide a mechanism for the assessment of potentially hazardous materials prior to them being delivered to site.
- Specify design standards for which hazardous materials storage structures must comply.

Control measures implemented on site include but are not limited to the following:

- Locating spill kits in high risk areas around mine infrastructure and construction areas within the Project boundary.
- Ensuring all BCOPL personnel and contractors are trained in incident and emergency response procedures. Specific training will also be provided to those personnel required to handle hazardous materials.
- All workshop and vehicle wash down water shall be directed to a sump/separator for containment and subsequent treatment or appropriate disposal.
- Vehicles, plant and equipment leaking fuel, oil coolant or any other hydrocarbons will not be operated where practicable and repaired at the earliest opportunity.

- All hazardous materials facilities on site will be designed, constructed and operated in accordance with all relevant legislation, standards and guidelines, with particular reference to AS 1940:2004 – The Storage and Handling of Flammable and Combustible Liquids.
- Refuelling operations will be undertaken within areas specifically designated for that purpose, where practicable.

4.8.2 Environmental Performance

Hazardous materials used at the BCM that require licensing are listed in Table 4-27. BGC contracting or Orica hold the appropriate licences and notifications for the storage, handling and use of these substances. The use of hazardous materials during the 2019 reporting period was comparable with the 2018 reporting period.

Table 4-27 Explosives and Hazardous Materials Licence/Notification Holders

Hazardous Materials:	Licence/Notification Holder:
Acetic Acid Solution Ammonium Nitrate Ammonium Nitrate Emulsion Oxidizing Liquids Bulk Diesel	Orica
Bulk Diesel	Boggabri Coal Operations Pty Ltd

All hydrocarbons including fuels and hydraulic/lubricating oils are stored in double-skinned, above ground tanks. Waste oils are stored in a bulk oil tank, for regular collection by a licensed waste contractor.

Minor hydrocarbon spills were recorded and managed in accordance with BCOPL and contractor-specific hazardous materials management documentation. All spills during the reporting period were considered to present a low environmental risk and were promptly cleaned up and moved to the bioremediation areas where appropriate. The management measures contained within relevant documentation were considered to be adequate for the prevention and clean-up of hazardous spills. These will continue to be implemented in the event of future incidents.

4.8.2.1 Diesel

Diesel fuel is stored in the maintenance workshop area in eight (8) double-skinned, aboveground tanks plumbed in series as “slave and master”, with a total nominal capacity of 784,000 litres. Bunded areas are inspected on a regular basis to ensure their integrity.

In July 2009, the use of biodiesel was introduced at the BCM. Biodiesel was used in all mine vehicles except for light vehicles until it was discontinued during May 2015. At this time, ultra-low sulphur diesel (ULSD) was introduced and now constitutes the primary fuel used.

Diesel fuel consumption quantities for the 2015 to 2019 reporting periods are summarised in Table 4-28. Fuel consumption at BCM has notably increased during the reporting period and over time as a result of constant increases in production rates.

Table 4-28 Diesel Fuel Consumption

Fuel type	Quantity (L)				
	2015 period	2016 period	2017 period	2018 period	2019 period
Biodiesel / ULSD*	63,783,795	65,412,763	62,586,313	67,132,896	65,987,493
Diesel	377,809	1,001,591	-	-	
Totals	**64,161,604**	**66,414,354**	**62,586,313**	**67,132,896**	**65,987,493**

**ULSD was used during the 2015, 2016, 2017 and 2018 reporting periods*

4.8.2.2 Ammonium Nitrate/Ammonium Nitrate Emulsions

Ammonium Nitrate (AN) and AN Emulsions are used in the blasting process and are stored in 1.2 tonne bulker bags and 40 tonne mobile trailers within a bunded compound. The AN storage compound is fitted with lockable access gates and is subject to daily inspections to safeguard against theft and/or spillages.

4.8.2.3 Ammonium Nitrate/Fuel Oil

Ammonium Nitrate/Fuel Oil (ANFO) is a blasting agent used at BCM. Ingredients are stored separately. ANFO is blended using mobile mixing units at blasts sites.

4.8.2.4 Detonators

Detonators and other high explosives are used in the blasting process and are stored in purpose built isolated magazines, to the west of the AN and AN Emulsion compound, at the toe of the western overburden emplacement area. The magazines incorporate security fencing, lockable entry points and are bunded.

4.8.2.5 Hydraulic/lubricating oils

Hydraulic/lubricating oils are stored in double-skinned above-ground tanks adjacent to the heavy vehicle workshop area. Waste oils are stored in a bunded bulk oil tank which is regularly removed off-site by a licensed waste contractor.

4.8.2.6 Cleaning agents

Cleaning agents are used in the equipment wash down facility for preparing the fleet of mobile equipment prior to maintenance. The cleaning agents are kept within covered stores in the maintenance workshop area, adjacent to the wash down facility.

Water collected at the bunded wash down facility is treated by an oil-water separator at the wash down bay and recycled for site dust suppression.

4.8.2.7 Herbicides

Herbicides are used across the site for noxious weed control and are purchased on an as-needs basis. Therefore they are not stored on-site. Application of herbicides is conducted only by suitably qualified persons and records of application areas are maintained.

4.9 Waste Management

4.9.1 Environmental Management

Condition 68 of the PA requires the following waste management actions:

- Implement all reasonable and feasible measures to minimise waste generated by the Project.
- Ensure waste generated by the Project is appropriately stored, handled and disposed of.
- Monitor and report on the effectiveness of waste minimisation and management measures in the Annual Review.

Waste management measures employed on site include:

- Green putrescible waste is collected on site and disposed of at an appropriate licensed waste management facility.
- Loose green waste is mulched and used on site for landscaping and rehabilitation (where feasible).
- General waste from operations (food etc.) is disposed of at an appropriate licensed waste management facility.
- Recyclable wastes are separated on site and collected for recycling at an appropriate facility.
- Contaminated soil is collected and transported to the on-site bioremediation area for treatment and eventual on-site disposal. This is undertaken in accordance with the site's Bioremediation Management Procedure.
- All plant and equipment wash down areas have oil/water separating devices. Water from these areas is collected onsite; sediment, oils and grease are separated and water is reused onsite for haul road dust suppression. Any sediment collected during wash down activities is placed into the in-pit bioremediation area for further treatment. Oily waste recovered from the oil/water separators is stored appropriately and transported offsite by a licensed waste contractor for disposal.
- Scrap metal materials are separated onsite and collected by a recycling contractor for off-site recycling.
- Sewage from site facilities is collected onsite in an aerated septic sewer system and reused on site for irrigation.
- All waste oils and greases are segregated and stored appropriately until collection by a licensed waste contractor for appropriate offsite recycling/disposal.
- Heavy earthmoving tyres are re-treaded and reused where possible. Otherwise, they are buried in pit in accordance with site guidelines.
- Waste chemicals (including solvents) are segregated, stored appropriately and transported offsite by a licensed waste contractor for appropriate disposal.
- Concrete wash down areas are located away from surface water drains.
- Clean water surface water/runoff is diverted around mine facilities (where feasible).
- Printer cartridges, bottles and Waste collectors are all donated too PlanetArk.

Bioremediation areas are operated to manage contaminated waste materials at BCM. A Bioremediation Management Procedure guides the implementation of the bioremediation process and includes details on required maintenance actions, sampling and testing of contaminated materials within the area.

4.9.2 Environmental Performance

This reporting period has seen an increase in many waste streams compared to the 2018 reporting period. This suggests that waste tracking and management techniques have improved over the reporting period for some waste streams, including the identification and tracking of new waste streams, particularly for recycling. The increase can also be attributed to some waste streams not having been tracked during previous reporting periods, namely recycled effluent and hazardous recycled materials.

Several extra waste streams have been tracked since 2018 including timber packaging and pallets and printer cartridges. Overall there has been a general increase in waste streams in the 2019 reporting period, namely oily water, waste grease, oily rags, hydraulic hoses, batteries, tyres and coolant. The majority of these waste streams have been able to be recycled. Mining operation waste collection statistics for the 2016, 2017, 2018 and 2019 reporting periods are summarised in Table 4-29.

Table 4-29 Summary of Mining Operation Waste Disposal

Waste Stream	2016 reporting period (tonnes)	2017 reporting period (tonnes)	2018 reporting period (tonnes)	2019 reporting period (tonnes)
General waste – bulk waste skips	94.24	95.26	154.62	55.62
General waste – industrial bins	82.74	82.25	351.34	410
Oily Rags	12.36	14.45	5.91	9.72
Oily Sludge	0	0	0.13	-
Oily Water - recycled	-	-	1.93	5.28
Waste Grease – recycled	3.68	6.98	5.70	6.47
Contaminated absorbent materials	5.48	4.65	0.06	-
Air filters	6.80	0.1	-	-
Scrap metal -recycled	264.66	153.84	264.73	223.25
Empty Drums - recycled	-	-	2.05	1.64
Paper and cardboard-recycled	9.32	1.17	66.48	46.59
Timber packaging and pallets -recycled	16.41	-	90.13	74.72
Oil filters - recycled	36.79	35.36	32.52	34.86
Hydraulic hoses	21.43	17.20	12.01	17.14
Comingled recycling (bottles and cans)	13.59	16.78	-	-
Batteries –recycled	14.92	14.41	7.54	20.85
Printer cartridges	0.08	-	0.06	0.04
Tyres (heavy oversize vehicle) – each	441	268	134	144
Tyres (light vehicle) - each	203	249	269	392
1,000L plastic containers (IBCs)	12	-	-	-
Oil- recycled (litres)	673,100	506,300	661,100[#]	621,300
Coolant – treatment and recycling (litres)	24,000	26,700	25,100[#]	25,800
Effluent (offsite) – recycled	-	-	982.49	848.55
TOTAL	**582.50***	**442.45***	**1,977.7***	**492.78**
Total Recycled	**359.45***	**228.54***	**1,453.63***	**1,255.24***

*total applies only to waste measured in tonnes
[#]total in kilograms

BCOPL and its contractors have continued to implement the waste management hierarchy. Wherever possible, waste materials are re-used on site in preference to direct disposal. Recycling of materials is also undertaken where possible to minimise waste. An example of reuse is the integration of an oil water separator at the washbay, which minimises waste water and returns water to the water management system for re-use in dust suppression activities.

Site induction packages include waste awareness components and waste practice is included in employee and contractor toolbox sessions. Environmental surveillance was undertaken by BCOPL throughout the reporting period, and observations and non-conformances were communicated as necessary to relevant employees and contractors.

4.9.2.1 Bioremediation Areas

Ten bioremediation areas have been utilised at the BCM since 2007, as listed in Table 4-30. Successful management of these bioremediation areas has allowed for onsite treatment of contaminated material and subsequently reduced the need to transfer contaminated waste material offsite. Only Bioremediation Areas 8 and 10 were active during the 2019 reporting period (refer to Table 4-30).

Bioremediation area management was undertaken in accordance with the BCM Bioremediation Management Procedure, which includes details on the management, watering, aeration, sampling and testing of contaminated waste materials within the area. The materials retained in the bioremediation area were turned and watered every month (or as required). The bioremediation agent '*Enretech Remediator*' was also applied to the materials as necessary.

Compliance sampling was undertaken in Area 10 during the reporting period.

Table 4-30 Summary of Bioremediation Areas

Bioremediation Area	Location	Est.	Decomm.	Description
Area 1	Blast reload compound	2007	2012	Original bioremediation area adjacent to the blasting reload compound. Approximately 90% of contaminated material was relocated to Area 3 when decommissioned. Remaining 10% remained in-pit following soil testing indicating acceptable toxicant concentrations.
Area 2	RL320 Merriown	2009	2010	In-pit dump established to contain 200m^3 of contaminated material from a single spill in the pit. Soil testing was undertaken and TPH/BTEX were found to be within acceptable limits. Results were provided in 2010 AEMR.
Area 3	RL340 dump	2010	2012	Contained two cells. Cell 2 was tested for TPH/BTEX in July 2012, and results were within acceptable limits. Remediated material was incorporated into the RL360 dump area. Materials in Cell 1 were moved to Area 4 in October 2012.
Area 4	RL360 dump	2012	2014	Contained two cells. 100% of treated materials from Cell 2 was transferred to Area 5 (Cell 1) for further TPH/BTEX testing. 100% of untreated materials from Cell 1 was transferred into Area 5 (Cell 2) for future treatment.
Area 5	RL380 dump	2014	2015	Contained three cells. Following soil testing showing toxicants to be within acceptable limits, 100% of treated material from Cell 1 was spread across the decommissioned area. 100% of treated materials from Cell 2 was transferred to Area 6 (Cell 1) for further TPH/BTEX testing. 100% of untreated material from Cell 3 was transferred into Area 6 (Cell 1) for further treatment.
Area 6	RL380 dump	2015	2016	Contained five cells which were all closed off when the new bio-pad at RL370 dump was commissioned. Soil from cells No. 4 and 5 has been certified as remediated and the bio-pad will be covered with waste material. In the other hand soil from cells No. 1, No. 2 and 3 was relocated to the new bio-pad at RL370 dump for remediation.
Area 7	RL 370 dump	2016	2017	Area 7 contained five cells and was constructed in August 2016. The volume of contaminated material stored and treated within Area 7 during the reporting period was approximately 1,030m^3. Area 7 was decommissioned in July 2018 after samples were deemed to be within acceptable limits.
Area 8	RL 380 dump	2017	Ongoing	Area 8 contains four cells constructed in October 2017. A total of 439m^3 of contaminated material was stored and treated within cells 1, 2 and 3 during the reporting period. Two rounds of sampling for PTH/BTEX was completed on Area 8 in August and November 2018 and were found to be within acceptable limits. This material will be dumped in an acceptable location in pit in 2019.
Area 9	RL 395 dump	2017	2018	Area 9 contains seven cells constructed in October 2017. A total of 1394m^3 of contaminated material was stored in Cells 1-4. Area 9 was decommissioned during August 2018 and contaminated material was relocated to the new bio-pad at RL340 dump (Area 10) for remediation. Validation sampling on the remaining pad was conducted and was found to be within acceptable limits.

Bioremediation Area	Location	Est.	Decomm.	Description
Area 10	RL 340 dump	2018	Ongoing	Area 10 was established in June 2018 with 6 cells. In December 2018 an extra 5 cells were added to the Area. In May 2019, cell 4 was certified as being remediated and was dumped and buried in pit to requirements. A total of 2,333 m^3 was stored in Area 10 at the end of the reporting period.

4.10 Spontaneous Combustion

4.10.1 Environmental Management

Spontaneous combustion is controlled by avoiding the disposal of combustible material in waste emplacement areas and emplacing combustible materials in locations where oxygen ingress is minimised (i.e. deep in-pit burial, away from rehabilitation areas).

Four key principles apply to the management of spontaneous combustion at BCM:

- Prevention
- Detection
- Control
- Incident management

Due to the varied nature of spontaneous combustion, the issue is dealt with on a case-by-case basis. Measures that were implemented during the reporting period include:

- Managing spontaneous combustion in accordance with the contractor's Spontaneous Combustion Management Plan (SCMP).
- Capping all areas of combustible material with inert material where possible, noting some mined areas cannot be capped. In some cases capping is not practical for areas that require re-working in the near or medium future.
- Placing any identified combustible materials deep within in-pit emplacement areas.
- Monitoring coal stockpiles for signs of spontaneous combustion and responding as required.
- Implementing Safe work method statements as required.

The EA (Hansen Bailey, 2010) completed for the current PA reported that spontaneous combustion presents a low risk of causing environmental impacts at BCM. All risks to rehabilitation from spontaneous combustion are managed in accordance with the strategies outlined in the MOP.

4.10.2 Environmental Performance

BCOPL currently apply the principals above to minimise the occurrence of spontaneous combustion and have had significant success in reducing the area affected by it.

No spontaneous combustion incidents occurred during the reporting period.

