

Boggabri Coal Operations Pty Ltd

Boggabri Coal Mine 2020 Annual Review

3 August 2021

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BOGGABRI COAL

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Revision Control Chart

Rev No	Original	1	2	3	4
Revision Date	28 April 2021	3 August 2021			
Prepared by	James Bailey & Associates	S Torrance			
Reviewed by	H Russell	H Russell			
Approved by	R Taylor	R Taylor			
Signature					

Distribution Control

Company	Position
BCOPL	Environment Superintendent
Department of Regional NSW – Mining Exploration and Geosciences	Regional Environment Officer
Department of Planning, Industry and Environment	Senior Planning Officer
Department of Primary Industries – Agriculture	Area Manager North West
Department of Planning, Industry and Environment – Water	Water Regulation Officer
NSW Environment Protection Authority	Regional Operations Officer Armidale
Forestry Corporation of NSW	Forestry Occupancy Supervisor
Community Consultative Committee	Chairperson
Goldings Contractors Pty Ltd (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	• Idemitsu Resources Australia Pty Limited via its subsidiary company, Boggabri Coal Pty Ltd – 80%; • Chugoku Electric Power Australia Resources Pty Ltd – 10%; and • NS Boggabri Pty Limited – 10%.
Mining Lease #	CL 368, ML 1755
Name of holder of mining lease	• Idemitsu Resources Australia Pty Limited via its subsidiary company, Boggabri Coal Pty Ltd – 80%; • Chugoku Electric Power Australia Resources Pty Ltd – 10%; and • NS Boggabri Pty Limited – 10%.
Water Licence #	See Table 2-2 below for details
Name of holder of water access licences	• Idemitsu Resources Australia Pty Limited via its subsidiary company, Boggabri Coal Pty Ltd – 80%;

Annual Review Title Block	
	• Chugoku Electric Power Australia Resources Pty Ltd – 10%; and • NS Boggabri Pty Limited – 10%.
MOP Commencement Date	1 January 2020
MOP Completion Date	31 December 2024
Annual Review Commencement Date	1 January 2020
Annual Review Completion Date	31 December 2020
I, Russell Taylor, certify that this audit report is a true and accurate record of the compliance status of Boggabri Coal Mine for the period 1 January 2020 to 31 December 2020 and that I am authorised to make this statement on behalf of Boggabri Coal Operations Pty Limited.	
Name of authorised reporting officer	Russell Taylor
Title of authorised reporting officer	General Manager
Signature of authorised reporting officer	
Date 28 April 2021	

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2019 Site Water Balance

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
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
HVAS	High Volume Air Sampler
HTV	High Trigger Value
IAR	Idemitsu Australia Resources Group
IBA	Independent Biodiversity Audit
LOR	Limit of Reporting

Abbreviations	Terms
LTV	Low Trigger Value
MCC	Maules Creek Coal Mine
MEG	DPEI - Department of Mining, Exploration and Geoscience
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
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
SSD	State Significant Development 09_0182
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 SSD 09_0182 (including Statement of Commitments), mining leases and other relevant approvals as at the end of the 2020 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?
SSD 09_0182 (incl. Statement of Commitments)	No
Coal Lease 368	No
Mining Lease 1755	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
WAL42234	Yes

Table 1-2 Non-Compliances During the Reporting Period

Relevant approval	Ref.	Condition Description	Compliance status	Comment	Where addressed in the Annual Review
SSD 09_0182	Schedule 3 Condition 9	Sound Power Levels	Non-Compliance Low Risk	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: Sound power screening during 2020 recorded 4 items of screened plant that recorded exceedances of 3dB or greater	Section 6.3.2.2
SSD 09_0182	Schedule 3 Condition 27	24h PM_{10} criterion of 50µg/m^3	Non-Compliance Low Risk	One exceedance of the short term 24-hour average criteria (50 µg/m^3) occurred at the Cooboobindi HVAS monitor on the 2 February 2020, with a result of 57 µg/m^3.An investigation by BCOPL found that for the 24hr period the HVAS monitor was operational, the wind was blowing from the north to north west and from the south. During this monitoring period, Wilberoi East, Tarrawonga and Goonbri TEOMs had results of 22.98, 40.54 and 24.26 ug/m^3 respectively. The monitor was surrounded by cropping land and it was likely impacted by localised ploughing and not mining activities.	Section 6.2.2.2.1
			Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: The status of extraordinary event days has not been agreed with the Secretary and DPIE was not notified of recorded exceedances of the relevant air quality criteria. Whilst it is acknowledged that exceedances of the air quality criteria do not necessarily equate to a non-compliance, it is considered that all exceedances should be notified to DPIE, particularly given that note (a) to Schedule 3 Condition 27 states that criteria are "Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources)". If the exceedance is not attributable to BCOPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification.	Section 6.2.2.2.1
SSD 09_0182	Schedule 3 Condition 31	Air Quality and Greenhouse Gas Management Plan (AQGHGMP)	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: Not effectively implementing the AQGGMP due to the following: 1) DPIE was not notified of recorded exceedances of the relevant air quality criteria. Whilst it is acknowledged that exceedances of the air quality criteria do not necessarily equate to a non- compliance, it is considered that all exceedances should be notified to DPIE, particularly given that note (a) to Schedule 3 Condition 27 states that criteria are "Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources)". If the exceedance	Section 6.2.2.2.1 and Table 6-6

Relevant approval	Ref.	Condition Description	Compliance status	Comment	Where addressed in the Annual Review
				is not attributable to BCOPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification; 2) While notes relating to exceedances of relevant air quality criteria were provided, these exceedances (even though not necessarily non- compliances) were not logged in the Incident Register and evidence of completion of BCOPL Incident Report Forms were not provided. It is also noted that a standard methodology was not adopted for the presentation of the investigation findings.	
SSD 09_0182	Schedule 3 Condition 38(b)	Surface Water Management Plan (SWMP)	Non-Compliance (Low Risk)	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: The implementation of the currently approved SWMP is non-compliant as the clean water drain presented in Appendix A of the SWMP to the north of the disturbance area has been mined through and has not been reinstated. It is acknowledged that the update to the SWMP (Rev8) has been prepared depicting the absence of the clean water drain and that a report has been prepared by GHD to justify not reinstating this drain and to evidence that the site is not harvesting clean water outside of harvestable rights allowances. The update to the SWMP was submitted to the DPIE for approval in July 2019; however, given that it has yet to be approved the implementation of the approved SWMP is non-compliant.	Section 7.1.2.1
SSD 09_0182	Schedule 3 Condition 38(c)	Groundwater Management Plan (GWMP)	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: The implementation of the currently approved GWMP is non-compliant as groundwater monitoring was not undertaken at all required bores during the reporting period. It is acknowledged that the updated the GWMP (Rev 8) was submitted to DPIE in July 2019 to update the current monitoring on site, however it is yet to be approved.	Section 7.2.2
SSD 09_0182	Schedule 3, Condition 54	Eucalyptus Forestry Plantation Offset Strategy	Non - Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: BCOPL are required to prepare a Eucalyptus Forestry Plantation Offset Strategy to the satisfaction of Forestry NSW within 12 months of the date of SDD 09_0182. SSD 09_0182 was approved 18 July 2012. BCOPL have shown evidence of progress being made on this strategy. At the end of the reporting period BCOPL have provided Forestry NSW with a draft strategy. Evidence has been provided that Forestry NSW does not see benefit in the strategy	Table 11-1

Relevant approval	Ref.	Condition Description	Compliance status	Comment	Where addressed in the Annual Review
				proposed by Boggabri Coal.	
SSD 09_0182	Schedule 3 Condition 64	Gunnedah Traffic Study	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: No report was provided to Gunnedah Shire Council within 12 months of the Gunnedah Traffic Study.	Section 6.12.2.2
SSD 09_0182	Schedule 5 Condition 4	Annual Review	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: While long term trends associated with groundwater are presented in the annual reviews, there is little information relating to longer terms trends for air quality, surface water and noise over the life of mine as required by this condition.	Section 6.2.2.5 Section 6.3.2.4 Section 7.1.3.4.4
SSD 09_0182	Schedule 5 Condition 5	Revision of Strategies, Plans and Programs	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: BCOPL do not have a suitable way to track and manage the required revisions of management plans, strategies and programs required under SSD 09_0182 to successfully comply with this condition.	Section 6
EPL 12407	P1.3	Water Quality Monitoring	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: The water monitoring at BCM was not in line with monitoring sites within the EPL due to sites being compromised by mining. An EPL variation (submitted 19 March 2019) seeking the update of monitoring locations to reflect current monitoring operations at BCM was approved on 5 February 2021.	Section 7.1.2.1 and Section 7.2
EPL 12407	M2.2	Air Monitoring Requirements	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: The HVAS monitoring at BCM was not in line with monitoring sites within the EPL. The Merriown HVAS was no longer relevant as the property was Mine-Owned. The HVAS has been relocated to Glenhope. An EPL variation (submitted 19 March 2019) seeking the update of monitoring	Section 6.2

Relevant approval	Ref.	Condition Description	Compliance status	Comment	Where addressed in the Annual Review
				locations to reflect current monitoring operations at BCM was approved on 5 February 2021.	
EPL 12407	M2.3	Groundwater Monitoring	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: Groundwater locations was not able to be undertaken (site 10,11 and 18). This was due to 10 and 11 being destroyed by mining and 18 being blocked. A variation for the EPL was lodged in March 2019 to remove the destroyed bores from the monitoring requirements. This variation was approved 5 February 2021.	Section 7.2
EPL 12407	M2.2	Deposited Dust Monitoring Requirements	Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: During the sampling period for February 2020, depositional dust results for monitoring point 25 (D5-Goonbri), were not obtained as the sampling bottle was broken during the sampling period.	Section 6.2.2.1
CL368	Condition 4	Rehabilitation Reporting	Administrative Non-Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: The annual reviews generally cover these requirements. However, progression towards rehabilitation completion criteria is only mentioned with regard to the species richness analogue benchmark. The 2020 IEA stated that rehabilitation areas should be tracked against the phases in the MOP with evidence provided to justify whether the rehabilitation has met the rehabilitation objectives of that phase and domains.	Section 8.2.4
CL368	Condition 9	Cooperation Agreement	Non - Compliance	The non-compliance was identified during the Independent Environmental Audit. The auditor's comments were: BCM is required to make every reasonable attempt, and be able to demonstrate its attempts, to enter into a cooperation agreement with the holder of any overlapping titles. It was identified during the 2020 Resources Regulator Audit that Petroleum Exploration Licence 0001 (PEL001) overlaps with approximately half of CL368. No evidence that any attempt had been made to contact the overlapping title holder to discuss any arrangements for a co-operation agreement. An official caution was issued on 8 April 2020 to BCOPL as a result of this breach.	Table 11-2

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 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) on behalf of Idemitsu Australia Resources (IAR) and its joint venture partners. BCOPL is owned by Idemitsu Australia Resources Group (IAR), a subsidiary of Japanese company, Idemitsu Kosan Pty Ltd. BCM is owned by the following joint venture partners:

- IAR via its subsidiary company, Boggabri Coal Pty Ltd – 80%;
- Chugoku Electric Power Australia Resources Pty Ltd – 10%; and
- NS Boggabri Pty Limited – 10%.

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 2009, BCOPL lodged a major project application under the former Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Project Approval 09_0182, 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 2033 (the Project).

Under Project Approval 09_0182, 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 beneficiation of ROM coal required for the mine to reach the approved production rates. The grant of the Project Approval also facilitates the upgrade of the overburden and coal production fleet and other ancillary infrastructure, as well as the option of a dragline.

Seven modifications to Project Approval 09_0182 have been lodged since granting of the original approval. One of these modifications (Mod 1) was subsequently withdrawn. Mod 7 was most recently approved by the Independent Planning Commission (IPC) on the 27 May 2019.

On 20 June 2019, a delegate of Minister declared the Project Approval 09_0182, as modified to be “State Significant Development” under Clause 6 of Schedule 2 of the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*, for the purposes of the EP&A Act. Accordingly, from 20 June 2019, PA 09_0182 is known as SSD 09_0182 (SSD).

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 Department of Regional NSW – Resources Regulator. BCM currently operates in accordance with the MOP, Amendment A dated March 2020 that applies to activities at the BCM between 2020 and 2024.

2.2 Mine Contacts

Table 2-1 BCM Mine Contacts

General Manager Operations: Company: Address: Phone: Fax:	**Russell Taylor** Boggabri Coal Operations Pty Limited 386 Leard Forest Rd, Boggabri, NSW, 2382 02 6749 6000 02 6743 4496
Health, Safety, Environment, Community and Training Manager: **Company:** **Address:** **Phone:** **Fax:**	**Danielle Nieuwenhuis** 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

2.3 Purpose and Scope of Report

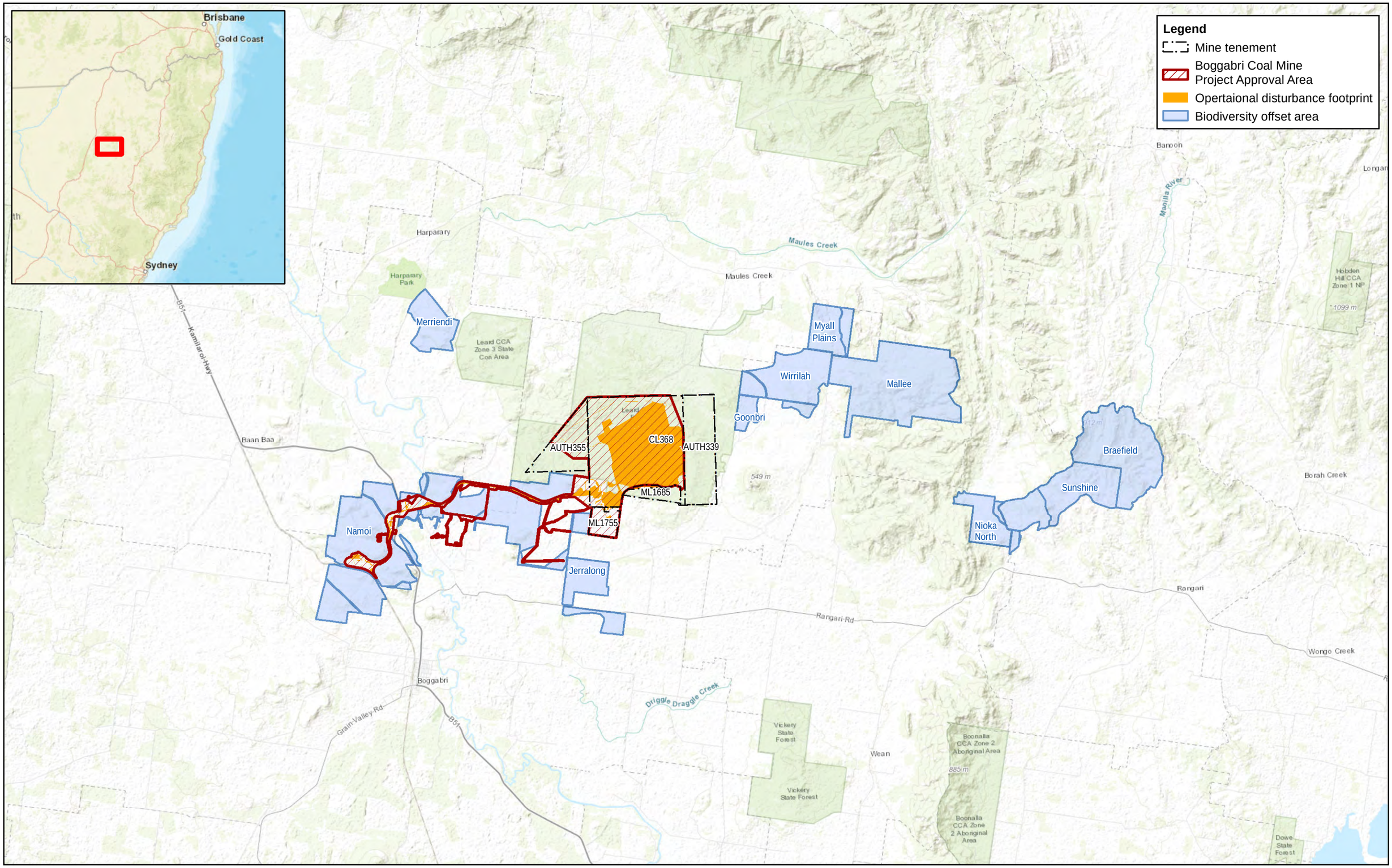
This Annual Review discusses the environmental performance of BCOPL and its contractors, in relation to compliance with the conditions of SSD 09_0182, and other relevant leases, licences and approvals. It provides a summary of operational and environmental management activities undertaken at the BCM during the reporting period (1 January to 31 December 2020) 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) and relevant modification documentation. The Annual Review also covers community relations and addresses mine development and rehabilitation undertaken during the reporting period.

The Annual Review has been prepared in accordance with the following:

- Schedule 5, Condition 4 of SSD 09_0182;
- *Post-approval requirements for State significant mining developments – Annual Review Guideline* (Annual Review Guideline) (NSW Government, 2015);
- Coal Lease 368 (CL 368) and Mining Lease 1755 (ML 1755);
- 2020-2024 MOP, Amendment A dated March 2020; and
- Outcomes from the 2019 Annual Review feedback and inspection.

Key requirements of these approvals are described in Appendix A. A map illustrating the mine locality and project boundary is provided in Figure 2-1, while figures illustrating the relevant monitoring points and land ownership are included within Appendix B. Offset properties for BCM are identified on the figures provided in Appendix C.

BCOPL requested an extension of one month to the submission of the 2020 Annual Review from DPIE and the Resources Regulator. Both DPIE and Resources Regulator approved this extension requesting the Annual Review be submitted by the 29 April 2021. Correspondence confirming this approval is provided in Appendix D.



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Scale 1:175,000

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 BC2021_AEMR001_A1_locality

AUTHOR. suansrir

REVIEWED BY. N.Cooper

DATE. 9/03/2021

IDEMITSU BOGGABRI COAL

FIGURE 2-1

TITLE. LOCALITY PLAN

Idemitsu Australia Resources Pty Ltd

DRAWING. F:\WSP O365\Boggabri GIS-Ecology - General\5_Shared\54_Production\Maps\2021\Environment\AEMR\BC2021_AEMR001_A1_locality.mxd

3 APPROVALS

3.1 Approvals, Licences and Mining Leases

Table 3-1 summarises the key mining leases and approvals currently held by BCOPL which are relevant to the operations at BCM.

Table 3-1 Key Approvals, Consents, Mining Leases and Licences

Description	Date granted/ commencement date	Expiry/duration
Project Approvals		
SSD 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/Mining Leases		
Coal Lease CL 368	15 November 1990	14 November 2032
Mining Lease ML1755	30 June 2017	30 June 2038
Mining Leases/Authorisations		
Authorisation A 355	19 July 1984	11 April 2018 (renewal lodged)
Authorisation A 339	11 April 1984	11 April 2022
Environment Protection Licences		
Environment Protection Licence (EPL) 12407	11 January 2006	In perpetuity (Anniversary 11 January)
Water Licences		
WAL12691	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
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
WAL37519	6 June 2016	In perpetuity
WAL42234	9 January 2019	In perpetuity
90FW833717	21 September 2015	4 April 2030
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 2021
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

Description	Date granted/ commencement date	Expiry/duration
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 of NSW Agreements/Permits		
Forestry Compensation Agreement	15 May 2009	14 November 2032
Land Access and Compensation Arrangement	15 May 2009	11 April 2018 (renewal lodged)
Crown Lands Licences		
RI 507102	12 November 2012	14 November 2032
RI 533986	5 June 2014	14 November 2032

4 SUMMARY OF OPERATIONS

4.1 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); and
- Cultural Heritage Management Plan (CHMP).

The adopted clearing protocol follows a two-stage clearing process to minimise impacts on native biodiversity. Prior to the removal of vegetation, trained ecologists survey the areas proposed for clearing (refer to Section 6.5.2.3). Archaeological survey and salvage is also undertaken as part of the clearing process to identify and recover artefacts within the approved disturbance limits (refer to Section 6.9.2.1).

Soil sampling is undertaken prior to the stripping of topsoils and subsoils to identify the qualities of soil resource and to determine soil amelioration requirements. The results of soil sampling are entered into a soil inventory which is subsequently used to assist with rehabilitation planning.

Topsoil is then stripped in accordance with the approved Soil Management Protocol (SMP) and BMP. Stripped topsoil is preferentially 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.

During 2020 a total of 212,562m^3 of topsoil was stripped and pushed into windows. 130,381m^3 of this topsoil was loaded and hauled to stockpiles. There was 50,050m^3 of subsoil striped, loaded and hauled to stockpiles. A total of 30,000 m^3 of topsoil was spread over 6 ha of new rehabilitation area. At the end of December 2020, there was a total of 1,869,302m^3 topsoil and 50,050m^3 subsoil stored in stockpiles across the BCM.

4.2 Mining Operations

4.2.1 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 2020 is listed in Table 4-1.

Table 4-1 Equipment Fleet as at December 2020

Equipment	Number in fleet
Haul trucks	48
Excavators	12
Front end loaders	5
Dozers	21
Graders	4
Water carts	6
Service trucks	5
Drills	4
Total	**105**

4.2.2 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 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; and
- Coal processing through the CHPP.

Mining activities were compliant with the requirements of SSD 09_0182, including no clearing of native vegetation within 250 m of Maules Creek Mine lease boundary.

4.2.3 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.

4.2.3.1 Pit C

Pit C is a north progressing continuation of the 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.

4.2.3.2 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.

4.2.4 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 the Merriown and Bollol Creek Pits to the east and south east, the Jeralong and Bollol Creek Pits to the north and the surface mine limit to the West and South (refer Figure 8-1).

4.3 Production Statistics

From January to December 2020, mine production at BCM was carried out by BCOPL utilising Goldings Contractors Pty Ltd (Goldings) (previously operating as BGC prior to January 2020).

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 2020 calendar year in relation to the previous 2019 calendar year and those forecast for the 2021 calendar year is provided in Table 4-2 below.

Table 4-2 Production and Waste Rock Summary

Material	Project Approval Limit	Reporting Period (Calendar Year)		
		2019 (actual)	2020 (actual)	2021 (predicted)
Waste Rock/ Overburden (Mbcm^3)	N/A	54.3	55.4	53.5
ROM Coal (Mt)	8.6	7.4	7.5	8.2
Reject Material (Mt)	N/A	1.4	1.3	1.3
Stripped Topsoil (kbcm^3)	N/A	116.48	264.59	456
Saleable Product (Mt)	8.6 (by rail)	6.1	6.3	7.0

Mining operations during the 2020 calendar year remained below the ROM coal and railed product coal limits specified in SSD 09_0182. Specific conditions from Schedule 2 of SSD 09_0182 are presented in Table 4-3 with responses on the compliance of each also provided.

Table 4-3 Compliance with SSD Conditions

SSD 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.	Not triggered – transport of product coal by road was ceased following the completion of the Boggabri Rail Spur Line. Product coal from BCM was transported via the rail spur during 2020.
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 – 7.5 Mt of ROM Coal was extracted in 2020.
11. The Proponent may process up to 4.2 million tonnes of ROM coal in the CHPP in any calendar year.	Compliant– 3.8 Mt of ROM coal was processed in the CHPP during 2020.
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.	Not triggered – no coal was processed from the Tarrawonga Coal Mine in 2020.
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 – 6.3 Mt of product coal from the BCM was transported by rail in 2020. No coal from the Tarrawonga Coal Mine was transported in 2020.

SSD Condition No. and Description	Compliance Response
13. The Proponent may transport up to 200 tonnes of coal per year from the site by road for marketing and testing purposes. All other coal must be transported from the site via the Boggabri Rail Spur Line, except in exceptional circumstances as agreed with RMS and Council and approved by the Secretary.	Compliant – transport of product coal by road was ceased following the completion of the Boggabri Rail Spur Line. The Rail Spur was operational throughout 2020. Fifty tonne (50 t) of coal was transported by road for product testing and analysis purposes.

4.3.1 Saline or Potentially Acid Forming Materials

BCOPL monitors and manages the reject materials generated through its operations in accordance with the BCM Reject PAF Testing Procedure (October 2016). In January 2020, routine monitoring identified a reject sample with potentially acid forming qualities. This result was encountered from the sampling of the reject material from a special non-product typical sample (grab sample) of BR11-12 coal. In an operational setting, this coal would typically be co-blended with other non-PAF forming feed coals and limestone to manage water quality and maintain lower product sulfur and reject acid potential. Reject materials from the processing of this coal sequence were appropriately managed and co-disposed deep within the pit void in accordance with process outlined within Section 2.3.7 of the MOP.

A new reject sampler was installed and commissioned within the CHPP in September 2020. In line with the commissioning of this infrastructure, a static geochemical and physical testing program for weekly reject composites has been undertaken in coordination with RGS Environmental Pty Limited, to determine the variability in reject characteristics over a 26 week period. This program will provide recommendations for future reject management, which includes a continuous sampling programme.

4.4 Exploration

BCOPL undertook an exploration drilling programme in 2020, to improve knowledge of coal quality and structure for modelling purposes.

A total of 90 infill holes were drilled by BCOPL during the reporting period. Details of BCM's infill drilling during 2020 and relevant figure is provided in Appendix E.

4.5 Construction Activities during 2020

A summary of construction activities undertaken during the reporting period and their completion status is provided in Table 4-4.

Table 4-4 Summary of Construction Activities during the Reporting Period

Infrastructure	Commencement Date	Completion Date
Construction of a new product stockpile expansion	July 2019	February 2020

4.6 Next Reporting Period

4.6.1 Mining

During 2021, mining activity will involve the continuation of extraction within Pits C and E. Mining will advance in a northerly direction through Pit C and easterly direction into E Pit. Mining will advance towards the north utilising 100 m wide mining strips. Backfilling of the completed mining void will continue to the south as mining proceeds to the north.

4.6.2 Exploration

Exploration proposed for 2021 includes the drilling of 50 holes with total depths varying from 150m to 493m. The exploration programme will continue to improve knowledge of coal quality, structure, geotechnical, geochemical and fugitive emissions purposes.

4.6.3 Construction

Activities during the 2021 reporting period will involve the replacement of the ROM stockpile bin and the construction of an awning at the Ausdrill laydown area.

4.6.4 Production Waste

During 2021, coal reject materials will continue to be co-disposed within the pit void in a planned manner in accordance with the process described within the approved MOP. Rejects co-disposal will be undertaken in a manner to ensure that a minimum of five metres of non-carbonaceous material covers any reject deposit. The location of the reject material deposition will be determined depending on the planned mining and dumping sequence.

5 ACTIONS REQUIRED FROM 2019 ANNUAL REVIEW

The 2019 Annual Review was provided to NSW Department of Primary Industries (DPI) – Land and Natural Resources, DPI – Water (now known as DPIE – Water), NSW Environment Protection Authority (EPA), Department of Planning, Industry and Environment (DPIE), DPIE – Resources Regulator and Forestry Corporation of NSW in March 2020.

BCOPL received confirmation from DPIE on 25 June 2020 that the 2019 Annual Review generally satisfies the Annual Review requirements. However, two comments were received from DPIE regarding actions to be addressed in the 2020 Annual Review.

No feedback was received in writing from any other regulatory agency.

Table 5-1 Actions from the 2019 Annual Review

Action required from 2019 Annual Review	Requested by	Action taken by BCOPL	Where discussed in Annual Review
Section 4.6.2 reports that a number of groundwater bores were not monitored during the reporting period due to access and maintenance. The Department requires that all bores that form the monitoring suite are monitored throughout the reporting period. Please ensure that all monitoring is undertaken as required during subsequent monitoring periods;	DPIE	BCOPL re-drilled monitoring bore MW6 in August 2020 and has since undertaken the required sampling. Other bores that were unable to be sampled due to progression of mining have been removed from EPL 12407.	Section 7.2.1.1
Section 8 does not report on the renovation or removal of buildings as required by Section 8 of the Department's *Annual Review Guideline* (October 2015). Please ensure all subsequent Annual Reviews report on the renovation or removal of buildings as required.	DPIE	BCOPL have included this information within this Annual Review. All subsequent Annual Reviews will report on these requirements.	Section 8.2.4

6 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; and
  - Respond to non-compliance incidents and emergencies;
- Outlines BCM's monitoring, reporting and auditing requirements; and
- 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, SSD 09_0182 and other statutory requirements. The revision status of approved key EMPs, as required by SSD 09_0182, is summarised in Table 6-1.

It is noted that the Water Management Plan (WMP) has been updated and submitted to DPIE in July 2019; this update is still awaiting approval from DPIE at the end of the reporting period.

In response to recommendations within the 2020 Independent Environmental Audit (IEA), BCOPL will work to create a register to capture and track details of when documents are updated including the review and revision of management plans.

Table 6-1 Key EMPs

Management Plan	Version Approved by DPIE	Awaiting Approval
Mining Operations Plan (MOP)	March 2020 – 2020 to 2024 Amendment A	-
Blast Management Plan (BLMP)	November 2018 (Rev 5)	-
Blast Fume Management Protocol	July 2018 (Rev 3)	-
Air Quality and Greenhouse Gas Management Plan (AQGHGMP)	July 2018 (Rev 6)	-
Traffic Management Plan (TMP)	January 2015 (Rev 3)	
Cultural Heritage Management Plan (CHMP)	November 2016 (Rev 7)	-
Environment Management Strategy (EMS)	January 2013 (Rev 1)	-
Noise Management Plan (NMP)	April 2019 (Rev 13)	-
Water Management Plan (WMP) Surface Water Management Plan (SWMP) Groundwater Management Plan (GWMP) Site Water Balance (SWB)	May 2017 (Rev 6)	Rev 8 was submitted to DPIE in July 2019 and awaiting approval
Social Impact Management Plan (SIMP)	July 2016 (Rev 4)	Rev 5 October 2020 – Under consultation

Management Plan	Version Approved by DPIE	Awaiting Approval
Rehabilitation Management Plan (RMP)	N/A	Incorporated into the MOP at the request of DPIE. The current MOP was approved in April 2020.
Biodiversity Management Plan (BMP)	October 2018 (Rev 12)	-
Biodiversity Offset Strategy	March 2019 (Rev G)	-
Pollution Incident Response Management Plan (PIRMP)	N/A	-

6.1 Meteorology

6.1.1 Environmental Management

SSD 09_0182 (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* Guideline (EPA, 2007) 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 B.

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 6-2.

Table 6-2 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

6.1.2 Environmental Performance

6.1.2.1 Temperature

Maximum, minimum and average temperatures are calculated daily from the 15 min recordings. Figure 6-1 shows average monthly temperature records for the reporting period (2m MET recordings). Compared to the previous reporting period, the average minimum and maximum temperatures are notably higher in summer.

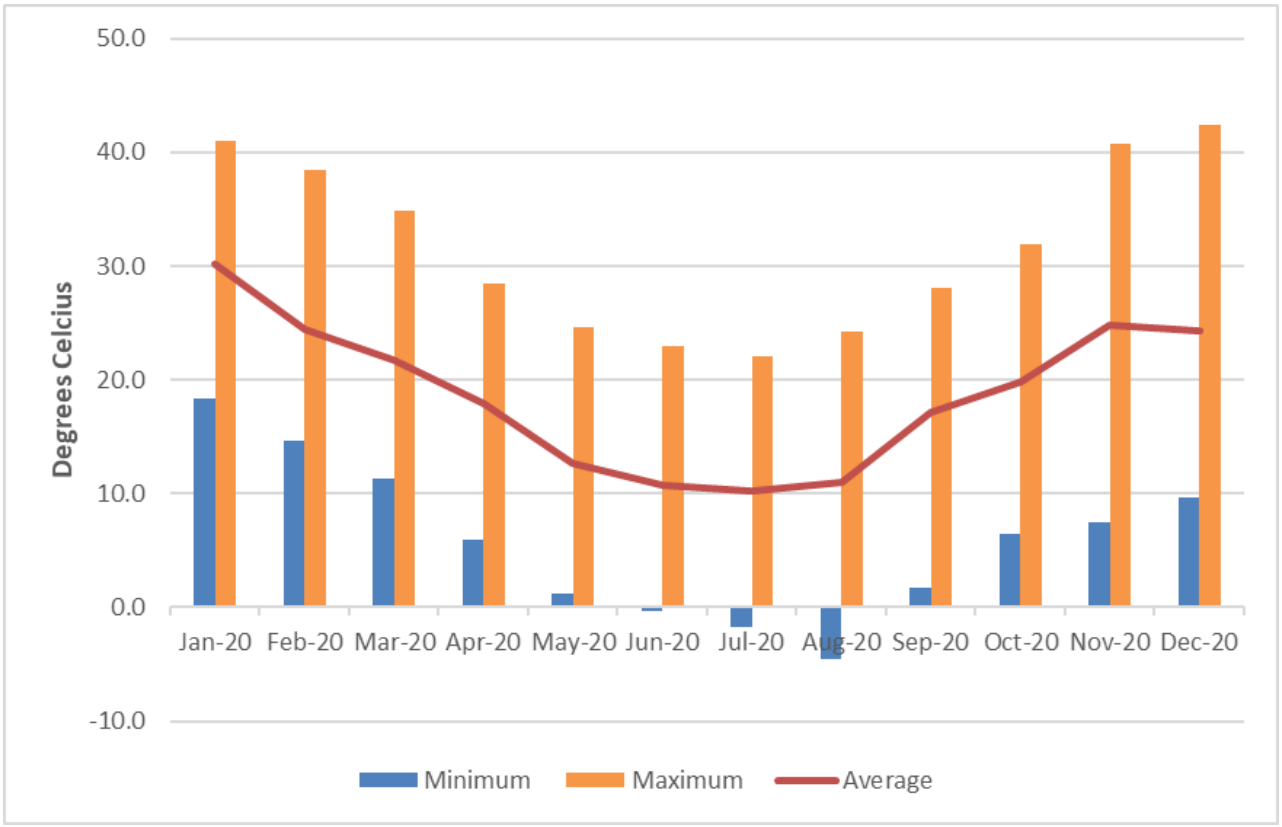


Figure 6-1 2020 Monthly Temperature Records

6.1.2.2 Rainfall

Rainfall is measured using an RG5 type flow-through monitor, with a 15-minute recording interval. Monthly rainfall totals for the 2020 reporting period are presented in Figure 6-2. A comparison of 2019-2020 rainfall is shown in Figure 6-3.

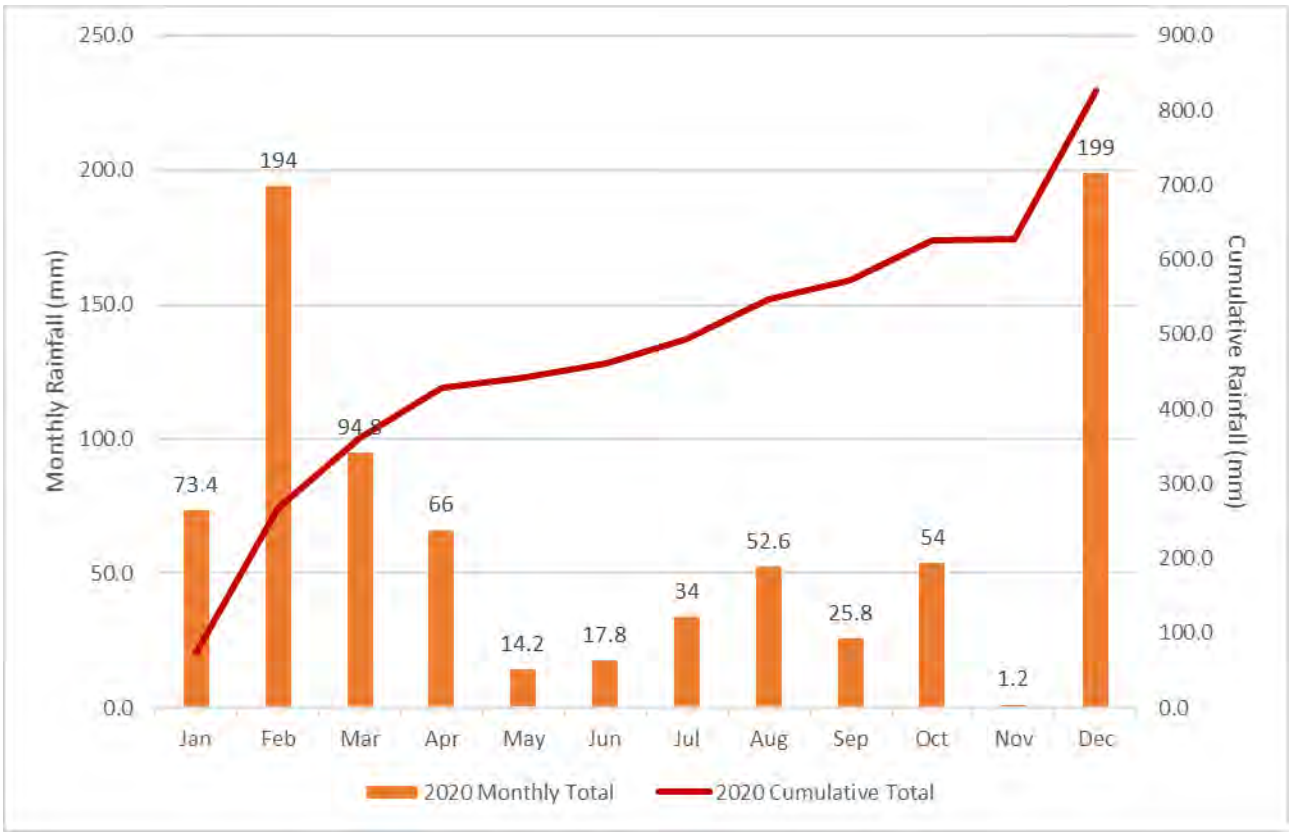


Figure 6-2 Monthly Rainfall

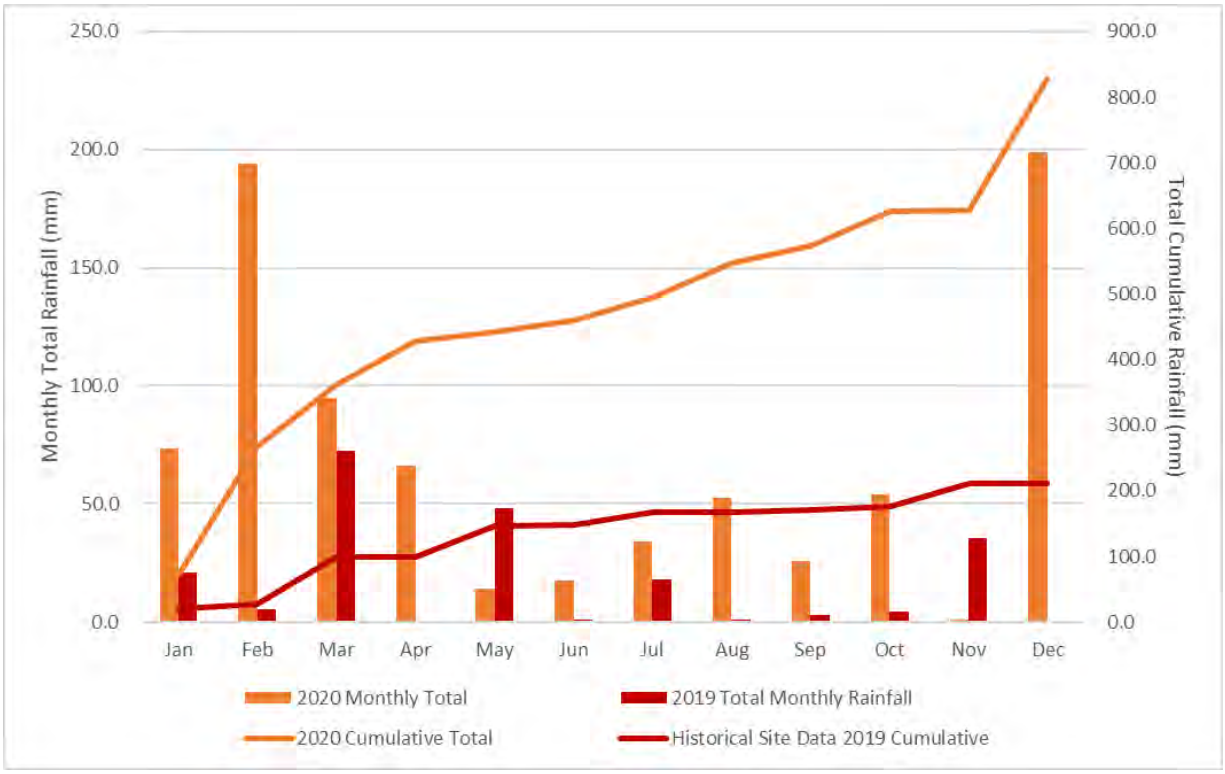


Figure 6-3 Comparison of 2019 and 2020 Rainfall

6.1.2.3 Wind

Wind speed and direction are important parameters for the planning and 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 the 2020 reporting period are provided in Table 6-3 and presented in the wind roses in Figure 6-4, Figure 6-5 and Figure 6-6. Wind speed values are displayed as metres per second.

The prevailing wind conditions during the 2020 reporting period were relatively consistent with the historical data as presented in the 2010 EA (Hansen Bailey, 2010) which indicate BCM predominately receives wind from the south-east in summer and the north and north-west in winter. Autumn and spring months experienced a combination of these wind conditions.

The meteorological data from MET identified that average monthly wind speed generally did not exceed 3 m/s.

Table 6-3 Monthly Average and Maximum Wind Speeds and Dominant Wind Directions

Month	Average Wind Speed (m/s)	Maximum Wind Speed Recorded (m/s)	Dominant Wind Directions
January 2020	3.0	20.1	NNW
February 2020	2.4	17.0	SE
March 2020	2.5	13.5	SE
April 2020	1.6	17.3	NW
May 2020	1.7	11.3	SSE
June 2020	1.4	13.5	NW
July 2020	1.5	10.1	NNW
August 2020	2.0	15.7	NW
September 2020	2.1	15.8	SSE
October 2020	2.0	17.2	SSE
November 2020	2.6	16.8	SSE
December 2020	2.7	19.9	SSE

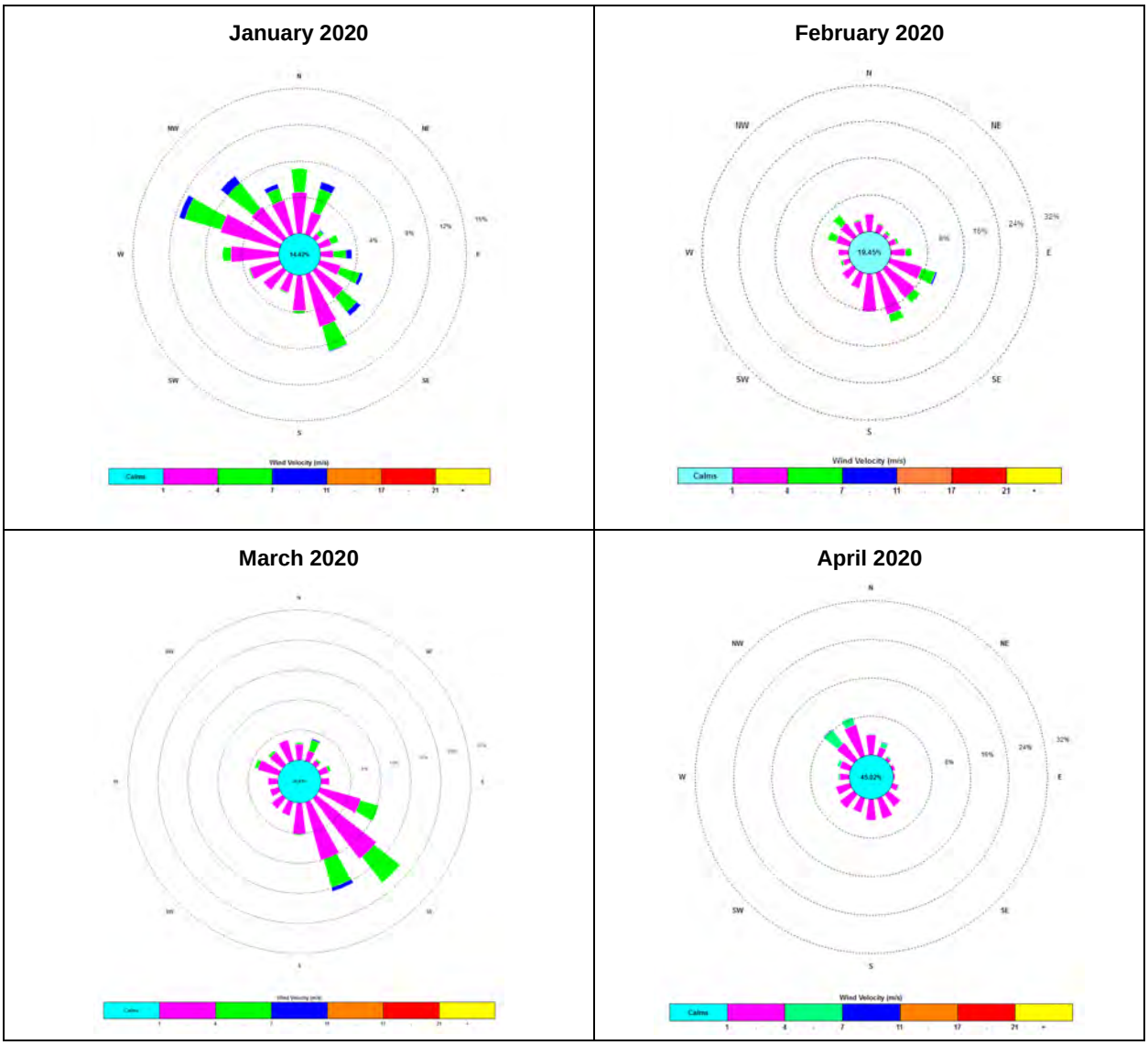


Figure 6-4 Monthly Wind Rose Summary January – April 2020

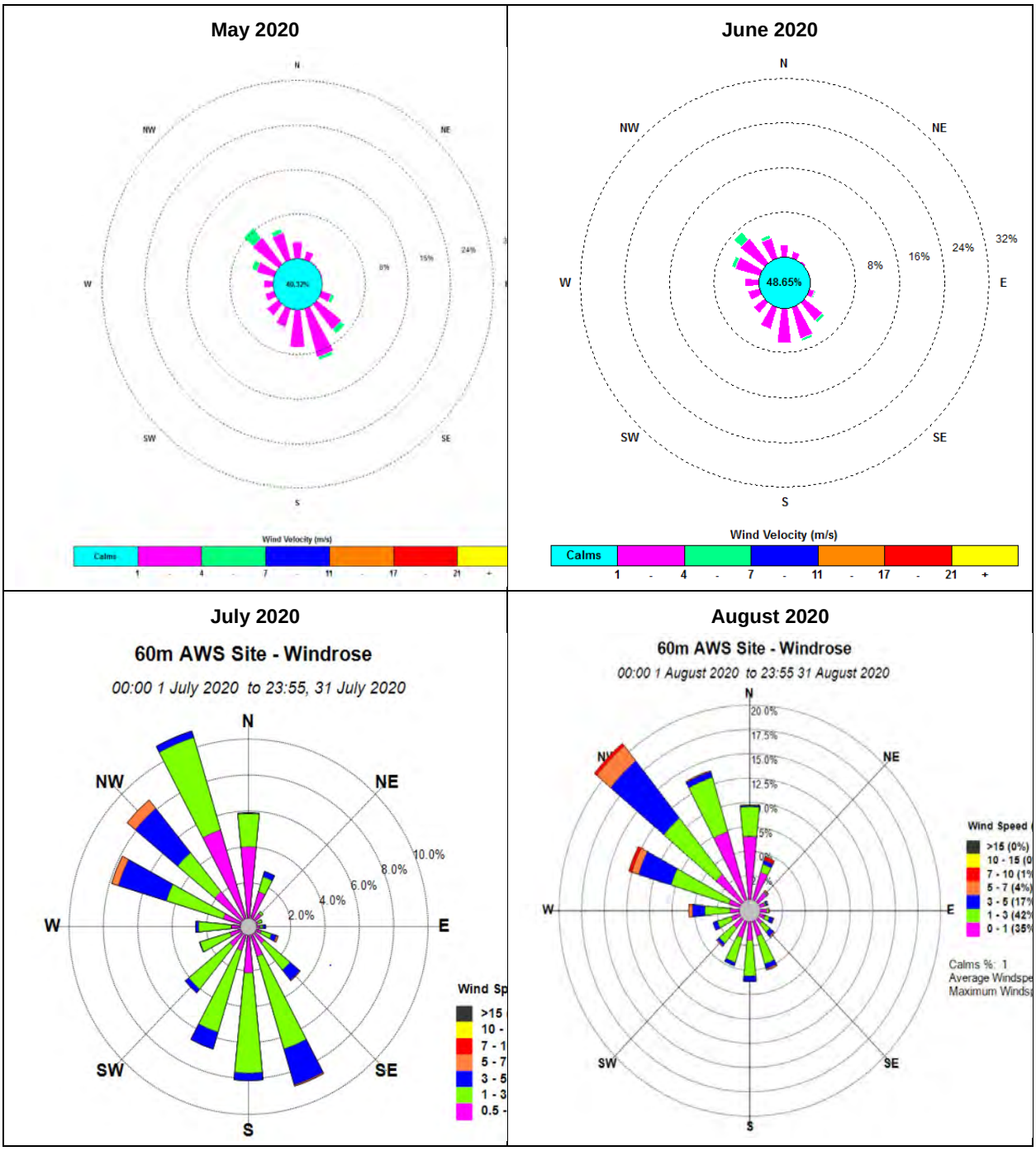


Figure 6-5 Monthly Wind Rose Summary May – August 2020

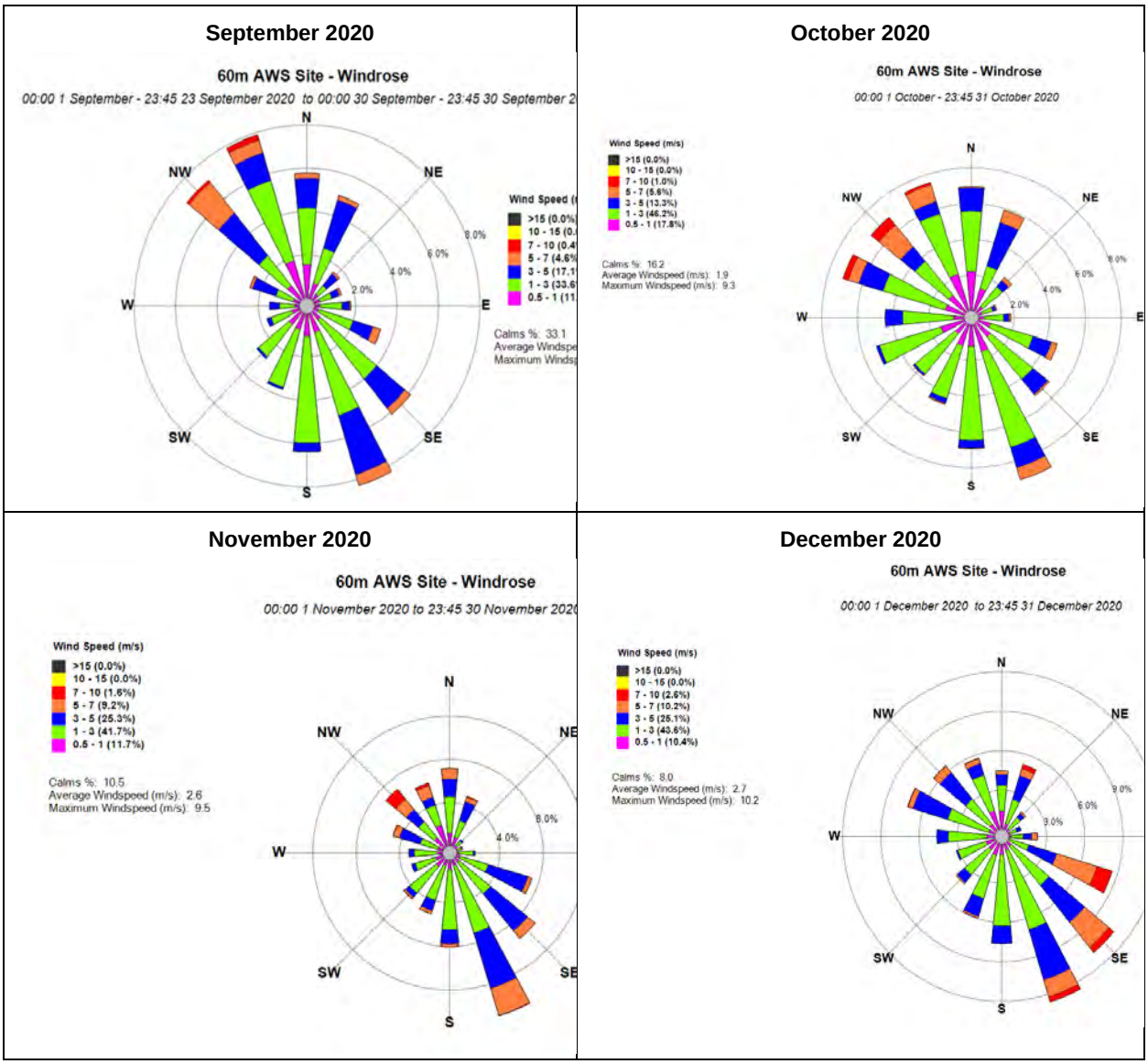


Figure 6-6 Monthly Wind Rose Summary September – December 2020

6.1.3 Improvements and Initiatives

Building on the work completed during the previous reporting periods, 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.

6.2 Air Quality

6.2.1 Environmental Management

Air quality management at BCM is undertaken in accordance with the approved 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 generally maintaining compliance with criteria specified in SSD 09_0182. Air quality mitigation measures to be undertaken at BCM are listed in Table 5.3 of the AQGHGMP. During the reporting period, mitigation measures included the following:

- Dust suppression with bulk water trucks using dust suppression additives 'Dust Knock' and 'AGT Wetter' in mining areas, construction areas and haul roads during the 2020 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; and
- Monitoring meteorological conditions to plan and modify operations as required.

These mitigation measures will continue to be employed during 2021.

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, three TEOMs, and will include up to four portable real-time PM_{10} monitors details of which are provided in Table 6-4. A figure showing the location of each air quality monitoring site is provided in Appendix B.

Table 6-4 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
Cooboobindi/Glenhope	Yes	HVAS (PM_{10})	$\mu g/m^3$	Every 6 days
Merriown	No	HVAS (PM_{10})	$\mu g/m^3$	Every 6 days
Tarrawonga	No	TEOM (PM_{10})	$\mu g/m^3$	Continuous
Wilberoi East	Yes	TEOM (PM_{10} and $PM_{2.5}$)	$\mu g/m^3$	Continuous
BTM Complex Portable Samplers (x4)	No	TEOM (PM_{10} and $PM_{2.5}$)	$\mu g/m^3$	Continuous

*Cooboobindi HVAS unit moved to Glenhope property in June 2020

The Merriown HVAS unit was removed from EPL 12407 in November 2019, as this was located on Mine Owned property. Therefore, the air quality criteria listed in SSD 09_0182 and EPL 12407 were not applicable for that location. The HVAS unit that was located at Cooboobindi property was moved there in February 2019 when a neighbour requested it to be moved from their privately owned property.

There were limited locations for it to be moved so it was temporarily moved to Cooboobindi and was operational from the 15 March 2019 to the 26 May 2020. During its time, BCOPL was preparing another location on the nearby privately owned Glenhope property. Glenhope HVAS became operational on the 1 June 2020.

An EPL variation (submitted 19 March 2019) seeking the update of monitoring locations to reflect current monitoring operations at BCM was approved on 5 February 2021.

6.2.2 Environmental Performance

6.2.2.1 Depositional Dust

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

In accordance with SSD 09_0182 (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.*

6.2.2.1.1 Results

Depositional dust samples were subject to visual analysis by a NATA accredited laboratory to determine sample contamination by naturally occurring impurities. Table 6-5 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 2020.

Table 6-5 Depositional Dust – Annual Average Results

Monitoring Point	Annual average limit (g/m^2/month)	Corrected annual average* (g/m^2/month)
D4	4	2.1
D5	4	1.2
D6	4	1.3

* Annual average applies to 2020 calendar year.

Depositional dust systems are often subject to contamination by naturally occurring impurities such as bird droppings, insects and vegetation. However, no samples were observed to be contaminated during the 2020 reporting period. In February 2020, no result was able to be taken for D5 (Goonbri) due to the sample bottle being broken at the time of sampling. This regarded as a non-compliance under the EPL (see Table 1-2).

The results for D4 and D5 are above the predicted levels documented in the EA (i.e. 0.5 and 0.6 g/m^2/month) for the closest corresponding year of operations (Year 10). It is important to note that since the 2010 EA (Hansen Bailey, 2010) was prepared, further approvals for mining operations within the BTM

Complex have been granted which have subsequently resulted in increased background dust deposition levels. 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 SSD 09_0182.

Depositional dust levels recorded during the 2020 reporting period remain within the range of historical results.

6.2.2.2 PM_{10}

BCM monitors PM_{10} dust compliance through one HVAS unit (Cooboobindi/Glenhope) and one TEOM (Wilberoi East). 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 criteria specified under SSD 09_0182 and the EPL 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 Cooboobindi/Glenhope HVAS unit comprise monitoring at Cooboobindi up until June 2020, with the remainder of the reporting period being monitored from the Glenhope property (see Appendix B).

PM_{10} is also monitored for compliance at one TEOM (Wilberoi East), which is located approximately 5 km south-east of BCM. Sampling is undertaken continuously (5 minute intervals) with the 24 hr averages provided in this report. Monitoring will continue to be completed throughout 2021.

6.2.2.2.1 Results

The PM_{10} monitoring results over the reporting period for the Cooboobindi HVAS are provided in Figure 6-7. Figure 6-8 provides the results for the Glenhope HVAS for the time period it was in place during the monitoring period (June to December). The PM_{10} monitoring results of the Wilberoi East TEOM over the reporting period is provided in Figure 6-9, which also includes BCMs rolling average over the reporting period. The annual average has excluded the events deemed to be 'extraordinary events', as described in Table 6-6.

In accordance with SSD 09_0182, 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.

One (1) exceedance of the short term 24-hour average criteria (50 µg/m^3) occurred at the Cooboobindi HVAS monitor on the 2 February 2020, with a result of 57 µg/m^3. An investigation discussed in Table 6-6 below found that BCM did not impact the HVAS monitor during this sampling period. The annual average PM_{10} concentrations at the Cooboobindi HVAS monitor over the reporting period was 17.5 µg/m^3 over the six months it was operational. Based on this, the annual average PM_{10} criterion (30 µg/m^3) was not exceeded at the Cooboobindi HVAS during the six months of record during the reporting period.

PM_{10} results for the Wilberoi East TEOM recorded a total of five (5) exceedances of the short-term 24-hour average criteria (50 µg/m^3) during the reporting period. In all five occasions, the PM_{10} 24-hour average levels for the Namoi/North-west Slopes region exceeded 50 µg/m^3, indicating that ambient air quality was greater than the relevant assessment criteria, irrespective of dust originating from the BCM. Further detail on these extraordinary events are provided in Table 6-6.

