



Boggabri Coal Operations Pty Ltd
Boggabri Coal Mine
2021 Annual Review
5 December 2022



Revision Control Chart


Rev No	1	2	3	4
Revision Date	5 May 2022	13 May 2022	5 December 2022	
Prepared by	James Bailey & Associates	James Bailey & Associates	T McDermott	
Reviewed by	H Russell	H Russell	H Russell	
Approved by	S Dunlop	S Dunlop	S Dunlop	
Signature				

Distribution Control

Company	Position
Boggabri Coal Operation Pty Ltd (BCOPL)	Environment Superintendent
Department of Regional NSW – Mining Exploration and Geosciences	Regional Environment Officer
Department of Planning and Environment	Senior Planning Officer
Department of Primary Industries – Agriculture	Area Manager North West
Department of Planning 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	<ul style="list-style-type: none"> • Idemitsu 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 Leases	<ul style="list-style-type: none"> • Idemitsu 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	<ul style="list-style-type: none"> • Idemitsu 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%.
MOP Commencement Date	1 January 2020

Annual Review Title Block	
MOP Completion Date	2 July 2022*
Annual Review Commencement Date	1 January 2021
Annual Review Completion Date	31 December 2021
I, Stewart Dunlop, certify that this audit report is a true and accurate record of the compliance status of Boggabri Coal Mine for the period 1 January 2021 to 31 December 2021 and that I am authorised to make this statement on behalf of Boggabri Coal Operations Pty Limited.	
Name of authorised reporting officer	Stewart Dunlop
Title of authorised reporting officer	Deputy General Manager
Signature of authorised reporting officer	
Date	5 December 2022

* NSW Rehabilitation Reforms is scheduled to commence from 2 July 2022 at which point the MOP will be superseded.

Contents

	Page Number
1 STATEMENT OF COMPLIANCE.....	1
2 INTRODUCTION.....	4
2.1 Mine Operation Introduction and History	4
2.2 Mine Contacts	5
2.3 Purpose and Scope of Report.....	5
3 APPROVALS.....	7
3.1 Approvals, Licences and Mining Leases.....	7
4 SUMMARY OF OPERATIONS	9
4.1 Mining Preparation	9
4.2 Mining Operations	9
4.2.1 Equipment	9
4.2.2 Activities	10
4.2.3 Operational Closures During 2021	10
4.2.4 Pit Progression	10
4.2.5 Production Waste	10
4.3 Production Statistics.....	11
4.3.1 Saline or Potentially Acid Forming Materials	12
4.4 Exploration	12
4.5 Construction Activities during 2021.....	12
4.6 Next Reporting Period.....	13
4.6.1 Mining	13
4.6.2 Exploration	13
4.6.3 Construction	13
4.6.4 Production Waste	13
5 ACTIONS REQUIRED FROM 2020 ANNUAL REVIEW	14
6 ENVIRONMENTAL MANAGEMENT AND PERFORMANCE	15
6.1 Meteorology	16
6.1.1 Environmental Management	16
6.1.2 Environmental Performance	17
6.1.3 Improvements and Initiatives	21
6.2 Air Quality.....	21
6.2.1 Environmental Management	21
6.2.2 Environmental Performance	23
6.2.3 Improvements and Initiatives	26
6.3 Operational Noise	26

6.3.1	Environmental Management	26
6.3.2	Environmental Performance	27
6.3.3	Improvements and Initiatives	31
6.4	Blasting.....	32
6.4.1	Environmental Management	32
6.4.2	Environmental Performance	32
6.4.3	Improvements and Initiatives	34
6.5	Biodiversity	35
6.5.1	Environmental Management	35
6.5.2	Environmental Performance	36
6.5.3	Improvements and Initiatives	49
6.6	Hazardous Materials	49
6.6.1	Environmental Management	49
6.6.2	Environmental Performance	50
6.7	Waste Management.....	52
6.7.1	Environmental Management	52
6.7.2	Environmental Performance	54
6.8	Spontaneous Combustion.....	55
6.8.1	Environmental Management	55
6.8.2	Environmental Performance	56
6.9	Heritage.....	56
6.9.1	Environmental Management	56
6.9.2	Environmental Performance	56
6.9.3	Preliminary Results	58
6.9.4	Improvements and Initiatives	60
6.10	Greenhouse Gases	60
6.10.1	Environmental Management	60
6.10.2	Environmental Performance	60
6.10.3	Improvements and Initiatives	61
6.11	Public Safety	62
6.11.1	Environmental Management	62
6.11.2	Environmental Performance	62
6.12	Traffic	63
6.12.1	Environmental Management	63
6.12.2	Environmental Performance	63
6.13	Socio-economic.....	64
6.13.1	Socio-economic Management	64
6.13.2	Environmental Performance	65
7	WATER MANAGEMENT	70
7.1	Surface Water	70
7.1.1	Erosion and Sediment Control	70
7.1.2	Surface Water Quality Monitoring	71
7.1.3	Environmental Performance	73
7.1.4	Improvements and Initiatives	81
7.2	Groundwater	81

7.2.1	Environmental Management	81
7.2.2	Environmental Performance	83
7.2.3	Improvements and Initiatives	93
8	REHABILITATION	94
8.1	Rehabilitation Methodology.....	94
8.2	Rehabilitation Progress.....	95
8.2.1	Summary of Land Rehabilitation	95
8.2.2	2021 Plantings	95
8.2.3	Rehabilitation Status	95
8.2.4	Comparison with MOP Predictions	97
8.3	Removal of Buildings	97
8.4	Rehabilitation Biodiversity Monitoring	97
8.4.1	Photographic Monitoring	98
8.4.2	Summary of Findings	100
8.5	Growth Performance	102
8.5.1	Growth Medium Suitability	102
8.6	Rehabilitation Improvements and Initiatives	102
8.7	Rehabilitation in 2022.....	103
8.7.1	Topsoils and Forest Resources	103
8.7.2	Drainage and Erosion Controls	103
8.7.3	Seed Collection and Planting	103
8.7.4	Temporary stabilisation	103
8.7.5	Monitoring	103
9	COMMUNITY	104
9.1	Community Programs and Investment.....	104
9.2	Community Consultative Committee.....	105
9.3	Complaints	105
9.3.1	Management of Complaints	105
9.3.2	Registered Environmental Complaints	106
9.4	Workforce Profile.....	107
9.4.1	BCOPL Employees	107
9.4.2	Mining Contractors	107
10	AUDITS.....	109
10.1	Independent Environmental Audit (2020)	109
10.1.1	Scope of Audit	109
10.1.2	Audit Outcomes	109
10.1.3	DPE Review	109
10.1.4	Status of audit recommendations	110
10.2	EPBC Independent Audit (2020).....	110
11	INCIDENTS AND NON-COMPLIANCES	111

12 ACTIVITIES PROPOSED FOR NEXT ANNUAL REVIEW PERIOD113

REFERENCES.....114

List of Tables

Table 1-1	Statement of Compliance	1
Table 1-2	Non-Compliances During the Reporting Period	2
Table 2-1	BCM Mine Contacts	5
Table 3-1	Key Approvals, Consents, Mining Leases and Licences	7
Table 4-1	Equipment Fleet as at December 2021	9
Table 4-2	Production and Waste Rock Summary	11
Table 4-3	Compliance with SSD Conditions	11
Table 4-4	Summary of Construction Activities during the Reporting Period	13
Table 6-1	Key EMPS	15
Table 6-2	MET Parameters	16
Table 6-3	Monthly Average and Maximum Wind Speeds and Dominant Wind Directions (60m AWS)	19
Table 6-4	Air Quality Monitoring Sites	22
Table 6-5	Depositional Dust – Annual Average Results	23
Table 6-6	Current Attended Noise Monitoring Locations	27
Table 6-7	Noise Limits	28
Table 6-8	Summary of Attended Noise Monitoring Results - dB(A) L_{Aeq} (15 minutes) & L1 (1 min)	29
Table 6-9	Summary of 2021 Sound Power Screening Results	30
Table 6-10	Vegetation communities identified in 2021 tree clearing area	37
Table 6-11	Animal Groups Encountered During Clearing Operations	39
Table 6-12	Threatened Species Encountered During Clearing Operations	39
Table 6-13	Preliminary Stygofauna Sampling Data	40
Table 6-14	Explosives and Hazardous Materials Licence/Notification Holders	50
Table 6-15	Diesel Fuel Consumption	51
Table 6-16	Waste Disposal in Litres from 2018-2021	53
Table 6-17	Summary of Bioremediation Areas	55
Table 6-18	BCOPL GHG and Energy Statistics	60
Table 6-19	Social Impact Monitoring Summary	65
Table 6-20	Local School Enrolments 2011 - 2019	69
Table 7-1	Surface Water Quality Monitoring Regime	72
Table 7-2	Surface Water Quality Testing Parameters	73
Table 7-3	Summary of Frequency Based Monitoring Results – Rainfall Events	75
Table 7-4	Summary of Frequency Based Monitoring Results	76
Table 7-5	Water Take	77
Table 7-6	Predicted Water Demand	78
Table 7-7	Water Storage Summary	79
Table 7-8	Groundwater Quality Testing Parameters	81
Table 7-9	Groundwater Monitoring Bores	82
Table 7-10	Minimum Measured Groundwater Levels	83
Table 7-11	Groundwater Level Trigger Value	86
Table 7-12	Results Summary for In Situ Water Quality Measurements	88
Table 7-13	Results Summary for Analysis of Major Ions	90
Table 7-14	Results Summary for Analysis of Metals	91
Table 7-15	Results Summary for Analysis of Nutrients	91
Table 7-16	Long Term Mann-Kendall Water Quality Trends	92
Table 8-1	Rehabilitation Status	95

Table 8-2	Survey Locations for Rehabilitation Monitoring Sites at BCM	98
Table 9-1	BCOPL Community Funding 2021	104
Table 9-2	Complaint Summary	107
Table 9-3	Residential Locality of BCOPL Employees	107
Table 9-4	Residential Locality of Contractor Employees	108
Table 11-1	Notices and Warnings Received during the Reporting Period	111
Table 11-2	Non-Compliances and Exceedances during 2021	112
Table 12-1	Activities Proposed for Next Reporting Period	113
Table A-0-1	Annual Review requirements	1

List of Figures

Figure 2-1	Locality Map	6
Figure 6-1	2021 Monthly Temperature Records	17
Figure 6-2	Monthly Rainfall	18
Figure 6-3	Comparison of 2020 and 2021 Rainfall	18
Figure 6-4	Monthly Wind Rose Summary January – December 2021	Error! Bookmark not defined.
Figure 6-7	Merriown PM ₁₀ Monitoring 2021 Results	24
Figure 6-8	Glenhope PM ₁₀ Monitoring 2021 Results	25
Figure 6-9	Summary of Peak Vibration Monitoring Results	33
Figure 6-10	Blast Overpressure Results	34
Figure 6-11	Sources of BCM Scope 1 and Scope 2 Emissions	61
Figure 7-1	Monthly Dust Suppression Water Usage (ML)	78
Figure 7-2	Modelled vs Observed Site Water Inventory	80
Figure 7-3	Long Term Groundwater Levels for all Bores	84
Figure 7-4	Groundwater Trends in pH	87
Figure 7-5	Groundwater Trends in Electrical Conductivity	88
Figure 8-1	Extent of Mining and Rehabilitation at the end of the 2021 Reporting Period	96
Figure 8-2	2008 Rehabilitation (13 years old)	98
Figure 8-3	2008D Rehabilitation (13 years old)	99
Figure 8-4	2010 Rehabilitation (11 years old)	99
Figure 8-5	2018A Rehabilitation (3 years old)	99

List of appendices

Appendix A	Annual Review Requirements
Appendix B	Environmental Monitoring Location Maps
Appendix C	Biodiversity Monitoring Maps
Appendix D	Regulator Correspondence
Appendix E	BCM 2021 Exploration Drilling
Appendix F	2021 BCM IEA Response Action Plan
Appendix G	Proposed 2022 Tree Clearing Areas Covered by Arch Survey and Salvage during 2021

Acronyms

Abbreviations	Terms
$\mu\text{g}/\text{m}^3$	Micrograms per metre cubed
$\mu\text{S}/\text{cm}$	Microsiemens per centimetre
Ausdrill	Ausdrill Limited
AHCS	Aboriginal Heritage Conservation Strategy
AIA	Agricultural Impact Assessment
AN	Ammonium Nitrate
ANFO	Ammonium Nitrate/ Fuel Oil
AQGHGMP	Air Quality and Greenhouse Gas Management Plan
ASCF	Aboriginal Stakeholder Consultative Forum
BBAM	BioBanking Assessment Methodology 2014
BC Act	Biodiversity Conservation Act 2016 NSW
BCM	Boggabri Coal Mine
BCOPL	Boggabri Coal Operations Pty Limited
BCT	Boggabri Coal Terminal
BFMP	Blast Fume Management Protocol
BLMP	Blast Management Plan
BMP	Biodiversity Management Plan
BOA	Biodiversity Offset Area
BOS	Biodiversity Offset Strategy
BTM Complex	Boggabri-Tarrawonga-Maules Creek Complex
CCC	Community Consultative Committee
CHMP	Cultural Heritage Management Plan
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
DAWE	Department of Agriculture, Water and the Environment (Cth)
dB(A) L_{eq} (15 minutes)	Decibels A-Weighted with a Equivalent Continuous Sound Pressure Level over 15minutes
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EA	Environmental Assessment
EC	Electrical Conductivity
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i> (NSW)
EPA	Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
EPL	Environment Protection Licence
Forestry NSW	NSW Forestry Corporation of NSW
g/m²/month	Grams per metre squared per month
GHG	Greenhouse Gas
GJ	Gigajoules
GSC	Gunnedah Shire Council
GWMP	Groundwater Management Plan

Abbreviations	Terms
ha	Hectares
HTV	High Trigger Value
HVAS	High Volume Air Sampler
IA	Idemitsu Australia Pty Ltd
IEA	Independent Environment Audit
IMT	Indurated mudstone/tuff
kbcm	Kilo Bank Cubic Metres
LA ₁ (1 minute)	The noise level which is exceeded for 1 per cent of the specified time period of 1 minute.
L _{Aeq} (15 minutes)	Equivalent Continuous Sound Pressure Level over 15minutes
LGA	Local Government Area
LTV	Low Trigger Value
m/s	metres per second
mAHD	metres Australian Height Datum
Mbcm	million bank cubic metres
mBGL ^B	metres Below Ground Level
mbtoc	Metres below top of casing
MCCM	Maules Creek Coal Mine
MEG	Department of Regional NSW - Division of Mining, Exploration and Geoscience
MET Station	BCM Meteorological Monitoring Station
mg/L	milligrams per litre
MIA	Mine Infrastructure Area
ML	Mining Lease
MOP	Mining Operations Plan
Mt	Million tonnes
Mtpa	Million Tonnes Per Annum
MTV	Medium Trigger Value
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i> (Cth)
NGERs	National Greenhouse and Energy Reporting
NMP	Noise Management Plan
NPI	National Pollutant Inventory
NSC	Narrabri Shire Council
Orica	Orica Australia Pty Ltd
PA	Project Approval
PAF	Potential Acid Forming
PM ₁₀	Particulate matter < 10 µm
PM _{2.5}	Particulate matter < 2.5 µm
RAPs	Registered Aboriginal Parties
RBS	Leard Forest Regional Biodiversity Strategy
RMP	Rehabilitation Management Plan
ROM	Run of Mine
SIMP	Social Impact Management Plan
SPL	Sound Power Level
SSD	State Significant Development approval (formerly Project Approval) 09_0182
SWB	Site Water Balance

Abbreviations	Terms
SWMP	Surface Water Management Plan
t CO ₂ -e	Tonnes of Carbon Dioxide Equivalent
TCM	Tarrawonga Coal Mine
TEOM	Tapered Element Oscillating Microbalance
TLO	Train Load-out Facility
TMP	Traffic Management Plan
TSP	Total Suspended Particulates
ULSD	Ultra-Low Sulphur Diesel
WAL	Water Access Licence
WMP	Water Management Plan

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 Boggabri Coal Mine’s (BCM’s) planning approval State Significant Development approval (SSD) 09_0182 (including Statement of Commitments), mining leases (MLs) and other relevant approvals as at the end of the 2021 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	Yes
Authorisation 355	Yes
Authorisation 339	Yes
EPL 12407	No
WAL 12691	Yes
WAL 12767	Yes
WAL 15037	Yes
WAL 24103	Yes
WAL 29473	Yes
WAL 29562	Yes
WAL 2571	Yes
WAL 2572	Yes
WAL 2595	Yes
WAL 2596	Yes
WAL 36547	Yes
WAL 37519	Yes
WAL 37067	Yes
WAL 42234	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	Sound power screening during 2021 recorded thirteen items of screened plant that recorded exceedances of 3dB or greater.	Section 6.3.2.2.2
SSD 09_0182	Schedule 3 Condition 38(b)	Surface Water Management Plan (SWMP)	Non-Compliance Low Risk	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.	Section 7.1.2.1
SSD 09_0182	Schedule 3 Condition 38(c)	Groundwater Management Plan (GWMP)	Non-Compliance Low Risk	Groundwater monitoring was not undertaken at all required bores during the reporting period because some monitoring bores have been mined through. The GWMP needs to be revised to account for destroyed monitoring bores.	Section 7.2.1.1
SSD 09_0183	Schedule 3 Condition 54	Eucalyptus Forestry Plantation Offset Strategy	Non-Compliance Low Risk	BCOPL are required to prepare a Eucalyptus Forestry Plantation Offset Strategy to the satisfaction of Forestry corporation of NSW (Forestry NSW) within 12 months of the date of SDD 09_0182. SSD 09_0182 was approved 18 July 2012.	Section 11
EPL12407	M2.2	Air Monitoring requirements	Non-Compliance Low Risk	The High Velocity Air Sampler (HVAS) unit located at the Glenhope property could not be accessed due to regional flooding and accordingly did not obtain samples on 23 and 29 November 2021.	Section 6.2.2.2.1
EPL12407	M2.2	Air Monitoring requirements	Non-Compliance Low Risk	The HVAS monitoring network in place for the BCM was not in line with monitoring sites specified within the EPL. The Cooboobindi HVAS was relocated to the Glenhope property during June 2020. An EPL variation was approved on 5 February 2021.	Section 6.2.1

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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

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 Pty Ltd (IA) and its joint venture partners. BCOPL is owned by IA, a subsidiary of Japanese company, Idemitsu Kosan Pty Ltd. BCM is owned by the following joint venture partners:

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

Environmental assessment 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 (now known as SSD 09_0182), was granted by the NSW Planning Assessment Commission (now Independent Planning Commission) in June 2012, allowing for extraction of up to 8.6 Million tonnes per annum (Mtpa) of run of mine (ROM) coal from BCM until the end of 2033 (the Project).

Under SSD 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 SSD 09_182 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 on the 27 May 2019.

On 20 June 2019, a delegate of Minister declared the SSD 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 operates in accordance with the MOP, Amendment A dated March 2020 that applies to activities at the BCM between 2020 and 2024. An Addendum to the MOP, Amendment A was approved on 28 January 2022. With the commencement of the Rehabilitation Reforms on 2 July 2022, the approved MOP will be replaced by a Rehabilitation Management Plan and other supporting documentation. This documentation is under preparation in accordance with the relevant Resources Regulator Form and Way and Guideline documents.

2.2 Mine Contacts

Table 2-1 BCM Mine Contacts

Acting General Manager Operations: Company: Address: Phone: Fax:	Stewart Dunlop 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

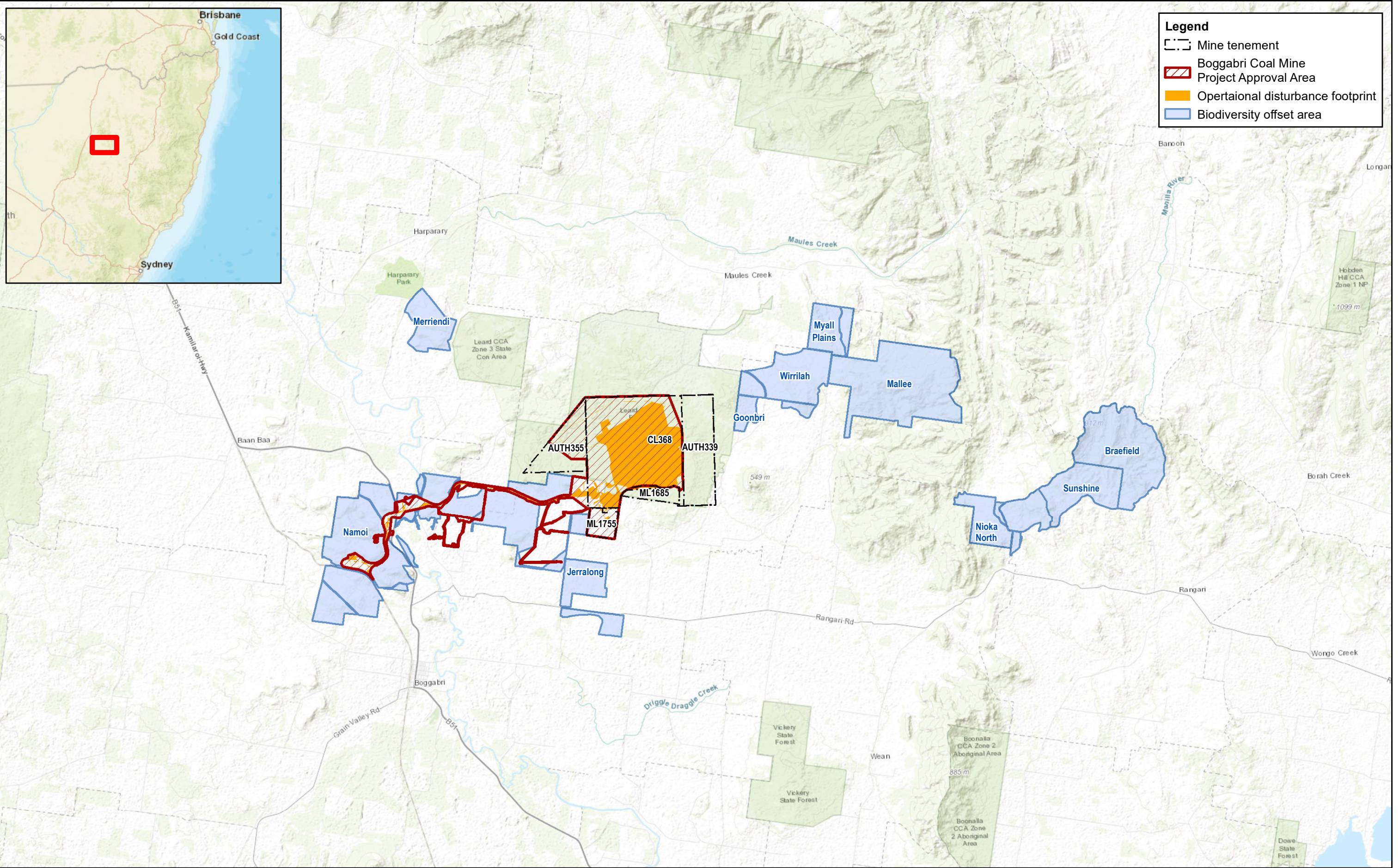
This Annual Review discusses the environmental performance of BCOPL and its contractors, in relation to compliance with the conditions of SSD 09_0182, and other relevant leases, licences and approvals. It provides a summary of operational and environmental management activities undertaken at the BCM during the reporting period (1 January to 31 December 2021) 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); and
- 2020-2024 MOP, Amendment A dated March 2020 and MOP Addendum dated December 2021 (approved 28 January 2022).