4.11 Heritage

4.11.1 Environmental Management

The management of cultural heritage issues at BCM is undertaken in accordance with the Cultural Heritage Management Plan (**CHMP**). The current CHMP was revised following the determination of Modification 5 and was approved by DPIE in February 2017.

The CHMP prescribes:

- The policies and practices for the preservation of sites during construction and operations.
- Other facets of cultural heritage practices and conservation measures including salvage of sites as required and the practice of due diligence inspections.
- Other relevant cultural heritage considerations including consultation with the Aboriginal community.

During the reporting period, BCM's archaeological salvage program continued in conjunction with the staged tree-clearing program. As with previous years, all tree-clearing was subject to comprehensive archaeological salvages lead by qualified archaeologists and Registered Aboriginal Parties (RAPs), as specified in the CHMP and "construction clearing checklist".

4.11.2 Environmental Performance

4.11.2.1 Archaeological Salvage

The BCM CHMP details the requirements for Archaeological salvage. RAPs participated in the inspection of the proposed clearing footprint prior to the clearing program. In 2019, 120 ha of the area was inspected. Inspection of the tree clearing area resulted in the collection of 11 previously unrecorded stone artefacts and the identification of one modified tree. In addition, three known sites were revisited for collection:

- NV 15 – two chalcedony flakes could not be located and are considered salvaged.
- NV16 – one isolated mudstone flake could not be relocated and is considered salvaged.
- NV 10 – one fine grained siliceous (FGS) broken flake salvaged. Three others could not be relocated and are considered salvaged.
- NV 33 – A modified tree was relocated.

NV 82, an area of potential archaeological deposit (PAD) was inspected in more detail and 14 surface artefacts were collected over an approximate are of 8 ha. Test pits were undertaken in four locations, on terraces on the eastern and western sides of a deeply incised drainage line. These yielded an additional 30 artefacts over 34 m^2.

Salvage works were also undertaken at BC 34 during the reporting period. BC 34 is an extensive artefact scatter in an area of historic disturbance. The salvage works recovered 69 surface artefacts.

Eight artefacts were collected in the latter part of 2019 in the course of access track and borehole inspections. Drill sites over A355 and CL368 were inspected and any artefacts that would be impacted were collected.

Figure 4-19 Artefacts collected from BC34

4.11.2.2 Biodiversity Offset Inspections

RAPs participated in inspections within the biodiversity offset area to identify cultural heritage values during the reporting period. The results will inform the Cultural Heritage Values Report for the biodiversity offset area and be reported in the 2020 Annual Review.

4.11.2.3 Aboriginal Community Consultation

To facilitate ongoing Aboriginal stakeholder consultation, BCOPL has initiated an Aboriginal Stakeholder Consultative Forum (ASCF), which is open to all RAPs registered in the course of BCOPL projects including project modifications. The ASCF provides an inclusive platform for information exchange between BCOPL and Aboriginal stakeholders, and allows for continued dialogue on cultural heritage issues and their management at BCM.

ASCF meetings are generally held bi-annually. During the reporting period, two meetings took place in February and July 2019. Key topics discussed at the ASCF meetings included:

- Updates on correspondence with agencies.
- Updates on air quality; noise and groundwater monitoring results.
- Discussion on BCM site water storage changes and status.
- Updates on management plans and revision status.
- Updates on exploration.
- Discussion about community complaints.
- A list of all sponsorships and donations during the 2019 period provided to attendees.
- Discussion about the Biodiversity Offsets Cultural heritage video production.
- Discussion on concept of final void design and inclusion of bush tucker.

- Discussion about consultation of RAPs regarding types of vegetation to be included in offsets and rehabilitation.
- Impact of feral animals.
- Discussions about indigenous employment at BCM and that RAPs are a part of the employment process.

The ASCF is considered to be a proactive and positive step in managing Aboriginal stakeholder relations at BCM.

4.11.3 Improvements and Initiatives

Pursuant to BCM's PA, an Aboriginal Heritage Conservation Strategy (AHCS) for the BTM Complex was developed in September 2014. The strategy was prepared in accordance with the guiding principles of DECCWs *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) and the Australian Heritage Commission's (2002) *Ask First* principles. Version 2 of the AHCS, dated 16 October 2016 was approved by DPIE on 10 November 2017.

The strategy (in particular the options for conservation and enhancement) is based on an extensive desktop analysis complemented by a cultural values assessment component. The cultural values assessment incorporated many opportunities for consultation including five formal opportunities for input from RAPs, as well as informal opportunities.

The implementation of the AHCS shall be detailed in Stage 1 AHCS Implementation Report that will be prepared in consideration of the *Guide to assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)* and *Aboriginal Cultural Heritage Regional Studies: an illustrative approach* (Guilfoyle, 2006) and the *Aboriginal Regional Assessment Policy* (OEH 2011).

The cultural values film *The Kamilaroi* was completed and shown to the community at the Gunnedah theatre. The film release was a success and was well received. Detailed recording of the Rock Inn was also completed and a report prepared.

4.12 Greenhouse Gases

4.12.1 Environmental Management

In accordance with the *National Greenhouse and Energy Reporting Act 2007* ***(NGER Act)****,* and the *National Environment Protection (National Pollutant Inventory (**NPI**)) Measure,* IAR submits mandatory National Greenhouse and Energy Reporting (**NGER**s) and NPI reporting on an annual basis on behalf of BCM.

The AQGHGMP details air quality and greenhouse gas management and mitigation measures and outlines BCM's monitoring and reporting requirements for Greenhouse Gas (GHG) emissions.

4.12.2 Environmental Performance

Key GHG and energy statistics for BCOPL as reported in the 2018-2019 NGERs submission to the Clean Energy Regulator are summarised in Table 4-31 alongside statistics from the 2014-2015, 2015-2016, 2016-2017 and 2017-2018 periods. As the reporting period for NGERs ends in June, data for the current financial year is not yet available.

For reporting purposes, emissions are categorised as either direct (Scope 1) or indirect (Scope 2) emissions. Scope 1 emissions are from sources that are owned or controlled by BCOPL. Scope 2 emissions are a consequence of the activities of BCOPL, but occur at external sources; e.g. emissions resulting from the purchase of electricity. Emissions are calculated as tonnes of carbon dioxide equivalent (t CO2-e).

Three gasses constitute the emissions of BCOPL, being primarily carbon dioxide, in addition to methane and nitrous oxide.

Table 4-31 BCOPL GHG and Energy Statistics

GHG/Energy	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
Scope 1 (t CO_2-e)	41,800	190,606	183,750	177,065	203,082
Scope 2 (t CO_2-e)	8,596	19,585	19,190	17,991	18,647
Total Scope 1 and Scope 2 (t CO_2-e)	50,396	210,191	202,940	195,056	221,729
Energy consumed (total) (GJ)	2,243,915	2,752,598	2,661,699	2,554,023	2,924,043
Energy consumed (net) (GJ)	2,243,915	2,752,598	2,661,699	2,554,023	2,924,043
Energy produced (GJ)	118,371,750	150,548,706	145,260,066	181,068,912	181,878,777

Sources of Scope 1 and Scope 2 emissions for 2018-2019 are illustrated in Figure 4-20. The main contributor to Scope 1 emissions was the combustion of diesel oil. Scope 2 emissions are attributed to the purchase of 22,740,726 kWh of electricity from the state grid.

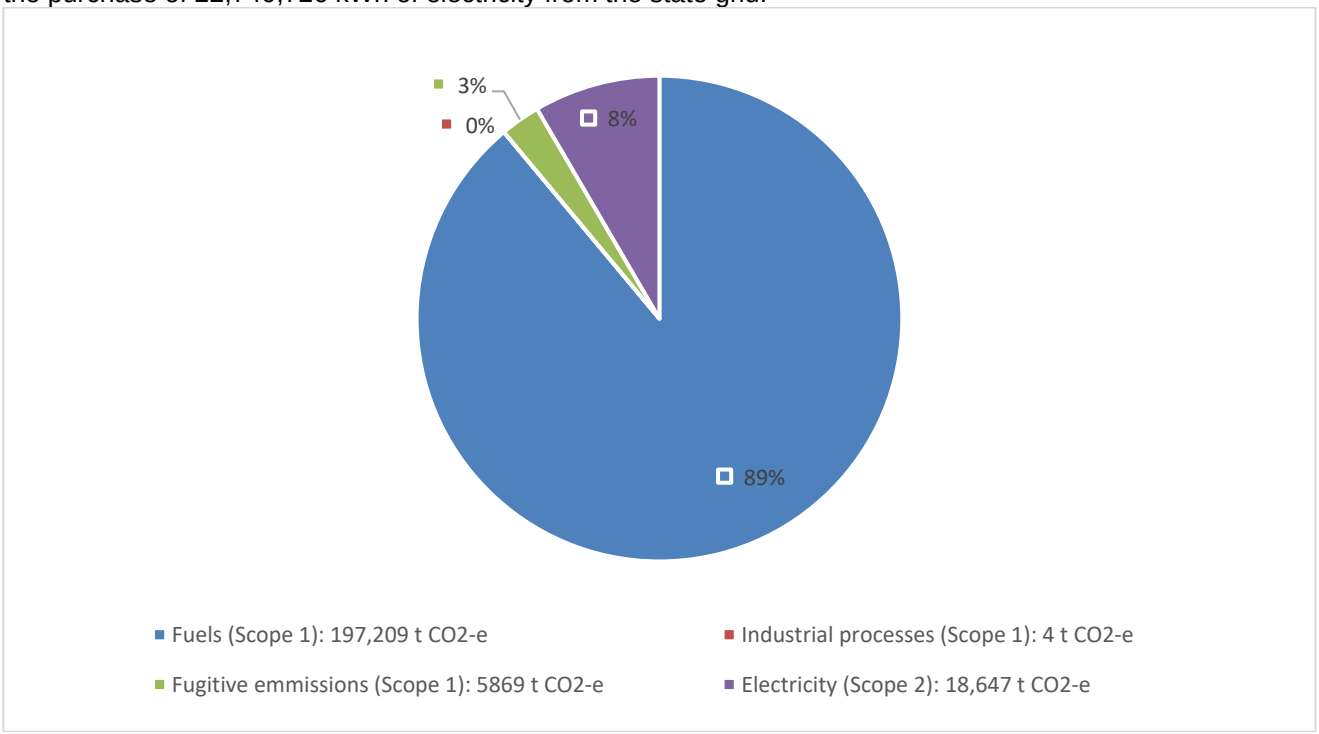


Figure 4-20 Sources of BCM Scope 1 and Scope 2 Emissions

Electricity usage during 2018-2019 was similar to 2016-2017 and 2017-2018 periods due to the ongoing operation of the CHPP. Emissions from diesel combustion were similar to the 2015-2016 NGERS reporting period.

4.12.3 Improvements and Initiatives

BCOPL continued to target a decrease in fuel burn during 2019 through improved operating conditions and practices, and efficient engine configuration. This initiative involved reviewing existing operating practices and engine configurations, and assessing the viability of alternate products through engaging specialist consultants. It is considered that all decreases in fuel burn achieved will improve fuel consumption and therefore GHG efficiencies.

4.13 Public Safety

4.13.1 Environmental Management

The management of public safety at the BCM involves four key elements as follows:

- Traffic – to ensure a safe environment for public access to and egress from the site and movement within the site.
- Bushfire – to ensure that the public both onsite and offsite are not exposed to increased risk of bushfire as a result of the project.
- Lighting – to ensure the provision of adequate lighting to minimise adverse risk to the public both onsite and offsite.
- Security – to restrict public access to areas of BCM where non-inducted and non-trained members of the public may be exposed to adverse risks posed from mining and related activities.

4.13.2 Environmental Performance

4.13.2.1 Traffic

Additional detail on traffic management is detailed in Section 4.14.

4.13.2.2 Bushfire

During the reporting period, management of bushfire risk at BCM was achieved through monitoring and maintenance of bushfire hazards including:

- Monitoring and maintaining equipment and areas where bushfire hazards are present to prevent and minimise the potential outbreak of bushfire.
- Regular monitoring of fuel loads adjacent to mining areas and within the mining lease area portion of Leard State Forest.
- Maintaining adequate water supplies.
- Maintaining access tracks and fire breaks around the mining lease.
- Prohibition of burning any materials on-site.
- Maintaining appropriate firefighting equipment in consultation with the NSW Rural Fire Service and maintaining a fire control and emergency system in accordance with the Coal Mines Health and Safety Act 2002.
- Assessing contractor safety plans to adequately address fire control and response.

BCOPL has historically worked closely with the NSW Rural Fire Service and Forests NSW, and will continue to do so, to ensure that bushfire risks on-site are actively identified and managed. During 2018 BCOPL installed water fill points across biodiversity offset land to also aid in bushfire fighting circumstances.

No bushfires or fire related incidents at BCM were recorded during the reporting period. Current management controls are considered to be appropriate.

4.13.2.3 Lighting

BCOPL and its subcontractors ensure the careful positioning of on-site light sources to actively minimise associated impacts on surrounding receivers, while maintaining adequate illumination levels for operational activities to be carried out safely. This is particularly the case for the lighting sets at the waste emplacement areas. Lighting is provided and maintained in accordance with *AS/NZS 1158.0:2005 Lighting for roads and public spaces* and *AS 1680.1-1990 Interior lighting – General principles for recommendations*.

The control strategies implemented during the reporting period are considered appropriate and will be continued.

4.13.2.4 Security

BCOPL implements a Site Access and Security Procedure which defines the conditions under which employees, contractors and visitors can access BCM. It outlines policies and strategies for limiting unauthorised access by members of the public with no commercial cause to be on the site, with a view to limiting the risk of personal harm, theft or damage of assets or personal property.

During the reporting period security measures implemented by BCOPL included, but were not limited to:

- Maintaining site fencing, gates, and signage at perimeters and road.
- Providing CCTV surveillance at various areas of the site.
- Implementing an on-site tracking system to monitor personnel and vehicles.
- Performing security patrols including out-of-hours patrols by trained security personnel.
- Implementing a site wide policy for vehicle access.
- Maintaining community engagement through the CCC.

4.14 Traffic

4.14.1 Environmental Management

Traffic generated by construction and operation activities at BCM is managed in accordance with the approved Traffic Management Plan (TMP). The TMP focuses on the broader issues of traffic management at BCM and prescribes the overall requirements of the contractors associated with the BCM. It details management strategies that address environmental and safety risks associated with traffic generated from construction and operation activities to mitigate potential impacts and to satisfy the requirements of the Project Approval and other statutory obligations. The TMP also considers traffic associated with the Tarrawonga Coal Mine (TCM) and Maules Creek Mine.

The TMP describes forecast operational traffic volumes, site access arrangements, safety improvements, monitoring requirements and control measures to ensure the safe movement of pedestrians and vehicles, and to ensure roads are maintained in a ‘fit for purpose’ state.

Traffic counts were undertaken at six monthly intervals during the construction phase (2012 – 2015) and at 12 monthly intervals post- construction (mid-2015 onwards); to ensure actual traffic volumes are consistent with the TMP. Where there are significant variations in the traffic volumes on a given road as a result of BCM’s operation, amendments to the TMP shall be considered. Internal and external audits of the implementation of the TMP are undertaken periodically.

BCOPL undertook traffic counts on internal and external roads over a two week period at five sites for BCM in February of 2018.

4.14.2 Environmental Performance

4.14.2.1 Traffic Monitoring

Traffic incidents, monitoring of road conditions and road kill observations are recorded in weekly inspections and incident reports, where relevant. There were fourteen traffic-related incidents recorded on roads in the vicinity of the BCM during the 2019 reporting period. These included one event of speeding, two events of a vehicle turning right at a left turn only intersection, one near miss with a truck at Maules Creek mine entrance of BCOP access road, one event of failing to stop at a stop sign and nine separate events of kangaroo strike. No injuries were sustained in any of the incidents and no members of the public were affected.