During early 2020 in particular, the Air Quality Index across the Namoi/North-west Slopes region was poor to hazardous on 36% of summer days with air quality affected by dust storms and bushfire smoke (DPIE, 2020a). This is likely to be due to the prolonged, intense drought and extreme bushfire weather conditions. In accordance with note 'd' of Schedule 3 Condition 27 of BCM's SSD, PM_{10} exceedances were disregarded when calculating the average annual PM_{10} concentration if they were caused by 'extraordinary events' (dust events and bush fires).

As requested by DPIE following feedback on the 2019 Annual Review, these results have been excluded from the PM_{10} annual calculation. Following advice from the 2020 IEA (SLR, 2020), BCOPL will seek the concurrence of the Secretary for the classification of 'extraordinary events' prior to the status of days being classified moving forward in 2021.

Table 6-6 provides a summary of the exceedances of 24 hour PM_{10} criteria that have deemed extraordinary events during the reporting period.

Table 6-6 PM_{10} 24 hour Average Exceedance Investigations

Date	Monitoring Site	PM_{10} 24hr Result (µg/m^3)	Investigation
6 January 2020	Wilberoi East TEOM	117.55	As described in DPIE's air quality summary for 2019-2020 in the Namoi/North West Slopes Region (DPIE, 2020a), the region experienced elevated PM_{10} levels due to dust and bushfire smoke on that day and therefore considered an extraordinary event. Major fires were burning; at Mount Kaputar, north-east of Narrabri; and to the east and south-east of the region, over several hundred thousand hectares along the Great Dividing Range.
11 January 2020	Wilberoi East TEOM	50.22	As described in DPIE's air quality summary for 2019-2020 in the Namoi/North West Slopes Region (DPIE,2020a), the region experienced elevated PM_{10} levels due to dust and bushfire smoke on this day and therefore considered an extraordinary event. Major fires were burning; at Mount Kaputar, north-east of Narrabri; and to the east and south-east of the region, over several hundred thousand hectares along the Great Dividing Range.,
20 January 2020	Wilberoi East TEOM	83.86	As described in DPIE's air quality summary for 2019-2020 in the Namoi/North West Slopes Region (DPIE, 2020a), region experienced elevated PM_{10} levels due to dust on this day and therefore considered an extraordinary event.
2 February 2020	Cooboobindi HVAS	57	An investigation by BCOPL found that for the 24hr period the HVAS monitor was operational, the wind was blowing from the north to north west and from the south. During this monitoring period, Wilberoi East, Tarrawonga and Goonbri TEOMs had results of 22.98, 40.54 and 24.26 ug/m3 respectively. The monitor was surrounded by cropping land and it was likely impacted by localised ploughing and not mining activities.
3 February 2020	Wilberoi East TEOM	64.7	As described in DPIE's air quality summary for 2019-2020 in the Namoi/North West Slopes Region (DPIE,2020a) the surrounding area experienced elevated PM_{10} levels due to dust and therefore considered an extraordinary event.
20 August 2020	Wilberoi East TEOM	107.5	The NSW Air Quality Index indicated the North West Slopes Region experienced hazardous levels. Other monitors in the surrounding area including Tarrawonga TEOM (128.2 µg/m^3), Goonbri TEOM (136.4 µg/m^3) and Velyama TEOM (73.9 µg/m^3) also all recording exceedances. Therefore, this is considered an extraordinary event.

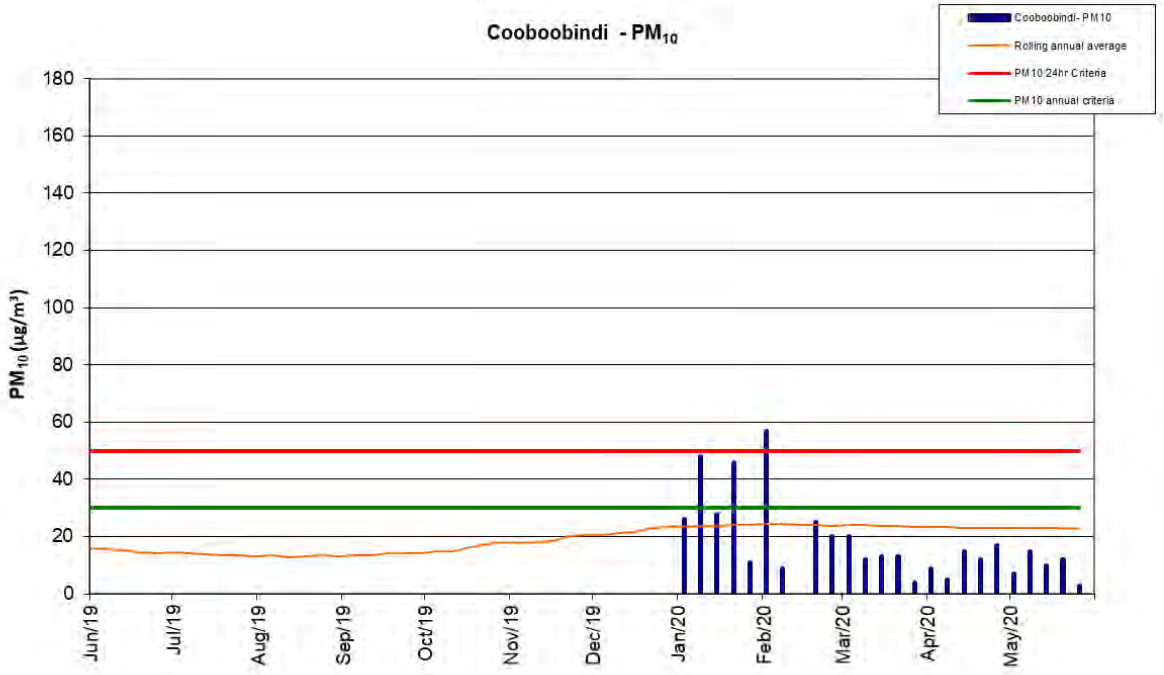


Figure 6-7 Cooboobindi PM_{10} Monitoring 2020 Results

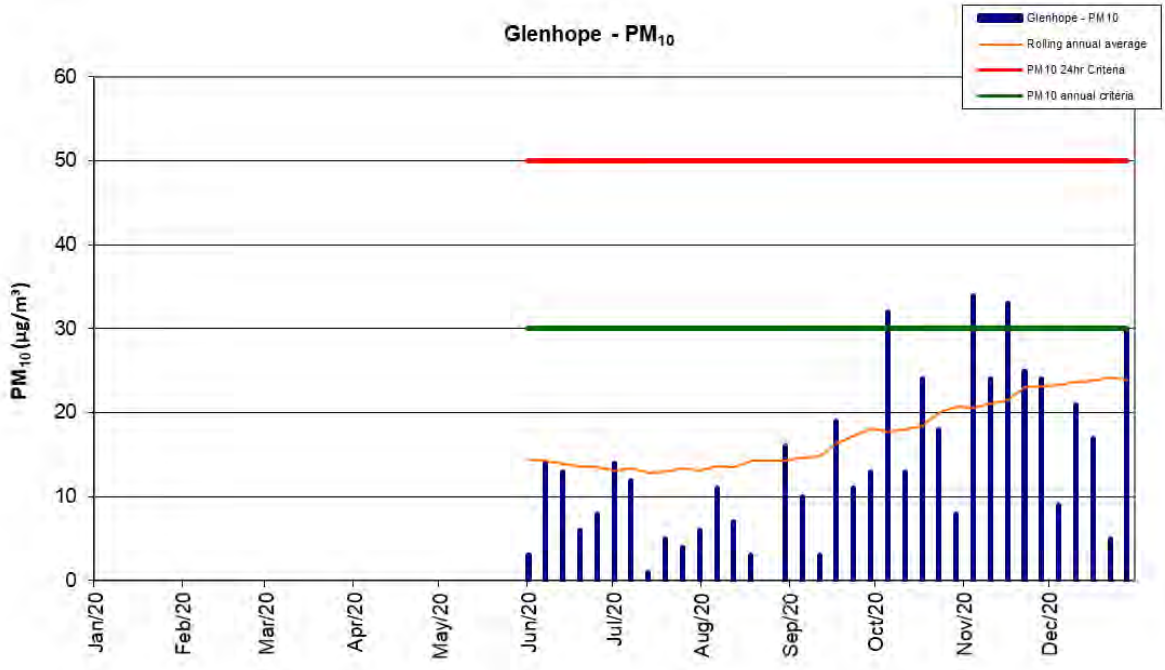


Figure 6-8 Glenhope PM_{10} Monitoring 2020 Results`

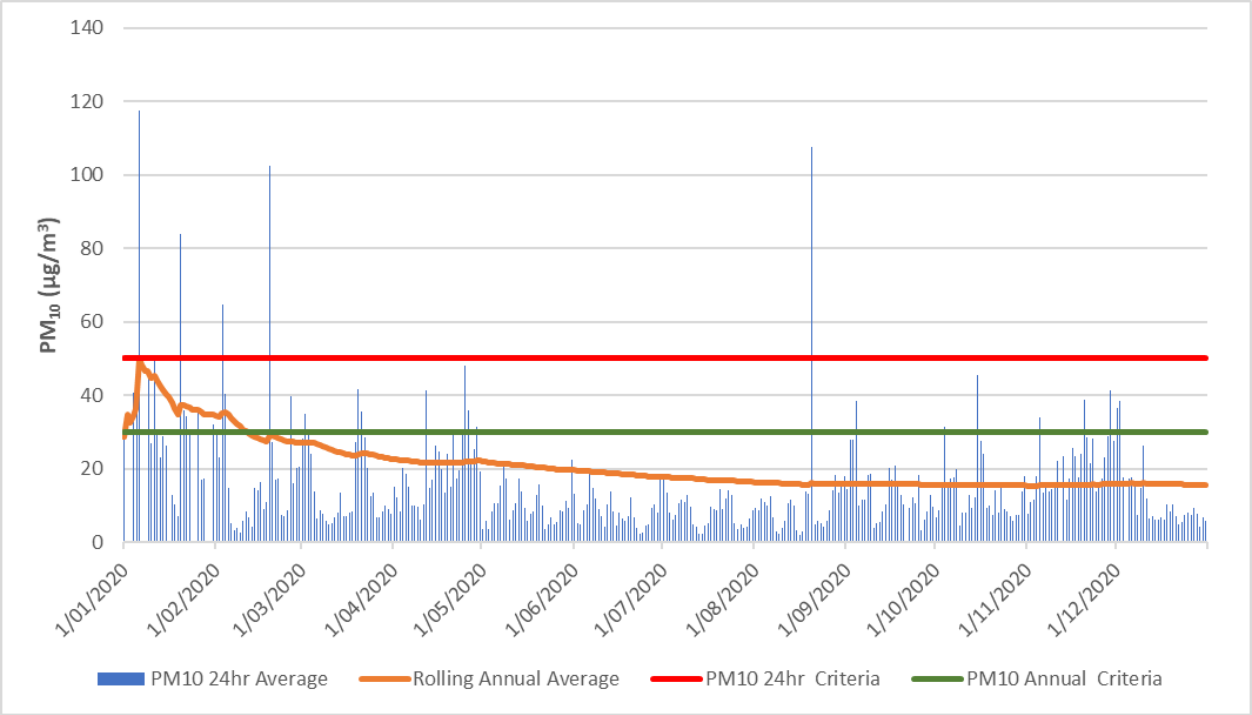


Figure 6-9 Wilberoi East PM_{10} Monitoring 2020 Results

6.2.2.3 Total Suspended Particulates

The ambient air quality criterion for Total Suspended Particulates (TSP) quoted in Table 9 of SSD 09_0182 (annual average 90 µg/m^3) 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/m^3 (annual average) will always be satisfied when the long-term PM_{10} criterion of 30 µg/m^3 is satisfied.

As discussed in Section 6.2.2.2, BCOPL monitored PM_{10} at the Cooboobindi property until May 2020, with the monitoring commencing at Glenhope property in June 2020.

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), BCOPL consider that compliance with the long-term annual average TSP criteria can be demonstrated via the application of the known relationship between PM_{10} and TSP. The calculation of TSP is based on the available data at the Cooboobindi HVAS monitoring location (January to May) and Glenhope HVAS monitoring location (June to December).

The results indicate the annual average TSP at the Cooboobindi/Glenhope (32.6 µg/m^3) is below the air quality criterion in SSD 09_0182 for the reporting period.

6.2.2.4 Odour

There is no requirement to conduct odour monitoring at BCM. It is considered that there is a very low risk of odour generation as a result of BCM's operations. Complaints were received during the reporting period in relation to odour from a blast event that occurred on the 24th of July. The EPA determined that there was no evidence to support the view that any of the blasting limits had been contravened (refer to Section 9.3.

6.2.2.5 Long Term Trend Analysis

It is noted that air quality results are generally higher than what was predicted within the 2010 EA (Hansen Bailey, 2010). This is due to the fact the 2010 EA (Hansen Bailey, 2010) was assessed prior to surrounding mines being approved (Maules Creek Coal Mine and Tarrawonga Coal Mine). Therefore, BCM's cumulative assessment did not take into consideration the impact these approvals would have on the surrounding air quality. Although the 2020 results are generally slightly higher than what was predicted for Year 10 of the 2010 EA (Hansen Bailey, 2010), it is noted that BCM still generally comply with all required criteria. In accordance with SSD 09_0182 a long term trend analysis of air quality monitoring results at BCM has been undertaken using data from 2015 to 2020 to identify any trends in the monitoring. The results indicate the following:

- Depositional dust monitoring results have been generally consistent since mining operations commenced. There have been no exceedances of the annual depositional dust criteria since mining operations commenced to 2020;
- PM_{10} concentrations are slightly higher from 2017 to 2019 coinciding with drought conditions and lower than average rainfall. These conditions led to increases in the number of days when the 24-hour average PM_{10} concentration exceeded 50 µg/m^3 and increases in the annual average PM_{10} concentrations. The increases in PM_{10} concentrations were observed across many locations in NSW and were not unique to BCM. Concentrations decreased in 2020, coinciding with increased rainfall;
- There are seasonal variations with higher PM_{10} concentrations generally occurring in the warmer months;
- Excluding extraordinary events, BCOPL has complied with the PM_{10} criteria specified in SSD 09_0182 in all years between 2015 and 2019 with only one exceedance during 2020 (see Section 6.2.2.2.1);
- Annual average TSP concentrations were clearly higher in 2018 and 2019 than in the preceding five years. Again, this outcome was influenced by the drought conditions and lower than average rainfall. The increases in TSP concentrations were not unique to the area; and
- A reduction in complaints relating to dust from 2015 to 2020 at BCM, with no complaints received in 2019 or 2020.

6.2.3 Improvements and Initiatives

BCOPL continued to implement and refine the real-time air quality management system at the BCM.

6.3 Operational Noise

6.3.1 Environmental Management

Operational noise is managed by BCOPL in accordance with the approved NMP and EPL 12407. 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. Blast management is detailed in Section 6.4.

BCOPL proactively implements a range of noise mitigation measures for operational activities at BCM. Mitigation measures for BCM are included in Table 5.2 of the NMP. 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; and
- Conducting train speed noise testing to optimise train speed for minimum noise.

BCOPL engaged acoustic specialists to undertake attended noise monitoring in 2020 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 SSD 09_0182, to assess the performance of mine plant against the sound power levels utilised within the modelling in the 2010 EA (Hansen Bailey, 2010). Sound power level monitoring for 2020 was conducted over five events in July and October. Results of this monitoring is presented in Section 6.3.2.2.

6.3.2 Environmental Performance

6.3.2.1 Attended Noise Monitoring

Monthly attended noise monitoring surveys were carried out during 2020. 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 with DPIE and the EPA. This alternative method was adopted from January 2016 onwards.

The monthly monitoring was undertaken at the three locations in Table 6-7, which were addressed within the updated NMP and EPL 12407. The results are presented in the following sections.

Table 6-7 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 SSD 09_0182 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 upon 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; and
- Night – all other times.

In addition to the above, the noise levels during the night period 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 6-8.

Table 6-8 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)

*Noise criteria does not apply if BCOPL has an agreement with the owner(s) of the relevant residence to generate higher noise levels

Table 5 in Schedule 3 of SSD 09_0182 also specifies long-term intrusive noise goals at all privately owned existing residences, which concur with the limits specified in Table 6-8.

6.3.2.1.1 Results

A summary of the attended noise monitoring results is provided in Table 6-10. This includes all monthly monitoring conducted in 2020.

Noise levels assessed as part of the monitoring program remained within the relevant operational noise and sleep disturbance criteria. The monitored noise levels also remained below the maximum noise levels predicted in the noise assessment completed for the EA (Hansen Bailey, 2010).

Attended noise monitoring also considered the assessment of cumulative noise from the Boggabri-Tarrawonga-Maules Creek Complex (BTM Complex) and confirmed the noise levels were within the cumulative noise criteria specified under SSD 09_0182 (refer to Table 6-8).

Following a noise complaint received 12 May 2020, BCOPL arranged for further attended monitoring to occur on the complainant's property boundary. The monitoring occurred during July and August 2020, over four nights with results shown in Table 6-9. No further complaints have been received.

Table 6-9 Additional Attended Noise Monitoring

Monitoring Date	dB(A) Leq (15 min)
8 July 2020	^
9 July 2020	^
3 August 2020	23
4 August 2020	<20

^ BCM Inaudible.

Table 6-10 Summary of Attended Noise Monitoring Results - dB(A) $L_{Aeq\ (15\ minutes)}$ & L1 (1 min)

	Sylvania (N2)		Picton (N3)		Barbers Lagoon (N4)	
	Criteria dB(A) Leq (15 min)@	Criteria dB(A) L1 (1 min)#	Criteria dB(A) Leq (15 min)@	Criteria dB(A) L1 (1 min)#	Criteria dB(A) Leq (15 min)@	Criteria dB(A) L1 (1 min)#
	35	45	35	45	35	45
29-Jan	^	^	^	^	^	^
17-Feb	^	^	^	^	29	35
17-Mar	^	^	^	^	^	^
1-Apr	^	^	<25	27	^	^
14-May	^	^	^	^	^	^
3-Jun	^	^	^	^	25	29
8-Jul	^	^	28	38	^	^
3-Aug	28	33	<25	<25	^	^
1-Sep	^	^	^	^	27	31
1-Oct	^	^	^	^	^	^
9-Nov	^	^	^	^	^	^
8-Dec	22	25	^	^	^	^

^ BCM Inaudible.

@ Operational noise impact criteria.

Sleep disturbance noise criteria.

6.3.2.2 Sound Power Screening

Schedule 3, Condition 10 of SSD 09_0182 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 at the following dates during the 2020 reporting period: 6 July, 7 July ,8 July, 9 October and 19 October (Global Acoustics, 2020a) and is available on BCM's website. The results of this modelling were then compared against the sound power levels used within the noise modelling for the EA (Hansen Bailey, 2010). The plant assessed for sound power screening during both rounds consisted of the following:

- Komatsu PC450LC-8 (EX127) – excavator;
- Komatsu PC300LC (EX128) -excavator;
- Komatsu HD1500-7 (DT178, DT180, DT181) -haul truck;
- Komatsu 730E (DT279, DT281, DT282, DT285, DT288, DT289, DT290, WC041, WC043, WC042) – haul truck;
- Komatsu 930E (DT267, DT755) – haul truck;
- Komatsu D475A (TD02, TD074, TD075, TD076, TD079, TD081) – dozer;
- CAT6060 (EX255 and EX 256) – excavator;
- CAT 992K (WL03) – loader;
- CAT 775G (TK828, TK829) – haul truck;

- CAT D10T (TD08, TD09) – dozer;
- Hitachi EX1900-6 (EX258) -excavator;
- Hitachi EH3500ACII (DT304, DT305) – haul truck; and
- ReichDrill C700D (DR650, DR 655) -drill.

A total of 35 items of plant were screened during the 2020 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.

6.3.2.2.1 Methodology

The measurement and calculation methodology adopted for the 2020 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 immission 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'; and
- ISO 6395:2008(E) 'Earth-moving machinery – Determination of sound power level – Dynamic test conditions'.

6.3.2.2.2 Results

The results of the 2020 sound power screening program indicated that there were 4 items of screened plant that recorded exceedances of 3dB or greater, consisting of two Hitachi EP3500ACII (DT304 and DT305), one Komatsu 930E truck (DT755) and one Komatsu DA475A (TD079). A summary of the sound power level monitoring results is provided in Table 6-11.

Table 6-11 Summary of 2020 Sound Power Screening Results

Plant type	Criteria (dB)	Number of exceedances of 3dB or more during testing	Comment/Recommendation
Hitachi EP3500ACI	117	2	Trucks DT304 and DT305 exceeded the linear target by 4 dB and 3 dB respectively. Further action will be determined and reported following completion of the trial.
Komatsu DA475A	116	1	TD79 exceeded the A-weighted target by 3 dB during the 1st gear reverse test and was noted as tonal in the 1/3 octave band during the dynamic tests. The SPL attenuation exhaust kit trial will continue during 2021. Key findings and

Plant type	Criteria (dB)	Number of exceedances of 3dB or more during testing	Comment/Recommendation
			recommendations will be reported following completion of the trial.
Komatsu 930E	117	1	Truck DT755 exceeded the A-weighted target by 5 dB. Further action will be determined and reported following completion of the trial.

6.3.2.3 Noise Model Validation

In accordance with SSD 09_0182 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 (AIA) (Bridges Acoustics, 2010). This involved comparing 2020 attended noise monitoring results with modelled noise impacts for the 2010 Acoustic Impact Assessment. Predictions from Year 10[1] of the AIA were utilised, as that stage best aligns with 2020, which is Year 8 of the Project (Global Acoustics, 2020b).

Attended monitoring results for the three locations above were filtered to extract those that were taken during meteorological conditions that were similar to the prevailing meteorological conditions utilised within the AIA.

A total of 18 of the 36 attended monitoring events undertaken in 2020 occurred during meteorological conditions that coincided with modelled prevailing meteorological conditions. During periods when these conditions did occur, measured levels from BCM were either inaudible or lower than noise levels predicted in the AIA (Bridges Acoustics, 2010).

6.3.2.4 Long Term Trend Analysis

Attended compliance monitoring results indicate a trend toward reduced noise levels from BCM over time with all attended results since September 2018 being either inaudible, or at levels too low to quantify. Full compliance with approved noise limits has been achieved since 2015. Further, since SSD 09_0182 was granted in 2012, there have been a total of 10 complaints received relating to noise, none of which can be directly attributed to BCM's operations.

6.3.3 Improvements and Initiatives

The sound power level (SPL) attenuation trial continued during the reporting period. The trial is currently ongoing as the kits have shown reliability issues. The results from the monitoring will be reported in future annual reviews once the trial has been finalised.

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

6.4 Blasting

6.4.1 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; and
- Reducing blast fume.

Blast fume is managed in accordance with BCM's Blast Fume Management Protocol (BFMP). The BFMP was prepared to satisfy the conditions of SSD 09_0182 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.

6.4.2 Environmental Performance

6.4.2.1 Blast Events

SSD 09_0182 permits blasting to occur only between 9:00 am and 5:00 pm Monday to Saturday, at a rate of up to one blast per day and an average of up to four blasts per week (when averaged over the calendar year), unless otherwise exempted.

6.4.2.1.1 Results

Blasting events were not undertaken more than once a day at any time during the reporting period. 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.

A total of 91 blast events occurred during the 2020 reporting period, which remains well within the permitted maximum blasts when averaged over the calendar year.

6.4.2.2 Blast Peak Vibration

Monitoring of peak vibration was conducted at Goonbri (MP1) and Wilberoi East (MP3) during the entire 2020 reporting period (refer to Appendix B).

The applicable SSD and CL368 limits for peak vibration are 10 mm/sec at any privately owned residence, and 5 mm/sec at any noise sensitive location for up to 5 percent of all blast events occurring within the reporting period.

6.4.2.2.1 Results

Blast monitoring results indicate all blasts complied with the vibration limits of 5 mm/sec (and peak vibration of 10 mm/sec) (refer to Figure 6-10). Blast vibration monitoring results for the 2020 reporting period were lower than those reported for the previous 2019 reporting period. Blast vibration for the past few years has consistently remained well below the relevant limits.

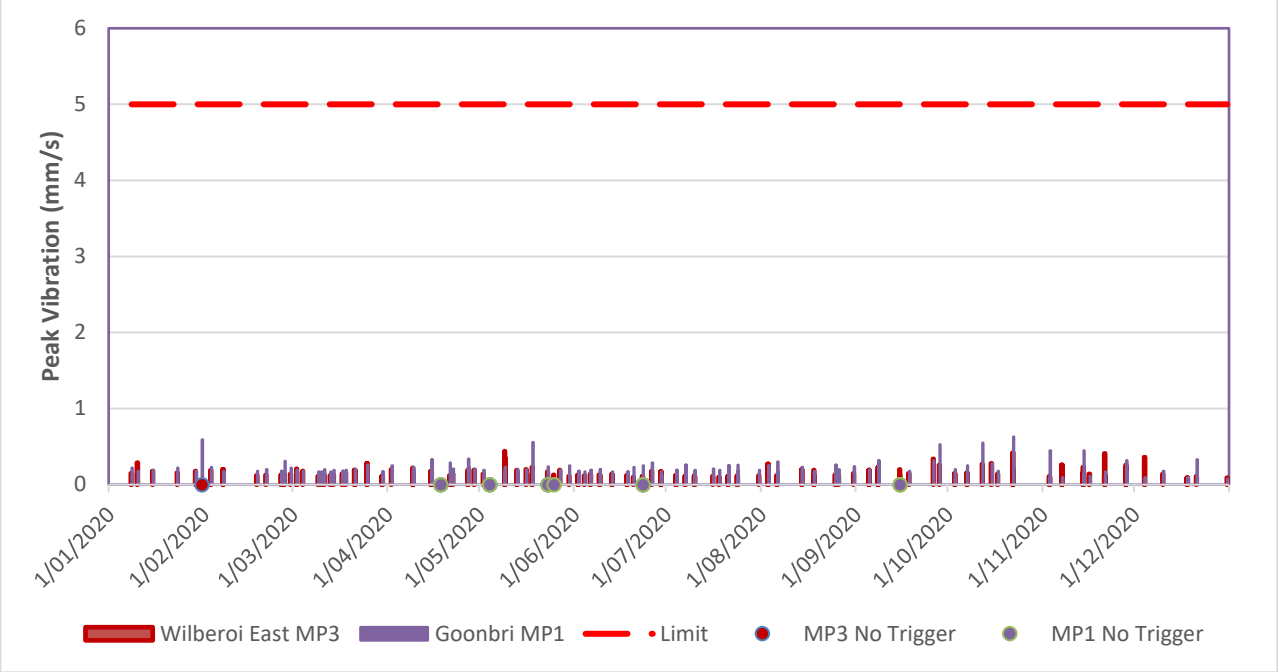


Figure 6-10 Summary of Peak Vibration Monitoring Results

6.4.2.3 Blast Overpressure

Monitoring of blast overpressure was conducted at Goonbri (MP1) and Wilberoi East (MP3) during the entire 2020 reporting period (refer to Appendix B).

The applicable criteria for airblast overpressure under SSD 09_0182 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.

6.4.2.3.1 Results

Figure 6-11 illustrates the blast overpressure monitoring results for the 2020 reporting period.

The monitoring results indicate that one blast exceeded 115 dB(A) overpressure limits (5% allowable exceedance applies) at non mine owned property. This exceedance of the 115 dB(A) overpressure limit did not trigger a non-compliance with SSD 09_0182, as this single blast (out of a total of 91 blasts) remains well within the 5% allowable exceedance of this limit.

BCOPL complied with all its blast overpressure criteria during the 2015, 2016, 2017 and 2018 reporting periods with only one exceedance occurring in the previous reporting period (2019).

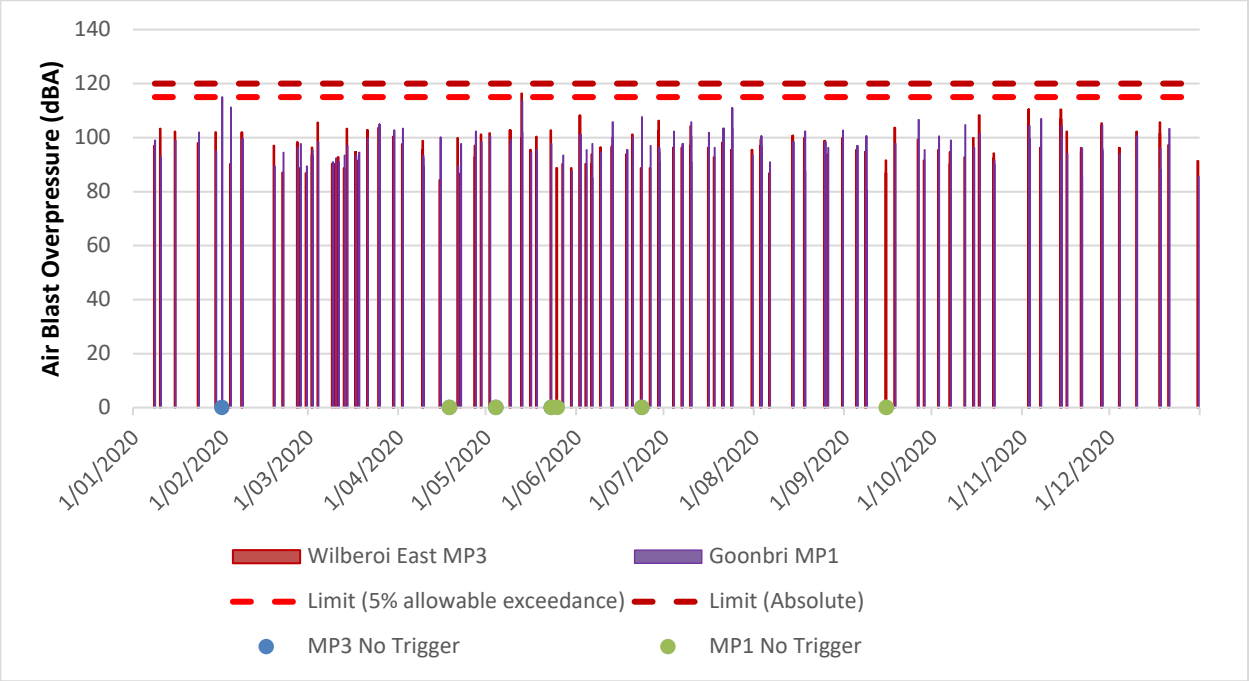


Figure 6-11 Blast Overpressure Results

6.4.2.1 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).

6.4.2.1.1 Results

Eighteen fume events were recorded 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 2020 reporting period.

During the reporting period there were two blast fume events in July 2020 which resulted in complaints from the community. See Table 9-2 for further details.

6.4.3 Improvements and Initiatives

During 2020 BCOPL reassessed the explosive product being used in blasting activities. Due to higher rainfalls than previous reporting periods, a more robust explosive selection was used to reduce the potential for fume events.

6.5 Biodiversity

6.5.1 Environmental Management

Biodiversity issues at BCM are managed in accordance with the approved Biodiversity Management Plan (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 the 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; and
- No impacts outside those predicted in the 2010 EA (Hansen Bailey, 2010) 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 BCM compiles with legislative and SSD 09_0182 offset requirements.

The BOS was revised in 2018 in accordance with Schedule 3, Condition 43 of SSD 09_0182 to incorporate an additional 1000 ha of offsets. The revised strategy also included additional offset requirements identified in Condition 39, Table 15 of SSD 09_0182. 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 SSD 09_0182. 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 SSD 09_0182.

BCOPL has implemented a range of biodiversity monitoring activities since the commencement of operations, in addition to those studies completed for the 2010 EA (Hansen Bailey, 2010). 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 biodiversity corridor monitoring (a program to monitor biodiversity within a vegetation corridor between BCM and Maules Creek Coal Mine);
- BOA monitoring (an annual program to assess the progress of the BOAs in achieving biodiversity targets) including autumn Box Gum Woodland monitoring;
- 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);

- Stygofauna monitoring (an annual program design to monitor groundwater monitoring bores along the Namoi floodplain for Stygofauna); and
- Stream and riparian vegetation health assessment and terrestrial vegetation monitoring within the locality of MOD5 (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 SSD 09_0182 and internal management plans.

6.5.2 Environmental Performance

6.5.2.1 Environmental Management Correspondence

Correspondence with MCCM and TCPL has been undertaken on a regular basis to discuss cooperative management and protection of the vegetated corridor and Leard Forest Regional Biodiversity Strategy.

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.

An Annual Summary Report would summarise 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 biodiversity offset performance and outcomes (vegetation community attributes, key weed attributes, fauna monitoring results, threatened flora and fauna monitoring results).

6.5.2.2 Commonwealth Consent Fauna Surveys

In accordance with the Commonwealth's Department of Agriculture, Water and the Environment (DAWE) 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 phrygia* (Regent Honeyeater) and *Lathamus discolor* (Swift Parrot). Targeted surveys for Regent Honeyeater and Swift Parrot were undertaken during July and August 2020, whilst surveys for Corben's Long-eared Bat were undertaken in January 2021.

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 these surveys 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 July and August 2020 survey period there was again an overall lull in the appearance of blossom resources across the BOAs. The region has seen relief from a prolonged dry period, but previous extreme stress and dieback experienced by the canopy species can, 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 not recorded in any BOAs during the monitoring period (January 2021). The only threatened bat species recorded during the monitoring program was the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), which is listed as Vulnerable under the NSW BC Act. This species was recorded from within the Merriendi BOA in January 2021.

6.5.2.3 Vegetation Clearing

Vegetation clearing for the reporting period commenced on 2 February 2020 and ended 30 April 2020, inclusive of pre-clearing surveys, and Stage 1 and Stage 2 clearing operations. The program included the removal of vegetation from within the priority mining area and 57 exploration pad locations. The extent of clearing totalled 98.81 ha of vegetation, encompassing six vegetation communities.

One vegetation community associated with a Threatened Ecological Community was impacted upon by the 2020 tree clearing program; being PCT1383 - *White Box Grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion.* PCT 1383 is consistent with the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (Box Gum Woodland) Threatened Ecological Community listed as Critically Endangered under the EPBC Act and BC Act. A total of 51.19 ha of vegetation mapped as this Threatened Ecological Community was removed in 2020.

The extent of each vegetation community cleared during the 2020 clearing period is provided in Table 6-12.

Table 6-12 Vegetation Communities Identified in 2020 Tree Clearing

Vegetation Community	Threatened Ecological Community		Total 2020 Clearing Community Extent (ha)
	BC Act	EPBC Act	
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion – PCT 1381	Not listed	Not listed	13.71
Narrow- leaved Ironbark – pine – Brown Bloodwood shrub/grass open forest in the north west of the Nandewar Bioregion – PCT 1380	Not listed	Not listed	0.11
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion – PCT 1383[1]	Critically Endangered	Critically Endangered	51.19
White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion – PCT 1313	Not listed	Not listed	33.48

Vegetation Community	Threatened Ecological Community		Total 2020 Clearing Community Extent (ha)
	BC Act	EPBC Act	
Black Cypress Pine – Dwyer's Red Gum low woodland / open forest on rocky ridges mainly of the Nandewar Range – PCT 610	Not listed	Not listed	0.17
White Box – White Cypress Pine – Silver leaved Ironbark shrubby open forest of the Nandewar Bioregion – PCT 1307	Not listed	Not listed	0.16
		Total	**98.81**

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

6.5.2.4 Vegetation Clearing Ecological Monitoring

As with previous years, the 2020 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 and relocation surveys completed prior to the commencement of the clearing activities recorded 3,907 habitat, hollow-bearing and/or significant trees within the 2020 tree clearing area and a further 771 within the marked exploration pads and tracks. These trees were marked in preparation for the Stage 2 clearing process.

During Stage 1 and Stage 2 clearing operations, 409 animals were successfully relocated, 320 animals were observed from habitat trees and evaded capture, and 24 animals were killed or euthanized as a result of clearing operations (Table 6-13). The most abundant groups of animals encountered during 2020 clearing operations were reptiles (562 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 6-13 Animal Groups Encountered During Clearing Operations 2020

Fauna Group	Number of individuals recorded			
	Relocated	Observed	Deceased/ Euthanised	Total
Reptiles	374	171	17	562
Microchiropteran bats	22	137	7	166
Birds	5	4	0	9
Amphibians	5	0	0	5
Mammals	3	8	0	11
Total	**409**	**320**	**24**	**753**

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 2020 clearing operations (refer to Table 6-14).

Table 6-14 Threatened Species Encountered during Clearing Operations 2020

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
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	–	V
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	–	V
Little Lorikeet	*Glossopsitta pusilla*	–	V
Turquoise Parrot	*Neophema pulchella*	–	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 1,389 lineal metres of woody debris was designated for salvage.

6.5.2.4.1 Stygofauna Surveys

Due to limitations imposed by Covid-19 State border restrictions in 2020, Stygofauna sampling was completed in February 2021. A total of four groundwater bores were sampled, including MW6, Victoria Park, Bellview and Cooboobindi monitoring bores (Appendix C). The samples obtained are currently under detailed analysis.

6.5.2.5 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 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 2021, 16 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 and the Namoi Offset Area (Rocklea property)).

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 C. 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 100m transects for vegetation cover abundance;
- Two 100m 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; and
- A reference photograph for each transect.

6.5.2.5.1 Results

Whilst above average rainfall was received in the region in 2020 the data acquired during the 2020 monitoring event should be considered with respect to extended severe drought conditions, and the long-term implications, experienced in the locality between 2017-2019.

- Vegetation across the three monitoring locations retained a moderate to high diversity of native plant species and a low to moderate diversity of exotic species. Comparatively, replicate monitoring sites associated with Leard State Forest retained a higher mean native plant species richness than the two reference locations. Exotic plant species richness was also lowest within Leard State Forest replicate sites however was closely followed by the Rocklea property. Mean exotic species richness was highest within the Central Offset Area;
- One threatened flora species (Tylophora linearis) was recorded during the survey at two replicate monitoring sites associated with Leard State Forest (LSF3 and LSF4) and at two replicate monitoring sites associated with the Rocklea property (ROC1 and ROC2). 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 61 species of diurnal bird were recorded during replicate monitoring surveys with the Fuscous Honeyeater, Rufous Whistler, Grey Fantail, Galah, Yellow Thornbill, Silvereye and Weebill, commonly recorded. Mean diurnal bird species richness and abundance was higher within the potential impact location compared to the two control locations during the 2020 monitoring event;
- Five 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 and Varied Sittella;
- Invertebrate species diversity was comparable across all monitoring locations with Hymenoptera (ants) and Arachnids (exclusively spiders) being equally the most diverse morpho-types recorded during the 2020 monitoring program. Leard State Forest contained the highest mean invertebrate species abundance compared to the Rocklea property and Central Offset Area reference locations; and
- Microchiropteran bat data for the Leard State Forest Biological Monitoring Program is currently under detailed analysis.

6.5.2.6 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 MCCM. 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 2020 monitoring was undertaken in November 2020 at seven replicate monitoring sites positioned within BCMs legislated 250 m wide portion of the corridor. Monitoring targeted native vegetation, birds and microbats. Of these, three are new monitoring locations which were established during the 2020 monitoring program. Remaining data was collected from established monitoring sites:

- Sixth year data for site 2;
- Eighth year data for sites 3-5; and
- First year data for sites 6-8.

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 100m 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; and
- 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 July and August 2020, and Corben's Long-eared Bat in January 2021.

6.5.2.6.1 Results

In summary, the results from the eighth 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 BCM are not likely to have substantially impacted biological values within the corridor.

- A total of 164 species of plant were recorded collectively across the replicate corridor monitoring sites, which included 18 exotic species, one of which is classified as Priority Weeds under the NSW *Biosecurity Act 2015* and Weeds of National Significance (*Opuntia stricta*).* No threatened species of plant were recorded during the 2020 monitoring event. Despite this, *Tylophora linearis* (listed as Vulnerable under the BC Act and Endangered under the EPBC Act) is known to occur within the biodiversity corridor;
- The native and exotic plant species richness and cover recorded in 2020 was considerably high when compared to all other monitoring events completed to date (between 2013 and 2019), with both native and exotic species richness well exceeding the Leard State Forest analogue benchmark. The higher native and exotic species richness is likely attributable to favourable seasonal conditions experienced across the region in 2020 (i.e. a period of high rainfall preceding the monitoring session). These favourable conditions saw the emergence of many native and exotic annual species, which although commonly occur within Leard State Forest in favourable years, otherwise succumb to desiccation during years of lower rainfall and higher temperatures;

- Diurnal bird species richness at each replicate monitoring site was similar during the 2020 monitoring event. Mean diurnal bird species richness (as averaged from seven replicate monitoring sites) from the 2020 monitoring event was comparable but slightly higher than 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 33 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. Three threatened species of bird listed as Vulnerable under the BC Act were recorded from replicate monitoring sites during surveys; Turquoise Parrot, Speckled Warbler and Varied Sittella;
- Targeted Swift Parrot and Regent Honeyeater surveys were conducted in the corridor over two discrete sampling periods in July and August 2020. 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* and other *Eucalyptus* spp. blossom resources within the corridor and larger Leard State Forest remnant in 2020 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 eight harp trap nights targeting Corben's Long-eared Bat were completed across four locations within the corridor. Corben's Long-eared Bat was not recorded within the corridor during the 2020 monitoring program. A total of four non-threatened microchiropteran bats were however recorded from the corridor using harp traps;
- Three pest species (Pig, Black Rat and House Mouse) and two native species (Eastern Grey and Common Wallaroo) were recorded in the corridor during the survey with remote sensing camera traps; and
- Microchiropteran bat data for the Leard State Forest Biological Corridor Monitoring program is currently under detailed analysis.

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.

6.5.2.7 Annual Stream and Riparian Vegetation Health Monitoring

The BCM 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 monitor stream and riparian vegetation health due to the potential for impacts on surface water and groundwater systems. Survey methodologies for the 2020 monitoring program were completed between 17-18 May 2020 and 9-10 November 2020, at five replicate monitoring sites, incorporating:

- Quantitative transect/plots (one BioBanking plot);
- Stream characteristics (for example channel size, composition, flow category, clarity etcetera – stream health monitoring locations only); and

- Photographic monitoring.

Monitoring of terrestrial vegetation in the locality of MOD5 was also completed in conjunction with the stream and riparian health monitoring program in 2020. The purpose of this monitoring is to assess the impacts of the MOD5 borefield on terrestrial native vegetation health and composition within the locality of MOD5 and its proposed draw down impacts associated with groundwater extraction. Survey methodologies for the 2020 monitoring program were completed between 17-18 May 2020 and 9-10 November 2020, at 11 replicate monitoring sites (including the five stream and riparian health monitoring sites), incorporating:

- Quantitative transect/plots (one BioBanking plot)
- Photographic monitoring.

Data collected during the reporting period includes third year spring data and first year autumn data for all replicate monitoring sites.

6.5.2.7.1 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 (NSW Department of Planning, 2019).

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) (NSW Department of Planning, 2019).

These drought conditions began to ease in early 2020 as rainfall received in the region appeared to be on a trajectory to meet and exceed the long-term annual mean rainfall (1884-2020). By the end of 2020 the region had received 758.8 mm of rainfall which is well above the mean annual rainfall for the region of 591.5 mm (Bureau of Meteorology, 2020). Due to the high rainfall received in summer (particularly in January and February 2020), the Namoi River categorisation of Stage 4 (Critical Drought) was reduced to Stage 3 (Severe Drought).

The results from the 2020 stream and riparian health 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. Native species diversity and cover showed considerable increases since the 2019 monitoring program, particularly at the monitoring sites located along Nagero Creek. This suggests that the reductions in 2019 were attributable to drought conditions rather than impacts associated with the project.

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 at some sites 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 that 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 observed in the autumn monitoring period was likely attributable to severe drought conditions associated with low rainfall received over an extended period of time

between 2017 and 2019, no releases of water from Lake Keepit Dam between December 2018 and March 2020 (NSW Department of Planning, 2019) and water extractions associated with surrounding land uses. By the spring session in 2020 water had begun to return to the Namoi River, however water levels were still lower than that recorded during the 2018 baseline monitoring period.

Otherwise, in autumn 2020 stream characteristics and riparian vegetation along Nagero Creek was in the best condition it had ever been observed at across all monitoring sessions completed to date (between 2018 and 2020). Specifically, the volume of water along Nagero Creek was the highest ever observed likely in response to the higher than average rainfall received in the region in January and February 2020. In response to these favourable conditions the riparian vegetation along the watercourse was also in higher condition than otherwise observed, with many emergent macrophytes present at the time of monitoring. By the spring session in 2020, many of the stream characteristics and vegetation health had returned to a similar condition observed in the 2018 baseline monitoring session.

Overall, the structure and health of Nagero Creek was in moderate to good condition. The stream is an ephemeral waterway with intermittent flow which is heavily dependent on high rainfall (water was present in autumn 2020, however no water was recorded within this creek during the 2020 spring 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 riverbanks 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.

The results of the 2020 terrestrial vegetation monitoring within the locality of MOD5 confirmed that the composition and health of terrestrial vegetation had remained relatively consistent since the 2018 baseline data. 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 data. Native species diversity and cover showed considerable increases since the 2019 monitoring program suggesting that the reductions in 2019 were attributable to drought conditions rather than impacts associated with the project.

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 is largely attributed to past land uses (predominantly agriculture) that have cleared canopy and midstorey components and heavily disturbed the soil profile at some sites leading to the dominance of exotic species in the groundcover.

6.5.2.8 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 and autumn Box Gum Woodland monitoring was completed.

The 2020 biodiversity offset monitoring represents the sixth 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); and
- Western Offset Area (Merriendi BOA).

The aims of the 2020 biodiversity offset monitoring were to:

- Outline the monitoring results for the 10 BOAs that form part of the BOS;
- Provide results of autumn and spring 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 2020 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; and
- Recommend potential mitigation or management actions that may be required based on the results of the 2020 biodiversity offset monitoring event.

Importantly, data acquired during the 2020 monitoring event should be considered with respect to extended severe drought conditions, and the long-term implications, experienced by the locality between 2017-2019.

6.5.2.8.1 Habitat Management Zone

Vegetation data collected as part of the 2020 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.

Most vegetation attributes showed an increase in value compared to the 2019 monitoring period. This is most likely due to the region receiving normal to above normal rainfall in the months preceding the survey session. Despite this, some vegetation attributes showed decreases in value between the 2019 and 2020 survey sessions. This is most likely due to the continued and prolonged effects of the severe drought conditions experienced in previous years. Vegetation attributes affected by these conditions include:

- Native overstorey projected foliage cover has increased slightly in some BOA locations, but remains below the values recorded pre-drought, indicating that it is slowly recovering from the prolonged dry period and canopy dieback experienced in 2018 to 2019; and
- Native midstorey projected foliage cover has continued to decrease across all BOAs, highlighting the continued effect of a large-scale dieback event associated with serve drought conditions.

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 2020 included:

- One threatened flora species, *Tylophora linearis*, was recorded during the 2020 monitoring session from monitoring site W1 (Wirrilah BOA) (habitat management zone);
- Native species richness has increased across all BOAs;
- Exotic species richness was higher across all BOAs, however exotic ground cover percentage remained relatively consistent to the values recorded in the 2019 monitoring session. An increase in exotic species richness can most likely be attributed to high rainfall and favourable seasonal conditions in the months preceding the monitoring session;
- Livestock grazing still occurs within some areas of the Namoi and Eastern Offset BOAs, however, has been removed from other management areas;

- Some monitoring locations contained Cypress Pine densities that exceed the 650 stems/per hectare threshold (M3, M4, Ma4, My3, W1 and W4). 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 maybe 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 etcetera 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;
- 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 one habitat management zone sites (S3) – although not a priority weed under the Biosecurity Act, 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. 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; and
- *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. Key findings identified in habitat management zones during the 2020 monitoring event included:

- The presence of 13 threatened fauna species, including Speckled Warbler, Dusky Woodswallow, Brown Treecreeper, Diamond Firetail, Varied Sittella, Turquoise Parrot, Grey-crowned Babbler, Painted Honeyeater, Hooded Robin, Spotted Harrier, 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);
- Diurnal bird species richness was typical of relatively undisturbed woodland and open forest habitats in the region;
- Mean diurnal bird species richness in 2020 was higher or remained near constant across all BOAs, with BOAs achieving between 42% and 87% of the Leard State Forest analogue benchmark;
- 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; and
- Several introduced species were recorded during the 2020 monitoring period, including Pig, Fox, Rabbit, Goat, Cat, Brown Hare and House Mouse.

6.5.2.8.2 Habitat Restoration Zone

The habitat restoration zone was 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, 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 findings identified within the habitat management zones in 2020 included:

- Native species richness and native shrub groundcover (shrubs <1m) was generally higher than previous years;
- Exotic species richness was much higher across all BOAs in comparison with previous years. An increase in exotic species richness can most likely be attributed to high rainfall and favourable seasonal conditions in the months preceding the monitoring session;
- Livestock grazing still occurs within the Namoi Offset Area but has been 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 etcetera. 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;
- 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; and
- *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,

Australian Pipit, Willie Wagtail, Rufous Songlark and Eastern Rosella. However, one threatened bird species, the Grey-crowned Babbler, was found in in two management locations, My1 and N9 (Myall Plains BOA and Namoi Boa respectively).

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

6.5.2.8.3 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 ground layer composition recorded during baseline monitoring supports this assumption. Likewise, the paucity of fauna species proves how disturbed this area currently is. The planned supplementary canopy planting and some targeted weed and pest management activities should serve to increase woody canopy cover 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 2020 included:

- Native species richness and native grass groundcover was generally higher than previous years;
- Exotic species richness was much higher than previous years. An increase in exotic species richness can most likely be attributed to high rainfall and favourable seasonal conditions in the months preceding the monitoring session;
- 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 and control of this species should be considered;
- Mean diurnal bird species richness was observed in 2020 to be slightly increased compared to the 2019 survey results. Corridor enhancement zones possessed a low diurnal bird species richness, typically achieving between 16% and 21% of the Leard State Forest analogue benchmark for bird species richness; and
- Microchiropteran bat data for the BOA Monitoring program is currently under detailed analysis.

6.5.2.9 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.

During the 2020 reporting period the contract works for the biodiversity areas went out for tender. After a lengthy process, this tender resulted in specialised contractors being successful. Weed control works were undertaken in the Namoi and Eastern offset areas during 2020. During Quarter 1, 2 and 3 weed control was conducted at Eastview, Braefield, Victoria Park, Sunshine, Heathcliffe and Daisymede properties. During Q4 the new contractors were onboarded to site, with a site wide weed survey and control plan scheduled for January 2021.

Vertebrate pest control and monitoring programs within BCOPL's BOAs continued during the reporting period. Apex Predator Solutions conducted the vertebrate pest control works during 2020 with a major focus on pig control after the winter harvest in the region. Motion cameras were set up across the offset areas to get an understanding of what was occurring. A pig trapping program was then initiated along with thermal shooting targeting the problem pigs which were trap shy. These works resulted in over 130 pigs controlled along with some foxes and hares. During the Q4 works, neighbouring private landholders also conducted pig trapping works for a combined effort.

6.5.2.10 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 the SSD 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.

6.5.2.11 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.

BCOPL consults with the Maules Creek Coal Mine in relation to staged clearing limits to ensure that clearing of the Leard State Forest is completed in an orderly manner. This approach also limits the clearing of the forest and maximises rehabilitation performance, increasing the development of areas for displaced fauna to move into.

6.5.3 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. In 2020 BCOPL installed 10 koala watering units in various locations throughout its BOAs with an objective of maximising the presence of koalas. These units are equipped with cameras.

6.6 Hazardous Materials

6.6.1 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; and
- 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; and
- 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 is also be provided to those personnel required to handle hazardous materials;
- All workshop and vehicle wash down water is 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*; and
- Refuelling operations will be undertaken within areas specifically designated for that purpose, where practicable.

6.6.2 Environmental Performance

Hazardous materials used at the BCM that require licensing are listed in Table 6-15. Golding or Orica Australia Pty Ltd (Orica) hold the appropriate licences and notifications for the storage, handling and use of these substances. The use of hazardous materials during the 2020 reporting period was comparable with the 2019 reporting period.

Table 6-15 Explosives and Hazardous Materials Licence/Notification Holders

Hazardous Materials:	Licence/Notification Holder:
Acetic Acid Solution Ammonium Nitrate Ammonium Nitrate Emulsion Oxidizing Liquids Bulk Diesel	Golding / 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.

6.6.2.1 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 768,000 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 2016 to 2020 reporting periods are summarised in Table 6-16. Fuel consumption at BCM has notably increased during the reporting period and over time as a result of the progressive ramp up to approved maximum production rates.

Table 6-16 Diesel Fuel Consumption

Fuel type	Quantity (L)				
	2016 period	2017 period	2018 period	2019 period	2020 Period
Biodiesel / ULSD*	65,412,763	62,586,313	67,132,896	65,987,493	69,734,267
Diesel	1,001,591	-	-	-	-
Totals	**66,414,354**	**62,586,313**	**67,132,896**	**65,987,493**	**69,734,267**

**ULSD was used during the all reporting periods*

6.6.2.2 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 the bunded AN storage compound. The AN storage compound is fitted with lockable access gates and is subject to daily inspections to safeguard against theft and/or spillages.

6.6.2.3 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.

6.6.2.4 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 storage compound, at the toe of the western overburden emplacement area. The magazines incorporate security fencing, lockable entry points and are bunded.

6.6.2.5 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.

6.6.2.6 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.

6.6.2.7 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.

6.7 Waste Management

6.7.1 Environmental Management

Condition 68, Schedule 3 of SSD 09_0182 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; and
- Monitor and report on the effectiveness of waste minimisation and management measures in the Annual Review.

Waste management measures employed on site include:

- 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. Any sediment collected during wash down activities is placed into the in pit bioremediation area for further treatment.
- Scrap metal materials are separated onsite and collected by a recycling contractor for off-site recycling;
- Sewage from permanent site facilities is collected onsite and treated within an aerated septic sewer system, with treated effluent being applied to a transpiration area. Sewage collected from in-pit crib hut locations is collected by a licenced waste contractor and disposed of off-site at an appropriate treatment facility
- 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); and
- 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.

6.7.2 Environmental Performance

This reporting period has seen a reduction in many non-recyclable waste streams compared to the 2019 reporting period. This could be due to BCOPL encouraging staff to work from home during the onset of

COVID-19. An increase in recycled waste was recorded at BCM during the reporting period. This suggests that management techniques have improved over the reporting period for some waste streams.

Several extra waste streams have been tracked since 2018 including timber packaging and pallets and printer cartridges. The inclusion of recording 1,000L plastic containers was introduced during the reporting period. Overall, there has been a general decrease in waste streams in the 2019 reporting period. Mining operation waste collection statistics for the 2017, 2018, 2019 and 2020 reporting periods are summarised in Table 6-17.

Table 6-17 Summary of Mining Operation Waste Disposal

Waste Stream	2017 reporting period (tonnes)	2018 reporting period (tonnes)	2019 reporting period (tonnes)	2020 reporting period (tonnes)
General waste – bulk waste skips	95.26	154.62	55.62	43.84
General waste – industrial bins	82.25	351.34	410	380.7
Oily Rags	14.45	5.91	9.72	4.28
Oily Sludge	0	0.13	-	-
Oily Water - recycled	-	1.93	5.28	4.36
Waste Grease – recycled	6.98	5.70	6.47	6.5
Contaminated absorbent materials	4.65	0.06	-	-
Air filters	0.1	-	-	-
Scrap metal -recycled	153.84	264.73	223.25	269
Empty Drums - recycled	-	2.05	1.64	1.0
Paper and cardboard-recycled	1.17	66.48	46.59	41.27
Timber packaging and pallets -recycled	-	90.13	74.72	86.26
Oil filters - recycled	35.36	32.52	34.86	31.77
Hydraulic hoses	17.20	12.01	17.14	23.87
Comingled recycling (bottles and cans)	16.78	-	-	-
Batteries –recycled	14.41	7.54	20.85	15.93
Printer cartridges	-	0.06	0.04	0.05
Tyres (heavy oversize vehicle) – each	268	134	144	162
Tyres (light vehicle) - each	249	269	392	363
1,000L plastic containers (IBCs)	-	-	-	48
Oil- recycled (litres)	506,300	661,100#	621,300	557,700#
Coolant – treatment and recycling (litres)	26,700	25,100#	25,800	18,000#
Effluent (offsite) – recycled	-	982.49	848.55	867.30
TOTAL	**442.45***	**1,977.7***	**1,748.02**	**1,776.13***
Total Recycled	**228.54***	**1,453.63***	**1,255.24***	**1,323.39***

*Total applies only to waste measured in tonnes

#Total in litres

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.

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.

6.7.2.1 Bioremediation Areas

Thirteen bioremediation areas have been utilised at the BCM since 2007. 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. Bioremediation Areas 10 through 13 were active during the 2020 reporting period (refer to Table 6-18). Bioremediation Areas 1 through 8 have been reported in previous Annual Reviews and have not been included below in Table 6-18.

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 as required. The bioremediation agent '*Enretech Remediator*' was also applied to the materials as necessary.

Compliance sampling was undertaken in Areas 10, 11 and 12 during the reporting period.

Table 6-18 Summary of Bioremediation Areas

Bioremediation Area	Location	Est.	Decomm.	Description
Area 9	RL 395 dump	2017	August 2018	Area 9 contained 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 Area 10 bio-pad at RL340 dump for remediation. Validation sampling on the remaining pad was conducted and was found to be within acceptable limits.
Area 10	RL 340 dump	2018	February 2020	Area 10 was established in June 2018 with 6 cells. In December 2018 an extra 5 cells were added to the area. Before decommissioning, Area 10 held 1984m^3 of material. 1224m^3 was successfully remediated and disposed of in pit >20m below final surface and the rest was relocated to Area 11 for further remediation.
Area 11	RL 280 Western Central Dump	March 2020	August 2020	Area 11 was established in March 2020 containing 6 cells. 759.7m^3 of material from Area 10 was relocated to cells 3 & 4 for further remediation. Area 11 was decommissioned in August 2020. 1290m^3 was buried >20m below final surface and the rest relocated to Area 12.

Bioremediation Area	Location	Est.	Decomm.	Description
Area 12	RL 309 East ROM 8	August 2020	November 2020	Area 12 was commissioned in August 2020. 366.2m^3 of contaminated material was held here and relocated to Area 13 after decommissioning in November 2020.
Area 13	Adjacent to North Ramp	November 2020	Ongoing	Area 13 was commissioned in November 2020 1266m^3 of material was stored at this location at the end of the reporting period.

6.8 Spontaneous Combustion

6.8.1 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; and
- 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 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; and
- Implementing Safe work method statements as required.

The 2010 EA (Hansen Bailey, 2010) 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.

6.8.2 Environmental Performance

BCOPL continued to apply the above principals to minimise the occurrence of spontaneous combustion onsite. Two spontaneous combustion incidents occurred during January and March of the reporting period. Both incidents were reported and managed in accordance with the site Spontaneous Combustion Management Plan.