Key requirements of these approvals are described in Appendix A. A map illustrating the mine locality and BCM 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 2 months to the submission of the 2021 Annual Review from the date of the extension request on the 14 March 2022 from DPE. DPE acknowledged this extension requesting that the Annual Review be submitted by the 14 May 2022. Correspondence confirming this acknowledged is provided in Appendix D.



Legend

- Mine tenement
- Boggabri Coal Mine
- Project Approval Area
- Operational disturbance footprint
- Biodiversity offset area

0 3 6 km

Scale 1:175,000

Projection: Transverse Mercator
 Coordinate System: GDA 1984 MGA Zone 56
 Scale correct when printed at A3 Landscape

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

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DOCUMENT BC2021_AEMR001_A1_locality
AUTHOR: suansrir
REVIEWED BY: N.Cooper
DATE: 9/03/2021



FIGURE **2-1**

TITLE: **LOCALITY PLAN**

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-Jul-12	31-Dec-33
EPBC Act Approval 2009/5256 (as varied)	11-Feb-13	31-Dec-53
Coal Leases/Mining Leases		
Coal Lease CL 368	15-Nov-90	14-Nov-32
Mining Lease ML1755	30-Jun-17	30-Jun-38
Mining Leases/Authorisations		
Authorisation A 355	19-Jul-84	11-Apr-18 (renewal lodged)
Authorisation A 339	11-Apr-84	11-Apr-22 (renewal lodged)
Environment Protection Licences		
Environment Protection Licence (EPL) 12407	11-Jan-06	In perpetuity (Anniversary 11 January)
Water Licences		
Water Access Licence (WAL)12691	1-Nov-06	In perpetuity
WAL12767	1-Nov-06	In perpetuity
WAL15037	1-Nov-06	In perpetuity
WAL24103	29-Jun-11	In perpetuity
WAL29473	16-Jan-12	In perpetuity
WAL29562	16-Jan-12	In perpetuity
WAL2571	1-Jul-04	In perpetuity
WAL2572	1-Jul-04	In perpetuity
WAL2595	1-Jul-04	In perpetuity
WAL2596	1-Jul-04	In perpetuity
WAL36547	17-Jan-14	In perpetuity
WAL37519	16-Feb-16	In perpetuity
WAL42234	9-Jan-19	In perpetuity
90FW833717	21-Sep-15	4-Apr-30
90FW834023	21-Sep-15	4-Jun-29
Mining Operations Plans (MOP)		
Current MOP	1-Jan-20	2-Jul-22
Radiation Licences		

Description	Date granted/ commencement date	Expiry/duration
Licence No. 5083602	14-Jun-17	14-Jun-22
Council Approvals		
CC 04-04-2012 Mod1	22-Oct-12	In perpetuity
CC 02-03-2012	6-Jun-12	In perpetuity
CC 10-01-2012 Mod1	1-Jun-12	In perpetuity
OC 09-10-2013	19-Nov-13	In perpetuity
OC 02-04-2013	9-Apr-13	In perpetuity
OC 01-03-2013	28-Mar-13	In perpetuity
C6 – Approval to Operate a System of Sewage Management	20-Feb-12	13-May-24
Part 5 Determination – Goonbri Road Upgrade	28-Mar-14	In perpetuity
Forestry Corporation of NSW Agreements/Permits		
Forestry Compensation Agreement	15-May-09	14-Nov-32
Land Access and Compensation Arrangement	15-May-09	11-Apr-18 (renewal lodged)
Crown Lands Licences		
RI 507102	12-Nov-12	14-Nov-32
RI 533986	5-Jun-14	14-Nov-32

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 6.9.1).

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 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 2021, a total of 353,676m³ of topsoil was stripped and pushed into windows. 377,254m³ of topsoil was loaded and hauled to stockpiles for future reuse on rehabilitation. No topsoil was spread onto shaped overburden areas for rehabilitation during the reporting period.

As at the end of December 2021, a total of 2,016,469 m³ of topsoil and 260,669m³ of subsoil materials was stored in soil stockpiles across the BCM.

4.2 Mining Operations

4.2.1 Equipment

Truck and excavator operations continued to be undertaken as approved in the MOP (2020-2024) for the reporting period. The mining equipment fleet as at December 2021 is listed in Table 4-1.

Table 4-1 Equipment Fleet as at December 2021

Equipment	Number in fleet
Haul trucks	49
Excavators	12
Front end loaders	2
Dozers	19
Graders	4
Water carts	5
Service trucks	5
Drills	5
Total	101

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 Coal Mine (MCCM) lease boundary.

4.2.3 Operational Closures During 2021

Operational closures and lost production at BCM was experienced across 58 days during the 2021 reporting period. This was generally as a result of the wet weather, flooding and COVID. A total of 16 days of lost production were due to extreme flooding impacts in November and December 2021 which restricted access to the site.

4.2.4 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, mining development was primarily on Pits C and E (refer to Figure 8-1).

The 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. These pits are being progressively backfilled with waste in accordance with the MOP final landform design.

4.2.4.1 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.

4.2.4.2 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.

4.2.5 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 2021, mine production at BCM was carried out by BCOPL, with the assistance of Goldings Contractors Pty Ltd (Goldings). 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 2021 calendar year in relation to the previous 2020 calendar year and those forecast for the 2022 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)		
		2020 (actual)	2021 (actual)	2022 (predicted)
Waste Rock/ Overburden (Mbcm)	N/A	55.4	45.4	56.9
ROM Coal (Mt)	8.6	7.5	7.6	8.4
Reject Material (Mt)	N/A	1.3	1.5	1.8
Stripped Topsoil (kbcm)	N/A	264.59	377.25	184.25
Saleable Product (Mt)	8.6 (by rail)	6.3	6.6	7.0

Mining operations during the 2021 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 2021.
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 – 7.6 Mt of ROM coal was extracted in 2021.
11. The Proponent may process up to 4.2 million tonnes of ROM coal in the CHPP in any calendar year.	Compliant – 3.96 Mt of ROM coal was processed in the CHPP during 2021.
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 2021.
12. The Proponent may transport up to 10 million tonnes of product coal via the Boggabri Rail Spur Line in any calendar year; comprising:	Compliant – 6.7 Mt of product coal from the BCM was transported by rail in 2021. No

SSD Condition No. and Description	Compliance Response
(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.	coal from the Tarrawonga Coal Mine was received at BCM for transported during 2021.
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 2021. 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 Potentially Acid Forming (PAF) Testing Procedure (October 2016). In 2021, routine monitoring identified a number of coal reject samples with PAF qualities. This result was encountered following fortnightly sampling of coal reject materials from the CHPP over a 4 month period (October 2021 to February 2022). Reject materials 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 throughout 2021. All data, including the reject sampling undertaken in late 2021 indicated that there was a low risk of oxidation of reject materials given that the potential for acid forming conditions is appropriately managed by ensuring that there is *“at least 5 metres of non-carbonaceous capping material (must be category 3) (...) dumped over the top of the reject emplacement cell.”*

The elevated levels of sulphur and subsequent PAF qualities within the coal seams were investigated to determine if they will remain for ongoing mining operations. This investigation identified that the sulphur levels are not expected to change until mid to late 2024, where a small increase in sulphur content is predicted. BCOPL will continue to conduct routine sampling and testing of coal reject materials to identify PAF potential and to appropriately handle and disposed of these materials in accordance with the process currently described within Section 2.3.7 of the MOP.

4.4 Exploration

BCOPL continued an exploration drilling programme throughout 2021, to improve knowledge of coal quality and structure for modelling purposes.

A total of 39 exploration holes were drilled by BCOPL during the reporting period. Details of BCM's borehole drilling during 2021 and relevant figure is provided in Appendix E.

4.5 Construction Activities during 2021

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
ROM 1 Bin Construction	November 2021	November 2022 (predicted)
Ausdrill laydown area	April 2021	May 2021

4.6 Next Reporting Period

4.6.1 Mining

During 2022, 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 2022 includes the drilling of 64 holes with total depths varying from 180 m to 355 m. The exploration programme will continue to improve knowledge of coal quality, structure, geotechnical, geochemical and fugitive emission calculation purposes.

4.6.3 Construction

Construction activities during the 2022 report period are proposed to include the construction of temporary in pit mining offices (including associated access road), a security hut, and a lime dosing plant.

4.6.4 Production Waste

During 2022, 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 2020 ANNUAL REVIEW

The 2020 Annual Review was provided to NSW Department of Primary Industries (DPI) – Land and Natural Resources, DPE – Water, NSW Environment Protection Authority (EPA), Department of Planning, Industry and Environment (DPIE) (DPE), Department of Regional NSW – Resources Regulator and Forestry NSW in August 2021.

Correspondence received from DPE confirmed that the 2020 Annual Review satisfies the Annual Review Guideline requirements (see Appendix D). No comments were received from DPE regarding actions to be addressed in the 2021 Annual Review.

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) was updated and submitted to DPE (now known as DPE) in July 2019. BCOPL submitted a further revision to DPE in January 2022 for review and approval.

In response to recommendations within the 2020 Independent Environmental Audit (IEA), BCOPL has created a register to capture and track details of when documents have been updated including the requirement for the review and revision of management plans.

Table 6-1 Key EMPS

Management Plan	Version Approved by DPE*	BCOPL Revision	Awaiting Approval
Mining Operations Plan (MOP)	March 2020 – 2020 to 2024 Amendment A December 2021 – 2021 to 2 July 2022 MOP Addendum	Under revision for Rehabilitation Reforms	-
Blast Management Plan (BLMP)	November 2018 (Rev 5)	Under Revision	-
Blast Fume Management Protocol	July 2018 (Rev 3)	Under Revision	-
Air Quality and Greenhouse Gas Management Plan (AQGHGMP)	July 2018 (Rev 6)	Under Revision	-
Traffic Management Plan (TMP)	June 2017 (Rev 4)		TMP submitted to DPE for approval 23 March 2021.
Cultural Heritage Management Plan (CHMP)	November 2016 (Rev 7)	Under Revision	-
Environment Management Strategy (EMS)	June 2020 (Rev 2)	Under Revision	-

Management Plan	Version Approved by DPE*	BCOPL Revision	Awaiting Approval
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)	Under Revision	Rev 8 was submitted to DPE in July 2019. BCOPL is in consultation with NRAR.
Social Impact Management Plan (SIMP)	August 2021 (Rev 7)		
Rehabilitation Management Plan (RMP)	April 2020 (Rev 9)	Under Revision	Incorporated into the MOP at the request of DPE. 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	August 2021		-

*Based on internal final approval date

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 is shown on the Environmental Monitoring Location Plan in Appendix B.

The MET 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 and the method are outlined in Table 6-2.

Table 6-2 MET Parameters

Parameter	Units	Frequency	Averaging period
Temperature at 2 m	°C	Continuous	15 minute
Temperature at 10 m	°C	Continuous	15 minute
Wind direction at 10 m	°	Continuous	15 minute
Sigma theta at 10 m	°	Continuous	15 minute
Rainfall	mm/hr.	Continuous	1 hour
Solar radiation	W/m2	Continuous	15 minute

Parameter	Units	Frequency	Averaging period
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.

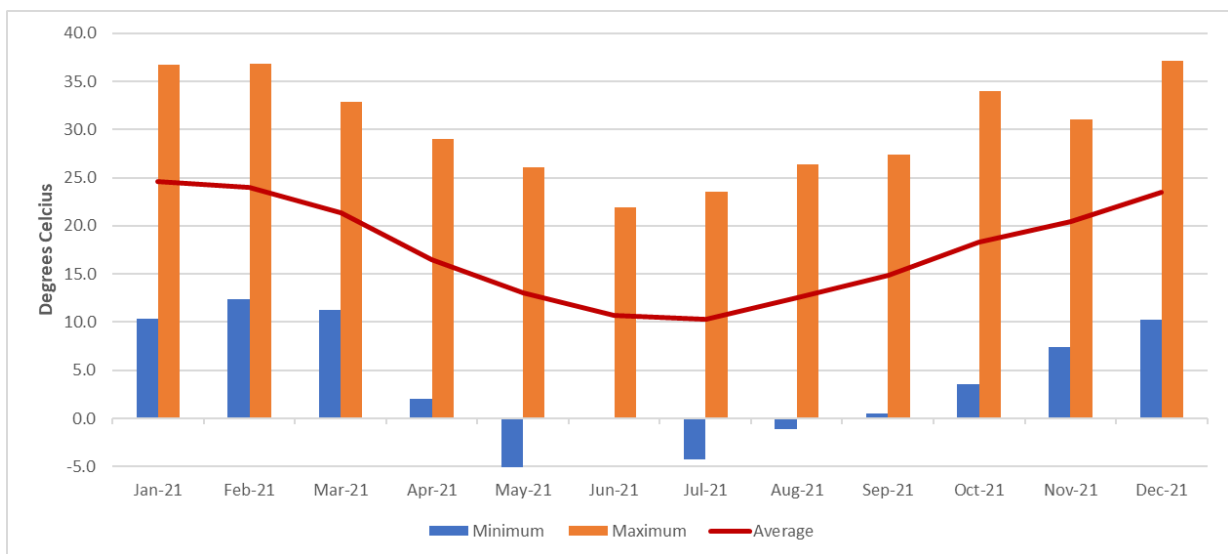


Figure 6-1 2021 Monthly Temperature Records

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 2021 reporting period are presented in Figure 6-2. Extreme rainfall conditions were experienced in November which resulted in extensive flooding in the local area which lead to 16 days operation shutdowns during November and December as is presented in Figure 6-3. A comparison of 2020-2021 rainfall is shown in Figure 6-3.

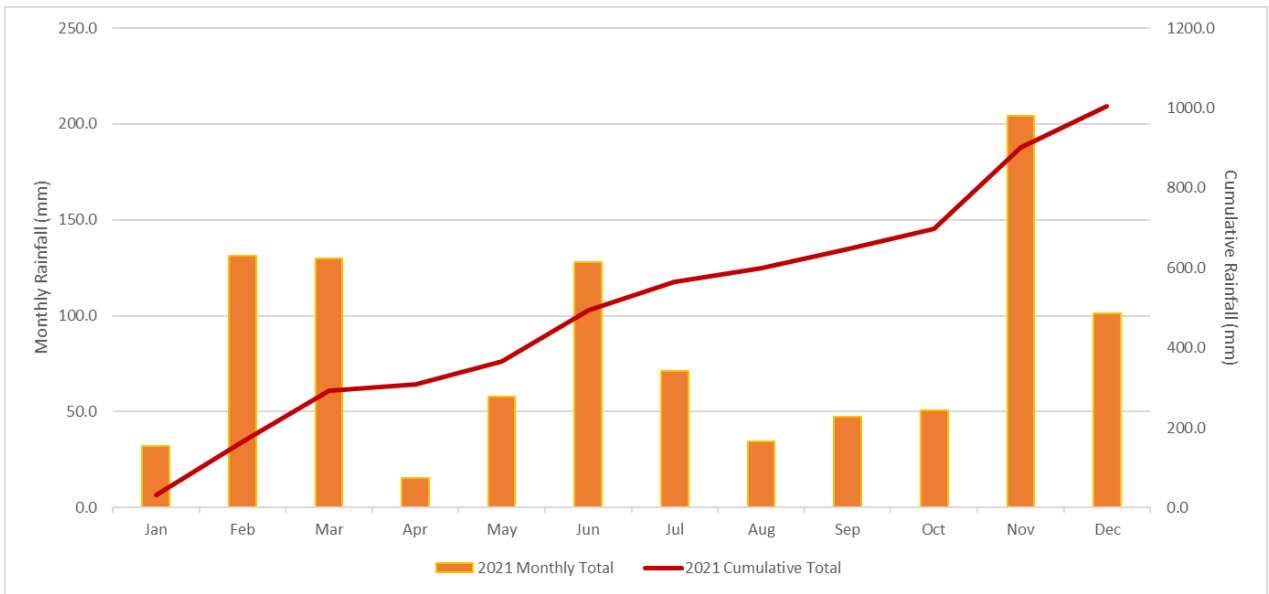


Figure 6-2 Monthly Rainfall

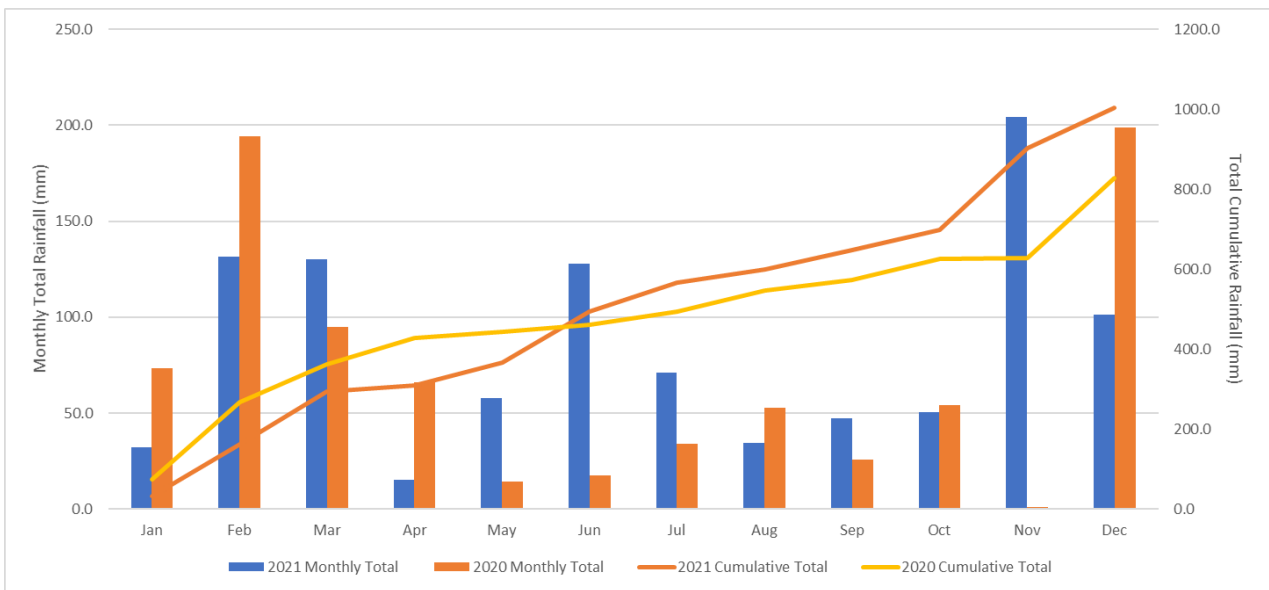


Figure 6-3 Comparison of 2020 and 2021 Rainfall

6.1.2.3 Wind

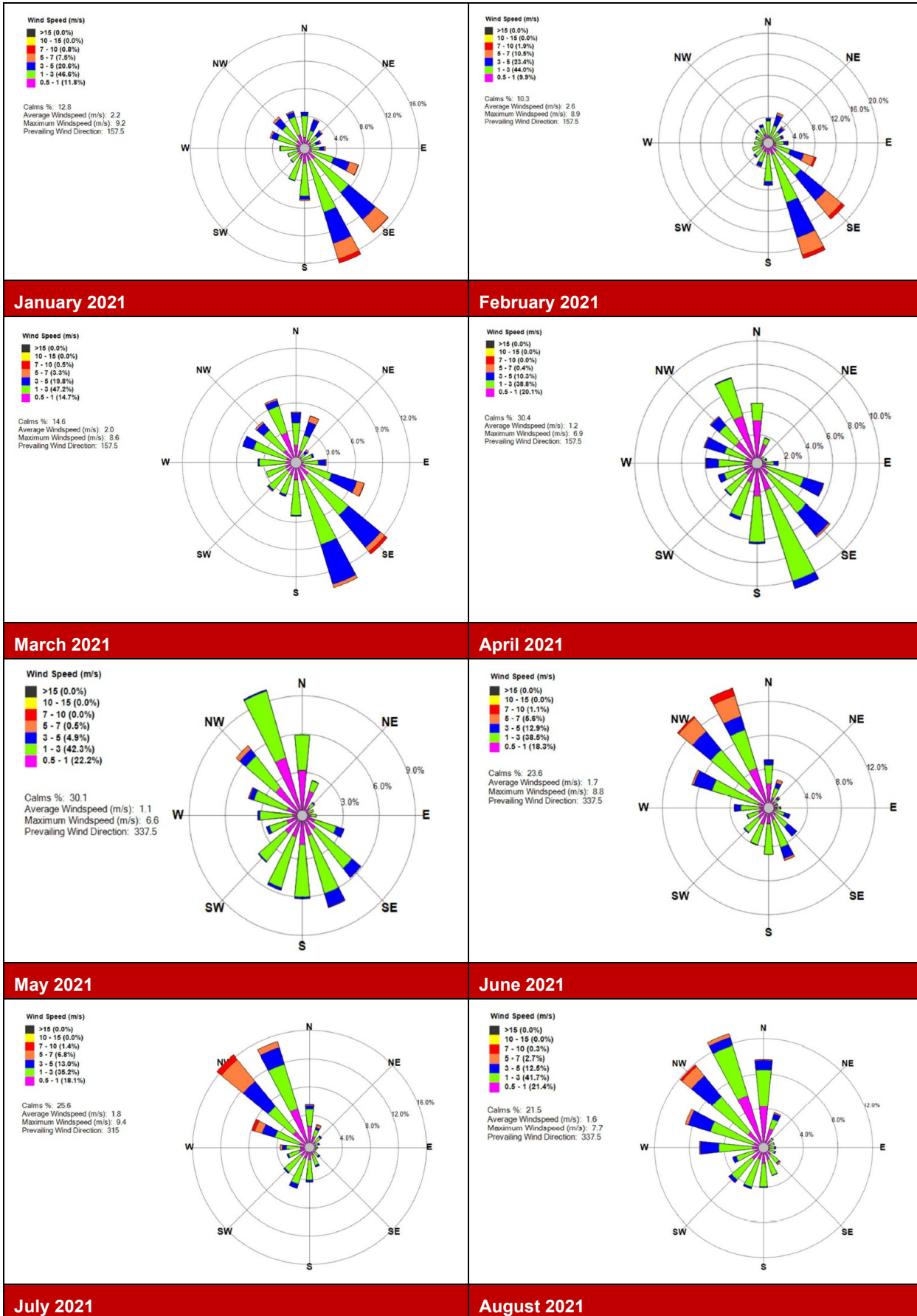
Wind speed and direction are important parameters for the planning and preparation of blasting activities, investigating noise and dust complaints, and assessing cumulative impacts as a result of other coal mines operating in the region. Wind data for the 2021 reporting period are provided in Table 6-3 and presented in the wind roses in Figure 6-4. Wind speed values are displayed as metres per second.