During 2019, (2,808 in 2018) 2,097 different individuals accessed the site, with 5,675 visits over the reporting period. This equates to an average of 15.5 persons visiting the site per day. This translates to a decrease of 5 persons per day of visitors to the site in 2018 (20.8 visits per day).

4.14.2.1.1 Inspections and Audits

A Traffic Audit was completed between 30 April 2019 and 13 May 2019 to investigate routes and quantify the number of vehicles entering BCM site via each of the potential access routes, and to identify if BCM related vehicles are utilising the Whitehaven Tarrawonga Mine's private haul road as part of their journey to and from BCM. It was determined that during the weekday morning peak, an average of 80% of vehicles entered the mine using the former haul road compared to 20% using the Leard Forest road. During the weekday afternoon peak an average of 76% of vehicles enter the mine using the former haul road as compared to 24% using Leard Forest road.

Of the traffic originating from the Kamilaroi Highway, around 83% of traffic originates and returns to the south in the direction of Boggabri and Gunnedah.

4.15 Socio-economic

4.15.1 Socio-economic Management

Socio-economic impacts at the BCM are managed via implementation of the Social Impact Management Plan (SIMP). The SIMP was drafted in November 2013 and approved by the Director-General on 21 April 2014. The approved SIMP contains a commitment to undertake a major review of the document every three years, the first of which was scheduled to be undertaken between January and June 2016.

Accordingly, the SIMP was revised and issued to DPIE in June 2016. BCOPL are currently undertaking further revision of the SIMP, which will be submitted for approval in 2020.

The approved SIMP summarises the findings of the Social Impact Assessment completed as part of the Environmental Assessment for the Continuation of Mining at the Boggabri Coal Mine (Hansen Bailey, 2010). It outlines BCOPL's commitments to the mitigation and management of social impacts throughout the life of the Project. This includes implementing adaptive management in response to impacts on:

- Housing affordability
- Local employment
- Local businesses
- Social and community infrastructure
- Community cohesion
- Farming communities
- Indigenous communities
- Traffic

The SIMP also outlines strategies for the management of cumulative social impacts from BCM and other mines in the region.

4.15.2 Environmental Performance

Section 7.1 of the approved SIMP outlines a range of measures to be used to monitor the social impact of the BCM. BCOPL's performance against each of the monitoring mechanisms outlined in the SIMP has been assessed as part of the annual review process. The findings of that review are presented in Table 4-32.

Table 4-32 Social Impact Monitoring Summary

Monitoring Mechanism	Type	Frequency	Purpose	Status
Employment records	Quantitative	Quarterly	Monitor employment diversity (gender, Indigenous status), local residency, journey to work.	Details of the profile of the BCM workforce are provided in Section 7.4.
Procurement records	Quantitative	Six monthly	Monitor project spend on goods and services with local and regional business, including sub-contractors.	Approximately $20,314,391 was spent on good procured from the local or regional areas around BCM.
Housing data	Quantitative	Quarterly	Monitor changes in house prices and rentals, vacancy rates, motels and temporary accommodating.	A summary of housing data monitoring is provided in Section 4.15.2.1
Land use data	Quantitative	Annual	Monitor availability of zoned and serviced residential land and supply of new housing.	Refer to Section 4.15.2.2 for a summary of key land availability and housing supply data for the Narrabri and Gunnedah LGAs.
Social statistics	Quantitative	Six monthly	Monitor changes in service provider statistics (hospital admission rates, GP attendance, school enrolments, emergency response, reported crime).	Refer to Section 4.15.2.3 for a summary of key social statistics.
Attendance records	Quantitative	Annual	Monitor workforce and community participation in education and training programs, induction programs, local sports events, local business forums and business events.	Details of workforce participation during the reporting period are provided in Section 7.1.
Workforce survey	Qualitative	Annual	Record workforce perceptions about general wellbeing, family functioning, and community issues.	BCOPL rolled out a Workforce Engagement Survey in August and September 2019 for its Boggabri Coal Staff. The key outcomes of that survey found that the BCM culture is positive, with the majority of staff experiencing supportive, friendly and collegial environment.

Monitoring Mechanism	Type	Frequency	Purpose	Status
Community survey	Qualitative	Annual	Record community perceptions about company reputation, workforce integration into the community, access to local services, and specific project impacts.	Community is regularly engaged through the CCC meetings. Meetings discuss various topics on how the company is interacting with the community and any specific impacts that are viewed by the local community.
Local business survey	Qualitative	Annual	Record perceptions about access to the supply chain, tender opportunities, and business engagement and support programs.	BCOPL is a member of the Narrabri and District Chamber of Commerce, which meets regularly to discuss business trends and opportunities within Narrabri and its surrounds. The District Chamber of Commerce allows Boggabri Coal to provide information to local businesses on upcoming events. The Boggabri Business Association meeting is attended by management to provide the local business with updates on coming events and engage in local business issues. BCOPL's involvement in the Narrabri and Boggabri's business communities provides a mechanism for the company to gauge business perceptions about the BCM within the local community.
Indigenous community focus group	Qualitative	Annual	Record perceptions about engagement of Indigenous community in employment and business opportunities related to the project.	BCOPL facilitates an Aboriginal Stakeholder Community Forum (ASCF). The ASCF provides a forum for raising general issues by stakeholders or BCOPL. The forum met twice during the reporting period and discussed matters including Keeping Place for Aboriginal salvage items, and results of environmental monitoring on site. Stakeholder perceptions regarding BCOPLs impacts on ground water and surface water and socioeconomic opportunities made available to stakeholders.
Community complaints	Qualitative	Quarterly	Monitor community complaints, issues and suggestions regarding the project, including any follow-up conducted by BCOPL.	Details of all community complaints received during the reporting period and responses made by BCOPL are presented in Section 7.3.

4.15.2.1 Housing

Time series data between Q2 2012 and Q1 2020 indicates that there have been a number of changes in the local housing market over the course of the past eight years (SQM Research, 2019). These include:

- A steady increase in property listings (i.e. homes for sale) in Boggabri from 25 in February 2014 up around 50 throughout 2018 and in December of 2019 was at 60 listings.
- A steady increase in property listings have been observed Gunnedah since 2012, peaking in March 2015 at 450 listings, followed by a slight decrease down to 288 listings in Q4 2018.
- A slight increase in property listings in Narrabri from 113 in October 2012 up to 259 in April 2017. Has fluctuated around 200 listings in 2019, and in December was at 201 listings. (SQM Research, 2019.).

The data also indicates there have also been substantial changes in residential vacancy rates over the past eight years. The vacancy rates in Narrabri peaked at around 5% in December 2015 before dropping significantly to around 1.5% in April 2018. Throughout 2019, vacancy rates hovered around 3% finishing in December at 3.3%.

A similar pattern can be observed in Boggabri, where vacancy rates peaked at the end of 2013, before decreasing to around 1.5% in August 2014 before increasing to over 7% in 2015 and fluctuating at this level until early 2017. The level since dropped to around 3% in the middle of 2018, before picking up towards the end of the year finishing in December 2019 at 5.4%.

Within Gunnedah, vacancy rates peaked at 5.3% in May 2013 and August 2015 before a drop to around 1.8% in June 2018. As of December 2019, Gunnedah's vacancy rate was 3.6% (SQM Research, 2019). House prices in Narrabri and Boggabri decreased between 2012 and 2017, while Gunnedah experienced steady increase in house prices between 2012 and 2015 and then a slight decrease between 2016 and 2018. Although there were changes in the market between 2012 and 2019, the current market data indicates that properties are readily available, both for sale and rental (SQM Research, 2018).

4.15.2.2 Land Availability and New Housing Supply

In 2018 DPIE, in partnership with local government, released a report titled 'New England North West Housing and Land Monitor' to provide an annual review of housing and employment land data. This is the most up-to-date publically available data on land availability and new housing supply for the region. The 2018 report analysed land availability and new housing supply across 12 LGAs (including the Narrabri and Gunnedah LGAs) within the New England and North West regions for the 2014, 2015; 2016 and 2017 financial years. The findings of report, with regard to land availability and new housing supply within the Narrabri and Gunnedah LGAs, are summarised below.

New dwellings approval rates within the Gunnedah and Narrabri LGAs during the 2014, 2015, 2016 and 2017 financial years are listed below in Table 4-33. Within the Gunnedah LGA, the number of rural residential dwelling approvals declined between 2014 and 2017, while detached and multi-unit dwellings fluctuated. In Narrabri approvals for detached and multi-unit dwellings declined, while rural residential dwellings fluctuated. Figure 4-21 shows the total number of new dwelling commencements between 2014 and 2017 in the Gunnedah and Narrabri LGA areas.

Table 4-33 Approval Rates for New Dwellings in Gunnedah and Narrabri 2014-2017

Dwelling Type	FY 2014		FY 2015		FY 2016		FY 2017	
	Gunnedah	Narrabri	Gunnedah	Narrabri	Gunnedah	Narrabri	Gunnedah	Narrabri
Rural Residential	43	17	19	16	21	4	9	15
Detached	41	26	35	17	25	12	35	7
Multi-Unit	5	9	7	4	5	2	3	0
Total	**89**	**52**	**61**	**37**	**51**	**18**	**47**	**22**

Source: DPE, 2018

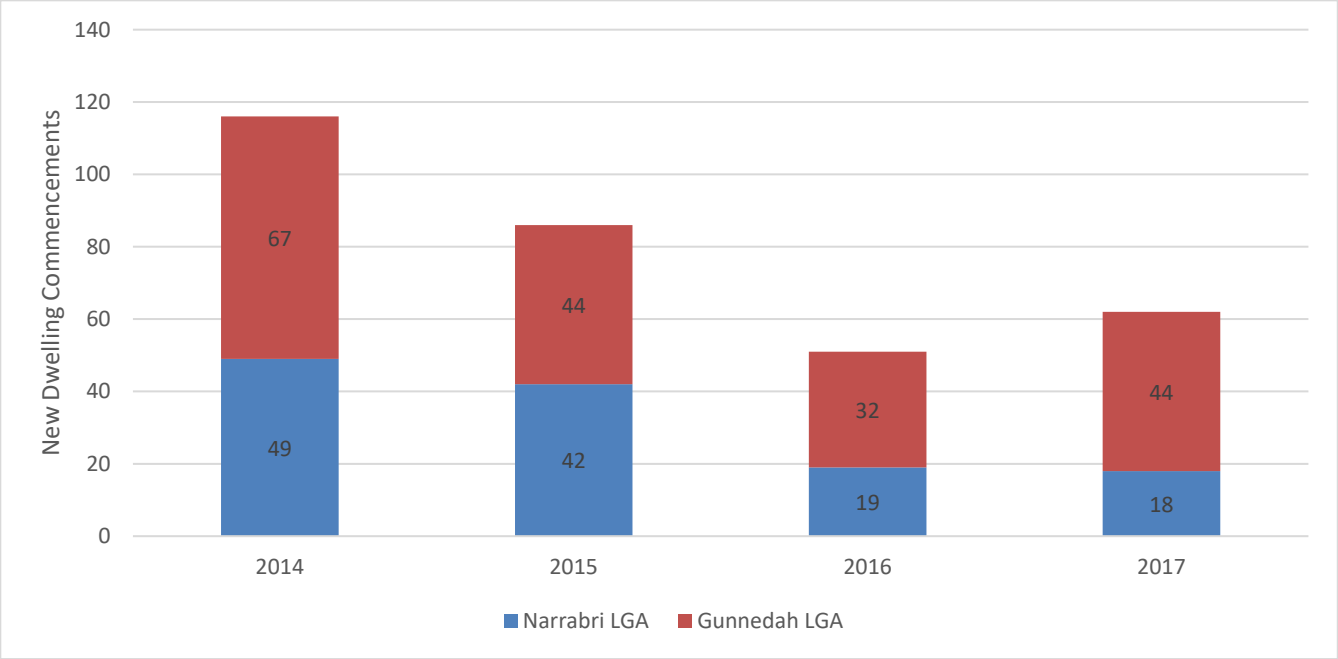


Figure 4-21 New Dwelling Commencements in Gunnedah and Narrabri 2014-2017

Source: DPE, 2018

The availability of employment land (i.e. industrial zoned land) within the Gunnedah and Narrabri LGAs during the 2014, 2015, 2016 and 2017 financial years is shown in Figure 4-22 and Figure 4-23 respectively. Within the Narrabri LGA in 2017, approximately 561.3 ha of land was available for employment purposes, with approximately 30% vacant. Within the Gunnedah LGA, approximately 428 ha of land was available during 2017, with approximately 55% vacant.