6.9 Heritage

6.9.1 Environmental Management

The management of cultural heritage issues at BCM is undertaken in accordance with the Cultural Heritage Management Plan (CHMP). The CHMP was revised following the determination of Modification

5 and was approved by DPIE in February 2017. A review of the CHMP was commenced in 2020 and will be finalised in 2021.

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; and
- 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.

Field investigations, reporting and salvage works undertaken during 2020 include:

1. Due diligence assessment in February for the tree clearing associated with the 2020-21 exploration drilling program (for those holes not assessed in 2019);
2. Due diligence assessment, engagement and preparation of an Aboriginal Cultural Heritage Report for Project Approval Modification 8.
3. Preparation of a Statement of Heritage Impact for non-Aboriginal heritage for Modification 8.
4. Due diligence archaeological inspections of:
    - An additional area to be cleared around the weather station mast to ensure compliance with relevant standards;
    - maintenance of an existing track/fire trail requires grading and widening in places; and
    - a small area to be developed as a test track for autonomous vehicles; and
5. Inspection of tree clearing areas proposed for 2022 and 2023.

6.9.2 Environmental Performance

6.9.2.1 Archaeological Salvage

Two artefacts were collected in February 2020 during borehole and access track inspections.

The due diligence assessment to support a Modification application to SSD 09_0182 was undertaken over an area of approximately 110 ha on the 28th and 29th September 2020. Six previously unrecorded sites were recorded during the survey. The newly identified sites were registered on AHIMS on the 22 October 2020. Twenty eight artefacts were also recorded in the location of Site 20-4-0139 which had previously been subject to an archaeological salvage in 2013. The artefacts were exposed on windrows from the grader scrapes in the intervening seven years.

The location of additional tree clearing areas were inspected in late December 2020. The due diligence inspection of the additional 2.25 hectares for the 2021 tree clearing area resulted in the collection of one artefact, TC 20/2, a silcrete primary flake (Figure 6-12). The eastern side of the 2022 and 2023 tree clearing areas (2.25 ha) were also inspected in December 2020 and resulted in the collection of a single distal broken flake (TC 20/1).

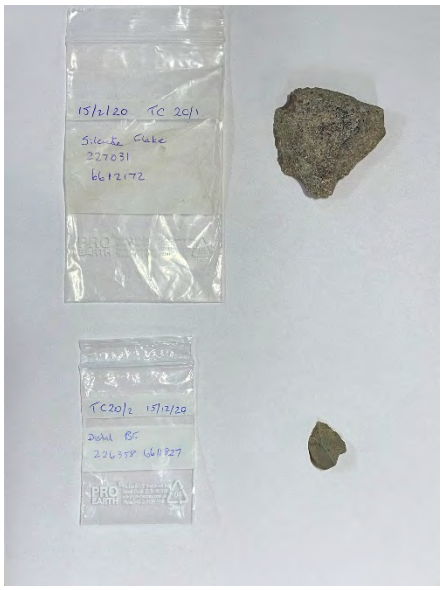


Figure 6-12 Artefacts collected from TC20/1 TC20/2

6.9.2.2 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 the project. 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.

Meetings of the ASCF were held in February, July and December 2020. Key areas discussed include:

- environmental monitoring including results of regular air, noise, surface and groundwater sampling;
- correspondence with agencies;
- rainfall data and water storage information;
- status of management plans such as the revision of the CHMP;
- exploration activities;
- community complaints;
- sponsorships and donations;
- pest management including weeds and feral animals;
- final landform design concepts;
- Planning for the field work and findings of the archaeological due diligence study;
- the keeping place; and
- tree planting in rehabilitation and offset areas.

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

In addition to the ASCF meetings, a meeting was held in September with the RAPs and/or their representatives to discuss an upcoming modification application being prepared. This included details on the scope of proposed modification, an outline the proposed field archaeological field survey methodology, and arrangements for the field work that was undertaken following the meeting.

6.9.3 Improvements and Initiatives

Pursuant to SSD 09_0182, 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 2011a)* and *Aboriginal Cultural Heritage Regional Studies: an illustrative approach* (Guilfoyle, 2006) and the *Aboriginal Regional Assessment Policy* (OEH 2011b).

An archival record of the Nagero Shearing Shed was prepared in June 2020 prior to its planned demolition in 2021. The 2010 EA (Hansen Bailey, 2010) found the structure was in poor condition and of low local significance. In accordance with the statement of commitments (Table 17) from the 2010 EA (Hansen Bailey, 2010), an archival record has been prepared prior to it being demolished. It is planned to remove the structure in accordance with the requirements of *Australian Standard AS 2601-2001 The Demolition of Structures.*

6.10 Greenhouse Gases

6.10.1 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 (NGERs) 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.

6.10.2 Environmental Performance

Key GHG and energy statistics for BCOPL as reported in the 2019-2020 NGERs submission to the Clean Energy Regulator are summarised in Table 6-19 alongside statistics from the 2015-2016, 2016-2017,2017-2018 and 2018-2019 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 6-19 BCOPL GHG and Energy Statistics

GHG/Energy	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Scope 1 (t CO_2-e)	190,606	183,750	177,065	203,082	174,391
Scope 2 (t CO_2-e)	19,585	19,190	17,991	18,647	16,865
Total Scope 1 and Scope 2 (t CO_2-e)	210,191	202,940	195,056	221,729	191,256
Energy consumed (total) (GJ)	2,752,598	2,661,699	2,554,023	2,924,043	2,526,744
Energy consumed (net) (GJ)	2,752,598	2,661,699	2,554,023	2,924,043	2,526,744
Energy produced (GJ)	150,548,706	145,260,066	181,068,912	181,878,777	155,466,162

Sources of Scope 1 and Scope 2 emissions for 2019-2020 are illustrated in Figure 6-13. The main contributor to Scope 1 emissions was the combustion of diesel oil. Scope 2 emissions are attributed to the purchase of 20,821,125 kWh of electricity from the state grid.

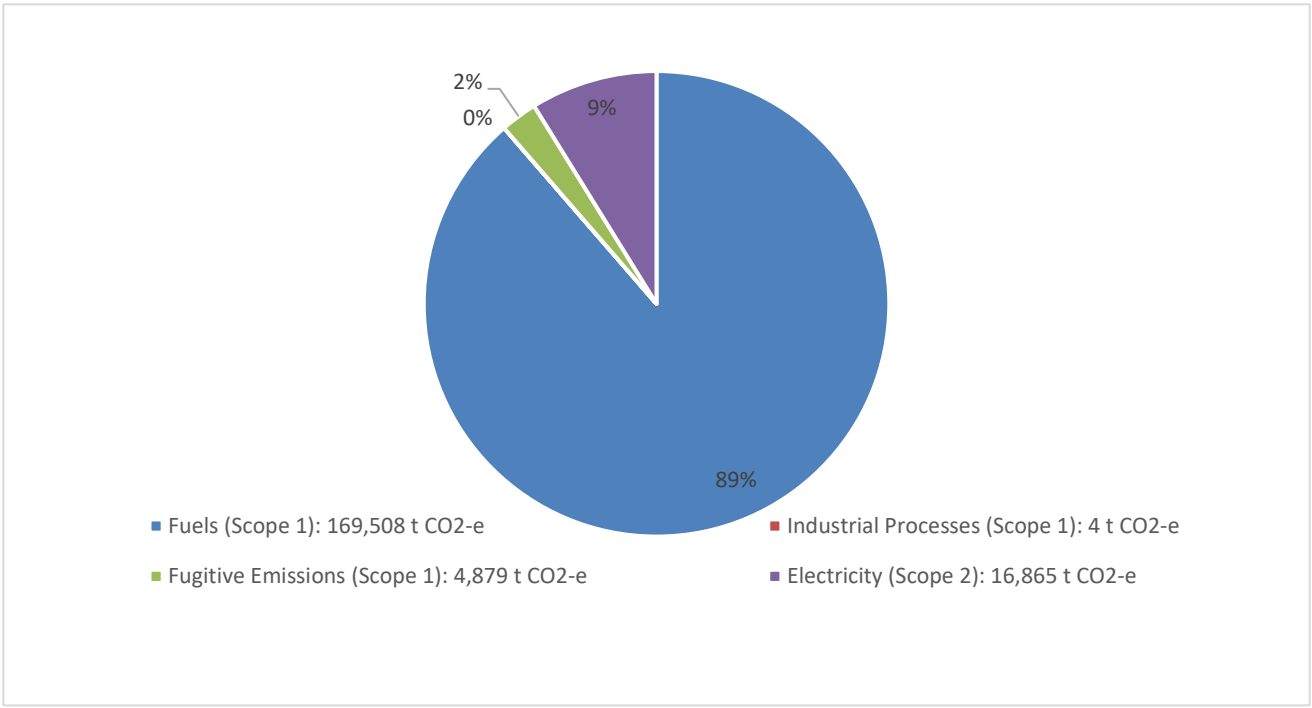


Figure 6-13 Sources of BCM Scope 1 and Scope 2 Emissions

Electricity usage during 2019-2020 was similar to 2018-2019 periods due to the ongoing operation of the CHPP. Emissions from diesel combustion were also similar to the 2018-2019 NGERS reporting period.

6.10.3 Improvements and Initiatives

BCOPL continued to target a decrease in fuel burn during 2020 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.

6.11 Public Safety

6.11.1 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; and
- 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.

6.11.2 Environmental Performance

6.11.2.1 Traffic

Additional detail on traffic management is detailed in Section 6.12.

6.11.2.2 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; and
- Assessing contractor safety plans to adequately address fire control and response.

BCOPL has historically worked closely with the NSW Rural Fire Service and Forestry Corporation of 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.

6.11.2.3 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.

6.11.2.4 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:

- Implementing a security check point where workers, contractors and visitors had to be approved by management to access the site and undergo a temperature check (due to COVID-19 restrictions);
- 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; and
- Maintaining community engagement through the CCC.

6.12 Traffic

6.12.1 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 SSD 09_0182 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.

6.12.2 Environmental Performance

6.12.2.1 Traffic Monitoring

Traffic incidents, monitoring of road conditions and road kill observations are recorded in weekly inspections and incident reports, where relevant. There were seven traffic-related incidents recorded on roads in the vicinity of the BCM during the 2020 reporting period. These included one event of speeding, three events of vehicles being involved in accidents on the drive to site, one event of a car performing an illegal U-turn on the Kamilaroi Highway, one event where a driver left the road to avoid hitting a kangaroo

and another where a kangaroo hit the side of a light vehicle. No injuries were sustained in any of the incidents and no members of the public were affected.

During 2020, 3,650 different individuals accessed the site, including 1,420 visitors over the reporting period. This equates to an average of 10 persons visiting the site per day.

6.12.2.2 Inspections and Audits

No traffic audits were completed during the reporting period. Due to COVID-19, BCOPL took measures of limiting site access to essential staff and where possible encouraged staff to work from home. Throughout the reporting period all staff and contractors required to work on site had to be signed off by the General Manager.

The 2020 IEA highlighted a non-compliance in accordance with Schedule 3, Condition 64 of SSD 09_0182. This condition relates to the Gunnedah Traffic Study which was completed with the aim of mitigating impacts of coal rail transportation on road safety congestion in the Gunnedah LGA. BCOPL was required to provide a report to Gunnedah Shire Council (GSC) within 12 months of the completion of the Traffic Study which identified proposals for implementing any recommendations that came from earlier consultation with GSC. BCOPL did not provide a report within this timeframe, however GSC has opened a new rail overpass to traffic in November 2020 which is an outcome of this study and aims to improve road safety and congestion. It is assumed that the completion of this new construction completes this requirement. No further action is required of BCM.

Socio-economic

6.12.3 Socio-economic Management

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

BCOPL undertook a further revision of the SIMP during the reporting period. The draft SIMP was distributed to stakeholders (including DPIE) for consultation in December 2020 and is in the process of being revised to address the outcomes of this feedback.

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; and
- Traffic.

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

6.12.4 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 6-20.

Table 6-20 Social Impact Monitoring Summary

Monitoring Mechanism	Type	Frequency	Purpose	Status (2020 Reporting Period)
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 9.4..
Procurement records	Quantitative	Six monthly	Monitor project spend on goods and services with local and regional business, including sub-contractors.	Approximately $20,165,770 was spent on goods 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 6.12.4.1
Land use data	Quantitative	Annual	Monitor availability of zoned and serviced residential land and supply of new housing.	Refer to Section 6.12.4.2 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 6.12.4.3 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 are provided in Section 9..
Workforce survey	Qualitative	Annual	Record workforce perceptions about general wellbeing, family functioning, and community issues.	BCOPL did not conduct workforce engagement survey during 2020 as IAR have decided to transition to a new platform to conduct a full organizational health survey with broader functionalities. This survey has been undertaken February 2021 and will be reported on in the 2021 Annual Review.

Monitoring Mechanism	Type	Frequency	Purpose	Status (2020 Reporting Period)
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 BCOPL to provide information to local businesses on upcoming events. The Boggabri Business & Community Progress Association and the Boggabri Business Chamber Incorporated meetings were attended by management throughout the reporting period to provide the local business with updates on upcoming events and engage in local business issues. BCOP'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 BCOP. The forum met three times during the reporting period and discussed matters including Keeping Place for Aboriginal salvage items, results of environmental monitoring on site and consultation for an upcoming modification and the 2020 Draft Social Impact Management Plan.
Community complaints	Qualitative	Quarterly	Monitor community complaints, issues and suggestions regarding the project, including any follow-up conducted by BCOP.	Details of all community complaints received during the reporting period and responses made by BCOPL are presented in Section 9.3.

6.12.4.1 Housing

Housing vacancy data indicates there have been substantial changes in residential vacancy rates over the past 11 years. Between 2009 and 2020, residential vacancy rates in Narrabri fluctuated significantly from less than 1% (two vacancies) in 2009, to a peak of around 5% (55 properties) in December 2015 and a current vacancy rate of 1.4% (19 vacancies) in December 2020 (SQM Research, 2020).

Between 2009 and 2020, vacancy rates in Boggabri peaked in September 2013 at around 14% (25 vacancies) before dropping to a ten-year low of around 2% (4 vacancies) in September 2014. Between 2014 and 2019, vacancy rates in Boggabri fluctuated with another low of 2% in May 2018 before

increasing to 4.6% in April 2019, and then decreasing to a current rate of 1.6% (five vacancies) (SQM Research, 2020).

Between 2009 and 2020, vacancy rates in Gunnedah peaked in both May 2013 and August 2015 at around 6% (more than 75 vacancies and more than 80 vacancies respectively). Over the 11-year period, vacancy rates dropped to a low of around 1% in September 2014 before increasing through to the August 2015 high. The current residential vacancy rate in Gunnedah is 0.7% (12 vacancies) (SQM Research, 2020).

6.12.4.2 Land Availability and New Housing Supply

DPIE housing projections from 2016 to 2041 for the areas of interest are summarised below (DPIE, 2020b). DPIE housing projections indicate that the number of households in Gunnedah LGA and New England North West Region are expected to increase between 2016 and 2041, whilst the number of households is anticipated to decline (0.8%) in Narrabri LGA during the period of 2016 to 2041. This is consistent with the NSW population decline projections for Narrabri LGA. DPIE projections suggest a forecast reduction in demand for housing in Narrabri into the future.

Dwelling Approvals

The GSC Community Strategic Plan indicates that improved housing affordability and diversity is needed. GSC has identified that residential and commercial development increased significantly from 2009 to 2014 and now remains constant. This indicates a substantial level of growth that is predicted to be sustained throughout the coming decade. In the Gunnedah LGA, 14 residential buildings were approved to be built in 2019-2020 (Profile ID, 2020).

Building Approvals

Building approvals data provides an indication of population growth and the expansion of urban areas. Residential building approvals data from the Australian Bureau of Statistics shows:

- For the period 2017-2018:
  - Approvals for ten new houses in Narrabri LGA, with a total value of approximately $3.9 million (M).
  - Approvals for 41 new houses in Gunnedah LGA, with a total value of approximately $15.9 M.
- For the period 2018-2019:
  - Approvals for eight new houses in Narrabri LGA, with a total value of approximately $3.8 M.
  - Approvals for 30 new houses, and two other residential buildings in Gunnedah LGA, with a total value of approximately $10.2 M. (ABS, 2019).

Future Development

Future land development in the Narrabri and Gunnedah LGAs will be centred around housing development, and several key precinct plans. All future land development options are considered to be in draft stage at the end of 2020.

The NSC is continuing to prepare a CBD precinct plan (Master Plan). The Master Plan will improve the functionality and appeal of the Narrabri business precinct, which will also include improvements to the existing industrial and logistics precinct to be able to support the development of the Northern NSW Inland Port. NSC has a series of additional planning studies underway that will lead to appropriate zonings and the finalisation of the Master Plan for the 'Inland Port'. These studies are anticipated to be released in the first half of 2021. The Northern NSW Inland Port will facilitate future manufacturing, production and industrial and logistics operations (The Courier, 2020). It was noted during consultation with NSC that it had purchased several land parcels to develop and rezone for the purposes of supporting the 'Inland Rail' project.

In addition, the NSC is developing a Bellata Recreation Precinct Plan. The Bellata Recreation Precinct Plan will include a recreation park, sports oval, tennis courts, golf course and memorial hall in the suburb of Bellata (Ross Planning, 2019).

The GSC Local Strategic Planning Statement - Future 2040 (Gunnedah Shire Council, 2020b) report presents the planning priorities for the Gunnedah LGA over the next 20 years. The Local Strategic Planning Statement - Future 2040 report indicates that the GSC will undertake regular monitoring of housing development, land demand and supply to remain informed of housing demands.

6.12.4.3 Social statistics

6.12.4.3.1 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 2019. At the time of writing, no enrolment records were available for the 2020 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. Narrabri and Gunnedah High Schools experienced similar declines in enrolment numbers since 2008. Enrolments at St Mary's College and Sacred Heart Boggabri have remained relatively stable. The declining enrolment at the two largest high schools (Narrabri High School and Gunnedah High School) may be attributed to a growing trend of boarding school education or a shift to accessible private education options. A summary of annual enrolments for local schools between 2011 and 2019 is provided in Table 6-21.

Table 6-21 Local School Enrolments 2011 - 2019

School	Annual Enrolments								
	2011	2012	2013	2014	2015	2016	2017	2018	2019
Boggabri									
Boggabri Public School	98	101	105	123	117	117	113	88	83
Sacred Heart Boggabri	37	32	33	34	23	24	37	43	39
Narrabri									
Narrabri Public School	≈ 400	≈ 395	≈ 400	≈ 410	≈ 410	406	403	399	394
Narrabri West Public School	≈ 230	≈ 240	≈ 280	≈ 280	≈ 300	370	348	327	330
Narrabri High School	568	589	588	614	587	540	508	488	489
St Xavier's Narrabri	240	224	113	171	195	178	188	189	187
Fairfax Public School	8	8	13	10	10	12	14	11	11
Gunnedah									
Carinya Christian School – Gunnedah	37	43	6	17	42	69	89	99	155
Saint Mary's College Gunnedah	-	-	379	408	401	379	357	364	379
St Xavier's Gunnedah	-	-	350	350	358	350	371	381	365
G S Kidd Memorial School	45	49	32	33	40	40	40	36	36
Gunnedah Public School	≈ 135	≈ 130	≈ 120	≈ 122	≈ 122	≈ 122	156	155	156
Gunnedah South Public School	≈ 480	≈ 520	≈ 570	599	616	620	634	629	636
Gunnedah High School	≈ 550	≈ 550	≈ 500	≈ 450	≈ 430	430	391	414	426

6.12.4.3.2 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. Further consultation during early 2021 with health care providers over an upcoming modification at BCM support this feedback. Findings indicated that current demand upon health services is manageable.

7 WATER MANAGEMENT

Water management at BCM is undertaken in accordance with the approved water management plans, prepared in accordance with SSD 09_0182. 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; and
- 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; and
- **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).

7.1 Surface Water

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; and
- Where practicable, divert 'clean' runoff to downstream creeks.

In accordance with SSD 09_0182, 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.

7.1.1 Erosion and Sediment Control

Erosion and sediment control at BCM is guided by the WMP and the SWMP, 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; and
- 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; and
    - Sediment retention basins.

7.1.2 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 and EPL12407.

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 a rainfall event sufficient enough to generate flow in ‘Nagero Creek’ 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 7-1.

Table 7-1 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 w4ater 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	Discharge water quality (from EPL points 1,3 & 4)	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	Discharge water quality (from EPL points 1,3 & 4)	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
37	SD10 & SD12	Near CHPP	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 overtopping event from a dam as a result of excessive rainfall (i.e. typically via the emergency spillway).
*Controlled discharge water quality: a controlled discharge event from a dam (i.e. drawdown of a dam after adequate sediment settlement has occurred).
^EPL Point – Licensed discharge point

Surface water quality testing parameters from the SWMP are specified in Table 7-2.

Table 7-2 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, dissolved metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc, iron)
Frequency based (quarterly)	Conductivity, pH, Temp

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.

7.1.2.1 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.

BCOPL submitted an updated SWMP (Rev 8) to DPIE for approval in July 2019; however, no approval has yet been received. It is noted that the implementation of the currently approved SWMP is non-compliant as the clean water drain presented in the SWMP to the north of the disturbance area has been mined through and has not been reinstated.

This current clean water drainage system is presented in the SWMP (Rev8) submitted to DPIE which removes this clean water drain. GHD were commissioned by BCOPL to complete a report to justify not reinstating this drain and provided evidence that BCM is not harvesting clean water outside of harvestable rights allowances (GHD, 2017). As the current SWMP (Rev8) is yet to be approved by DPIE the implementation of the approved SWMP is considered noncompliant.

BCOPL continue to liaise with DPIE throughout the reporting period with regard to the approval of the revised water management system.

7.1.3 Environmental Performance

7.1.3.1 Surface Water Quality Criteria

7.1.3.1.1 EPL Compliance Criteria

EPL 12407 sets concentration limits for pollutants discharged from the three licenced discharge points 1, 3 and 4 (SD6, SD3 and SD4). The limits specified in the EPL are shown in Table 7-3.

7.1.3.1.2 Ambient Water Quality Interim Trigger Levels

The SWMP specifies interim trigger levels for ambient water quality monitoring. Sufficient baseline data for the formation of statistically sound trigger levels was not available for Nagero Creek and the ANZECC (2000) default guidelines were considered to be unsuitable, as the ambient water quality has historically exceeded some of the criteria. The SWMP assigns interim trigger levels based on the ANZECC guideline values for the protection of Environmental Values (2010) and the 80th percentile value of the historic ambient monitoring results collected from SW2 (upstream of the BCM) as recommended by ANZECC (2000) for developing site-specific trigger values for slightly to moderately disturbed ecosystems.

7.1.3.2 Results of Event Based Monitoring

There was one surface water discharge event during the reporting period on 8 February 2020 from licensed discharge Point 1 (SD6). The discharge occurred solely as a result of rainfall measured at the premises which exceeded 38.4mm in the 5 days prior. Sampling was undertaken in accordance with the EPL at Point 1 (SD6), upstream (SW2) and downstream (SW1) of the LDP. The samples were analysed for the parameters included in test suite A as specified in EPL 12407 and the SWMP. The results are shown in Table 7-3 and demonstrate compliance with the criteria.

7.1.3.3 Results of Ambient Water Quality Monitoring

As outlined in the SWMP, BCOPL has undertaken monitoring upstream (SW2) and downstream (SW1) of the BCM following rainfall that is sufficient to generate flow within Nagero Creek. During the 2020 reporting period three rainfall events were sampled. On two of these occasions there was adequate flow at SW2 to collect samples for analysis.

The results have been compared to the interim trigger levels discussed in section 7.1.3.1.2. The 80th percentile for historic results gathered between 2008 and 2016 have recently been reviewed and were found to be incorrect. The corrected 80th percentile trigger levels are shown in Table 7-4.

Exceedences of the appropriate ANZECC (2000) guidelines and/or the 80th percentile of historic results have occurred at both SW1 and SW2 for Total Nitrogen, Total Phosphorus, TSS and Copper. Reactive Phosphorus was exceeded at SW1 during the three monitoring events. These concentration levels are consistent with those used to create the ‘Narego Creek’ baseline specified in the approved SWMP on which the 80th percentile is based.

Table 7-3 Summary of Event Based Discharge Monitoring Results

Date	Parameters							
	pH (pH units)	Total Suspended Solids* (mg/L)	Oil and Grease (mg/L)	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrogen (total) (mg/L)	Total Phosphorus as P (mg/L)	Reactive Phosphorus (mg/L)
EPL 12407 Criteria	6.5-8.5	50	10	-	-	-	-	-
Licenced Discharge Point 1- SD6 (Downstream of MIA, referred to as Nagero Dam)								
08/02/2020	7.49	326*	<5	113	0.76	<1.0	0.3	0.12
SW1 (Nagero Creek Downstream of BCM)								
08/02/2020	7.87	506*	<5	334	2.86	4.0	0.12	0.04
SW2 (Nagero Creek Upstream of BCM)								
08/02/2020	7.08	206*	<5	11	3.25	4.0	0.04	<0.01

(*) The total suspended solids (TSS) concentration limits specified for Points 1, 3 and 4 may be exceeded for water discharged provided that:

- *the discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4mm over any consecutive 5 day period immediately prior to the discharge occurring; and*
- *all practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store runoff from a 38.4mm 5 day rainfall event.*

Note: 38.4mm equates to the 5 day 90%ile rainfall depth for Gunnedah sourced from Table 6.3a Managing Urban Stormwater: Soil and Construction Volume 1:4th edition, March 2004.

Table 7-4 Summary of Ambient Water Quality Monitoring Results

Date	Parameters															
	pH (pH units)	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrogen (total) (mg/L)	Total Phosphorus as P (mg/L)	Total Suspended Solids (mg/L)	Oil and Grease (mg/L)	Reactive Phosphorus (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Nickel (mg/L)	Lead (mg/L)	Zinc (mg/L)	Iron (mg/L)
ANZECC (2000) guideline	6.5-8.0[a]	3-350[a]	0.7[a]	0.25[a]	0.02[a]	40[b]	Not be noticeable as a visible film on the water	0.015[a]	0.035[a]	0.0002[a]	0.001[a]	0.0014[a]	0.011[c]	0.0034[a]	0.005[b]	10[c]
80th Percentile (SWMP)	7.5	184	0.048	1.24	0.27	114		0.05	0.001	<0.0001	<0.001	0.004	0.0054	0.0036	0.042	3.778
SW1 (Nagero Creek Downstream of BCM)																
16/01/2020	7.14	114	0.55	4.1	1.19	262	<5	0.14	0.002	<0.0001	<0.001	0.003	0.003	<0.001	<0.005	0.45
17/12/2020	6.91	172	0.77	2.9	0.71	507	<5	0.22	0.001	<0.0001	<0.001	0.003	0.004	<0.001	<0.005	0.83
22/12/2020	6.75	92	0.65	1.8	0.35	216	<5	0.14	<0.001	<0.0001	<0.001	0.001	0.002	<0.001	<0.005	0.37
SW2 (Nagero Creek Upstream of BCM)																
17/12/2020	6.6	109	0.46	2.4	0.84	208	<5	<0.01	0.001	<0.0001	<0.001	0.003	0.003	<0.001	<0.005	0.64
22/12/2020	6.77	104	0.35	1.7	0.12	54	<5	<0.01	<0.001	<0.0001	<0.001	0.002	0.004	<0.001	<0.005	0.95

< Below detectable limit

a: ANZECC (2000) guideline for the protection of aquatic ecosystems, south-east Australia, slightly to moderately disturbed ecosystem, upland streams (>250mAHD);

b: ANZECC (2000) guideline for aquatic foods;

c: ANZECC (2000) guideline for irrigation water (short term)

7.1.3.4 Results of Frequency Based Monitoring

Frequency based monitoring was undertaken on the following dates:

- Quarter 1 – 5 March 2020;
- Quarter 2 – 2 June 2020;
- Quarter 3 – 16 September 2020; and
- Quarter 4 – 7 December 2020.

Due to a lack of water, monitoring samples were unable to be obtained during the third and fourth quarter for 2020 at SD4 and the fourth quarter at MW3. The in situ results for quarterly monitoring are provided in Table 7-5, with the laboratory results indicated in brackets.

Table 7-5 Summary of Frequency Based Monitoring Results

	MW3	SD3	SD4	SD6	SD10	SD12	SD23
pH							
Q1	8.53	8.85	8.1	7.9	7.91	8.39	8.83
Q2	8.61	8.34	8.59	8.49	8.01	8.78	8.72
	(8.23) *	(8.26) *	(7.71) *	(8.48) *	(8.05) *	(8.69) *	(8.65) *
Q3	8.67	8.68	*DRY*	8.55	8.25	8.88	8.64
Q4	*DRY*	8.75	*DRY*	8.32	7.78	8.7	8.05
				(8.33) *	(7.84) *	(8.73) *	(8.21) *
Average	**8.60**	**8.66**	**8.35**	**8.32**	**7.99**	**8.69**	**8.56**
Conductivity (µS/cm)							
Q1	421	834	211.5	365.0	1,471	954	1,226
Q2	894	724	235.4	1,430	1,396	1,922	394
	(933)*	(771)*	(253) *	(1,530) *	(1,540) *	(2,000) *	(1,410) *
Q3	1,344	851	*DRY*	1,256	1,791	1,826	1,386
Q4	*DRY*	1,016	*DRY*	1,836	1,859	2,322	1,735
		(1,020) *		(1,780) *	(1,980) *	(2,290) *	(1,680) *
Average	**886**	**856.25**	**223.45**	**1,222**	**1,629**	**1,756**	**1,185**

Results show pH measured in situ ranged from 7.78 to 8.88, with an average of 8.45 across all sediment dams included in quarterly monitoring. This is a slightly higher average than recorded in the 2019 reporting period where the average overall pH was 8.39. The in situ pH results were generally similar to the lab analysis results.

Conductivity measured in situ ranged from 211 µS/cm to 1,922 µS/cm with an average of 1,108 µS/cm across all surface water monitoring locations during the reporting period. This is a lower average than recorded during 2019 reporting period where the average overall conductivity was 1,406 µS/cm. The in situ conductivity results were generally similar to the lab analysis results.

7.1.3.5 Demand, Take and Usage

In accordance with its surface water licences and SSD 09_0182, BCOPL accesses surface water from the Namoi River from time to time. BCOPL also holds water entitlements for groundwater extraction from the Namoi River alluvium. 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 2019 to 30 June 2020) is detailed in Table 7-6.

Table 7-6 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	2020	612	66	1470.07	1536.07
29473 29562	Gunnedah Oxley Basin Murray Darling Basin Groundwater Source, NSW Murray Darling Basin Porous Rock Groundwater Sources WSP	842	210.5	0	529	12.58	541.58
2571 2572 2595 2596	Lower Namoi Regulated River, Upper Namoi and Lower Namoi Regulated River WSP	30.6	188	0	0	0	0
37067	Upper Namoi Regulated River, Upper Namoi and Lower Namoi Regulated River WSP	64	0	0	0	0	0
42234	Upper Namoi Zone 11 Maules Creek Groundwater source. Purchased 9/1/2019	20	40	0	4	0	4

*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.

7.1.3.5.1 Water Demand

Core water demands during the 'water year' reporting period (1 July 2019 to 30 June 2020) were for coal processing in the CHPP and dust suppression. Quantities of water were also required for vehicle washdown and potable water uses. Table 7-7 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 2010 EA (Hansen Bailey, 2010); however, these have been updated a number of times since to account for changes to water demand and usage in light of approved changes to the operations.

Table 7-7 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	1,460 ML/yr	1,460 ML/yr	365 ML/yr

7.1.3.5.2 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 1,041.38 ML of water was used for dust suppression. This represents a reduction in water use from the previous reporting period, when 1,252.74 ML of water was used. This is attributed to a much higher rainfall during the 2020 reporting period. A cumulative rainfall of 826.8 mm was recorded at the end of 2020 compared to only 210.8mm recorded for 2019. The moisture content of product coal that was output from the CHPP in 2020 has been estimated as 584 ML. This represents 9.2% of the 6,300,000 tonnes of coal leaving the BCM being estimated as water.

In addition, a total of 216.45 ML of water was used in the CHPP & MIA during the reporting period. This includes water used in the coal bypass, processing plant and train load out. The total water usage for dust suppression and the CHPP is below the predicted demand as detailed in Table 7-7.

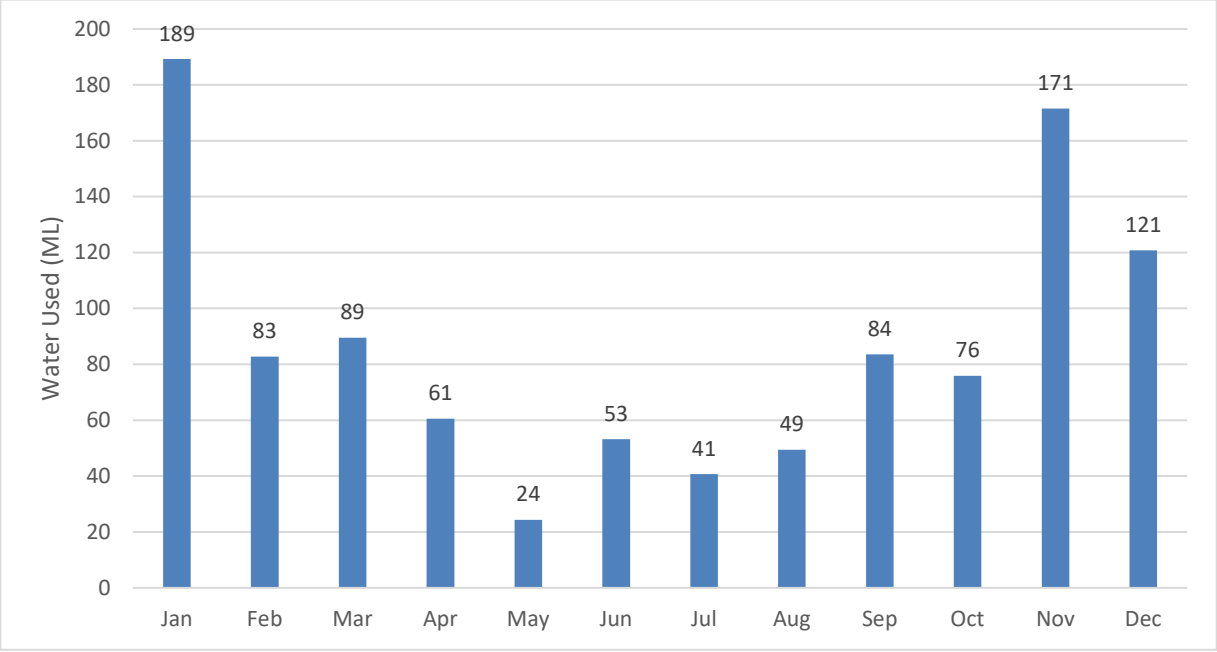


Figure 7-1 Monthly Dust Suppression Water Usage (ML)

7.1.3.5.3 Water Storage

Details of BCM's water storage dams including their design capacity and storage at the beginning (as at 7January 2020) and end of the reporting period (as at 29 December 2020), are outlined in Table 7-8.

Table 7-8 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	194.8	76.5	102.3	14.45	50.36
SD6	Downstream of MIA (referred to as Nagero Dam)	Dirty Water: Runoff from grassed areas near MIA, and overflows from SD10 and SD8	65.2	28.5	52.2	2.64	17.39
SD7	Eastern spoil dump	Dirty Water: runoff from spoil dump and clean runoff from undisturbed catchment	210.3	-	95.1	61.21	72.95
SD8	In MIA	Dirty Water: runoff from MIA	11.2	4.9	13.39	0.23	3.32
SD23	Near topsoil stockpile	Dirty Water: runoff from topsoil stockpile	51.6	-	16.96	16.28	16.7
Dirty water total			**533.1**	**109.9**	**280.0**	**94.81**	**160.72**
Contaminated water							
SD10	CHPP	Contaminated Water: runoff from product coal stockpile	31.4	81.9	116.4	45.84	55.09
SD11	At rail loop	Contaminated Water: runoff from rail loop	3.8	10	16.4	0	3.81
SD12	CHPP	Contaminated Water: runoff from ROM coal stockpile	46.2	120.5	206.6	30.57	63.98
SD28	Train load out facility (**TLO**)	Contaminated Water: Runoff from TLO	0.7	1.7	3.5	0.24	1.04
SD29*	CHPP	Contaminated Water: Runoff from coal stockpile area south	-		10.5	0	-

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	10.7	13.1	153.5	0	4.23
MW5	In pit	Contaminated Water Storage Dam	208.4	1,000	2,200	500.5	701.73
MW8	In pit	Contaminated Water: surplus mine water from pit	-	-	52.93	-	30.21
Contaminated water total			**301.1**	**1227.2**	**2,759.8**	**577.2**	**860.1**

*Decommissioned during the previous reporting period

7.1.3.5.4 Long Term Trend Analysis

In accordance with SSD 09_0182 a long term trend analysis of surface water monitoring results at BCM has been undertaken using data from 2015 to 2020 to identify any trends in the monitoring. The results indicate the following:

- The pH of surface water monitoring locations has generally remained relatively stable between 2015 and 2020 with averages ranging from 8.30 to 8.72; and
- EC has generally remained stable from 2015-2020 with averages ranging from 1,108 µS/cm and 1,1432 µS/cm. Monitoring locations SD12 and SD23 are systematically elevated. Monitoring location SD4 has been dry for most of 2017-2019 and MW3 and SD6 recently recording dry in 2019 likely due to drought conditions. At the sites with sufficient water for consistent sampling, results have shown a slight increase in EC during 2017-2019 which is likely due to the drought's impact on flow conditions.

7.1.4 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.

7.2 Groundwater

7.2.1 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 7.

The GWMP provides a framework defining how BCOPL will assess, manage, and mitigate impacts to the groundwater system. This framework particularly focuses on impacts to the shallow alluvial aquifer attributable to 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 several groundwater bores. The amount of water extracted from groundwater sources and corresponding entitlements are identified in Table 7-6.

7.2.1.1 Groundwater Monitoring Program

BCOPL's groundwater monitoring program focuses on potential impacts to environmental assets and groundwater users in the area surrounding BCM, and aims to:

- Identify changes to the natural groundwater system attributable to mining operations.
- Demonstrate compliance with the SSD.

Groundwater monitoring during 2020 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 December 2020), as listed in Table 7-9.

Table 7-9 Groundwater Quality Testing Parameters

Monitoring type	Determinants
Six-monthly laboratory analysis (June and November)	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 (March, June, September, and December)	Electrical Conductivity (EC), pH, temperature, groundwater level

Groundwater quality field parameters (Electrical Conductivity (EC), pH and temperature) were measured quarterly, while sampling for major ions, dissolved metals and nutrients was undertaken in June and November 2020. Four groundwater monitoring bores (IBC2102, IBC2103, IBC2104 and IBC2105) that were mined through were removed from the monitoring network and the EPL was amended to reflect these changes. Bore MW6 was blocked throughout 2019 and into the first half of 2020. This bore was redrilled in August 2020.

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.

During the reporting period, the active groundwater monitoring network comprised five monitoring bores screened across different geological units. Details of these bores are listed in Table 7-10 and their respective locations are shown in Appendix B.

Table 7-10 Groundwater Monitoring Bores

EPL ID	Bore	Licence	Depth (mBGL [B])	Screen interval (mbtoc [A])	Geological Unit	Screened geology	Notes for reporting period
7	GW3115	90BL253832	-	0-42	Colluvial Aquifer	Boggabri Volcanics (weathered)	Water level and quality
12	IBC2110	90BL253841	100	91-97	Colluvial Aquifer	Boggabri Volcanics	Water level and quality
13	IBC2111	90BL253840	45	36-42	Colluvial Aquifer	Boggabri Volcanics (weathered)	Water level and quality
-	BC2181 (MW4)	90BL255765	114	105-111	Maules Creek Formation Aquifer	Merriown Coal Seam	Water level and quality
-	MW6	90BL254255	34	28-34	Nagero Creek Alluvium	Alluvium	Re-drilled August 2020

Three additional locations (Belleview 3, Victoria Park MB and Cooboobindi) have been monitored since 2017, including groundwater level and quality. 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.

7.2.1.2 Annual Groundwater Monitoring Review

BCOPL commissioned Engeny Water Management to update the groundwater monitoring analysis for inclusion in the Annual Review, in accordance with the GWMP. The review assesses BCM's groundwater monitoring data and provides analyses on groundwater levels and groundwater quality during the 2020 reporting period. Findings from the review are summarised in the following sections.

7.2.2 Environmental Performance

All bores that have been impacted through the encroachment of mining activities, have been removed from the groundwater monitoring network as described within the GWMP currently awaiting approval from DPIE, and the NSW EPA approved an application to vary EPL 12407.

7.2.2.1 Groundwater Level Results

The minimum water levels recorded in 2020 have been compared with the trigger levels defined in the GWMP and are provided in Table 7-11.

During the monitoring period, bores screened in the Boggabri Volcanics (IBC2110, IBC2111 and GW3115) remained within trigger values defined in the GWMP, as did the monitoring bore within the alluvium (MW6). However, the monitoring bore within the Merriown seam (BC2181) dropped below the trigger value. The drop in water level within BC2181 triggered a review by a suitably qualified hydrogeologist. The review concluded that the observed impacts were consistent with the predicted depressurisation of the coal seam aquifer resulting from the progression of approved mining operations.

Table 7-11 Minimum Measured Groundwater Levels

Monitoring bore	Trigger value (5th percentile) (mAHD)	Minimum water level 2020 reporting period
GW3115	257.00	257.01
IBC2110	257.25	263.41
IBC2111	256.75	263.16
BC2181	240.65	238.39
MW6	258.67	262.37

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 7-2. Figure 7-2 also includes historical monitoring data from the discontinued bores.

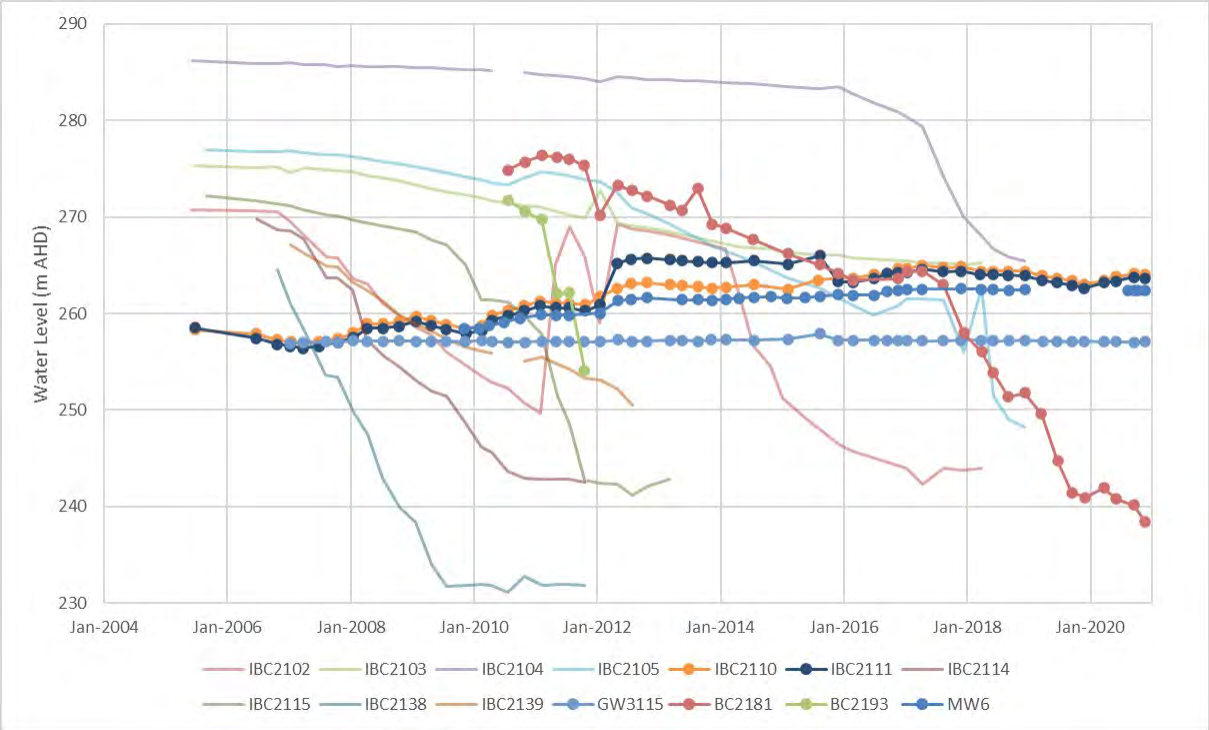


Figure 7-2 Long Term Groundwater Levels for all Bores

Figure 7-2 clearly shows that the monitoring bores within the Boggabri Volcanics (IBC2110, IBC2111 and GW3115) and alluvium (MW6) have continued to remain relatively stable. A clear downward trend continues for the monitoring bore within the Merriown Seam (BC2181), as mining progresses and depressurises the seam (as predicted to occur over time).

7.2.2.1.1 Quaternary Alluvium

Monitoring bore MW6 is the only bore screened in the alluvium. Monitoring of MW6 resumed in August 2020. As indicated in Section 7.2.2.1 and Figure 7-2, the recorded water level in MW6 has remained relatively stable at around 262m AHD for at least the last four years.

7.2.2.1.2 Boggabri Volcanics

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

As indicated in Figure 7-2, the recorded water level in IBC2110 and IBC2111 have increased slightly during 2020 but remain within the recent range of about 263m AHD to 265m AHD. GW3115 has continued to remain relatively stable at about 257m AHD, showing no clear movement in 2020 (Figure **7-2**).

7.2.2.1.3 Maules Creek Formation

The groundwater monitoring network at BCM includes a single bore in the Merriown Seam (BC2181).

As indicated in Section 7.2.2.1 and Figure 7-2, water levels in BC2181 continue to decrease as mining progresses.

7.2.2.2 Comparison of predicted and annual water levels

AGE (2010) developed and calibrated a groundwater model to predict possible void inflows and drawdown caused by the coal extraction activities. AGE have since revised the groundwater model to include cumulative impacts from adjacent operations within the BTM Complex.

Modelled water levels within the Maules Creek Formation were predicted to decrease over the life of the mine (AGE, 2010). Drawdown has been observed in the Maules Creek Formation, which is consistent with the predicted decrease in water levels at BC2181 (Section 7.2.2.1). As the groundwater levels within BC2181 are expected to continue to decrease as mining progresses, it is proposed that the water level trigger value for this bore will be removed.

The BTM Ground Water Model was validated and updated in 2018. Immediately following acceptance of this model by DPIE, the BTM commenced consultation with members of DPIE's Resource Assessments team and their Water Division along with NRAR. Validation, update and consultation of this ground water model has been ongoing throughout 2018, 2019, 2020 & 2021, with submission of the resulting model report to DPIE scheduled to occur in August 2021.

7.2.2.3 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 GWMP for the currently active monitoring bores are presented in Table 7-12.

7.2.2.4 Compensatory groundwater

In accordance with Schedule 3, condition 34 of the SSD, BCOPL is required to provide a compensatory water supply to any landowner of privately-owned land whose water supply is adversely and directly impacted because of the project.

No adverse or direct impacts to water supply was reported in 2020, therefore no compensatory water supplies were provided.

Table 7-12 Groundwater Quality Trigger Values

Parameter	Trigger values	Exceedance criteria	Coal Measures	Alluvium	Boggabri Volcanics		
			BC2181	MW6	IBC2110	IBC2111	GW3115
pH	Median		7.0	7.2	7.9	6.9	7.6
	HTV (99.87th %ile)	1 data point	8.2	7.6	8.3	8.1	8.3
	MTV (97.73rd %ile)	2 consecutive data points	7.8	7.6	8.2	7.8	8.1
	LTV (84.13th %ile)	5 consecutive data points	7.2	7.5	8.0	7.3	7.8
	LTV (15.87th %ile)	5 consecutive data points	6.8	7.0	7.7	6.8	7.5
	MTV (2.27th %ile)	2 consecutive data points	6.7	6.9	7.6	6.5	7.2
	HTV (0.13th %ile)	1 data point	6.6	6.9	7.4	6.5	7.2
EC (µS/cm)	Median		740	2,045	2,035	2,320	3,435
	LTV (84.13th %ile)	5 consecutive data points	834	2,257	2,124	2,438	3,577
	MTV (97.73rd %ile)	2 consecutive data points	1,093	2,350	2,331	2,540	3,783
	HTV (99.87th %ile)	1 data point	1,269	2,369	2,660	2,559	3,846
Sulphate (mg/L)	Median		23	52	52	59	180
	LTV (84.13th %ile)	5 consecutive data points	30	67	83	83	202
	MTV (97.73rd %ile)	2 consecutive data points	43	75	100	93	211
	HTV (99.87th %ile)	1 data point	52	77	121	107	212
Chloride (mg/L)	Median		49	278	284	342	647
	LTV (84.13th %ile)	5 consecutive data points	77	391	391	400	697
	MTV (97.73rd %ile)	2 consecutive data points	118	483	467	455	745
	HTV (99.87th %ile)	1 data point	139	511	509	490	767
Sodium (mg/L)	Median		70	375	431	348	714
	LTV (84.13th %ile)	5 consecutive data points	84	403	465	366	767
	MTV (97.73rd %ile)	2 consecutive data points	139	414	491	379	802

7.2.2.5 Groundwater Quality Results – Field Parameters

Time series plots of pH and EC are presented in Figure 7-3 and Figure 7-4 respectively. Water quality field parameters for EC and pH have also been compared to the trigger values, with results presented in Table 7-12.

EC was within trigger values throughout 2020 at all monitoring locations, except for IBC2110 and IBC2111 which are installed in the Boggabri Volcanics.

The exceedance of the EC trigger values at IBC2110 in November 2020 is considered to be an outlier. However, there is a gradual increasing trend in EC at IBC2110. The exceedance of EC trigger values at IBC2111 is associated with an increasing trend in EC at this monitoring location. The increasing trend at both IBC2110 and IBC2111 may be related to the observed historical trends in groundwater level in alluvium and Boggabri Volcanics monitoring bores.

There were exceedances of the pH trigger values in 2020. The lower bound HTV was exceeded in both June and November 2020 at IBC2110, IBC2111, GW3115 and MW6. Despite exceeding trigger values, the pH at BC2181 remained within the historical range of values in 2020.

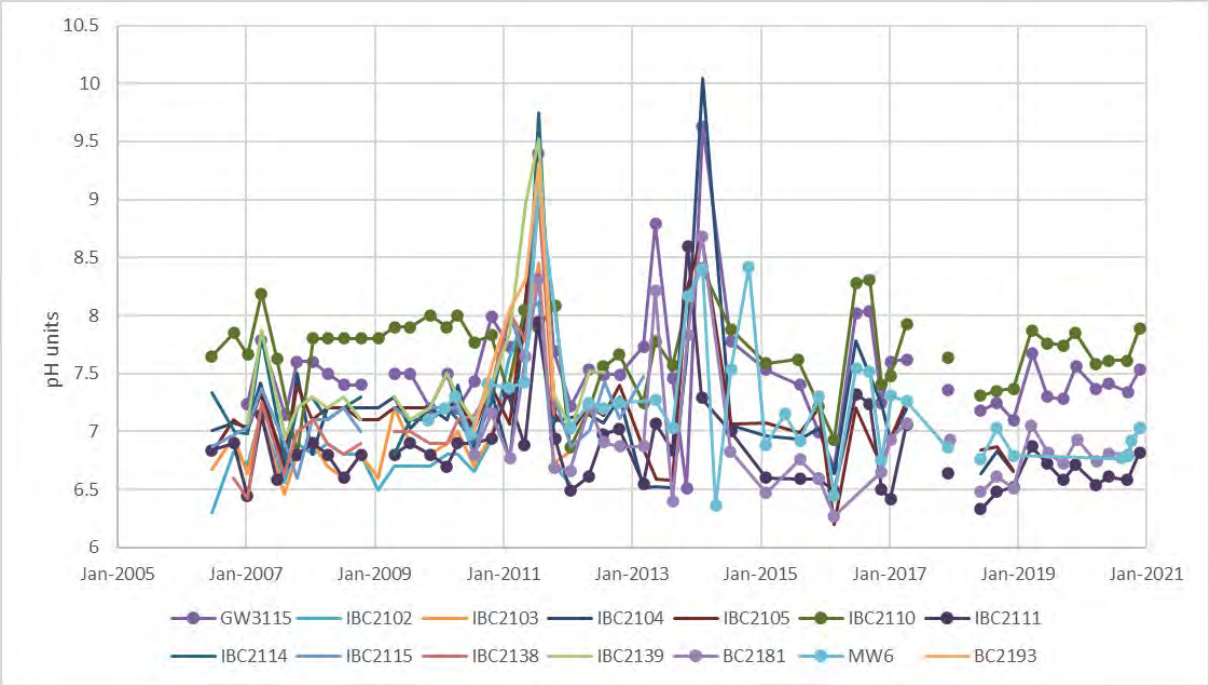


Figure 7-3 Groundwater Trends in pH

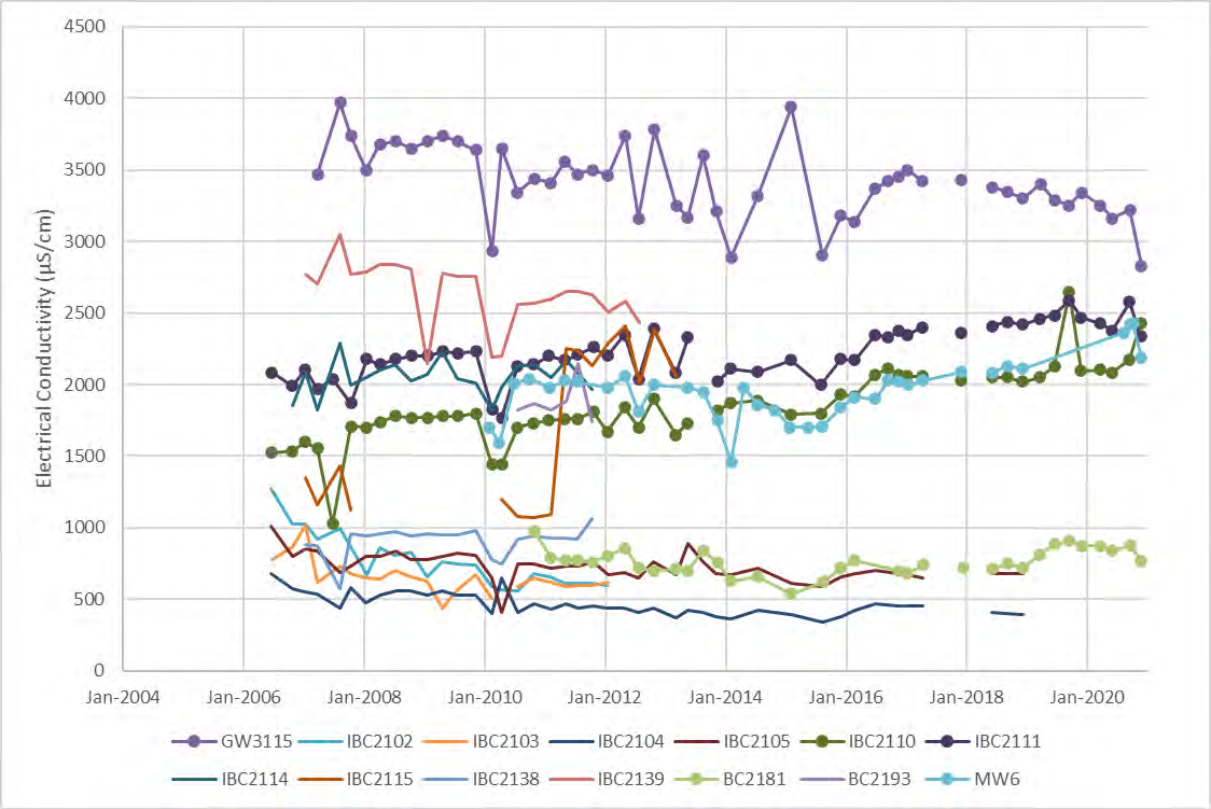


Figure 7-4 Groundwater Trends in Electrical Conductivity

Table 7-13 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)			
23/03/2020	257.08	7.37 [a]	3,250
2/06/2020	257.06	7.41 [a]	3,160
17/09/2020	257.01	7.34 [a]	3,220
25/11/2020	257.09	7.53	2,830
IBC2110 (Boggabri Volcanics)			
23/03/2020	263.41	7.58 [a]	2,102
2/06/2020	263.82	7.61 [a]	2,085
16/09/2020	264.14	7.61 [a]	2,176 [a]
24/11/2020	264.05	7.89	2,431 [a]
IBC2111 (Boggabri Volcanics)			
23/03/2020	263.16	6.54	2,426
3/06/2020	263.36	6.61	2,379
16/09/2020	263.75	6.58	2,578
24/11/2020	263.61	6.82	2,335

Bore and date sample	Standing Water Level (m AHD)	pH (pH units)	Electrical Conductivity (µS/cm)
BC2181 (Merriown Seam)			
24/03/2020	241.94	6.74 [a]	875 [b]
4/06/2020	240.77	6.81	839 [b]
17/09/2020	240.16 [a]	6.80	876 [b]
25/11/2020	238.39 [a]	7.03	769
MW6 (Alluvium			
24/03/2020	262.4	6.77 [a]	2,362 [C]
4/06/2020	262.4	6.79 [a]	2,425 [C]
17/09/2020	262.4	6.92 [a]	2,428 [C]
25/11/2020	262.4	7.03	2,185

Notes:

[a] 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

[c] two consecutive exceedances of the MTV (as defined in Table 7-11)

7.2.2.5.1 Groundwater - Major Ions

Major ion compositions were analysed as part of the analytical suite. Results for major ions are presented in Table 7-14.

All major ions at sites sampled were compliant with the trigger values except for exceedances for chloride and sulfate. The HTV for chloride was exceeded in both June and November 2020 for GW3115. The HTV for chloride was exceeded in November 2020 at IBC2110. The HTV for sulfate was exceeded at IBC2110 and IBC2111 in November 2020.

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 at these bores 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.

Table 7-14 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)							
2/06/2020	663	154	559 [a]	57	16	626	4
25/11/2020	737	175	558 [a]	60	16	620	4
IBC2110 (Boggabri Volcanics)							
2/06/2020	429	74	353	14	5	426	3
24/11/2020	466	122 [a]	511 [a]	20	24	484	5

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)
IBC2111 (Boggabri Volcanics)							
3/06/2020	672	78	389	127	43	339	5
24/11/2020	695	108 [a]	399	136	43	339	5
BC2181 (Merriown Seam)							
4/06/2020	418	16	37	70	25	70	10
25/11/2020	376	21	35	72	23	65	9
MW6 (Alluvium)							
12/08/2020	671	61	425 [b]	73	30	371	6
17/09/2020	660	70 [a]	415 [b]	74	35	416 [c]	7
9/10/2020	691	70 [a]	513 [a]	79	33	408 [b]	7
25/11/2020	706	77 [a]	351	76	33	387	6

Notes:
[a] exceedance of the HTV (as defined in Table 7-11)
[b] an exceedance of the LTV (but less than 5 consecutive readings that would constitute a breach of the trigger).
[c] an exceedance of the MTV (but less than 2 consecutive readings that would constitute a breach of the trigger).