The prevailing wind conditions during the 2021 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 (60m AWS)

Month	Average Wind Speed (m/s)	Maximum Wind Speed Recorded (m/s)	Dominant Wind Directions
January 2021	2.3	9.9	SSE
February 2021	2.7	9.6	SSE
March 2021	2.0	11.7	SSE
April 2021	1.3	7.1	NNW
May 2021	1.2	7.9	NNW
June 2021	1.8	9.3	NNW
July 2021	1.9	10.4	NW
August 2021	1.7	8.0	NNW
September 2021	2.1	9.6	NNW
October 2021	2.1	10.3	NNW
November 2021	2.4	14.3	SSE
December 2021	2.3	11.3	SSE



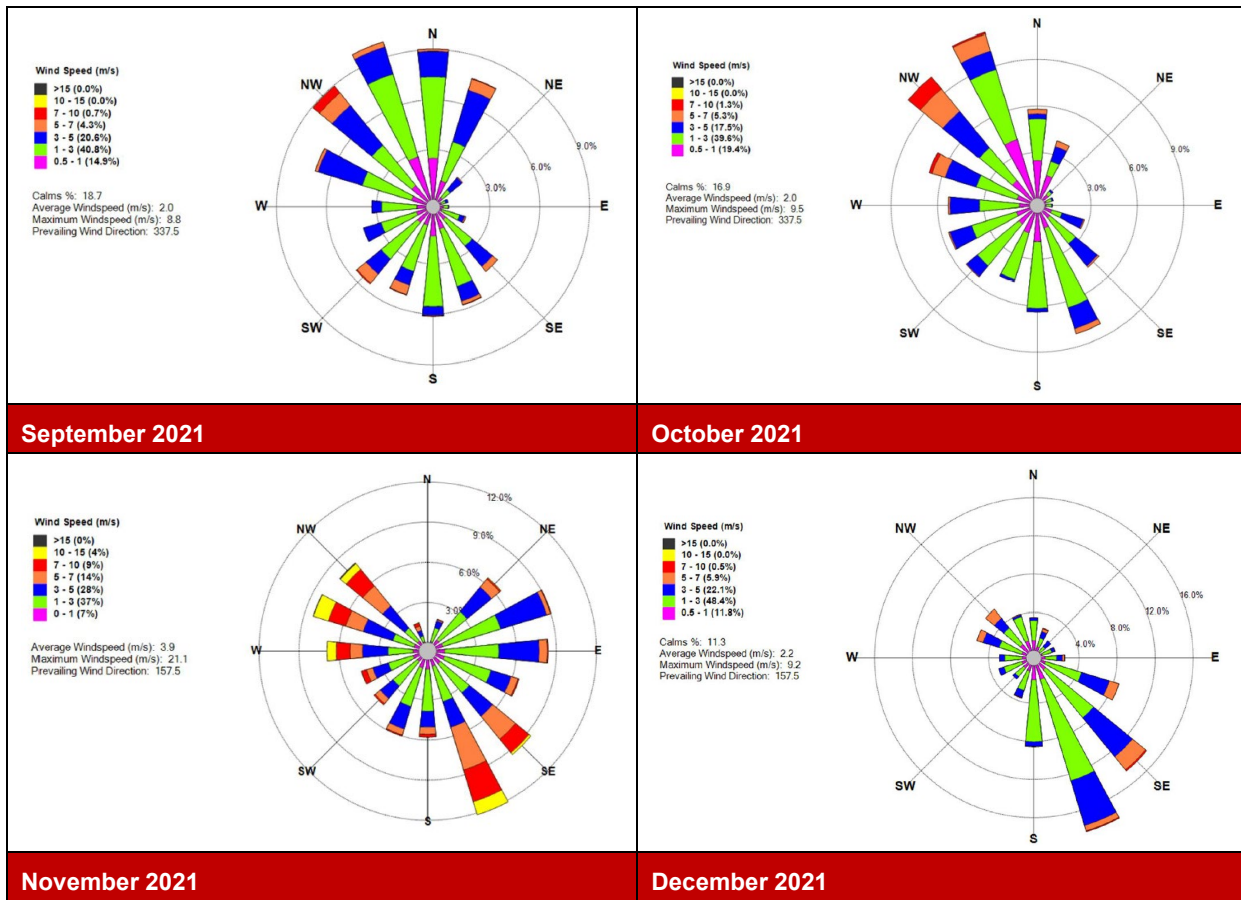


Figure 6-4 Monthly Wind Rose Summary January – December 2021

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:

- Visual assessments of mining and coal transport areas to identify dust sources and modify operations as required;
- 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 2022.

BCOPL implements a air quality monitoring program to measure concentrations of depositional dust, Particulate matter < 10 µm (PM₁₀) and Particulate matter < 2.5 µm (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. PM₁₀ 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. PM₁₀ monitoring utilises High Velocity Air Sampler (HVAS) and tapered element oscillating microbalance (TEOM) monitoring units, whilst PM_{2.5} is measured only using a TEOM monitoring unit.

The current air quality monitoring program includes 3 depositional dust gauges, two HVAS, three TEOMs, and will include up to four portable real-time PM₁₀ 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
Glenhope	Yes	HVAS (PM ₁₀)	µg/m ³	Every 6 days
Merriown	No	HVAS (PM ₁₀)	µg/m ³	Every 6 days
Tarrowonga	No	TEOM (PM ₁₀)	µg/m ³	Continuous
Wilberoi East	Yes	TEOM (PM ₁₀ and PM _{2.5})	µg/m ³	Continuous
Velyama	No	TEOM (PM ₁₀ and PM _{2.5})	µg/m ³	Continuous
Goonbri	No	TEOM (PM ₁₀ and PM _{2.5})	µg/m ³	Continuous
BTM Complex Portable Samplers (x4)	No	TEOM (PM ₁₀ and PM _{2.5})	µg/m ³	Continuous

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.

Monitoring data is routinely compared to the air quality assessment criteria provided within SSD 09_0182 and the EPL. Exceedances of the relevant air quality assessment criteria is considered an ‘incident’ under SSD 09_0182 and the Secretary will be notified as soon as practicable after the proponent becomes aware of the incident. Exceedances of the criteria can be attributed to variations in weather conditions, these ‘extraordinary events’ can be justified with evidence meteorological data from the site and surrounding areas. This evidence is logged in the incident register.

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/m²/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 2021.

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	1.23
D5	4	0.78
D6	4	0.78

* Annual average applies to 2021 calendar year.

The results for D4 and D5 are above the predicted levels documented in the EA (i.e. 0.5 and 0.6 g/m²/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 Boggabri-Tarrawonga-Maules Creek Complex (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 for the 2021 reporting period remained well below the relevant assessment criteria specified in SSD 09_0182. Further the depositional dust levels recorded during the 2021 reporting period remain within the range of historical results.

6.2.2.2 PM₁₀

BCM monitors PM₁₀ dust compliance through one HVAS unit (Glenhope) and one TEOM (Wilberoi East) (see Appendix B). Sampling is undertaken for a period of 24 hours every 6 days. PM₁₀ monitoring is ongoing from previous reporting periods with a 24hr average and Annual average provided for comparison with the relevant air quality assessment criteria.

6.2.2.2.1 Results

Figure 6-5 provides the results for the Glenhope HVAS whilst the PM₁₀ monitoring results of the Wilberoi East TEOM over the reporting period is provided in Figure 6-6.

In accordance with SSD 09_0182, the short-term concentration limit for PM₁₀ over each 24-hour period is 50 µg/m³ while the long-term concentration limit for the annual average is 30 µg/m³.

There were two occasions where data was not collected at the Glenhope HVAS during 2021. The Glenhope HVAS unit was unable to be accessed between run times due to regional flooding on the 23 and 29 November 2021. These are classed as non-compliances and were notified to DP&E and the EPA through the Annual Return submitted on 7 March 2022 and have been listed as a non-compliance in Table 1-2.

No exceedances of the PM₁₀ 24-hour air quality assessment criteria were recorded during the reporting period.

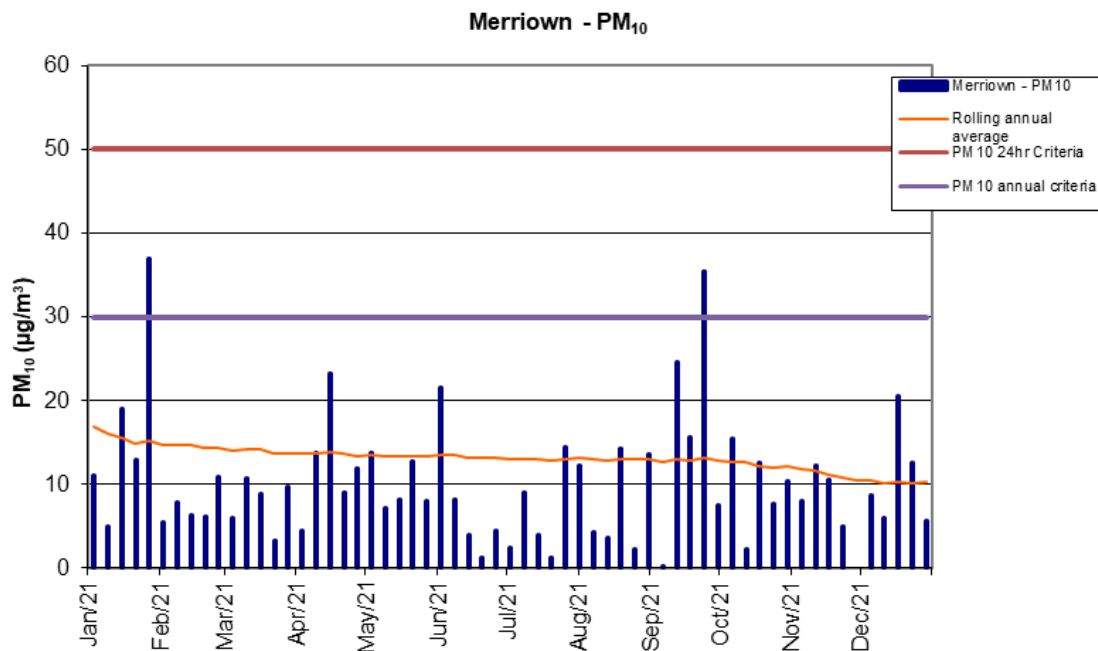


Figure 6-5 Glenhope HVAS PM₁₀ Monitoring 2021 Results

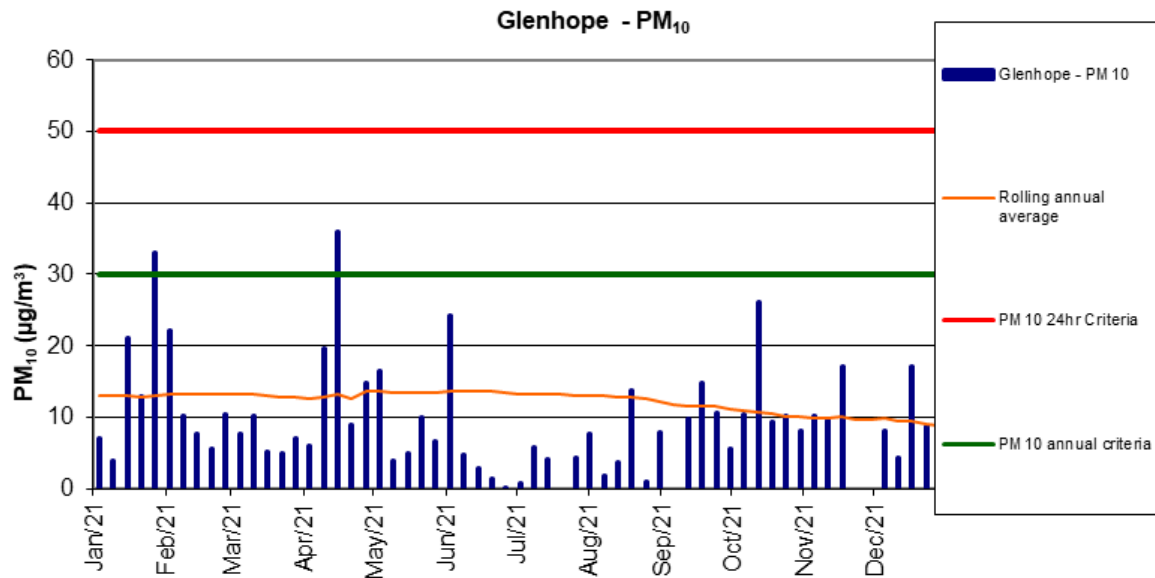


Figure 6-6 Wilberoi East TEOMGlenhope PM₁₀ Monitoring 2021 Results

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/m³) is based on a value derived by the National Health and Medical Research Council in 1996. There is an established relationship between TSP concentration and the concentration of PM₁₀. In areas where coal mining is a significant component of the local particulate emission inventory, PM₁₀ typically comprises ~40% of the TSP (SPCC, 1986 and others).

As prior studies have confirmed that the long-term average PM₁₀ to TSP ratio is close to 0.4:1, that is, 40% of TSP is comprised of PM₁₀, inversely, the relationship between TSP and PM₁₀ can be written as: TSP = PM₁₀ x 2.5. Due to the nature of the relationship between TSP and PM₁₀ levels, the TSP criterion of 90 µg/m³ (annual average) will always be satisfied when the long-term PM₁₀ criterion of 30 µg/m³ is satisfied.

In consideration of the historical PM₁₀ monitoring undertaken for the BCM (i.e. results have historically been significantly below the PM₁₀ 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 PM₁₀ and TSP. The calculation of TSP is based on the available data at the Merriwon HVAS monitoring location and Glenhope HVAS monitoring location.

The results indicate the annual average TSP at the Cooboobindi/Glenhope (30.5 µg/m³) is below the TSP air quality criterion in SSD 09_0182 (i.e. 90 µg/m³) 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.

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 (MCCM and Tarrawonga Coal Mine (TCM)). Therefore, BCM's cumulative assessment did not take into consideration the impact these approvals would have on the surrounding air quality. Whilst the 2021 results are generally marginally higher than that predicted for Year 10 of the 2010 EA (Hansen Bailey, 2010), it is noted that the monitoring results continue to comply with the 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 2021 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 between the commencement of mining operations and as at end of 2021;
- PM₁₀ concentrations are slightly higher between 2017 and 2019, coinciding with drought conditions and lower than average rainfall during this period. These conditions led to increases in the number of days when the 24-hour average PM₁₀ concentration exceeded 50 µg/m³ and increased annual average PM₁₀ concentrations. The elevated PM₁₀ concentrations were observed across many locations in NSW and were not unique to BCM. Concentrations have decreased during 2020 and 2021, coinciding with increased rainfall;
- There are seasonal variations with higher PM₁₀ concentrations generally occurring in the warmer months;
- 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, 2020 or 2021.

6.2.3 Improvements and Initiatives

BCOPL continued to implement and refine the real-time air quality management system at BCM during the reporting period. The real-time air quality management system resulted in 441 triggers, which subsequently resulted in a review of operations in order to appropriately manage emissions from the BCM to remain within the relevant criteria.

6.3 Operational Noise

6.3.1 Environmental Management

Operational noise is managed by BCOPL in accordance with the approved Noise Management Plan (NMP) and EPL 12407. Revision 13 of the NMP was approved by the DPE 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

BCOPL engaged acoustic specialists to undertake attended noise monitoring in 2021 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 (SPL) monitoring is undertaken annually, in accordance with SSD 09_0182, to assess the performance of mine plant against the SPL utilised within the modelling in the 2010 EA (Hansen Bailey, 2010). SPL monitoring for 2021 was conducted in September. 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 2021. 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 DPE and the EPA. This alternative method was adopted from January 2016 onwards.

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

Table 6-6 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_{Aeq} (15 minutes) for day, evening and night time periods which are defined as follows:

- Day – 7 am to 6 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 6-7.

Table 6-7 Noise Limits

	Operational Noise Impact Criteria			Sleep Disturbance Criteria Night L_{Aeq} (1 min)	Cumulative Noise Criteria (BTM complex) Day, Evening, Night, L_{Aeq} (15 min)
	Day L_{Aeq} (15 min)	Evening L_{Aeq} (15 min)	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 6-7.

6.3.2.1.1 Results

A summary of the attended noise monitoring results is provided in Table 6-8. This includes all monthly monitoring conducted in 2021.

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 BTM Complex and confirmed the noise levels were within the cumulative noise criteria specified under SSD 09_0182 (refer to Table 6-7).

Table 6-8 Summary of Attended Noise Monitoring Results - dB(A) LAeq (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
12-Jan	^	^	^	^	^	^
11-Feb	^	^	^	^	<20	<20
25-Mar	<25	29	^	^	^	^
14-Apr	^	^	^	^	^	^
6-May	^	^	^	^	^	^
17-Jun	^	^	^	^	^	^
19-Jul	^	^	^	^	^	^
3-Aug	^	^	^	^	^	^
8-Sep	^	^	^	^	^	^
19-Oct	^	^	^	^	^	^
3-Nov	^	^	<25	29	<20	<20
15-Dec	^	^	^	^	<20	23

^ 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 was undertaken on the 13 September 2021 (Global Acoustics, 2021) and is available on BCM's website. The results of this monitoring was then compared against the SPLs 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 HD1500-7 (DT178, DT180, DT181) -haul truck;
- Komatsu 930E (DT265, DT304, DT306, DT307, DT 308, DT751, DT752, DT754, DT755, DT757, DT291, DT292) – haul truck;
- Hitachi EH3500ACII (DT304, DT306, DT307, DT308) – haul truck;
- CAT 775G (TK828) – water cart;
- Komatsu D475A (TD082, TD083, TD084, TD085, TD086) – dozer;
- Komatsu 375A-6 (TD093) – dozer;
- Komatsu WA1200-3 (WL188) – Loader;
- Komatsu WA600 (WL190) – Loader;
- CAT6060 (EX123, EX255 and EX 256) – excavator;
- Liebherr R9400 (EX129) – Excavator;

- CAT 16M (GR060) – Grader; and
- CAT 24M (GR063) – Grader;

A total of 43 items of plant were screened during the 2021 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 2021 sound power screening was undertaken 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 SPLs 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 SPL – Stationary test; conditions'; and
- ISO 6395:2008(E) 'Earth-moving machinery – Determination of SPL – Dynamic test conditions'.

6.3.2.2.2 Results

The results of the 2021 sound power screening program indicated that there were 13 items of screened plant that recorded exceedances of 3dB or greater. A summary of the SPL monitoring results is provided in Table 6-9.

Table 6-9 Summary of 2021 Sound Power Screening Results

Plant type	Criteria (dB)	Number of exceedances of 3dB or more during testing	Comment/Recommendation
Hitachi EP3500ACII	117	4	Truck DT308 exceeded the A-weighted target by 3 dB. Truck DT306 exceeded the linear target by 5 dB. Trucks DT307 and DT308 both exceeded the linear target by 4 dB. Further action will be determined and reported following completion of the trial.
CAT6060	120	1	EX255 exceeded the A-weighted target by 3 dB. Key findings and recommendations will be reported following completion of the trial.
Komatsu 930E	117	8	Trucks DT752, DT751, and DT755 exceeded the A-weighted target by 6 dB, 7 dB and 8 dB respectively. Trucks DT754 and DT757 both exceeded the A-weighted target by 4 dB. Truck DT757, DT752, DT751, and DT755 exceeded the linear target by 4 dB, 6 dB, 8 dB and 9 dB respectively. Trucks DT292 and DT291 both exceeded the linear target by 3 dB.

Plant type	Criteria (dB)	Number of exceedances of 3dB or more during testing	Comment/Recommendation
			respectively. Further action will be determined and reported following completion of the trial.

Exceedances to SPLs have been classified as a low risk non-compliance as the routine attended noise monitoring undertaken at the nearest receivers indicates that noise from the site remains well within the relevant criteria and is generally inaudible.

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 2021 attended noise monitoring results with modelled noise impacts for the 2010 Acoustic Impact Assessment. Predictions from Year 10¹ of the AIA were utilised, as that stage best aligns with 2021, which is Year 10 of the Project (Global Acoustics, 2020b).

Measured BCM-only noise levels were assessed for the applicability of modifying factors in accordance with the EPA's NPfl. There were no intermittent or tonal noise sources, as defined in the NPfl, audible from site during the survey.

A total of 18 of the 36 attended monitoring events undertaken in 2021 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 SPL attenuation trial continued during the reporting period. The trial is currently ongoing as the kits have shown reliability issues. Inspections and maintenance were conducted on all 6 attenuated Komatsu 930E trucks in May 2021, with no major defects found. SPL testing and maintenance of the attenuated fleet will continue in 2022 and the results from the monitoring will be reported in the annual review.

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 142 blast events occurred during the 2021 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 2021 reporting period (refer to Appendix B).

The applicable SSD, EPL, 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 6-7). Blast vibration monitoring results for the 2021 reporting period were on average higher than those reported for the previous 2020 reporting period. Blast vibration for the past few years has consistently remained well below the relevant limits.