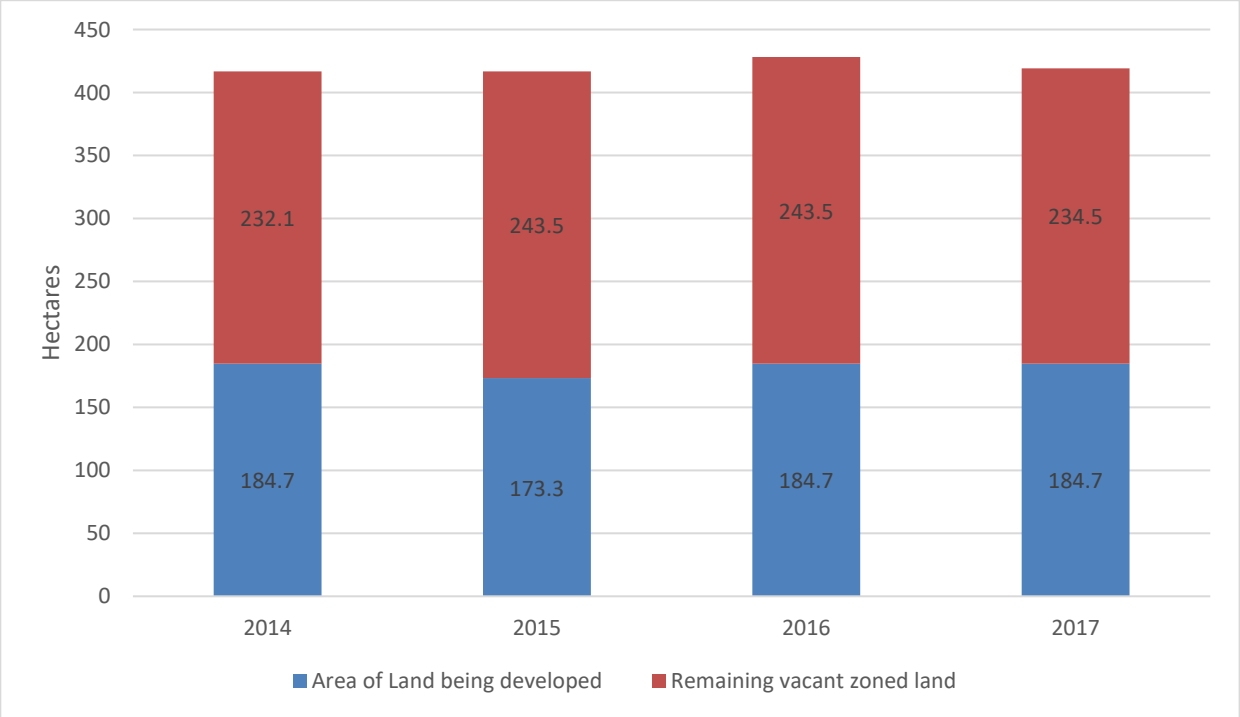


Figure 4-22 Employment Land Availability Gunnedah LGA 2014-2017

Source: DPE, 2018

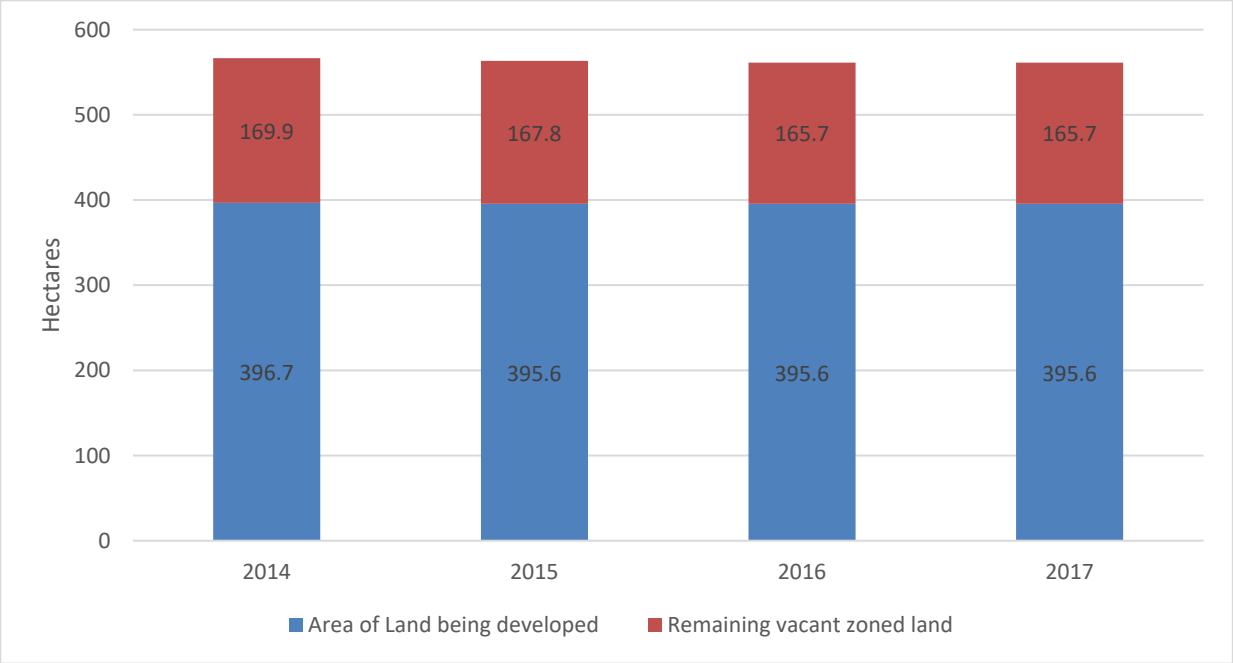


Figure 4-23 Employment Land Availability Narrabri LGA 2014-2017

Source: DPE, 2018

4.15.2.3 Social statistics

4.15.2.3.1 Schools

As part of the social impact monitoring required under the SIMP, BCOPL completed a review of school enrolment records for all public schools in Gunnedah, Narrabri, Maules Creek and Boggabri between 2011 and 2018. At the time of writing, no enrolment records were available for the 2019 reporting year.

Enrolment records indicate there have been gradual increases and decreases in student numbers amongst schools, with no significant trends observed between different years. The schools with the largest increase in enrolments were Gunnedah South Public School and Narrabri West Public School. Gunnedah South Public School had a gradual increase in student numbers from approximately 480 in 2011 up to 629 students in 2018. Student numbers at Narrabri West Public School increased from around 230 students in 2011 up to 327 students in 2017. Conversely, Gunnedah High School saw a decline in student numbers from around 550 students in 2011 down to 414 students in 2018. Boggabri Public School and Fairfax Public School (Boggabri) have both seen fluctuations in enrolments between 2011 and 2018. A summary of annual enrolments for local schools between 2011 and 2018 is provided in Table 4-34.

Table 4-34 Local School Enrolments 2011 - 2018

School	Annual Enrolments							
	2011	2012	2013	2014	2015	2016	2017	2018
Carinya Christian School – Gunnedah	37	43	6	17	42	69	89	99
Saint Mary's College Gunnedah	-	-	379	408	401	379	357	364
St Xavier's Gunnedah	-	-	350	350	358	350	371	381
St Xavier's Narrabri	240	224	113	171	195	178	188	189
Sacred Heart Boggabri	37	32	33	34	23	24	37	43
G S Kidd Memorial School	45	49	32	33	40	40	40	36
Gunnedah Public School	≈ 135	≈ 130	≈ 120	≈ 122	≈ 122	≈ 122	156	155

School	Annual Enrolments							
	2011	2012	2013	2014	2015	2016	2017	2018
Gunnedah South Public School	≈ 480	≈ 520	≈ 570	599	616	620	634	629
Boggabri Public School	98	101	105	123	117	117	113	88
Narrabri Public School	≈ 400	≈ 395	≈ 400	≈ 410	≈ 410	406	403	399
Narrabri West Public School	≈ 230	≈ 240	≈ 280	≈ 280	≈ 300	370	348	327
Fairfax Public School	8	8	13	10	10	12	14	11
Narrabri High School	568	589	588	614	587	540	508	488
Gunnedah High School	≈ 550	≈ 550	≈ 500	≈ 450	≈ 430	430	391	414

4.15.2.3.2 Health

BCOPL contacted local healthcare service providers via telephone during early 2020 to evaluate the effects that BCM may have had on healthcare services in recent years. The feedback received indicated that the demand on local services has remained stable in recent years and that local providers are sufficiently staffed to cope with the number of patient visits they typically receive.

5 INCIDENTS AND NON-COMPLIANCES

As identified in Table 1-2 of the Statement of Compliance, low risk non-compliances occurred during the 2019 reporting period relating to blasting and operational noise. The incidents and non-compliances that occurred for each environmental aspect are detailed in the following sub-sections.

No penalty infringement notices were received during the 2019 reporting period.

5.1 Blasting

On 21 August a blast that was fired exceeded the 120dBL criteria as seen in Schedule 3, Condition 15 of the Project Approval. Analysis of meteorological data at BCM during the period of this blast event was conducted by Todoroski Air Sciences (2019). This exceedance was attributed to a short term fluctuation in the upper air wind conditions that could not have been reasonably foreseen. The exceedance was reported to DPIE on 28 August.

5.2 Operational noise

The 2019 sound power screening program indicated that there were 22 items of screened plant that recorded exceedances of 3dB or greater, consisting of Komatsu haul trucks (KOM 930E-4), one CAT excavator (CAT6030), one Hitachi excavator (EX2600-6), one CAT dozer (D11T), one Komatsu water cart (HD785-7) and a Reich drill (C700D). A total of 30 exceedances were recorded during the screening program period during various tests.

The SPL attenuation exhaust kit trial will continue during 2020. Key findings and recommendations will be reported following completion of the trial.

5.3 Notices, Warnings and Other Compliance-Related Correspondence

The notices and warnings received from regulatory agencies and BCOPL's response is summarised in Table 5-1.

Table 5-1 Notices and warnings received during the reporting period

Agency	Dates	Correspondence Details	BCOPL Response
DAWE	7 June 2019	A show cause notice was issued by the Commonwealth Department of Environment and Energy (now Department of Agriculture, Water and the Environment (DAWE)) in regard potential contravention of two conditions of the Boggabri Coal Mine Extension (EPBC 2009/5256) approval. The conditions were: • Condition 12: Requires that an approved Offset Management Plan is implemented prior to the commencement of new mining operations. New mining operations commenced on 3 February 2014 and there is no approved Offset Management Plan. • Condition 28: Requires that an annual compliance report is published on the BCM website within three months of the commencement of new mining operations, and evidence of publication provided to the department. The Department has not been able to locate the 2019 report on your website and has no received evidence of publication.	BCOPL provided a response to DAWE on 28 June 2019 which is summarised as follows. Condition 12: As can be seen by the factual record, BCOPL has at all times worked with both State and Federal Government in seeking approval of and preparing revisions to the BMP in response to changes in offset areas, monitoring and the regional biodiversity strategy. BCOPL considers that it has been proactive in complying with all the conditions of its Approval including condition 12. The Federal and State Agencies and BCOPL have been operating for the last five years on the basis that the BMP submitted to the Department in 2014 was approved. In the circumstances, BCOPL considers that its action have been undertaken consistent with the Approval conditions. Condition 28: BCOPL submitted the compliance report for 2019 to the Department on 3 May 2019 but omitted to publish it on the Idemitsu website on the same day. The compliance report was uploaded to the website on 11 June 2019 as soon as BCOPL was made aware of the administrative oversight. BCOPL acknowledges this administrative contravention and has already taken steps to ensure that it never happens again by updating its online reporting system to ensure that the compliance report is published on its website on or prior to 3 May each year. A response from DAWE has not been received.
DPIE	18 October 2019	In accordance with Schedule 5, Condition 8 of PA 09_0182 BCOPL is required notify, at the earliest opportunity, the Secretary and any other relevant agencies of an incident, that has caused, or threatens to cause material harm to the environment. Within 7 days of the incident, BCOPL shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports may be requested. BCOPL was issued with a warning letter from DPIE on 18 October 2019 for not reporting a blast overpressure exceedance to DPIE until 28 August 2019 despite blast data being sent to BCOPL staff on 21 August 2019. The exceedance was determined to have the potential to cause, or threaten to cause, material harm to the environment.	Analysis of meteorological data at BCM during the period of this blast event was conducted by Todoroski Air Sciences (2019). This exceedance was attributed to a short term fluctuation in the upper air wind conditions that could not have been reasonable foreseen. The exceedance was reported to DPIE on 28 August.

6 AUDITS

6.1 EPA Compliance Audit (2018)

6.1.1 Scope of Audit

The NSW EPA undertook a Compliance Audit against EPL 12407 in June 2018 as part of a focused compliance audit program examining the information reported in BCOPL's 'Environmental Management Systems and Environmental Practices' statements in Annual Returns and the Boggabri Coal PRIMP.

The audit assessed compliance against:
1. Condition R1.1 of EPL 12407 which requires the licence to complete and supply an Annual Return in the Approved Form.
2. Legislative requirements for PRIMPs –Part 5.7A of the Protection of the Environment Operations Act 1997 (POEO) and Chapter 7, Part 3A of the POEO (General) Regulation 2009.

6.1.2 Audit Outcomes

The audit findings determined that no further actions were required for the BCOPL Environmental Management Systems and Practices, and the auditor made two recommendations for improvement.

Six non-compliances were determined for the BCOPL PRIMP which was determined to be non-compliant with the relevant legislative criteria. Several actions were identified required by the EPA for the PRIMP to ensure that it contains the required information and is maintained and implemented to comply with the legislative requirements.

6.1.3 Status of audit recommendations

BCOPL provided a response to the EPA audit recommendations and findings in 2018. An updated PIRMP was developed by BCOPL and approved in August 2018 incorporating the items proposed referred to in BCOPL's initial response.

The PIRMP was tested in 2019 and an updated PIRMP was developed and approved in August 2019 incorporating a description of the hazards to human health or the environment associated with the activity to which the licence relates and the likelihood of any such hazards occurring, including details of any conditions or events that could, or would, increase that likelihood.

BCOPL will continue to implement these recommendation findings throughout the 2020 reporting period.

6.2 Independent Biodiversity Audit (2018)

6.2.1 Scope of Audit

An Independent Biodiversity Audit (IBA) was undertaken in March 2018 by an approved assessor (Umwelt Australia Pty Ltd) and addressed the period since the last IBA in February 2015.

The IBA assessed compliance of BCM operations and its biodiversity offsets, against the PA (Schedule 3, Conditions 39-54), approved Biodiversity Management Plan, Biodiversity Offset Strategy, Rehabilitation Management Plan and relevant commitments in the EA.

6.2.2 Audit Outcomes

The IBA found three non-compliances and two administrative non-compliances with the Project Approval that apply to the Boggabri Coal Mine. Many of these issues were of a more technical nature relating to formal compliance management, including in particular appropriate documentation. Overall on-site environmental management performance of the site was found to be generally good to very good, with excellent knowledge amongst staff and relevant contractors.

Overall, the audit found that the management strategies, plans and programs that had been prepared for BCM were generally adequate and prepared in accordance with the relevant compliance requirements. The Biodiversity Management Plan and Rehabilitation Management Plan are generally comprehensive documents which mostly comply with the approval conditions. However, several recommendations were made, the majority of which were actioned in the 2018 reporting period and reported in the 2018 Annual Review.

6.2.3 Status of Audit Recommendations

A summary of the status of the implementation of the remaining recommendations from the IBA not actioned in the 2018 reporting period is provided in Table 6-1.

Table 6-1 Status of IBA Recommendations

Audit Recommendation	BCOPL Final Response	Status
Trialling different forms of planting other than strip-based tubestock is encouraged. It is understood that there must be careful balance between meeting restoration objectives and financial cost. However, in some areas it is recommended that patch planting is trialled, where the prospects for in-filling between patches through natural generation/recruitment are high.	Boggabri Coal will review the overall approach and if possible introduce different forms of tube stock planting such as clusters or clump plantings in small areas. If a new approach is taken on then it is to be reviewed to see if any benefit will be provided by changing the approach in small discrete areas.	Five areas of cluster/clumping planting on the Springfield property have been undertaken during 2019.
Dedicate small but appreciable portions of BOAs and the rehabilitation area to these trials and undertake appropriate monitoring over several years to detect if any positive differences result	.-	Monitoring of these planted areas described above will be incorporated into subsequent monitoring programs.
Establish nest boxes (targeting those fauna species that are the subject of Condition 45) in the rehabilitation area to provide more structural and habitat diversity to encourage occupation by threatened fauna species.	Boggabri Coal will aim to introduce nest boxes in the rehabilitation area.	Nest boxes have been made and will be installed in the rehabilitated areas in the 2020 reporting period.

6.3 Independent Environmental Compliance Audit (2017)

6.3.1 Scope of Audit

In accordance with Schedule 5, Conditions 10 and 11 of the PA, BCOPL engaged an independent certified auditor to undertake an independent environmental compliance audit of BCM. The audit was undertaken by SLR Consulting Pty Ltd in August 2017 and covered the period from 19 August 2014 to 31 July 2017. It assessed BCOPL's compliance with the conditions of the PA and other relevant leases, licences and approvals. It also included assessing the environmental performance of the project in meeting the requirements of the PA through the implementation of a range of environmental management measures outlined in the various environmental management plans developed for the project. It did not however audit aspects of the project related to biodiversity. These aspects have been audited separately during the 2018 IBA by specialist biodiversity auditors, as agreed with DPIE.

6.3.2 Audit Outcomes

Out of the total 285 compliance requirements (approval conditions and Statement of Commitments) audited, BCOPL achieved an overall compliance rate of 93%. Twenty non-compliances were observed, thirteen of which were considered low-risk and seven of which were recorded as administrative non-compliances. There were no high or moderate risk non-compliances recorded. A total of eighty-two recommendations were made by the auditor.

In conclusion, the auditor found BCOPL to be generally in compliance with the conditions of the PA, its leases, licences and approvals for the BCM.

6.3.3 DPIE Review

The independent environmental compliance audit (IEA) was lodged with the DPE on 26 October 2017. The DPIE found the audit to generally satisfy the requirements of the PA and the DPIE's Independent Audit Guidelines (2015).

The DPE also requested that a status update on outstanding actions be included in future Annual Reviews until each action is completed.

6.3.4 Status of Audit Recommendations

As requested by the DPIE, a summary of the status of the implementation of outstanding recommendations from the independent environmental compliance audit is provided in Table 6-2. All other recommendations have been actioned in the previous reporting period as reported in the 2018 Annual Review.