7.2.2.5.2 Groundwater - Metals

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

A summary of the metal concentrations recorded during the reporting period is presented in Table 7-15.

Table 7-15 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)									
2/06/2020	<0.001	<0.0001	<0.001	0.002	<0.001	0.091	0.003	0.035	3.54
25/11/2020	<0.001	<0.0001	<0.001	<0.001	<0.001	0.088	<0.001	0.024	2.72
IBC2110 (Boggabri Volcanics)									
2/06/2020	<0.001	<0.0001	<0.001	<0.001	<0.001	0.079	0.008	<0.005	<0.05
24/11/2020	<0.001	<0.0001	<0.001	<0.001	<0.001	0.016	0.008	0.006	<0.05
IBC2111 (Boggabri Volcanics)									
3/06/2020	<0.001	<0.0001	<0.001	0.042	<0.001	0.015	0.002	0.19	<0.05
24/11/2020	<0.001	<0.0001	<0.001	0.025	<0.001	0.033	0.004	0.194	0.08
BC2181 (Merriown Seam)									
4/06/2020	<0.001	<0.0001	<0.001	0.003	<0.001	0.108	0.006	0.072	<0.05
25/11/2020	0.006	<0.0001	<0.001	<0.001	<0.001	0.115	0.002	0.018	2.22

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)
MW6 (Alluvium)									
12/08/2020	<0.001	<0.0001	<0.001	0.022	<0.001	0.034	0.005	0.127	0.14
17/09/2020	<0.001	<0.0001	<0.001	0.006	<0.001	0.04	<0.001	0.063	0.05
9/10/2020	<0.001	<0.0001	<0.001	0.008	<0.001	0.038	0.003	0.049	0.05
25/11/2020	<0.001	<0.0001	<0.001	0.008	<0.001	0.063	0.004	0.087	0.05

7.2.2.5.3 Groundwater - Nutrients

Nutrient concentrations during 2020 were generally similar to historical concentrations, with spikes in nitrate (and total nitrogen) concentrations at GW3115 and IBC2110 in June 2020, compared to previous years, and spikes in phosphorus concentrations at IBC2110, IBC2111 and BC2181 in June 2020, compared to previous years, as presented in Table 7-16.

Table 7-16 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)								
2/06/2020	0.09	<0.01	0.32	0.32	-	0.5	0.01	<0.01
25/11/2020	0.13	<0.01	0.03	0.03	-	0.2	<0.01	<0.01
IBC2110 (Boggabri Volcanics)								
2/06/2020	0.18	<0.01	0.12	0.12	-	0.5	0.57	0.04
24/11/2020	0.19	<0.01	0.06	0.06	-	0.3	0.02	<0.01
IBC2111 (Boggabri Volcanics)								
3/06/2020	<0.01	<0.01	5.75	5.75	-	6.2	0.06	<0.01
24/11/2020	<0.01	<0.01	4.04	4.04	-	4.2	0.03	0.01
BC2181 (Merriown Seam)								
4/06/2020	0.09	<0.01	0.13	0.13	-	4.4	0.52	<0.01
25/11/2020	0.25	<0.01	0.06	0.06	-	0.5	0.04	<0.01
MW6 (Alluvium)								
12/08/2020	0.05	<0.01	1.91	1.91	2.2	<0.01	<0.01	0.05
17/09/2020	<0.01	<0.01	2.18	2.18	2.8	0.1	0.05	<0.01
9/10/2020	<0.01	0.02	2.18	2.2	2.6	0.07	<0.01	<0.01
25/11/2020	0.04	<0.01	2.18	2.18	2.5	0.07	0.04	0.04

Note: '-' denotes not analysed

7.2.2.5.4 Long-Term Water Quality Trend Analysis

Long term trends in groundwater quality were assessed using the Mann-Kendall test for the last five years of data (Table 7-17).

Table 7-17 Long Term Mann-Kendall Water Quality Trends

Analyte	GW3115	IBC2110	IBC2111	BC2181	MW6
pH	S	N	↑	N	S
EC	↓↓↓	↑↑	↑↑↑	↑↑↑	↑↑↑
Sulfate	N	N	N	↓↓	↑↑↑
Chloride	N	N	N	S	↑↑↑
Sodium	↓↓↓	S	S	S	↑
Calcium	↓↓↓	S	N	↑↑↑	↑↑↑
Magnesium	↓↓↓	N	↑↑	N	↑↑↑
Potassium	S	N	N	N	S
Nickel	I	↑↑↑	N	N	↑↑
Zinc	↑	S	N	↑	↑↑
Iron	↓	S	N	S	N
Nitrite	I	S	S	S	N
Nitrate	S	N	S	N	↑↑
Phosphorus	S	↑↑	N	N	N

↓↓↓ (↑↑↑) = decreasing (increasing) trend with > 99% confidence

↓↓ (↑↑) = decreasing (increasing) trend with > 95% confidence

↓ (↑) = probable decreasing (increasing) trend with > 90% confidence

S = Stable

N = No trend

I = Insufficient data

The analysis (Table 7-17) suggests statistically strong increasing trends are most notable at MW6. This is in part due to a two year data gap at this monitoring point. Should the strong increasing trend continue, further investigations into the potential causes of the increases will be required.

7.2.2.5.5 Groundwater Quality Summary

Groundwater quality was generally within trigger values except for several exceedances for pH and EC, and a number of exceedances for sulfate and chloride.

7.2.2.6 Mine Void Groundwater Inflow

7.2.2.6.1 Inflow Volumes

The groundwater make reported by BCOPL for the reporting period is 529 ML. This reported volume includes water that entered the 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 greater than the reported groundwater make.

7.2.2.6.2 Inflow Water Quality

A water quality sample was taken from the pit floor in November 2020. Results indicate that the water is mostly clean water catchment inflows into the pit.

7.2.3 Improvements and Initiatives

BCOPL will continue to estimate groundwater volumes intercepted by the pit using various information sources including modelling for the 2010 EA, updated BTM groundwater modelling, observations, and pump records for pit dewatering. Accurate accounting for the source of water that accumulates on the pit floor is required to continue to improve water management across the site, including water balance modelling and water inventory forecasting.

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 the MOP.

The MOP guides rehabilitation for all operational activities and associated infrastructure, and fulfils the rehabilitation requirements specified in SSD 09_0182. It focuses on rehabilitation of active pit and waste emplacement areas within CL368. However, closure components also consider lands and infrastructure occupied by the private haul road, rail spur, 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, leases, 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 revegetate 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); and
- 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; and
- Vegetation species and seed collection.

8.2 Rehabilitation Progress

8.2.1 Summary of Land Rehabilitation

During 2020 there was a variety of works conducted in the BCM rehabilitation area including:

- 55 ha of tube stock tree planting (approximately 43,000 trees);
- 33 ha of rehabilitation maintenance and repair; and
- 22 ha of bulk shaping of rehabilitation areas.

Intense storms during 2019 resulted in damage to parts of the rehabilitated areas with extensive erosion. During the second half of 2019 and into early 2020 design works were carried out to repair this damage and limit the chance of future erosion in these areas. During 2020 there was a significant focus of getting these works completed with the largest area of maintenance and repair works conducted in the BCM rehabilitation area.

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 2020 Plantings

The 2020 rehabilitation program involved intensive tube stock planting across the southern region of the BCM's waste emplacement area.

Seed used for the tube stock planted for the 2020 rehabilitation site was sourced locally from the South Brigalow Bioregion and was collected by 'FloraBank' trained personnel.

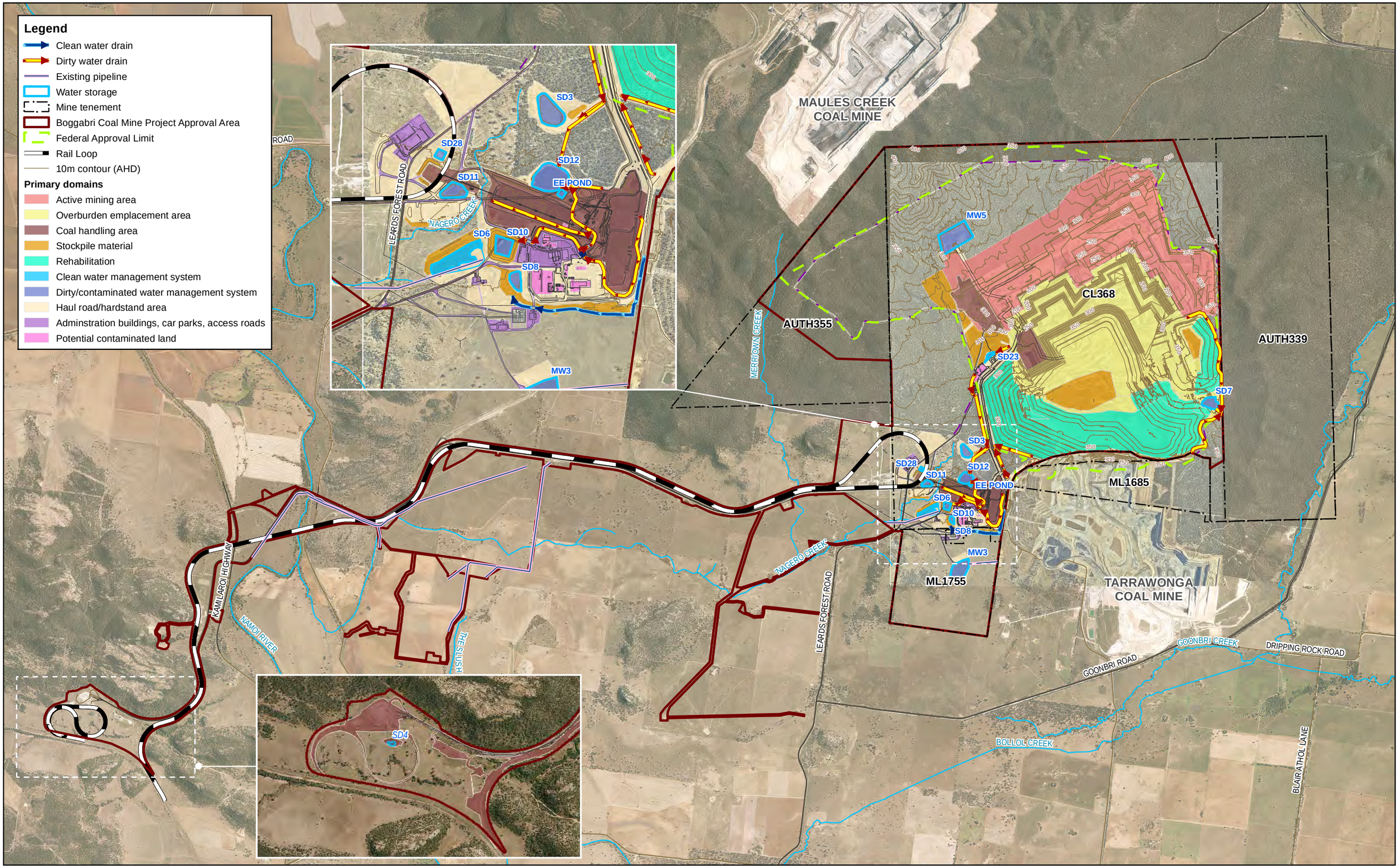
8.2.3 Rehabilitation Status

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 2019 and 2020 and predicted values for 2021 are summarised in Table 8-1.

Table 8-1 Rehabilitation Status

Mine Area Type	2019 Reporting Period (Actual) (ha)	2020 Reporting Period (Actual) (ha)	2021 Reporting period (Predicted) (ha)
A. Total mine footprint	1433.9	1529.99	1548.62
B. Total actual disturbance	1338.6	1406.29	1385.42
C. Land being prepared for rehabilitation	N/A	N/A	N/A
D. Land under active rehabilitation	263.7	292.1	320.5
E. Completed Rehabilitation	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 BC2021_AEMR008_A4_EOY2020
AUTHOR. AUVL502876
REVIEWED BY. N.Cooper
DATE. 21/07/2021

IDEMITSU
BOGGABRI COAL

FIGURE 8-1

TITLE. MINING AND REHABILITATION AT END OF 2020 REPORTING PERIOD

8.2.4 Comparison with MOP Predictions

The Independent Environmental Audit completed in November 2020 highlighted the need to report on progress in respect of rehabilitation completion criteria in future annual reviews. In accordance with the approved Action Plan BCOPL presented in Appendix F, BCOPL will report on this in the 2021 Annual Review.

8.3 Removal of Buildings

No buildings were removed from the BCM during the reporting period.

8.4 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 November 2020 within ten monitoring plots located within rehabilitation areas. Of the ten plots, three were new monitoring locations established during the 2020 monitoring program (refer to Table 8-2). 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); and
- 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)	
	Easting	Northing	A	B
RH2008	226985	6609210	190º	310º
RH2008D	227128	6608951	210º	270º
RH2010	227117	6609125	315º	85º
RH2011	226819	6609901	205º	5º
RH2016	230013	6610349	315º	230º
RH2017	227930	6609359	205º	315º
RH2018A	229429	6608914	225º	345º
RH2018B	229567	6609131	0º	30º
RH2018BC	228411	6609191	95º	245º
RH2020	228959	6609097	245º	310º

8.4.1 Photographic Monitoring

Photographs of the monitoring sites for 2008, 2010, 2016, 2017, 2018 and 2020 rehabilitation areas are provided in Figure 8-2, Figure 8-3, Figure 8-4, Figure 8-5, Figure 8-6 and Figure 8-7 respectively.

Figure 8-2 2008 Rehabilitation Area (12 years old)

Figure 8-3 2010 Rehabilitation Area (10 years old)

Figure 8-4 2016 Rehabilitation Area (Four years old)

Figure 8-5 2017 Rehabilitation Area (Three years old)

Figure 8-6 2018 Rehabilitation Area (Two years old)

Figure 8-7 2020 Rehabilitation Area (One year old)

8.4.2 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 2020 monitoring event should be considered with respect to the extended and severe drought conditions experienced between 2017 and 2019 from which biological variables have been sampled.

8.4.2.1 Vegetation

A total of 179 species of plant were recorded from ten replicate mine rehabilitation monitoring sites during the 2020 monitoring event, of which 135 were native (75%) and 44 species were exotic (25%). No plant species recorded in the mine rehabilitation area during the 2020 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:

- Mean native species richness was generally recorded highest from within the older rehabilitation areas (RH2008, RH2008D, RH2010 and RH2011) and lowest within the younger sites (RH2018C and RH2020). The lower native species diversity recorded at the 2020 rehabilitation areas is not unexpected given the area was established within the same year the surveys were completed as opposed to the other monitoring sites, which were established eight to eleven years prior;
- There was an increase in mean native species diversity observed within all rehabilitation areas compared to the 2019 monitoring event. The increase is likely attributed to favourable seasonal conditions preceding the survey period which provided relief from severe drought conditions observed between 2017 and 2019;
- Native vegetation groundcover percentage cover is low across all rehabilitation age-classes, however generally highest in the younger rehabilitation sites where the canopy cover is lowest;
- Mean exotic species richness has generally increased in all mine rehabilitation monitoring sites. This is most likely attributable to favourable seasonal conditions preceding the survey period, which provided relief from severe drought conditions observed between 2017 and 2019. This supports the monitoring data completed to date, which indicates that mean exotic species richness fluctuates and can be influenced by seasonal climatic conditions. This is illustrated by the notable increase of mean exotic richness in 2016, which occurred following a period of high rainfall, and the subsequent decline in 2018 and 2019 in response to drought conditions;
- Data acquired during the 2020 mine rehabilitation monitoring event indicates that all mine rehabilitation age classes sampled failed to meet the RMP exotic species richness performance criteria. To meet the RMP performance criteria mine rehabilitation areas must be at or below the Leard State Forest exotic species analogue benchmarks for their respective final land use secondary domain. The two final land use secondary domains sampled in 2020 where shrubby woodland/forest (analogue benchmark of 2.8 exotic species) and grassy woodlands (analogue benchmark of 2.2 exotic species). All mine rehabilitation age class exceeded these analogue benchmark values during the 2020 monitoring event. Subsequently, all mine rehabilitation areas failed to meet the RMP exotic species performance criteria in 2020.
- 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 2020;
- Planted canopy species within one (RH2008) of the three older rehabilitation areas (i.e. RH2008, RH2008D and RH2010) were observed producing reproductive structures (including a combination of bud, fruit and flowers), recruitment from the soil seed bank was not however recorded at any of the older sites. This is different from the 2019 monitoring session where all three of the older rehabilitation areas recorded reproductive structures. Canopy species at the remaining 2020 monitoring locations showed no sign of reproductive structures;
- Many native groundcover and midstorey species recorded across all rehabilitation areas were observed recruiting from the soil seed bank and/or were producing reproductive structures. This suggests the groundcover and midstorey stratum is trending towards a self-sustaining native ecosystem.

8.4.2.2 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, Rufous Whistler, Superb Fairy-wren and Weebill. One threatened species, the Speckled Warbler, which is listed as Vulnerable under the BC Act, was recorded within the mine rehabilitation area during the 2020 monitoring program.

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 2010 (RH2010) recorded the highest mean diversity (9.5), followed by 2008 (RH2008 and RH2008D) (7.8).

Data acquired during the 2020 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 2020 monitoring event. Importantly, the analogue monitoring sites from which the benchmark was deduced, were also lower than the benchmark during the 2020 monitoring event, achieving a combined mean for bird species richness of 12.6.

Diurnal bird abundance across the mine rehabilitation area mirrored species richness for the 2020 monitoring event, generally observing a reduction within the younger rehabilitation age-classes. Mine rehabilitation planted in 2016 (RH2016) recorded the highest mean abundance (58.5), followed by 2017 (RH2017) (16), 2010 (RH2010) (15) and 2008 (RH2008 and RH2008D (11.8).

Data acquired during the 2020 monitoring event indicate that mean diurnal bird abundance for each mine rehabilitation age-class generally occurred below the Leard State Forest analogue benchmark of 26.1 (shrubby woodland/forest) and 31.6 (grassy woodland. Exceptions to this was the mine rehabilitation planted in 2016 (RH2016) with a mean abundance of 58.5. It is noted however, that this monitoring location occurs immediately adjacent to remnant vegetation associated with Leard State Forest. Additionally, a large mixed group of White-browed and Masked Woodswallow was recorded foraging at RH2016 during the survey period, inflating average bird abundance for this location.

8.4.2.3 Microchiropteran Data

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

8.4.2.4 Invertebrates

A total of 7,674 invertebrates from 28 morpho-species were recorded along the 20 transects established within the one year old (2020), two year old (RH2018A, RH2018B and RH2018C), three year old (2017), four year old (2016), nine year old (RH2010) and 12 year old (RH2008 and RH2008D) rehabilitation plots.

The 2008 mine rehabilitation age-class recorded the highest mean diversity of invertebrates at 8.0, which was comparable to the combined mean of 7.8 (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 2020 monitoring event. Insect diversity was generally lower in the younger mine rehabilitation age-classes. 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 is largely consistent with shrubby woodland/ forest on skeletal soils and a small area of grassy woodland on fertile soils. A mean invertebrate species richness analogue benchmark of 14.8 was calculated from two Leard State Forest shrubby woodland/ forest monitoring sites and a benchmark of 14.0 for grassy woodlands on fertile soils, 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 and 11.2 morpho-species respectively). None of mine rehabilitation monitoring areas met this benchmark in 2020. Importantly, the analogue replicate monitoring sites from which the benchmark was deduced, were also considerably lower than the benchmark during the 2020 monitoring event.

8.4.2.5 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 2020 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	House Mouse	1
RH2008D	No species recorded	-
RH2010	House Mouse	2
RH2011	Common Wallaroo	1
RH2016	No species recorded	-
RH2017	Swamp Wallaby	1
RH2018A	No species recorded	-
RH2018B	No species recorded	-

8.4.2.6 Salvaged Woody Debris Monitoring

Salvaged woody debris has been incorporated into the 2008 and RH2017 mine rehabilitation area only. Two locations were sampled during the 2020 monitoring event, with House Mouse and Wolf Spider 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 three reptiles and one mammal was recorded from extant habitats associated with the larger Leard State Forest remnant during the 2020 monitoring event.

8.5 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.

8.5.1 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.

8.6 Rehabilitation Improvements and Initiatives

During the 2020 reporting period BCOPL has continued with approved rehabilitation activities as usual. No trials or research projects were undertaken during the reporting period. During 2020, large-scale rehabilitation repairs project was undertaken in the southern rehabilitation area to remediate erosion damage caused during 2019 and early 2020. There was a total of 33 ha of rehabilitation maintenance and repair work conducted where erosion scours were remediated and planted out with tube stock.

8.7 Rehabilitation in 2021

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.

8.7.1 Topsoils and Forest Resources

The gathering of topsoil and subsoil from Leard State Forest will continue, in conjunction with the 2021 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 salvaged to be used in rehabilitation and biodiversity offset 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.

8.7.2 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).

8.7.3 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.

8.7.4 Temporary stabilisation

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

8.7.5 Monitoring

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

9 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 SSD 09_0182 (Schedule 3, Condition 77(b)), BCOPL has prepared a SIMP, in consultation with relevant stakeholders. BCOPL have been undertaking further revisions to the SIMP during the reporting period (as discussed earlier).

9.1 Community Programs and Investment

BCOPL is committed to supporting the local community in which they operate. Over the 2020 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 $107,987 to local projects and sponsorships in the 2020 reporting period, as summarised in Table 9-1.

Contributions for the reporting period are about 31% less than the previous year's contributions ($155,750). This is due to the impacts of Covid-19 on community events that occurred during the reporting period of 2020.

BCOPL also regularly hosts site visits from the community, industry professionals, the media and other interested parties. Due to the impacts and restrictions that the Covid-19 pandemic brought, no mine site tours were able to be completed during the reporting period.

Table 9-1 BCOPL Community Funding 2020

Community group/project	BCM Contribution
Gunnedah Girls Academy	$30,000
Westpac Helicopter Partnership	$30,587
Boggabri Camp fire	$10,000
Maules Creek Campdraft	$8,000
Dorothea MacKellar Memorial Society	$5,000
Manilla Show	$2,500
Black "n" Blue Youth Centre	$2,500
Boggabri Anglican Church - Carols	$1,500
Boggabri Golf Club	$4,000
Boggabri Public School - Awards	$200
Boggabri Public School - Awards	$200
Country Education Foundation	$1,000
Gunnedah AFL	$2,500
Gunnedah Carols in The Park	$200
Gunnedah High School	$500
Kamilaroi Galmaays RLFC	$500
Curlewis Public School Christmas Fundraiser	$1,000
Soldier Donation - Lcahlan Woolford	$2,000
Namoi Bush Cricket - Fletch and Hindy	$1,500

Community group/project	BCM Contribution
Sacred Hearts Boggabri - Awards	$200
Boggabri Districts Historical Society	$1,000
Gunnedah Motorcycle Club	$1,000
Sacred Hearts Boggabri - Pre School	$1,000
Two Good Foundation	$1,100
Total	**$107,987**

9.2 Community Consultative Committee

In accordance with SSD 09_0182 (Schedule 5 Condition 7), a Community Consultative Committee (CCC) based on the Department of Planning, Industry and Environment (DPIE) *Community Consultative Committees Guideline for State Significant Projects 2019* has continued through the reporting period.

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.

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

- 20 February 2020;
- 14 May 2020;
- 13 August 2020; and
- 29 October 2020.

Key topics discussed included:

- Recent correspondence with regulatory agencies;
- Updates on the status of management plan revisions;
- Management of biodiversity offset properties;
- Proposed Modification 8 to BCM;
- Updates on community sponsorships;
- Environmental monitoring program and results;
- Mining and rehabilitation activities;
- Community complaints; and
- Progress of the Early Learning Facility construction in Boggabri.

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/

9.3 Complaints

9.3.1 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; and
- 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 BCM 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.

9.3.2 Registered Environmental Complaints

Three community complaints were received by BCOPL during the 2020 reporting period. This is an increase from 2019, with no complaints being recorded during 2019. This is still an improvement from previous years including four complaints in 2018 and five complaints in 2017.

A summary of complaints received during the reporting period and BCOPL's responses is provided in Table 9-2. Complaints were handled in accordance with BCM's Complaints Management Protocol as previously described. Where the EPA was either notified of the complaint, or directly received the original complaint, results of the investigation and follow-up actions conducted by BCOPL and its contractors were provided to the EPA for review.

Complaints received during the reporting period were tabled at the CCC meetings for discussion. Monthly summaries of complaints are made publicly available on BCOPL's website at: https://www.idemitsu.com.au/operations/boggabri-coal/approvals-plans-reports/

Table 9-2 Complaint Summary

Date of Complaint	Complaint Reference	Issue	BCOPL Response
1-8 May 2020	Community Member	Noise	Environmental Superintendent called complainant on the 12th May. A further meeting was held at complainant's residence. Further phone calls to complainant occurred in June. Additional attended monitoring was conducted at the property boundary which demonstrated compliance with the relevant criteria. (see Section 6.3.2.1.1)
24 July 2020	Community Member/EPA	Blasting	BCOPL provided details of the complaint to DPIE, Resources Regulator and has discussed the matter with EPA. BCOPL provided requested information to EPA.
31 July 2020	EPA	Blasting Odour	BCOPL discussed the complaint with EPA. BCOPL provided requested information to the NSW EPA. No further action was taken by EPA as no evidence of any exceedance of limits had occurred.

9.4 Workforce Profile

As of 31 December 2020, the total workforce on BCM was 707 employees. A breakdown of the workforce and their residential locality are detailed in Sections 9.4.1 and 9.4.2.

9.4.1 BCOPL Employees

Wherever possible, local personnel are employed by BCOPL and its contractors. The BCOPL team at BCM consists of 415 staff, the majority (~82%) of whom are based locally within the Narrabri, Gunnedah and Tamworth LGA's. All BCOPL employees are employed full time. A breakdown of the location is found in Table 9-3.

Table 9-3 Residential Locality of BCOPL Employees

Locality	BCOPL Employee Residency
Boggabri	57
Baan Baa	1
Gunnedah	178
Curlewis	7
Narrabri	39
Manilla	19
Tamworth	40
Other NSW	70
QLD	4
Total	415

9.4.2 Mining Contractors

Expansion project related construction activities concluded in late 2015, at which point the BCM moved to an operational phase. The reporting period represents the BCM's fifth year of operations since the grant of the SSD.

At the end of December 2017, the BCM shifted to a combination of owner-operator (i.e. BCOPL personnel) and mining contractor operated. The major mining contractors operating on site at this time were BGC and One Key. As at January 2020, BGC are now operating as Goldings.

During the reporting period, the major mining contractors on site included Goldings, Orica, Action Drill & Blast Pty Ltd (Action Drilling) and One Key.

The largest share of the total contractor workforce at BCM during the 2020 reporting period is attributed to the mine contractor Goldings. At the end of December 2020, the Goldings workforce consisted of 161 personnel, predominantly contract staff, 62% of which resided locally. The One Key workforce was 64 personnel, Orica workforce was 38 personnel and Action Drilling 29 personnel.

Ninety seven percent (97%) of the BCM contractors resided in NSW and 65% resided within the localities of Boggabri, Baan Baa, Gunnedah, Curlewis, Narrabri, Maules Creek, Manilla and Tamworth.

Table 9-4 Residential Locality of Contractor Employees

Locality	One Key Resources Pty Ltd	Goldings	Orica	Action Drilling
Boggabri	5	13	8	3
Baan Baa	0	0	0	0
Gunnedah	31	43	13	2
Curlewis	0	6	0	0
Narrabri	3	12	3	3
Maules Creek	0	2	0	0
Manilla	7	7	1	0
Tamworth	9	17	1	0
Other NSW	9	57	9	20
QLD	0	4	3	1
Total	**64**	**161**	**38**	**29**

10 AUDITS

10.1 Independent Environmental Audit (2020)

10.1.1 Scope of Audit

In accordance with Schedule 5, Conditions 10 and 11 of SSD 09_0182, BCOPL engaged independent certified auditors to undertake an independent environmental compliance audit (IEA) of BCM during November 2020. It was broken into two parts.

SLR Consulting Pty Ltd was approved by the DPIE to assess BCOPL's compliance with the conditions of SSD 09_0182 and other relevant leases, licences and approvals. It also included assessing the environmental performance of the project in meeting the requirements of SSD 09_0182 through the implementation of a range of environmental management measures outlined in the various environmental management plans developed for the project. This covered the period from the 3 August 2017 to 6 November 2020.

The biodiversity aspects of the project were audited separately by Umwelt (Australia) Pty Limited as agreed with the DPIE. This audit also took place during November 2020 and addressed the period since the last Independent Biodiversity Audit (IBA) which was finalised in May 2018.

10.1.2 Audit Outcomes

Overall, 267 conditions were identified during the audit conducted by SLR, 46 (17%) were not triggered during the audit period, and 23 (9%) were a note for information. Of the 198 remaining audited conditions, 172 (87%) were compliant, 9 (5%) were non-compliant (low risk) and 12 (6%) were administrative non-compliances. Five (5) conditions could not be verified based on available information at the time of the audit. No high or medium risk non-compliances were identified. A total of 26 recommendations were made by the auditor.

The final report noted by the auditor that it was evident that the site was generally being managed with a commitment to minimise the impact on the environment and surrounding residents.

The biodiversity component of the audit found one non-compliance with SSD 09_0182 that applies to the BCM. This related to Schedule 3, Condition 54. There is evidence that BCOPL has made efforts to finalise this project approval requirement working with Forestry Corporation of NSW, with a draft report currently with Forestry Corporation of NSW. Noting significant time has passed since the date of SSD 09_0182 and to avoid future non-compliance ratings, the audit recommended that this outstanding issue is finalised promptly.

Overall, the audit found that the management plans, strategies, and programs that have been prepared for the mine were adequate and prepared in accordance with the relevant compliance requirements. The audit found that on-site staff displayed a good understanding of the key biodiversity issues and were focused on implementing measures that would minimise impacts and achieve good biodiversity/environmental outcomes.

10.1.3 DPIE Review

The IEA was lodged with the DPIE on 17 December 2020. The DPIE found the audit to generally satisfy the requirements of SSD 09_0182 and the DPIE's Independent Audit Guidelines (2015).

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

10.1.4 Status of audit recommendations

BCOPL have proposed completion dates for the actions in response to the non-compliances highlighted in the 2020 IEA (Refer to the Response Action Plan in Appendix F).

The status of these actions will be addressed within the 2021 Annual Review.

10.2 EPBC Independent Audit (2020)

An independent audit of the approval conditions for the Boggabri Coal Mine Extension was undertaken in November 2020 by an approved assessor (Umwelt Australia Pty Limited).

The final audit report was received by BCOPL on the 25th of March 2021 and submitted to the Department of Agriculture Water and Environment (DAWE) on the same day. Following acceptance of the audit report by DAWE, BCOPL will report the outcomes of this audit in the 2021 Annual Review.

10.3 NSW Resources Regulator Compliance Audit (2020)

10.3.1 Scope of Audit

A compliance audit was undertaken against the requirements of the Mining Act 1992 and the conditions of the mining leases during March 2020 by the NSW Resources Regulator. The audit covered mining activities associated with BCM, a review of documents and records pertaining to the mining and exploration activities and the assessment of compliance for 1 January 2018 to 10 March 2020.

10.3.2 Audit Outcomes

Overall, the audit found that BCOPL has achieved a high level of compliance with the requirements of the mining lease and MOP in relation to mining operations undertaken at the BCM. BCOPL had developed and implemented effective systems for compliance management, but a gap was identified in the identification of compliance requirements. The lease holder did not have copies of the most recent set of mining lease conditions and did not have systems or processes in place to identify when changes to the mining lease conditions occurred. Further development of the compliance management systems, to address these issues, would be beneficial to promote a more robust approach to compliance management on site.

One non-compliance ranked NC3, one observation of concern and two suggestions for improvement were noted by the auditor. An official caution was issued on the 8 April 2020 in relation to the NC3 non-compliance (see Table 11-2).

10.3.3 Status of Audit Recommendations

As described in Table 11-2, BCOPL have undertaken an internal investigation during the reporting period regarding this one non-compliance. BCOPL's internal compliance tracking system has been updated and systems in place to ensure annual meetings between BCOPL and the holder of overlapping Petroleum Exploration Licence (i.e. Santos), with the first meeting occurring during the reporting period.

The observation of concern involved an area in the southern rehabilitation area that had experienced erosion impacts. Resources Regulator acknowledged the BCOPL were aware of this issue and had already commenced actions to address the erosion issue at the time of the inspection.

11 INCIDENTS AND NON-COMPLIANCES

All incidents and non-compliances are detailed in Table 1-2 of the Statement of Compliance. Low risk non-compliances occurred during the 2020 reporting period relating to blasting, operational noise, air quality, surface and groundwater management, traffic, internal document review, EPL variations, rehabilitation, biodiversity and conditions of CL368. Actions that have resulted from the Independent Environmental Audits can be found in the Response Action Plan in Appendix F.

No penalty infringement notices were received during the 2020 reporting period.

Table 11-1 Non-Compliances and Exceedances during 2020

Time Period	Summary	Non-Compliance	Details
Ongoing	Sound Power Levels	SSD 09_0182 & AQGHGMP	BCOPL will continue to consult with DPIE over this issue and how that can be resolved. Further detail on BCOPL actions are included in Section 6.3.2.2.
2 February 2020	Exceedance of 24hr averaging period (PM10 criterion) at Cooboobindi HVAS (refer to Appendix B)	SSD 09_0182 & AQGHGMP	One exceedance of the short term 24-hour average criteria (50 µg/m3) occurred at the Cooboobindi HVAS monitor on the 2 February 2020, with a result of 57 µg/m3. An investigation by BCOPL found that for the 24hr period the HVAS monitor was operational, the wind was blowing from the north to north west and from the south. During this monitoring period, Wilberoi East, Tarrawonga and Goonbri TEOMs had results of 22.98, 40.54 and 24.26 ug/m3 respectively. The monitor was surrounded by cropping land and it was likely impacted by localised ploughing and not mining activities.
Ongoing	Reporting of exceedances caused by 'extraordinary events'	SSD 09_0182	The 2020 IEA review alerted BCOPL to the requirement of seeking the Secretary for the classification of 'extraordinary events' prior to the status of days being classified as 'extraordinary events'. BCOPL confirm all exceedances of the relevant air quality criteria will be investigated in accordance with the requirements of the AQGHGMP to determine if they are attributable to BCOPL operations. BCOPL will inform DPIE of exceedances of air quality criteria regardless of whether it is a non-conformance or not. Evidence of investigation or data used in concluding whether an exceedance is attributable to BCOP will be provided with exceedance notification to DPIE. A standard methodology for the investigation and reporting of any exceedance of relevant air quality criteria will be incorporated into the next revision of the AQGHGMP. BCOPL have included the following within this document: 1) a table of all days with exceedances of the 24-hour average criteria together with findings of any investigations into the status of days as determined by DPIE (extraordinary day or not) (refer to Section Table 6-6); and 2) all valid data captured by the TEOMs will be reported. Extraordinary days will then be excluded from the annual average calculations (refer to Section 6.2.2.2.1).
Ongoing	Implementation of the AQGHGMP	SSD 09_0182 & AQGHGMP	The status of 'extraordinary events' was not agreed with the Secretary and DPIE was not notified of recorded exceedances of the relevant air quality criteria. The implementation of the AQGHGMP was deemed non-compliant as described in the 2020 IEA. BCOPL confirm all exceedances of the relevant air quality criteria will be investigated in accordance with the requirements of the AQGHGMP to determine if they are attributable

			to BCOPL operations. A standard methodology for the investigation and reporting of any exceedance of relevant air quality criteria will be incorporated into the next revision of the AQGHGMP. This will reflect outcomes of consultation with DPIE in relation to the classification of the status of days as 'extraordinary events'.
Ongoing	Implementation of the SWMP	SSD 09_0182 & SWMP	The implementation of the currently approved SWMP is non-compliant as the clean water drain presented in Appendix A of the SWMP to the north of the disturbance area has been mined through and has not been reinstated. A report was commissioned by BCOPL to justify not reinstating this drain by illustrating BCM is not harvesting clean water outside of the harvestable rights allowances. BCOPL also submitted an update to the SWMP to DPIE for approval in July 2019 which has this drain removed from Appendix A of the SWMP. BCOPL will continue to liaise with DPIE with regard to the approval of the revised SWMP (Rev 8).
Ongoing	Implementation of the GWMP	SSD 09_0182 & EPL 12407	The implementation of the currently approved GWMP is non-compliant as groundwater monitoring was not undertaken at all required bores during the reporting period. Groundwater bores 2102 and 2103 were not monitored in 2018 and 2019 due to damage of the bore casing. Monitoring at bores 2104 and 2105 was not undertaken as they were not accessible and MW6 was not monitored as it was blocked. BCOPL have submitted an updated GWMP (Rev 8) to DPIE in July 2019 to update the current monitoring on site, BCOPL will continue to liaise with DPIE over the approval of the revised GWMP (Rev 8).
Ongoing	Development of the Eucalyptus Forestry Plantation Offset Strategy	SSD 09_0182	BCOPL submitted a Forestry Planation Offset Strategy in July 2013 to NSW Forestry Corporation. BCOPL have been making progress on this strategy. At the end of the reporting period, BCOPL have provided NSW Forestry Corporation with a draft strategy. Feedback has been received which suggests NSW Forestry Corporation does not see benefit in the proposed strategy. BCOPL will continue to liaise with NSW Forestry Corporation to finalise this strategy.
Ongoing	Consultation over the Gunnedah Traffic Study	SSD 09_0182	BCOPL was required to provide a report to Gunnedah Shire Council (GSC) within 12 months of the completion of the Traffic Study which identified proposals for implementing any recommendations that came from earlier consultation with GSC. BCOPL did not provide a report within this timeframe, however GSC has opened a new rail overpass to traffic in November 2020 which is an outcome of this study and aims to improve road safety and congestion. It is assumed that the completion of this new construction completes this requirement. No further action is required of BCM.
Ongoing	Long Term Trends presented within Annual Review	SSD 09_0182	The 2020 IEA identified that while long term trends associated with groundwater are presented in BCM's Annual Reviews, there is little information relating to longer terms trends for air quality, surface water and noise over the life of mine as required by this condition.

			BCOPL have included further detail within this document and will continue to report on long term trends within future Annual Reviews.
Ongoing	Revision of Strategies, Plans and Programs	SSD 09_0182	Within three months of the submission of an Annual Review, an incident report, an audit or any modification BCOPL is required to review the strategies, plans and programs required under SSD 09_0182. BCOPL currently do not have a suitable way to track these required revisions. BCOPL will create a register to capture and track details of when documents are updated including the review and revision of management plans and relevant supporting documents.
Ongoing	Water Quality Monitoring Location changes	EPL 12407	The water monitoring at BCM was not in line with monitoring sites within the EPL due to sites being compromised by mining. An EPL variation (submitted 19 March 2019) seeking the update of monitoring locations to reflect current monitoring operations at BCM was approved on 5 February 2021. No further action is required of BCOPL.
Ongoing	HVAS Air Monitoring Location changes	EPL 12407	The HVAS monitoring at BCM was not in line with monitoring sites within the EPL. The Merriown HVAS was no longer relevant as the property was Mine-Owned. The HVAS has been relocated to Glenhope. An EPL variation (submitted 19 March 2019) seeking the update of monitoring locations to reflect current monitoring operations at BCM was approved on 5 February 2021. No further action is required of BCOPL.
Ongoing	Groundwater Monitoring Location changes	EPL 12407	Groundwater locations was not able to be undertaken (site 10,11 and 18). This was due to 10 and 11 being destroyed by mining and 18 being blocked. A variation for the EPL was lodged in March 2019 to remove the destroyed bores from the monitoring requirements. This variation was approved 5 February 2021. No further action is required of BCOPL.
February 2020	Depositional Dust Sample bottle broken at DG-Goonbri	EPL 12407	The sampling bottle was broken at D5-Goonbri for the February sampling period, Therefore, no results were able to be obtained. No complaints were received regarding dust during the reporting period. There have been no exceedances of the annual depositional dust criteria since mining operations commence at BCM.
Ongoing	Rehabilitation Reporting in Annual Reviews	CL368	The 2020 IEA review identified the need to report BCM's rehabilitation progression of BCM's completion criteria against the MOP and justify whether the rehabilitation has met the objectives of those phase and domains. BCOPL have included further detail within this document over comparison with the approved MOP and will continue to report on progress in respect to rehabilitation completion criteria in future Annual Reviews.

10 March 2020 / Ongoing	Cooperation Agreement with overlapping Title	CL368	During the 2020 Resources Regulator Audit it was found that PEL001 overlaps with approximately half of CL368. BCM is required to make every reasonable attempt, and be able to demonstrate its attempts, to enter into a cooperation agreement with the holder of any overlapping titles. An official caution was issued on 8 April 2020 to BCOPL as a result of this breach. Further details on BCOPL's response and actions are described in Table 11-2.

11.1 Notices, Warnings and Other Compliance-Related Correspondence

The notices and warnings received from regulatory agencies and BCOPL's response is summarised in Table 11-2.

Table 11-2 Notices and Warnings Received during the Reporting Period

Agency	Dates	Correspondence Details	BCOPL Response
NSW Resources Regulator	8 April 2020	During an audit on 10 March 2020, BCOPL advised that it was unaware of an overlapping title of CL368 with Petroleum Exploration Licence 0001(PEL001). BCOPL was also unaware of the requirements of Condition 9 of the lease, which requires BCOPL to make every reasonable attempt to enter into a co-operation agreement with the over lapping title holder. BCOPL could not provide any evidence that any attempt had been made to contact the overlapping titleholder to discuss an arrangement for a co-operation agreement. The NSW Resources Regulator issued BCOPL with an official caution.	An internal investigation was undertaken by BCOPL. BCOPL internal compliance tracker was updated with the new conditions. A task has been created for annual meetings between BCOPL and Santos.
EPA	8 July 2020	A formal warning letter was issued by the NSW EPA in relation to breaches of Environmental Protection Licence 12407. The letter was in response to a self-reported blasting overpressure exceedance that occurred 21 August 2019 (the previous reporting period). BCOPL provided a response to the NSW EPA on the 4 September 2019 which was summarised as below: – No blast performance issues have been identified that would have contributed to the exceedance. – There were no overloaded holes or incorrect tie in of blast. – Wind speeds at the premises were within blasting limits. – Blast design investigations indicate that tie in and firing conditions of the blast would ordinarily result in basic blast emission of less than 115dBL and that 123dBL can only be explained by the effects of meteorology – Regional Met data has shown that location wind speeds were exceeding 7m/s around the time of the blast. The NSW EPA found that BCOPL had breached licence condition L4.1. No enforcement action was proposed on this occasion.	BCOPL will ensure that blasts will only be undertaken during appropriate weather conditions. Delays will be implemented if required based on weather conditions in accordance with the Blast Management Plan. The TARP notification system will be revised to distinguish between ‘triggers’ and ‘exceedances’.

12 ACTIVITIES PROPOSED FOR NEXT ANNUAL REVIEW PERIOD

Activities that are proposed for the next Annual Review reporting period are detailed in Table 12-1.

Table 12-1 Activities Proposed for Next Reporting Period

Activity	Target Completion Date
Clearing of vegetation in advance of mining	February-April 2021
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
Close out actions from the IEA and EPBC compliance audit. Updates to actions and future due dates are contained in the audit action plan in Appendix F	Refer to Appendix F
Undertake exploration program ahead of mining.	Throughout 2021
Review and update management plans where required by SSD 09_0182.	June 2021

REFERENCES

AGE (2010), *Continuation of Boggabri Coal Mine Groundwater Assessment, prepared for Boggabri Coal Pty Limited*, Dated October 2010

ANZECC (2000), *Australian and New Zealand Water Quality Guidelines, Australian and New Zealand Environment and Conservation Council*

Australian Explosives Industry and Safety Group Inc. (AEISG) (2011), *Code of Practice: Prevention and Management of Blast Generated NOx Gases in Surface Blasting, Edition 2*

Australian Heritage Commission (2002) *Ask First – A guide to respecting Indigenous heritage places and values*

Bridges Acoustics (2010), *Acoustic Impact Assessment Continuation of Boggabri Coal Mine Environmental Assessment*, prepared for Boggabri Coal Operations Pty Limited. Dated October 2010

Department of Environment, Climate Change and Water (2008), *Managing Urban Stormwater: Soils and Construction (the Blue Book) Volume 2E Mines and Quarries*

Department of Environment, Climate Change and Water (2010), *Aboriginal cultural heritage consultation requirements for proponents 2010*, Sydney

Department of Planning, Industry and Environment (2015), *Annual Review Guidelines - Post-approval requirements for State significant mining developments.*

Department of Planning, Industry and Environment (2020a), *Namoi/North West Slopes Region Air Quality Summer 2019-2020 Summary*.

Department of Planning, Industry and Environment (2020b). *2019 NSW Population Projections*.

GHD (2017), *Boggabri Coal Water Management – Clean Water Diversion Drain and Harvestable Rights*. Dated 31 October 2017.

Global Acoustics (2020a), *Boggabri Coal Mine Mobile Plant Sound Power Survey 2020.*

Global Acoustics (2020b), *Boggabri Coal Mine Environmental Noise Monitoring Annual Report 2019*

Guilfoyle, D (2006), *Aboriginal Cultural Heritage Regional Studies: an illustrative approach,* Department of Environment and Conservation, Sydney

Gunnedah Shire Council. (2020b). *Local Strategic Planning Statement - Future 2040.* Gunnedah.

Hansen Bailey (2010), *Continuation of Boggabri Coal Project Environmental Assessment*

Landcom (2004), *Managing Urban Stormwater: Soils and Construction (the Blue Book)* Volume 1

NSW Environment Protection Agency (2007), *Approved Methods for Sampling of Air Pollutants in New South Wales,* Department of Environment and Conservation, Sydney

NSW Resources Regulator (2020), *Compliance Audit Program Boggabri Coal Mine*.

Office of Environment and Heritage *(*2011a), *Guide to assessing and reporting on Aboriginal cultural heritage in NSW,* NSW Office of Environment and Heritage, Sydney

Office of Environment and Heritage (2011b*), Aboriginal Regional Assessment Policy* NSW Office of Environment and Heritage*,* Sydney

Profile ID. (2020). *Gunnedah Shire Council Community Profile*.

Ross Planning. (2019). *Narrabri Shire Council - Bellata Recreation Precinct Plan.* Narrabri Shire Council.

SLR (2020), *Boggabri Coal Mine Independent Environmental Audit 2020*.

SQM Research. (2020). Residential Vacancy Rates. Retrieved July 30, 2020, from SQM Research: https://sqmresearch.com.au/

The Courier. (2020, December). *Narrabri Project Well Advanced.* Retrieved from https://narrabricourier.com.au/2019/12/05/narrabri-project-well-advanced/

Umwelt (2017), Leard Forest Regional Biodiversity Strategy (Stage 2 – Strategy Report) (RBS)

Umwelt (2020), *Boggabri Coal Mine Biodiversity Compliance Audit (PA 09_0182) 2020*.

WSP (2018), *Boggabri Coal Mine Biodiversity Offset Strategy*

Appendix A

Annual Review Requirements

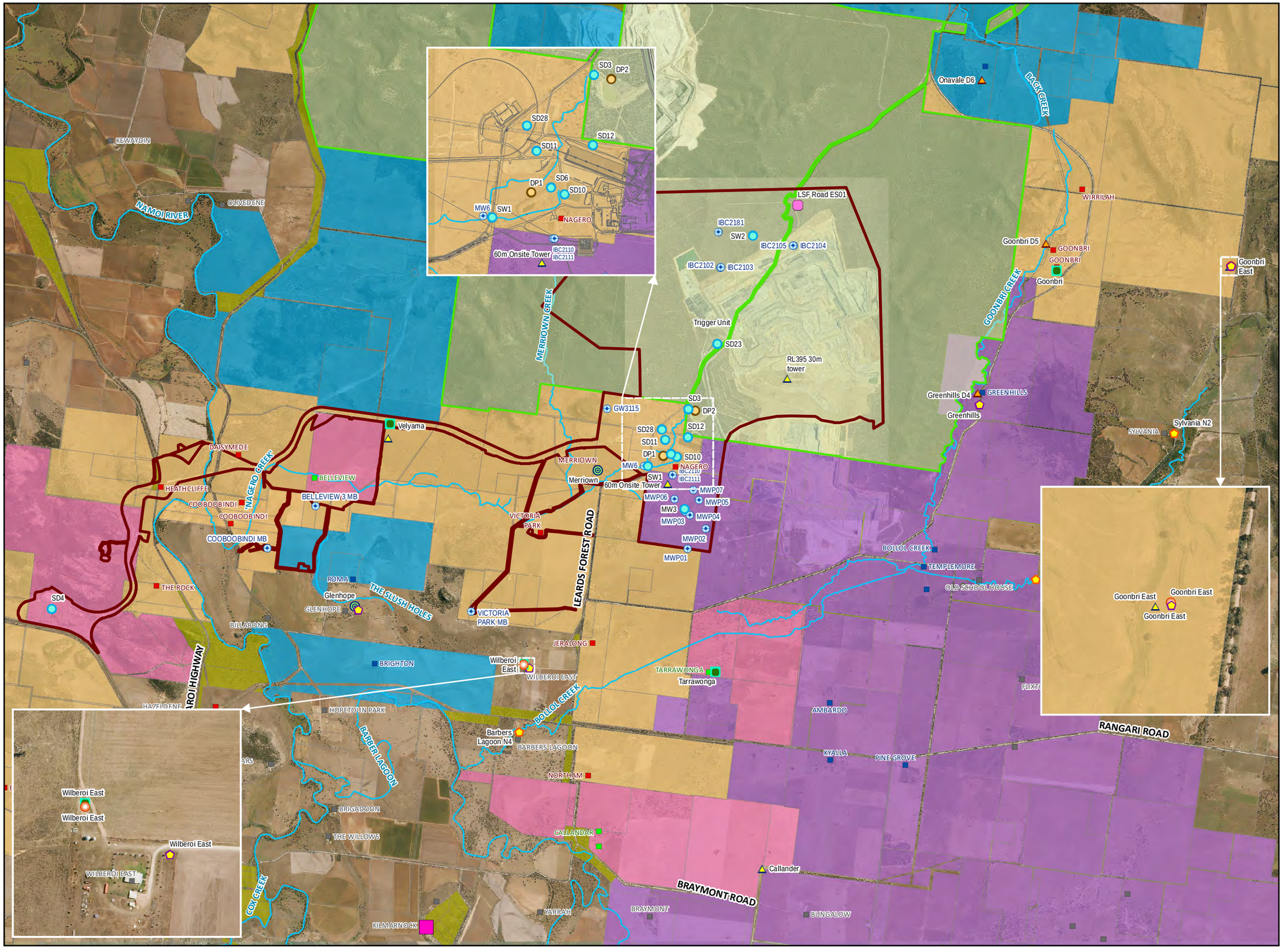
Table A-1 Annual Review requirements

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
ML 1755	Condition 3(f)	(f) The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must: i. provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP; ii. be submitted annually on the grant anniversary date (or at such other times as agreed by the Minister); and iii. be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at www.resources.nsw.gov.au/environment. Note: The Rehabilitation Report replaces the Annual Environmental Management Report.	Section 8
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 9.3
		(c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;	Section 4, Section 8
		(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 5

Licence, Approval or Guideline	Section Reference	Requirement	Reference in this report
	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 6.3
	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
	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 6.7
	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 11
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

Appendix B

Environmental Monitoring Location Map



Legend

- Blast monitor
- Dust gauge
- E-sampler
- High volume air sampler (PM10)
- Meteorological station
- Noise monitor (attended)
- Real time noise monitoring
- 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
- Crown
- 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);

DOCUMENT	BC2021_AEMR002_A2_MON
AUTHOR.	Victor.Lau
REVIEWED BY.	N.Cooper
DATE.	29/03/2021

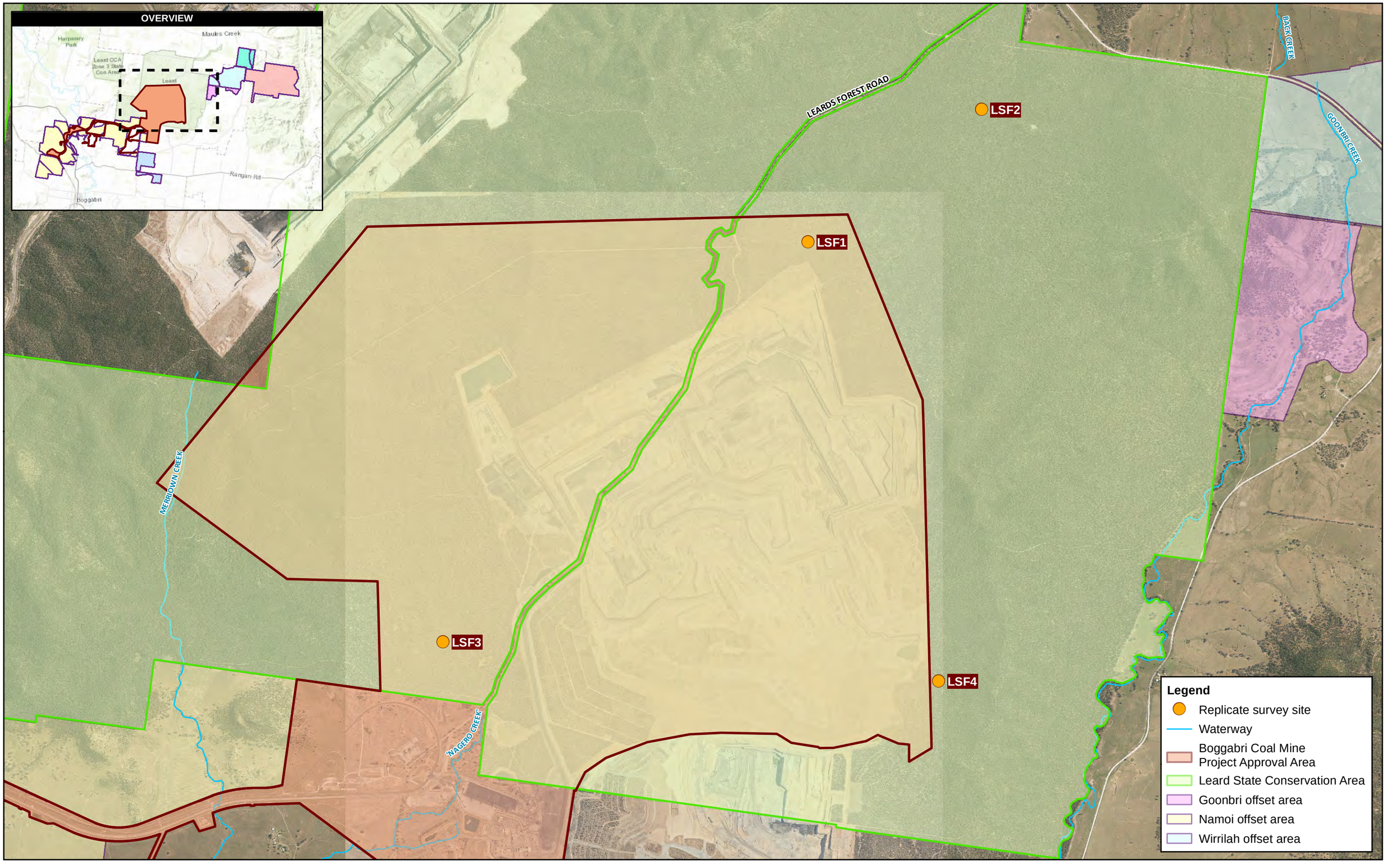
IDEMITSU
BOGGABRI COAL

FIGURE **B-1**

TITLE. BOGGABRI COAL MINE PROJECT
BOUNDARY AND ENVIRONMENTAL
MONITORING SITES

Appendix C

Biodiversity Monitoring Maps



N
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S
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,

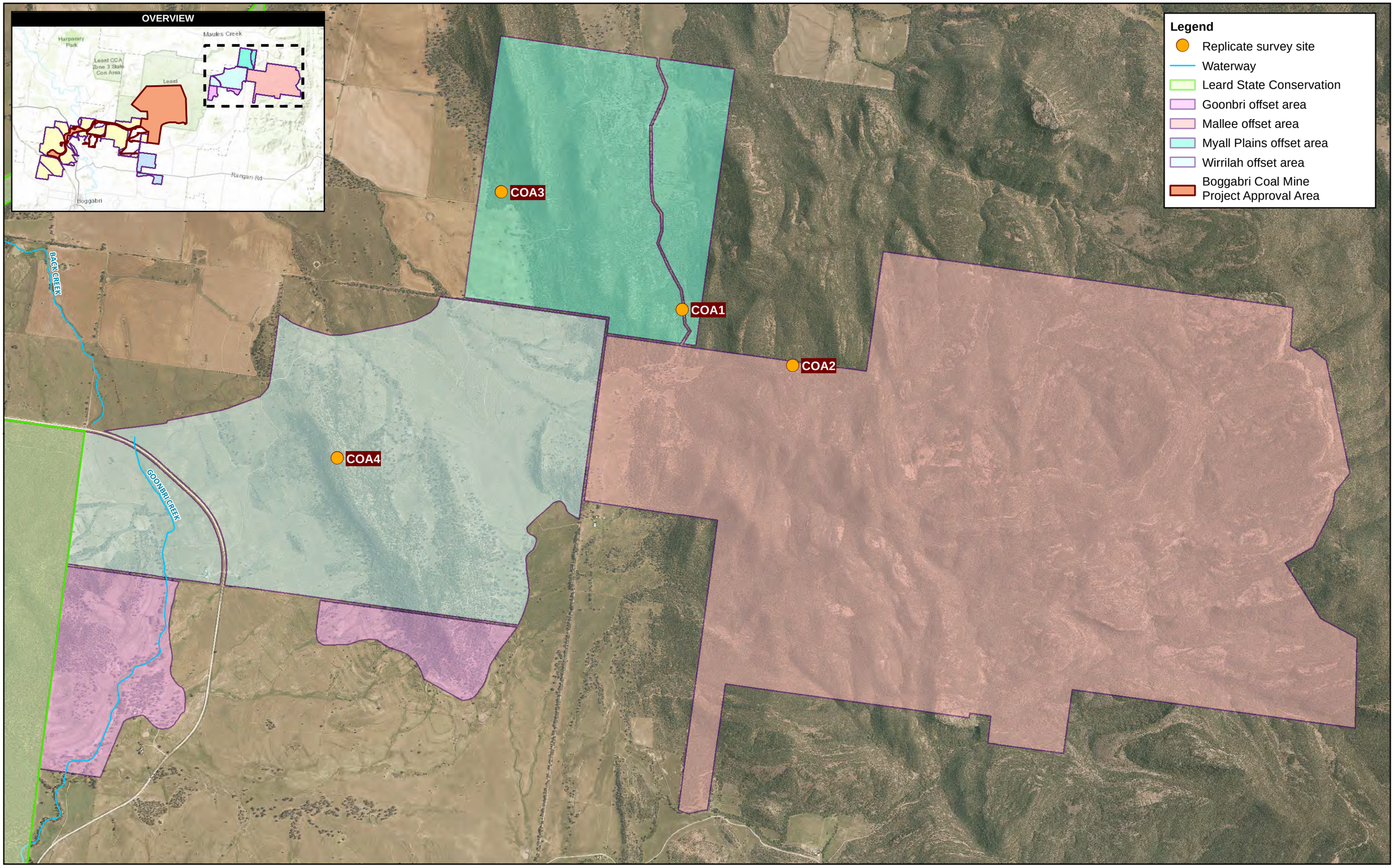
DOCUMENT	BC2021_AEMR003_A1_MON_LSF
AUTHOR.	suansrir
REVIEWED BY.	N.Cooper
DATE.	12/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-1