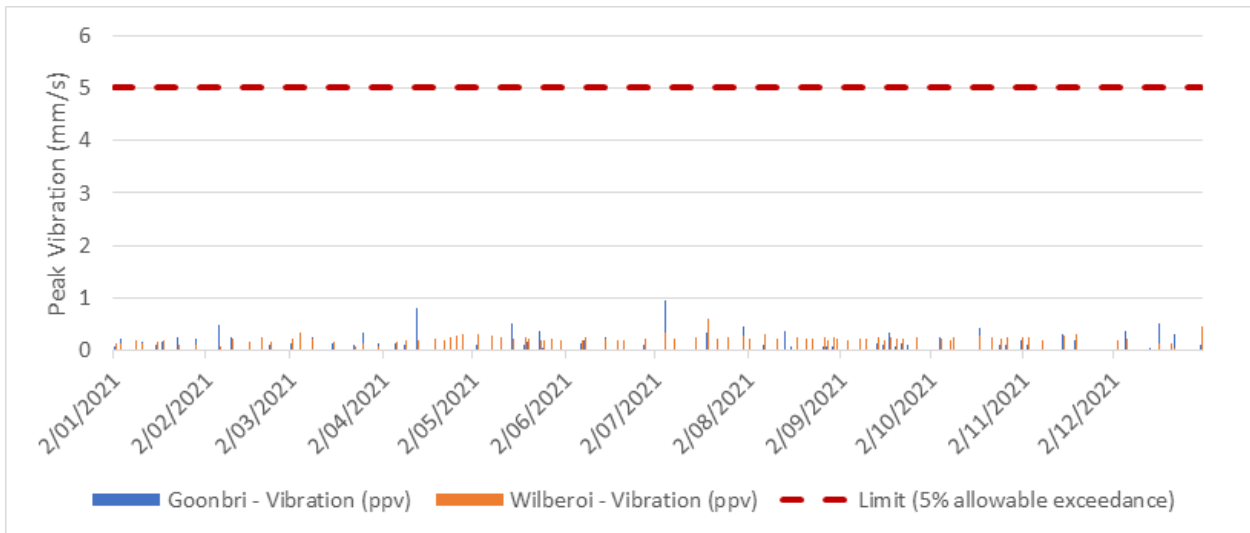


Figure 6-7 Summary of Peak Vibration Monitoring Results

6.4.2.3 Blast Overpressure

Monitoring of blast overpressure was conducted at Goonbri (MP1) and Wilberoi East (MP3) during the entire 2021 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 6-8 illustrates the blast overpressure monitoring results for the 2021 reporting period.

The monitoring results indicate that no blasts exceeded 115 dB(A) overpressure limits (5% allowable exceedance applies) at the two monitoring locations.

BCOPL complied with all its blast overpressure criteria during the 2015, 2016, 2017, 2018 and 2020 reporting periods. One exceedance of the 120 dB(A) criteria occurred in the 2019 reporting period.

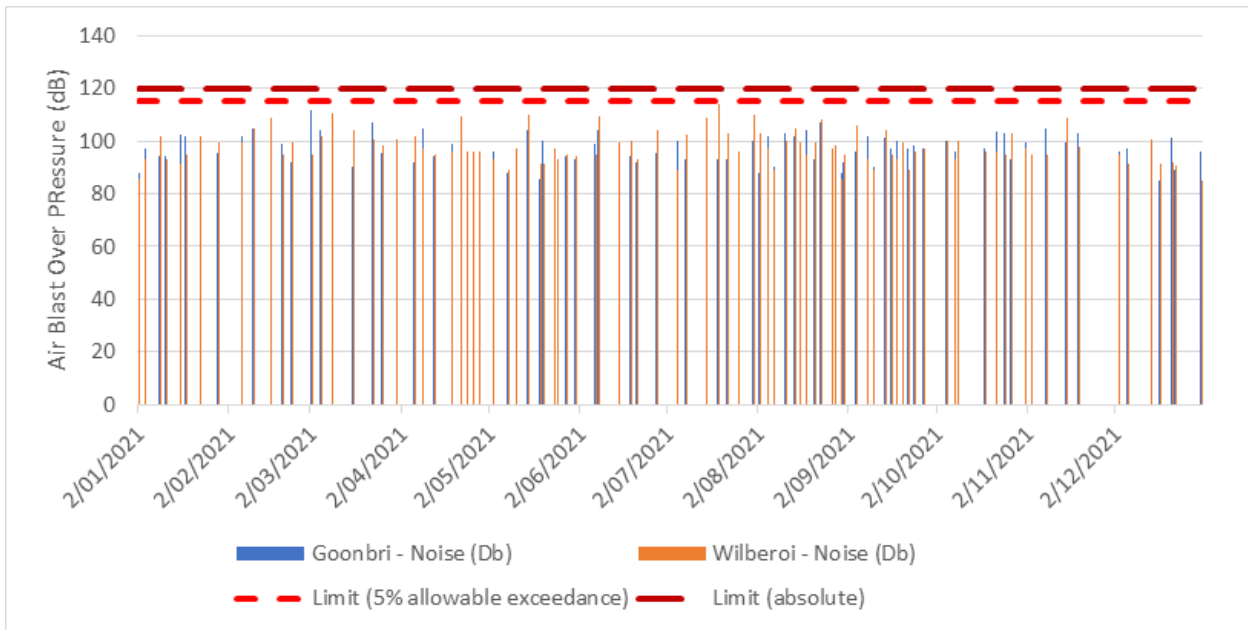


Figure 6-8 Blast Overpressure Results

6.4.2.1 Blast fume

Blast fume at BCM is managed and monitored in accordance with the Blast Fume Management Protocol (2018). 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

A total of 25 blast 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 recorded remained within the relevant criteria during the 2021 reporting period.

During the 2021 reporting period there were two blast events in July 2021 which resulted in complaints from the community. See Table 9-2 for further details.

6.4.2.2 Blast Monitoring Results

All blast monitoring results are provided on BCOPL’s website for the 2021 reporting period.

6.4.3 Improvements and Initiatives

During 2021, BCOPL preferentially utilised explosive products which are specifically designed to reduce the potential for fume events during blasting. This was predominantly due to the higher than average rainfall conditions experienced during the reporting period. The use of these specifically designed products is a best case initiative used to minimise the potential for adverse blast fume being generated during blasting impacts.

6.5 Biodiversity

6.5.1 Environmental Management

Biodiversity issues at Boggabri Coal Mine (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 Boggabri Coal Operations Pty Limited (BCOPL)
- Describe the measures (short, medium and long-term) to be implemented to manage remnant vegetation and habitat within the Project Boundary and BOAs, including detailed performance and completion criteria
- Describe the practical management strategies (including procedures) to be implemented to manage impacts on flora and fauna, maximising salvage and beneficial use of resources in areas to be impacted for habitat enhancement, rehabilitate creeks, drainage lines and disturbed areas, control weeds and pests
- Describe biodiversity monitoring and reporting requirements.

No impacts outside those predicted in the 2010 EA have occurred during the reporting period, indicating the management strategies specified by the BMP and implemented across the site are adequate to address potential impacts.

BCM's biodiversity offset requirements are outlined in the *Boggabri Coal Mine Biodiversity Offset Strategy* (WSP, 2018) (BOS). The BOS guides the implementation of BOAs. It identifies potential suitable offsets to adequately compensate the Project's impacts on local biodiversity, ensuring the Project complies with legislative and SSD 09_0182 offset requirements.

The BOS was revised in 2018 in accordance with Schedule 3, Condition 43 of the 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 the 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 the 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 the SSD 09_0182. This process was ongoing through 2021, with several site visits by representatives of the NSW Biodiversity Conservation Trust for formal commitments and approvals under the new legislative apparatus.

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

- 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 designed to monitor groundwater monitoring bores along the Nagero Creek and Namoi River floodplain for Stygofauna)
- 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 the 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 BCM, Tarrawonga Coal Mine (TCM) and Maules Creek Coal Mine (MCCM) (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.

The Annual Summary Report summarises 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 Approval Fauna Surveys

In accordance with the Commonwealth's Department of Agriculture, Water and the Environment Conditions of Approval 13c and 14, BCOPL have commissioned annual surveys across BCM biodiversity offset lands for *Nyctophilus corbeni* (Corben's Long-eared Bat), *Anthochaera phrygia* (Regent Honeyeater) and *Lathamus discolor* (Swift Parrot). Targeted surveys for Regent Honeyeater and Swift Parrot were undertaken during June and August 2021, whilst surveys for Corben's Long-eared Bat were undertaken in December 2021, and January and February 2022. The targeted surveys were undertaken at the locations provided on Figures B1 to B8 in Appendix C.

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 June and August 2021 survey period there was again a general lack of blossom across the BOAs and throughout the region. During the surveys there were only two very limited locations where nectarivorous bird activity was noticeably elevated beyond normal resident bird occurrences, being two planted Mugga Ironbarks at Goonbri BOA and a small group of around five White Box in the north-eastern section of the Braefield BOA. Nomadic nectarivorous birds that move into the region were largely absent across the BOAs from east to west. 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, and the Leard State Forest boundary corridor. Whilst Corben’s Long-eared Bat was not recorded in any BOA during the monitoring period (December 2021 and January and February 2022), two individuals were captured in the Leard State Forest boundary corridor in February 2022. Corben’s Long-eared Bat is listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Importantly, the December 2021 survey period was impacted by a major flood event experienced by the Namoi River and its tributaries, including Goonbri Creek, Bollo Creek and Gins Creek. With flash flooding of rural roads experienced between the BCM and the BOAs, the first targeted Corben’s Long-eared Bat trapping session in December 2021 within the Central offsets was terminated after two nights due to site access constraints, animal welfare and safety considerations.

6.5.2.3 Vegetation Clearing

Vegetation clearing for the reporting period commenced on 1 February 2021 and ended 22 April 2021, 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 12 exploration pad locations. The extent of clearing totalled 19.16 ha of vegetation, encompassing five vegetation communities.

One vegetation community associated with a Threatened Ecological Community was impacted upon by the 2021 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 13.30 ha of vegetation mapped as this Threatened Ecological Community was removed in 2021.

The extent of each vegetation community cleared during the 2021 clearing period is provided in Table 6-10.

Table 6-10 Vegetation communities identified in 2021 tree clearing area

Vegetation Community	Threatened Ecological community		Threatened Ecological community
	BC ACT	BC ACT	
Narrow-leaved Ironbark shrubby woodland of the Brigalow Belt South Bioregion – PCT 1381	Not listed	Not listed	1.36
Narrow- leaved Ironbark – pine – Brown Bloodwood shrub/grass open forest in	Not listed	Not listed	0.11

Vegetation Community	Threatened Ecological community		Threatened Ecological community
	BC ACT	BC ACT	
the north west of the Nandewar Bioregion – PCT 1380			
White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion – PCT 1383 ¹	Critically Endangered	Critically Endangered	13.30
White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion – PCT 1313	Not listed	Not listed	4.16
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	0.23
White Box – White Cypress Pine – Silver leaved Ironbark shrubby open forest of the Nandewar Bioregion – PCT 1307	Not listed	Not listed	<0.01

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 2021 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 1,107 habitat, hollow-bearing and/or significant trees within the 2021 tree clearing area and a further 169 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, 86 animals were successfully relocated, 104 animals were observed from habitat trees and evaded capture, and three animals were killed or euthanised as a result of clearing operations (Table 6-11). The most abundant groups of animals encountered during 2021 clearing operations were reptiles (131 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 6-11 Animal Groups Encountered During Clearing Operations

Fauna Group	Number of individuals recorded			
	Relocated	Observed	Deceased / Euthanised	Total
Reptiles	72	56	3	131
Microchiropteran bats	12	33	0	45
Birds	0	12	0	12
Amphibians	2	0	0	0
Mammals	0	3	0	5
Total	86	104	3	191

The attendance of the ecologist's supervising tree clearing greatly enhanced the likelihood of survival for the above listed species. In addition to the abovementioned animals, eight threatened species were encountered during the 2021 clearing operations (Table 6-12).

Table 6-12 Threatened Species Encountered During Clearing Operations

Common Name	Scientific Name	EPBC ACT	BC ACT
Pale-headed Snake	<i>Hoplocephalus bitorquatus</i>	-	V
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	V
Dusky Woodswallow	<i>Artamus cyanopterus</i>	-	V
Speckled Warbler	<i>Chthonicola sagittata</i>	-	V
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis</i>	-	V
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	-	V
Little Lorikeet	<i>Glossopsitta pusilla</i>	-	V
Turquoise Parrot	<i>Neophema pulchella</i>	-	V

2. Listed as Vulnerable (V) under the BC Act.

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 Sheath-tail-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 479 lineal metres of woody debris was designated for salvage.

6.5.2.5 Stygofauna Surveys

Due to limitations imposed by Covid-19 State border restrictions throughout 2021 and subsequent flood impacts experienced in the Boggabri region in November and December 2021, stygofauna sampling was completed between 15-21 February 2022. A total of 10 groundwater bores were sampled as detailed in Table 6-13 and illustrated in Figure B-6 provided in Appendix C. Stygofauna were detected in three bores,

including IBC2111, MWP07 and Cooboobindi house bore. Stygofauna specimens are currently undergoing detailed analysis and taxonomic review.

Table 6-13 Preliminary Stygofauna Sampling Data

Bore	Stygofauna present	Diversity
Cooboobindi monitoring bore	No	–
IBC2111	Yes	2
Belleview monitoring bore	No	–
Victoria Park monitoring bore	No	–
MWP 07	Yes	2
GW3115	No	–
MWP06	No	–
MWP05	No	–
IBC2110	No	–

6.5.2.6 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 December 2021, 17 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))(see Appendix C)).

As discussed in previous Annual Reviews, 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 the figures 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
- A reference photograph for each transect.

6.5.2.6.1 Results

Over the 2020/2021 period leading up to the 2021 surveys. The region received above average rainfall helping to relieve some of the pressures on vegetation caused by prolonged extreme dryness experienced between 2017 and 2019. Rainfall totals exceeded the previous year with a total of 1003.6mm received.

Vegetation across the monitoring locations retained a high level of native plant species and moderate to low diversity of exotic species. The Leard State Forest replicate sites showed the highest level of native plant species richness, followed by the Central Offset Area and the Rocklea property respectively. Comparatively, the Central Offset Area had the highest mean exotic species richness, followed by the Leard State Forest and the Rocklea property respectively.

No threatened flora species were recorded during the field surveys. However, at monitoring site LSF 3B, the threatened flora species *Tylophora linearis* was previously recorded in 2020 and individuals were marked. The area was searched extensively with no individuals recorded. This is likely due to the drought and all the individuals had died off. *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 52 species of bird were recorded during replicate monitoring surveys, with the Rufous Whistler, Weebill, Silvereye and White-browed Woodswallow commonly recorded. Mean diurnal bird species richness was higher within the potential impact location in comparison to the two control locations during the 2021 monitoring event.

Seven threatened species of bird listed as Vulnerable under the NSW BC Act were recorded during duplicate surveys at replicate monitoring sites, including Speckled Warbler, Dusky Woodswallow, Brown Treecreeper (eastern subspecies), Diamond Firetail, Varied Sittella, Little Lorikeet and Turquoise Parrot.

Invertebrate species diversity was comparable between Leard State Forest and the Central Offset Area, however, the Rocklea Property returned a reduced insect diversity in 2021. Across all monitoring locations Hymenoptera (ants) and Arachnids (exclusively spiders) were the most diverse morpho-types recorded during the 2021 monitoring program. Leard State Forest contained the highest mean invertebrate species abundance compared to the Rocklea Property and Central Offset Area reference locations.

Microchiropteran bat call sequence files for the Leard State Forest Biological Monitoring Program are currently being processed.

6.5.2.7 Annual Leard State Forest Biodiversity Corridor 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. Refer to Figure B-4 within Appendix C.

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.

This report presents the results from the ninth biodiversity monitoring event associated with the Leard State Forest Biodiversity Corridor. Biodiversity surveys were scheduled for November 2021, however, Boggabri Coal Mine was largely inaccessible during this period with an incredible 304.8 mm of rain received in November alone and the Namoi River experiencing a major flood event. The townships of

Gunnedah and Narrabri were listed under a Natural Disaster Declaration from 9 November 2021 onwards.

Biodiversity survey commenced on 11 December 2021 at three replicate monitoring sites (LC3, LC4 and LC6) with limited methodologies employed. The remaining sites, LC2, LC5, LC7 and LC8 were not sampled during the 2021 survey period. This was a corollary of the continued wet cycle experienced in the region, and although no rainfall was experienced during visitation to the monitoring sites, December's highest rainfall was recorded on 8 December 2021 (46.2 mm) with a further 27.2 mm recorded on 9 December 2021. The effects of previous and ongoing rainfall limited safe access across the corridor and the monitoring event was terminated on 11 December 2021, with BCM again inaccessible from flood water associated with the Namoi River.

General biodiversity survey methodologies for the 2021 monitoring was undertaken in December 2021 at three (of seven) replicate monitoring sites positioned within BCMS legislated 250 m wide portion of the corridor. Monitoring targeted native vegetation and bird assemblages.

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

- One 100m vegetation survey transect for cover and abundance
- One 20-minute area searches within 80 m (approximately 2 ha) of fixed monitoring sites.

In addition, targeted seasonal survey methodologies were apportioned to Swift Parrot and Regent Honeyeater in June and August 2021, and Corben's Long-eared Bat in February 2022.

6.5.2.7.1 Results

A total of 76 species of plant were recorded from the two replicate monitoring sites transects associated with the corridor, including 71 native species (93%) and five exotic species (7%). No threatened species of plant were recorded during the 2021 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.

Diurnal bird species richness at each replicate monitoring site was similar during the 2021 monitoring event. Although a small increase in mean diurnal bird species richness was observed during the 2021 survey period, it remains suppressed in comparison to the baseline monitoring survey (2013) and the Leard State Forest analogue benchmark. It is likely that bird activity and population dynamics has been affected to some degree by prolonged severe drought between 2017-2019, with bird populations rebounding following increased rainfall through 2020 and 2021, increasing general productivity for woodland birds.

A total of 22 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. One threatened species of bird, Speckled Warbler, which listed as Vulnerable under the NSW BC Act, was recorded during surveys at replicate monitoring site LC3.

Targeted Swift Parrot and Regent Honeyeater surveys were conducted in the corridor over two discrete sampling periods in June and August 2021. The Swift Parrot and Regent Honeyeater were not recorded during these targeted surveys with blossom values within the scant patches of *E. albens* within the corridor exhibiting the same very low blossom occurrences observed within the larger Leard State Forest remnant and across Boggabri Coal's adjacent biodiversity offset areas that were surveyed during the same periods. Within the corridor, and during annual monitoring further afield in Leard State Forest, avian diversity was limited to normal numbers of resident nectarivorous bird species.

A total of eight harp trap nights was completed from four locations within the corridor. A total of 42 individuals from seven species of microchiropteran bat were trapped, processed and released, including two individual Corben's Long-eared Bat.

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.

6.5.2.8 Annual Stream and Riparian Vegetation Health & Terrestrial GDE Monitoring within the Locality of MOD5

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 to monitor stream and riparian vegetation health due to the potential for impacts on surface water and groundwater systems. Survey methodologies for the 2021 monitoring program were completed between 4–9 May 2021 at five replicate monitoring sites, incorporating:

- Quantitative transect/plots (one BioBanking plot);
- Stream characteristics (for example channel size, composition, flow category, clarity – stream health monitoring locations only (see Figure B-8 within Appendix C)); 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 2021. 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 2021 monitoring program were completed between 4–9 May 2021 at 11 replicate monitoring sites (including the five stream and riparian health monitoring sites), incorporating:

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

Importantly, the spring monitoring session for these programs commenced at the start of November 2021, in conjunction with the BOA monitoring program. However, these programs were suspended on 5 November 2021 following recent rainfall (and predicted rainfall totals expected over subsequent days) making site access problematic across landscapes underlain by black soil and clay-based tracks. An exceptional 304.8 mm of rain was received in November 2021 alone and a total of 976.8 mm recorded for the year. The effects of ongoing significant rainfall prevented access to the sites throughout November and December 2021, with Boggabri Coal Mine inaccessible from major flood waters associated with the Namoi River. The townships of Gunnedah and Narrabri were listed under a Natural Disaster Declaration from 9 November 2021 onwards.

6.5.2.8.1 Results

The results from the 2021 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. The fluctuations in vegetation attribute values observed across the monitoring locations is likely attributable to climatic conditions experienced in the region, which has encompassed the cyclic nature from severe drought to major flood events. Nevertheless, these fluctuations were within the boundaries of the probable mean, as predicted by the standard error. It is considered unlikely that these changes in vegetation attributes are due to impacts associated with the project.

A large proportion of vegetation attributes across all sites failed to meet the BioBanking Assessment Methodology 2014 (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), which have cleared canopy and midstorey components and heavily disturbed the soil profile leading to the dominance of exotic species in the groundcover.

Similarly, stream characteristics of Nagero Creek and the Namoi River were relatively consistent with the 2018 baseline monitoring results. Exceptions to these included changes in attributes that are affected by drought conditions, such as water height, flow and where water was present, turbidity.

Overall, the structure and health of Nagero Creek was in moderate condition. The stream is an ephemeral waterway with intermittent flow, which is heavily dependent on high rainfall. In contrast to the volume and quality of water recorded along Nagero Creek in 2020, the autumn 2021 monitoring event recorded limited standing water in isolated pools. 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. Although not surveyed in spring 2021, and similarly to the Namoi River, Nagero Creek experienced a major flood event in November and December 2021.

Overall, the structure and health of Namoi River was in low to moderate condition. The Namoi River within proximity of the project no longer persisted as a depleted perennial river with sections of stagnant pools, with constant moderate flow observed during the autumn 2021 monitoring session. 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 scouring 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. Although not surveyed in spring 2021, the Namoi River experienced major flood events in November and December 2021.

The results from the 2021 monitoring program confirmed that the health of terrestrial vegetation 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 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 was largely attributed to past land uses (predominantly agriculture), which have cleared canopy and midstorey components and heavily disturbed the soil profile leading to the dominance of exotic species in the groundcover.

6.5.2.9 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 2021 biodiversity offset monitoring represents the seventh year of biodiversity monitoring completed on all ten BOAs for the Project (see figures B-1 to B-8 within Appendix C). 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 into four management areas, which includes:

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

The aims of the 2021 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 2021 monitoring results against biodiversity benchmark data collected during the 2015 baseline monitoring event and against Leard State Forest analogue benchmark data (fauna) and BBAM vegetation community benchmarks
- Recommend potential mitigation or management actions that may be required based on the results of the 2020 biodiversity offset monitoring event.

Importantly, the 2021 annual BOA monitoring program was significantly impacted by severe weather systems and exceptional rainfall events experienced across the Boggabri region in November and December 2021. BOA monitoring commenced at the start of November 2021, and as the survey progressed it became apparent predicted rain events would be heavier than initially forecast. With the intervention of rain, access became problematic and impossible by vehicle for a number of sites. Following recent rainfall and predicted rainfall totals expected over subsequent days, the monitoring program was suspended on 5 November 2021. An exceptional 304.8 mm of rain was received in November 2021 alone, over four times the average rainfall for the month. The effects of ongoing significant rainfall prevented access to the sites throughout November and December 2021, with Boggabri Coal Mine inaccessible from major flood waters associated with the Namoi River. The townships of Gunnedah and Narrabri were listed under a Natural Disaster Declaration from 9 November 2021 onwards.