Table 6-2 Status of Outstanding IEA Recommendations

Reference	Requirement	Compliance	Key Findings (reported by exception)	Recommendation	Proposed Action	Target Completion Date	Completion Date
Project Approval 09_0182							
S3.56(e)	(e) include the following for the management of historic heritage: a detailed plan for the implementation of mitigation and management measures for historic heritage items identified to be impacted by the project, in particular proposed consultation, archival recording, research and archaeological investigations to be undertaken for the locally significant Heathcliffe residence prior to and during any disturbance; a detailed plan for management measures for maintaining or enhancing the heritage values of heritage items on project-related land which are outside of the approved disturbance area; a description of the measures that would be implemented for: managing the discovery of human remains or previously unidentified heritage items on site; and ensuring workers on site receive suitable heritage inductions prior to carrying out any development on site, and that suitable records are kept of these inductions.	Not verified	The CHMP provides a detailed plan for the management/mitigation for historic sites outside of the disturbance area in Section 5.3.5. However, no evidence has been provided to show that this plan is being implemented for the unassessed heritage assets.	Evidence should be provided to show that the plan for the management/mitigation for historic sites outside of the disturbance area (Section 5.3.5) is being implemented for unassessed heritage assets.	BCOPL will implement the recommendation	16 April 2019	September 2020. In 2019 cultural heritage assessment of BOA's was undertaken along with assessment of The Rock Inn. Once completed reports have been received, they will be included in a revised CHMP

Reference	Requirement	Compliance	Key Findings (reported by exception)	Recommendation	Proposed Action	Target Completion Date	Completion Date
S3.57(c)	(c) incorporate methodology including: sub-surface testing; staged salvage, based on anticipated mine planning; pre-disturbance monitoring; site assessment and reporting protocols; research objectives to inform knowledge of Aboriginal occupation; protection, storage and management of salvaged Aboriginal objects; addressing relevant statutory requirements under the National Parks and Wildlife Act 1974; and proposed long-term plan for protection of salvaged Aboriginal objects.	Non-Compliance (Low Risk)	The statutory requirements under the National Parks and Wildlife Act 1974 (NPW Act) require that the AHIMS database be updated, including the registration of new sites and impacts/salvage of known sites. Consistency between the site status and location data shown on the AHIMS database and the mine administered site status database (Site status all sites 28022017.xlsx: ID21) was checked using a sample of 65 of 275 sites listed on the mine administered database. The status of 15 sites listed on the mine database as having undergone salvage were found not to have been updated on AHIMS. Five of these sites were listed as 'ASIR Form Submitted' on the mine database; however, the AHIMS site status does not appear to have been updated. Aboriginal Site Impact Recording (ASIR) forms for the remaining ten sites do not appear to have been submitted to AHIMS. The status of three sites (NV37, NV38	A brief audit of the AHIMS database versus the mine database indicates discrepancies (e.g. site status and location) and it is recommended that a AHIMS-Mine Site rectification programme occur over the following three years, prior to the next audit, to ensure that these datasets match, which is vital to ensuring no inadvertent impacts.	BCOPL will implement the recommendation .	16 July 2019	September 2020 review of the mine database and the AHIMS database has determined that all of the discrepancies are the result of a poorly maintained AHIMS database. The next revision of the CHMP will include reference to any discrepancies

Reference	Requirement	Compliance	Key Findings (reported by exception)	Recommendation	Proposed Action	Target Completion Date	Completion Date
			and NV39 under AHIMS ID 20-4-207) listed on AHIMS as having been 'destroyed' appears to be incorrect. The mine database indicates that the sites have only been partially destroyed, with the scarred tree still in situ. Location information for two sites differed between the AHIMS database and mine database: BC48 (AHIMS ID: 20-4-0141) and BC53 (AHIMS ID: 20-4-0146).				

7 COMMUNITY

BCOPL's involvement with the local community is guided by:

- Studies undertaken as part of the EA for the Project.
- BCM's Social Impact Management Plan (SIMP).
- Consultation with key stakeholders including the Community Consultative Committee (CCC).
- BCOPL's internal environmental management plans and corporate guidance.

In accordance with the PA (Schedule 3, Condition 77(b) BCOPL prepared a SIMP, in consultation with Narrabri and Gunnedah Shire Councils, the CCC, Aboriginal stakeholders, TCPL and Maules Creek Mine; and other relevant Government agencies and service providers. A revised SIMP will be submitted for approval in 2020.

The purpose of the SIMP is:

- To present a summary of the potential positive and negative social impacts of the project during the construction, operational and decommissioning phases.
- To detail specific social impact management and mitigation strategies and related implementation actions.
- To reflect the main findings of the Social Impact Assessment prepared as part of the approval process for the Continuation of Boggabri Coal Mine, including associated community and stakeholder engagement.
- To provide for ongoing and active roles for the community, local government and State government agencies throughout the life of the project.
- To provide clear definition of the roles and responsibilities for social impact management that apply to all BCOPL employees, contractors and subcontractors.

The SIMP incorporates a monitoring program to track the performance of social impact management activities against key performance indicators and expected outcomes.

7.1 Community Programs and Investment

BCOPL is committed to supporting the local community in which they operate. Over the 2019 reporting period and in concurrence with previous reporting periods, BCOPL and its contractors were involved in a number of community initiatives and events. BCOPL contributed $185,750 to local projects and sponsorships in the 2019 reporting period, as summarised in Table 7-1. Contributions for the reporting period are about 20% greater than the previous year's contributions ($130,510).

BCOPL also hosts occasional site visits from the community, industry professionals, the media and other interested parties. In addition to a contribution of $10,000 to the 2019 Boggabri Drovers Campfire event, BCM hosted a number of the participants for mine site tours.

Table 7-1 BCOPL Community Funding 2018

Community group/project	BCM Contribution
Gunnedah Girls Academy	$30,000
Westpac Rescue Helicopter	$30,000
Clontarf Foundation	$30,000
Boggabri Drovers Campfire	$10,000
Maules Creek Campdraft	$8,000
Namoi Carp Muster	$5,000
Boggabri Carp Muster	$5,000
Dorothea Mackellar Memorial Society	$5,000
Boggabri Rugby League	$3,500
Manilla Show	$2,500
Discretionary Sponsorships	$56,750
Total	**$185,750**

7.2 Community Consultative Committee

In accordance with the PA (Schedule 5 Condition 7), BCOPL continues to operate a Community Consultative Committee (CCC) based on the Department of Planning's Guidelines for Establishing and Operating Community Consultative Committees for Mining Projects 2007.

The purpose of the CCC is to provide a forum for open discussion between representatives of BCOPL, the community, the local council and other stakeholders on issues directly relating to BCM's operations and community relations.

Regular CCC meetings were held during the reporting period on the following dates:

- 14 February 2019
- 16 May 2019
- 15 August 2019
- 31 October 2019

Key topics discussed included:

- Recent correspondence with regulatory agencies
- Audit presentation
- Updates on the status of management plan revisions
- Management of biodiversity offset properties
- Vegetation corridor
- Updates on community sponsorships
- Environmental monitoring program and results
- Mining and rehabilitation activities
- Community complaints

Copies of the minutes from CCC meetings are publicly available on the BCM website: https://idemitsu.com.au/operations/boggabri-coal/approvals-plans-and-reports/community-consultative-committee/

7.3 Complaints

7.3.1 Management of Complaints

Community complaints are managed in accordance with the BCOPL Complaint Management Procedure. This procedure outlines a standard process for reporting and responding to community complaints for all BCOPL employees and contractors at BCM.

The procedure includes reporting:

- The nature of the complaint
- The method of the complaint, for example, telephone
- The monitoring results, including any relevant conditions at the time of the complaint
- Site investigation outcomes
- Site activity and activity changes
- Any necessary actions assigned

BCOPL maintains a 24 Hour Community Response Line to provide the community or interested stakeholders with an accessible and reliable communications point for complaints. In turn, the response line allows for rapid response to community complaints. The phone number for this Community Response Line is 1800boggabri (1800 264 422 74).

The Community Response Line is advertised in the local media every three months and is available on the IAR website. It is also available from site personnel and community representatives on the CCC.

Where possible, complainants are contacted within 24 hours of BCOPL's Environment Superintendent being advised of a complaint. Where requested to notify the complainant of any remedial or required actions undertaken, a follow-up on the complaint is made by BCOPL's Environment Superintendent or other authorised representative.

Every effort is made to ensure that concerns are addressed to facilitate a mutually acceptable outcome for both the complainant and mining entity concerned. All complaints received are tabled at CCC meetings. BCOPL maintains records of completed internal complaint forms for a period of no less than five years.

7.3.2 Registered Environmental Complaints

No community complaints were received by BCOPL during the 2019 reporting period, which was a significant improvement on the four complaints received in the 2018 reporting period.

7.4 Profile

As of December 31 2019, the total workforce on BCM was 542 employees, a breakdown of the workforce and their residential locality are detailed in Sections 7.4.1 and 7.4.2.

7.4.1 BCOPL Employees

Wherever possible, local personnel are employed by BCOPL and its contractors. The BCOPL team at BCM consists of 379 staff, the majority of whom are locally based. All of the BCOPL employees are employed full time. A breakdown of the local government areas where BCOPL employees reside is presented in Table 7-2.

Table 7-2 Residential Locality of BCOPL Employees

Locality	BCOPL Employee Residency
Gunnedah	152
Boggabri	49
Narrabri	39
Baan Baa	3
Manilla	20
Tamworth	22
Curlewis	5
Other NSW	84
QLD	4
Tasmania	1
Total	**379**

7.4.2 Mining Contractors

At end of December 2017 the mine shifted to a combination of owner-operator (i.e. BCOPL personnel) and mining contractor operated. Major mining contractors operating on site from December 2017 onwards were BGC Contracting Pty Ltd (BGC) and OneKey Resources (OneKey).

The largest share of the total project workforce at BCM during the 2019 reporting period is attributed to the mine contractor OneKey. At the end of December 2019 the OneKey workforce consisted of 83 personnel, predominantly contract staff, 78% of which resided locally. The BGC workforce was 35 personnel, consisting of 29 full time contract employees. Other subcontractors provided 51 employees.

Ninety seven percent of the BCM employees resided in NSW and 70% resided within the localities of Gunnedah, Manilla, Boggabri, Narrabri, Maules Creek, Curlewis, Baan Baa and Tamworth.

Table 7-3 Residential Locality of Contractor Employees

Locality	One Key Resources Pty Ltd	Bgc Contracting Pty Ltd	Other Contractor
Boggabri	6	3	3
Gunnedah	24	8	7
Narrabri	3	2	5
Manilla	4	1	0
Tamworth	6	3	3
Curlewis	5	1	1
Maules Creek	2	1	0
Other NSW	32	8	22
QLD	1	2	8
Total	**83**	**29**	**51**

8 REHABILITATION

The principal objective for rehabilitation at BCM is to return the site to a condition where its landforms, soils, hydrology, flora and fauna are self-sustaining and compatible with the surrounding landscape. Progressive rehabilitation is an ongoing activity at BCM and is carried out in accordance with regulatory requirements, and Mining Operations Plan (MOP).

The MOP guides rehabilitation for all operational activities and associated infrastructure, and fulfils the rehabilitation requirements specified in the PA. It focuses on rehabilitation of active pit and waste emplacement areas of CL 368. However, closure components also consider lands and infrastructure occupied by the private haul road, rail spur and power line easements, and the BCT.

Rehabilitation objectives for the BCM are:

- To ensure compliance with the requirements of all relevant environmental legislation, conditions of applicable licences, approvals or permits.
- To provide specific rehabilitation management and mitigation procedures for site personnel.
- To establish a clear set of indicators and rehabilitation completion criteria.
- To rehabilitate the site to a safe and stable condition.
- To revegetation the post mine landscape with native vegetation, comprising a mixture of native grassy woodland, shrubby woodland/open forest, riparian forest vegetation types and Box-Gum Woodland with fauna habitat for threatened species to encourage the re-establishment of pre-mining biodiversity values.
- To ensure rehabilitated areas form part of a regional east-west wildlife corridor created as part of the BCM Biodiversity Offset Strategy. The proposed corridor will create a linkage to remnant vegetation between Namoi River (west of BCM) through the Leard State Forest to the Nandewar Range (east of BCM).
- To ensure sustainability of the post mining ecological values of the landscape.

8.1 Rehabilitation Methodology

The adopted rehabilitation methodology is described in detail in the MOP. Key components of the methodology include:

- Temporary stabilisation
- Landform design
- Topsoil stripping and handling
- Soil amelioration as necessary
- Topsoil spreading
- Drainage and erosion control
- Revegetation methods and timing
- Vegetation species and seed collection

8.2 Rehabilitation Progress

8.2.1 Summary of Land Rehabilitation

During the 2019 reporting period 15.4 ha of BCM's overburden emplacement area was rehabilitated. This was approximately 14.68 ha less than was planned to be completed by the end of 2019. This decrease in area rehabilitated was due to significant industrial action which occurred onsite during the second half of 2019. This area is scheduled to be caught up during 2020
Rehabilitation was undertaken in accordance with the requirements specified in the MOP including:

- Shaping surfaces to a maximum slope of 10 degrees
- Covering areas to be rehabilitated with a minimum depth of 150 mm topsoil
- Planting native vegetation as outlined in the RMP

The extent of mining and rehabilitation activities at the end of the 2019 reporting period is illustrated on Figure 8-1. A detailed breakdown of rehabilitation/disturbance footprints for the previous, current and future reporting period is also provided in Table 8-1.

8.2.2 2019 Plantings

The 2019 rehabilitation program involved spreading topsoil, application of ameliorants, deep ripping and seeding with native pasture and understorey species and the planting of tree species tubestock.

Seed supplied for the 2019 rehabilitation site was sourced locally from the South Brigalow Bioregion. It was collected by 'FloraBank' trained personnel.

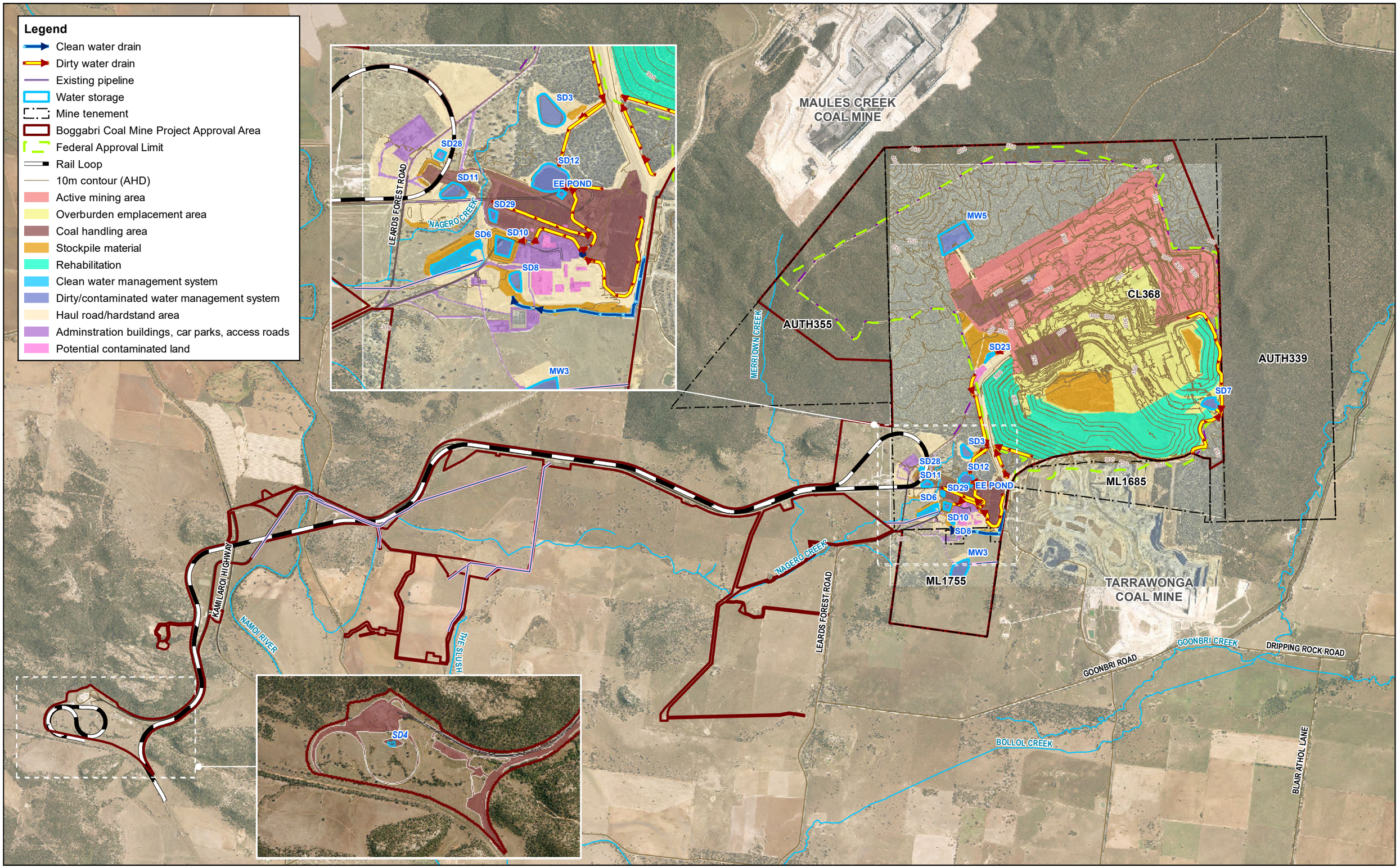
8.2.3 Rehabilitation Status

BCOPL has adopted ten primary rehabilitation domains (refer to Figure 8-1). These domains define areas based on operational or functional purpose and geophysical similarities. The MOP outlines the regulatory requirements, rehabilitation objectives, indicators and completion criteria for each rehabilitation phase of all rehabilitation domains.