TITLE. LOCATION OF REPLICATE SURVEY SITES - LEARD STATE FOREST

DRAWING F:\WSP O365\Boggabri GIS-Ecology - General\5_Shared\54_Production\Maps\2021\Environment\AEMR\BC2021_AEMR003_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,

DOCUMENT BC2021_AEMR004_A1_MON_COA

AUTHOR. suansrir

APPROVED BY. N.Cooper

DATE. 12/03/2021

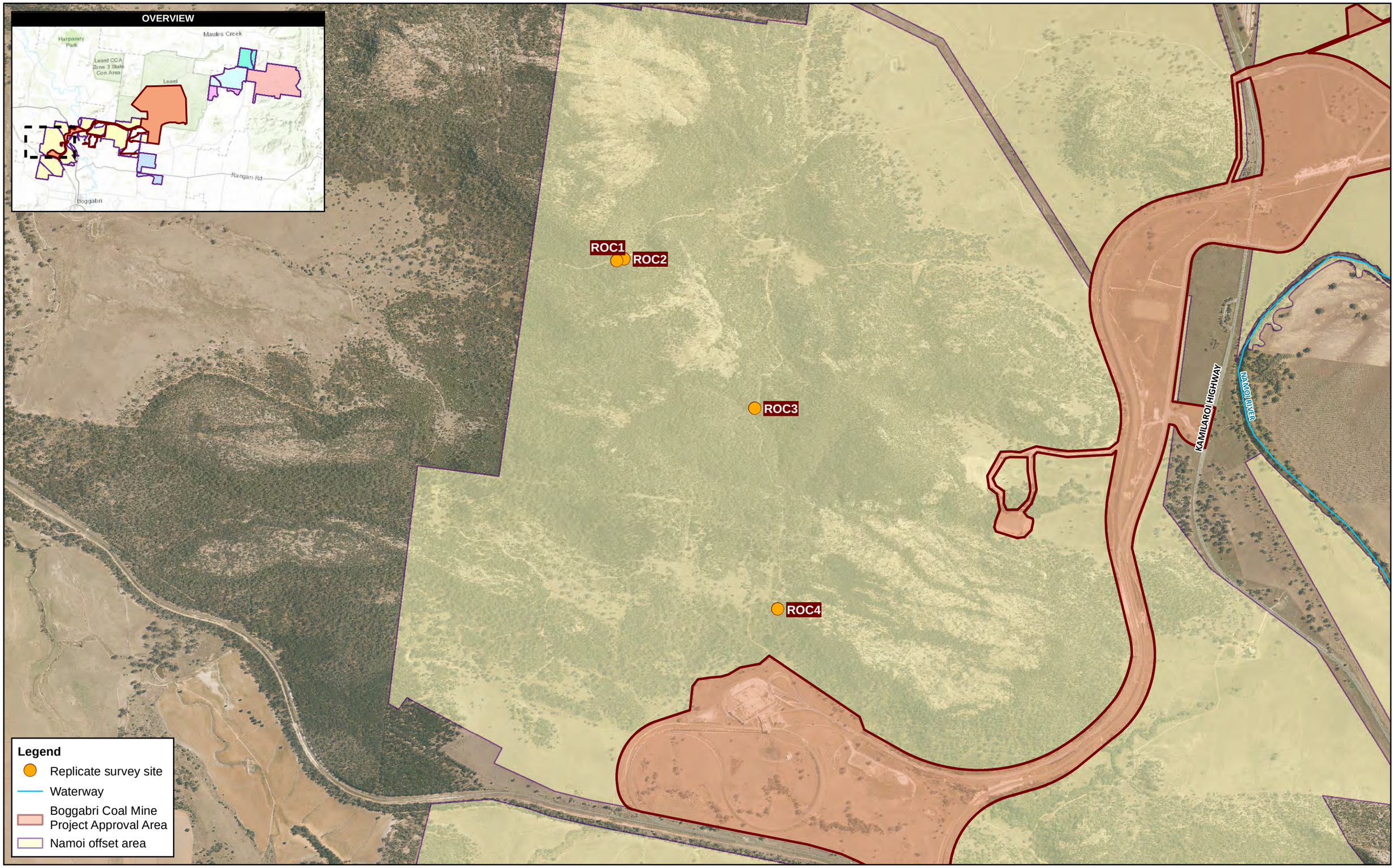
IDEMITSU BOGGABRI COAL

FIGURE C-2

TITLE. LOCATION OF REPLICATE SURVEY SITES - CENTRAL OFFSET AREA

Idemitsu Australia Resources Pty Ltd

DRAWING: F:\WSP O365\Boggabri GIS-Ecology - General\5_Shared\54_Production\Maps\2021\Environment\AEMR\BC2021_AEMR004_A1_MON_COA.mxd



N
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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,

DOCUMENT BC2021_AEMR005_A1_MON_Rocklea

AUTHOR. suansrir

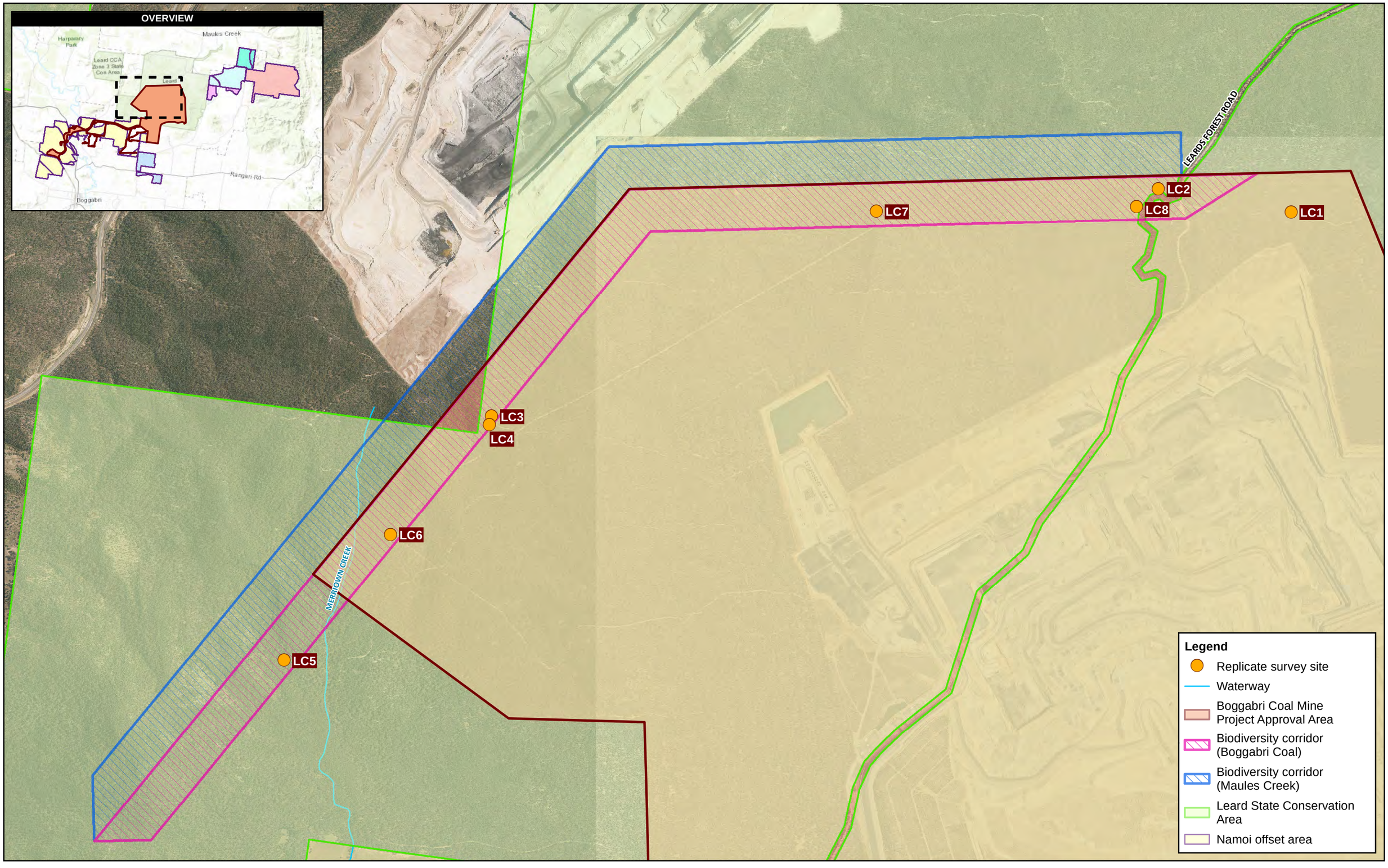
REVIEWED BY. N.Cooper

DATE. 12/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-3

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



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Scale 1:20,000

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

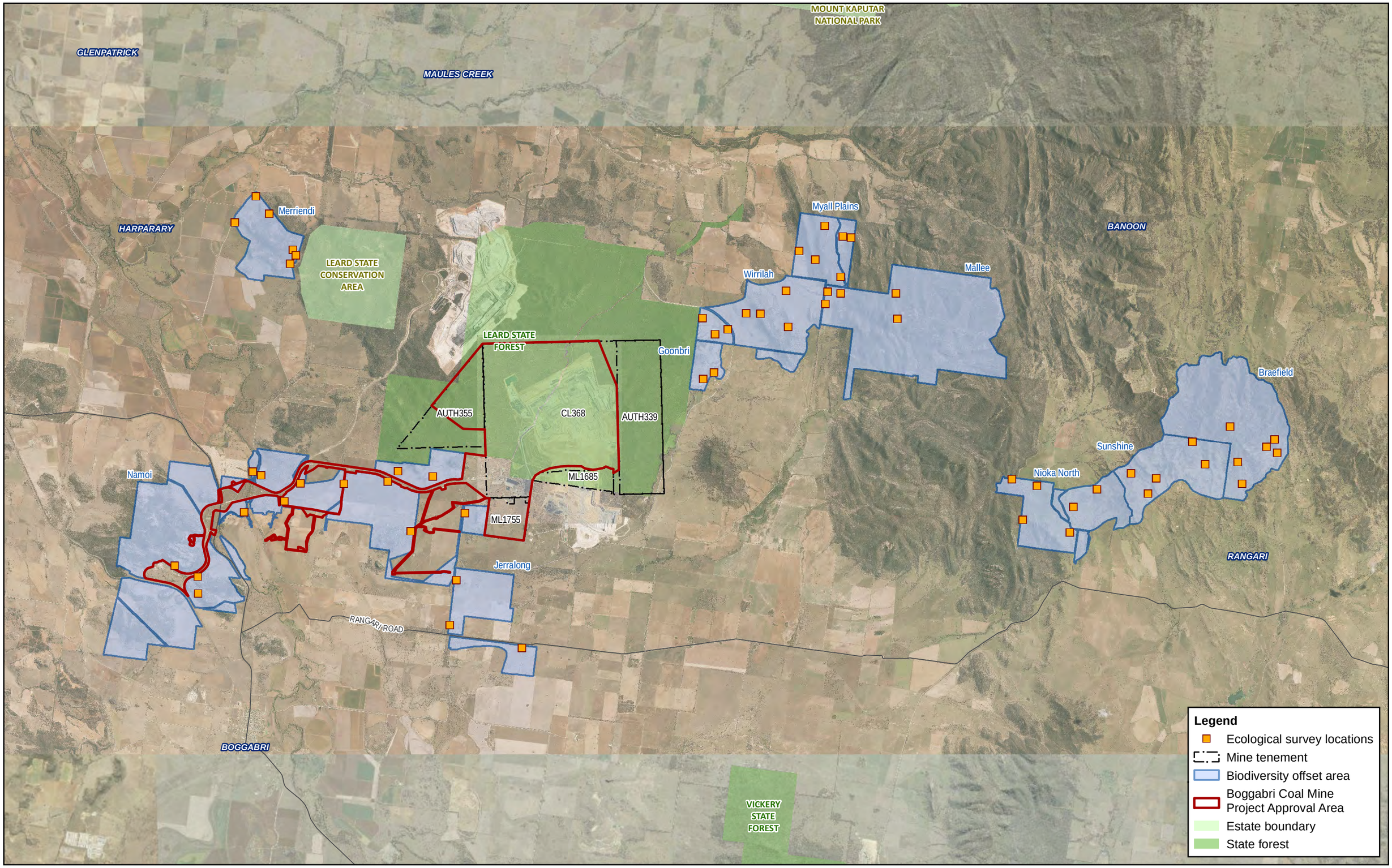
Imagery:
Atlass-Aerometrex Pty Ltd via BCOPL (2017)Sources: Esri, HERE, Garmin, Intermap,

DOCUMENT BC2021_AEMR006_A1_MON_Corridor
AUTHOR. suansrir
REVIEWED BY. N.Cooper
DATE. 15/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-4

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



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Scale 1:125,000

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

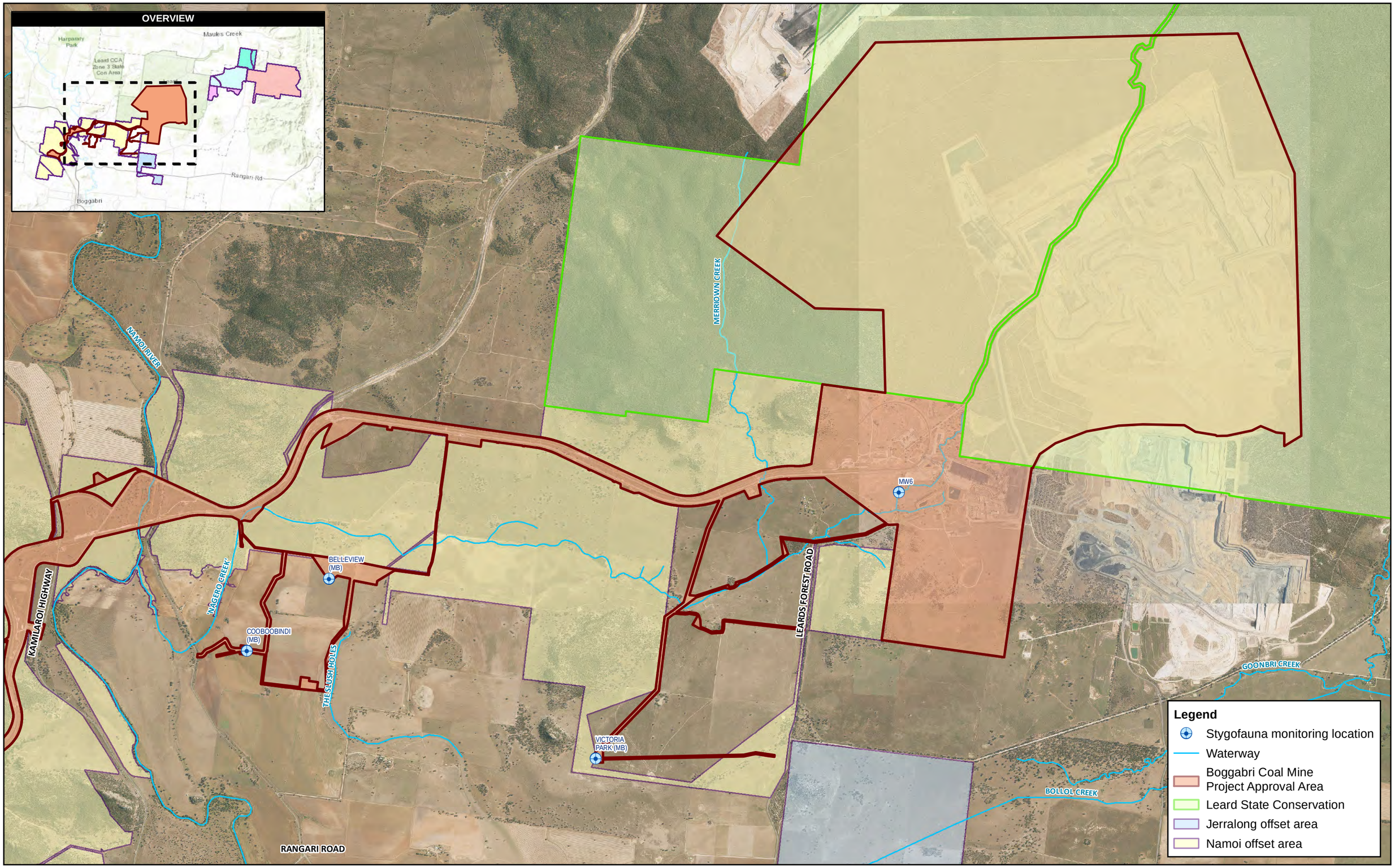
Imagery: BCOPL (2017,2018);Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c)

DOCUMENT BC2021_AEMR007_A1_MON_Replicate
AUTHOR. suansrir
REVIEWED BY. N.Cooper
DATE. 12/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-5

TITLE. LOCATION OF REPLICATE SURVEY SITES



N
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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,

DOCUMENT	BC2021_AEMR009_A1_MON_stygo
AUTHOR.	suansrir
REVIEWED BY.	N.Cooper
DATE.	12/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-6

TITLE. LOCATION OF STYGOFAUNA MONITORING SITES

DRAWING F:\WSP O365\Boggabri GIS-Ecology - General\5_Shared\54_Production\Maps\2021\Environment\AEMR\BC2021_AEMR009_A1_MON_stygo.mxd

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0 100 200 300 M

Scale 1:10,000

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,

DOCUMENT BC2021_AEMR011_A1_MON_Rehab

AUTHOR. suansrir

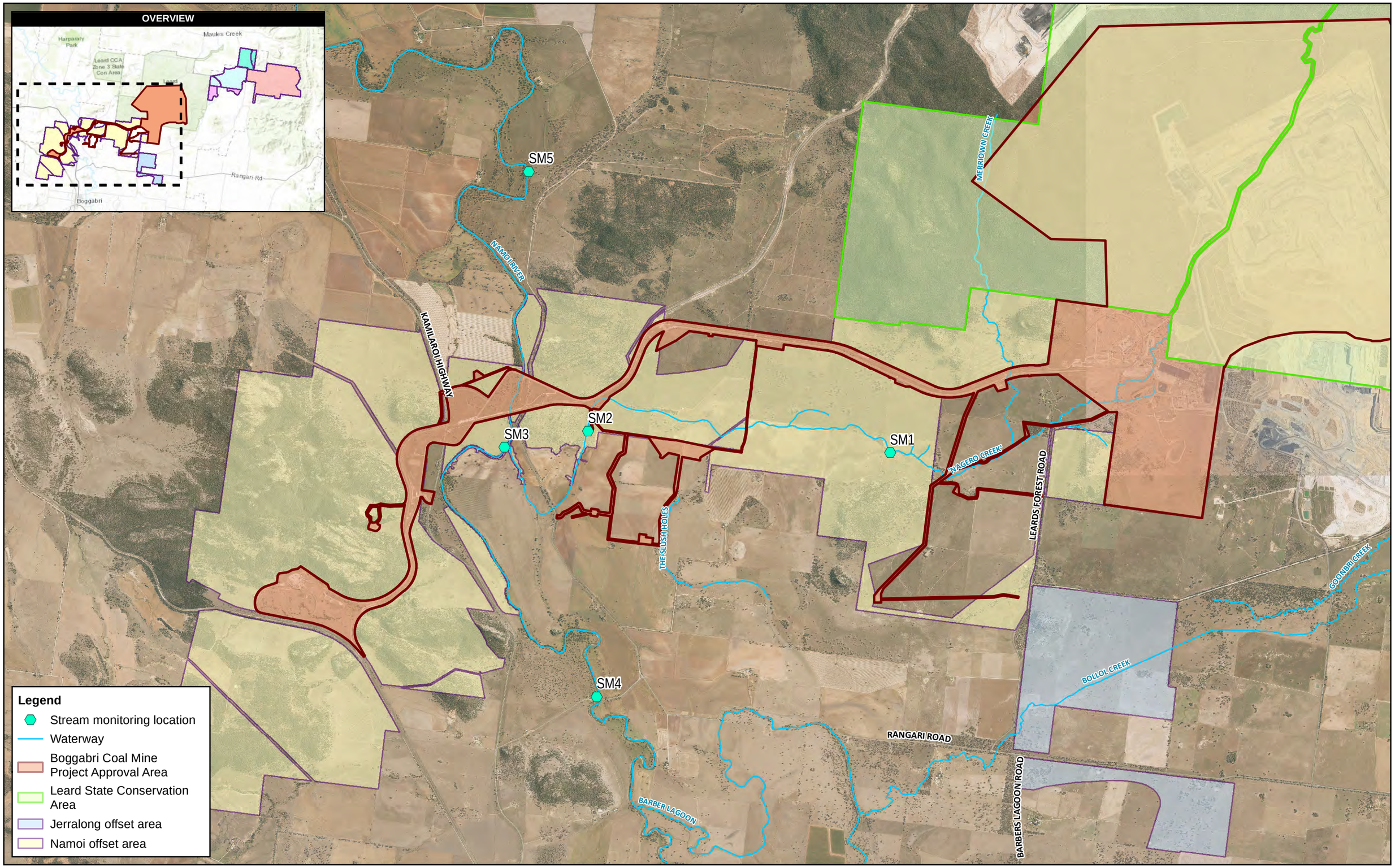
REVIEWED BY. N.Cooper

DATE. 15/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-7

TITLE. LOCATION OF REPLICATE SURVEY SITES - MINE REHABILITATION AREA



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

DOCUMENT BC2021_AEMR010_A1_MON_Stream
AUTHOR. suansrir
REVIEWED BY. N.Cooper
DATE. 15/03/2021

IDEMITSU
BOGGABRI COAL

FIGURE C-8

TITLE. LOCATION OF REPLICATE SURVEY SITES - STREAM AND RIPARIAN VEGETATION HEALTH MONITORING SITES

Appendix D

Regulator Correspondence

Mr Hamish Russell
Environmental Superintendent
Boggabri Coal Operations Pty Ltd
PO Box 12
BOGGABRI NSW 2382

22/03/2021

Dear Mr Russell

Boggabri Coal Mine (09_0182)
RE: Annual Review Due Date Extension Application

I refer to the Annual Review Due Date Extension Application letter, submitted on 18 March 2021 seeking an extension of the due date to submit the 2020 Annual Review (AR) for the Boggabri Coal Mine.

The Department has carefully reviewed the document and has determined in this instance to grant an extension to the due date of submission of the AR to **29 April 2021**. Please note that this extension only applies to the extent of the project approval 09_0182. Additional approval for an extension may be required to ensure compliance with other approvals and licences regulated by other Departments and agencies.

Please ensure that a copy of this correspondence is appended to the AR.

If you wish to discuss the matter further, please contact James Epstein, Senior Compliance Officer, on (02) 6575 3419 or via email compliance@planning.nsw.gov.au

Yours sincerely

Heidi Watters
Team Leader Northern
Compliance

As nominee of the Planning Secretary

Tamie Gray

From: Resources Regulator <nswresourcesregulator@service-now.com>
Sent: Thursday, 22 April 2021 12:49 PM
To: Sarah Torrance; Hamish Russell
Subject: MAAG0010446 | Boggabri Coal 2020 Annual Review due date extension application

Dear Sarah,

Coal Lease (CL) 368 (Act 1973) Boggabri Coal Pty Limited , Approval of Annual Review Submission Date Extension

NOTICE OF APPROVAL

I refer to your email dated 23 March 2021 (MAAG0010446: Boggabri Mine Annual Review 2020 - Extension of Time Request for Submission) requesting a one (1) month extension to the Annual Review submission date.

In accordance with Condition 4(a) of CL 368, the Resources Regulator accepts the request; to allow for additional time for the Annual Review to be completed.

An extension to the Annual Review submission date is approved, under delegation from the Minister for Resources, Secretary Department of Regional NSW, to **29 April 2021**.

If you require additional information, please contact the Resources Regulator on 1300 814 609 or via email at nswresourcesregulator@service-now.com

Regards,

Jen Warner
Inspector Environment
MAI - Team 2 | Resources Regulator
M 0499 466 185

The Department of Regional New South Wales acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work.

Mr Hamish Russell
Environmental Superintendent
Boggabri Coal Pty Limited

By Email Only: hamish.russell@boggabricoal.com.au

30/06/2021

Dear Mr Russell

Boggabri Coal Project (MP 09_0182)
Annual Review 2020 - request for additional information

Reference is made to the Annual Review for the period 1 January 2020 to 31 December 2020, submitted to the Department of Planning, Industry and Environment (the Department) on 29 April 2021, as required under Schedule 5, Condition 4, of MP 09_0182, as modified (the approval).

The Department has reviewed the Annual Review and considers more information is required to satisfy the requirements of the Approval in relation to the Annual Review. In accordance with Schedule 2, Condition 4, please amend the Annual Review and resubmit via the Major Projects portal with the following additional information by **14 July 2021**:

a) Section 6.5.2.9 describes the weed and pest management program generally. However, this section is not clear if weed management actually occurred in 2020 and if the weed monitoring and management undertaken in 2020 was in accordance with the approved Biodiversity Management Plan. Please update the Annual Review to describe weed and pest monitoring and management actually undertaken in 2020, and whether such monitoring and management was consistent with the approved Biodiversity Management Plan;

b) Section 7.1.3 must be updated to include a comparison of surface water quality against relevant performance criteria;

c) Section 7.2.2.2 states that the groundwater model has been updated since 2010, but not when. Confirm when the groundwater model is due to be reviewed and potentially updated in accordance with Condition 38(d) which requires an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions;

d) Update the Annual Review to include a revised site water balance in accordance with Section 8.3 of the approved *Site Water Balance* which states "*the relevant monitoring data will be used to revise the SWB annually and will be provided in the Annual Review*"; and

e) Section 8.2.3 states that "BCOPL has adopted ten primary rehabilitation domains (refer to Figure 8-1)." However, Figure 8-1 shows mining domains and no rehabilitation domains. Include a figure showing rehabilitation areas in accordance with the Departments' *Annual Review Guideline* (2015).

If you have any questions please contact James Epstein, Senior Compliance Officer, on (02) 6575 3419 or via email compliance@planning.nsw.gov.au

Yours sincerely

Heidi Watters
Team Leader Northern
Compliance

From: Hamish Russell
To: James Epstein
Cc: Heidi Watters; Sarah Torrance
Subject: RE: Boggabri Coal - Annual Review(MP09_0182-PA-19)- Reminder of Due Date for Response to RFI
Date: Wednesday, 14 July 2021 10:33:55 AM
Attachments: image008.png
image009.png
image010.png
image011.png
image012.png
image013.png
image015.png
image016.png
image017.png
image018.png
image020.png
image021.png
image022.png

Thanks James.

Appreciated.

Regards,

Hamish Russell
ENVIRONMENTAL SUPERINTENDENT

idemitsu

386 Leard Forest Road Boggabri
+61 2 6749 6009 +61 438 003 915
hamish.russell@boggabricoal.com.au
idemitsu.com.au

From: James Epstein <James.Epstein@planning.nsw.gov.au>
Sent: Wednesday, 14 July 2021 10:16 AM
To: Hamish Russell <Hamish.Russell@boggabricoal.com.au>
Cc: Heidi Watters <Heidi.Watters@Planning.nsw.gov.au>
Subject: RE: Boggabri Coal - Annual Review(MP09_0182-PA-19)- Reminder of Due Date for Response to RFI

Hi Hamish

Thank you for the letter to extend the due date to submit the additional information for the Boggabri Coal Annual Review to 6 August 2021. The Department has reviewed the request and in this instance has accepted this request. Please note that no further extensions of time will be approved.

I have updated the due date in the Major Projects portal accordingly.

If you have any questions I can be contacted on the details provided below.

Regards

James Epstein
Senior Compliance Officer
Energy, Industry and Compliance | Planning & Assessment
Department of Planning, Industry and Environment
T 02 6575 3419 | **M** 0429 395 691 | **E** james.epstein@planning.nsw.gov.au
PO Box 3145, Singleton NSW 2330

www.dpie.nsw.gov.au

The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

If you are submitting a compliance document or request as required under the conditions of consent or approval, please note that the Department is no longer accepting lodgement via compliance@planning.nsw.gov.au.

The Department has recently upgraded the Major Projects Website to improve the timeliness and transparency of its post approval and compliance functions. As part of this upgrade, proponents are now requested to submit all post approval and compliance documents online, via the Major Projects Website. To do this, please refer to the instructions available here.

From: Hamish Russell <Hamish.Russell@boggabricoal.com.au>
Sent: Wednesday, 14 July 2021 6:23 AM
To: James Epstein <James.Epstein@planning.nsw.gov.au>
Subject: RE: Boggabri Coal - Annual Review(MP09_0182-PA-19)- Reminder of Due Date for Response to RFI

James,

I have attempted to submit this due date extension request via the portal. The portal isn't playing the game.

Please find attached to this email BCO's request to extend the due date to respond to your Request for Additional Information.

Regards,

Hamish Russell
ENVIRONMENTAL SUPERINTENDENT

386 Leard Forest Road Boggabri
+61 2 6749 6009 +61 438 003 915
hamish.russell@boggabricoal.com.au
idemitsu.com.au

From: no-reply@majorprojects.planning.nsw.gov.au <no-reply@majorprojects.planning.nsw.gov.au>
Sent: Wednesday, 14 July 2021 12:34 AM
To: Hamish Russell <Hamish.Russell@boggabricoal.com.au>
Subject: Boggabri Coal - Annual Review(MP09_0182-PA-19)- Reminder of Due Date for Response to RFI

The Department is contacting you to remind you that the stage forecast date for the Response to RFI is currently 14/07/2021.

If you feel this task cannot be completed by this date please request an extension or revise the stage forecast date by signing in to your profile.

If you have any enquiries, please contact James Epstein on 0429395691 at james.epstein@planning.nsw.gov.au.

To sign in to your account click here or visit the Major Projects Website.

Please do not reply to this email.

Kind regards

The Department of Planning, Industry and Environment

Subscribe to our newsletter

Appendix E

BCM 2020 Exploration Drilling

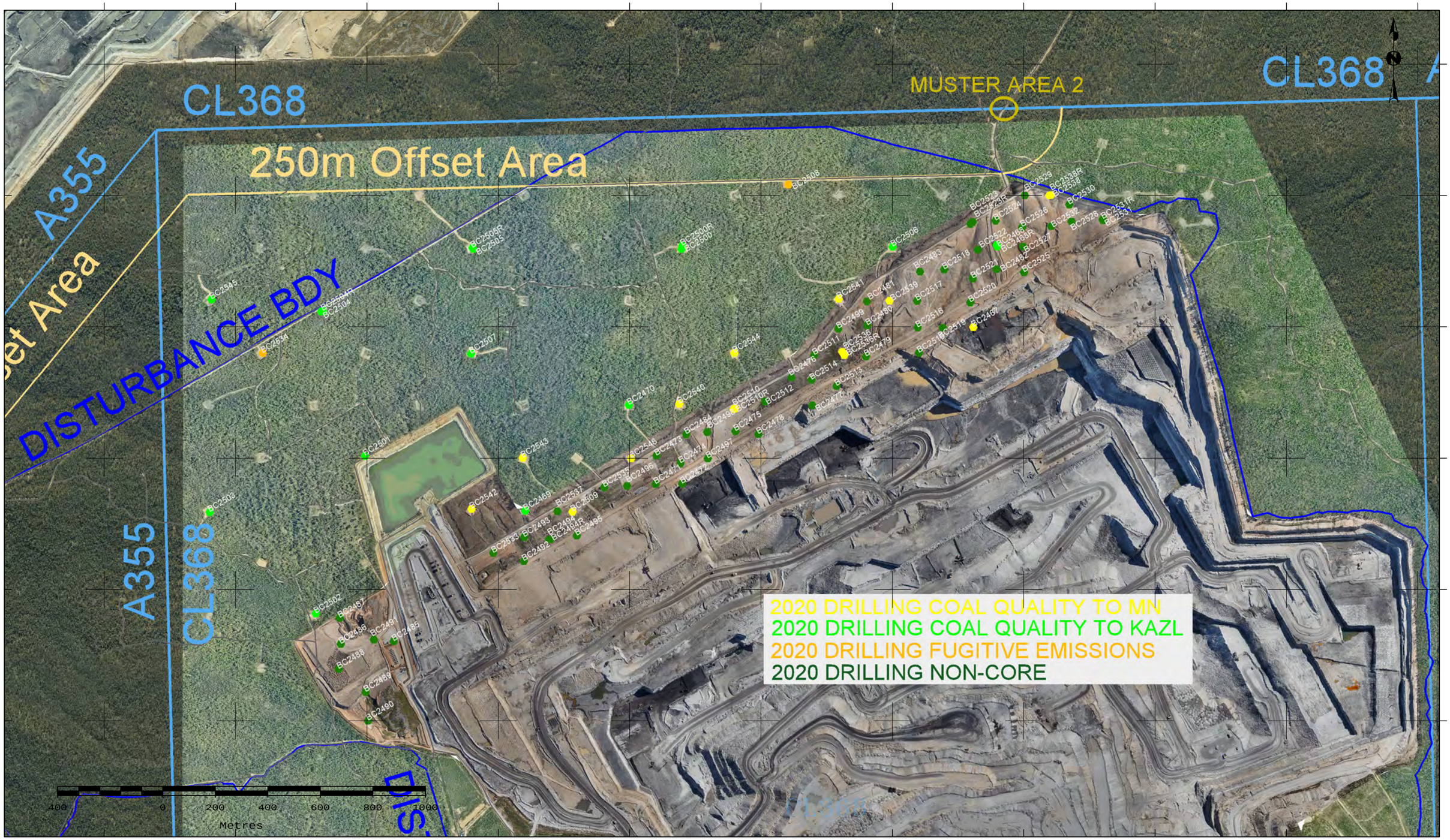
Table E-2 2020 BCM Infill Drilling

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2467	228308.68	6612498.93	345.94	189.34	8/01/2020	15/01/2020	Open	Structure and Quality
BC2468	228397.87	6612811.68	368.97	20.77	15/01/2020	16/01/2020	Open	Structure and Quality
BC2468R	228399.64	6612806.63	368.79	435.14	22/02/2020	19/03/2020	Open	Structure and Quality
BC2469	226602.83	6611800.12	327.75	262.26	22/03/2020	15/04/2020	Sealed	Structure and Quality
BC2470	226997.02	6612201.44	323.71	270.22	15/04/2020	3/05/2020	Sealed	Structure and Quality
BC2471	227098.7	6611901.2	316.89	90	20/04/2020	20/04/2020	Open	Structure
BC2472	227199.15	6611902.75	315.19	91	21/04/2020	21/04/2020	Open	Structure
BC2473	227101.56	6612009.17	318.87	85	21/04/2020	21/04/2020	Open	Structure
BC2474	227193.13	6611980.41	316.88	91	22/04/2020	22/04/2020	Open	Structure
BC2475	227402.59	6612102.13	317.13	109	23/04/2020	23/04/2020	Open	Structure
BC2476	227616.06	6612307	334.73	139	23/04/2020	24/04/2020	Open	Structure
BC2477	227694.85	6612200.56	329.89	145	24/04/2020	27/04/2020	Open	Structure
BC2478	227489.53	6612090.92	318.81	120	27/04/2020	28/04/2020	Open	Structure
BC2479	227899	6612387.59	328.66	157	28/04/2020	29/04/2020	Open	Structure
BC2480	227904.45	6612506.01	333.69	157	29/04/2020	1/05/2020	Open	Structure
BC2481	227902.53	6612597.79	337.91	157	4/05/2020	4/05/2020	Open	Structure
BC2482	228397.15	6612719.51	366.02	217	5/05/2020	5/05/2020	Open	Structure
BC2483	228106.34	6612710.2	358.17	212	6/05/2020	7/05/2020	Open	Structure
BC2484	227215.06	6612090.61	318.88	91	8/05/2020	8/05/2020	Open	Structure
BC2485	226100.67	6611302.8	323.84	79	11/05/2020	11/05/2020	Open	Structure
BC2486	225899.33	6611292.37	323.62	67	11/05/2020	12/05/2020	Open	Structure
BC2487	225895.13	6611391.57	325.49	73	11/05/2020	11/05/2020	Open	Structure

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2488	225891.6	6611197.31	323.82	67	12/05/2020	12/05/2020	Open	Structure
BC2489	225994.13	6611109.57	313.21	67	13/05/2020	13/05/2020	Open	Structure
BC2490	226002.99	6611000.55	315.48	67	13/05/2020	13/05/2020	Sealed	Structure
BC2491	226025.14	6611309.44	323.43	73	14/05/2020	14/05/2020	Sealed	Structure
BC2492	226597.2	6611608.91	321.43	91	14/05/2020	15/05/2020	Sealed	Structure
BC2493	226599.02	6611700.14	323.48	85	15/05/2020	15/05/2020	Sealed	Structure
BC2494	226699.48	6611692.78	322.05	33	18/05/2020	18/05/2020	Sealed	Structure
BC2494R	226694.13	6611691.5	322.11	91	18/05/2020	19/05/2020	Sealed	Structure
BC2495	226798.66	6611705.66	321.79	91	19/05/2020	19/05/2020	Sealed	Structure
BC2496	226989.92	6611894.76	320.84	91	19/05/2020	20/05/2020	Open	Structure
BC2497	227297.17	6611998.58	315.77	97	20/05/2020	20/05/2020	Open	Structure
BC2498	227294.85	6612099.03	316.79	97	25/05/2020	25/05/2020	Open	Structure
BC2499	227793.43	6612493.38	330.91	144	25/05/2020	26/05/2020	Open	Structure
BC2500	227197.08	6612796.43	333.26	81.7	24/04/2020	27/04/2020	Sealed	Structure and Quality
BC2500R	227199.86	6612808.79	333.49	306.8	28/04/2020	16/05/2020	Sealed	Structure and Quality
BC2501	225991.5	6612008.46	350.39	258.31	4/05/2020	25/05/2020	Sealed	Structure and Quality
BC2502	225804.48	6611408.45	328.76	219.29	15/05/2020	7/06/2020	Sealed	Structure and Quality
BC2503	225401.11	6611794.96	347.84	231.63	16/05/2020	26/05/2020	Sealed	Structure and Quality
BC2504	225825.41	6612558.49	394.07	291.28	26/05/2020	3/06/2020	Sealed	Structure and Quality
BC2504R	225831.13	6612561.02	393.92	291.78	19/09/2020	3/10/2020	Sealed	Gas
BC2505	226404.6	6612797.06	365.67	309.81	27/05/2020	10/06/2020	Sealed	Structure and Quality
BC2505R	226401.75	6612800.64	365.71	39.49	11/06/2020	12/06/2020	Sealed	Structure and Quality
BC2506	228002.26	6612805.17	348.99	345.17	7/06/2020	25/06/2020	Sealed	Structure and Quality
BC2507	226396.52	6612398.24	361.08	288.01	13/06/2020	29/06/2020	Sealed	Structure and Quality

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2508	227603.65	6613041.53	347.02	333.05	27/06/2020	16/07/2020	Sealed	Gas
BC2509	226782.36	6611796.56	324.39	90.33	30/06/2020	3/07/2020	Sealed	Coal Quality
BC2510	227400.72	6612188.32	318.19	105.6	6/07/2020	17/07/2020	Open	Coal Quality
BC2510R	227395.92	6612186.36	318.17	36.54	18/07/2020	18/07/2020	Open	Coal Quality
BC2511	227702.38	6612392.73	331.44	139	26/05/2020	27/05/2020	Open	Structure
BC2512	227514.32	6612215.16	323.72	120	27/05/2020	28/05/2020	Open	Structure
BC2513	227787.16	6612273.58	324.6	145	28/05/2020	28/05/2020	Open	Structure
BC2514	227691.96	6612297.29	331.13	145	29/05/2020	29/05/2020	Open	Structure
BC2515	228102.18	6612401.36	330.89	169	1/06/2020	1/06/2020	Open	Structure
BC2516	228097.32	6612497.78	336.25	175	2/06/2020	2/06/2020	Open	Structure
BC2517	228095.07	6612599.36	346.87	181	4/06/2020	4/06/2020	Open	Structure
BC2518	228198.16	6612718.5	354.42	193	4/06/2020	5/06/2020	Open	Structure
BC2519	228192.61	6612496.89	336.82	187	8/06/2020	9/06/2020	Open	Structure
BC2520	228297.35	6612593.33	348.23	193	10/06/2020	10/06/2020	Open	Structure
BC2521	228306.58	6612684.11	352.83	199	11/06/2020	11/06/2020	Open	Structure
BC2522	228326.02	6612793.87	362.27	211	12/05/2020	17/06/2020	Open	Structure
BC2523	228306.62	6612899.26	374.52	17	18/06/2020	18/06/2020	Open	Structure
BC2523R	228297.96	6612891.97	373.93	229	18/06/2020	19/06/2020	Open	Structure
BC2524	228393.53	6612904.05	371.23	211	22/06/2020	24/06/2020	Open	Structure
BC2525	228501.41	6612707.7	353.5	199	24/06/2020	25/06/2020	Open	Structure
BC2526	228494.56	6612880.04	363.14	211	26/02/2020	29/06/2020	Open	Structure
BC2527	228498.24	6612806.24	356.28	205	29/06/2020	30/06/2020	Open	Structure
BC2528	228681.97	6612901.22	359.92	217	1/07/2020	2/07/2020	Open	Structure
BC2529	228504.34	6613000.26	381.41	229	3/07/2020	6/07/2020	Open	Structure

Hole	MGA Easting	MGA Northing	RL (m)	Total Depth (m)	Drill Start	Drill Finish	Borehole Status	Purpose
BC2530	228673.41	6612965.4	367.85	229	7/07/2020	8/07/2020	Open	Structure
BC2531	228801.32	6612906.09	373.77	24	13/07/2020	13/07/2020	Open	Structure
BC2531R	228801.41	6612910.1	374.21	235	13/07/2020	14/07/2020	Open	Structure
BC2532	228604.81	6612882.86	359.23	217	15/07/2020	16/07/2020	Open	Structure
BC2533	226480.98	6611639.6	323.18	85	17/07/2020	17/07/2020	Open	Structure
BC2534	225602.81	6612400.27	394.07	219.14	18/07/2020	13/08/2020	Sealed	Gas
BC2535	226903.18	6611889.3	324	91	20/07/2020	20/07/2020	Sealed	Structure
BC2536	227808.6	6612405.52	326.21	144.61	19/07/2020	23/07/2020	Open	Structure and Quality
BC2536R	227816.37	6612392.9	325.85	147.65	23/07/2020	12/08/2020	Open	Structure and Quality
BC2537	226725.02	6611798.16	326.02	91	20/07/2020	21/07/2020	Sealed	Structure
BC2538	228597.85	6613000.28	373.64	228.25	13/08/2020	26/08/2020	Open	Structure and Quality
BC2538R	228603.96	6613002.14	373.69	159.73	12/11/2020	16/11/2020	Open	Spon Com
BC2539	227990.38	6612599.93	339.24	159.5	13/08/2020	24/08/2020	Open	Structure and Quality
BC2540	227188.63	6612205.88	320.36	84.59	25/08/2020	28/08/2020	Sealed	Structure and Quality
BC2541	227795.03	6612606.54	338.73	207.5	29/08/2020	12/09/2020	Sealed	Structure and Quality
BC2542	226398.15	6611806.9	331.99	146.9	29/08/2020	1/09/2020	Sealed	Structure and Quality
BC2543	226592.93	6612000.81	334.23	93.55	29/08/2020	16/09/2020	Open	Structure and Quality
BC2544	227398.35	6612400.64	322.05	165.5	5/10/2020	9/10/2020	Sealed	Structure and Quality
BC2545	225408.14	6612604.53	414.6	309.86	12/10/2020	5/11/2020	Sealed	Structure and Quality
BC2546	227005.57	6611999.19	321.25	87.43	5/12/2020	11/12/2020	Open	Structure and Quality



REVIEW	NAME	SIGNATURE	DATE	SCALE 1:14000	TITLE 2020 Exploration Drilling					
DRAWN BY	Mariah		07-Apr-2021							
DWN CHECKED	Jana		07-Apr-2021	ORIG PLOT SIZE A3 Land.						
				VULCAN DATABASE boggworking	PLOT LOCATION O:\Technical_Services\Survey\12.Plots	DESCRIPTION BOGGABRI COAL MINE			DWG No. 1	
				VULCAN LAYER NAME 2020_Drilling_Text	PLOT FILE NAME 2020ExplorationDrillng				Revision 1	

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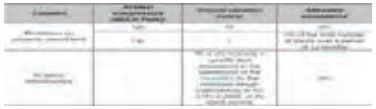
BOGGABRI COAL

Appendix F

2020 BCM IEA Response Action Plan

Boggabri Coal Mine Independent Environmental Audit, August 2020 – Audit Action Plan

Reference	Schedule and Condition Number	Condition	Compliance status	Evidence	Recommendation	Proposed action	Target Completion Date
Project Approval 09_0182							
NC1	Schedule 3 Condition 9	The Proponent shall: (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; - Ensure that all equipment and nose 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; and Monitor and report on the implementation of these requirements annually on its website.	Non-Compliant Low Risk	(a) Annual testing of mobile plant and equipment is undertaken. Test results are compared with the Boggabri Coal Mine Environmental Assessment (Hanson Bailey 2010). Sound power screening levels greater than 3 dBA are considered significant and require further investigation. Non compliances of sound power levels for a number of mobile plant were reported in the 2017, 2018 and 2019 Annual Reviews. BCOPL have been implementing a plant attenuation, monitoring and review program across the audit period which has involved the trail of three sound attenuation kits on six 930E Komatsu trucks. This trial is ongoing. As reported in the Boggabri Coal Mine - Noise Modelling Assessment (April 2020) the majority of the mining fleet currently operates at sound power levels higher than modelled for the EA. The noise modelling assessment was undertaken to evaluate if compliance with noise limits can be achieved with the current plant.	**NC REC**: continue investigations and dialogue with DPIE regarding sound power level requirements.	BCO will continue to liaise with DPIE regarding sound power level requirements.	30/01/2022
NC2	Schedule 3 Condition 15	The Proponent shall ensure that the blasting on the site does not cause exceedances of the criteria in Table 6.  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)	As reported in the 2019 Annual Review, a blast fired on 21 August 2019 recorded an airblast overpressure of 123 dBL exceeding the 120dBL criteria. This exceedance was attributed to a short- term fluctuation in the upper air wind conditions that could not have been reasonably foreseen. An incident report was prepared which concluded that: *Blast design investigations indicate that tie in and firing conditions of the blast would ordinarily result in basic blast emission of less than 115dBL and that 123dBL can only be explained by the effects of meteorology.* It is noted that no exceedances have been recorded since this time. The real time blast monitoring and weather system has been sighted and is implemented. This 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. Notification of the exceedance was sent via text and email but was originally missed. This is attributable to the amount of trigger text messages which were received, particularly under the old system.	**NC REC**: Ensure blasts are undertaken under appropriate weather conditions. Delays to blasts should be implemented if required based on real time weather data review. **NC REC**: Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed	Blasts will only be undertaken during appropriate weather conditions. Delays will be implemented if required based on weather conditions in accordance with the Blast Management Plan The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances.	01/08/2021
NC3	Schedule 3 Condition 22	The proponent shall prepare and implement a Blast Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) Be submitted to the Secretary for approval within 6 months from the date of project work. (b) be prepared in consultation with the EPA, the CCC and interested members of the local community potentially affected by blasting operations; (c) propose any alternative ground vibration limits for public infrastructure in the vicinity of the site; (d) describe the measures that would be implemented to ensure: - best management practice is being employed; and - compliance with the relevant conditions of this approval; (e) include a road closure management plan for blasting within 500 metres of a public road, that has been prepared in consultation with Council; (f) include a specific blast fume management protocol to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated;	Non-Compliant (Low Risk)	**Preparation** The latest version of the Blast Management Plan is dated November 2018. Approved by DPIE on 21st February 2019. i. The Blast Management Plan was originally prepared in January 2013, with this being within six months of the Project Approval. ii. the current Blast Management Plan November 2018 summarises consultation undertaken in Appendix D iii. Alternate ground vibration covered in Section 5.1 of plan iv. Section 6 of BLMP v. Section 6.3 of BLMP vi. Appendix C vii. Section 7 of BLMP iii. Appendix E of BLMP **Implementation** Non-compliant due to 120 dBL exceedance.	**NC REC**: Ensure blasts are undertaken under appropriate weather conditions. Delays to blasts should be implemented if required based on real time weather data review.	Blasts will only be undertaken during appropriate weather conditions. Delays will be implemented if required based on weather conditions in accordance with the Blast Management Plan	01/08/2021

		(g) include a monitoring program for evaluating the performance of the project including: - compliance with the applicable criteria; and - minimising fume emissions from the site; and (h) include a Leard Forest Mining Precinct Blast Management Strategy that has been prepared in consultation with other mines within the Leard Forest Mining Precinct to minimise cumulative blastingimpacts. *Note: The Leard Forest Mining Precinct Blast Management Strategy can be developed in stages and will need to be subject to ongoing review dependent upon the determination of and commencement of other mining projects in the area.*					
NC4	Schedule 3 Condition 27	Except for the air quality affected land in Table 7, the Proponent shall ensure that particulate matter emissions generated by the project do not exceed the criteria listed in Table 9, Table 10 and Table 11 at any residence on privately-owned land or on more than 25 percent of any privately-owned land. Table 9: Long-term criteria for particulate matter  Table 10: Short-term criteria for particulate matter  Table 11: Long-term criteria for deposited dust  Notes to Table 9, Table 10 and Table 11: a Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources); b Incremental impact (ie incremental increase in concentrations due to the project on its own); c Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method. d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary.	Administrative Non-Compliance	Evidence of air quality monitoring in Annual Reviews. Evidence of assessing the potential contribution of the site towards air quality criteria provided as notes and not included in the Annual Reviews. 1 Jan 2017 - 31 Dec 2017 - Table 4-3 of the Annual Review identifies the Roma and Merriown monitoring locations as locations to be used for compliance monitoring. However, Section 4.2.2.2 of the 2017 Annual Review outlines that the one exceedance of the short-term PM10 criterion recorded at the Merriown HVAS monitor and the two exceedances recorded at the Roma HVAS monitor "are not considered exceedances as the monitoring location is not used as a compliance measurement tool". Moreover, the exceedances described above do not match data presented in the charts. According to the chart, only a single exceedance of the 24-hour average PM10 criteria was recorded at Roma and no exceedances at Merriown. 1 Jan 2018 - 31 Dec 2018 - Based on the information provided, the site was within criteria. There were some days of extraordinary events and some days when the site was upwind from the monitoring stations which recorded an exceedance. 1 Jan 2019 - 31 Dec 2019 - Based on the information provided, the site's compliance could not be established. The Annul Review mentions that 53 exceedances of the short term PM10 criteria were recorded by the Wilberoi East TEOM and that these were either due to extraordinary events (41 occasions) or due to sources other than the site. No evidence of incident investigations for 2019 was provided. Based on the information presented, there is no evidence that the criteria in S3 C27 have been exceeded as a result of BCOPL emissions. Admin non-compliant as status of extraordinary event days has not been agreed with the Secretary and DPIE was not notified of recorded exceedances of the relevant air quality criteria. Whilst it is acknowledged that exceedances of the air quality criteria do not necessarily equate to a non-compliance, it is considered that all exceedances should be notified to DPIE, particularly given that note (a) to Schedule 3 Condition 27 states that criteria are "Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources)". If the exceedance is not attributable to BCOPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification.	**NC REC**: It is recommended that in line with the requirements of note (d) of Schedule 3 Condition 27 of the Boggabri Coal PA, confirmation be sought from the secretary on the status of days believed to be extraordinary events prior to classifying any day as an extraordinary event day and removing the day from the annual average. **NC REC**: all exceedances of the relevant air quality criteria be investigated in accordance with the requirements of the AQGHGMP to determine if they are attributable to BCOPL operations **NC REC**: DPIE should be informed of any exceedance of the relevant air quality criteria, regardless of the exceedance being a non-compliance or not. If the exceedance is not attributable to BCOPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification; **NC REC**: a standard methodology should be developed for the investigation and reporting of any exceedances recorded by the air quality monitors. **Improvement REC**: In the interest of transparency it is recommended that: 1) a table of all days with exceedances of the 24-hour average criteria be included in the annual reports together with findings of any investigations and status of days as determined by DPIE (extraordinary day or not); and all valid data captured by the TEOM be reported and included in the chart. Extraordinary days may then be excluded from the annual average calculations	BCOPL will seek the concurrence of the secretary for the classification of 'extraordinary events' prior to the status of days being classified as 'extraordinary events'. All exceedances of the relevant air quality criteria will be investigated in accordance with the requirements of the AQGHGMP to determine if they are attributable to BCOPL operations. BCOP will inform DPIE of exceedances of air quality criteria regardless of whether it is a non-conformance or not. Evidence of investigation or data used in concluding whether an exceedance is attributable to BCOP will be provided with exceedance notification to DPIE. . A standard methodology for the investigation and reporting of any exceedance of relevant air quality criteria will be incorporated into the next revision of the AQGHGMP. BCOPL will report in the Annual Review 1) a table of all days with exceedances of the 24-hour average criteria together with findings of any investigations into the status of days as determined by DPIE (extraordinary day or not); and **2)** all valid data captured by the TEOMs will be reported. Extraordinary days can then be excluded from the annual average calculations.	01/08/2021
NC5	Schedule 3 Condition 31	The Proponent shall prepare and implement an Air Quality and Greenhouse Gas Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared in consultation with the EPA and the CCC, and be submitted to the Secretary for approval within 6 months from the date of project approval; (b) integrate the recommendations of a Site Specific Best Management Determination and Reactive Dust	Administrative Non-Compliance	There is evidence of the site not effectively implementing the AQGHGMP as follows: 1) DPIE was not notified of recorded exceedances of the relevant air quality criteria. Whilst it is acknowledged that exceedances of the air quality criteria do not necessarily equate to a non- compliance, it is considered that all exceedances should be notified to DPIE, particularly given	**NC REC**: all exceedances of the relevant air quality criteria be investigated in accordance with the requirements of the AQGHGMP to determine if they are attributable to BCOPL operations **NC REC**: DPIE should be informed of any exceedance of the relevant air quality criteria, regardless of the exceedance	All exceedances of the relevant air quality criteria will be investigated in accordance with the requirements of the AQGHGMP to determine if they are attributable to BCOPL operations. A standard methodology for the investigation and reporting of any exceedance of relevant air quality	01/08/2021

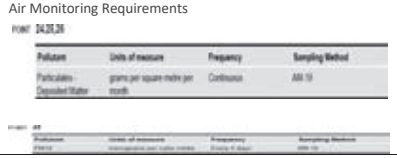
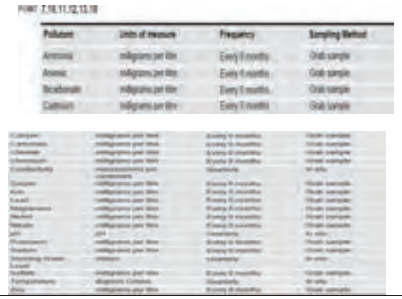
		Management Strategy prepared to the satisfaction of the EPA; (c) describe the measures that would be implemented to ensure: … (d) describe the proposed air quality management system; (e) include a risk/response matrix to codify mine operational responses to varying levels of risk resulting from weather conditions and specific mining activities; (f) include commitments to provide summary reports and specific briefings at CCC meetings on issues arising from air quality monitoring; (g) include an air quality monitoring program that: …. includes a Leard Forest Mining Precinct Air Quality Management Strategy that has been prepared in consultation with other coal mines in the Precinct to minimise the cumulative air quality impacts of all mines within the Precinct, that includes:		that note (a) to Schedule 3 Condition 27 states that criteria are "Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources)". If the exceedance is not attributable to BCOPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification; 2) while notes relating to exceedances of relevant air quality criteria were provided, these exceedances (even though not necessarily non- compliances) were not logged in the Incident Register and evidence of completion of BCOPL Incident Report Forms were not provided. It is also noted that a standard methodology was not adopted for the presentation of the investigation findings.	being a non-compliance or not. If the exceedance is not attributable to BCOPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification; **NC REC**: a standard methodology should be developed for the investigation and reporting of any exceedances recorded by the air quality monitors.	criteria will be incorporated into the next revision of the AQGHGMP. This will reflect outcomes of consultation with DPIE in relation to the classification of the status of days as 'extraordinary events'.	