6.5.2.9.1 Habitat Management Zone

Vegetation data collected as part of the 2021 monitoring session suggests that the vegetation types within the habitat management zones 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 have shown general increases in value since the 2019 monitoring period. This is most likely due to the region receiving normal to above average rainfall in the months preceding the

survey sessions in both 2020 and 2021. Despite this however, some vegetation attributes still appear to be declining based on the limited 2021 survey session results. These declines are most likely due to the continued effects of severe drought experienced in previous years that have led to large-scale canopy and shrub dieback events.

Vegetation attributes affected by the prolonged drought conditions included native overstorey and midstorey projected foliage cover. In 2021, native overstorey and midstorey stratum at some of these locations yielded higher percentage covers suggesting that vegetation is showing signs of recovery. Despite this however, some sites continued to show a decline suggesting that recovery of these attributes after the large-scale dieback event may be long-term in nature.

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 2021, included:

- Native species richness has remained relatively consistent across all BOAs.
- Exotic species richness has remained relatively consistent since 2020 across all BOAs. An increase in exotic species richness since 2019 can most likely be attributed to higher rainfall in the months preceding the monitoring session.
- In 2021 evidence of livestock grazing was observed within the Braefield BOA, however, has been removed from other management areas.
- Only a single habitat management zone monitoring site surveyed in spring 2021 contained Cypress Pine densities that exceeded the 650 stems/per hectare threshold (W1). There are also other monitoring sites not surveyed in 2021 that have historically also contained densities above the threshold including M3, M4, Ma4, My3 and W4. Although they exceed this threshold, most vegetation attributes at these locations generally meet, are within or exceed the BBAM benchmark values for their corresponding vegetation type. It is possible that the germination and recruitment of canopy and midstorey species at these locations may be prohibited by the high density of Cypress Pine present, given the lack of canopy species recruitment and low cover of midstorey species recorded at some locations. Further investigations into the management of Cypress Pine at these locations will be carried out. Continual monitoring of all other locations where Cypress Pine density is above the threshold will be performed in subsequent years to confirm whether Cypress Pine is inhibiting canopy recruitment prior to undertaking Cypress Pine thinning.
- Most Box Gum Woodland monitoring sites within habitat management zones meet or are considered likely to meet the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely's Red Gum grassy woodland and derived native grasslands (exception to this is S3).
- Box Gum Woodland monitoring sites within habitat management zones largely meet, are within or exceed BBAM benchmarks. Exceptions to this included the occasional site which did not meet fallen timber, hollow bearing tree, overstorey projected foliage cover and native groundcover (grass) percentage 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 measures for this species will be investigated and implemented. Furthermore, biosecurity measures will be identified and introduced to avoid the spread of this weed into other BOA properties. For example, vehicles should remain on tracks, avoid driving in paddocks where this species occurs and brush down tyres when leaving and entering any other BOAs.
- *Phyla canescens** recorded at two habitat management zone sites (N3 and N15) – although not a priority weed under the Biosecurity Act this species is highly invasive and control measures for this species will be investigated and implemented. 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 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 11 threatened species recorded in these zones. Key findings identified in habitat management zones during the 2021 monitoring event included:

- The presence of 11 threatened fauna species recorded across the habitat management zones in 2021, including Brown Treecreeper, Diamond Firetail, Dusky Woodswallow, Grey-crowned Babbler, Hooded Robin, Little Eagle, Little Lorikeet, Speckled Warbler, Spotted Harrier, Turquoise Parrot and Varied Sittella. Additional threatened species of microchiropteran bat may be identified from bat call sequence data that is currently being processed.
- Diurnal bird species richness was typical of relatively undisturbed woodland and open forest habitats in the region.
- Comparatively, mean diurnal bird species richness in 2021 was higher than in 2020, which is likely a sign of recovery from the previous years sustained prolonged drought period and a return of normal rainfall to the North-West Slopes and Plains of NSW and Eastern Australia.
- Mean diurnal bird species richness in habitat management zones achieved between 77% and 97% 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.
- Several introduced species were recorded during the 2021 monitoring period, including Fox, Pig, Rabbit, Goat, Cat and Brown Hare.

6.5.2.9.2 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 surveyed in 2021 generally fall below the BBAM vegetation type benchmarks for a range of attributes. Due to the general lack of canopy, midstorey, fallen logs and 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, Merriendi, Nioka North 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 2021 included:

- Native species richness has remained relatively consistent across all BOAs.
- Exotic species richness has remained relatively consistent since 2020 across all BOAs. An increase in exotic species richness since 2019 can most likely be attributed to higher rainfall in the months preceding the monitoring session.
- In 2021 evidence of livestock grazing was observed within the Braefield BOA, however, has been removed from other management areas.
- No habitat restoration zone monitoring sites surveyed in spring 2021 exceeded the Cypress pine density thresholds. In previous years however at least one monitoring location has contained Cypress Pine densities which exceeded the 650 stems/per hectare threshold (Wi3 – over double the threshold). Although, it has exceeded this threshold previously most vegetation attributes meet, are within or exceed the BBAM benchmark values for its corresponding vegetation type. This site will be monitored in subsequent years to confirm whether Cypress Pine is inhibiting canopy recruitment etc. prior to undertaking Cypress Pine thinning.

- Most Box Gum Woodland monitoring sites within habitat restoration zones 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 (exceptions to this were sites Ni5 and S2). This is an improvement on previous years and is likely attributable to favourable seasonal conditions in 2021 preceding the survey period.
- 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 aside from restoration tube stock planting. This is not unexpected given many of these areas occur as derived native grassland. Most other vegetation attributes meet the BBAM benchmarks.
- Due to the above, management within habitat restoration zones will continue to 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, interim fauna habitat resources such as salvaged fallen timber and nest boxes will 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.
- *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 measures for this species will be investigated and implemented. 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 moderate abundance and cover, however, it has potential to become highly prolific and form dense mats that 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.

Key findings identified in habitat restoration zones in 2021 included:

- Mean diurnal bird species richness was observed in 2021 to be higher than the 2020 monitoring event, which is consistent with the general recovery of the North-West Slopes and Plains and Eastern NSW from a prolonged period of dry conditions.
- Habitat restoration zones possessed a low diurnal bird species richness, typically averaging between 41 % and 47 % of the Leard State Forest analogue benchmark for bird species richness.
- Several introduced species were recorded opportunistically in habitat restoration zones during the 2021 monitoring period, including Pig, Fox, Brown Hare and Cat.

6.5.2.9.3 Corridor Enhancement Zone

The corridor enhancement zone has been significantly disturbed by past land use practices, including clearing, cropping and 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 demonstrates how disturbed such areas are. The planned supplementary canopy planting and some targeted weed and post 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 2021 included:

- Native species richness has remained relatively consistent across all BOAs.
- Exotic species richness has remained relatively consistent since 2020 across all BOAs. An increase in exotic species richness since 2019 can most likely be attributed to higher rainfall in the months preceding the monitoring session.
- Of the Box Gum Woodland monitoring sites within corridor enhancement zones 75% met the EPBC Act listing for the threatened ecological community White Box – Yellow Box – Blakely’s Red Gum grassy woodland and derived native grasslands (only exception to this was S5 which failed to meet the listing criteria).
- Box Gum Woodland monitoring sites within corridor enhancement zones largely failed to meet BBAM benchmark values 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. This is not unexpected given many of these areas occur as derived native grassland. Most other vegetation attributes meet the BBAM benchmarks.
- Due to the above, management within habitat restoration zones will continue to 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, interim fauna habitat resources such as salvaged fallen timber and nest boxes will 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). Control measures for this species will be investigated and implemented.

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 2021 BCOPL installed 10’TreeTroff’ watering units in various locations throughout its BOAs with an objective of maximising watering opportunities for wildlife. 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 6-14. 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 2021 reporting period was comparable with the 2020 reporting period.

Table 6-14 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 2021 reporting periods are summarised in Table 6-15. 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 6-15 Diesel Fuel Consumption

Fuel type	Quantity (L)					
	2016 period	2017 period	2018 period	2019 period	2020 Period	2021 Period
Biodiesel / ULSD*	65,412,763	62,586,313	67,132,896	65,987,493	69,734,267	60,559,675
Diesel	1,001,591	-	-	-	-	-
Totals	66,414,354	62,586,313	67,132,896	65,987,493	69,734,267	60,559,675

*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.

Table 6-16 Waste Disposal in Litres from 2018-2021

Waste Stream	2018 reporting period (tonnes)	2019 reporting period (tonnes)	2020 reporting period (tonnes)	2021 reporting period (tonnes)
General waste – bulk waste skips	154.62	55.62	43.84	60.7
General waste – industrial bins	351.34	410	380.7	401.8
Oily Rags	5.91	9.72	4.28	8.99
Oily Sludge	0.13	-	-	
Oily Water - recycled	1.93	5.28	4.36	7.13
Waste Grease –recycled	5.7	6.47	6.5	5.25
Contaminated absorbent materials	0.06	-	-	-
Scrap metal -recycled	264.73	223.25	269	1684.06
Aluminium Wire - recycled	-	-	-	9.02
Copper Wire - recycled	-	-	-	5.63
Empty Drums - recycled	2.05	1.64	1	0.92
Paper and cardboard- recycled	66.48	46.59	41.27	28.43
Timber packaging and pallets - recycled	90.13	74.72	86.26	129.75
Oil filters - recycled	32.52	34.86	31.77	31.21
Hydraulic hoses	12.01	17.14	23.87	26.47
Batteries –recycled	7.54	20.85	15.93	5.79
Nicad Batteries - recycled	-	-	-	0.15
Printer cartridges	0.06	0.04	0.05	0.06
Tyres (heavy oversize vehicle) – each	134	144	162	174
Tyres (light vehicle) - each	269	392	363	116
1,000L plastic containers (IBCs)	-	-	48	74
Oil- recycled (litres)	661,100#	621300#	557,700#	518740#
Coolant – treatment and recycling (litres)	25,100#	25800#	18,000#	19700#
Effluent - offsite recycled (Litres)	982.49#	848.55#	867.3#	807.5#

Waste Stream	2018 reporting period (tonnes)	2019 reporting period (tonnes)	2020 reporting period (tonnes)	2021 reporting period (tonnes)
TOTAL	1,977.7*	1,748.02	1,776.13*	2405.36*
Total Recycled	1,453.63*	1,255.24*	1,323.39*	1907.19*

* Total applies only to waste measured in tonnes

Total in Litres

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 an increase in many non-recyclable waste streams compared to the 2020 reporting period. This could be due to the return of staff to work from home due to the reducing prominence of COVID-19 in the community. An increase in recycled waste was recorded at BCM during the reporting period. There was also a 'truck body' cutting and recycling program that was operated over February and May. This operation was performed outside usual waste procedures and recycled large amounts of scrap steel, aluminium and copper which has resulted in an effect on long term waste trends. 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 previous reporting period. Overall, there has been a general increase in waste streams in the 2021 reporting period. Mining operation waste collection statistics for the 2018, 2019, 2020 and 2021 reporting periods are summarised in Table 6-16.

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 wash bay, 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 13 through 15 were active during the 2021 reporting period (refer to Table 6-17). Bioremediation Areas 1 through 9 have been reported in previous Annual Reviews and have not been included below in Table 6-17.

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. 4 sampling events in areas 13 & 14 were undertaken during the reporting period.

Table 6-17 Summary of Bioremediation Areas

Bioremediation Area	Location	Est.	Decomm.	Description
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.
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	January 2021	Area 13 was commissioned in November 2020 1266m ³ of material was stored at this location at the end of the reporting period.
Area 14	RL309 North Rom8	January 2021	November 2021	Area 14 was commissioned with 7 cells. Material was held and treated in accordance with procedure. A disposal of treated material occurred in September before Area was 14 was decommissioned.
Area 15	RL320 East	November 2021	Ongoing	Area 15 commissioned with 7 cells. Remaining cells were moved to cell 7 of Area 15 biopad. Approx 90m ³ of contaminated material currently stored in Area 15 biopad.

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;

- 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 minor spontaneous combustion incidents occurred during March and July 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 CHMP. The current CHMP was revised following the determination of Modification 5 and was approved by DPE in February 2017. A review of the CHMP commenced in late 2020 and will be finalised in 2022. An outline of the process and the draft document was discussed at Aboriginal Stakeholder Consultative Forum (ASCF) meetings in 2021. Time has been allowed for review of the draft CHMP by Registered Aboriginal Parties (RAPs) and feedback to be incorporated. The CHMP prescribes:

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

During the reporting period, BCMs 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 RAPs, as specified in the CHMP.

Field investigations, reporting and salvage works undertaken during 2021 focussed on the proposed 2022 tree clearing areas not covered by previous archaeological due diligence and salvage works. This included a small area on the eastern side of MW5 not covered in the 2021 due diligence archaeological inspections and a larger area to the west of MW5 (see Appendix G). The larger area to the west of MW5 include sites previously recorded (BC54 and BC34) by Hamm in 2005.

6.9.2 Environmental Performance

6.9.2.1 Archaeological Salvage

The aim of the Archaeological salvage work was to:

- Identify and salvage Aboriginal artefacts within the 2022 tree clearing areas to mitigate harm (refer to Appendix G);
- Use the artefacts salvaged and the landscape context of the area to develop a picture of prehistoric landuse and Aboriginal occupation of the area;

- Engage and involve the RAPs in all phases of the archaeological and cultural salvage; and
- Comply with the CHMP as approved by DPE and thereby comply with legislative requirements.

In the tree clearing area to the east of MW5, five artefacts were salvaged from three different locations. This included one broken mudstone core, two broken mudstone flakes, and two mudstone flake pieces.

The main focus of salvage work in 2021 was the area to the west of MW5 which includes the previously recorded sites BC34 and BC54. These adjacent sites are effectively considered to be one site covering the east and west sides of a deeply incised drainage line which runs roughly north south through the area. The salvage works involves the collection of surface artefacts followed by test excavations with open area excavations as required. The key steps undertaken over these two sites are summarised as follows:

Surface collection (completed)

- Identified locations of previously recorded surface artefacts within the 2022 tree clearing boundary and marked with flags;
- Surface walk over across area to identify any additional objects that had been exposed and marked with flags;
- Artefacts collected and details of all artefacts recorded (GPS, site context, condition etc);
- Consultation between RAPs and archaeologists' in the field to determine location of test excavation transects; and
- Collected artefacts were placed in a secure storage facility as per CHMP. Cleaning and detailed analysis, final counts and cataloguing has not yet been completed.

Test Pitting (Completed)

- Surface walk over and salvage repeated in the location of each test pit prior to commencement of test pitting;
- Four transects for test pitting were targeted initially based on the presence of artefacts on the surface. In total, eight transects were developed with test pits spaced between 10 to 15 metres;
- Between two and eleven pits were developed per transect with a total of 47 test pits. Each pit was one metre square in area and excavated to depths between 200mm and 400mm in depth. All material removed from the pits was screened through a 5mm sieve and artefacts were removed and bagged for each pit.
- The test pit phase was conducted over 3 weeks with RAPs and/or representatives;
- At the conclusion of the test excavations, artefact totals were collated to assist with the selection of pits that were to be expanded during the open area excavation.

Open Area Excavation (work program continued into 2022)

- The overall objective is to develop a picture of landform use including the extent and general nature of the site. This is achieved by obtaining a statistically valid sample of artefacts and determined site boundaries;
- A selection of the test pits were expanded and subject of targeted salvage works;
- To the end of December 2021, seven of the 47 test pits had been expanded covering an area of approximately 85m²;
- The open excavation with the highest density of artefacts (OA1) was expanded to 40m² producing approximately 3,500 artefacts. Excavation in this area has continued in 2022 and will be reported within the 2022 annual review;
- Further locations for expansion are discussed with RAPs in the field. The open area excavations commenced early December and has continued into 2022. In general, open areas are expanded

until artefact numbers drop off. Certain uncommon artefact/site types may trigger expansion of excavations in order to provide site context; and

- Additional technical expertise will also be sought in 2022 to assist with explaining the landscape and landform use.



Plate 1

Pit 1 Open Area 1

6.9.3 Preliminary Results

The results of the test pits and open area excavations to the end of December 2022 are summarised as follow:

- A total of 86 m² of material was excavated to December 2021 (including open areas);
- As there is no opportunity to conserve any part of BC54 and BC34 in-situ, further open area excavation is warranted to maximise the data retrieved;
- Results indicate that artefacts are generally located in the upper 300 mm of soil. The A soil horizon is generally up to 400mm in depth.
- The test pit artefact densities retrieved vary from 0 to 177 per m². However, the upper number may reduce slightly following closer analysis of the artefacts;
- The open area excavations range between 34 to 222 artefacts per m²;
- Preliminary recording of artefacts indicates a predominance of chert and indurated mudstone/tuff (IMT) in raw material. A review of raw material identification is required to determine chert / chalcedony identification.

6.9.3.1 Discussion

In total, approximately 5,000 artefacts had been salvaged from the surface collection and excavation work up to the end of December 2021. When compared to other sites in the area, it is considered likely to be the most significant site found to date in the Leard State Forest and possibly the Nandewar Ranges. More artefacts have been retrieved from BC54/BC34 than salvaged across the remainder of Project Boundary.

The preliminary numbers indicate the potential for a diversity of artefact type and raw material type, which in turn provides the potential to demonstrate Aboriginal landscape use and activities. Archaeological sites of this scale are rare in the context of the Leard State Forest.

The archaeological salvage works of BC54 / BC34 will continue in 2022. Due to the significance of the findings, the area was excised from the planned tree clearing to be undertaken in 2022 and delayed until 2023. The salvage works will continue in accordance with the CHMP until completed.

6.9.3.2 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 of BCOPL 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 May and November 2021. Key areas discussed in this forum include:

- Project update (including environmental monitoring, rainfall and water storage);
- Exploration update;
- Status of management plans such as the revision of the Cultural Heritage Management Plan;
- Update on Modification 8 to SSD 09_0182;
- The keeping place; and
- Archaeological salvage works.

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

In addition to the ASCF meetings, salvage program planning meetings have been held since early 2021 discussing timing and planning requirements for the 2021 salvage program and progress of this program for the 2022 tree clearing area. In the context of COVID 19 and significant wet weather in November and December, the salvage process has required flexibility and continued into 2022.

6.9.3.3 Historic Cultural Heritage

The Nagero Shearing Shed was demolished in May 2021. The work was undertaken in accordance with the requirements of *Australian Standard AS 2601-2001: The Demolition of Structures*. In accordance with the statement of commitments (Table 17) from the Boggabri EA, an archival record of the Nagero Shearing Shed was prepared in 2020 prior to the commencement of demolition activities. The Environmental Assessment (2012) found the structure was in poor condition and of low local significance.



Plate 2

Nagero Shearing Shed Prior to Demolition in May 2021

6.9.4 Improvements and Initiatives

Pursuant to BCM's Project Approval, 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 DPE on 10 November 2017.

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

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

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*, IA 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 2020-2021 NGERs submission to the Clean Energy Regulator are summarised in Table 6-18 alongside statistics from the 2015-2016, 2016-2017, 2017-2018, 2018-2019, 2019-2020 and 2020-2021 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 6-18 BCOPL GHG and Energy Statistics

GHG/Energy	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
Scope 1 (t CO ₂ -e)	190,606	183,750	177,065	203,082	174,391	184,492
Scope 2 (t CO ₂ -e)	19,585	19,190	17,991	18,647	16,865	18,004

Total Scope 1 and Scope 2 (t CO ₂ -e)	210,191	202,940	195,056	221,729	191,256	202,496
Energy consumed (total) (GJ)	2,752,598	2,661,699	2,554,023	2,924,043	2,526,744	2,719,576
Energy consumed (net) (GJ)	2,752,598	2,661,699	2,554,023	2,924,043	2,526,744	2,719,576
Energy produced (GJ)	150,548,706	145,260,066	181,068,912	181,878,777	155,466,162	183,237,714

Sources of Scope 1 and Scope 2 emissions for 2020-2021 are illustrated in Figure 6-9. 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.

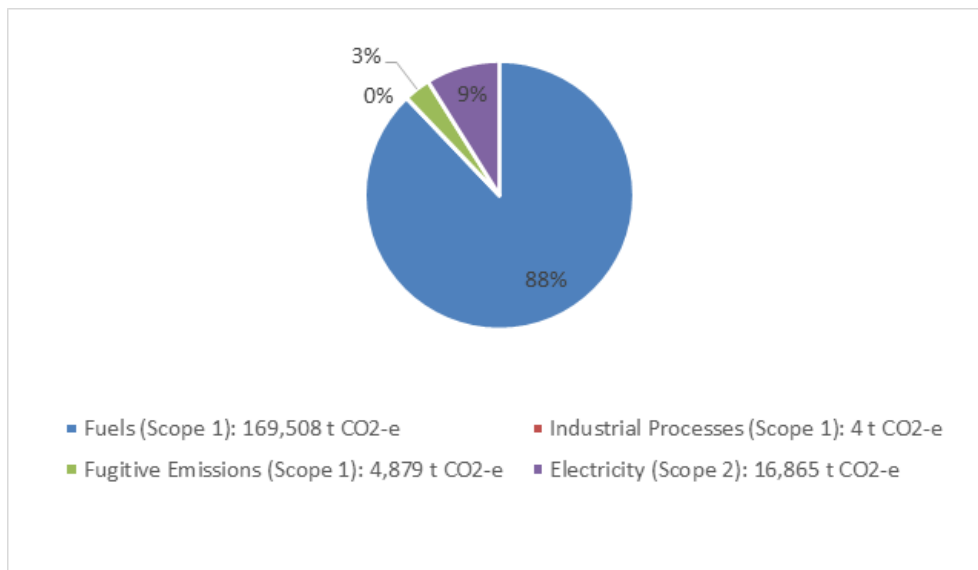


Figure 6-9 Sources of BCM Scope 1 and Scope 2 Emissions

Electricity usage during 2020-2021 was similar to 2019-2020 periods due to the ongoing operation of the CHPP. Emissions from diesel combustion were also similar to the 2019-2020 NGERs reporting period.

6.10.3 Improvements and Initiatives

BCOPL continued to target a decrease in fuel burn during 2021 through improved operating conditions and practices, and efficient engine configuration. This initiative involved reviewing existing operating practices and engine configurations as well as, 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.

During 2021, IA conducted an investigation in relation to the potential GHG initiatives which could potentially be implemented across its Queensland and NSW operations, including the BCM. Following on from this work, detailed site specific reviews of existing GHG measures and potential measures available to further reduce direct GHG measures are under consideration for implementation at BCM during 2022, the outcomes of which will be reported within the 2022 Annual Review.