The calculated rehabilitation status based on the requirements of the *Annual Review Guideline* (2015) for 2017, 2018, 2019 and predicted values for 2020 are summarised in Table 8-1.

Table 8-1 Rehabilitation Status

Mine Area Type	2017 Reporting Period (Actual) (ha)	2018 Reporting Period (Actual) (ha)	2019 Reporting Period (Actual) (ha)	2020 Reporting period (Predicted) (ha)
A. Total mine footprint	1337.8	1300.5	1433.9	1499.4
B. Total actual disturbance	1179.1	1062.3	1338.6	1196.5
C. Land being prepared for rehabilitation	N/A	N/A	N/A	N/A
D. Land under active rehabilitation	158.7	238.2	263.7	302.9
E. Completed Rehabilitation	None	None	None	None



0 0.5 1 1.5 KM

Scale 1:50,000
Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL (2017,2018);

DOCUMENT	PS118825_AEMR_008_A2_EOY2019
AUTHOR.	suansrir
REVIEWED BY.	N.Cooper
DATE.	24/03/2020

IDEMITSU BOGGABRI COAL

FIGURE **8-1**

TITLE. **MINING AND REHABILITATION AT END OF 2019 REPORTING PERIOD**

DRAWING: \\corp.pbwan.net\ANZ\SectionData\Environment\EPSE\ECOLOGY\Z_boggabri\GIS\5_Shared_GIS\54_Production\Maps\2020\Environment\AEMR\PS118825_AEMR_008_A2_EOY2019.mxd

8.3 Rehabilitation Biodiversity Monitoring

Biodiversity monitoring of rehabilitation areas is completed annually to assess the biodiversity status of rehabilitated areas to further guide rehabilitation methodologies, procedures and maintenance activities, in order to achieve site rehabilitation objectives. The monitoring reports on aspects of ecosystem establishment and ecosystem development.

Rehabilitation monitoring for the reporting period was undertaken in September 2019 within six monitoring plots located within rehabilitation areas (refer to Table 8-2). One monitoring plot, MR2011 was not accessible for survey due to a lack of safe access/egress. The monitoring program involved:

- Two 100m vegetation survey transects for cover and abundance.
- One BioBanking plot.
- Two nights of passive microbat ultrasonic recordings.
- Two standard 20-minute, 2 ha bird and general fauna census (generally within 80 m radius of fixed monitoring site and consistent with rehabilitation age-class) on separate mornings.
- Two consecutive nights of passive infra-red/motion sensor camera detection.
- Two 30-person minute, ~1 ha searches of salvaged woody debris on each two separate days.
- Two 100 metre transect surveys with ten invertebrate pitfall traps in each transect line (total of 20 pitfall traps per replicate monitoring site).
- Photo point monitoring (to track changes in plant growth and ecology of the rehabilitated areas)
- Salinity monitoring (observational).
- Canopy species recruitment and presence of reproductive structures monitoring (observational).

Table 8-2 Survey Locations for Rehabilitation Sites at BCM

Site Reference Number	Location (GDA94 Zone56)		Transect Orientation (2018)		Plot orientation (position of steel stake)
	Easting	Northing	A	B	
RH2008	226985	6609210	250	190	SE corner
RH2008D	227128	6608951	240	195	NE corner
RH2010	227117	6609125	310	70	SE corner
RH2011	226819	6609901	Not surveyed	Not surveyed	Not surveyed
RH2018A	229429	6608914	195	280	Four Posts
RH2018B	229567	6609131	120	15	Four Posts
RH2018C	228411	6609191	220	30	Four Posts

8.3.1 Photographic Monitoring

Photographs of the monitoring sites for 2008, 2010, and 2018 rehabilitation areas are provided in Figure 8-2, Figure 8-3 and Figure 8-4 respectively.

Figure 8-2 2008 Rehabilitation Area (11 years old)

Figure 8-3 2010 Rehabilitation Area (nine years old)

Figure 8-4 2018 Rehabilitation Area (one year old)

8.3.2 Summary of Findings

Monitoring results indicate that native species diversity and structure of the vegetation are progressing over time. Acquired data indicate that biodiversity values (vegetation, birds and invertebrates) are trending well against analogue sites associated with the Leard State Forest remnant. Importantly, data acquired during the 2019 monitoring event should be considered with respect to the extended and severe drought conditions from which biological variables were sampled.

8.3.2.1 Vegetation

A total of 109 species of plant were recorded from six replicate mine rehabilitation monitoring sites during the 2019 monitoring event, of which 86 were native (79%) and 23 species were exotic (21%). No plant species recorded in the mine rehabilitation area during the 2018 monitoring event were listed as threatened species under the BC Act and/or EPBC Act. Flora surveys and data analysis of the project's rehabilitation areas identified the following:

- Native species richness is generally increasing over time as rehabilitation areas continue to age. Older rehabilitation areas (i.e. RH2008, RH2008D and RH2010) showed a slight decrease in mean native and exotic species richness in 2019. This change could be attributed to drought conditions experienced in the region during the 2019 monitoring program. Conversely, the younger rehabilitation areas (RH2018A, RH2018B and RH2018C) showed a slight increase in mean native and exotic species richness in 2019. The increase observed in the 2018 rehabilitation areas is likely to due to its young age (i.e. 18 months at time of survey) and watering of tube stock throughout the year. Germination, reproduction and colonisation of disturbance tolerant native species within these younger rehabilitation areas appears to be progressing well.

- Only one rehabilitation site (i.e. RH2008D) met the LSF analogue for mean native species richness and therefore met the RMP performance criteria. Two monitoring locations (RH2008D and RH2010) exceeding the mean BBAM benchmark native species richness for shrubby woodland/forest on skeletal soils.
- Native vegetation groundcover percentage cover is low across all rehabilitation age-classes.
- Exotic species richness has tended to initially increase over the first few years after rehabilitation areas are established and then slowly decrease as canopy cover increases. Mean exotic species richness is also appearing to fluctuate and be influenced by seasonal climatic conditions as illustrated by the notable increase in mean exotic species richness following high rainfall received in 2016 and the subsequent decline in 2018 and 2019 in response to drought conditions.
- Structural characteristics which take time to develop within natural ecosystems (such as fallen timber and hollow bearing trees) are mostly absent across the rehabilitation area except for salvaged timber and stags which have been distributed/erected in localised areas.
- No salinity was identified in any of the rehabilitation monitoring sites surveyed during 2019.
- Planted canopy species showed evidence of reproductive structures (including bud, fruit and/or flower) at the three older rehabilitation sites (i.e. RH2008, RH2008D and RH2010), recruitment of canopy species from the soil seed bank at these locations was not observed. Canopy at the three younger rehabilitation sites (i.e. RH2018A, RH2018B and RH2018C) showed no evidence of recruitment or reproductive structures. The lack of reproductive structures from the RH2018 sites is not unexpected given the tube stock were planted only 18 months prior to surveys being completed. These results indicate that canopy within the rehabilitation areas is not yet self-sustainable.
- Groundcover and midstorey species were observed recruiting from the soil seed bank at all monitoring sites. Species within these strata were also observed producing reproductive structures indicating that they are progressing well towards becoming self-sustainable. Whist species diversity within these strata are showing promise, vegetative cover of these species is still low.

8.3.2.2 Birds

A total of 34 species of bird were recorded from duplicate surveys at replicate monitoring sites in the mine rehabilitation area. This comprised several woodland and generalist species of bird common to the region. Species commonly recorded included Mistletoebird, White-plumed Honeyeater and Rufous Whistler. Two threatened species, listed as Vulnerable under the BC Act were recorded from replicate monitoring sites, including Speckled Warbler and Turquoise Parrot. A comparison of mean diurnal bird species richness between mine rehabilitation area monitoring sites indicate that the more structurally diverse and oldest mine rehabilitation areas retain a higher mean diurnal bird diversity. Mine rehabilitation planted in 2008 (RH2008 and RH2008D) recorded the highest mean diversity (8.8), closely followed by RH2010 (8.0).

Data acquired during the 2019 monitoring event indicate that mean diurnal bird species richness for each mine rehabilitation age-class occurred below the Leard State Forest analogue benchmark of 13.7. To meet the RMP performance criteria, each rehabilitation area must meet 80 % of the Leard State Forest analogue benchmark (i.e. 11.0 species). No replicate monitoring site met the RMP performance criteria during the 2019 monitoring event. Importantly, the analogue monitoring sites from which the benchmark was deduced, were also considerably lower than the benchmark during the 2019 monitoring event, achieving a combined mean for bird species richness of 7.8.

Diurnal bird abundance across the mine rehabilitation area mirrored species richness for the 2019 monitoring event, observing a reduction within the younger rehabilitation age-classes. Mean bird abundance occurred below the Leard State Forest analogue benchmark during the 2019 monitoring event.

8.3.2.3 Microchiropteran Data

Microchiropteran bat data for the Mine Rehabilitation Monitoring program is currently under detailed analysis.

8.3.2.4 Invertebrates

A total 10,398 invertebrates from 23 morpho-species were recorded along the 12 transects established within the 2018 rehabilitation areas (RH2018A, RH2018B and RH2018C), nine year old (RH2010) and 11 year old (RH2008 and RH2008D) rehabilitation plots. The 2010 mine rehabilitation age-class recorded the highest mean diversity of invertebrates at 8.0, which was comparable to the combined mean of 7.4 (as averaged from four long-term monitoring locations in Leard State Forest) recorded from extant habitats associated with the larger Leard State Forest remnant during the 2019 monitoring event. A reduction in insect diversity was observed in the younger mine rehabilitation age-classes, as well as the 2008 mine rehabilitation areas. Hymenoptera (ants) were the most diverse and abundant group recorded within the mine rehabilitation area

In accordance with the Boggabri Coal Mine Operation Plan, the final land use and secondary domain within the current mine rehabilitation monitoring area (seven replicate monitoring sites) is consistent with shrubby woodland/forest on skeletal soils. A mean invertebrate species richness analogue benchmark of 14.8 was calculated from two Leard State Forest shrubby woodland/forest monitoring sites, as a means by which to assess the mine rehabilitation progression towards the RMP completion criteria. To meet the RMP performance criteria each rehabilitation area must meet 80 % of the Leard State Forest analogue benchmark mean (i.e. 11.8 morpho-species). None of mine rehabilitation monitoring areas met this benchmark in 2019. Importantly, the analogue replicate monitoring sites from which the benchmark was deduced, were also considerably lower than the benchmark during the 2019 monitoring event.

8.3.2.5 Passive Infra-red Motion Sensor Cameras

Motion sensing cameras were positioned at each mine rehabilitation replicate monitoring site for a minimum of two nights during the 2019 monitoring event. Native and pest animal species recorded are described in Table 8-3.

Table 8-3 Species recorded via passive infra-red motion sensor cameras

Replicate monitoring site	Species	Abundance
RH2008	Australian Raven Fox Common Wallaroo	1 1 1
RH2008D	Swamp Wallaby Brown Hare	2 1
RH2010	Swamp Wallaby	3
RH2011	Not sampled in 2019	–
RH2018A	Common Wallaroo	2
RH2018B	Common Wallaroo	2
	Fox	1
RH2018C	Nothing recorded	–

8.3.2.6 Salvaged woody debris monitoring

Salvaged woody debris has been incorporated into the 2008 mine rehabilitation area only. One location was sampled during the 2019 monitoring event, with no animals recorded. Woody debris monitoring was also completed at the four analogue replicate monitoring sites associated with the Annual Leard State Forest Biological Monitoring program. A combined mean of 2.8 reptiles was recorded from extant habitats associated with the larger Leard State Forest remnant during the 2019 monitoring event.

8.4 Growth Performance

BCOPL commissioned a review of site rehabilitation in May 2013 with the purpose of measuring, analysing and reviewing the growth of rehabilitation trees planted between 2008 and 2012 to inform future rehabilitation management. A summary of findings for the different yearly plantings was provided in the 2014 AEMR. No further growth performance studies were undertaken at BCM during the reporting period.

8.4.1 Growth Medium Suitability

In early 2016 Landloch was commissioned to undertake a preliminary evaluation of growth media within the 2008 to 2014 rehabilitation areas (Landloch, 2016). The assessment was conducted in accordance with the procedure detailed in the Soil Management Protocol (2015). Samples were subject to soil surface descriptions, morphological descriptions, field tests and laboratory analysis.

The analysis concluded that there were no major limitations to plant growth. In general terms, the growth media were considered adequate to support vegetation and are clearly able to support the growth of tubestock planted.

Nutritional differences in topsoil materials between rehabilitation sites and analogue sites were identified but can be easily rectified with fertiliser application. Erosion was also noted across rehabilitation areas which may be improved through incorporation of gypsum. Overburden substrate alkalinity was observed to be high but did not appear to be impacting growth of seedlings. The growth media criteria have been updated in the revised SMP, which is currently awaiting DPIE approval. No further growth medium suitability studies were undertaken during the reporting period.

8.5 Rehabilitation Improvements and Initiatives

During the 2019 reporting period BCOPL has continued with approved rehabilitation activities as usual. No trials or research projects were undertaken during the reporting period. Prolonged dry conditions were experienced throughout 2019 which may impact the success of BCOPLs rehabilitation activities. To counter the potential effect of the dry conditions on its rehabilitation activities BCOPL subjected its recently planted tubestock to a significant watering program.

8.6 Rehabilitation in 2020

Rehabilitation activities proposed for the next reporting period will focus on the progressive decommissioning of mining areas and overburden emplacement areas, followed by the establishment of suitable landforms and growth mediums. All rehabilitation will be undertaken in accordance with the MOP.

8.6.1 Topsoils and Forest Resources

The gathering of topsoil from Leard State Forest will continue, in conjunction with the 2020 tree clearing program as specified in the MOP. Other recovered forest resources from the tree clearing program, such as salvaged timber containing hollows, will be placed in rehabilitation areas. Particular emphasis will be placed on the insertion of salvaged logs, hollows and stags into the rehabilitation area and installation of nest boxes into the rehabilitation areas during 2020. Topsoils will be ameliorated where required, including through application of gypsum, and spread on shaped landforms or stockpiled for later use.

8.6.2 Drainage and Erosion Controls

Drainage and erosion controls will be installed on exposed overburden emplacement areas undergoing rehabilitation in accordance with the *NSW Soil Conversation Service, Design Manual for Soil Conservation Works – Technical Handbook No. 5* (Aveyard, 1982).