NC6	Schedule 3 Condition 38b	A Surface Water Management plan, which includes:
		- Detailed baseline data on surface water flows and quality in the waterbodies that could potentially be affected by the project.
		- Detailed baseline data on soils within the irrigation management area;
		- Detailed baseline data on hydrology across the downstream drainage system of the Namoi River floodplain from the mine site to the Namoi River.
		- A detailed description of the water management system on site, including the;
		  Clean water diversion system
		  Erosion and sediment controls (dirty water system);
		  Mine water management systems irrigation areas
		  Discharge limits in accordance with EPL requirements
		  Water storages
		  Haul road and Boggabri Rail Spur Line and bridge flood and water diversions;
		- Detailed plans including design objectives and performance criteria for:
		  Design and management of final voids
		Design and management for the emplacement of reject materials, sodic and dispersible soils and acid or sulphate generating materials.
			Non-Compliant (Low Risk)	The implementation of the currently approved surface water management plan is non-compliant as the clean water drain presented in Appendix A of the SWMP to the north of the disturbance area has been mined through and has not been reinstated. It is acknowledged that the update to the SWMP (Rev8) has been prepared depicting the absence of the clean water drain and that a report has been prepared by GHD to justify not reinstating this drain and to evidence that the site is not harvesting clean water outside of harvestable rights allowances.
				The update to the SWMP was submitted to the DPIE for approval in July 2019; however, given that it has yet to be approved the implementation of the approved SWMP is non-compliant. It is recommended to continue to liaise with DPIE with regard to the approval of the revised water management system and the removal of the clean water diversion.
					NC REC: continue to liaise with DPIE with regard to the approval of the revised water management system and the removal of the clean water diversion.	BCOP will submit to DPIE revised SWMP's that contemplate the removal of the clean water diversion drain.	01/08/2021

NC7	Schedule 3 Condition 38(c)	(c) a Groundwater Management Plan, which includes: detailed baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores including a detailed survey/schedule of groundwater dependent ecosystems (including stygo-fauna), that could be affected by the project; the monitoring and testing requirements specified in the PAC recommendations for groundwater management as set out in Appendix 6; detailed plans, including design objectives and performance criteria, for the design and management of the proposed final void; groundwater assessment criteria including trigger levels for investigating any potentially adverse groundwater impacts; a program to monitor and assess: o groundwater inflows to the open cut mining operations; o the seepage/leachate from water storages, backfilled voids and the final void; o interconnectivity between the alluvial and bedrock aquifers; o background changes in groundwater yield/quality against mine-induced changes;	Administrative Non-Compliance	"Preparation Approved Groundwater Management Plan (May 2017) reviewed. * Baseline data provided in Section 3.3 *Monitoring and testing requirements in Section 4 * Trigger levels included in Section 5 * Section 7.3 states groundwater model will be reviewed very three years. * Procedures for managing exceedances is included Implementation Groundwater monitoring is undertaken quarterly with a detailed analysis of results presented in the Annual Groundwater Monitoring Review undertaken by GHD. The review assesses BCM's groundwater monitoring data and provides analyses on groundwater levels and groundwater quality. Findings from the review are summarised in the Annual Reviews. Based on the results presented in the Annual Reviews, groundwater levels have remained within trigger levels during the audit period.	**NC REC:** Continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	BCOP will continuing to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	01/08/2021

		o the impacts of the project on: - regional and local (including alluvial) aquifers; - groundwater supply of potentially affected landowners; - aquifers potentially affected by the mine irrigation area; - groundwater dependent ecosystems (including potential impacts on stygo-fauna) and riparian vegetation. a program to validate the groundwater model for the project, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions; and a plan to respond to any exceedances of the performance criteria; and		Groundwater bores 2102 and 2103 were not monitored in 2018 and 2019 due to damage of the bore casing. Monitoring at bores 2104 and 2105 was not undertaken as they were not accessible and MW6 was not monitored as it was blocked. Boggabri, Tarrawonga, Maules Creek Complex Numerical Model Update prepared by AGE dated 17 August 2018. "			
NC8	Schedule 3 Condition 64	Within 12 months of the completion of the Gunnedah Traffic Study, the Proponent shall provide a report of the outcomes of this liaison and identify any proposals recommended by either the Proponent or the Gunnedah Shire Council towards implementing reasonable and feasible recommendations, to the satisfaction of the Secretary."	Administrative Non-Compliance	No evidence of a report could be provided however, the rail over pass in Gunnedah was constructed during the audit period and opened to traffic in November 2020. This condition can be closed out.		NO ACTION REQUIRED	NO ACTION REQUIRED
NC9	Schedule 4 Condition 3	As soon as practicable after obtaining monitoring results showing: (a) An exceedance of the relevant criteria in schedule 3, the Proponent shall notify the affected landowner in writing of the exceedance, and provide regular monitoring results to each of these parties until the projects is complying with the relevant criteria again; and (b) An exceedance of the relevant air quality criteria in schedule 3, the Proponent shall send a copy of: - The NSW Health fact sheet entitled "mine Dust and You" (as may be updated from time to time); and The air quality monitoring data, in an appropriate format so that a medical practitioner can assist the resident in making an informed decision on the health risks associated with occupation of the property to the landowner/s and/or existing tenants of the land.	Non-Compliant (Low Risk)	(a) **Non-compliant** - A blast on the 21 August 2019 exceeded the limit of 120 dBL. A recording of 123dBL was recorded at Wilderoi East. Verbal notification was provided to landowners. However, this was not notified to EPA and residents until 28 August. The DPIE and EPA issued notices for the non-reporting. No reportable dust exceedances were recorded in the audit period.	**NC REC:** Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed.	The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances'.	01/08/2021
NC10	Schedule 5 Condition 4	"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; (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; (c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance; (d) identify any trends in the monitoring data over the life of the project; (e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and describe what measures will be implemented over the next year to improve the environmental performance of the project."	Administrative Non-Compliance	"Annual reviews for 2017, 2018 and 2019 were provided. They are also available on the BCOPL website. Each were submitted to DPIE prior to the end of March. A) Rehabilitation details are provided in Section 8 of the Annual Review b) Monitoring results and comparison with performance are included in Section. 4. Complaints are summarised in Section 7.3 c) non-compliances are summarised in Section 5 d) trends in monitoring are included in Section 4. As noted in the previous audit, while long term trends associated with groundwater are presented in the annual reviews, there is little information relating to longer terms trends for air quality, surface water and noise over the life of mine as required by this condition. e) discrepancies against predictions (as relevant) are covered in Section 4 next years activities and improvements are included in section 5 and 9"	**Improvement REC:** Include additional information in the annual reviews regarding longer term trends particularly in terms of surface water, noise and air quality	BCOP will include additional information in the annual reviews regarding longer term trends particularly in terms of surface water, noise and air quality.	Annual Review 2021
NC11	Schedule 5 Condition 5	"Within 3 months of the submission of: (a) an annual review under condition 4 above; (b) an incident report under condition 8 below; (c) an audit under condition 10 below; and (d) any modification to the conditions of this approval,	Administrative Non-Compliance	"It is acknowledged that BCOPL has been progressively working on updating management plans for several years with revised versions submitted to department. Management plans and strategies have been updated over	**Improvement REC:** Prepare a document review register to evidence dates when documents are reviewed. Register should identify if any changes are identified as being required.	BCOP will create a register to capture and track details of when documents are updated including the review and revision of management plans and relevant supporting documents.	01/07/2021

		the Proponent shall review the strategies, plans, and programs required under this approval. Where this review results in revisions to any such document, then within 4 weeks of the completion of the revision, unless the Secretary agrees otherwise, the revised document must be submitted to the Secretary for approval."		the last three years with the exception of the CHMP which is dated November 2016. "			
NC12	Schedule 5 Condition 8	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. For any other incident associated with the project, the Proponent shall notify the Secretary and any other relevant agencies as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.	Non-Compliant (Low Risk)	This 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. Notification of the exceedance was sent via text and email but was originally missed. This is attributable to the amount of trigger text messages which were received, particularly under the old system.	**NC REC:** Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed.	The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances'.	01/08/2021
NC13	9	Boggabri Coal will manage its blasting practices such that the recommended DECCW guidelines, existing at the time of approval; will be met at all privately owned receivers.	Non-Compliant (Low Risk)	As reported in the 2019 Annual Review, a blast fired on 21 August 2019 recorded an airblast overpressure of 123 dBL exceeding the 120dBL criteria. This exceedance was attributed to a short- term fluctuation in the upper air wind conditions that could not have been reasonably foreseen.	**NC REC:** Ensure blasts are undertaken under appropriate weather conditions. Delays to blasts should be implemented if required based on real time weather data review. **NC REC:** Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed.	Blasts will only be undertaken during appropriate weather conditions. Delays will be implemented if required based on weather conditions in accordance with the Blast Management Plan The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances'.	01/08/2021
NC14	P1.3	The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point. 	Administrative Non-Compliance	'Review of "EPL Boundary and Environmental Monitoring Locations" figure confirm locations of each EPA monitoring ID number. There was no water discharge events in 2017 to 2019 therefore sampling was not triggered. In February 2020 there was one discharge event. Sampling was undertaken at SW1, SW2 and SD6. Groundwater bores 2102 and 2103 were not monitored in 2018 and 2019 due to damage of the bore casing. Monitoring at 2104 and 2105 was not undertaken as they were not accessible and MW6 was not monitored as it was blocked.	**NC REC:** Continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	BCOP will continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	01/08/2021
NC15	L4.1	The airblast overpressure level from blasting operations at the premises must not exceed 120dB (Lin Peak) at any time at any noise sensitive locations. Error margins associated with any monitoring equipment used to measure this are not to be taken into account in determining whether or not the limit has been exceeded.	Non-Compliant (Low Risk)	'As reported in the 2019 Annual Review, a blast fired on 21 August 2019 recorded an airblast overpressure of 123 dBL exceeding the 120dBL criteria. This exceedance was attributed to a short- term fluctuation in the upper air wind conditions that could not have been reasonably foreseen. An incident report was prepared which concluded that: Blast design investigations indicate that tie in and firing conditions of the blast would ordinarily result in basic blast emission of less than 115dBL and that 123dBL can only be explained by the effects of meteorology. This 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. Notification of the exceedance was sent via text and email but was originally	**NC REC:** Ensure blasts are undertaken under appropriate weather conditions. Delays to blasts should be implemented if required based on real time weather data review. **NC REC:** Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed.	Blasts will only be undertaken during appropriate weather conditions. Delays will be implemented if required based on weather conditions in accordance with the Blast Management Plan The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances'.	01/08/2021

				missed. This is attributable to the amount of trigger text messages which were received, particularly under the old system.			
NC16	M2.2	Air Monitoring Requirements 	Administrative Non-Compliance	In the 2019 - 2020 annual return sampling at three of the HVAS was not undertaken as private residences requested urgent removal of the monitoring units.	**NC REC:** Continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	BCOP will continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	01/08/2021
NC17	M2.3		Administrative Non-Compliance	As reported in the Annual Returns sampling of some groundwater locations was not able to be undertaken (site 10,11 and 18). This was due to 10 and 11 being destroyed by mining and 18 being blocked. A variation has been submitted to the EPA for a variation to remove the destroyed bores.	**NC REC:** Continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	BCOP will continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	01/08/2021
NC18	M2.3		Administrative Non-Compliance	There was no sample undertaken at location 39 for three out of the four quarters in the 2017 - 2018 reporting period. The 2017-2018 annual return also identified that samples were not taken from sites 19 and 20 but these have subsequently been removed from the EPL.	**NC REC:** Continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	**BCOP** will continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	01/08/2021
NC19	R2.2	The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.	Administrative Non-Compliance	'As reported in the 2019 Annual Review, a blast fired on 21 August 2019 recorded an airblast overpressure of 123 dBL exceeding the 120dBL criteria. This exceedance was attributed to a short- term fluctuation in the upper air wind conditions that could not have been reasonably foreseen.	**NC REC:** Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed.	The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances.	01/08/2021
NC20	4	(a) The lease holder must lodge Environmental Management Reports (EMR) 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; (ii) report on the extent of compliance with regulatory requirements; and have regard to any relevant guidelines adopted by the Director-General.	Administrative Non-Compliance	The site annual reviews are prepared to meet this condition. Annual reviews are prepared for the site for the period of 1 January to 31 December. All Annual Reviews for audit period are signed and dated prior to end of March. Also sighted submission confirmation of submission for each year. The annual reviews generally cover these requirements. However, progression towards rehabilitation completion criteria is only mentioned with regard to the species richness analogue benchmark. Rehabilitation areas should be tracked against the phases in the MOP with evidence provided to justify whether the rehabilitation has met the rehabilitation objectives of that phase and domains. It is noted that the Resources Regulator has recently released proposed amendments to the rehabilitation compliance and reporting requirements	**NC REC:** Future Annual Reviews must report on progress in respect of rehabilitation completion criteria. **NC REC:** Review rehabilitation monitoring process in line with the Resources Regulator Annual Rehabilitation Report guidance (http://www.resourceregulators.nsw .gov.au/ _data/assets/pdf_file/00171262330/ Form- And-way-Annual-rehabilitation-report-and -forward-program-for-large- mines.pdf) to ensure that progress against completion criteria is completed as required.	BCOP will report on progress in respect of rehabilitation completion criteria in future Annual Reviews. BCOP will review the rehabilitation monitoring process in line with the Resources Regulator Annual Rehabilitation Report guidance (http://www.resourceregulators.nsw .gov.au/ _data/assets/pdf_file/00171262330/ Form- And-way-Annual-rehabilitation-report-and -forward-program-for-large- mines.pdf) to ensure that progress against completion criteria is completed as required.	2021 Annual Review
NC21	10	**(a) Ground Vibration** The lease holder must ensure that the ground vibration peak particle velocity generated by any blasting within the lease area does not exceed 10 mm/second and does not exceed 5 mm/second in more than 5% of the total number of blasts over a period of 12 months at any dwelling or occupied premises as the case may be, unless determined otherwise by the Department of Environment, Climate Change and Water. **(b) Blast Overpressure** The lease holder must ensure that the blast overpressure noise level generated by any blasting within the lease area does not exceed 120 dB (linear) and does not exceed 115 dB (linear) in more than 5% of the total number of blasts over a period of 12 months, at any dwelling or occupied premises, as the case may	Non-Compliant (Low Risk)	A blast on the 12 August 2019 exceeded the limit of 120 dBA. A recording of 123dBA was recorded at Wilberoi East. Landowners were verbally notified and notification was provided to DPIE as per PA 09_0182	**NC REC:** Ensure blasts are undertaken under appropriate weather conditions. Delays to blasts should be implemented if required based on real time weather data review.	Blasts will only be undertaken during appropriate weather conditions. Delays will be implemented if required based on weather conditions in accordance with the Blast Management Plan	01/08/2021

		be, unless determined otherwise by the Department of Environment, Climate Change and Water.					

Reference	Schedule and Condition Number	Condition	Compliance status	Evidence Collected	Recommendation	Proposed action	Target date completion
Project Approval - Schedule 3, Conditions 39-54 (BIODIVERSITY MATTERS)							
NC1 (Biodiversity Compliance Audit)	Schedule 3, Condition 54	The Proponent shall prepare a Eucalyptus Forestry Plantation Offset Strategy to the satisfaction of Forests NSW, within 12 months of the date of this approval. The Forestry Plantation Offset Strategy shall provide at least a minimum 168 ha plantation area (as committed in the EA), or alternative as agreed by Forests NSW. The Strategy shall identify proposed funding and management arrangements for the development and maintenance of the plantation offset. If there is a dispute over these requirements, either party may refer it to the Secretary for resolution, whose decision shall be final.	Non-compliance	Boggabri Coal have provided Umwelt with information that shows evidence of progress being made on this strategy. As of November 2020 Boggabri Coal have provided Forestry NSW with a draft strategy. Evidence has been provided that Forestry NSW does not see benefit in the strategy proposed by Boggabri Coal.	It is recommended that an extension to this approval condition is sought. It is recommended that, together with Forests NSW, this strategy is promptly finalised to the satisfaction of the relevant parties.	BCOP will continue to consult with Forests NSW to seek achieve their satisfaction.	01/12/2021

Improvement Recommendations

Rec #	Aspect	Recommendation	Proposed response	Target Completion Date
Improvement REC 1	Blasting	Recommend for drone footage to continue for longer so that future complaints may be verified to determine whether blast fume did remain and travel off site at a distance.	Drone footage will be extended beyond the initial blast to record more of the blast cloud to assist with determining whether blast fume did remain and travel off site at a distance.	31/3/21
Improvement REC 2	Noise Management Plan	Update the Noise Management Plan to reflect new TARPs developed since the transition to Teledata real time system.	The next revision of the noise management plan will include the revised TARPs.	01/08/2021
Improvement REC 3	Dust	Regularly include discussion around dust impacts in morning briefings and make EPA Dust Handbook available to all operators. Empower operators to contact OC to request water cart or mitigation if dust generation is observed.	The EPA dust handbook will be made available at the morning briefings. During the prestart information session dust impacts will be discussed and operators reminded to call up OCE and request water carts when required.	Ongoing
Improvement REC 4	Weed management	Undertake weed management on topsoil stockpiles to mitigate risk of weed infestation to rehabilitation areas.	Periodic spraying and management of weeds in topsoil stockpiles will be undertaken as part of ongoing management of weeds and pests on site.	Ongoing
Improvement REC 5	Surface water management	Undertake appropriate investigations to determine how requirements for 1 GL air capacity can be retained following mining through of MW5.	The long term mine planning team is developing options to ensure adequate air capacity and water storage is planned and provided prior to MW5 being mined through.	Ongoing
Improvement REC 6	EPL	Vary the EPL in consultation with EPA to align with the appropriate borehole locations and remove those that have been mined through.	BCOP is continuing to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.	01/08/2021
Improvement REC 7	Heritage	Implement the outstanding recommendations from the 2017 Audit as reported in the 2019 Annual Review in the updated CHMP.	The CHMP is currently being revised and recommendations will be addressed in the revision.	01/07/2021
Improvement REC 8	Heritage	Incorporate the recommended improvements from the OEH into the revised CHMP.	The CHMP is currently being revised and recommendations will be addressed in the revision.	01/07/2021
Improvement REC 9	Rehabilitation	Undertake further investigations to confirm that the proposed "rice paddy" final landform meets this development consent condition of "constructed landforms drain to the natural environment" and the MOP rehabilitation objective of creating a stable free draining landform.	Investigation in landform design will be undertaken to confirm conformance with development consent.	01/07/2021
Improvement REC 10	Rehabilitation	Undertake additional weed management in rehabilitation areas and repairs to erosion / scouring as required.	Periodic spraying and management of weeds in rehabilitation areas will be undertaken as part of ongoing management of weeds and pests on site.	Ongoing
Improvement REC 11	Rehabilitation	Consider cover crops and/or hydromulch to assist with stabilisation in tubestock areas until tubestock takes off and ground cover increases.	A review of the 2020 tree planting and rehabilitation program will be undertaken to identify what has worked well and areas for improvement. The review consider the use of cover crops and/or hydromulching to assist with stabilisation.	01/08/21
Improvement REC 12	Annual review	Include additional information in the annual reviews regarding longer term trends particularly in terms of surface water, noise and air quality	BCOP will include additional information in the annual reviews regarding longer term trends particularly in terms of surface water, noise and air quality.	2021 Annual Review

Improvement REC 13	Management plans	Prepare a document review register to evidence dates when documents are reviewed. Register should identify if any changes are identified as being required.	BCOP will create a register to capture and track details of when documents are updated including the review and revision of management plans and relevant supporting documents.	01/06/21
Improvement REC 14	Real time monitoring data	Include the daily operational response information in the real time summary report available on the website to evidence to the public that operational changes are made.	A review of information provided on the website regarding operational responses to conditions will be undertaken.	01/06/21
Improvement REC 15	WAL reporting	It is recommended that the Annual Review includes additional information to detail the amounts of water in the account at the start of the accounting period and to provide further justification, transparency and evidence that the total water extraction remains within the total allowed allocations.	The information provided in the Annual Review on water allocations will be reviewed.	31/03/21

Biodiversity Improvement Recommendations

	Biodiversity Audit recommendations for continual improvement	Response	Target Completion Date
1	Recommendations to aid the continual improvement of the site: • Trial some thinning of dense eucalypts in woodland rehabilitation to stimulate the growth of those remaining and also to stimulate general flora species diversity and establishment	A trial of selectively thinning eucalyptus in the more advanced and dense rehabilitated areas will be undertaken. This will help to determine if such practices and may stimulate growth of the remaining flora and encourage greater species diversity.	December 2021
	• Perform remediation works in established rehabilitation areas affected by erosion	Areas affected by erosion will be remediated.	December 2021
	• Opportunities for rehab planting design improvements/trials	Rehab planting design improvements/ trials will be incorporated into future rehabilitation areas.	December 2024
	• Erect nest boxes over rehabilitation and Biodiversity Offset Areas (BOAs)	Installation of nest boxes in the rehabilitation area and the BOA's will commence in 2021	Commence 2021
	• Finalise placement of salvaged habitat (logs) across BOAs	A plan will be developed for the final placement of salvaged habitat logs across the BOAs.	December 2021
	• Ensure soil storage stockpiles are maintained at heights no greater than 3 m (as per management plan)	Soil storage stockpiles will be managed in accordance with the management plan.	Ongoing
2	Recommendations regarding the inadvertent understorey over clearing cleared area: • Regular walkover inspections to detect changes	Regular inspection of the IUO area will be undertaken to detect changes.	Ongoing
	• Ecological monitoring to assess the development of understorey vegetation and weeds	Ecological monitoring to assess the development of understorey vegetation will be undertaken during inspection.	Ongoing
	• Erosion areas be appropriately remediated	Remediation of eroded areas will be undertaken as required.	Ongoing
	• Ensure signage is effective.	Signage will be checked and replaced and or moved to ensure it remains effective.	Ongoing

Appendix G

2019 Site Water Balance



Boggabri Coal Operations Pty Ltd

Site Water Balance

April 2021

Revision Control Chart

Revision	Date	Prepared by	Reviewed by	Approved by
0	27/04/2012	L Doeleman	L Gleeson, T Swanson	J Rennick
1	14/09/2012	L Doeleman	B Bird	J Green
2	19/07/2013	N Harcombe, A Hedjripour	S Trott, V O'Keefe	C Dingle
3	9/10/2013	N Harcombe, A Hedjripour	S Trott, V O'Keefe	C Dingle
4	18/11/2013	N Harcombe	S Trott	J Green
5	12/02/2014	K Agllias	S Trott	J Green
6	4/06/2015	L Doeleman	N Geale	J Green
7	10/09/2015	L Doeleman	N Geale	J Green
8	18/05/2017	T Tinkler, A Wyatt	H Russell	P Forbes
9	23/04/2021	M Best, A Wyatt	K Halliday	H Russell

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Abbreviations

Abbreviation	Term
AR	Annual Review
ARI	Average Recurrence Interval
AWBM	Australian Water Balance Model
AWD	Available Water Determinations
BCM	Boggabri Coal Mine
BCOP	Boggabri Coal Operations Pty Limited
BOM	Bureau of Meteorology
BTM Complex	Boggabri-Tarrawonga-Maules Creek Complex
CCC	Community Consultative Committee
CD	Clean Water Highwall Dam
CHPP	Coal Handling and Preparation Plant
DPI&E	NSW Department of Planning, Industry and Environment
EA	Environmental Assessment
EC	Electrical Conductivity
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act, 1979*
EPL	Environment Protection Licence
GWMP	Groundwater Management Plan
HD	Highwall Dam
IFD	Intensity-Frequency-Duration
MCCM	Maules Creek Coal Mine
MIA	Mine Infrastructure Area
ML	Megalitres
Mtpa	Million Tonnes Per Annum
MWD	Mine water dam
NLLS	North West Local Lands Services (formerly Namoi Catchment Management Authority)
DPI Water	Department of Primary Industry – Water (formerly NSW Office of Water)
PAC	NSW Planning Assessment Commission
ROM	Run of Mine
SD	Sediment dam
SWB	Site Water Balance
SWMP	Surface Water Management Plan
TCM	Tarrawonga Coal Mine
TCPL	Tarrawonga Coal Pty Ltd
WAL	Water Access Licence
WMP	Water Management Plan
WSP	Water Sharing Plan

1. Introduction

This Site Water Balance (SWB) has been developed for Boggabri Coal Mine (BCM) which is managed by Boggabri Coal Operations Pty Ltd (BCOP). BCOP is owned by Idemitsu Australia Resources Pty Limited (80%), Chugoku Electric Power Australia Resources Pty Ltd (10%) and NS Boggabri Pty Limited (10%). BCM is located 15 km north-east of the township of Boggabri in north-western New South Wales, as shown in Figure B-1.

BCM is an open cut coal mine that has been operating since 2006. Truck and excavator operations are used to mine a run-of-mine (ROM) coal which is crushed and screened to produce a thermal coal product or washed in the Coal Handling Preparation Plant (CHPP) to produce Coking or Pulverised Coal Injected product. Product coal is loaded onto trains via a train loading facility at the mine site and transported by rail to the Port of Newcastle for overseas consumption.

Project Approval number 09_0182 for the Boggabri Coal Project, granted by the NSW Planning Assessment Commission (PAC) under Part 3A of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) on 18 July 2011, as modified from time to time, (Project Approval) allows BCOP to extend its mining operations for a further 21 years, and increase its production rate to 8.6 Mtpa of ROM coal from a total resource of 145 Mt.

In 2015, BCOP lodged an application under Section 75W of the EP&A Act 1997 to modify PA09_0182 (MOD 5). The modification was supported by an Environmental Assessment (Parsons Brinckerhoff, 2015) for the conversion of existing test bores to operational production bores for the supply water to BCM and the installation of ancillary infrastructure on adjoining properties. The application was determined by the NSW Department of Planning and Infrastructure, Executive Director under delegation by the Minister for Planning and was approved on 30 August 2016.

Schedule 3, Condition 38 (a) of the state Project Approval requires the preparation of a SWB. This SWB has been prepared in fulfilment of these requirements. The specific requirements of the SWB are listed in Table 1-2.

Conditions of approval under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) were granted by the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Department of Environment and Energy (DoEE)) on 11 February 2013 (EPBC Approval). The EPBC Approval conditions do not relate specifically to the SWB, but rather to the Surface Water Management Plan (SWMP). The SWB forms part of the SWMP.

The SWB considers the current Life-of-Mine planning and information available to define components of the SWB. To ensure clarity throughout the SWB, reference is made to two distinct mine plans for which demand, usage and storage characteristics are based, specifically the:

1. Mining Operations Plan 2020-2024 Amendment A (MOP): The MOP spans a period between 2020 and 2024. Mine plan snapshots and water management systems relevant to mine years existing and 2020, are aligned with the MOP.

2. Environmental Assessment (EA) Mine Plan: lodged in 2009 and conditionally approved by the NSW Minister for Planning and Infrastructure in July 2012. The EA

mine plan spans a 21 year period between 2013 and 2034. Mine plan snapshots and water management system for years 2024 and 2033 in this SWMP are based on the EA mine plan.

1.1 Application of the SWB

This SWB applies to all employees and contractors at the Boggabri Coal Mine and covers all areas within the 'Project Boundary' described in Appendix 1 of the Project Approval and shown in Figure B-1.

1.2 Related water management documents

This SWB report has been prepared as an integral part of, and should be read in conjunction with, the documents listed in Table 1-1. The WMP document hierarchy is shown in Figure 1-1.

Table 1-1 Related water management documents

Document	Description
Boggabri Tarrawonga Maules Creek (BTM) Complex Water Management Strategy	Regional strategy prepared in consultation with Tarrawonga Coal Pty Ltd (TCPL) and Maules Creek Coal Project (MCCM)
Water Management Plan	Overarching document setting out water management framework, statutory requirements, and procedural requirements
Surface Water Management Plan	Surface water baseline data, performance criteria, monitoring program, response plan, water management system description, erosion, and sediment controls
Groundwater Management Plan	Groundwater baseline data, performance criteria, monitoring program, response plan, groundwater model validation program
Site Water Balance report	Mine water balance modelling methodology, assumptions, and results, mine water management system operating philosophy

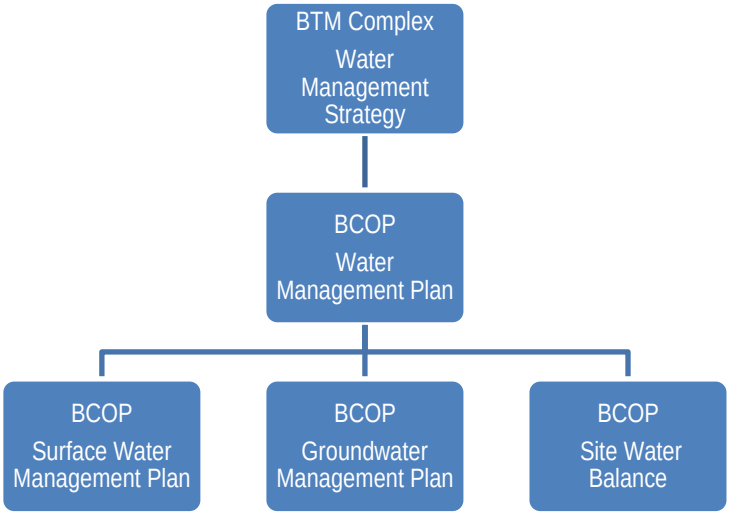

Figure 1-1 Document hierarchy

1.3 Consultation

Previous versions of this SWB have been prepared in consultation with representatives from the NSW Environment Protection Agency (EPA), NSW Department of Primary Industry – Water (DPI Water) (formerly Office of Water), North West Local Land Services (NLLS) (formerly Namoi Catchment Management Authority and the Community Consultative Committee (CCC).

The SWB has been prepared by suitably qualified persons approved by DP&E to undertake this work.

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1.4 Conditions of the Project Approval

The Project Approval conditions outlining the requirements for the SWB are provided in Section 2.3 of the WMP and summarised in Table 1-2.

1.5 Environment Protection Licence

The existing conditions described in this SWB reflect the conditions set out in the current EPL (12407, as at the date of the SWB). Condition L1.1 requires compliance with Section 120 of the *Protection of the Environment Operations Act 1997*. EPL discharge points will be reviewed and updated in consultation with the EPA. Discharge criteria are outlined in the Surface Water Management Plan (SWMP).

Table 1-2 Project conditions of approval – Planning Assessment Commission of NSW

Applicable Condition	Requirement	SWB Reference
Schedule 3, Condition 38(a)	The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must be prepared in consultation with OEH, DPIW, North Water Local Land Service and the CCC, by suitably qualified and experienced person/s whose appointment has been approved by the Secretary, and be submitted to the Secretary for approval within 6 months of the date of this approval [which shall include]:	This SWB forms part of the WMP. Suitably qualified and approved persons have prepared the plan in accordance with this requirement.
	▪ a Site Water Balance, that:	
	▪ includes details of:	Refer to Section 4 and Section 6
	▸ sources and security of water supply, including contingency for future reporting periods;	Refer to Section 4.5 and Table 6-1
	▸ prioritisation strategy for water sources;	Refer to Section 3.2
	▸ water use on site;	Refer to Section 4.6
	▸ water management on site;	Refer to Section 3
	▸ any off-site water discharges;	Refer to Section 4.7.3 and Table 6-1
	▸ reporting procedures, including the preparation of a site water balance for each calendar year;	Refer to Section 8.3
	▸ a program to validate the surface water model, including monitoring discharge volumes from the site and comparison of monitoring results with modelled predictions;	Refer to Section 8.2
	▸ methodologies used in the preparation of the site water balance, including provision of data sources, measurement type (direct sample / mass balance / engineer calculations / factors) and formulas used for all inflows, processes and outflows; and	Refer to Section 4 and Appendix A
	▪ is supported by an annual improvement program to identify and address deficiencies and improvements within monitoring, measurement and calculation methods; and	Refer to Section 8.1
	▪ includes an action plan and schedule to implement annual water efficiency initiatives and the recommendations in the Advisian peer review report titled “Peer Review of Site Water Balance Use Aspects of Boggabri Coal MOD 5 Project, 22 July 2016” as set out in Appendix 6A; and	Refer to Section 7
	▪ describes the measures that would be implemented to minimise clean water use on site	Refer to Section 3.1.1

2. Existing environment

2.1 Catchment description

The Boggabri Coal Mine and Mine Infrastructure Area (MIA) are contained within the catchment of an unnamed ephemeral drainage line locally referred to as Nagero Creek. Nagero Creek is an ephemeral stream that is a tributary of the Namoi River.

The Nagero Creek catchment is described in the Surface Water Management Plan (SWMP).

2.2 Climate data

Daily rainfall and evaporation data for the site for the 130 year period between 1889 and 2019 was obtained from the Bureau of Meteorology (BOM) Data Drill service. The Data Drill accesses grids of data derived by interpolating the BOM's station records, as described in Jeffrey, Carter, Moodie & Beswick (2001). The data in the Data Drill are all synthetic; no original meteorological station data are left in the calculated grid fields. However, the Data Drill does have the advantage of being available for any set of coordinates in Australia (BOM, 2006).

The Data Drill is considered superior to individual BOM station records and site meteorological station data for long-term water balance modelling purposes because it draws on a greater dataset, both spatially and in time. The Data Drill is also considered superior for modelling purposes as it does not contain gaps.

Plots of Data Drill sourced annual rainfall for the 130 year period between 1889 and 2019 is provided in Figure 2-1. A plot of Data Drill sourced average daily lake evaporation for each month of the year is provided in Figure 2-2. Summary statistics of Data Drill sourced annual rainfall and evaporation are provided in Table 2-1.

Daily evaporation estimates for open water bodies were obtained from the Data Drill based on Morton's Lake evaporation data. SILO calculates Morton's Lake evaporation using Morton's formula for shallow lakes as described in Morton (1983). Evapotranspiration estimates were based on Data Drill sourced daily FAO56 short crop as described in Smith (1998).

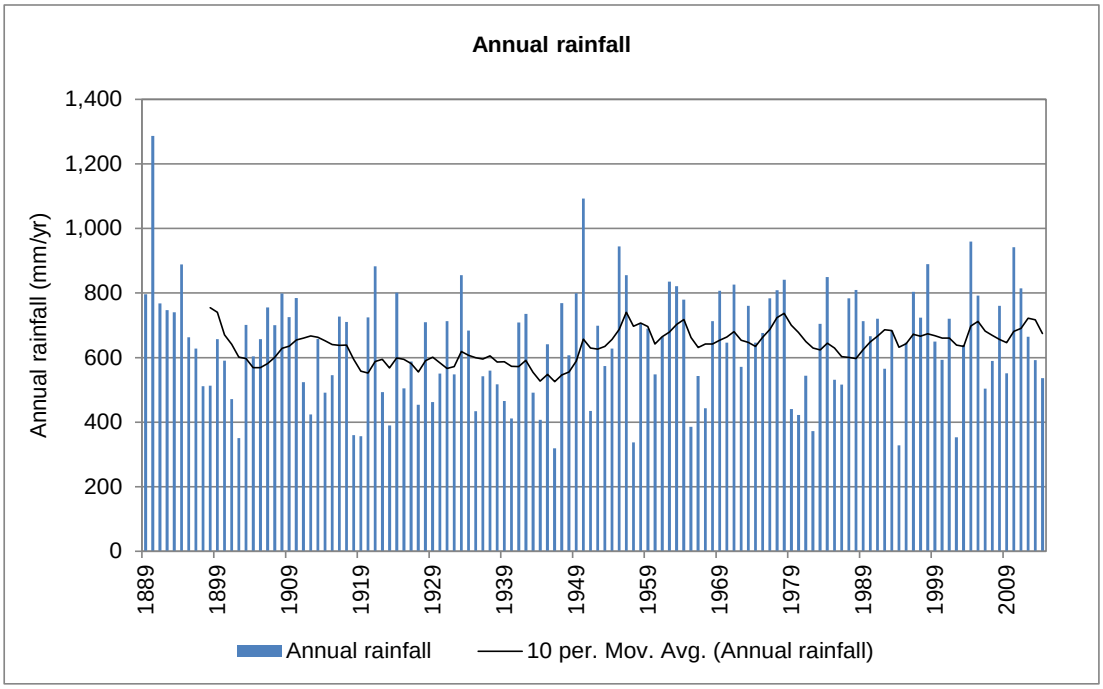


Figure 2-1 Annual rainfall for Boggabri from 1889 to 2019 (Data Drill)

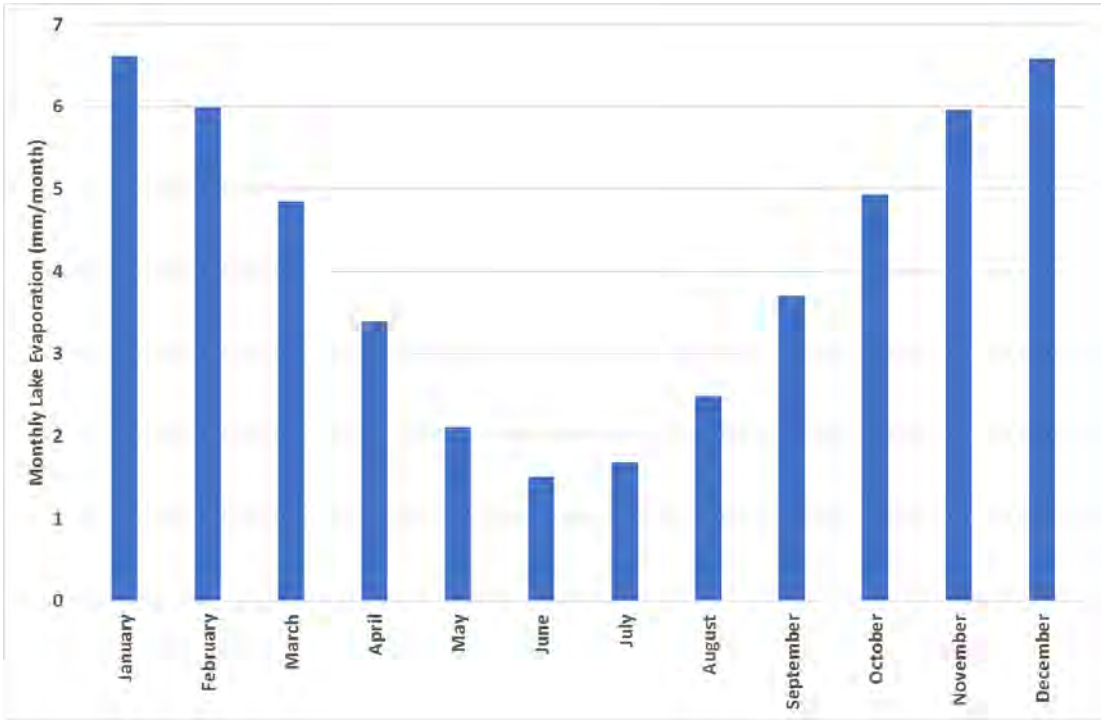


Figure 2-2 Average daily lake evaporation for Boggabri from 1889 to 2019 (Data Drill)

Table 2-1 Annual rainfall and evaporation statistics for Boggabri from 1889 to 2019 (Data Drill)

Percentile	Annual rainfall (mm/yr)	Annual potential evapotranspiration (mm/yr) [1]	Annual lake evaporation (mm/yr) [2]
minimum	319	1,253	1,389
5th percentile	363	1,310	1,414
10th percentile	423	1,339	1,441
50th percentile	658	1,418	1,511
90th percentile	831	1,536	1,594
95th percentile	887	1,574	1,617
maximum	1,287	1,634	1,643

[1] Potential evapotranspiration calculated using the Penman-Monteith formula given in Irrigation and Drainage paper No. 56 Food and Agriculture Organization of the United Nations (Smith, 1998).

[2] Lake evaporation calculated using Morton formula for shallow lakes given in the Journal of Hydrology, Volume 66, page 1-77, paper (Morton, 1983).

Daily rainfall data has been recorded at the Boggabri Coal Mine meteorological station since July 2006. The site meteorological station data has been used to verify the water balance model against site monitoring results recorded for the period from 2016 to 2019 (discussed in Section 5).

2.3 Design rainfall data

2.3.1 Intensity-frequency-duration rainfall data

Design intensity-frequency-duration (IFD) rainfall data for the mine site area was obtained from the BOM website, and is provided in Table 2-2. This information is typically used in the sizing of contaminated water dams (i.e. 100 year Average Recurrence Interval (ARI) 72 hour volume is typically used to achieve the no spills principle).

Table 2-2 IFD data for Boggabri Coal Mine site (1987 IFD Data)

Duration	Rainfall intensity (mm/hr)						
	1 year ARI	2 year ARI	5 year ARI	10 year ARI	20 year ARI	50 year ARI	100 year ARI
5 mins	70.7	92.9	123	144	171	209	240
10 mins	53.6	70.4	93.5	109	129	158	181
20 mins	39.3	51.6	68.3	79.3	93.9	115	131
30 mins	31.9	41.8	55.3	64.1	75.9	92.6	106
1 hr	21.1	27.7	36.6	42.4	50.2	61.2	70.2
2 hrs	13.2	17.3	22.9	26.6	31.5	38.4	44
3 hrs	9.84	12.9	17.1	19.9	23.6	28.8	33
6 hrs	5.91	7.77	10.3	12	14.3	17.4	20
12 hrs	3.58	4.71	6.29	7.34	8.73	10.7	12.3
24 hrs	2.19	2.9	3.9	4.58	5.47	6.73	7.77
48 hrs	1.33	1.76	2.39	2.82	3.39	4.20	4.86
72 hrs	0.95	1.26	1.73	2.04	2.46	3.06	3.55

2.3.2 Five day rainfall depths

Five day rainfall depths for the mine site have been estimated based on the values provided for Gunnedah in the guidelines *Managing Urban Stormwater – Soils and Construction – Volume 1* (Landcom 2004), and are provided in Table 2-3. These depths are typically used in the sizing of sediment dams. The guidelines recommend designing to the 90th percentile storm event for a sediment dam with duration of disturbance greater than three years and with a standard receiving environment.

Table 2-3 5-day rainfall depths for Boggabri Coal Mine site

Percentile	5-day rainfall depth (mm)
75th percentile	20.0
80th percentile	24.1
85th percentile	30.2
90th percentile	38.4
95th percentile	53.0

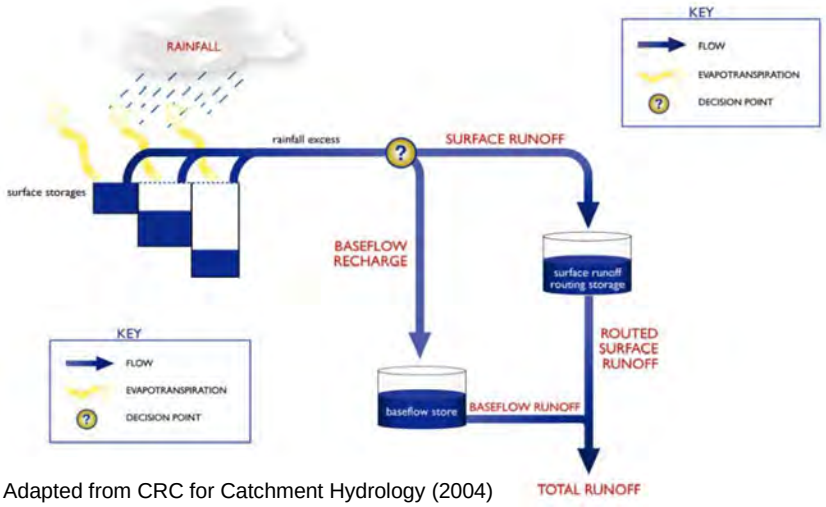
2.4 Rainfall-runoff

The volume of surface water runoff in the mine site catchment has been estimated using the Australian Water Balance Model (AWBM) rainfall-runoff model that has been incorporated into the site water balance model.

2.4.1 AWBM rainfall-runoff model

The AWBM (Boughton, 1993) was used to estimate catchment runoff from various land uses in the catchment area of the site. The catchment area reporting to each surface water storages at the site was distributed spatially to different land use categories. The land use categories considered were undisturbed, rehabilitated spoil, industrial (hardstand and infrastructure areas), mining void (pit), active spoil and pre-strip.

The AWBM is a partial area saturation overland flow model. The use of the partial area saturation overland flow approach is simple and provides a good representation of the physical processes occurring in most Australian catchments (Boughton, 1993). This is because daily infiltration capacity is rarely exceeded, and the major source of runoff is from saturated areas. A schematic layout of the AWBM is provided in Figure 2-3.



Adapted from CRC for Catchment Hydrology (2004)

Figure 2-3 Schematic layout of the AWBM rainfall-runoff model

To implement the AWBM in a given catchment, a set of nine parameters must be defined as summarised in Table 2-4. These parameters define the generalised model for a catchment. The model parameters were calibrated to produce the best match between the site observations and corresponding modelled variables. The calibration process and the adopted parameter values are described in Section 5.

Table 2-4 AWBM parameters

Parameter	Description
A1, A2, A3	Partial areas represented by surface storages
C1, C2, C3	Surface storage capacities
K_s	Daily surface flow recession constant
BFI	Baseflow index
K_{base}	Daily baseflow recession constant

3. Surface water management system

3.1 Design objectives

The key objectives of the water management system design for the Boggabri Coal Mine are to:

- separate clean runoff, dirty runoff and contaminated water generated from rainfall events and mining operations where reasonable and feasible;
- minimise the volume of contaminated mine water (surface runoff draining to pit) generated by the Project;
- provide enough on-site storage to store contaminated water that could affect the quality of downstream watercourses;
- where reasonable and feasible treat dirty runoff from un-rehabilitated overburden areas to settle coarse suspended solids; and
- where reasonable and feasible divert clean runoff to downstream creeks.

The following definitions have been adopted for the various runoff types:

- **Clean runoff** is defined as runoff from catchments that is not disturbed by mining operations.
- **Dirty runoff** is defined as runoff from disturbed areas within the mine site and includes runoff from the spoil dumps, haul roads and parts of the MIA. This water contains high levels of suspended solids.
- **Contaminated runoff** 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.

Water management system indicative layout plans for existing, 2021, 2024 and 2033 are provided in Figure B-2 to Figure B-5, Appendix B. Schematic diagrams showing the general connectivity between water sources, demands and storages for 2020, 2021, 2024 and 2033 are also provided in Figure B-6 to Figure B-9, Appendix B. Note year 2033 corresponds to ‘Year 21’ from the EA.

3.1.1 Clean water management system

The clean water management system will, where reasonable and feasible, divert clean water runoff from undisturbed catchments around the mine working area and into Nagero Creek. This minimises the clean catchment runoff entering the dirty and contaminated water systems and therefore minimise the clean water use on site.

In some instances, as the mine pit footprint changes, remnant undisturbed catchments that are unable to be feasibly diverted around the pit via clean water drains due to topographical limitations may remain. In these instances, where feasible, highwall dams (HD) will be constructed upslope of the pit to intercept these flows and provide temporary

storage, with subsequent controlled pump-out and discharge to a suitable receiving creek system at a downstream point.

In other locations it is not feasible to provide diversion drains or highwall dams due to the advancing topsoil stripping and stockpiling. In these circumstances clean water will be allowed to enter the active mining areas and the dirty water diversion system. BCOP will be required to account for the additional captured water and hold adequate licences or harvestable rights.

3.1.2 Dirty water management system

Dirty water runoff is captured in sediment dams to enable the settling of suspended solids. Runoff from large storm events (i.e. typically exceeding the 90th percentile 5 day rainfall depth) may exceed the capacity of some dirty water storage dams. In these conditions, water will either be transferred to mine water dams (MWDs) for storage and reuse or, if the water quality meets the requirements of EPL 12407, it will be released to Nagero Creek. Water captured in sediment dams should be suitable for release following settling of suspended solids. However, as spoil dump runoff has the potential to have elevated acidity, salinity, dissolved metals and oils and greases, sediment dams will be provided with manually operated valves on the outlet pipes. Alternatively, sediment dams will be provided with a mobile pump out system only. This will minimise discharge to the creek if water quality is not suitable (and to allow for flocculation or other measures required to attain the approved discharge water quality criteria).

During 2013 and 2014, site catchment inflows (direct rainfall, catchment runoff and groundwater inflows into the mine void) exceeded site water demands. This resulted in an annual water surplus at the BCM. Sediment dam water was discharged to Nagero Creek following settling under normal operating conditions in 2013 and 2014 to minimise the volume of water that accumulated onsite (when the EPL discharge criteria was met). Sediment dam water was only reused onsite in 2013 and 2014 when water quality was not suitable for discharge to the creek system.

Following the commissioning of the CHPP in 2015, the site demands increased and exceeded the average site catchment inflows. Therefore, the BCM moved to, and is predicted to remain in, an annual water deficit under most climatic conditions.

3.1.3 Contaminated water management system

Contaminated water will be stored in contaminated water dams, MWDs or the mining void and will not be discharged to Nagero Creek. The water management system will reuse as much contaminated water as possible onsite for dust suppression and coal washing (excluding a minimum imported water component required for potable and washdown demand). When the capacity of MWDs is reached surplus contaminated water will either be treated to meet the EPL water quality criteria for a controlled discharged or will be stored in the pit void.

3.2 Water source prioritisation strategy

Water required to satisfy the site demands will be sourced from onsite surface water storages and supplemented with imported water, in order of priority, from:

1. Surface water stored in water storages (consisting of contaminated water stored in mining water storages and pit void, and dirty water in sediment dams).

2. Imported water (consisting of groundwater from the Upper Namoi Zone 4 Groundwater Source via the borefield and river water from the Lower Namoi Regulated River Water Source via the pump station on the Namoi River).

Over the long term, contaminated and dirty water will be used for mining activities in preference to imported water. However, on occasion imported water may be sourced while stored water is present onsite to meet operational demands.

The water quality of contaminated and dirty water make it unsuitable for some water uses in the CHPP and washdown facilities (refer to Section 4.6.3). Therefore, imported water will be used for the supply of water for use on site facilities (i.e. administration buildings and bathhouses) and for washdown facilities.

3.3 Design criteria

3.3.1 Dirty water sediment dams

Dirty water sediment dams have been sized based on the criteria recommended in the guidelines *Managing Urban Stormwater - Soils and Construction - Volume 2E Mines and Quarries* (DECCW, 2008) (The Blue Book).

The Blue Book guidelines recommend that Type F/D sediment basins be provided for catchments with fine or dispersible soils. These are 'wet basins', comprising a 'settling zone' for temporary treatment storage and a 'sediment zone' for storage of sediment.

The Blue Book guidelines recommend that the 'settling zone' be sized to capture the 90th percentile 5 day duration storm event, and the 'sediment zone' be sized at 50% of the 'settling zone' volume. This sizing is based on site disturbance duration of more than three years, and results in an average sediment dam overflow frequency of approximately two to four overflows per year. For sizing purposes, a runoff coefficient of 0.75 has been adopted for disturbed areas such as overburden emplacement areas and topsoil stockpiles. A runoff coefficient of 0.4 has been adopted for undisturbed areas. As sediment dams have been sized for a 5 day management period, the 'settling zone' should be drained or pumped out within 5 days following a rainfall event that results in runoff entering the sediment dam.

Sediment dams in the MIA are sized in accordance with "Blue Book" requirements. MIA sediment dams will not capture contaminated runoff. Any contaminated water from the vehicle washdown bay in the MIA will be recirculated within the wash down bay system or drained to the CHPP contaminated water dams. A runoff coefficient of 0.85 has been adopted for disturbed areas in the upgraded MIA, which are expected to comprise mainly hardstand surfaces. A runoff coefficient of 0.75 was adopted for the existing MIA, which comprises a mix of hardstand surfaces and grassed surfaces.

Key design features of dirty water sediment dams are as follows:

- Configured as Type F/D basins as described in the Blue Book guidelines.
- 'Settling zone' for temporary treatment storage.
- 'Sediment zone' for sediment storage.
- Slotted riser and discharge pipe with valve arrangement to allow manual operation of pipe (alternatively a mobile pump-out system).
- Slotted riser and discharge pipe sized to drawdown 'settling zone' over three days.

Dirty water sediment dams are to be maintained in a drawn down state as much as practical, thus ensuring that sufficient capacity is available in the 'settling zone' to capture water from subsequent storm events. Water will only be stored in the 'settling zone' of dirty water sediment dams on a temporary basis (i.e. the nominated 5 day management period) following a rainfall event large enough to result in runoff entering the sediment dam. If water stored in the sediment dam is not suitable for discharge or is to be reused onsite. The sediment dam water would need to be pumped to the much larger MWDs for long term storage and onsite reuse.

3.3.2 Contaminated water dams

3.3.2.1 Contaminated water dams

Contaminated water dams (also called coal contact dams) capture runoff from the coal stockpile pads in the CHPP. Water stored in contaminated water dams is reused onsite for dust suppression or CHPP process water or pumped to MWDs for storage.

Contaminated water dams have been designed to store runoff from a 100 year ARI 72 hour duration design storm event, with a 20% allowance for sediment storage. A runoff coefficient of 0.85 has been adopted for disturbed areas in the CHPP, which are expected to comprise mainly hardstand surfaces. A runoff coefficient of 0.75 was adopted for the existing coal crushing and handling area which comprises a mix of hardstand surfaces and grassed surfaces.

Key design features of contaminated water dams are as follows:

- 'sediment zone' for storage of sediment.
- 'storm zone' for storage of the design storm storage.
- pump and pipeline system to draw down the 'settling zone' to the MWDs.

Contaminated water dams are to be maintained in a drawn down state as much as practical, so that sufficient capacity is available to capture water from subsequent storm events and minimising the risk of a wet weather overflow. Following a rainfall event, water held within contaminated water dams may be pumped to MWDs.

Contaminated water dam SD10 has an additional 'reuse zone' to provide operational capacity for the CHPP. SD10 has an additional 'reuse zone' for storage of 38.4 ML (on top of a 'sediment zone' for storage of 13.0 ML of sediment). Water can be stored in the 'reuse zone' of SD10 on a long term basis. The 'storm zone' would need to be maintained in a drawn down state. Excess water captured in contaminated water dams can be pumped to the MWDs and/or the pit, mitigating potential overflows.

3.3.2.2 Mine water dams

MWDs hold water of similar quality to the contaminated water dams. However, they generally only receive runoff from a small surface water catchment (i.e. they are primarily a permanent storage facility and are likely to have a 'turkey's nest' configuration). The MWDs are intended to receive and store contaminated water pumped from the sediment dams, contaminated storage dams or in-pit areas. MWDs may also hold imported water as outlined in Section 4.5.3 and will store water on a long term basis. The dams are operated with a freeboard to contain the 100 year ARI 72 hour duration storm event (refer to Section 4.4.3).

The design of MW5 was based on previous water balance modelling to the criteria of achieving retention of contaminated water generated within the site based on pit dewatering under historical climate conditions. The results of the water balance modelling indicate that the MWDs, as designed, are not expected to overflow. Boggabri Mine MWDs are not prescribed dams listed under the NSW Dam Safety Regulation so are not subject to specific design requirements under this regulation.

3.3.3 Clean water dams

Clean water highwall dams capture runoff from undisturbed catchments ahead of the pit where reasonable and feasible to reduce inflows to the pit and maintain more natural flows in the downstream creek system. Highwall dams are to be maintained in a drawn down state and are to be pumped out following a rainfall event of sufficient depth to result in runoff entering the dam. Where water quality meets the EPL discharge quality criteria highwall dams will be pumped out to the creek system.

Clean water highwall dams are sized to capture runoff from the 100 year ARI 24 hour storm event for the remnant catchment, assuming a runoff coefficient of 0.4 for undisturbed areas. Extreme events more than this capacity will spill into the pit. The pump-out systems for highwall dams are sized to empty the dam within 10 days. Clean water highwall dams are only present for the 2033 conceptual layout plan. In 2033 water from the clean water dams will be pumped to the east and then south around the edge of the mine disturbance area. The pumped clean water will be discharged into an existing drainage line/natural depression, which flows back to Nagero Creek north of the rail loop. Where required erosion sediment control measures will be used to minimise the potential for erosion at the pump outlet.

3.3.4 Diversion drains

Clean, dirty, and contaminated water diversion drains are to be designed to convey the peak flow rate from a 100 year ARI time of concentration (t_c) storm event.

3.4 Existing water management system

The existing water management system is shown in Figure B-2 and schematically in Figure B-6, Appendix B. A summary of the existing storage characteristics is provided in Table C 1, Appendix C. The 'required minimum capacity' in Table C 1 is the minimum capacity required to store the design event and the nominated sediment allowance.

MWD MW2 was decommissioned in late 2017. MWD MW5 was completed in late 2018 to cater for predicted pit dewatering requirements and has an approximate capacity of

2000 ML. MWD MW3 has a capacity of 116.4ML and can be utilised to dewater surplus water from SD10. The total out-of-pit MWD storage in MW3 and MW5 is 2116.4 ML.

Contaminated water dams SD28 (capacity 3.5 ML) and SD29 (capacity 10.5 ML) were commissioned at the beginning of 2015 as part of the MIA and CHPP upgrades. SD12 was upgraded in 2015 to a capacity of 200 ML (previous capacity 25.9 ML). The upgrade to SD12 catered for the expanded MIA and CHPP and haul road catchments. SD29 was decommissioned in 2019 to allow for the expansion of an additional stockpile at the CHPP with runoff from this area now directed to SD10.

A diversion drain constructed ahead of the mining void previously diverted runoff from undisturbed areas to the north of the mining void into the Nagero Creek catchment. During 2018, this diversion drain was mined through. Remnant undisturbed catchments to the east of the pit void drain directly into the mining void and this water is managed within the contaminated water management system. Temporary erosion and sediment controls will be installed to control runoff from disturbed areas. Erosion and sediment controls are outlined in the SWMP.

During 2017, BCOP commissioned the borefield approved under Modification 5.

Sediment dam SD3 was upgraded in 2015 to a capacity of 100 ML (previous capacity 31.8 ML). This upgrade catered for the expanding overburden catchment from 2015 to 2019. As the topography of the overburden dump does not allow for water stored in SD7 to be released to the creek system, water stored in SD7 is reused onsite.

A diversion drain diverts overflows from the Tarrawonga Coal Mine (TCM) northern waste rock emplacement area dams around the BCOP MIA. The TCM diversion drain does not interact with BCOP onsite water storage infrastructure.

A summary of the existing discharge points is provided in Table C 2, Appendix C. These are the existing discharge points and types listed in Section P1.3 of the EPL (12407, 4 April 2016).

3.5 2020 and 2021 water management system

An indicative layout of the proposed 2020 and 2021 water management system is shown in Figure B-3 and schematically in Figure B-7, Appendix B. A summary of the proposed 2021 storage characteristics is provided in Table C-3, Appendix C.

Mine water from the mining void will be pumped to MWDs MW5 or MW3. The total out-of-pit MWD storage in MW3 and MW5 will be 2116.4 ML. However, water will still be stored in-pit during extreme wet weather.

Remnant undisturbed catchments to the east of the pit void drain directly into the mining void and this water is managed within the contaminated water management system. Temporary erosion and sediment controls will be installed to control runoff from disturbed areas. Erosion and sediment controls are outlined in the SWMP.

A summary of the proposed 2021 discharge points is provided in Table C-4, Appendix C. EPL discharge points will be reviewed and updated in consultation with the Environment Protection Authority (EPA). Discharge criteria are outlined in the SWMP.

3.6 2024 water management system

An indicative layout of the proposed water management system is shown in Figure B-4 and schematically in Figure B-8, Appendix B. A summary of the proposed 2024 storage characteristics is provided in Table C 5, Appendix C.

The topography of the overburden dump will allow water stored in SD7 to be released to the creek system following settling (assuming that the EPL is modified to allow for discharge in this location and that discharge criteria is met).

A new diversion drain will divert runoff from the active overburden dump, as well as overflows from SD7 to SD3. SD3 may be upgraded in 2024 to a capacity of 209 ML (from existing capacity of 100 ML). The upgrade to SD3 in 2024 may be required as it is no longer proposed to commission sediment dam SD13 (as proposed in the EA) within the overburden emplacement area and storage capacity previously allocated to SD13 is now provided in SD3. Alternatively, if SD3 remains at 100 ML in 2024, it may be necessary to provide the appropriate additional storage capacity elsewhere (such as MW5). This will be reviewed as part of the 2020 site water balance review.

A summary of the proposed 2024 discharge points is provided in Table C-6, Appendix C. EPL discharge points will be reviewed and updated in consultation with the Environment Protection Authority

3.7 2033 water management system

An indicative layout of the proposed water management system is shown in Figure B-5 and schematically in Figure B-9, Appendix B. A summary of the proposed 2033 storage characteristics is provided in Table C 7, Appendix C.

New dirty water sediment dams, SD19, SD20, SD21, SD22 and SD24, will be provided to cater for runoff from the expanded spoil dump. SD7 will be decommissioned by 2033 as the overburden catchment draining to this sediment dam is expected to be fully rehabilitated.

New clean water highwall dams, CD5, CD6, CD7 and CD8, will be provided to minimise inflows from the natural catchment to the mining void. The highwall dams will be pumped out to the Nagero Creek system, however, they will overtop to the mining void during storm events that exceed the design capacity.

A summary of the proposed 2033 discharge points is provided in Table C-8, Appendix C. EPL discharge points will be reviewed and updated in consultation with the Environment Protection Authority.