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 *Work Health and Safety (Mines and Petroleum Sites) Act 2013*; 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 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 Community Consultative Committee (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 TCM and MCCM.

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 two traffic-related incidents recorded on roads in the vicinity of the BCM during the 2021 reporting period. These included one event was a car getting washed away on Braymont Road, the driver escaped with minor injuries. The other was an illegal intersection manoeuvre on a site access with no injuries sustained.

During 2021, 2,903 different individuals accessed the site.

6.12.2.2 Inspections and Audits

A traffic count audit was completed during the reporting period over a 2 week period between 13 and 27 October 2021 to investigate traffic flows on the key routes and to quantify the number of vehicles entering the BCM via each access routes. The traffic monitoring recorded an Annual Average Daily Traffic Volume (AADT) of 485 vehicles per day (vpd) travelling to BCM via the former BCM haul road and 213 vpd traveling to BCM via the Leard Forest Road. This equates to approximately 69.5% via the former BCM haul road and 30.5% via the Leard Forest Road. An analysis of the traffic counts indicates that less than 10% of vehicles travelling to the BCM were heavy vehicles (Class 4 to 12 vehicles). It is important to note that whilst Class 3 vehicles are also typically grouped as heavy vehicles, it was observed during the traffic counts that a significant proportion of Class 3 vehicles are small vehicles with wheel base of more than 3.1m, which includes small busses, utes and 4 x 4 vehicles that are often driven by workers involved in construction and mining projects. Accordingly, these vehicles have been reported as light vehicles. Over the 2-week traffic count period, the survey indicated an AADT of 698 vehicles (heavy and light vehicles). This figure is much lower than the predicted estimated daily traffic volume outlined in the Traffic Management Plan (2022). The TMP estimated a total of 1174 vehicle trips per day comprising 1138 vehicle trips per day generated by staff and 36 heavy vehicle movements per day.

Due to COVID-19, BCOPL took measures of limiting site access to essential staff and where possible encouraged office staff to work from home in 2020. This approach continued into the 2021 reporting period. However in line with the relaxing of the NSW Governments restrictions, personnel have largely returned to site. During the restriction period, all office staff and external contractors which were required to conduct work on the site were required to be signed off by the General Manager.

During November and December 2021, extreme rainfall experienced across the region which resulted in flooding of the Namoi River and associated tributaries which led to closures of the roads providing access to BCM. As discussed earlier, this resulted in several days of lost production. Once flooding receded, BCOPL implemented a clean up program for the key access routes.

6.13 Socio-economic

6.13.1 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 DPE in June 2016. A further revision was conducted on the SIMP during 2019 and 2020 with the revised draft SIMP being distributed to stakeholders (including DPE) for consultation in December 2020. Comments received during the consultation process were then addressed and the revised SIMP was approved by DPE in August 2021.

The approved SIMP summarises the findings of the Social Impact Assessment completed as part of the 2010 EA for the Continuation of Mining at the BCM (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.

6.13.2 Environmental Performance

Section 7.1 of the approved SIMP outlines a range of measures to be used to monitor the social impact of the BCM. BCOPL’s performance against each of the monitoring mechanisms outlined in the SIMP has been assessed as part of the annual review process. The findings of that review are presented in Table 6-19.

Table 6-19 Social Impact Monitoring Summary

Monitoring Mechanism	Type	Frequency	Purpose	Status (2021 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 \$21,706,572.14 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 6.13.2.1
Land use data	Quantitative	Annual	Monitor availability of zoned and serviced residential land and supply of new housing.	Refer to Section 6.13.2.2 for a summary of key land availability and housing supply data for the Narrabri and Gunnedah LGAs.
Social statistics	Quantitative	Six monthly	Monitor changes in service provider statistics (hospital admission rates, GP attendance, school enrolments, emergency response, reported crime).	Refer to Section 6.13.2.3 for a summary of key social statistics.
Attendance records	Quantitative	Annual	Monitor workforce and community participation in education and training programs, induction programs, local sports events, local business forums and business events.	Details of workforce participation are provided in Section 9.

Monitoring Mechanism	Type	Frequency	Purpose	Status (2021 Reporting Period)
Workforce survey	Qualitative	Annual	Record workforce perceptions about general wellbeing, family functioning, and community issues.	Workforce survey conducted in February 2021. Survey had good engagement and the workforce was happy with the current function of the organisation. Survey Identified shortfall in interdepartmental communication and a program has now been introduced to address this.
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. BCOPL's involvement in the Narrabri and Boggabri's business communities provides a mechanism for the company to gauge business perceptions about the BCM within the local community.
Indigenous community focus group	Qualitative	Annual	Record perceptions about engagement of Indigenous community in employment and business opportunities related to the Project.	BCOPL facilitates an Aboriginal Stakeholder Community Forum (ASCF). The ASCF provides a forum for raising general issues by stakeholders or BCOPL. The forum met 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 BCOPL.	Details of all community complaints received during the reporting period and responses made by BCOPL are presented in Section 9.3.

6.13.2.1 Housing

During 2020 BCOPL Commissioned an SQM Research report on the Narrabri, Gunnedah and Boggabri area. No housing survey was conducted during the 2021 reporting period.

Housing vacancy data indicated there have been substantial changes in residential vacancy rates over the past 11 years. Between 2009 and 2021, 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 vacancy rate of less than 0.6% (eight vacancies) in 2021 (SQM 2021).

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 in 2021 of 3% (ten vacancies) (SQM 2021).

Between 2009 and 2021, 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 12-year period, vacancy rates dropped to a low of around 1% in September 2014 before increasing through to the August 2015 high. The residential vacancy rate in Gunnedah during 2021 decreased to 0.7% (12 vacancies) (SQM 2021).

6.13.2.2 Land Availability and New Housing Supply

DPE housing projections from 2016 to 2041 for the areas of interest are summarised below (DPE, 2020b). DPE 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. DPE 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 remained constant till 2020. There was an increase in housing approvals in 2021 compared to 2020. This indicates a substantial level of growth that is predicted to be sustained throughout the coming decade. In the Gunnedah LGA, 64 residential buildings were approved to be built in 2020-2021 (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).
- For the period 2019-2020:
 - Approvals for six new houses in Narrabri LGA, with a total value of approximately \$2.3 M.

- Approvals for 14 new houses in Gunnedah LGA, with a total value of approximately \$5.6 M (ABS, 2021).
- For the period 2020-2021:
 - Approvals for four new houses in Narrabri LGA, with a total value of approximately \$1.3 M.
 - Approvals for 64 new houses, and one other residential buildings in Gunnedah LGA, with a total value of approximately \$24.5 M (ABS, 2021).

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 2021.

In 2020, the NSC finalised its Local Strategic Planning Statement – Future 2040 (NSC LSPS) (NSC, 2020) report which provides a road map to manage the forecast growth within the region whilst ensuring that NSC can continue to deliver the required services and facilities for its local community. The NSC LSPS is supported by the NSC's 2017-2027 Community Strategic Plan and the Narrabri Local Environmental Plan (LEP) to sustainably deliver the forecast growth over the next 20 years. In relation to housing, the NSC has committed to implementing a precinct plan for the Narrabri CBD (Master Plan). The Master Plan aims to identify the constraints and opportunities to 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 have continued throughout 2021 and are anticipated to be released in the near future. 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.

NSC has committed to developing a Housing Strategy in accordance with Planning Priority 7 of the NSC LSPS (*Provide new space to grow and deliver greater housing diversity to suit changing needs*). The Housing Strategy which remains under development will address matters such as "*capacity for residential development in the CBD, building heights and densities, changing demand for housing due to an ageing population*".

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.

6.13.2.3 Social statistics

6.13.2.3.1 Schools

As part of the social impact monitoring required under the SIMP, BCOPL completed a review of school enrolment records for all public schools in Gunnedah, Narrabri, Maules Creek and Boggabri between 2011 and 2019.

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 2020 is provided in Table 6-20.

Table 6-20 Local School Enrolments 2011 - 2019

School	Annual Enrolments									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Boggabri										
Boggabri Public School	98	101	105	123	117	117	113	88	83	69
Sacred Heart Boggabri	37	32	33	34	23	24	37	43	39	43
Narrabri										
Narrabri Public School	≈ 400	≈ 395	≈ 400	≈ 410	≈ 410	406	403	399	394	353
Narrabri West Public School	≈ 230	≈ 240	≈ 280	≈ 280	≈ 300	370	348	327	330	325
Narrabri High School	568	589	588	614	587	540	508	488	489	504
St Xavier's Narrabri	240	224	113	171	195	178	188	189	187	212
Fairfax Public School	8	8	13	10	10	12	14	11	11	8
Gunnedah										
Carinya Christian School – Gunnedah	37	43	6	17	42	69	89	99	155	186
Saint Mary's College Gunnedah	-	-	379	408	401	379	357	364	379	370
St Xavier's Gunnedah	-	-	350	350	358	350	371	381	365	382
G S Kidd Memorial School	45	49	32	33	40	40	40	36	36	33
Gunnedah Public School	≈ 135	≈ 130	≈ 120	≈ 122	≈ 122	≈ 122	156	155	156	164
Gunnedah South Public School	≈ 480	≈ 520	≈ 570	599	616	620	634	629	636	614
Gunnedah High School	≈ 550	≈ 550	≈ 500	≈ 450	≈ 430	430	391	414	426	432

6.13.2.3.2 Health

BCOPL contacted local healthcare service providers via telephone during early 2020 to evaluate the effects that BCM may have had on healthcare services in recent years. The feedback received indicated that the demand on local services has remained stable in recent years and that local providers are sufficiently staffed to cope with the number of patient visits they typically receive. 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 an event such as a 'wet weather discharge' rather than according to a set sampling regime.

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

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

Details of BCM's surface water quality monitoring program including monitoring locations, trigger events and sampling methods, are outlined in Table 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 water quality	As soon as practicable at the commencement of a wet weather discharge	Grab sample with conductivity and pH in situ
5	SW1 'Nagero Creek'	Downstream of mining	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) for field checks. 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 DPE throughout the reporting period regarding the approval of the revised water management system, as part of the subsequent updated SWMP (Rev 9) which was submitted to DPE for approval in January 2022.

7.1.3 Environmental Performance

7.1.3.1 Surface Water Quality Criteria - Interim Trigger Levels

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

7.1.3.2 Results of Ambient and Event Based Monitoring

The approved SWMP requires BCOPL to undertake surface water quality monitoring in Nagero Creek upstream (SW2) and downstream (SW1) of the BCM during or following rainfall events sufficient to generate flow within Nagero Creek.

There were six rainfall events during the reporting period that generated sufficient flow within the Nagero Creek to sample. The results of monitoring during these events are presented in Table 4.3. There were no surface water discharge events triggered during 2021.

The results of the ambient event-based monitoring (Table 4 3) suggest that there is little difference in the ambient water quality upstream and downstream of BCM, specifically:

- pH is generally slightly higher downstream (SW1) compared to upstream (SW2)
- salinity (conductivity) is slightly higher downstream (SW1) compared to upstream (SW2)
- nutrients (nitrate, nitrogen, phosphorous) are slightly higher downstream (SW1) compared to upstream (SW2)
- TSS is comparable between the upstream and downstream monitoring points
- Metals and other analytes are comparable between the upstream and downstream monitoring points

Table 7-3 Summary of Frequency Based Monitoring Results – Rainfall Events

Date	Parameters																	
	In situ pH (pH units)	In Situ Conductivity (mS/cm)	pH (pH units)	Conductivity (µS/cm)	Nitrate (mg/L)	Nitrogen (total) (mg/L)	Phosphate (total) (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)
SW1 (Nagero Creek Downstream of BCM)																		
25/02/2021	6.65	0.04	6.63	35	0.262	0.263	0.38	587	<5*	0.05	<0.001*	<0.0001*	0.001	<0.001*	0.001	<0.001*	<0.005*	1.12
24/03/2021	7.22	0.23	7.76	217	0.7	1.9	0.004	134	<5*	0.04	<0.001*	<0.0001*	<0.001*	0.002	<0.001*	0.002	<0.005*	0.21
11/10/2021	8.28	0.17	6.35	139	0.03	2.1	0.46	118	<5*	0.09	0.001	<0.0001*	0.003	0.003	0.001	0.005	0.008	2.37
22/11/2021	7.67	0.21	7.5	181	0.02	1	0.21	42	<5*	0.03	<0.001*	<0.0001*	<0.001*	0.002	0.003	<0.001*	<0.005*	0.5
24/11/2021	8.69	0.26	7.94	243	<0.01*	2.7	0.44	60	<5*	0.03	0.002	<0.001*	0.003	0.003	0.006	<0.001*	0.005	1.7
27/11/2021	8.39	0.23	7.18	200	0.03	1.4	0.15	44	<5*	0.04	<0.001*	<0.0001*	<0.001*	0.001	0.002	<0.001*	<0.005*	0.13
SW2 (Nagero Creek Upstream of BCM)																		
25/02/2021	6.68	0.08	7.17	73	0.22	1.4	0.26	232	<5*	0.01	<0.001*	<0.0001*	<0.001*	<0.001*	0.003	<0.001*	<0.005*	0.81
23/03/2021	7.11	0.22	7.62	199	0.25	1.8	0.32	177	<5*	0.11	<0.001*	<0.0001*	<0.001*	0.002	0.002	<0.001*	<0.005*	0.1
24/03/2021	6.50	0.13	7.12	109				12	<5*		<0.001*	<0.0001*	0.001	0.004	<0.001	0.002	<0.005*	1.14
22/11/2021	7.87	0.12	6.89	73	0.04	1.7	0.22	19	<5*	<0.01*	<0.001*	<0.0001*	0.001	0.001	0.003	<0.001*	<0.005*	1.11
24/11/2021	7.03	0.11	7.52	215	<0.01	1.1	0.1	386	<5*	<0.01*	0.001	<0.0001*	0.002	0.001	0.003	<0.001*	<0.004*	1.49
27/11/2021	7.66	0.15	6.7	116	0.04	2	0.18	22	<5*	0.01	<0.001*	<0.0001*	<0.001*	0.001	0.002	<0.001*	<0.005*	0.13

*Below detectable limit

7.1.3.3 Results of Frequency Based Monitoring

Frequency based monitoring was undertaken on the following dates:

- Quarter 1 – 9 March 2021;
- Quarter 2 – 7 June 2021;
- Quarter 3 – 3 September 2021; and
- Quarter 4 – 14 December 2021.

The in situ results for quarterly monitoring are provided in Table 7-4, with the laboratory results indicated in brackets.

Table 7-4 Summary of Frequency Based Monitoring Results

	MW3	SD3	SD4	SD6	SD10	SD12	SD23
pH							
Q1	9.19	8.04	8.3	8.81	8.56	8.89	9.08
Q2	8.92	8.30	7.9	8.59	9.03	8.27	8.34
	(8.86)	(8.13)	(7.31)	(7.60)	(8.58)	(7.97)	(8.08)
Q3	9.11	8.82	8.26	7.88	8.52	8.48	8.59
		(8.81)		(7.74)			
Q4	8.53	8.87	7.65	7.92	8.3	8.89	8.38
	(8.27)	(7.61)	(7.35)	(7.29)	(7.45)	(8.64)	(8.34)
Average	8.94	8.37	7.80	7.98	8.41	8.52	8.47
Conductivity (µS/cm)							
Q1	1286	616	178.1	501	1116	2122	1751
Q2	674	705	152.1	378	1350	2024	1552
	(663)	(685)	(138)	(376)	(1320)	(1970)	(1480)
Q3	566	755	164.4	1388	1372	1877	1801
		(770)		(1360)			
Q4	501	622	126.4	444	696	975	1055
	(484)	(642)	(115)	(428)	(682)	(947)	(1020)
Average	696	685	146	696	1089	1653	1443

Results show pH measured in situ (site samples) ranged from 7.65 to 9.19, with an average of 8.52 across all sediment dams included in quarterly monitoring. This is a slightly higher average than recorded in the 2020 reporting period where the average overall pH was 8.45. The in situ pH results were generally similar to the lab analysis results.

Conductivity measured in situ ranged from 126.4 µS/cm to 2,122 µS/cm with an average of 955.29 µS/cm across all surface water monitoring locations during the reporting period. This is a lower average than recorded during 2020 reporting period where the average overall conductivity was 1,108 µS/cm. The in situ conductivity results were generally similar to the lab analysis results.

7.1.3.4 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 2020 to 30 June 2021) is detailed in Table 7-5.

Table 7-5 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	Upper Namoi Zone 4 Namoi Valley (Keepit Dam to Gin's Leap), Upper and Lower Namoi Groundwater Sources WSP	1028	2056	90	60	590.21	650.21
12767							
24103							
12691							
36547							
37519							
29473	Gunnedah Oxley Basin Murray Darling Basin Groundwater Source, NSW Murray Darling Basin Porous Rock Groundwater Sources WSP	842	210.5	0	381	12.81	393.81
29562							
2571	Lower Namoi Regulated River, Upper Namoi and Lower Namoi Regulated River WSP	251.2	188	46	0	0	0
2572							
2595							
2596							
37067	Upper Namoi Regulated River, Upper Namoi and Lower Namoi Regulated River WSP	128	64	192 [^]	0	0	0
42234	Upper Namoi Zone 11 Maules Creek Groundwater source. Purchased 9/1/2019	20	40	0	1	0	1

*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.

[^] Includes 64ML forfeited due to account balance exceeding account limit

7.1.3.4.1 Water Demand

Core water demands during the 'water year' reporting period (1 July 2020 to 30 June 2021) were for coal processing in the CHPP and dust suppression (see Figure 7-1). Quantities of water were also required for vehicle washdown and potable water uses. Table 7-6 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 7-6 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

7.1.3.4.2 Water Usage

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

During the reporting period 817.12 ML of water was used for dust suppression. This represents a reduction in water use from the previous reporting period, when 1,041.38 ML of water was used. This is attributed to higher rainfall during the 2021 reporting period. A cumulative rainfall of 1003.6 mm was recorded at the end of 2021 compared to only 808.2mm recorded for 2020.

In addition, a total of 424.67 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 7-6.

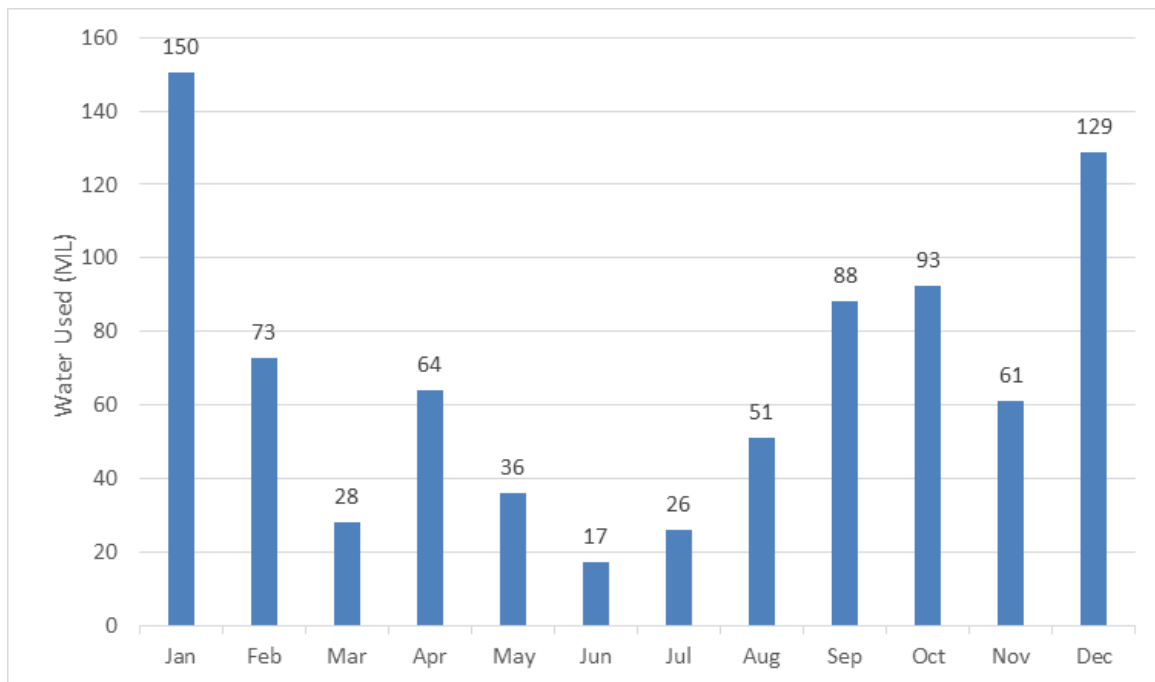


Figure 7-1 Monthly Dust Suppression Water Usage (ML)

7.1.3.4.3 Water Storage

Details of BCM’s water storage dams including their design capacity and storage at the beginning (as at 4 January 2021) and end of the reporting period (as at 27 December 2021), are outlined in Table 7-7.

Table 7-7 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	50.3	50.4
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	17.0	36.9
SD7	Eastern spoil dump	Dirty Water: runoff from spoil dump and clean runoff from undisturbed catchment	210.3	-	95.1	53.7	65.3
SD8	In MIA	Dirty Water: runoff from MIA	11.2	4.9	13.39	2.6	3.8
Dirty water total						123.7	156.5
Contaminated water							
SD23	Near topsoil stockpile	Dirty Water: runoff from topsoil stockpile	51.6	-	16.96	16.7	12.3
SD10	CHPP	Contaminated Water: runoff from product coal stockpile	31.4	81.9	116.4	45.0	53.8
SD11	At rail loop	Contaminated Water: runoff from rail loop	3.8	10	16.4	3.6	4.1
SD12	CHPP	Contaminated Water: runoff from ROM coal stockpile	46.2	120.5	206.6	50.3	46.1
SD28	Train load out facility (TLO)	Contaminated Water: Runoff from TLO	0.7	1.7	3.5	1.5	1.0
MW3	South of MIA	Contaminated Water: surplus pumped from SD2 and clean runoff from small grassed catchment	10.7	13.1	153.5	3.4	22.7
MW5	In pit	Contaminated Water Storage Dam	208.4	1,000	2,200	752.7	1534.7

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)
MW8	In pit	Contaminated Water: surplus mine water from pit	-	-	52.93	26.1	34.4
Contaminated water total						899.3	1709.2

7.1.3.5 Water Balance Modelling

The site water balance model was reviewed and recalibrated for 2021 (Appendix H BCOPL 2022) by comparing the observed and modelled site water inventory (Figure 7-2). The calibrated site water balance model is considered to provide a reasonable fit to the observed site water inventory and is therefore expected to continue to provide reasonable estimates of future water demands, inventories, and discharges.