8.6.3 Seed Collection and Planting

BCOPL engages contractors for the collection of seed from the Leard State Forest for future plantings. These seeds are sent to a local nursery for propagation and the seedlings are then returned to site for planting. Seed collection will remain an ongoing activity in the next reporting period. Native vegetation continues to be established on the western and southern overburden emplacement areas using tube stock propagated from seed collected from the Leard State Forest.

8.6.4 Temporary stabilisation

Temporary stabilisation works continue to occur in batters, windrows, drains and stockpiles, as necessary. These temporary exposed areas are typically seeded with fast growing, sterile cover crops using pasture species such as Rye Corn and Japanese Millet in order to reduce wind and water erosion.

8.6.5 Monitoring

Further rehabilitation biodiversity monitoring will be undertaken in the next reporting period through the services of qualified ecologists.

9 ACTIVITIES PROPOSED FOR NEXT ANNUAL REVIEW PERIOD

Activities that are proposed for the next Annual Review reporting period are detailed in Table 9-1.

Table 9-1 Activities proposed for next reporting period

Activity	Target Completion Date
Clearing of vegetation in advance of mining	February-April 2020
Continued implementation of a noise attenuation program for items of plant exceeding modelled sound power levels. This will continue as an iterative process and be ongoing throughout the next reporting period.	Ongoing
Continued implementation of the Southern Rehabilitation Strategy	Ongoing
Undertake Independent Audit in accordance with Condition 10 of Schedule 5 of the Project Approval	2020
Undertake significant exploration program ahead of mining.	Throughout 2020
Update the SIMP to reflect current mining activities and conditions	2020

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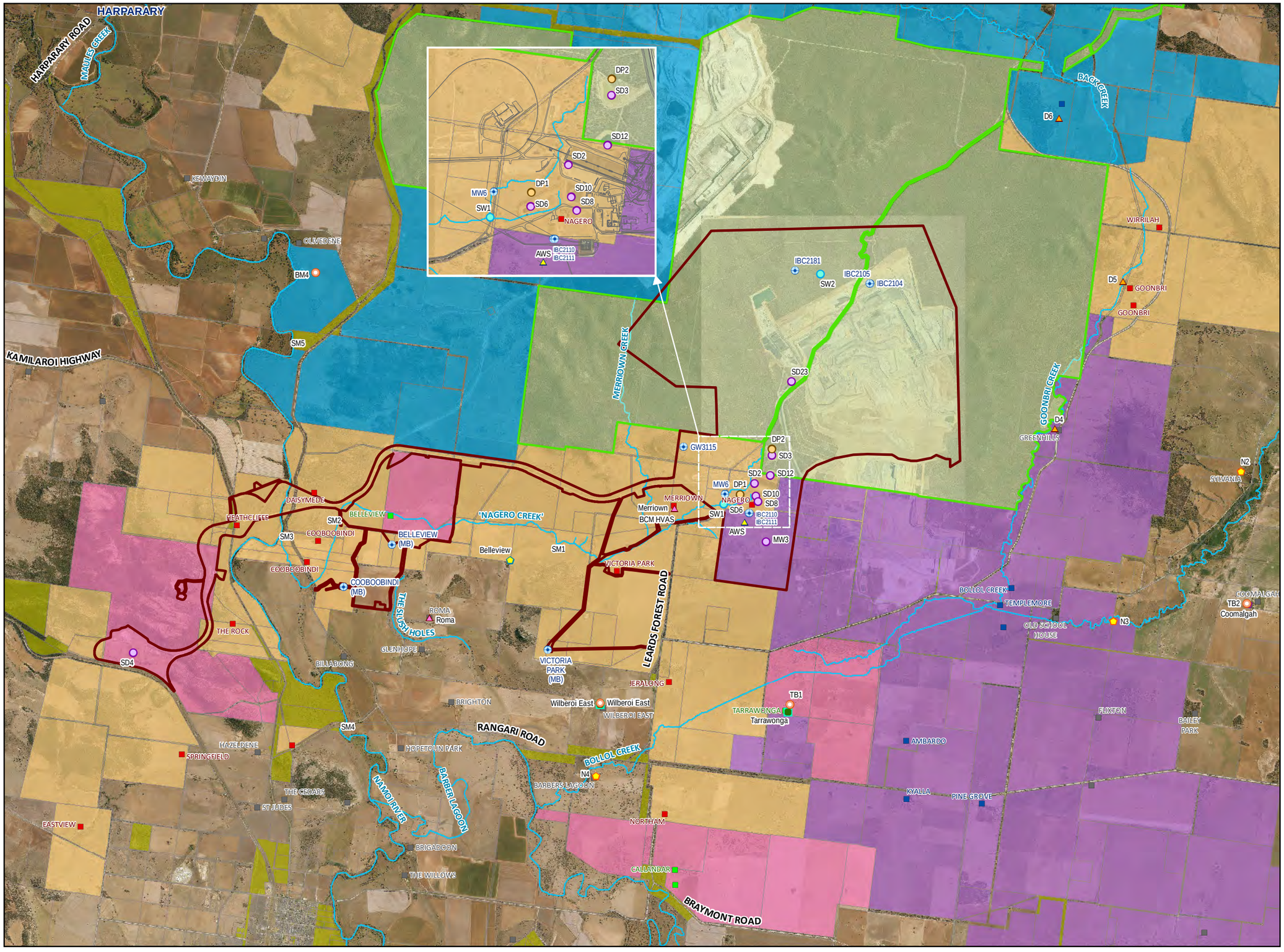
Appendix A

Environmental Monitoring Location Plan



Legend

- Blast monitor
- Dust gauge
- Meteorological station
- PM10 dust sampler
- Noise monitor (attended)
- Noise monitor (unattended)
- Real time noise monitoring
- Mine water sample point
- Surface water monitoring site
- Water quality discharge monitoring
- TEOM location
- Groundwater monitoring bores
- Boggabri Coal residence
- Whitehaven Coal residence
- Mine jointly owned residence
- Privately owned
- Waterway
- Boggabri Coal Mine Project Approval Area
- Boggabri Coal property
- Joint ownership property
- Maules Creek WHC property
- Tarrawonga WHC property
- Crown land
- Private property/Not specified
- Leard State Conservation Area

0 0.5 1 1.5 2 KM

Scale 1:75,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
BCOPL (2017,Dec 2018);

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REVIEWED BY.	N.Cooper
DATE.	18/02/2020

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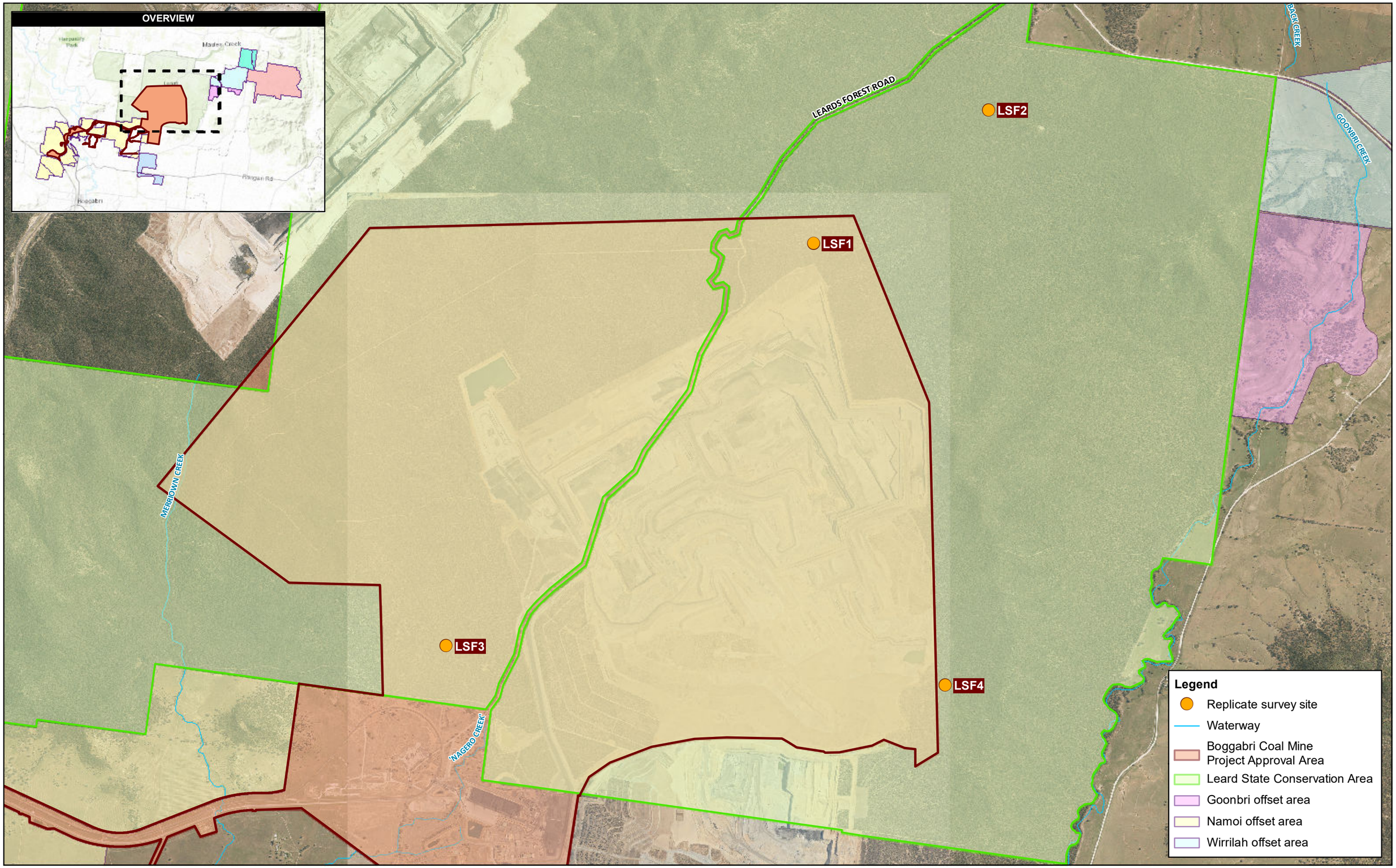
FIGURE A-1

TITLE. BOGGABRI COAL MINE PROJECT
BOUNDARY AND ENVIRONMENTAL
MONITORING SITES

DRAWING. \\corp.pbwan.net\ANZ\SectionData\Environment\EPSE\ECOLOGY\Z_boggabri\GIS\5_Shared_GIS\54_Production\Maps\2020\Environment\AEMR\PS118825_AEMR_002_A1_MON.mxd

Appendix B

Biodiversity Monitoring Maps



0 250 500 750 1,000 M

Scale 1:30,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
Atlass-Aerometrex Pty Ltd via BCOPL (2017)Sources: Esri, HERE, Garmin, Intermap,

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REVIEWED BY. N.Cooper
DATE. 24/03/2020

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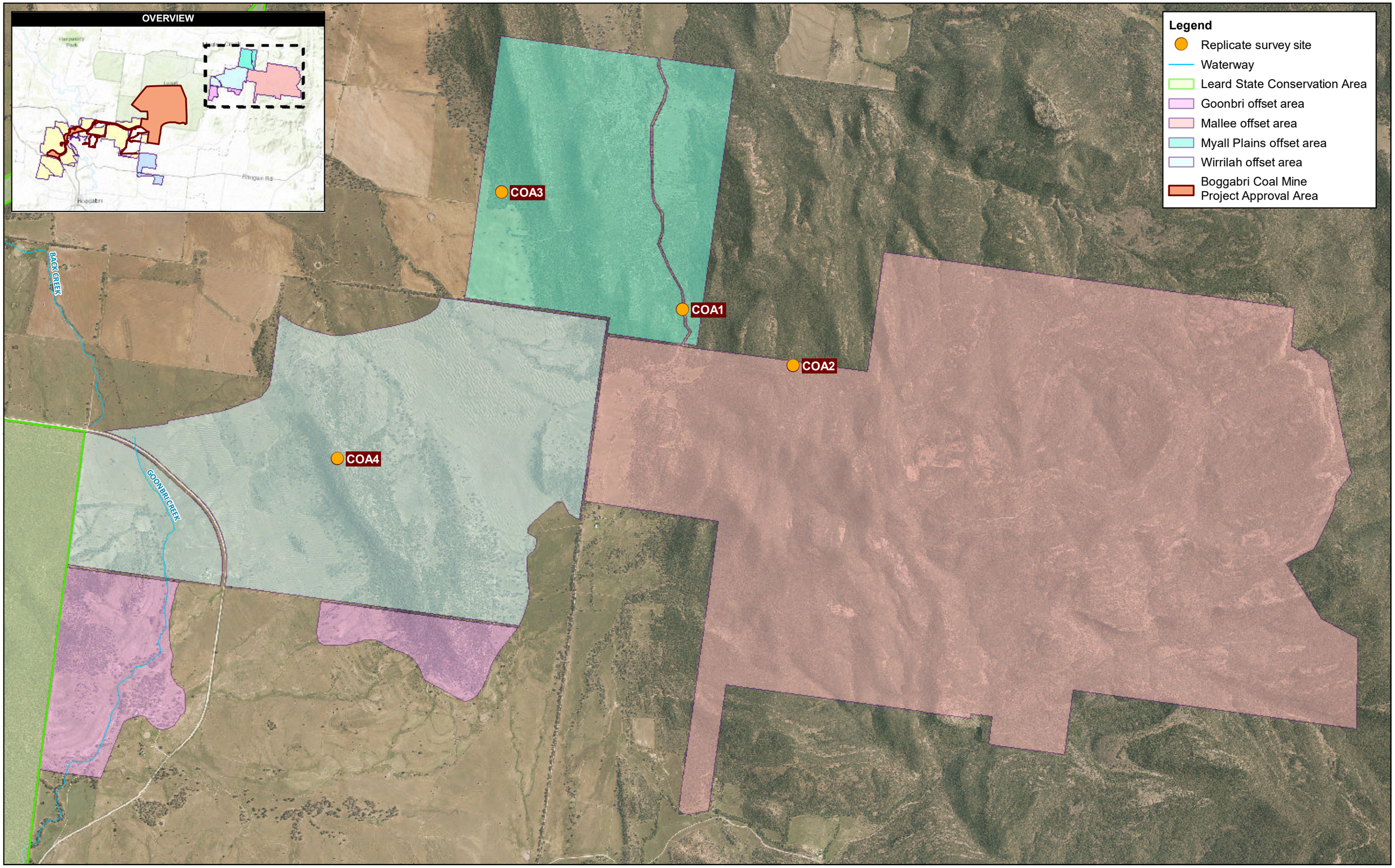
FIGURE **B-1**

TITLE. **LOCATION OF REPLICATE SURVEY SITES - LEARD STATE FOREST**

DRAWING: \\corp.pbwan.net\ANZ\SectionData\Environment\EPSE\ECOLOGY\Z_boggabri\GIS\5_Shared_GIS\54_Production\Maps\2020\Environment\AEMR\PS118825_AEMR_003_A1_MON_LSF.mxd



0 250 500 750 1,000 M

Scale 1:30,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
Atlass-Aerometrex Pty Ltd via BCOPL (2017)Sources: Esri, HERE, Garmin, Intermap,