4. Site water balance model methodology

4.1 Modelling approach

A water balance model of the water management system of Boggabri Coal Mine was developed. The model was used to quantify the water inflows (rainfall, catchment runoff, groundwater inflows, water imported from the borefield and the Namoi River) and outflows (evaporation, CHPP usage, dust suppression usage), and likely range of water deficits, surpluses and discharges from Boggabri Coal Mine.

The SWB model is used as a strategic planning tool to assess the performance of the water management system for the Boggabri Coal Mine under a wide range of climate scenarios (sampled from a historical rainfall record) that may occur over the life of the Project.

The water balance is modelled as lumped mass balance and considered each storage in the water management system. A site specific water balance equation was derived from the catchment scale water balance equation as described in Ladson (2008). The water balance equation applies conservation of mass to derive an ordinary differential equation governing the volume V in each storage varying through time t:

$$\frac{dV}{dt} = P \cdot A(V) + \boldsymbol{R}(\boldsymbol{S}, P, E_t) \cdot \boldsymbol{C}\left(1 - \frac{A(V)}{\| \boldsymbol{C} \|}\right) + G + I - E \cdot A(V) - O$$

where:

- P, E and $E_t$were precipitation, potential open water evaporation and potential evapotranspiration sampled concurrently from the historical record as described in Section 2.2;
- $A(V)$ was the water surface area of the storage as described in Section 4.4.1;
- $\boldsymbol{R}(\boldsymbol{S}, P, E_t)$ was the runoff for each surface type estimated using the AWBM as described in Section 2.4 (which accounts for the soil moisture state $\boldsymbol{S}$);
- $\boldsymbol{C}$ was the catchment area reporting to the storage distributed over the landuse types; and
- G was the groundwater inflows; I was the pumped and surface transfers into the storage and O was the pumped and surface transfers out of the storage.

In general terms, the change in site water storage is equal to the sum of all water inflows (rainfall, catchment runoff, groundwater inflows and pumped transfers into the site) minus all water outflows (evaporation and pumped transfers off site).

The evaporative losses and pumped outflow were limited by the available volume in the storage. If the volume exceeded the capacity C of the storage, the discharge, or overflow, rate D was calculated as:

$$D = \frac{dV}{dt} \qquad if\ V > C$$

4.2 Numerical implementation

The water balance model of the Boggabri Coal Mine was implement using GoldSim 12.0. Goldsim is computer simulation software widely used for mine site water balance studies. Goldsim uses the forward Euler method to solve the equations described in Section 4.1. A basic timestep of 1 day was used with shorter time steps inserted as required to represent the operation of pumps.

The water management system plans and schematics provided in Appendix B show the layout and interconnectivity of storages for the mine site.

4.3 Modelling assumptions

The following assumptions are included in the water balance model:

- Pumping operations based on the existing and proposed infrastructure has been included in the water balance model. It is assumed that pumping occurs at an average pump rate and no allowance has been made for changes of flow rate with changes in head.
- Low flow outlets from dirty water sediment dams are opened after a period of two days of no rainfall. This was assumed to be sufficient period for water quality criteria to be met. Low flow outlets have been represented in the water balance model such that the dams empty over a period of three days.
- The bottom half of the 'sediment zone' of dirty water sediment dams and contaminated water dams is half full of sediment throughout the simulation. Water that ponds in the top half of the 'sediment zone' evaporates over time and is not be used to supply dust suppression water or CHPP process water.
- No allowance has been made for seepage from water storages.
- Diversion drains capture all runoff from their local catchments and there is no bypass of diversion drains.
- Adequate surface water allocations or alternative water sources are available to make-up the external water requirement. Where the annual external water requirement exceeds BCOP's current water entitlements, it was assumed that BCOP would secure additional water to make up the difference.
- It is assumed that the Tarrawonga Coal Mine (TCM) catchment area to Nagero Creek discharging across the western boundary of mining lease 1579 (at Tarrawonga's LDP1) discharges directly to Nagero Creek. However, it is understood that these discharges are captured within SD6, the will be review and confirmed as part of the 2020 site water balance review.
- While the model assesses the performance of the system under historical extremes that may reasonably be expected to recur in the future. It does not explicitly consider the potential impact of future climate change.

- SD7 is diverted to SD3 at 1 January 2022 and the capacity of SD3 is increased from 100 ML to 209 ML at 1 January 2021 or MW5 if additional capacity is not provided.
- The borefield, as approved as part of MOD 5, was commissioned on 1 July 2017.

4.4 Site data

4.4.1 Storages

The storages in the water balance model are summarised in Table 4-1. The capacities are summarised from Table C.1, Table C.3, Table C.5 and Table C.7, referred to in Appendix C. The maximum water surface areas were measured from elevation data for existing storages, and design spatial data for future storages. The shape factor was used to estimate the geometry of storages for which stage storage relationships were not available. The value of the factor was inferred from elevation data and site experience and may vary from a value of 0, corresponding to a prismatic shape, to a value 1, corresponding to pyramidal shape.

Table 4-1 Storages

Storage	Capacity (ML)	Maximum water surface area (ha)	Shape factor
MW3	153.5	5.6	0.2
MW5	2200.0	15.8	0.6
Pit	10 000 (nominal)	100 (nominal)	0.3
SD10	116.4	3.3	0.3
SD11	16.4	0.5	0.3
SD12	206.6	3.0	0.3
SD19	179.9 (design)	6.34	0.3
SD20	41.8 (design)	2.2	0.3
SD21	55.6 (design)	2.7	0.3
SD22	2.4 (design)	0.2	0.3
SD23	9.5	0.8	0.4
SD24	7.3 (design)	0.3	0.4
SD28	3.5	0.3	0.3
SD3	102.3 (potentially increasing to 209.3 in 2024)	2.3	0.3
SD6	52.2	1.9	0.3
SD7	95.1	2.4	0.3
SD8	9.8	0.9	0.5

The ‘pit’ storage corresponds to several storages including MW5, SD7 and the ‘MN’ that are in the pit void or would spill into the pit void. These storages are relatively temporary and vary with open cut mining operations and, therefore, have been grouped as a nominal ‘pit’ storage. This includes all other such storages that may exist in the future as the open cut pit void develops.

To calculate direct rainfall and actual evaporation, the water surface area of each storage was calculated from the stage storage relationships (where available) referred to in Table D-1 of Appendix D. For other storages, the water surface area A corresponding to the water volume V was approximated using the approach described in Brooks and Hayashi (2002) from the maximum surface area A_{max} estimated from elevation data, the capacity C and the shape factor p as:

$$A = A_{max}\left(\frac{V}{C}\right)^{p}$$

4.4.2 Catchments

Catchment areas adopted in the water balance model are provided in Table 4-2. The study catchment was Nagero Creek to the point where the creek meets the floodplain approximately 1 km downstream of Boggabri Coal Mine.

Table 4-2 Catchment areas (ha)

System	Storage	2020	2021	2024	2033
Boggabri Coal Mine contaminated water dams [1]	MW3	22	22	22	22
	MW5	15	15	15	0
	SD10	29	28	28	28
	SD11	5	5	5	5
	SD12	45	45	45	366
	SD28	3	3	3	3
	Pit	1547	1369	1472	533
	Subtotal	*1670*	*1491*	*1594*	*961*
Boggabri Coal Mine dirty water dams	SD3	254	250	328	881
	SD6	64	64	64	64
	SD7	248	241	241	0
	SD8	13	13	13	13
	SD19	0	0	0	371
	SD20	0	0	0	100
	SD21	0	0	0	116
	SD22	0	0	0	7
	SD23	34	35	35	71
	SD24	0	0	0	17
	Subtotal	613	604	682	1641
Boggabri Coal Mine clean water dams	CD5	-	-	-	19
	CD6	-	-	-	21
	CD7	-	-	-	105
	CD8	-	-	-	17
	Subtotal	*-*	*-*	*-*	*162*
Rehabilitation released directly to Nagero Creek		-	-	-	521
TCM water management system within Nagero Creek catchment [2]		400	400	400	400
Undisturbed Nagero Creek catchment		1543	1540	1540	1364
Total		**4226**	**4037**	**4217**	**4529**

[1] Excludes approved irrigation area draining to Bollol Creek catchment.
[2] TCM lease area within Nagero Creek catchment assumed based on proposed operations at TCM.

The area of rehabilitated catchment increases from existing conditions to 2033. Progressive rehabilitation is undertaken and where the landform is stable with no sediment laden or otherwise polluted runoff, then runoff from catchment areas is returned to the natural system. While some of the rehabilitated areas have been rehabilitating for approximately five years, this rehabilitated area is unable to be segregated from the remaining overburden dump. For this reason, runoff from rehabilitated areas occurs only in 2033 when the clean water can be segregated from the dirty water runoff, captured, and released.

4.4.3 Operating rules

The modelled rules for the operation of the pumps and outlets are summarised in Table 4-3. The pumps were modelled to switch on and the valves modelled to open when the *on trigger* occurred if the *conditions* were true. The pump remained on and the valve remained open until the *off trigger* occurred or the *conditions* became false. The low operating volumes (LOV) and high operating volumes (HOV) are summarised in Table 4-4. These operating volumes do not include the 1000 ML of total freeboard required by the EPL.

The dewatering and release of sediment basins was subject to two site wide conditions:

- *Contaminated water excess*: the site was in contaminated water excess if the total volume of contaminated water exceeded the capacity of the contaminated water storages. Effectively, this prevented reuse of dirty water if there was water in pit.
- *Discharge allowed*: offsite releases from dirty water dams were allowed if there had been a 2 day period without rainfall. This condition was assumed to approximate the time required for the water quality in the dirty water storages to reach an adequate standard to allow off-site release.

The dewatering of contaminated storages to MW5 (and MW2 for historical validation modelling) was not constrained by the volume in these storages. If the volume in MW5 exceeded the HOV, the transfer was diverted to Strip #9 prior to being mined through in March 2019 and afterwards to the pit.

Table 4-3 Operating rules

Pump / Valve	Pump rate (ML/day)	On trigger	Off trigger	Conditions
Dewater SD10 to MW5	10.0	SD10 greater than HOV	SD10 less than HOV	MW5 less than HOV
Dewater SD10 to MW3	10.0	SD10 greater than HOV	SD10 less than HOV	MW3 less than HOV
				MW5 greater than HOV
Dewater SD10 to or Pit	10.0	SD10 greater than HOV	SD10 less than HOV	MW3 greater than HOV
				MW5 greater than HOV
Dewater SD11 to SD10	2.0	SD11 greater than HOV	SD11 less than LOV	SD10 less than HOV
Dewater SD12 to MW5	20.0	SD12 greater than HOV	SD12 less than LOV	
Dewater SD28 to SD11	1.0	SD28 greater than HOV	SD28 less than LOV	SD11 less than HOV

Pump / Valve	Pump rate (ML/day)	On trigger	Off trigger	Conditions
Dewater Pit to MW5	5.0 (10.0 if pit volume exceeds 200 ML)	Pit greater than HOV	Pit less than LOV	MW5 less than HOV
Makeup Strip #9 to MW2 (Validation model only)	5.0	MW2 less than LOV	MW2 greater than HOV	Pit less than HOV Strip #9 greater than LOV
Makeup MW5 to SD10	5.0	SD10 less than LOV	SD10 greater than HOV	MW5 greater than LOV
Makeup MW3 to SD10	3.5	SD10 less than LOV or MW3 greater than HOV	SD10 greater than HOV or MW3 less than LOV	MW3 greater than LOV and SD10 less than HOV
Dewater SD3 to SD12	5.0	SD3 greater than HOV	SD3 less than LOV	SD12 less than HOV Not contaminated water excess
Dewater SD19 to MW5	20.0	SD19 greater than HOV	SD19 less than LOV	Not contaminated water excess
Dewater SD23 to MW5	3.0	SD23 greater than HOV	SD23 less than LOV	Not contaminated water excess
Dewater SD6 to SD10	2.0	SD6 greater than HOV	SD6 less than LOV	SD10 less than HOV Not contaminated water excess
Dewater SD8 to SD6	1.0	SD8 greater than HOV	SD8 less than LOV	SD6 less than HOV Not contaminated water excess
Release SD3 to Creek (valve)	40.0	SD3 less than 40 ML below capacity	SD3 more than 40 ML below capacity	Rainfall exceed 1 mm/day
Release SD14 to Creek (valve)	17.0	SD14 greater than HOV	SD14 less than LOV	Discharge allowed
Release SD19 to Creek (valve)	62.0	SD19 greater than HOV	SD19 less than LOV	Discharge allowed and pump not on
Release SD20 to SD19 (valve)		SD20 greater than HOV	SD20 less than LOV	Discharge allowed
Release SD21 to Creek (valve)		SD21 greater than HOV	SD21 less the LOV	Discharge allowed
Release SD22 to Creek (valve)		SD22 greater than HOV	SD22 less than LOV	Discharge allowed
Release SD23 to Creek (valve)		SD23 greater than HOV	SD23 less than LOV	Discharge allowed
Release SD24 to Creek (valve)		SD24 greater than HOV	SD24 less than LOV	Discharge allowed
Release SD6 to Creek (valve)		SD6 greater than HOV	SD6 less than LOV	Discharge allowed and pump not on
Release SD8 to SD6 (valve)		SD8 greater than HOV	SD8 less than LOV	Discharge allowed and pump not on

Pump / Valve	Pump rate (ML/day)	On trigger	Off trigger	Conditions
Release CWDs to Creek (valve)		CWD greater than HOV	CWD less than LOV	

Table 4-4 Assumed Operating Volumes

Storage	LOV (ML)	HOV (ML)
MW2 (Validation model only)	87.7	163.6
MW3	5.0	131.0
MW5	600.0	1994.9
Strip #9 (Validation model only)	5.0	3369.3
Pit sump	5.0	10.0
SD10	19.4	61.7
Contaminated water dams (except SD10)	Sediment zone volume less 1 ML	Sediment zone volume
Dirty water sediment dams	Sediment zone volume less 1 ML	Sediment zone volume
Clean water dams	0	1

Due to the approximations required to model the importation of water into the site, as discussed in Section 4.5.3, the import of water from the borefield and the Namoi River was modelled according to the following rules:

- If the volume in either SD10 or MW5 fell below the LOV, water was supplied from the borefield to meet the simulated CHPP and dust suppression demand and the simulated evaporative losses at up to the maximum borefield extraction rate. SD10 was given the first preference in the assignment.
- If the volume in either SD10 or MW5 fell below a nominal low threshold of 5 ML, water was supplied from the river to meet the simulated CHPP and dust suppression demands and the simulated evaporative losses.

The effect of this was to maximise the use of available extraction capacity of borefield until the site had exhausted the storages on site, before importing water from the river.

4.5 Water sources

Water sources for the BCM comprise:

- rainfall-runoff;
- groundwater inflows to the mining void; and
- imported water.

4.5.1 Rainfall and runoff

Contaminated surface water runoff is captured in dams or the mining void and stored for onsite reuse. Dirty water runoff is also captured in sediment dams for settling of suspended solids prior to discharge to Nagero Creek (if water quality criteria are met).

The volume of inflows into each storage was calculated as the sum of the direct rainfall on to the water surface and the surface water runoff. The volume of direct rainfall was calculated as the product of the simulated rainfall depth (refer to Section 2.2) and area of water storages, calculated as described in Section 4.4.1. The volume of catchment runoff was calculated as the product of the catchment area (refer to Section 4.4.2) and the runoff depth calculated using the AWBM as described in Section 2.4.

4.5.2 Groundwater inflows to mining void

Seepage rates of groundwater into the mining void have been estimate from the results of the Continuation of Boggabri Coal Project Groundwater Assessment (AGE, October 2010). The estimate adopted was a worst-case cumulative groundwater impact assessment considering cumulative impacts associated with the concurrent operation of the Boggabri, Tarrawonga and Maules Creek coal mines. A summary of the groundwater inflows adopted in the water balance model is provided in Figure 4-1.

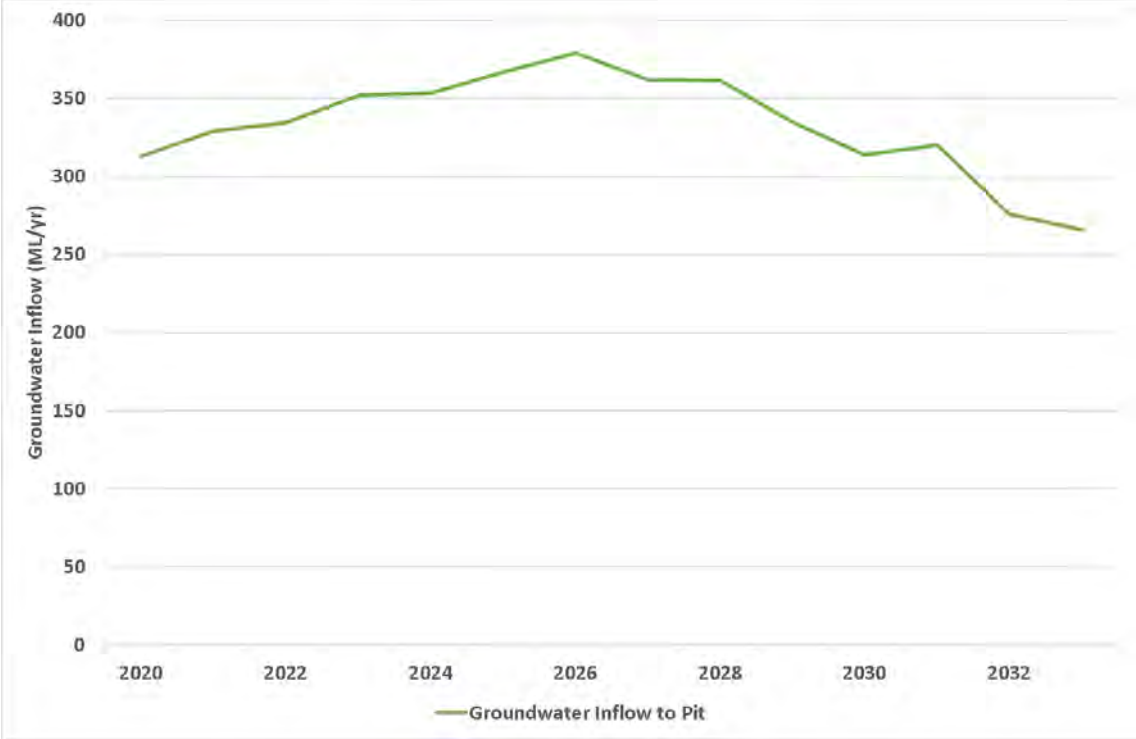


Figure 4-1 Estimated groundwater inflows to mining void

From Figure 4-1 it can be seen that groundwater inflow to the mining void is expected to increase until approximately 2026. After 2026, it is predicted that groundwater make within the mine void at Boggabri may be reduced by up to 40 % due to cumulative impacts from operations at Tarrawonga and Maules Creek coal mines. Some of the predicted pit inflows will be lost through evaporation, however, inflows that collect in the mine void will be pumped to mining water storages for onsite reuse.

4.5.3 Imported water

4.5.3.1 Groundwater entitlements

BCOP currently holds licences for the Upper Namoi Zone 4 Namoi Valley Groundwater Source, the Upper Namoi Zone 11 Namoi Valley Groundwater Source and the Gunnedah-Oxley Basin. Details of these water access licences (WALs) are provided in Table 4-5.

Table 4-5 Summary of groundwater WALs currently held by BCOP

Source	WAL category	WAL No.	Share (units)	Expiry	Current reliability (%)
Groundwater					
Upper Namoi Zone 4 Groundwater Source	Aquifer	WAL 15037	172	Perpetuity	95-100
Upper Namoi Zone 4 Groundwater Source	Aquifer	WAL 24103	275	Perpetuity	95-100
Upper Namoi Zone 4 Groundwater Source	Aquifer	WAL 12691	457	Perpetuity	95-100
Upper Namoi Zone 4 Groundwater Source	Aquifer	WAL 12767	3	Perpetuity	95-100
Upper Namoi Zone 4 Groundwater Source	Aquifer	WAL 36547	37	Perpetuity	95-100
Upper Namoi Zone 4 Groundwater Source	Aquifer	WAL 37519	84	Perpetuity	95-100
Upper Namoi Zone 11 Groundwater source	Aquifer	WAL 42234	20	Perpetuity	95-100
Total			**1048**		
Groundwater – pit interference					
Gunnedah-Oxley Basin MDB	Aquifer	WAL 29562	700	Perpetuity	100
Gunnedah-Oxley Basin MDB	Aquifer	WAL 29473	142	Perpetuity	95-100
Total			**842**		

A total of 1028 unit shares of groundwater would be available to BCOP from the aquifer access licences for the Upper Namoi Zone 4 Groundwater Source and 20 shares for Upper Namoi Zone 11. The actual volume of groundwater available would depend on the Available Water Determinations (AWD) made under the Water Sharing Plan (WSP), these are likely to be at or close to 1 ML per unit share from the water access licences. Water derived from the pit inflows can be reused onsite under WAL29562 providing further capacity for supplementation.

BCOP currently uses groundwater pumped from Lovton, Cooboobindi and Victoria Park Bores for existing operations. Groundwater pumped from Lovton and Victoria Park bore are currently used onsite for potable water, vehicle washdown, amenities and fire suppression. Groundwater pumped from Cooboobindi bore is used for dust suppression.

Groundwater can also be traded on a temporary or permanent basis within the greater Gunnedah-Oxley Basin Groundwater Source, and within Zone 4 of the Upper Namoi Valley (Keepit Dam to Gins Leap) Ground Water Source, subject to local impact considerations.

In the 2019 calendar year, Boggabri Coal was in receipt of 1,175 ML of groundwater as temporary transfers of WALs.

4.5.3.2 Surface water entitlements

BCOP currently holds general security and supplementary water access licences for the Lower Namoi Regulated River Water Source. Details of these water access licences are

provided in Table 4-6. The total share component under these licences is 422 unit shares of general security water and 32.2 unit shares of supplementary water. The actual volume of river water available to BCOP from the general security licences would depend on the Available Water Determinations (AWD) made from time to time in accordance with the Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2003. Supplementary access is also 'announced' from time to time and is dependent on the presence of unregulated flows in the regulated river, and on the operation of the WSP rules.

Table 4-6 BCOP water access licences for Lower Namoi Regulated River Water Source

Source	Water Access Licence category	Water Access Licence number	Share component (units)
Lower Namoi River	General Security	WAL 2571	51
Lower Namoi River	General Security	WAL 2595	243
Lower Namoi River	Supplementary Water	WAL 2596	26.6
Lower Namoi River	Supplementary Water	WAL 2572	5.6
Upper Namoi River	General Security	WAL 37067	128

The Namoi Regulated River water sharing plan estimates that there are in total 256,400 unit shares of general security access licences and 115,000 unit shares of supplementary water access licences. Access to entitlement will vary from year to year depending on climatic conditions and water availability.

A continuous accounting system is used in the Namoi Valley for general security entitlements. The maximum that may be held in an account is 2.0 ML per unit share. The amount carried over from one year to the next is unlimited (maximum account balance effectively limits carryover volumes). The maximum usage (including trade) in any season is 1.25 ML per unit share. The maximum water use over any 3 consecutive years is 3.0 ML per unit share (Ribbons, 2009).

BCOP can access surface water from the Namoi River in accordance with its surface water licences via a pump station from the Namoi River which has been constructed. BCOP can also trade additional water, either temporarily or permanently, to make up shortfalls on a contingency basis.

4.5.3.3 Import water model

In the absence of a detailed model of the entire Namoi River catchment, a conceptual model, consistent with the groundwater modelling described in Parsons Brinkerhoff (2015), was developed to estimate the likely volume extracted from the borefield and Lower Namoi River. The average rainfall over the previous four years was used as proxy for the water available for extraction from Lower Namoi Regulated River Source, and therefore in turn as a proxy for the likely borefield extraction rate, as shown in Figure 4-2. This model approximates the likely management of the borefield during periods when water is available for extraction from the Lower Namoi Regulated Source, extraction from the borefield is likely be less than the maximum rate of 9.4 ML/day in order to minimise the risk of impact on surrounding water users. It was assumed that sufficient additional surface water access licences will be acquired when required and sufficient volume will be available from the Namoi River. The relationship between 4 year average rainfall and borefield extraction rate in shown in Figure 4-2. This model does not account for actual daily management of the borefield and river

extraction, but it consistent with groundwater modelling described in Parsons Brinkerhoff (2015) and is representative the average of operational conditions.

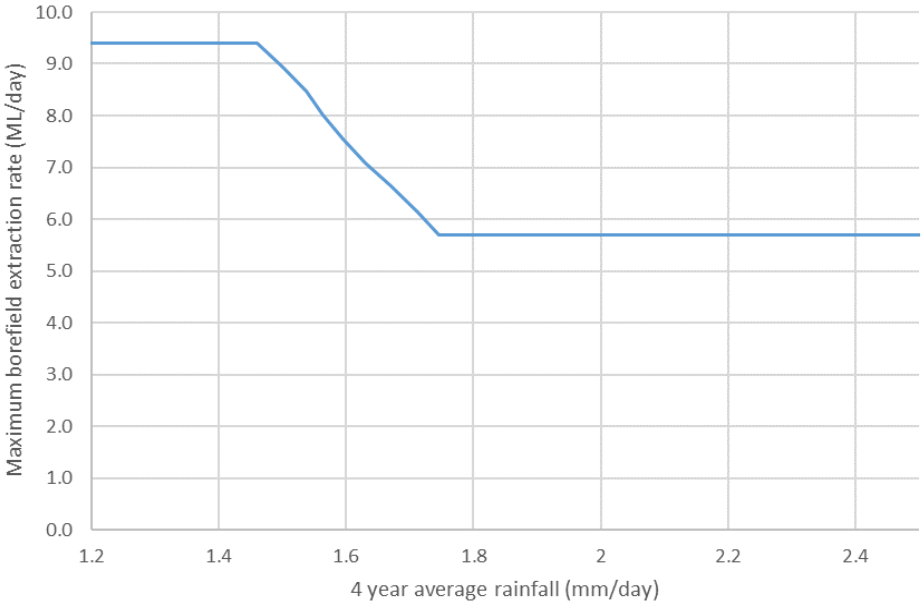


Figure 4-2 Assumed borefield extraction rate varying with 4 year average rainfall

4.6 Water Demands

Water demands comprise:

- dust suppression water;
- CHPP make-up water;
- vehicle washdown water; and
- potable water (for drinking water and amenities).

Water demand information was provided by BCOP. The demands provided in the Boggabri Coal Project Surface Water Assessment (Parsons Brinckerhoff, 2010) were revised based on more detailed project design and engineering work that has occurred since the Surface Water Assessment was undertaken in 2010, and updated demand information in line with the latest revision of the MOP.

4.6.1 Dust suppression

Water is required for dust suppression on haul roads and other disturbed areas. Dust suppression for the CHPP coal stockpiles, coal crushing areas, and coal loading areas and MIA are accounted for in the CHPP demands (refer to Section 4.6.2).

BCOP has provided revised estimates of dust suppression demands for the project. A summary of the haul road dust suppression demands adopted in the water balance model is provided in Table 4-7. Haul road dust suppression numbers have been revised following

lodgement of the EA, largely due to adjustments to the MOP (refer to MOP Amendment A) and more detailed project design and engineering work having been undertaken. BCOP estimates haul road dust suppression demand to be 4 ML/day on days when it is required.

Table 4-7 Haul road dust suppression demand estimates (dry day)

Project year	Dry day dust suppression demand (ML/day)
2020	4
2021	4
2024	4
2033	4

Historical water cart usage information is summarised in Figure 4-3. Variance in the amount of water used during future years is likely.

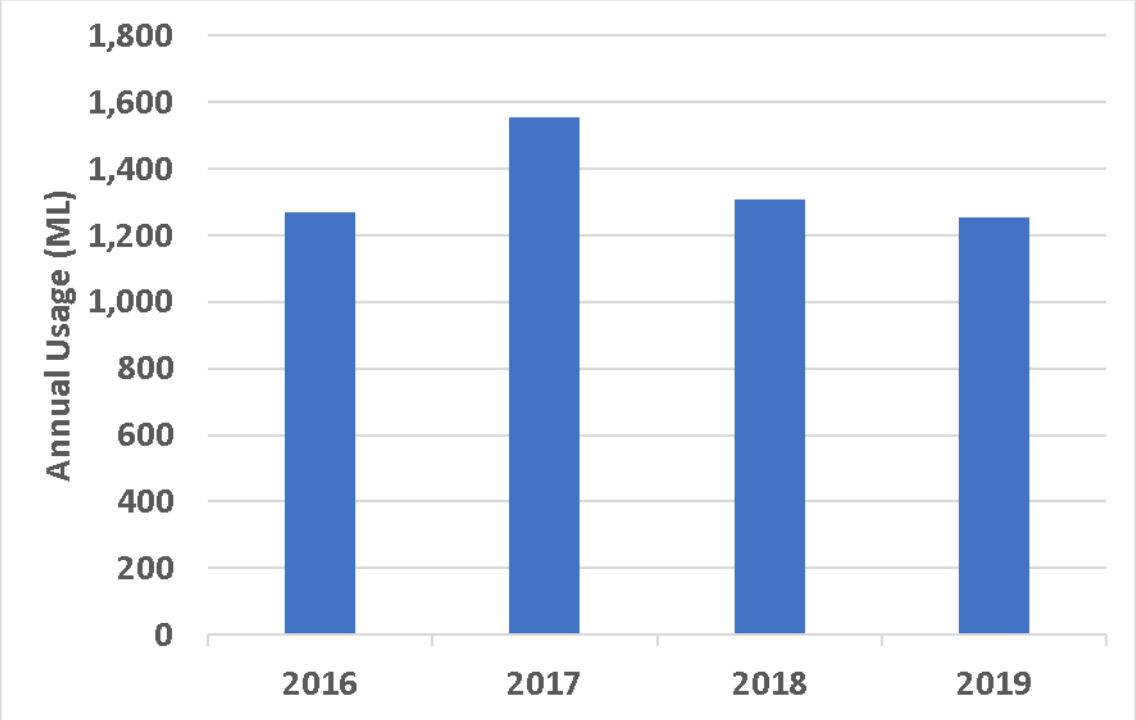


Figure 4-3 Observed water usage for dust suppression of haul roads

Water used for dust suppression at the mine site is sourced as a priority from recycled contaminated water contained in MW5, SD7 and SD23. When required, imported water will be used to supplement recycled water sourced from MW5.

For the purposes of the water balance analysis, it is assumed that dust suppression water will not be required on days with a total rainfall depth for more than 5 mm. On average, approximately 35 days per year have more than 5 mm of rainfall based on the historical rainfall record.

4.6.2 Coal handling and preparation plant

BCOP have calculated the net CHPP water requirement to be approximately 4 ML/day (equivalent to 1461 ML/annum). This water is required for coal washing, dust suppression and MIA washdown water. This is the net demand and accounts for water that is reused

within the process. This net demand is simulated in the model as a constant flow rate. The assumption of constant flow rate is of suitable accuracy for the purpose of the SWB model as actual day to day variations in operations will be attenuated by the water storage on site.

The CHPP was commissioned in 2015 and processes up to 4.2 Mtpa of coal from Boggabri Coal Mine. The breakdown of CHPP demands is summarised in Table 4-8.

Table 4-8 CHPP demand estimates

Project year	Coal washery feed (Mtpa)	Annual CHPP demand (ML)
2018	4.2	1,461
2019	4.2	1,461
2020	4.2	1,461
2022	4.2	1,461
2033	4.2	1,461

4.6.3 MIA and potable water

Water is required for vehicle washdown in the MIA. Washdown water is recycled, however, water is required to make-up evaporative losses. Make-up water for vehicle washdown is currently sourced from groundwater pumped from Victoria Park and Lovton bore.

Potable water is used in the administration building and amenities during operations. Potable water is currently sourced from groundwater entitlements (WAL 29473) assigned to the Lovton Bore. Wastewater from the administration building and amenities will be treated in an onsite Envirocycle treatment plant. Wastewater generated by the onsite Envirocycle treatment plant has not been considered in the water balance analysis.

BCOP estimates that approximately 1 ML/day (equivalent to 365 ML/yr) of water will be required for the MIA and potable water. This net demand is simulated in the model as a constant flow rate. The assumption of constant flow rate is of suitable accuracy for the purpose of the SWB model as actual day to day variations in operations will be attenuated by the water storage on site.

4.7 Other losses

4.7.1 Evaporation

Evaporative losses from storages was calculated as the product of the evaporation depth for open water, as described in Section 2.2, and the water surface area of the storage, as described in Section 4.4.1.

4.7.2 Seepage from dams

Some water will be lost from dams because of seepage through the foundation. Site dams should have low seepage losses and, depending on the subsoils, an engineered liner will be required. All dams are constructed with the best material available as water is a critical resource for BCOP.

Water balance modelling has assumed seepage losses to be negligible. This assumption is intended to be conservative from the perspective of containment performance but may not

be conservative for other outcomes of operational simulation modelling (such as water supply reliability).

4.7.3 Off-site releases

Modelled releases from site were comprised of:

- Pumped releases of clean water from high wall dams, that were modelled according to the operating rules in Section 4.4.3.
- Overflows of dirty water from dirty water dams due to rainfall events that exceeded the design rainfall event when the volume of storage exceeded the capacity of storage, as described in Section 4.1.
- Controlled releases of dirty water from dirty water dams were modelled according to the operating rules in Section 4.4.3. These releases will only occur when the water quality of the water is adequate, as described in Section 3.1.2.

5. Site water balance model validation

5.1 Methodology

The SWB model was simulated from 2016 to 2020 using actual observed rainfall and water usage as inputs. The modelled water storage volume was compared to the observed water storage volume to confirm that the SWB model is representative of the site water balance. The input data used for the validation is summarised in Table 5-1.

Table 5-1 Data used

Data	Source	Notes
Rainfall and evaporation	SILO Patched Point data for Station 55033 Boggabri (Mayfield)	Daily
Dust suppression usage, potable usage, washdown usage, CHPP usage	BCOP	Annual totals for 2016 to 2020 Groundwater extraction was assumed to include estimated pit inflows
Water volumes in, MW3, MW6, , SD23, SD28, SD3, SD6, SD7, SD8, SD10, SD11, SD12, S9	BCOP	Weekly

Actual washdown and potable usage and CHPP usage were used in the validation simulation and are summarised in Table 5-2.

Table 5-2 Observed water usage

Water usage	Average observed by BCOP from 2016 to 2019
CHPP net usage	120 L/ROM tonne (461 ML/year @ 4.0 Mtpa)
Washdown and potable usage	0.3 ML/day (110 ML/year)

5.2 Results

Observed and modelled total site water volume is compared in Figure 5-1.

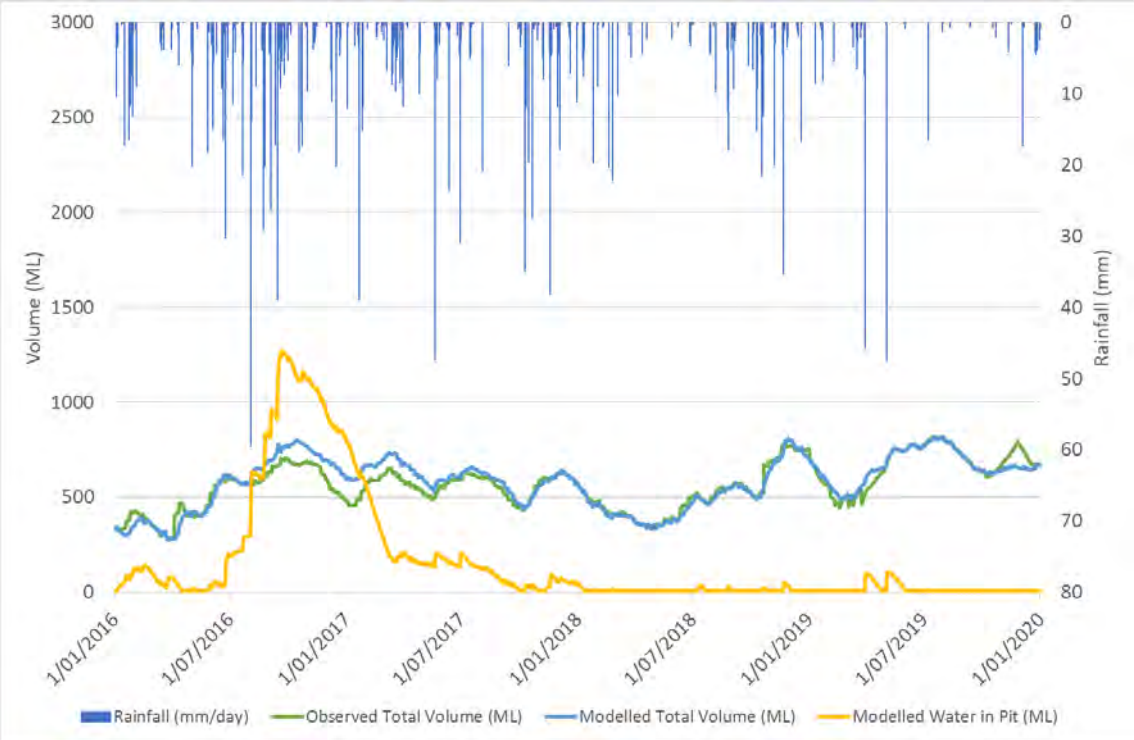


Figure 5-1 Total site water inventory

Figure 5-1 shows a good fit between observed and modelled total site water volume over 2016 to 2020. However, to reconcile the known water extractions and water usage, a significant volume of water (up to 1200 ML) must have accumulated in pit (or spoil) following the high rainfall period in mid-2017. This volume would not have been accounted for the in the weekly water volume surveys and been gradually drawn down over time.

As only annual totals of water extractions and water usage were supplied, the observed annual average was also compared against the modelled daily values for dust suppression (Figure 5-2) and river water extraction (Figure 5-3), to investigate seasonal variations.

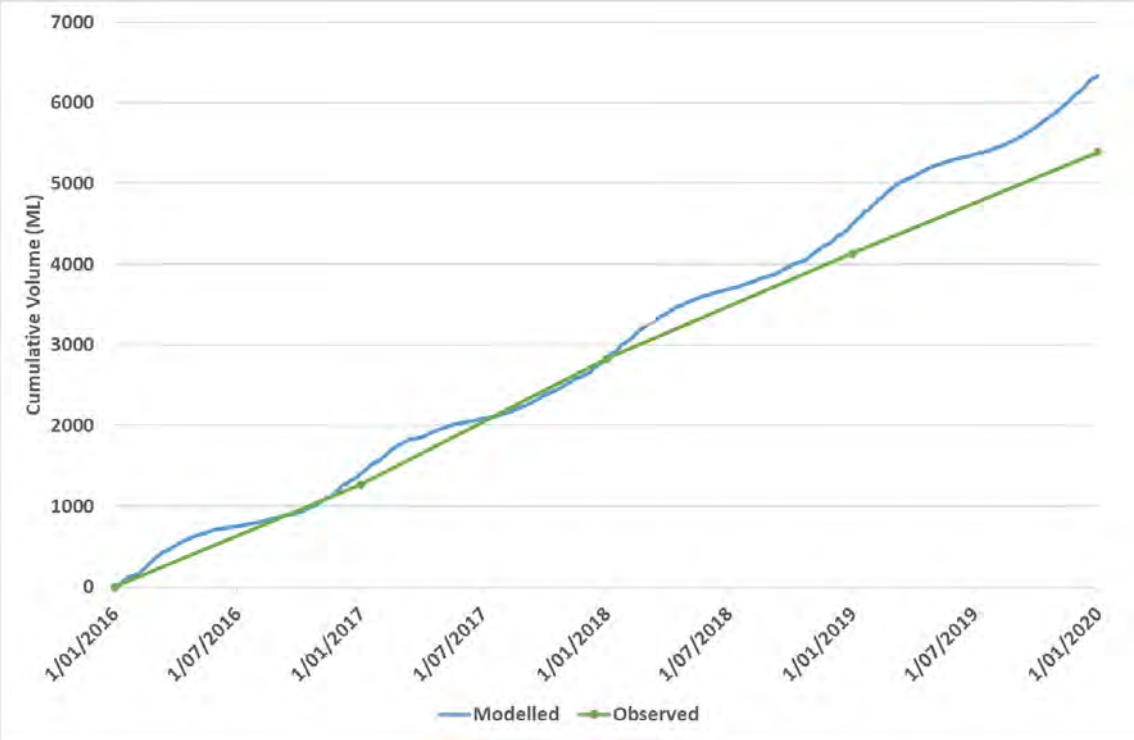


Figure 5-2 Dust suppression usage

Figure 5-2 shows a good fit between the total dust suppression usage over 2016 to 2018. From 2019 there appears to be some divergence from observed values with the model potentially beginning to overestimate demands. It is recommended that this relationship be monitored over the next period and the relationship reviewed if further divergence is observed. Figure 5-2 also shows how the model accounts for the seasonal variation in dust suppression usage, with higher demand during summer than in winter.

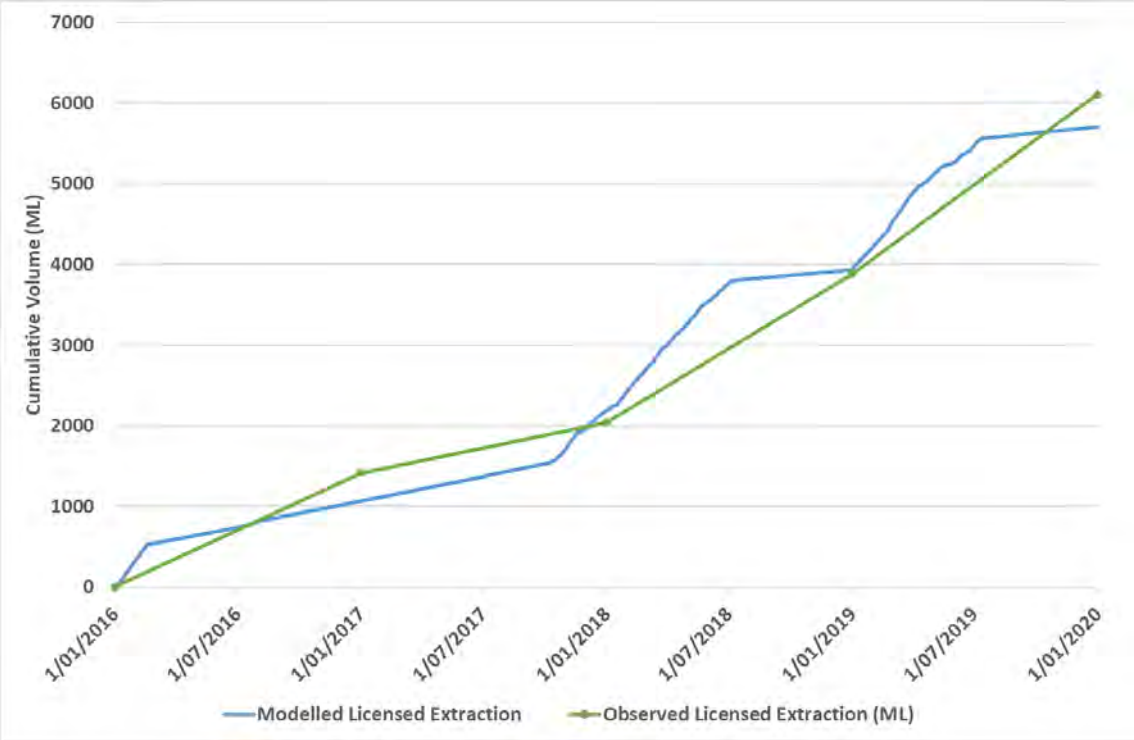


Figure 5-3 Total water extraction

Figure 5-3 shows a good fit between observed and modelled total water extraction from 2016 to 2020. Figure 5-3 also shows how the model simulates river water extractions, extracting water only when additional water was simulated to be required on site. The periods of extraction correspond to the period when water volume in the pit was being drawn down and licensed river or bore water was not being extracted.

Table 5-3 shows a comparison of total modelled inflows, outflows and change in storage compared to the observed change in storage for key mine and dirty water dams over the calibration period.

Final model levels were taken at 17/12/2019 to match the closest monitored data record.

Table 5-3 Comparison of Observed Storage Volumes to Modelled at Key Storages

	Element	MW3	MW5	SD10	SD11	SD12	SD28	Total
Modelled Inflows (ML)	Rainfall	88.5	39.1	45.0	5.2	31.3	3.4	211.5
	Pumped Transfer	153.0	4,505.1	4,004.7	0.0	74.6	0.0	8,741.3
	Runoff	18.4	1.8	122.7	22.0	248.4	2.7	416.0
	Subtotal	*259.9*	*4,546.0*	*4172.4*	*27.2*	*354.3*	*6.1*	*9,368.8*
Modelled Outflows (ML)	Evaporation	265.2	231.5	137.6	15.0	88.4	3.1	737.9
	Pumped Transfer	26.6	3,726.0	4,037.4	12.5	246.9	3.0	8,049.7
	Overflow	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Subtotal	*291.8*	*3,957.5*	*4175.0*	*27.6*	*335.3*	*6.1*	*8,787.5*
Modelled Volumes (ML)	Initial Volume	85.2	0.0	48.1	2.3	5.1	4.8	145.4
	Final volume	35.2	588.0	41.8	1.9	24.6	1.0	700.9
	Change	*-49.7*	*588.0*	*-6.4*	*-0.4*	*19.6*	*-3.8*	*555.5*
Observed Volumes (ML)	Initial Volume	85.2	0.0	48.1	2.3	5.1	4.8	145.4
	Final volume	0.0	621.1	50.7	0.9	30.5	30.5	733.6
	Change	*-85.2*	*621.1*	*2.5*	*-1.3*	*25.4*	*25.7*	588.2
Difference [A]		**35.5**	**-33.1**	**-8.9**	**1.0**	**-5.8**	**-29.5**	**-32.6**
Modelled Balance		17.8	0.5	3.8	0.0	-0.6	3.8	25.7
Modelled Balance as % of Total Flux		3.2%	0.0%	0.0%	0.0%	-0.1%	30.7%	0.3

[A] Observed volume change minus modelled volume change

There are minor differences in modelled balance compared to observed change in storage at MW5, SD6 and SD7 which is likely due to small variations in operating rules over the course of the 4-year model run.

There is a difference of 35.5 ML between observed and modelled change in storage at MW3 as MW3 was not utilised for the majority of 2019 due to low rainfall. The model operating rules (refer to Table 4-3) assume this storage is still operational for the duration of the calibration, however, in practice this water has been retained in the other dirty water storages for operational efficiency.

There is a 17.8 ML balance excess at MW3 which is unlikely to have a noticeable impact on the calibration results given the relative size of the volume when compared to the total flux and change in storage across the site in this period.

Estimates for evaporation and runoff are considered reasonable given the margin of the errors in the above table.

Overall, the SWB model was adequately validated against the available observed data from 2016 to 2020.

6. Site water balance model results

The water balance model, described in Section 4, was used to simulate the water management system over the life of the Boggabri Coal Mine (from 2020 to 2033). The simulation was repeated 127 times using simulated climatic conditions sampled from the historical record (see Section 2.2). The results of the simulation were statistically summarised.

6.1 Overall site water balance

The median annual site water balance is provided in Table 6-1 for the 2020, 2021, 2024 and 2033 'snapshot' year landforms.

Table 6-1 Median site water balance for each of the snapshot years

	2020	2021	2024	2033
Inflows (ML)				
Runoff and direct rainfall:				
▪ Clean water (highwall) dams	0	0	0	71
▪ Dirty water sediment dams	741	762	832	2059
▪ Contaminated water dams, MWDs and pit	1625	1634	1542	757
Groundwater make	313	329	353	266
Imported water from borefield	1028	1027	1029	1028
Import water from Namoi River	313	184	179	232
Total Inflows (ML)	**4020**	**3936**	**3935**	**4413**
Outflows (ML)				
Demands				
▪ Dust suppression - haul roads	1374	1396	1377	1401
▪ CHPP	1253	1252	1253	1253
▪ MIA and potable water	365	365	365	365
Evaporation:				
▪ Clean water (highwall) dams	-	-	-	29
▪ Dirty water sediment dams	128	133	126	241
▪ Contaminated water dams, MWDs and pit	336	388	367	336
Site wide release to Nagero Creek				
▪ Clean water (highwall dam) controlled discharge to creek	-	-	-	36
▪ Dirty water sediment dam overflows to creek	86	131	71	285
▪ Dirty water sediment dam controlled discharge to creek	41	136	369	567
Total Outflows (ML)	**3583**	**3802**	**3928**	**4513**
Change in storage (ML)	**436**	**134**	**7**	**-101**

Due the complex interaction of the different natural and operational processes in the SWB model, the median values of the different inflows and outflows do not coincide. Therefore, unlike mean values, the median of the total inflows and total outflows do not necessarily balance exactly. Nonetheless, median values have been shown as they are a more representative measure of central tendency for processes with skewed distribution, such as rainfall.

There is a significant increase in volumes of runoff reporting to dirty water sediment dams in 2033. This results in an increase of overflows and controlled discharges from these storages. This increase is due to a large portion of rehabilitated catchment south of SD19 (refer to Figure B-5) reporting to the dirty water management system. It is understood that the final landform is currently under consideration as part of the proposed Mine Modification 8 and will be addressed in subsequent water Balance Reports.

Median dust suppression usage is less than 1416 ML/year as dust suppression is modelled to occur only on days with total daily rainfall depth is less than 5 mm (refer to Section 4.6.1).

6.2 Imported water requirements

A summary of the simulated water imported to site over the life of the Mine is provided in Figure 6-2 and a summary table for the snapshot years is provided in Table 6-2. Note that the values in Figure 6-2 and Table 6-2 are not limited by the existing entitlements held by BCOP.

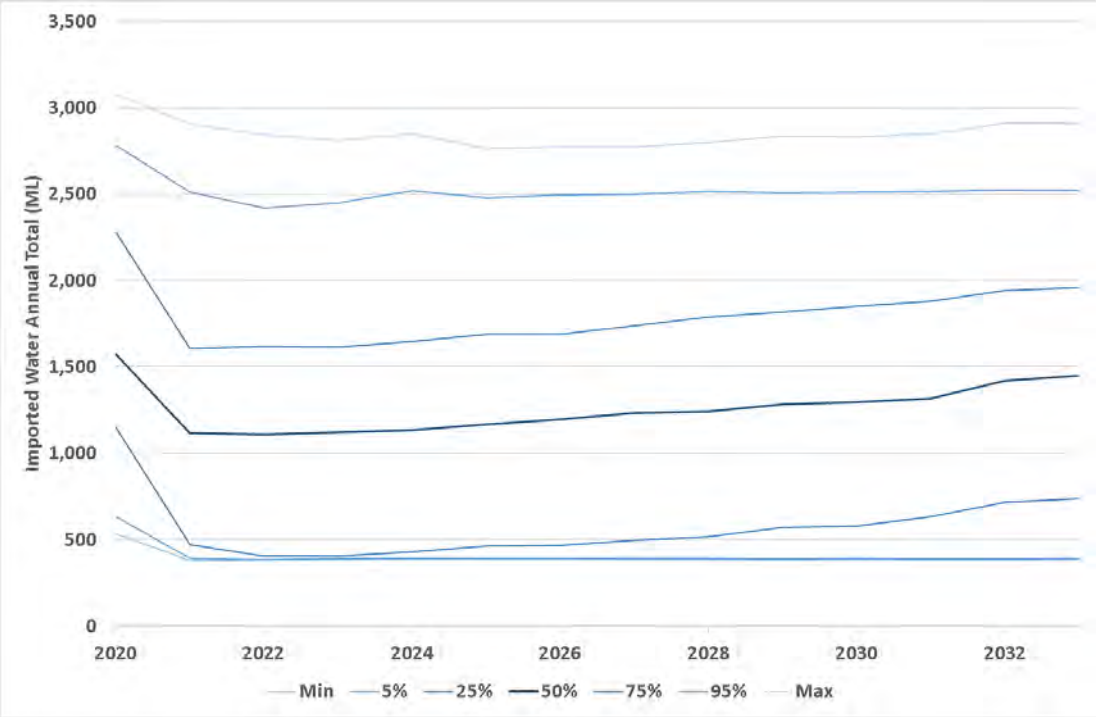


Figure 6-1 Simulated time series of annual water imported to site

Table 6-2 Annual totals of imported water requirements

	Annual total (ML)			
	2018	**2019**	**2022**	**2033**
5th percentile (wet)	631	392	392	391
25th percentile	1150	472	428	738
50th percentile (median)	1573	1119	1133	1451
75th percentile	2279	1607	1647	1957
95th percentile (dry)	2780	2511	2520	2520
Greatest result (driest on record)	3078	2905	2850	2909

Supplementary water will be imported to the BCM to meet dust suppression and CHPP process water demands. Even when the BCM is in a contaminated water surplus, high-quality imported water is required to meet the potable water and vehicle wash-down demands. The maximum modelled daily pump rate of imported water to the BCM was approximately 9.4 ML/day. The daily average pump rate is higher than the daily demand of 8.2 ML/day as it accounts for evaporation losses of imported water stored in SD10 and MW5.

A total of 1028 unit shares of groundwater will be available to BCOP from the existing Zone 4 Water Groundwater Source water access licences. The actual volume of groundwater available will depend on the Available Water Determination made under the relevant Water Sharing Plan. This entitlement does not include 842 unit shares of groundwater available to BCOP from the existing Gunnedah Oxley Basin Groundwater Source aquifer licence. Assuming an allocation of 1 ML per unit share, it can be expected that up to approximately 1870 ML/year be available to BCOP from the existing water access licences.

BCOP can access surface water from the Namoi River in accordance with its surface water licences via a pump station on the Namoi River. BCOP holds a total of 422 unit shares of general security surface water entitlements and an additional 32.2 unit shares which would be available to BCOP from the Namoi River.

Under the existing water licences, a maximum of 2324 ML (the actual volume is dependent on annual Available Water Determinations) is available for the supply of water to BCM. Groundwater can be traded on a temporary or permanent basis within the greater Gunnedah-Oxley Basin Groundwater Source, and within Zone 4 of the Upper Namoi Valley (Keepit Dam to Gins Leap) Ground Water Source. BCOP will source additional water by trading water, either temporarily or permanently so sufficient water is available for the operations at BCM.

6.3 Contaminated water storage and pit availability

Water balance modelling indicates that no overflows from mine water dams MW5 and MW3 or contaminated water dams SD10, SD11, SD12, SD28 and SD29 are expected over the life of BCM.

Summaries of the simulated daily time series of water stored in the mining void (pit sumps), MW5, and MW3 over the life of BCM are provided in Figure 6-2, Figure 6-3, and Figure 6-4, respectively. Note that the percentiles shown in the daily time series plots are daily percentile

ranks of the daily results, whereas the percentile shown in Table 6-1, and Figure 6-1 are percentile ranks of the annual results.

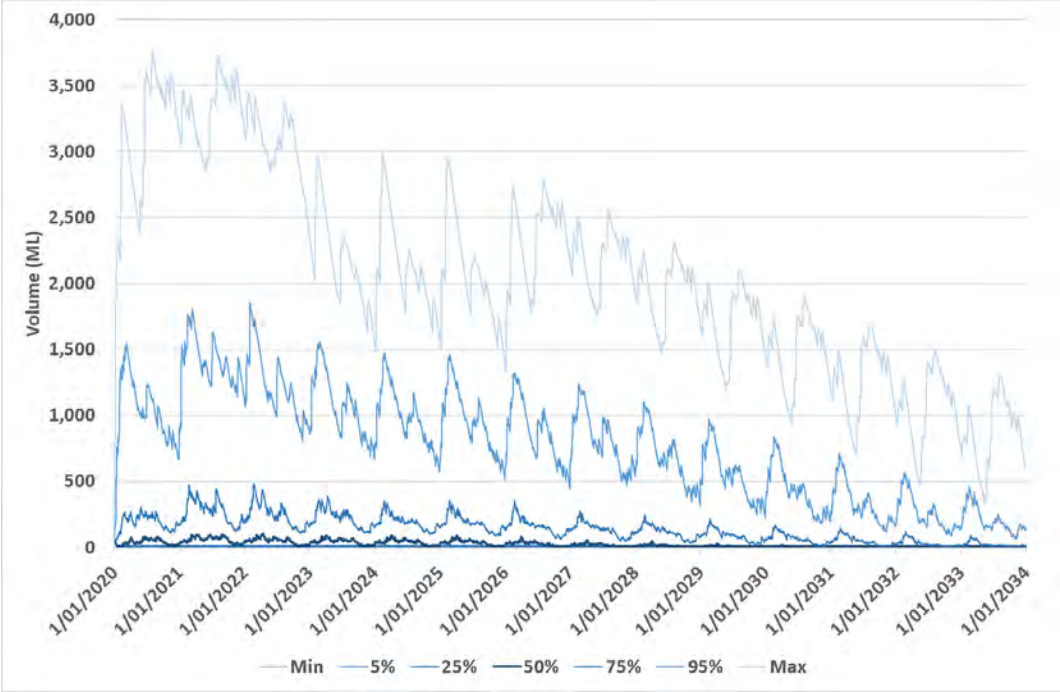


Figure 6-2 Simulated time series of water stored in-pit sumps

Figure 6-2 shows that the pit void is predicted to be empty most of the time, however, the volume stored at any one time may reach approximately 3,500 ML. This maximum volume may reduce following 2023 as the catchment area reporting to the pit void is reduced.

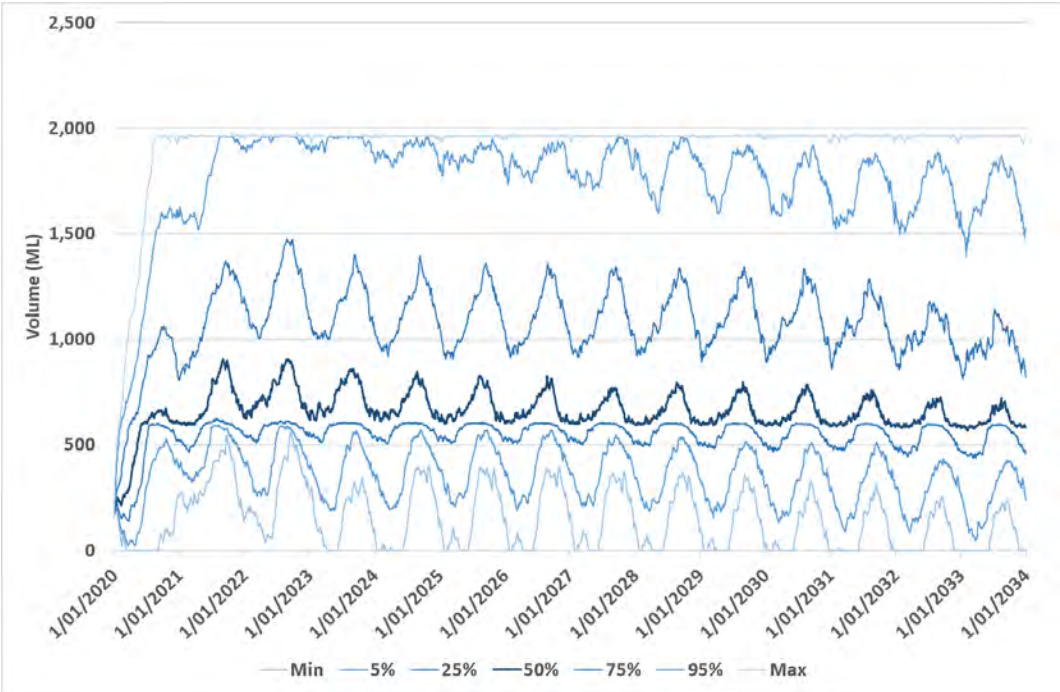


Figure 6-3 Simulated time series of water stored in MW5

Figure 6-3 shows that the volume stored in MW5, after its construction, is predicted to most likely remain close the assumed normal operating volume of 650 ML but may increase to the high operating volume or empty, depending on rainfall conditions.