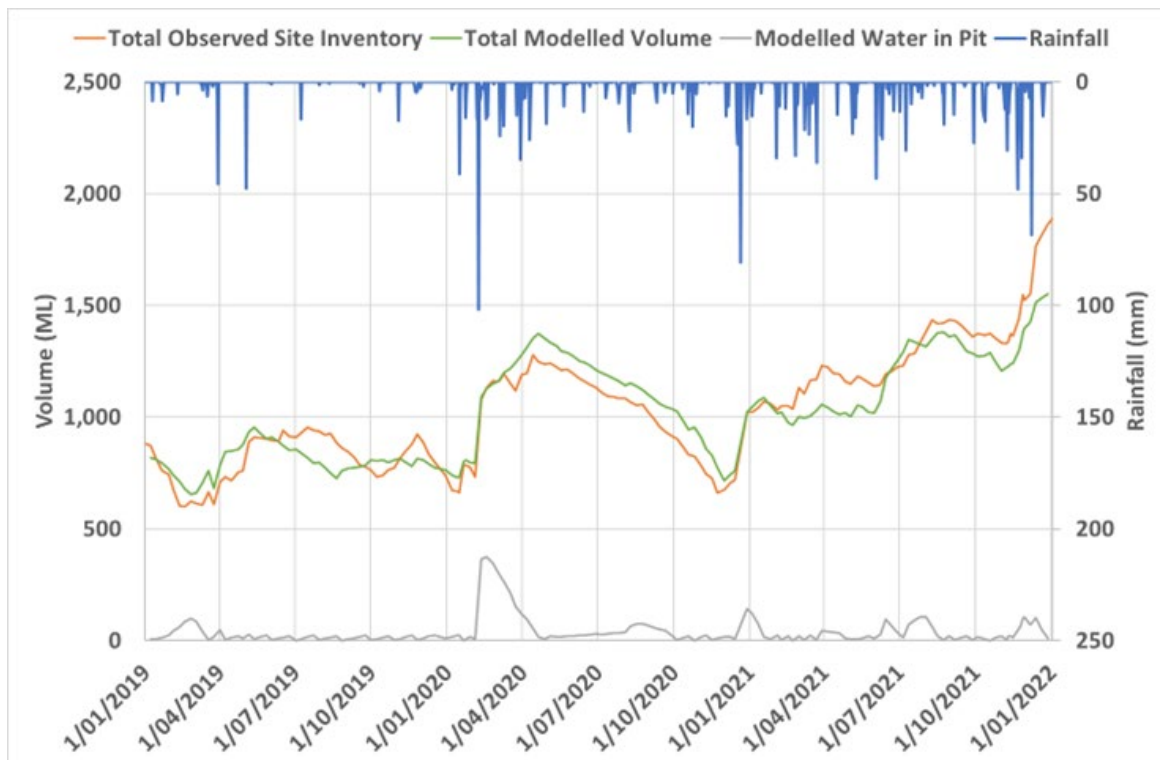


Figure 7-2 Modelled vs Observed Site Water Inventory

7.1.3.5.1 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 2021 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 2021 with averages ranging from about 7.8 to 8.9; and
- EC has generally remained stable from 2015-2021 with averages ranging from less than about 700 $\mu\text{S/cm}$ to greater than about 1,600 $\mu\text{S/cm}$
- EC levels in SD10, SD12 and SD23 remaining consistently high (greater than 1000 $\mu\text{S/cm}$).

- EC levels in SD6 have reduced from over 1000 $\mu\text{S}/\text{cm}$ in previous years to around 700 $\mu\text{S}/\text{cm}$ during the reporting period
- EC levels in SD4 remain low at about 150 $\mu\text{S}/\text{cm}$

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 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 7-5.

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 09_0182.

Groundwater monitoring during 2021 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 2021), as listed in Table 7-8.

Table 7-8 Groundwater Quality Testing Parameters

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

Groundwater quality field parameters (EC, pH and temperature) were measured quarterly, while sampling for major ions, dissolved metals and nutrients was undertaken in June and November 2021. Bores IBC2104 and IBC2105 have been destroyed due to the progression of mining in 2019.

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 7-9 and their respective locations are shown in Appendix B.

Table 7-9 Groundwater Monitoring Bores

EP L 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 unavailable for December 2021 due to inaccessibility. Sample taken in January 2022 and will be provided in the 2022 annual review.
-	MW6	90BL254255	-	18-22	Nagero Creek Alluvium	Alluvium	Water level and quality
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	Merriown Coal Seam	Water level and quality unavailable

EP L ID	Bore	Licence	Depth (mBGL ^B)	Screen interval (mbtoc ^A)	Geological Unit	Screened geology	Notes for reporting period
					Formation Aquifer		for December 2021 due to inaccessibility. Sample taken in January 2022 and will be provided in the 2022 annual review.
-	MW6	90BL254255	-	18-22	Nagero Creek Alluvium	Alluvium	Water level and quality

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 provide analyses on groundwater levels and groundwater quality during the 2021 reporting period. Findings from the review are summarised in the following sections.

7.2.2 Environmental Performance

7.2.2.1 Groundwater Level Results

The minimum recorded water levels recorded in 2021 have been compared with the trigger levels defined in the GWMP are provided in Table 7-10. Table 7-10 also includes updated trigger values that include the most recent monitoring data. This allows for long-term changes to the groundwater levels to be accounted for, whilst still allowing for sudden changes in groundwater levels to be identified and investigated.

During the monitoring period, two bores screened in the Boggabri Volcanics (IBC2110 and IBC2111) remained within trigger values defined in the GWMP. However, one bore in the Boggabri Volcanics dropped below the trigger value (GW3115). The monitoring bore within the alluvium (MW6) remained above the trigger value. Due to flooding and restricted access to IBC 2181, monitoring was deferred from December 2021 to January 2022. Relevant data will be included in the 2022 annual review.

The recalculated trigger values are generally within 300 mm of the triggers included in the GWMP and are all higher than the GWMP triggers (Table 7-10). This is in response to the recent higher than average rainfall resulting in increased groundwater recharge.

Table 7-10 Minimum Measured Groundwater Levels

Monitoring bore	Trigger value (5 th percentile) (mAHD)		Minimum water level 2021 reporting period
	GWMP ^A	Recalculated	
GW3115	256.98	256.99	256.96
IBC2110	257.11	257.28	264.11
IBC2111	256.62	256.78	263.9
BC2181		238.13	232.8
MW6	258.48	258.73	262.52

^A Approved trigger levels from the approved Groundwater Management Plan

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 7-3. Figure 7-3 also includes monitoring data from the discontinued bores.

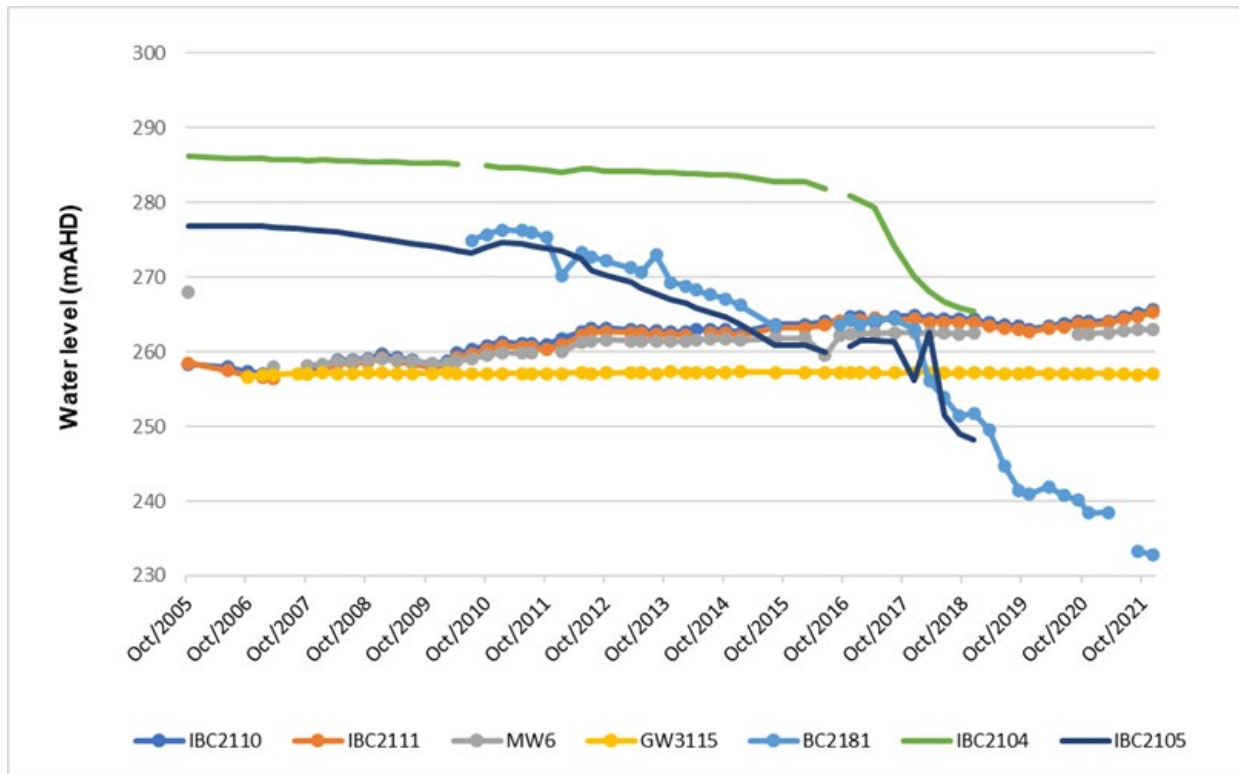


Figure 7-3 Long Term Groundwater Levels for all Bores

Figure 7-3 clearly shows that the monitoring bores within the Boggabri Volcanics (IBC2110, IBC2111 and GW3115) and alluvium (MW6) have continued to remain relatively stable, whilst a clear downward trend continues for the monitoring bore within the Meriown Seam (BC2181), as mining progresses and depressurises the seam.

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 7-3, the recorded water level in MW6 has remained relatively stable at around 262m AHD for at least the last five 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 7-3, the recorded water level in IBC2110 and IBC2111 have increased slightly during 2021 but remain within the recent range of about 263 mAHD to 265 mAHD.

Although GW3115 dropped below the trigger value of 256.99 mAHD, the measured value was only 0.03 mADH below, at 256.96 mAHD. Recorded water level at this location has remained continually stable at around 257 mAHD since 2006 (Figure 7-3).

7.2.2.1.3 Maules Creek Formation

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

As indicated in Section 7.2.2.1 and Figure 7-3, the water level in BC2181 continues 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 were predicted to decrease over the life of the mine (AGE, 2010). Drawdown has been observed in Maules Creek Formation, which is consistent with the predicted decrease in water levels at BC2181.

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 DPE in January 2022.

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 GMP for the currently active monitoring bores are presented in Table 7-11.

7.2.2.4 Compensatory groundwater

In accordance with Schedule 3 condition 34 of the SSD 09_0182, 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 2021, therefore no compensatory water supplies were provided.

Table 7-11 Groundwater Level Trigger Value

Parameter	Trigger values	Exceedance criteria	Coal Measures	Alluvium	Boggabri Volcanics		
			BC2181	MW6	IBC2110	IBC2111	GW3115
pH	Median		6.9	7.1	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	7.7	8.1
	LTV (84.13th %ile)	5 consecutive data points	7.2	7.4	8	7.2	7.8
	LTV (15.87th %ile)	5 consecutive data points	6.8	6.9	7.7	6.7	7.4
	MTV (2.27th %ile)	2 consecutive data points	6.3	6.8	7.6	6.5	7.2
	HTV (0.13th %ile)	1 data point	6.1	6.8	7.4	6.5	7.2
EC (µS/cm)	Median		752	2095	2045	2350	3430
	LTV (84.13th %ile)	5 consecutive data points	846	2310	2138	2490	3526
	MTV (97.73rd %ile)	2 consecutive data points	1056	2356	2434	2538	3773
	HTV (99.87th %ile)	1 data point	1267	2369	2666	2559	3846
Sulphate (mg/L)	Median		23	52	60	62	179
	LTV (84.13th %ile)	5 consecutive data points	30	70	85	85	202
	MTV (97.73rd %ile)	2 consecutive data points	43	74	125	102	211
	HTV (99.87th %ile)	1 data point	51	77	134	108	212
Chloride (mg/L)	Median		48	296	285	348	641
	LTV (84.13th %ile)	5 consecutive data points	76	296	396	409	695
	MTV (97.73rd %ile)	2 consecutive data points	116	479	465	471	743
	HTV (99.87th %ile)	1 data point	139	511	508	491	767
Sodium (mg/L)	Median		69	377	431	348	695
	LTV (84.13th %ile)	5 consecutive data points	83	403	463	365	766
	MTV (97.73rd %ile)	2 consecutive data points	137	414	490	379	802

7.2.2.5 Groundwater Quality Results – Field Parameters

Time series plots of pH and electrical conductivity (EC) are presented in Figure 7-4 and Figure 7-5 respectively. Water quality field parameters for EC and pH have also been compared to the trigger values, with results presented in Table 7-12.

There were exceedances of the pH trigger values for the lower bound MTV in both June and September 2021 at MW6 (Table 7-12). The lower bound LTV was exceeded a few times at GW3115 (September: Table 7-12), IBC2110 (June, September and December: Table 7-12) and IBC2111 (June, September and December: Table 7-12).

EC was within trigger values throughout 2021 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 June 2021 (Table 7-12) is considered 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.

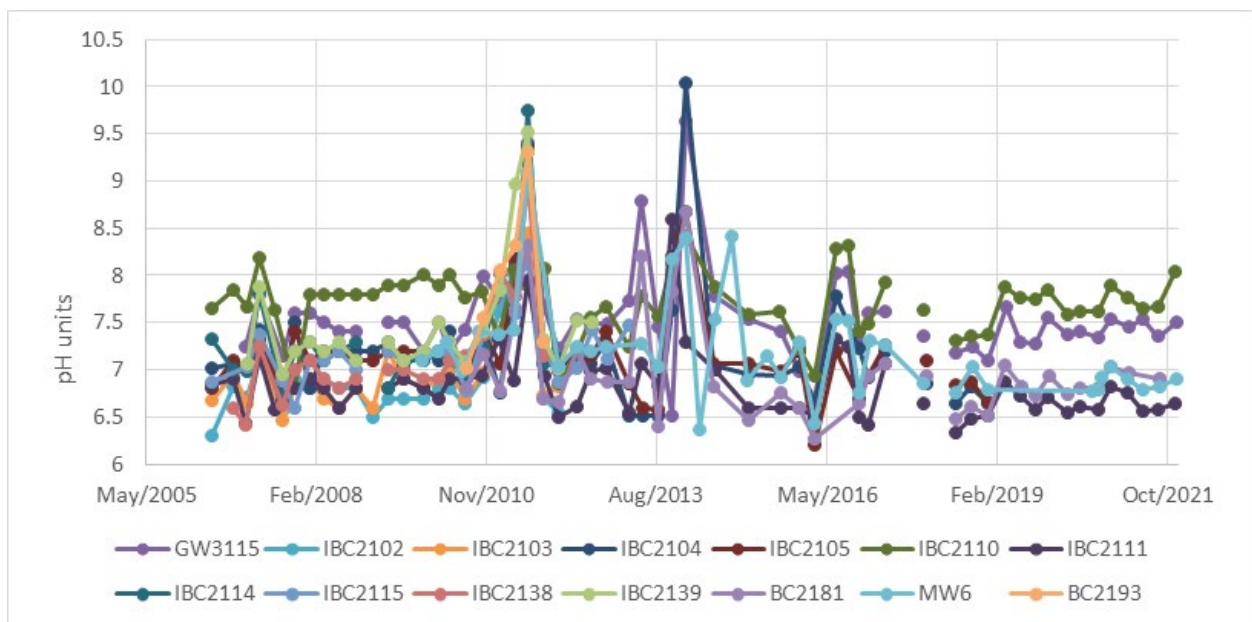


Figure 7-4 Groundwater Trends in pH

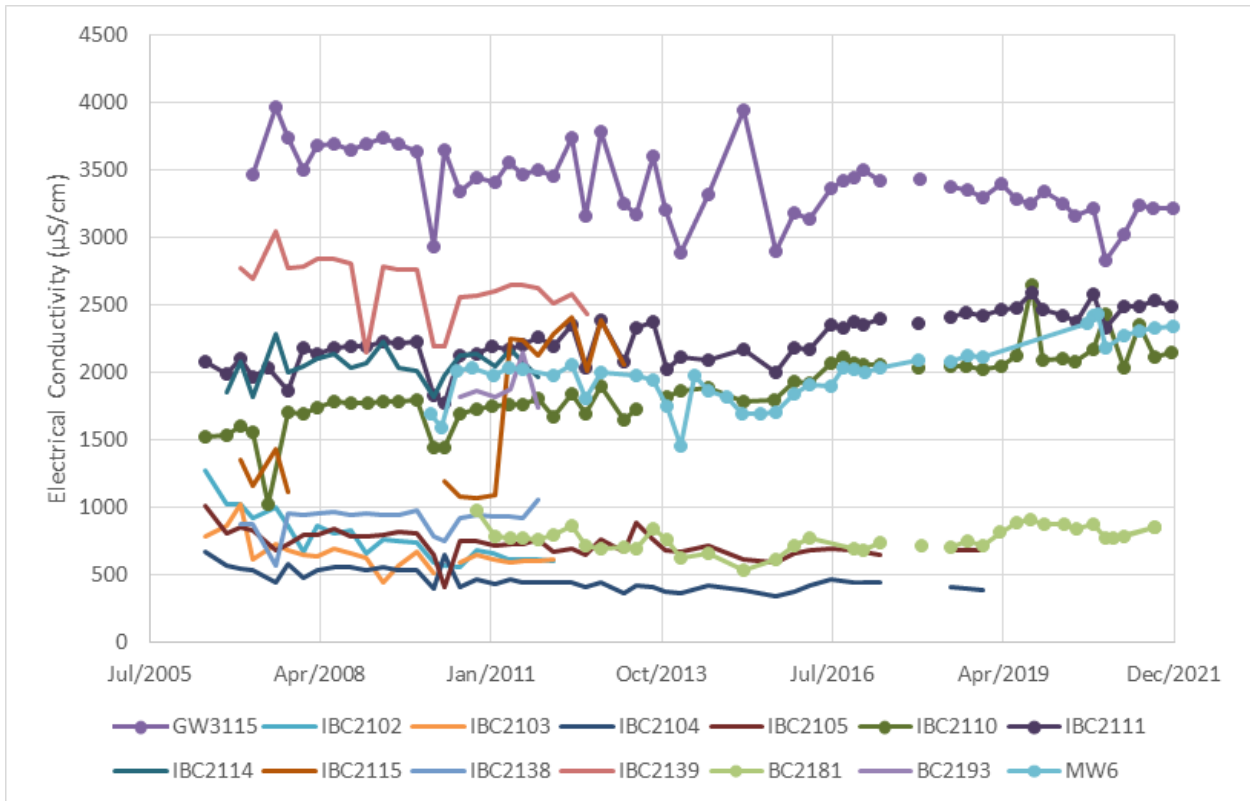


Figure 7-5 Groundwater Trends in Electrical Conductivity

Table 7-12 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)			
17/03/2021	257.05	7.46	3020
8/06/2021	257.02	7.53	3240
3/09/2021	256.96	7.35 ^a	3220
21/12/2021	257	7.50	3220
IBC2110 (Boggabri Volcanics)			
9/03/2021	264.11	7.77	2035
7/06/2021	264.72	7.65 ^a	2351 ^c
6/09/2021	265.18	7.67 ^a	2114
14/12/2021	265.64	8.04 ^a	2149
IBC2111 (Boggabri Volcanics)			
9/03/2021	263.9	6.75	2489 ^b
7/06/2021	264.32	6.56 ^a	2490 ^b

Bore and date sample	Standing Water Level (m AHD)	pH (pH units)	Electrical Conductivity (µS/cm)
6/09/2021	264.74	6.58 ^a	2530 ^b
14/12/2021	265.26	6.64 ^a	2490 ^b
BC2181 (Merriown Seam)			
17/03/2021	238.49	6.97	785
8/09/2021	Not available	6.90	852 ^a
8/09/2021	233.2	6.90	852 ^a
MW6 (Alluvium)			
10/03/2021	262.52	6.90	2276 ^b
8/06/2021	262.78	6.79 **	2310 ^b
9/09/2021	263	6.82 **	2336 ^b
21/12/2021	262.98	6.91	2338 ^b

Notes:

- ^a 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 exceedance of the MTV (but less than the 2 consecutive readings required for a breach of trigger)
- ^{***} exceedance of the HTV (as defined in section Table 7-11)
- ^{**} two consecutive exceedances of the MTV (as defined in Table 7-11)
- ^{*} five consecutive exceedances of the LTV (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 7-13.

All major ions at sites sampled were compliant with the trigger values except for exceedances for sodium, chloride, and sulfate. The HTV for sulfate was exceeded in June for IBC2110, and the MTV for sulfate was exceeded in June and December for IBC2111.

Statistically significant increasing trends in chloride and sulfate have been identified in bores installed in the alluvium (MW6) and the Boggabri Volcanics (IBC2111) (Section 7.2.2.5.4). The exceedance of trigger values for chloride and sulfate commenced in 2016. The trend in sulfate and chloride is associated with the increasing trend in EC in monitoring bores installed in the Boggabri Volcanics. Continued monitoring of major ions is recommended.

Table 7-13 Results Summary for Analysis of Major Ions

Bore and date sample	Bicarbonate as CaCO ₃ (mg/L)	Sulfate as SO ₄ (mg/L)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)
GW3115 (Boggabri Volcanics)							
8/06/2021	691	165	586	62	16	622	4
21/12/2021	491	158	624	60	18	613	5
IBC2110 (Boggabri Volcanics)							
7/06/2021	449	134 ^{***}	446 ^a	23	15	481 ^a	5
14/12/2021	315	85	403 ^a	15	9	412	3
IBC2111 (Boggabri Volcanics)							
7/06/2021	646	100 ^{**}	426 ^a	144	45	356	5
14/12/2021	505	97 ^{**}	463 ^b	141	42	333	6
BC2181 (Merriown Seam)							
8/06/2021	401	15	35	76	24	60	9
(December 2021 sampling delayed until January 2022 due to accessibility issues)							
MW6 (Alluvium)							
8/06/2021	657	70 ^a	388	84	33	401	7
21/12/2021	503	67 ^a	411 ^a	78	32	380	7

Note:

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

^b exceedance of the MTV (but less than 2 consecutive readings that would constitute a breach of the trigger).