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AUTHOR. suansrir

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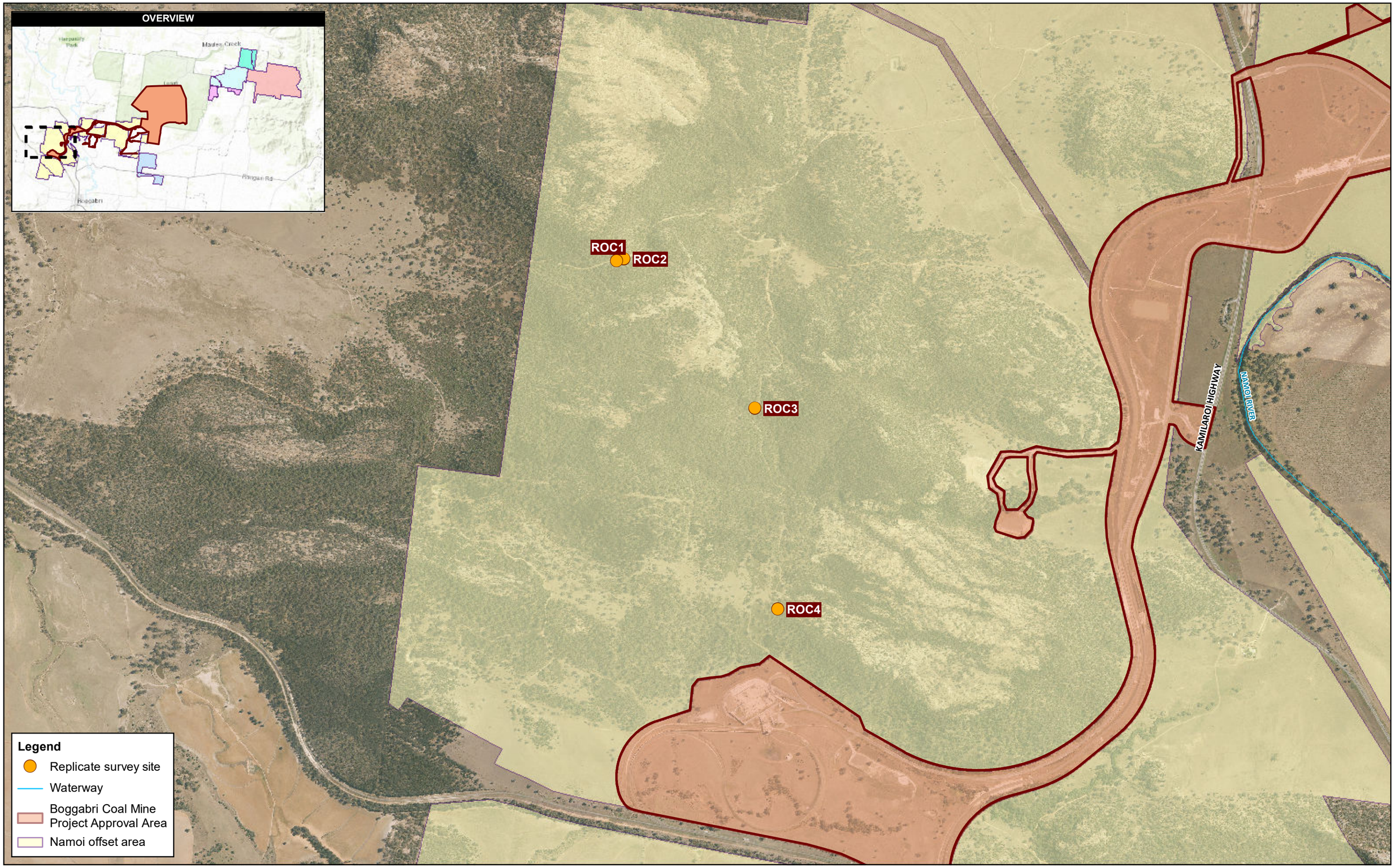
FIGURE **B-2**

TITLE. **LOCATION OF REPLICATE SURVEY SITES - CENTRAL OFFSET AREA**



N
W E
S

0 100 200 300 400 M

Scale 1:15,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
Atlass-Aerometrex Pty Ltd via BCOPL (2017)Sources: Esri, HERE, Garmin, Intermap,

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FIGURE **B-3**

TITLE. **LOCATION OF REPLICATE SURVEY SITES - ROCKLEA PROPERTY (NAMOI OFFSETS)**

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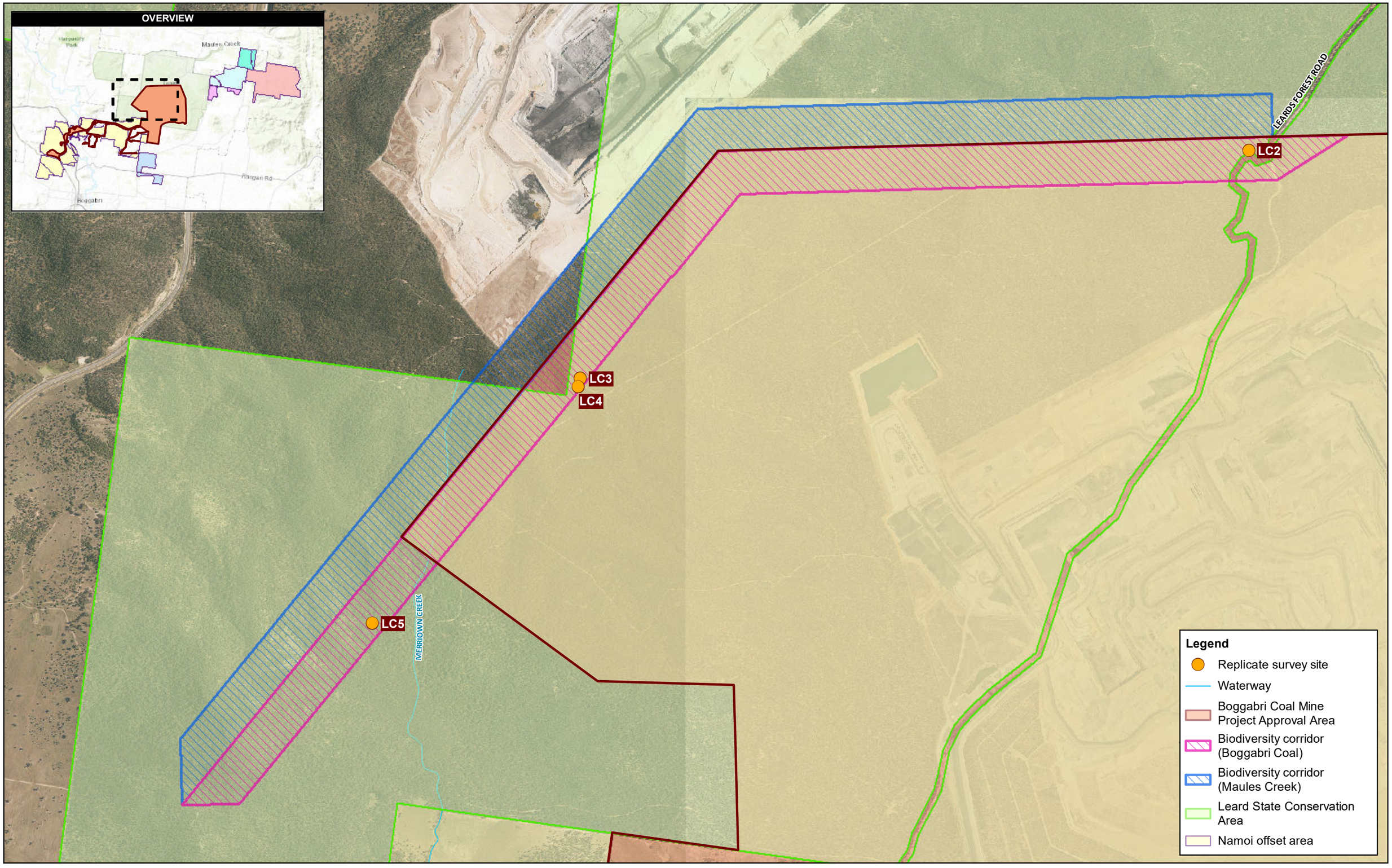

0 150 300 450 600 M

Scale 1:20,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
Atlass-Aerometrex Pty Ltd via BCOPL (2017)Sources: Esri, HERE, Garmin, Intermap,

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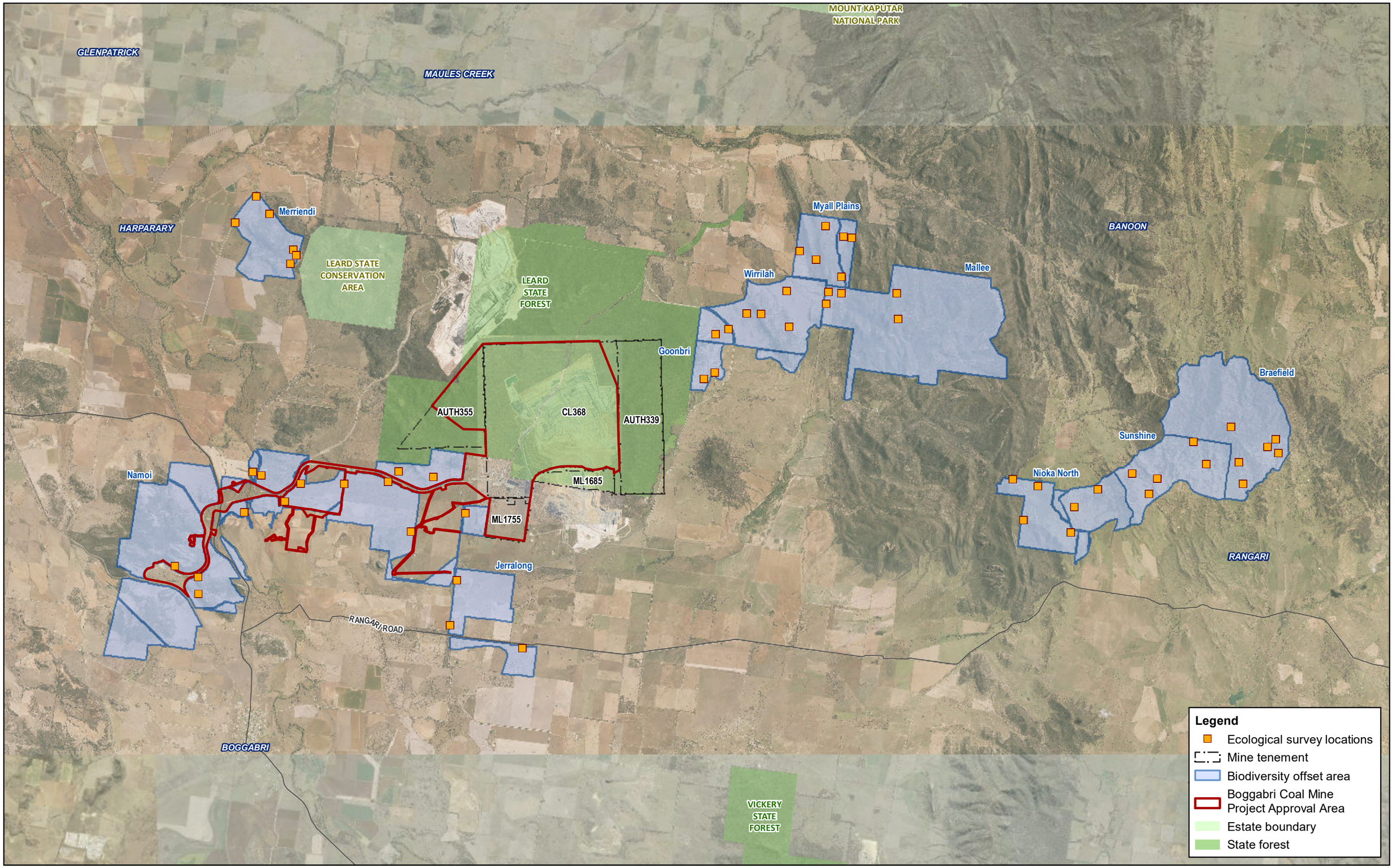
FIGURE **B-4**

TITLE. **LOCATION OF REPLICATE SURVEY SITES - LEARD STATE FOREST WILDLIFE CORRIDOR**



N
W E
S

0 1.5 3 km

Scale 1:125,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL (2017,2018);Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)

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AUTHOR.	suansrir
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DATE.	24/03/2020

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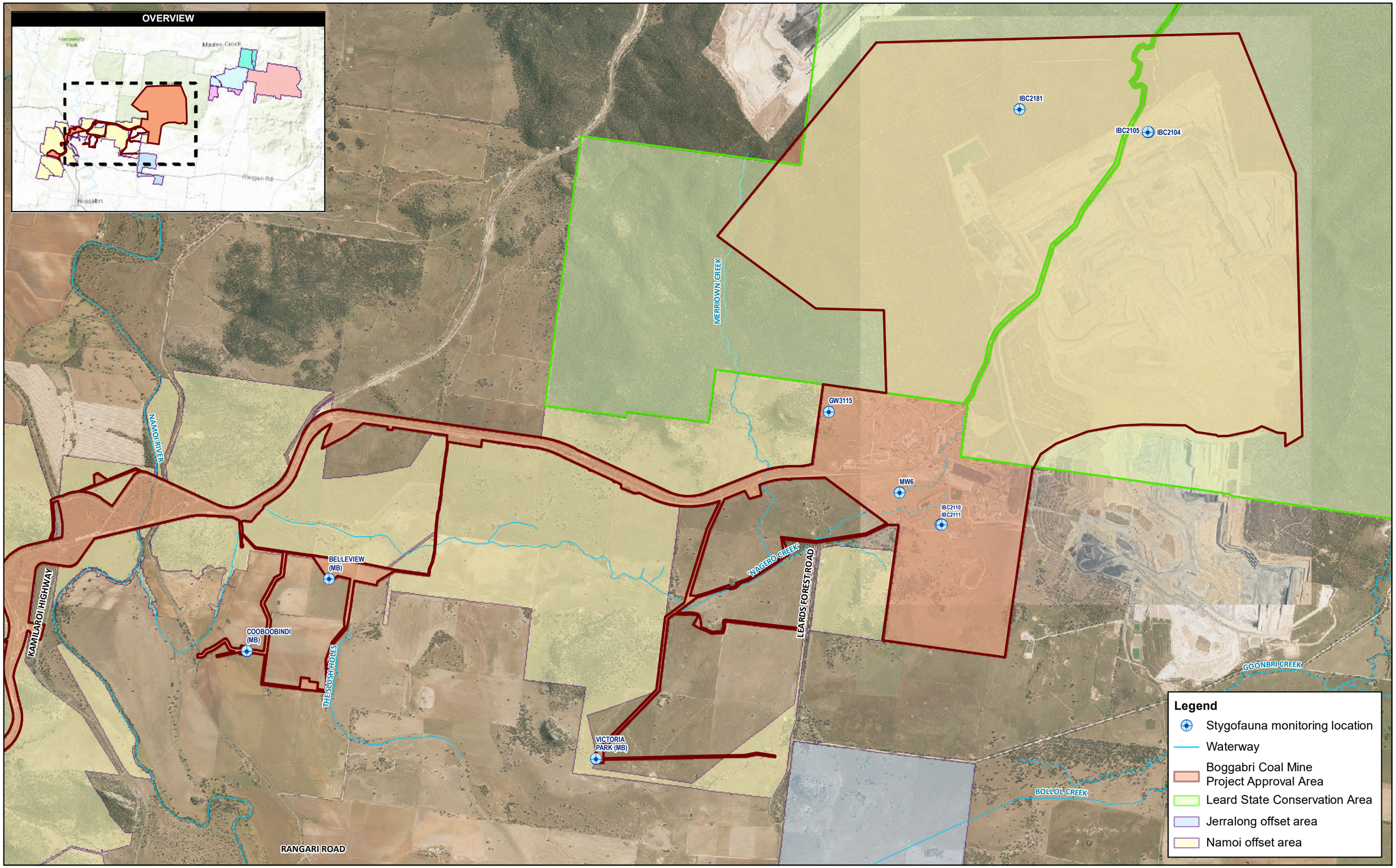
FIGURE **B-5**

TITLE. **LOCATION OF REPLICATE SURVEY SITES**



0 0.4 0.8 1.2 KM

Scale 1:40,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery:
Atlass-Aerometrex Pty Ltd via BCOPL (2017)Sources: Esri, HERE, Garmin, Intermap,

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AUTHOR. suansrir

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FIGURE **B-6**

TITLE. **LOCATION OF STYGOFAUNA MONITORING SITES**