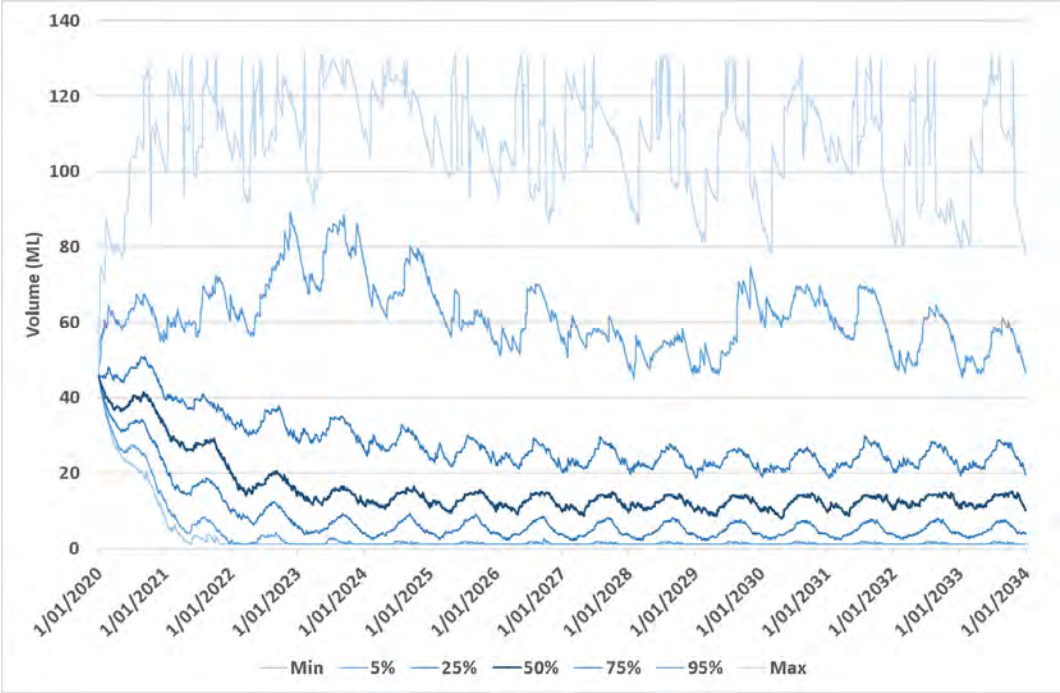


Figure 6-4 Simulated time series of water stored in MW3

Figure 6-4 shows that the volume stored in MW3 is predicted to remain relatively low, but may reach volumes up to approximately 130 ML. This reflects the assumed operating rules whereby MW3 is used as additional dewatering capacity for SD10 after MW5 reach their high operating volume.

7. Water efficiency initiatives

The action plan to implement water efficiency initiatives and the recommendations (Advisian, 2016) referenced in appendix 6A of the Project Approval are provided in Table 7-1.

Table 7-1 Water Balance Initiatives Action Plan

BCOP Water Efficiency Initiatives	
Action Plan	**Schedule**
Propose water efficiency initiatives during the SWB annual review process.	Annually during the SWB annual review process
Report on the effectiveness of water efficiency initiatives.	Annually in the AR
Water Efficiency Initiatives Project Approval Appendix 6A	
Action Plan	**Schedule**
1. Install meters for all major water flows including:	
• Water transfers from sediment dams and mine pits into mine water storages.	Completed
• All water-cart fill points.	Completed
• All elements of the anticipated water demand for various purposes associated with CHPP (as identified in Table 4 of the letters dated 8 July)	Completed
• All water imports including any bore water obtained onsite.	Within one week of commencing operation.
2. Install water level meters on all significant water storage as a check on inflows and outflows and a means of assessing evaporation and seepage losses. This data will also provide a basis for improving estimates of the runoff from different surface types (hardstand, mine pit, “raw’ overburden)	In progress
3. Collect moisture content data for all coal flows associated with the CHPP to permit full water balance accounting	Commencing 2021
4. Record all flow meters and water levels at least weekly (preferable by means for continuous recording) and analyse the data on a monthly basis to develop a full accounting of all water sources and losses.	Within one month of flow meters and water level instruments being installed.
5. Compare monitored gains from rainfall and losses by evaporation from water storages to the rainfall and evaporation data from the weather station.	Comparison of modelled storage levels compared with observed, outlined in Section 5.2
6. Update the site water balance annually bases on monitored data and provide details in the annual report to the Department.	Annual SWB revision as outlined in Section 8.3

8. Improvement and reporting

8.1 Review and Improvement

BCOP undertakes annual reviews to identify and address deficiencies and improvements within monitoring, measurement and calculation methods presented in the SWB. This includes a review of the monitoring, measurements and calculation methods used in the SWB and where required outline any improvements to address deficiencies in these. The results of the improvement program will be incorporated into the annual revision of the SWB presented as part of the Annual Review required under Schedule 5, condition 4 of the Project Approval.

8.1.1 Recommended Improvements

It is recommended that the following improvements are made to the model for the 2020 review:

- Structural improvements to the model to improve efficiency and allow for operational planning including:
  - Incorporation of a spoil seepage model for the pit backfill.
  - Integration of a model dashboard.
- Input data improvements including:
  - Review and update of stage storage curves for all dams.
  - Review and update the water use data for the CHPP to use newly available metered data.
- Staging and operational improvements including:
  - Review the staging of previously recommended upgrades to dams (e.g. SD3).
  - Investigate diversion of Tarrawonga LDP1 around SD6.

8.2 Validation Program

BCOP will perform a validation of the SWB model on an annual basis. The existing model will be used to simulate the water management system for the previous year using observed site rainfall. The observed borefield extraction, river water extraction, CHPP usage, dust suppression usage, potable/washdown usage, catchment areas, discharge events and storage volumes (in SD10, , MW3, MW5, and in-pit) will be compared to modelled results on a monthly basis.

As the BCM is predicted to be in water deficit under most climatic conditions and the contaminated water system is designed to contain and manage the 100 year ARI 72 hour rainfall event, discharges from the BCM are expected to be only from sediment dams following significant rainfall events. Therefore, the discharge volumes from the BCM may be estimated and validated using observations of the incidence of discharge events.

If the SWB model is found to not be realistically representative of the management system, an investigation will be undertaken that may involve a calibration process, similar to that described in Section 5, to identify the source of the discrepancy. The updated SWB model will be used to update predictions described in Section 6.

A summary of the validation will be incorporated into the annual revision of the SWB presented as part of the Annual Review.

8.3 Annual Review

The Annual Review summarises the environmental performance of the mine for the previous calendar year. In accordance with Schedule 5, condition 4 of the Project Approval, the relevant monitoring data will be used to revise the SWB annually and will be provided in the Annual Review.

The Annual Review is publicly available on the Boggabri Coal Mine website (www.idemitsu.com.au/operations/boggabri-coal/approvals-plans-reports/).

9. Review and revision

9.1 Review

Review of the SWB will be undertaken by BCOP in accordance schedule 5 condition 5 of the Project Approval within 3 months of the submitting the following:

- Annual Review under condition 4 of the Project Approval.
- An incident report under condition 8 of the Project Approval.
- An audit under condition 10 of the Project Approval.
- A modification to the Project Approval.

10. References

Australasian Groundwater & Environmental Consultants (AGE), October 2010. Continuation of Boggabri Coal Mine Project Groundwater Water Assessment.

Boggabri Coal Pty Limited (BCPL), March 2012. Mine Water Balance Review – Boggabri Coal Project.

Department of Environment, Climate Change and Water (DECCW), 2008. Managing Urban Stormwater - Soils and Construction - Volume 2E Mines and Quarries.

Smith M, 1998. Crop evapotranspiration: Guidelines for computing crop water requirements. Food and Agriculture Organization of the United Nations. Irrigation and Drainage paper No. 56.

Hansen Bailey, December 2010. Continuation of Boggabri Coal Mine Environmental Assessment.

Hansen Bailey, August 2011. Boggabri Coal Mine Environmental Assessment - Modification to Development Consent.

DECCW, 2008. *Managing Urban Stormwater - Soils and Construction - Volume 2E Mines and Quarries*. New South Wales Government.

Ladson, A., 2008. *Hydrology: An Australian Introduction.* Oxford University Press: Melbourne.

Morton, 1983. Operational estimates of areal evapotranspiration and their significance to the science and practice of hydrology. Journal of Hydrology, Volume 66, 1-77.

Parsons Brinckerhoff (PB), October 2010. Continuation of Boggabri Coal Mine Project Surface Water Assessment.

Parsons Brinckerhoff (PB), 2009. Boggabri Coal Mine 2008 Site Water Balance.

Parsons Brinckerhoff (PB), 28 August 2015. Boggabri Coal Mine – Drawdown Impact Assessment of Proposed Borefield Operations (2200555A_WAT_REP_Borefield assessment_RevC)

Ribbons C, 2009. Water availability in New South Wales Murray–Darling Basin regulated rivers, NSW Department of Water and Energy, Sydney.

Stephen J. Jeffrey, John O. Carter, Keith B. Moodie, Alan R. Beswick, Using spatial interpolation to construct a comprehensive archive of Australian climate data, *Environmental Modelling & Software*, Volume 16, Issue 4, June 2001, Pages 309-330, ISSN 1364-8152, http://dx.doi.org/10.1016/S1364-8152(01)00008-1.

Appendix A

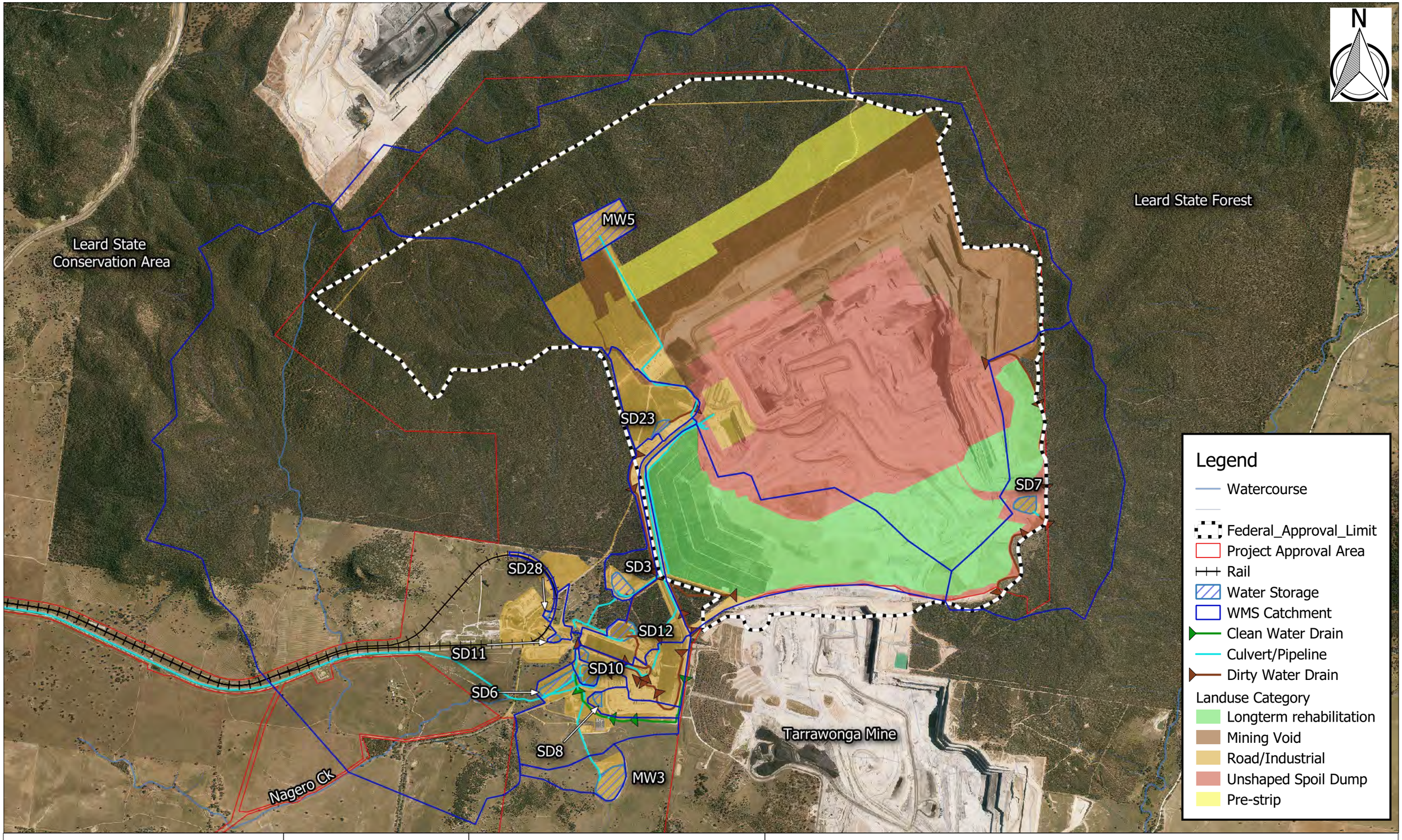
Summary of methodologies

Table A.1 Summary of methodologies

Process	Data source	Measurement type	Relevant formulas
Mass balance	NA	Mass conservation	Refer to Section 4.1
Staging of storages	Life-of-Mine plans	Assumed	Refer to Section 4.3
Historical rainfall	SILO Data Drill	Interpolated from observed rainfall gauges	Refer to Stephen et al. (2001) and Section 2.2
Historical potential evapotranspiration depth	SILO Data Drill	Interpolated from observed data	Refer to Smith (1998) and Section 2.2
Historical potential open water evaporation depth	SILO Data Drill	Interpolated from observed data	Refer to Morton (1983) and Section 2.2
Future climatic conditions	SILO Data Drill	Sampled concurrently from historical record	Refer to Section 2.2
Existing catchment and landuse areas	LiDAR and aerial imagery	Measured	Refer to Section 4.4.2 and Appendix B
Future catchment and landuse areas	Life-of-Mine plans	Measured	Refer to Section 4.4.2 and Appendix B
Catchment runoff	NA	Estimated using AWBM with validated parameters	Refer to Section 2.4, Section 4.5.1 and Section 5
Existing storage capacity	BCOP	As constructed	Refer to Section 4.4.1
Storage maximum surface area and geometry	LiDAR and aerial imagery	Measured	Refer to Section 4.4.1
Storage water surface area	NA	Calculated from stage storage relationships or approximated geometry	Refer to Section 4.4.1
Direct rainfall	NA	Calculated from modelled rainfall and water surface area	Refer to Section 4.5.1
Actual evaporation losses	NA	Calculated from modelled evaporation and surface area	Refer to Section 4.7.1
Groundwater inflows	Groundwater model predictions	Calculated	Refer to AGE (2010) and Section 4.5.2
Past CHPP usage	BCOP	Estimated from site experience	Refer to Section 4.6.2 and Section 5
Past dust suppression usage	BCOP	Measured as monthly totals	Refer to Section 5
Past potable and washdown usage	BCOP	Estimated from site experience	Refer to Section 4.6.3 and Section 5
Future CHPP usage	BCOP	Estimated from site experience	Refer to Section 4.6.2
Future dust suppression usage	BCOP	Estimated from site experience	Refer to Section 4.6.1
Future potable and washdown usage	BCOP	Estimated from site experience	Refer to Section 4.6.3
Site operating rules	BCOP	Idealised from actual site management	Refer to Section 4.4.3 and Section 4.5.3
Off-site releases	NA	Calculated from mass balance	Refer to Section 4.7.3

Appendix B

Water management system plans and schematics



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IDEMITSU BOGGABRI COAL

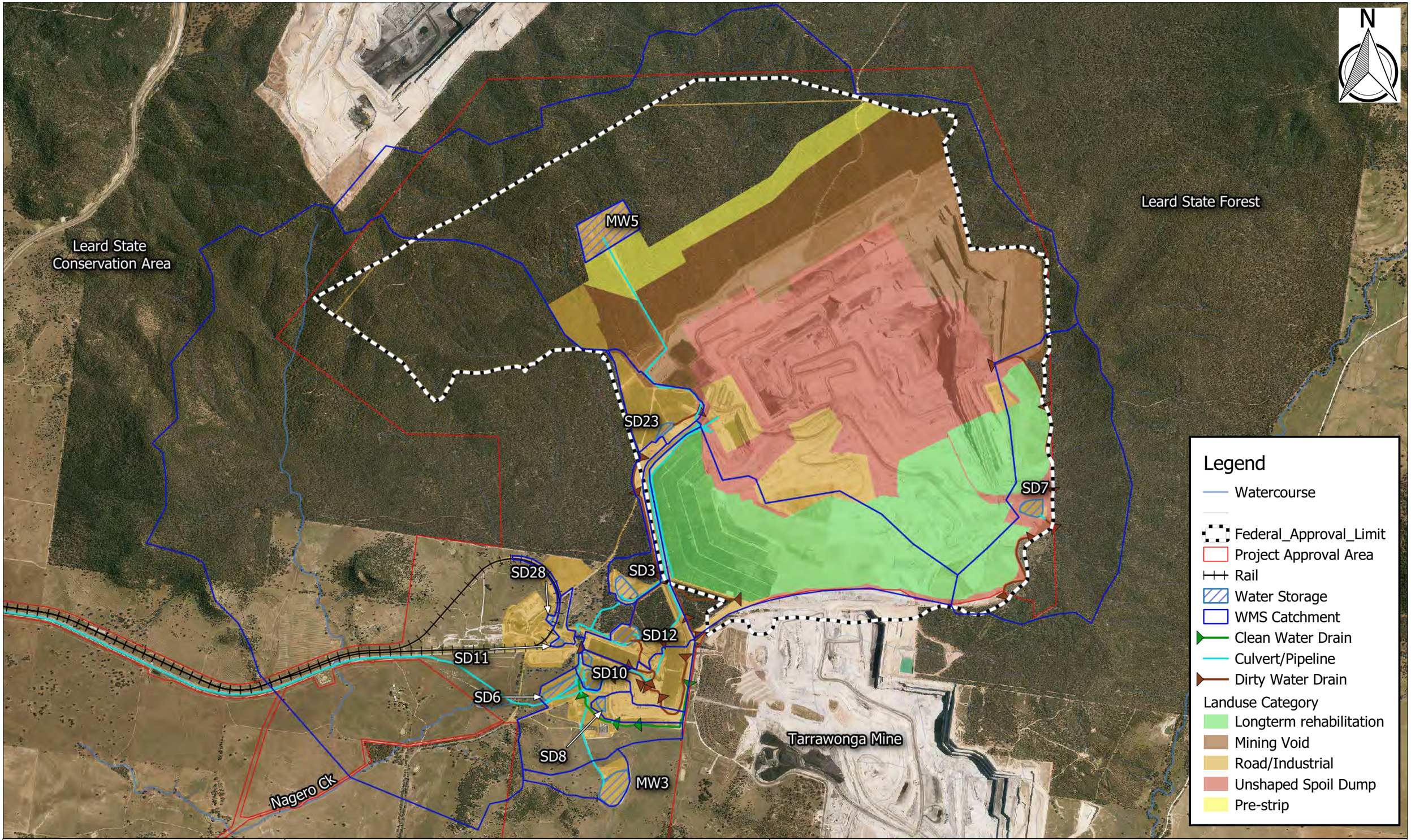
700 0 700 m

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Boggabri Coal Site Water Balance

Water Management System Indicative Layout - 2020

Job Number: N1220_001
Revision: 0
Drawn: Michael Best
Checked: AW
Date: 1/7/2020



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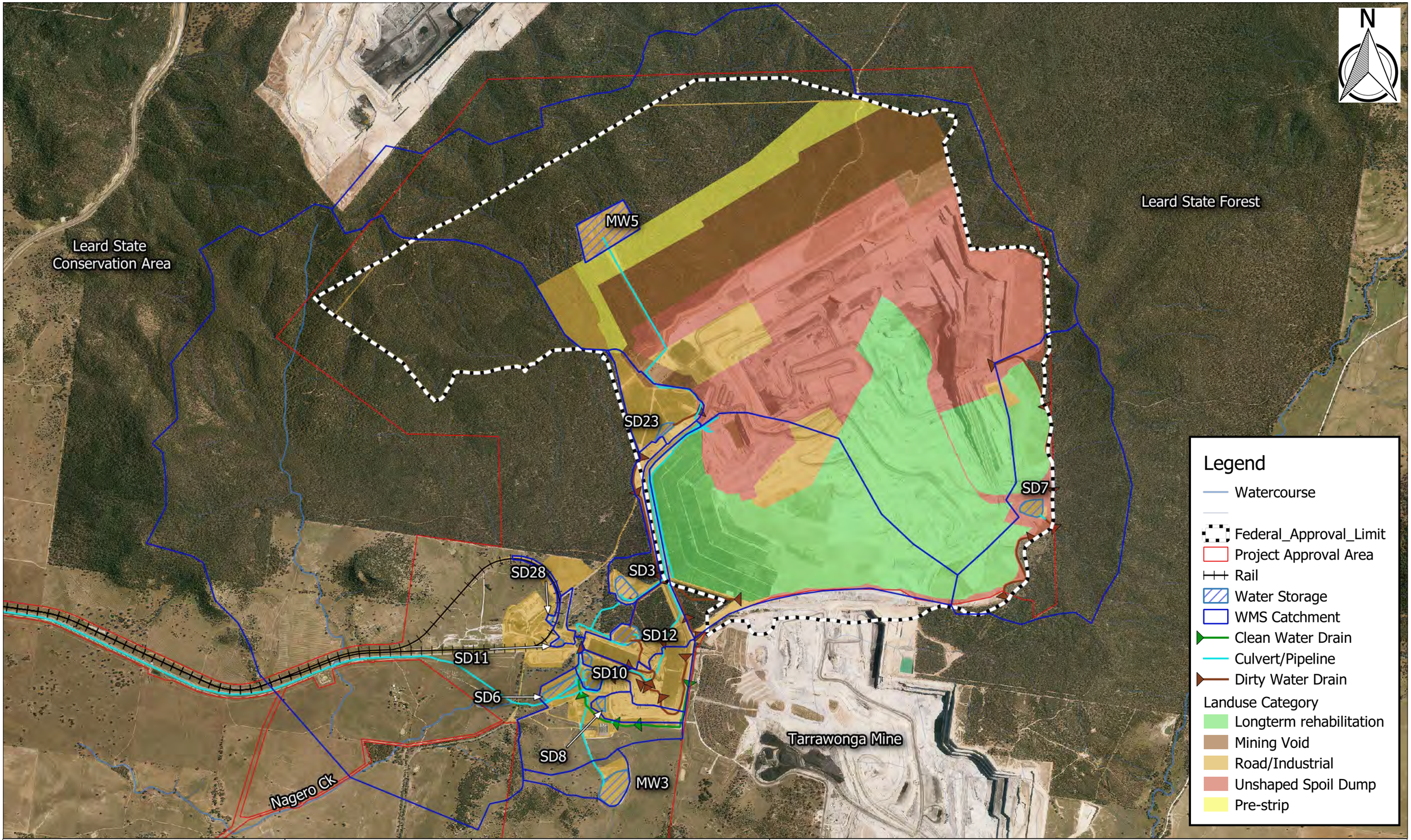
Boggabri Coal Site Water Balance

Water Management System Indicative Layout - 2021

Job Number: N1220_001
Revision: 0
Drawn: Michael Best
Checked: AW
Date: 1/7/2020



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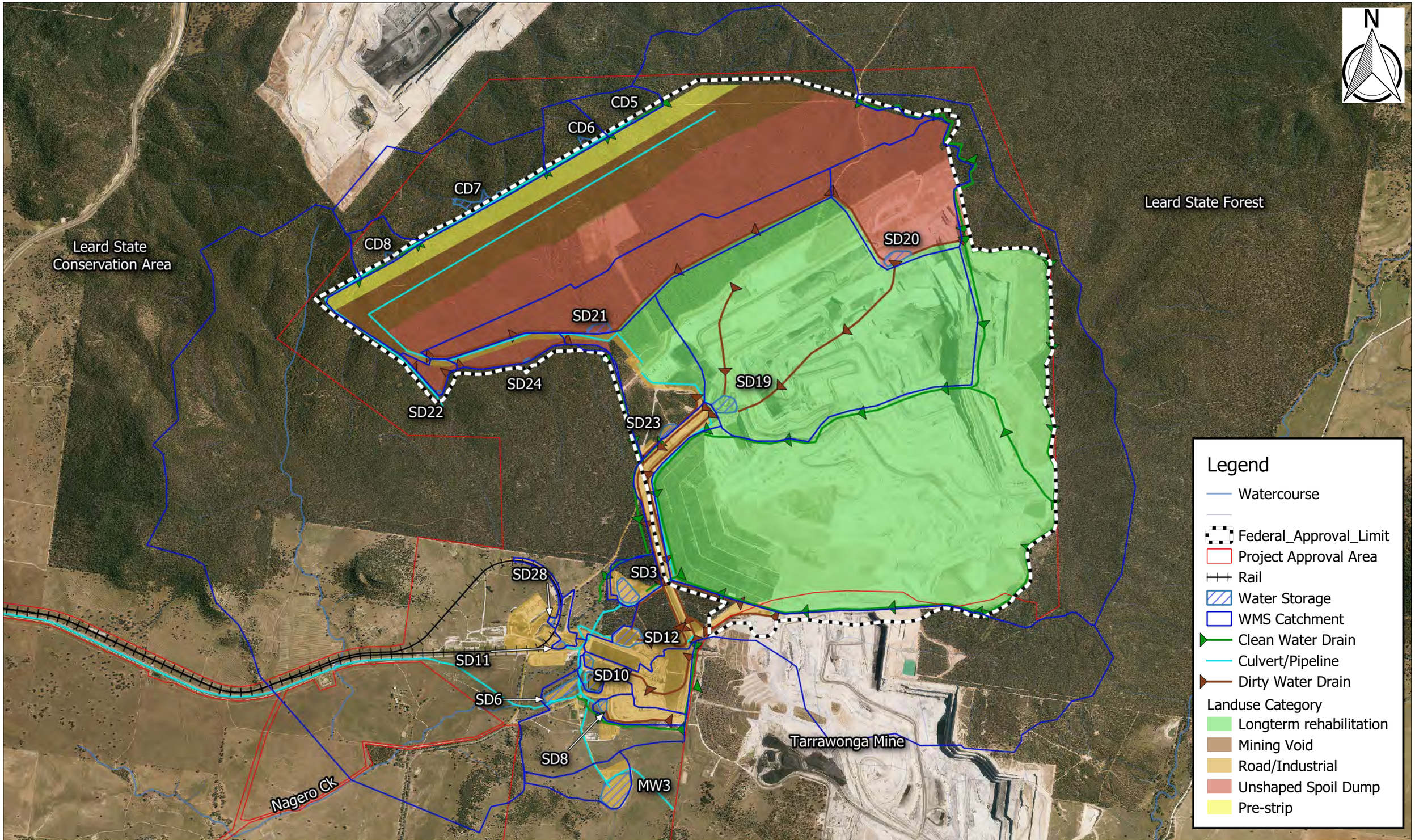
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Boggabri Coal Site Water Balance

Water Management System Indicative Layout - 2024

Job Number: N1220_001
Revision: 0
Drawn: Michael Best
Checked: AW
Date: 1/7/2020



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IDEMITSU BOGGABRI COAL

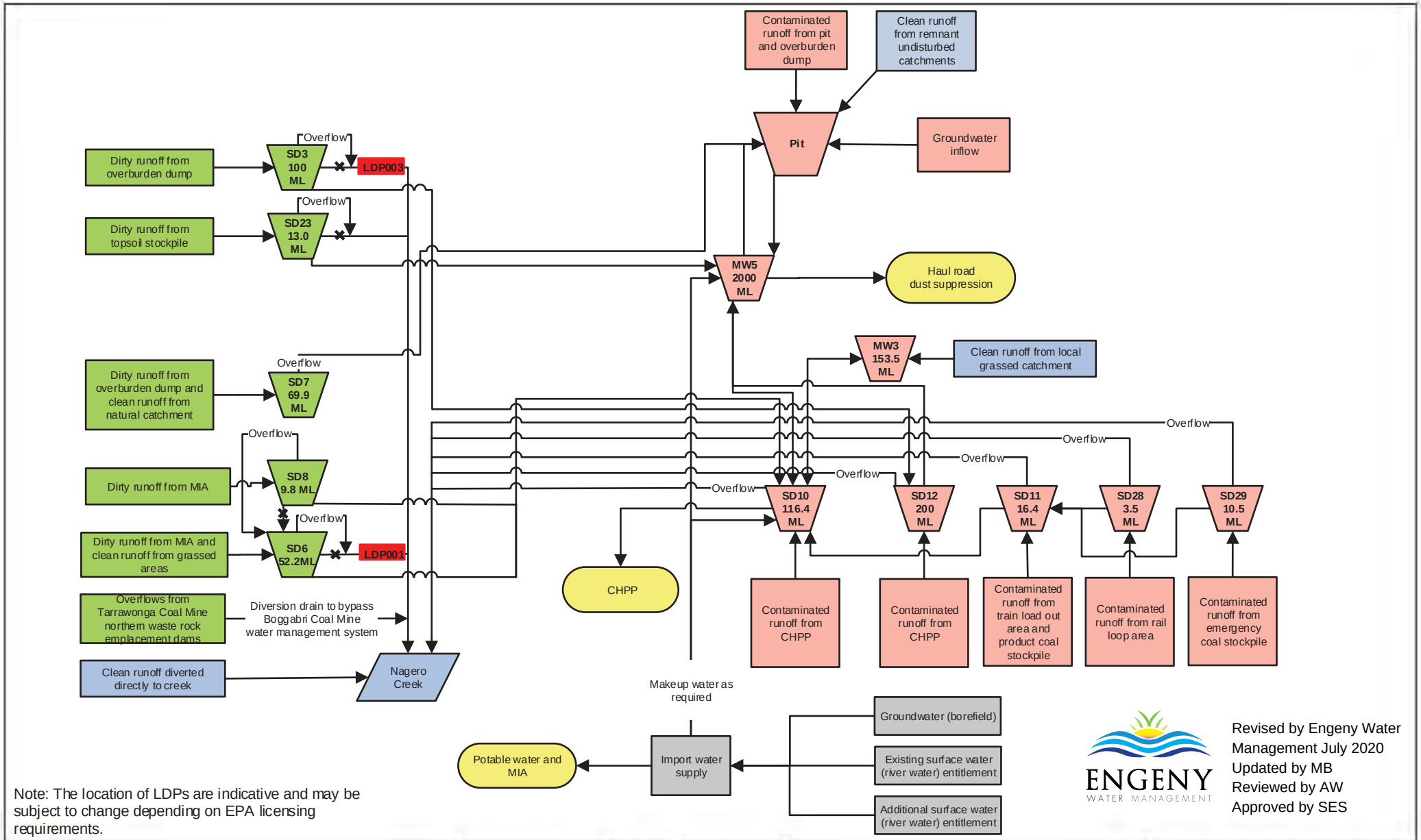
700 0 700 m

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

Boggabri Coal Site Water Balance

Water Management System Indicative Layout - 2033

Job Number: N1220_001
Revision: 0
Drawn: Michael Best
Checked: AW
Date: 1/7/2020



Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.

ENGENY WATER MANAGEMENT

Revised by Engeny Water Management July 2020
Updated by MB
Reviewed by AW
Approved by SES

LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve
- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

LOCATION	BCM
DRAWN	TT
CHECKED	AW
APPROVED	SG
SCALE	NTS

Boggabri Coal Operations Pty Ltd
Boggabri Coal Mine
Site Water Balance

Water balance model schematic
Indicative conditions (2020)

IDEMITSU BOGGABRI COAL

DATE 15 Jun 2018

Figure B-6

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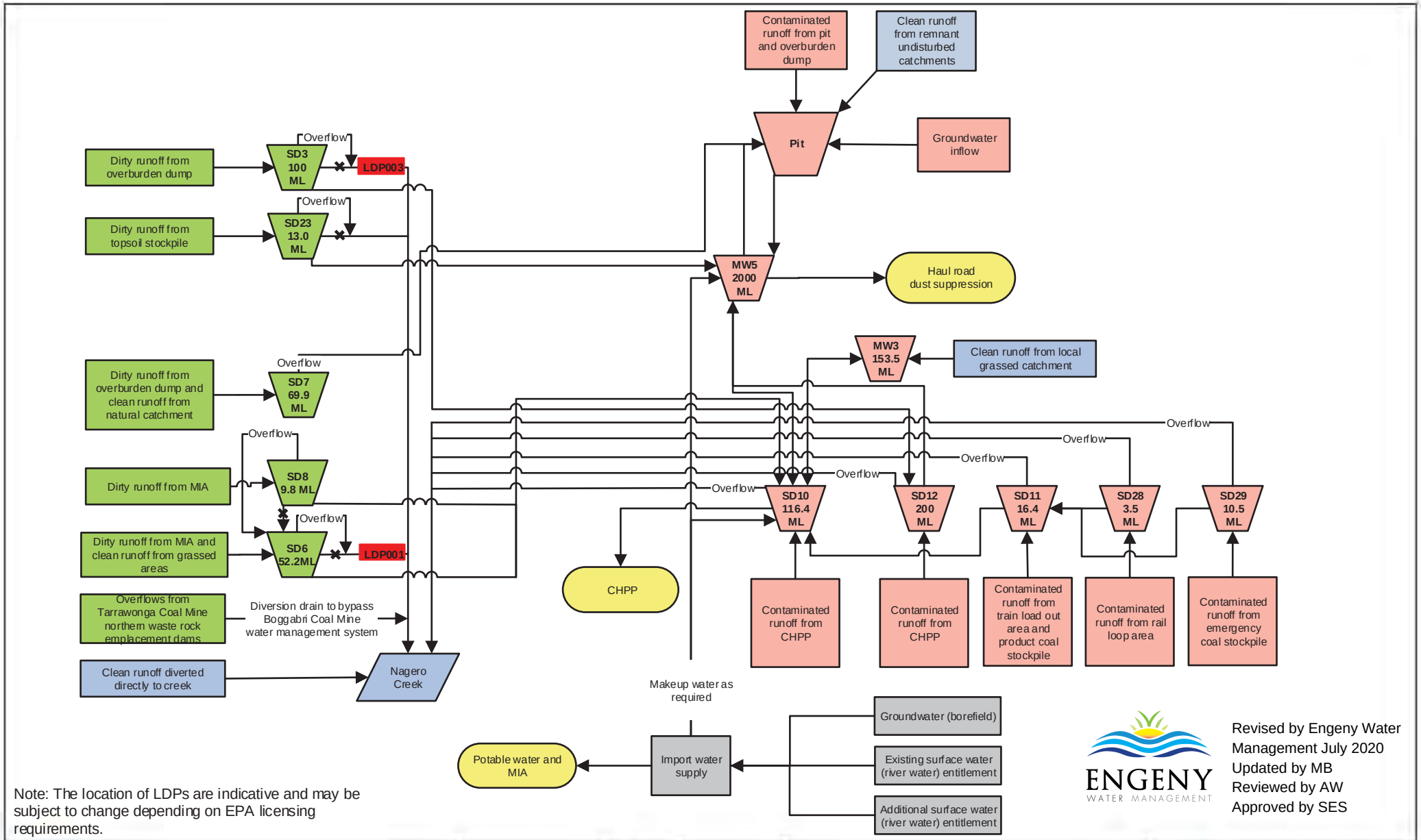

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ENGENY WATER MANAGEMENT

Revised by Engeny Water Management July 2020
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LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve
- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

LOCATION	BCM
DRAWN	TT
CHECKED	AW
APPROVED	SG
SCALE	NTS

Boggabri Coal Operations Pty Ltd
Boggabri Coal Mine
Site Water Balance

Water balance model schematic
Indicative conditions (2021)

IDEMITSU BOGGABRI COAL

DATE 15 Jun 2018

Figure B-7

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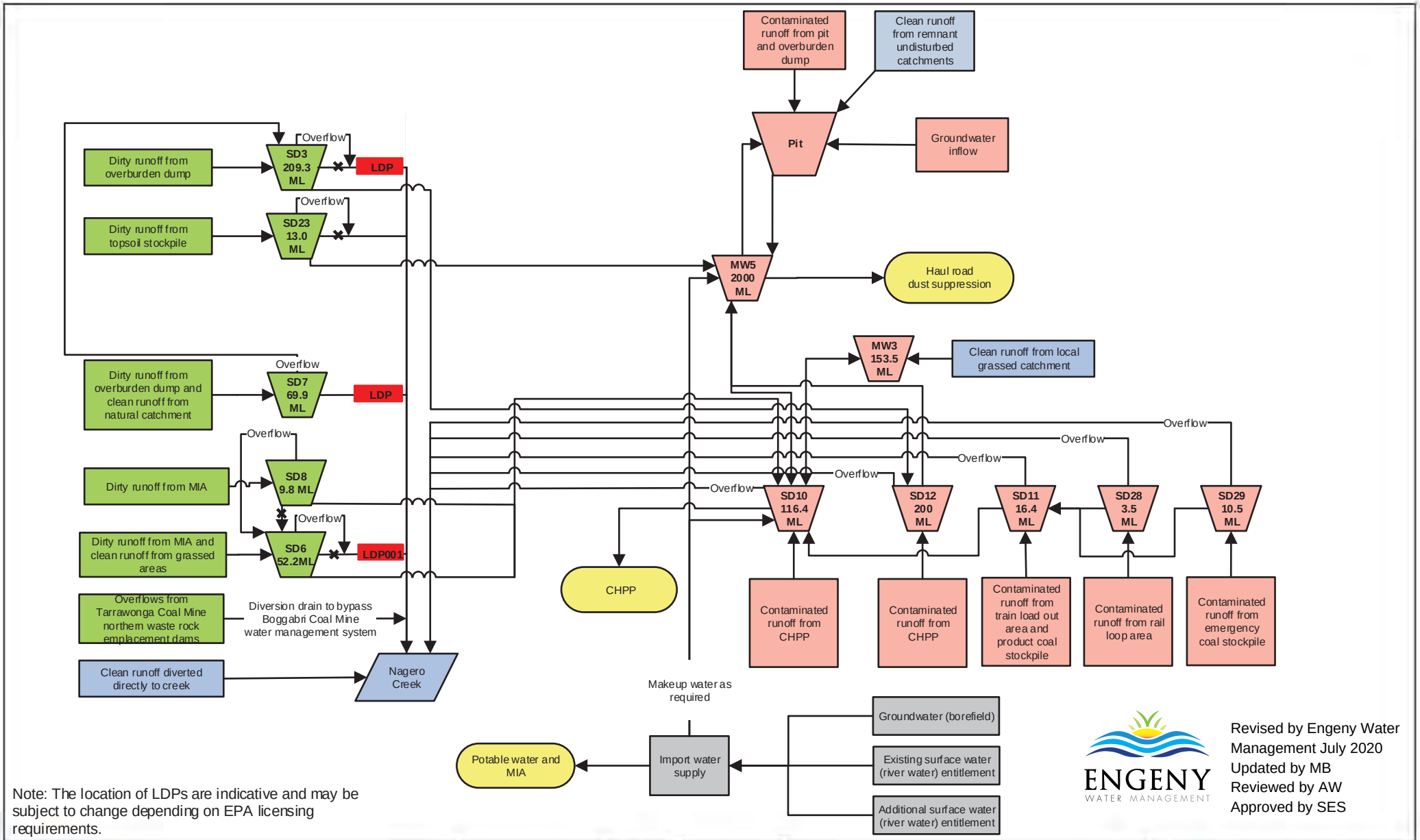

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ENGENY WATER MANAGEMENT

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LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve
- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

LOCATION	BCM
DRAWN	TT
CHECKED	AW
APPROVED	SG
SCALE	NTS

Boggabri Coal Operations Pty Ltd
Boggabri Coal Mine
Site Water Balance

Water balance model schematic
Indicative conditions (2024)

IDEMITSU BOGGABRI COAL

DATE 15 Jun 2018

Figure B-8

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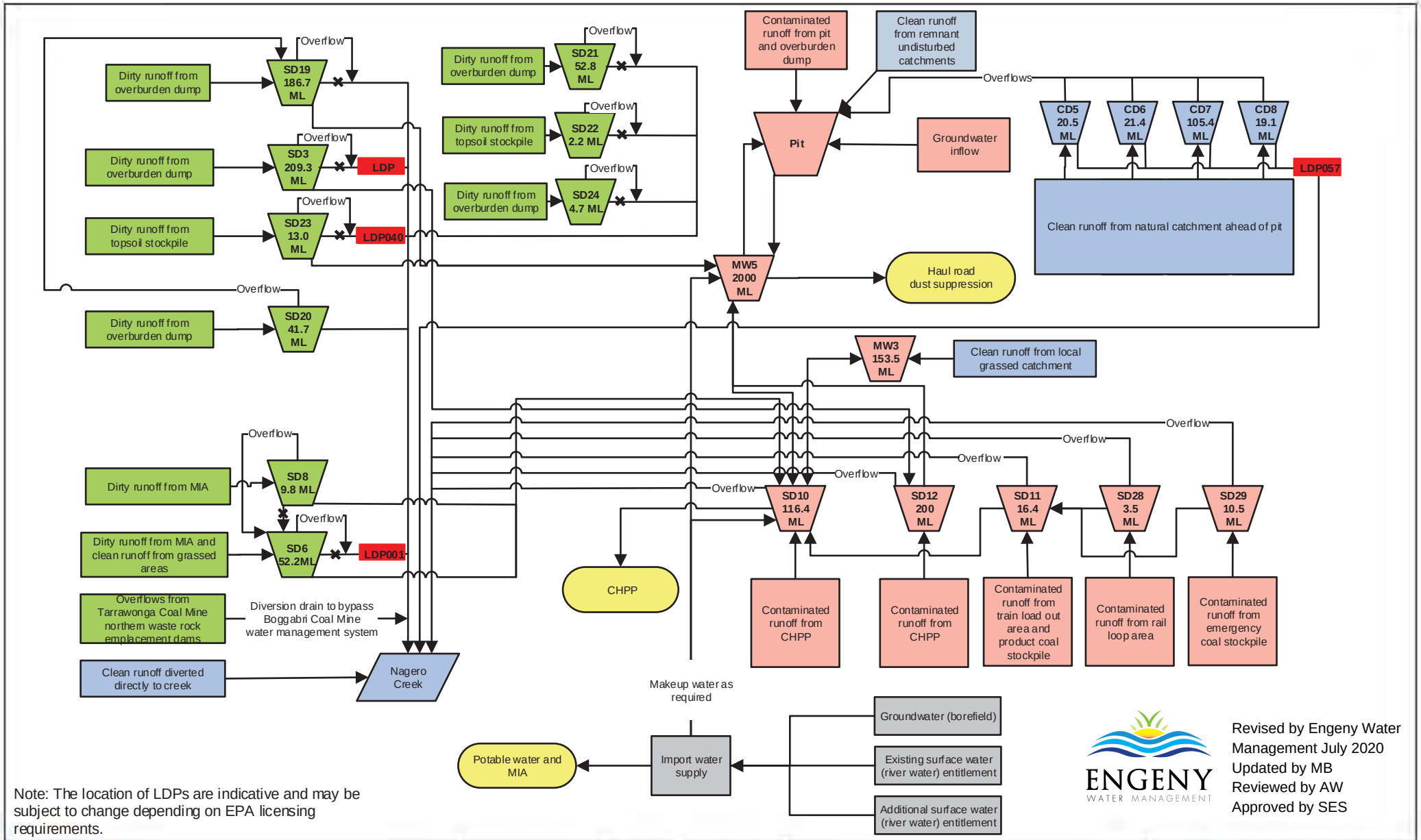

Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.

ENGENY WATER MANAGEMENT

Revised by Engeny Water Management July 2020
Updated by MB
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Approved by SES

LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve
- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

LOCATION	BCM
DRAWN	TT
CHECKED	AW
APPROVED	SG
SCALE	NTS

Boggabri Coal Operations Pty Ltd
Boggabri Coal Mine
Site Water Balance

Water balance model schematic
Indicative conditions (2033)

IDEMITSU BOGGABRI COAL

DATE 15 Jun 2018

Figure B-9

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Appendix C

Summary of storages and discharge points

Table C 1 Summary of 2020 storages

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Existing capacity (ML)	Notes
Dirty water dams									
SD3	Sediment dam located south-west of spoil dump	Dirty runoff from partially rehabilitated spoil dump	90th %ile 5 day	50%	0.4 to 0.75	139.8	60.5	102.3	Existing capacity of 102.3 ML exceeds required capacity.
SD6	Sediment dam located downstream of MIA (referred to as Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8	90th %ile 5 day	50%	0.4 to 0.75	63.5	14.6	52.2	Existing capacity of 52.2 ML exceeds required capacity.
SD7	Sediment dam located in eastern spoil dump	Dirty runoff from spoil dump and clean runoff from undisturbed catchment	90th %ile 5 day	50%	0.4 to 0.75	158.9	45.8	69.9	Existing capacity of 69.9 ML exceeds required capacity. Elevation of catchment does not allow return to environment.
SD8	Sediment dam located in MIA	Dirty runoff from MIA	90th %ile 5 day	50%	0.75	13.0	5.6	9.8	Existing capacity of 9.8 ML exceeds required capacity.
SD23	Sediment dam located near topsoil stockpile	Dirty runoff from topsoil stockpile	90th %ile 5 day	50%	0.75	20.0	8.7	9.5	Existing capacity of 9.5 ML exceeds required capacity.
Contaminated water dams									
SD10	Contaminated water dam located in CHPP	Contaminated runoff from product coal stockpile	100yr ARI 72hr	20%	0.85	27.1	70.7	116.4	Existing capacity of 116.4 ML exceeds required capacity. SD10 includes 'reuse zone' for water supply to CHPP.
SD11	Contaminated water dam located at rail loop	Contaminated runoff from rail loop	100yr ARI 72hr	20%	0.85	3.8	10.0	16.4	Existing capacity of 16.4 ML exceeds required capacity.

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Existing capacity (ML)	Notes
SD12	Contaminated water dam located in CHPP	Contaminated runoff from ROM coal stockpile	100yr ARI 72hr	20%	0.85	63.8	165.7	206.6	Existing capacity of 206.6 ML exceeds required capacity.
SD28	Contaminated water dam located in CHPP	Contaminated runoff from rail loop area	100yr ARI 72hr	20%	0.85	1.0	2.6	3.5	Existing capacity of 3.5 ML exceeds required capacity.
MW6	Mine water dam located within pit void	Contaminated water pumped from pit	100yr ARI 72hr	0%	1.0	3.8	9.7	175.8	Freeboard of 9.7 ML is maintained
MW3	Mine water dam located south of MIA	Surplus contaminated water pumped from SD10 and clean runoff from small grassed catchment	100yr ARI 72hr	0%	0.40	22.0	22.5	153.5	Freeboard of 22.5 ML is maintained
MW5	Mine water dam (turkey's nest dam)	Contaminated water pumped from pit	100yr ARI 72hr	0%	1.0 (Turkey's nest)	15.2	38.8	2000.0	Freeboard of 38.8 ML will be maintained
Pit	In-pit storage during wet periods	Contaminated runoff and groundwater make captured in the mining void sumps							Surplus contaminated water stored in-pit when capacity of Strip #9 and MWDs reached

Table C 2 Summary of 2020 discharge points

EPL identification number	Discharge type	Storage	Location / description	Stored water
Point 2	Discharge water quality monitoring and Wet weather discharge	SD3	Sediment dam located south-west of spoil dump	Dirty runoff from partially rehabilitated spoil dump
Point 1	Discharge water quality monitoring and Wet weather discharge	SD6	Sediment dam located downstream of MIA (Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8
Point 4	Discharge water quality monitoring and Wet weather discharge	SD4	Sediment dam located downstream of train load out area west of BCM	Runoff from train load out area

Table C 3 Summary of proposed 2021 storages

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
Dirty water dams									
SD3	Sediment dam located south-west of spoil dump	Dirty runoff from partially rehabilitated spoil dump	90th %ile 5 day	50%	0.4 to 0.75	213.2	92.1	100.0	
SD6	Sediment dam located downstream of MIA (referred to as Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8	90th %ile 5 day	50%	0.4 to 0.75	63.5	14.6	52.2	
SD7	Sediment dam located in eastern spoil dump	Dirty runoff from spoil dump and clean runoff from undisturbed catchment	90th %ile 5 day	50%	0.4 to 0.75	229.1	64.4	69.9	SD7 water is harvested as elevation of catchment does not allow for return to environment. SD7 overflows to pit in 2021.
SD8	Sediment dam located in MIA	Dirty runoff from MIA	90th %ile 5 day	50%	0.75	13.0	5.6	9.8	
SD23	Sediment dam located near topsoil stockpile	Dirty runoff from topsoil stockpile	90th %ile 5 day	50%	0.75	20.0	8.7	9.5	
Contaminated water dams									
SD10	Contaminated water dam located in CHPP	Contaminated runoff from product coal stockpile	100 yr ARI 72 hr + 'reuse zone'	20%	0.85	27.1	70.7	116.4	
SD11	Contaminated water dam located at rail loop	Contaminated runoff from rail loop	100yr ARI 72hr	20%	0.85	3.8	10.0	16.4	

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
SD12	Contaminated water dam located in CHPP	Contaminated runoff from ROM coal stockpile	100yr ARI 72hr	20%	0.85	52.6	136.6	206.6	
SD28	Contaminated water dam located in CHPP	Contaminated runoff from rail loop area	100yr ARI 72hr	20%	0.85	1.0	2.6	3.5	
MW3	Mine water dam located south of MIA	Surplus contaminated water pumped from SD10 and clean runoff from small grassed catchment	100yr ARI 72hr	0%	1.0 (Turkey's nest)	22.0	22.5	153.5	Freeboard of 22.5 ML will be maintained
MW5	Mine water dam (turkey's nest dam)	Contaminated water pumped from pit	100yr ARI 72hr	0%	1.0 (Turkey's nest)	15.2	38.8	2200.0	Freeboard of 38.8 ML will be maintained
In-pit	In-pit storage during wet periods	Contaminated runoff and groundwater make captured in the mining void sumps	Water balance	0%	-	-		-	Surplus contaminated water stored in-pit when capacity of MWDs reached

Table C 4 Summary of proposed 2021 discharge points

EPL identification number	Discharge type	Storage	Location / description	Stored water
Point 3	Discharge water quality monitoring and Wet weather discharge	SD3	Sediment dam located south-west of spoil dump	Dirty runoff from partially rehabilitated spoil dump
Point 1	Discharge water quality monitoring and Wet weather discharge	SD6	Sediment dam located downstream of MIA (Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8
Point 4	Discharge water quality monitoring and Wet weather discharge	SD4	Sediment dam located downstream of train load out area west of BCM	Runoff from train load out area

Table C 5 Summary of proposed 2024 storages

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
Dirty water dams									
SD3	Sediment dam located south-west of spoil dump	Dirty runoff from partially rehabilitated spoil dump, and overflows from SD7	90th %ile 5 day	50%	0.4 to 0.75	641.5	209.3	209.3	Upgrade from 100 ML to 209 ML required to cater for expanding spoil catchment (as SD13 is no longer proposed). Alternatively, if SD3 remains at 100 ML, a new sediment dam SD13 is required.
SD6	Sediment dam located downstream of MIA (referred to as Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8	90th %ile 5 day	50%	0.4 to 0.75	63.5	14.6	52.2	
SD7	Sediment dam located in eastern spoil dump	Dirty runoff from spoil dump and clean runoff from undisturbed catchment	90th %ile 5 day	50%	0.4 to 0.75	247.0	57.7	69.9	SD7 water released to environment following settling of suspended solids (assuming that the EPL discharge criteria is met)
SD8	Sediment dam located in MIA	Dirty runoff from MIA	90th %ile 5 day	50%	0.75	13.0	5.6	9.8	
SD23	Sediment dam located near topsoil stockpile	Dirty runoff from topsoil stockpile	90th %ile 5 day	50%	0.75	20.0	8.7	9.5	
Contaminated water dams									
SD10	Contaminated water dam located in CHPP	Contaminated runoff from product coal stockpile	100 yr ARI 72 hr + 'reuse zone'	20%	0.85	27.1	70.7	116.4	
SD11	Contaminated water dam located at rail loop	Contaminated runoff from rail loop	100yr ARI 72hr	20%	0.85	3.8	10.0	16.4	

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
SD12	Contaminated water dam located in CHPP	Contaminated runoff from ROM coal stockpile	100yr ARI 72hr	20%	0.85	52.6	136.6	206.6	
SD28	Contaminated water dam located in CHPP	Contaminated runoff from rail loop area	100yr ARI 72hr	20%	0.85	1.0	2.6	3.5	
MW3	Mine water dam located south of MIA	Surplus contaminated water pumped from SD10 and clean runoff from small grassed catchment	100yr ARI 72hr	0%	1.0 (Turkey's nest)	22.0	22.5	153.5	Freeboard of 22.5 ML will be maintained
MW5	Mine water dam (turkey's nest dam)	Contaminated water pumped from pit	100yr ARI 72hr	0%	1.0 (Turkey's nest)	15.2	38.8	2000.0	Freeboard of 38.8 ML will be maintained
In-pit	In-pit storage during wet periods	Contaminated runoff and groundwater make captured in the mining void sumps	Water balance	0%	-	-	Predicted maximum volume stored in pit 1120 ML	-	Surplus contaminated water stored in-pit when capacity of MWDs reached

Table C 6 Summary of proposed 2024 discharge points

EPL identification number	Discharge type	Storage	Location / description	Stored water
Point 3	Discharge water quality monitoring and Wet weather discharge	SD3	Sediment dam located south-west of spoil dump	Runoff from rehabilitated spoil dump and overflows from SD7
Point 1	Discharge water quality monitoring and Wet weather discharge	SD6	Sediment dam located downstream of MIA (Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8
TBA	Discharge water quality monitoring	SD7	Sediment dam located in eastern spoil dump	Dirty runoff from spoil dump and clean runoff from undisturbed catchment

Table C 7 Summary of proposed 2033 storages

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
Dirty water dams									
SD3	Sediment dam located south-west of spoil dump	Dirty runoff from partially rehabilitated spoil dump	90th %ile 5 day	50%	0.4 to 0.75	197.7	49.6	209.3	Sized for 2024 catchment
SD6	Sediment dam located downstream of MIA (referred to as Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8	90th %ile 5 day	50%	0.4 to 0.75	63.5	14.6	52.2	
SD8	Sediment dam located in MIA	Dirty runoff from MIA	90th %ile 5 day	50%	0.75	13.0	5.6	9.8	
SD19	Sediment dam located in spoil dump	Runoff from recently rehabilitated spoil dump and overflows from SD20	90th %ile 5 day	50%	0.75	415.3	179.9	179.9	New dam. Sized using 0.75 runoff coefficient for recently rehabilitated areas
SD20	Sediment dam located in spoil dump	Dirty runoff from spoil dump	90th %ile 5 day	50%	0.75	100.9	41.8	41.8	New dam
SD21	Sediment dam located in spoil dump	Dirty runoff from spoil dump	90th %ile 5 day	50%	0.75	127.5	55.6	55.6	New dam
SD22	Sediment dam located in spoil dump	Dirty runoff from spoil dump	90th %ile 5 day	50%	0.75	5.5	2.4	2.4	New dam
SD23	Sediment dam located near topsoil stockpile	Dirty runoff from topsoil stockpile	90th %ile 5 day	50%	0.75	20.0	8.7	9.5	

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
SD24	Sediment dam located in spoil dump	Dirty runoff from spoil dump	90th %ile 5 day	50%	0.75	16.9	7.3	7.3	New dam
Contaminated water dams									
SD10	Contaminated water dam located in CHPP	Contaminated runoff from product coal stockpile	100 yr ARI 72 hr + 'reuse zone'	20%	0.85	27.1	70.7	116.4	
SD11	Contaminated water dam located at rail loop	Contaminated runoff from rail loop	100yr ARI 72hr	20%	0.85	3.8	10.0	16.4	
SD12	Contaminated water dam located in CHPP	Contaminated runoff from ROM coal stockpile	100yr ARI 72hr	20%	0.85	52.6	136.6	206.6	
SD28	Contaminated water dam located in CHPP	Contaminated runoff from rail loop area	100yr ARI 72hr	20%	0.85	1.0	2.6	3.5	
MW3	Mine water dam located south of MIA	Surplus contaminated water pumped from SD10 and clean runoff from small grassed catchment	100yr ARI 72hr	0%	1.0 (Turkey's nest)	22.0	22.5	153.5	Freeboard of 22.5 ML will be maintained
MW5	Mine water dam (turkey's nest dam)	Contaminated water pumped from pit	100yr ARI 72hr	0%	1.0 (Turkey's nest)	15.2	38.8	2000.0	Freeboard of 38.8 ML will be maintained

Storage	Location / description	Stored water	Design criteria	Additional sediment allowance	Runoff coefficient	Catchment area (ha)	Required minimum capacity (ML)	Proposed capacity (ML)	Notes
In-pit	In-pit storage during wet periods	Contaminated runoff and groundwater make captured in the mining void sumps	Water balance	0%	-	-	Predicted maximum volume stored in pit 1310 ML	-	Surplus contaminated water stored in-pit when capacity of MWDs reached
Clean water dams									
CD5	Highwall dam located ahead of pit	Undisturbed catchment runoff	100yr ARI 72hr	0%	0.4	19.9	20.5	20.5	New dam
CD6	Highwall dam located ahead of pit	Undisturbed catchment runoff	100yr ARI 72hr	0%	0.4	20.7	21.4	21.4	New dam
CD7	Highwall dam located ahead of pit	Undisturbed catchment runoff	100yr ARI 72hr	0%	0.4	102.9	105.4	105.4	New dam
CD8	Highwall dam located ahead of pit	Undisturbed catchment runoff	100yr ARI 72hr	0%	0.4	18.3	19.1	19.1	New dam

Table C 8 Summary of proposed 2033 discharge points

EPL identification number	Discharge type	Storage	Location / description	Stored water
Point 3	Discharge water quality monitoring and Wet weather discharge	SD3	Sediment dam located south-west of spoil dump	Runoff from rehabilitated spoil dump
Point 1	Discharge water quality monitoring and Wet weather discharge	SD6	Sediment dam located downstream of MIA (Nagero Dam)	Runoff from grassed areas near MIA, and overflows from SD8
Point 4	Discharge water quality monitoring and Wet weather discharge	SD4	Sediment dam located downstream of train load out area west of BCM	Runoff from train load out area
TBC	Discharge to waters	-	Outlet from clean water dams	-