^{***} exceedance of the HTV (as defined in Table 7-11)

^{**} two consecutive exceedances of the MTV (as defined in Table 7-11)

^{*} five consecutive exceedances of the LTV (as defined in Table 7-11)

7.2.2.5.2 Groundwater - Metals

Analytical results indicated that dissolved metal concentrations for Cadmium, Chromium, Copper, and Iron were generally below laboratory limit of reporting (LOR) (Table 7-14). Concentrations of Manganese, Nickel, and Zinc above the LOR were recorded (Table 7-14), however remain at levels generally consistent with historically observed values.

A summary of the metal concentrations recorded during the reporting period is presented in Table 7-14.

Table 7-14 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)									
8/06/2021	0.003	<0.0001	<0.001	<0.001	<0.001	0.086	<0.001	0.04	3.13
21/12/2021	0.001	<0.0001	<0.001	<0.001	<0.001	0.093	0.002	0.034	2.4
IBC2110 (Boggabri Volcanics)									
7/06/2021	0.002	<0.0001	0.001	<0.001	<0.001	0.044	0.007	0.115	<0.05
14/12/2021	<0.001	<0.0001	<0.001	<0.001	<0.001	0.013	0.002	0.011	<0.05
IBC2111 (Boggabri Volcanics)									
7/06/2021	0.002	0.0005	<0.001	0.01	<0.001	0.015	0.004	0.139	<0.05
14/12/2021	<0.001	0.0002	<0.001	0.045	<0.001	0.008	0.004	0.165	<0.05
BC2181 (Merriown Seam)									
8/09/2021	<0.001	<0.0001	<0.001	0.002	<0.001	0.071	<0.001	0.012	<0.05
(December 2021 sampling delayed until January 2022 due to accessibility issues)									
MW6 (Alluvium)									
8/06/2021	0.003	0.0003	<0.001	<0.001	<0.001	0.016	0.002	0.055	<0.05
21/12/2021	<0.001	<0.0001	<0.001	0.01	<0.001	0.009	0.002	0.075	<0.05

7.2.2.5.3 Groundwater - Nutrients

Nutrient concentrations during 2021 were generally similar to historical concentrations, with spikes in nitrate (and total nitrogen) concentrations at GW3115 and IBC2110 in June 2021, compared to previous years, and spikes in phosphorus concentrations at IBC2111 June 2021, compared to previous years (Table 7-15).

Table 7-15 Results Summary for Analysis of Nutrients

Bore and date sample	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Nitrite + Nitrate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Reactive Phosphorus (mg/L)
GW3115 (Boggabri Volcanics)								
8/06/2021	0.14	<0.01	0.03	0.03	0.2	0.2	0.01	<0.01
21/12/2021	0.08	<0.01	<0.01	<0.01	<0.1	<0.1	0.01	<0.01
IBC2110 (Boggabri Volcanics)								
7/06/2021	0.29	<0.01	0.12	0.12	0.4	0.5	0.05	0.01
14/12/2021	0.02	<0.01	<0.01	<0.01	0.1	0.1	0.03	<0.01
IBC2111 (Boggabri Volcanics)								

Bore and date sample	Ammonia (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Nitrite + Nitrate (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Reactive Phosphorus (mg/L)
7/06/2021	0.04	<0.01	4.16	4.16	0.9	5.1	0.07	0.01
14/12/2021	<0.01	<0.01	3.94	3.94	1	4.9	0.02	0.01
BC2181 (Merriown Seam)								
8/09/2021	0.14	0.06	<0.01	<0.01	0.2	0.2	0.06	<0.01
(December 2021 sampling delayed until January 2022 due to accessibility issues)								
MW6 (Alluvium)								
8/06/2021	0.02	<0.01	2.3	2.3	0.6	2.9	0.06	0.02
21/12/2021	0.12	<0.01	2.33	2.33	0.9	3.2	0.03	0.01

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 7-16).

Table 7-16 Long Term Mann-Kendall Water Quality Trends

Analyte	GW3115	IBC2110	IBC2111	BC2181	MW6
pH	N	N	↓↓	N	S
EC	↓↓↓	↑↑	↑↑	↑↑↑	↑↑↑
Sulfate	S	N	↑	↓↓↓	↑↑↑
Chloride	S	N	↑	S	↑↑↑
Sodium	S	S	S	S	↑↑
Calcium	↓↓↓	S	↑	↑↑↑	↑↑↑
Magnesium	↓↓↓	↑	↑↑↑	↑	↑↑↑
Potassium	S	N	N	↓	S
Nickel	I	↑↑↑	↑	N	↑↑
Zinc	↑↑	N	N	↑	↑↑↑
Iron	↓↓	S	N	N	N
Nitrite	I	S	S	N	S
Nitrate	N	N	S	N	↑↑↑
Phosphorus	S	N	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 7-16) 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.

The recent decrease in EC at GW3115 is likely the result of increased groundwater recharge due to the extended period of higher than average rainfall.

7.2.2.5.5 Groundwater Quality Summary

Groundwater quality was generally within trigger values except for several exceedances for pH and EC at Boggabri Volcanics, Merriown Seam and Alluvium sites, and several 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 311 ML. This reported volume includes water that entered the pit via intercepted coal seams and was pumped from the pit or subject to evaporation.

Significant rainfall events make the estimation of total groundwater make into the pit difficult to estimate, however from previous years the estimated total groundwater take (including pit inflows) were less than the total licenced water take for the Gunnedah – Oxley Basin groundwater source (WAL 29562 and WAL 29473) is 842 ML/year.

7.2.3 Improvements and Initiatives

Estimates of the groundwater volumes intercepted by the pit have, to date, been undertaken based on pump records for pit dewatering. As mining progresses, an increasing proportion of this water will be a result of seepages from the backfilled pit. Accurate separation of this seepage water from the groundwater take is required to:

- Better account for the volume of groundwater intercepted by the pit; and
- Improve the accuracy of water management across the site, including water balance modelling and water inventory forecasting.

A backfill seepage model has been developed and included in the site water balance model (refer to the Site Water Balance Review, 2022) in order to better estimate these inflows. The model will continue to be reviewed and periodically re-calibrated as part of the periodic review of the site water balance model.

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 the reporting period, no final rehabilitation works were able to be conducted at BCM. This aligns with the MOP Addendum which was approved by the Resources Regulator on 28 January 2022. 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 2021 Plantings

No plantings occurred during the 2021 reporting period in the rehabilitation area.

8.2.3 Rehabilitation Status

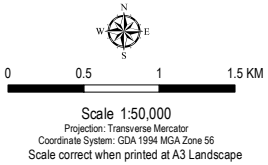
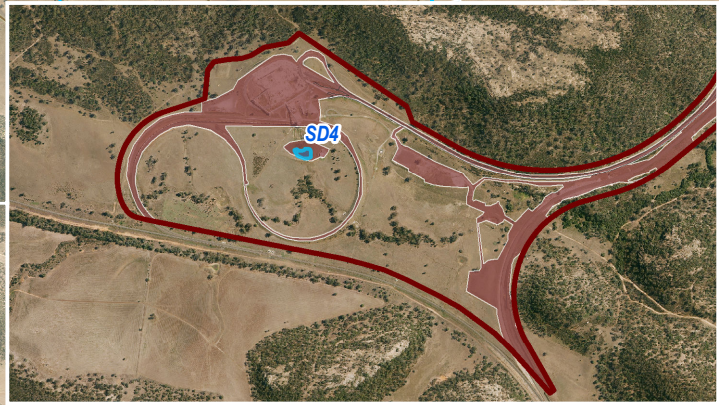
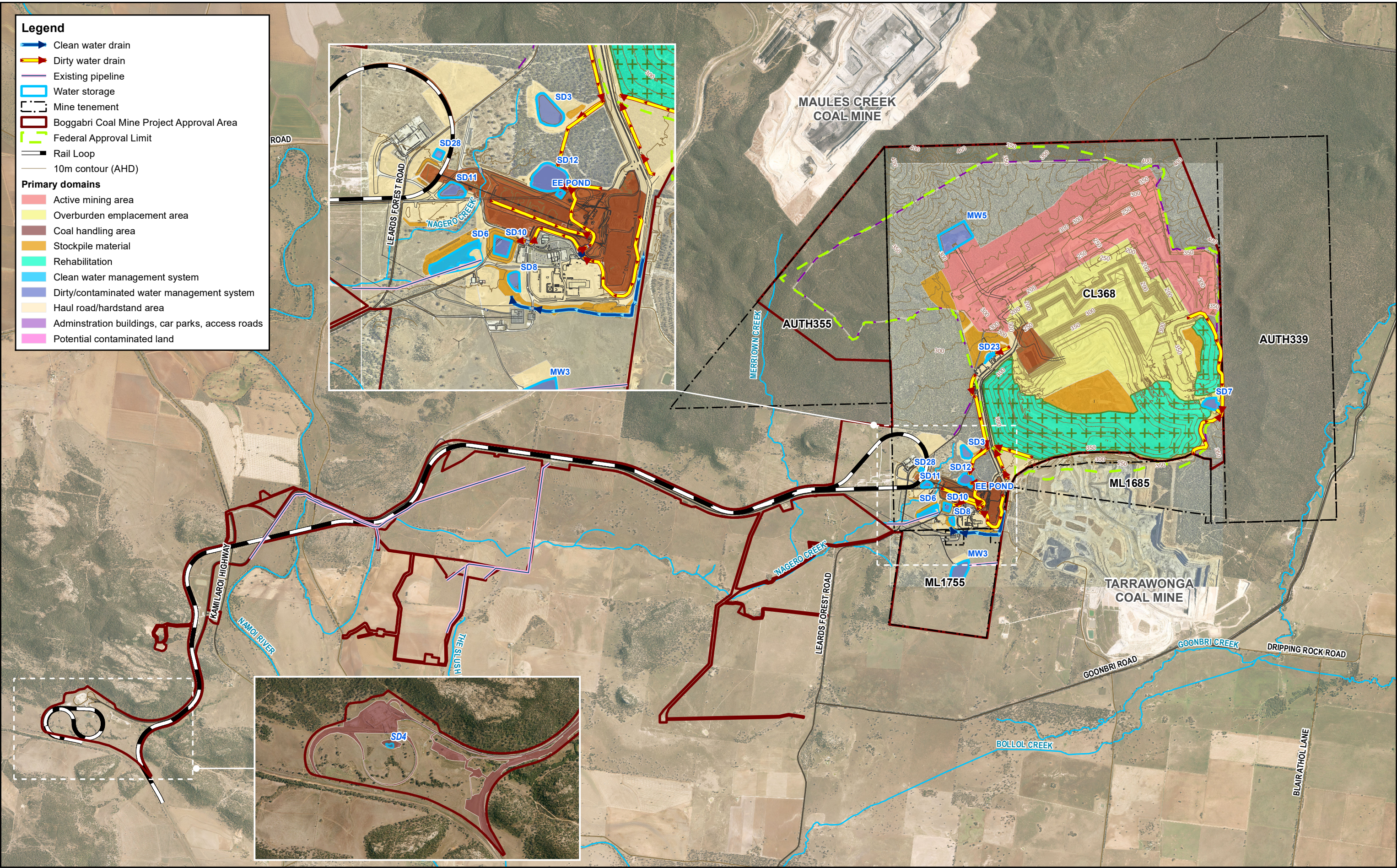
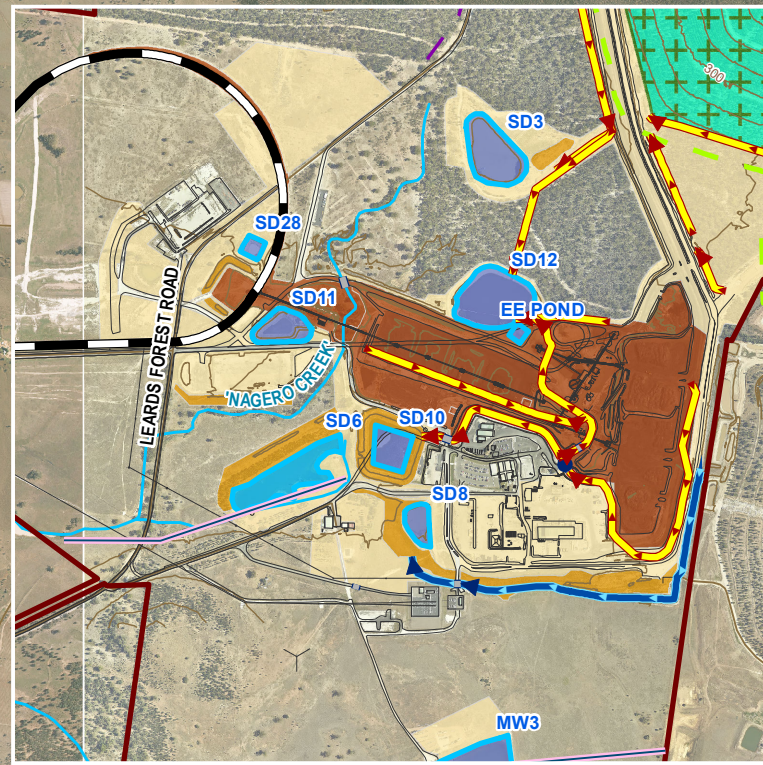
BCOPL has adopted ten primary rehabilitation domains (refer to Figure 8-1). These domains define areas based on operational or functional purpose and geophysical similarities. The MOP outlines the regulatory requirements, rehabilitation objectives, indicators and completion criteria for each rehabilitation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

The calculated rehabilitation status based on the requirements of the *Annual Review Guideline* (2015) for 2020 and 2021 and predicted values for 2022 in accordance with the approved MOP Addendum are summarised in Table 8-1.

Table 8-1 Rehabilitation Status

Mine Area Type	2020 Reporting Period (Actual) (ha)	2021 Reporting Period (Actual) (ha)	2022 Reporting period (Predicted) (ha)
A. Total mine footprint	1529.99	1567.50	1,599.7
B. Total actual disturbance	1406.29	1443.83	1,460.83
C. Land being prepared for rehabilitation	N/A	N/A	N/A
D. Land under active rehabilitation	292.1	292.1	292.1
E. Completed Rehabilitation	None	None	None

- Legend**
- Clean water drain
 - Dirty water drain
 - Existing pipeline
 - Water storage
 - Mine tenement
 - Boggabri Coal Mine Project Approval Area
 - Federal Approval Limit
 - Rail Loop
 - 10m contour (AHD)
- Primary domains**
- Active mining area
 - Overburden emplacement area
 - Coal handling area
 - Stockpile material
 - Rehabilitation
 - Clean water management system
 - Dirty/contaminated water management system
 - Haul road/hardstand area
 - Administration buildings, car parks, access roads
 - Potential contaminated land



Imagery: BCOP (2017,2018);

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AUTHOR: I.Augey

REVIEWED BY: N.Cooper

DATE: 14/04/2022



FIGURE

8-1

TITLE: **MINING AND REHABILITATION AT END OF 2021 REPORTING PERIOD**

8.2.4 Comparison with MOP Predictions

A MOP Addendum was approved by the Resources Regulator on 28 January 2022 to align the MOP with the disturbance and rehabilitation on the ground at BCM. Rehabilitation for the end of 2022 will be reported against the MOP Addendum and subsequent Forward Program which is being prepared to address the requirements of the Rehabilitation Reforms under the *Mining Act 1992*.

8.3 Removal of Buildings

As described within Section 6.9.3.3, the Nagero Shearing Shed which was in poor structural condition was demolished. The demolition works were undertaken in accordance with the requirements of *Australian Standard AS 2601-2001: The Demolition of Structures*.

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.

Biodiversity surveys in the mine rehabilitation areas were scheduled for November 2021, however due to the severe weather conditions experienced throughout the region and subsequent flooding of the Namoi River, the BCM was largely inaccessible during this period. A total of 304.8 mm of rain was received in November alone (over four times the average rainfall for the month) and the Namoi River experienced a major flood event. The townships of Gunnedah and Narrabri were subsequently listed under a Natural Disaster Declaration from 9 November 2021 onwards.

Rehabilitation monitoring for the reporting period commenced on 8 December 2021 at four (of 10) replicate monitoring sites located within seven mine rehabilitation age-classes (see Figure B-7 within Appendix C). Grassy woodland native ecosystem (secondary domain) within the mine rehabilitation area is known from two replicate monitoring sites; being RH2017 and RH2020. These monitoring locations, and a further four associated with shrubby woodland/forest native ecosystem (RH2011, RH2016, RH2018B and RH2018C), were not sampled during the 2021 survey period. This was a corollary of the continued wet cycle experienced in the region, and although no rainfall was experienced during visitation to the monitoring sites, December's highest rainfall was recorded on 8 December 2021 (46.2 mm) with a further 27.2 mm recorded on 9 December 2021. The effects of previous and ongoing rainfall limited safe access to and within the mine rehabilitation area (impassable roads). The monitoring program progressed on foot between accessible monitoring sites with a reduced sub-set of sampling methodologies employed. The monitoring event was terminated on 11 December 2021, with BCM again inaccessible from flood water associated with the Namoi River.

The monitoring program involved a reduced sub-set of sampling methodologies, including:

- Two 100m vegetation survey transects for cover and abundance
- 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
- Photo point monitoring (to track changes in plant growth and ecology of the rehabilitated areas)
- Salinity monitoring (observational)
- Canopy species recruitment and presence of reproductive structures monitoring (observational).

Table 8-2 Survey Locations for Rehabilitation Monitoring Sites at BCM

Site Reference	Location (GDA94 zone 56)		Transect Orientation (2020)	
	Easting	NORTHING	A	B
RH2008	226985	6609210	180°	240°
RH2008D	227128	6608951	260°	135°
RH2010	227117	6609125	74°	110°
RH2011	226819	6609901	Not sampled in 2021	
RH2016	230013	6610349		
RH2017	227930	6609359		
RH2018A	229429	6608914	243°	300°
RH2018B	229567	6609131	Not sampled in 2021	
RH2018C	228411	6609191		
RH2020	228959	6609097		

8.4.1 Photographic Monitoring

Photographs of the monitoring sites for 2008, 2008D, 2010 and 2018(A) rehabilitation areas are provided in Figure 8-2, Figure 8-3, Figure 8-4, and Figure 8-5 respectively.



Figure 8-2 2008 Rehabilitation (13 years old)



Figure 8-3 **2008D Rehabilitation (13 years old)**



Figure 8-4 **2010 Rehabilitation (11 years old)**



Figure 8-5 **2018A Rehabilitation (3 years 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.

8.4.2.1 Vegetation

A total of 150 species of plant were recorded from the four replicate mine rehabilitation monitoring sites surveyed during the 2021 monitoring event, of which 118 were native (79%) and 32 species were exotic (21%). 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 from the four sites surveyed in 2021 was recorded highest from within the older mine rehabilitation areas (RH2008, RH2008D and RH2010) and lowest within the younger sites (RH2018A)
- There was an increase in mean native species diversity observed across the monitoring sites surveyed in 2021 compared to the 2020 monitoring event. The increase in species diversity observed is likely attributed to the higher rainfall in 2020 and 2021.
- Two shrubby woodland/forest native ecosystem mine rehabilitation monitoring sites (RH2010 and RH2018A) were surveyed using the BBAM methodology. Both sites met or exceeded the native species richness, native midstorey percentage foliage cover and native groundcover (other) BBAM benchmark values. RH2010 met the native overstorey projected foliage cover and native ground cover (grasses) BBAM benchmark values.
- Native vegetation groundcover percentage cover has increased one rehabilitation sites (RH2010) which was surveyed using the BBAM methodology. However, only two BBAM plots were completed during this monitoring session.
- Mean exotic species richness is also appearing to fluctuate and be influenced by seasonal climatic conditions as illustrated by the notable increase in mean exotic species richness following high rainfall received in 2016, 2020 and 2021, and the subsequent decline in 2018 and 2019 in response to drought conditions.
- Data acquired during the 2021 monitoring event indicates that the mean native species richness for mine rehabilitation established in 2008 and 2010 exceed the Leard State Forest analogue benchmarks of 42.1 species for the shrubby woodland/forest final land use and secondary domain. To meet the Rehabilitation Management Plan (RMP) performance criteria, each rehabilitation area must meet 80 % of the Leard State Forest analogue benchmark (i.e. 33.7 species for shrubby woodland/forest). The remaining rehabilitation monitoring location sampled (i.e. RH2018A) met 80% of the Leard State Forest benchmarks in 2021. Based on this and monitoring data collected over the past eight years, mine rehabilitation areas appear to be meeting or progressing on a trajectory to meet the native species RMP performance criteria.
- Data acquired during the 2021 monitoring event indicates that the mean exotic species richness for all mine rehabilitation age-classes occurred above the Leard State Forest analogue benchmark of 2.8 exotic species for shrubby woodland/forest final land uses and secondary domain. To meet the RMP performance criteria, each rehabilitation area must be at or below the Leard State Forest analogue benchmark. All mine rehabilitation monitoring locations sampled failed to meet the RMP criteria for exotic species richness in 2021.
- 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 2021.

- Planted canopy species did not show evidence of reproductive structures (including bud, fruit and/or flower). Recruitment of canopy species from the soil seed bank at these locations was not observed.
- 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.
- There are isolated individuals of African Boxthorn, Prickly Pear and Galenia which are either priority weeds or weeds of concern that may spread if left untreated. Mitigation measures for these species will be investigated and implemented when required to control spread.

8.4.2.2 Birds

Bird data results presented for the 2021 monitoring period should be considered cautiously. A small subset of mine rehabilitation monitoring sites were accessible by foot only, due to the mine rehabilitation access roads being largely impassable following significant rainfall. Accordingly, duplicate bird surveys were generally completed outside core bird activity periods.

A total of 28 species of bird were recorded from duplicate surveys at replicate monitoring sites associated with the mine rehabilitation area during the 2021 monitoring event. This comprised several woodland and generalist species common to the region. Species commonly recorded included, Weebill, Brown Honeyeater, Rufous Whistler and Mistletoebird. Two threatened species were recorded from replicate monitoring sites, including Speckled Warbler and Hooded Robin, which are listed as Vulnerable under the BC Act. However, Brown Treecreeper was recorded opportunistically in the mine rehabilitation near monitoring site RH2008D.

Mine rehabilitation planted in 2018 (RH2018A) recorded the highest mean diversity (10.5), followed equally by 2008 (RH2008 and RH2008D) (8.0) and 2010 (RH20210) (8.0).

Within shrubby woodland/forest native ecosystems, mean diurnal bird species richness for each mine rehabilitation age-class occurred below the Leard State Forest analogue benchmark of 13.7 during the 2021 monitoring event. To meet the RMP performance criteria, each rehabilitation area must meet 80 % of the Leard State Forest analogue benchmark (i.e. 11.0 species). All mine rehabilitation age-classes sampled achieved <80% of the analogue benchmark and therefore did not meet the RMP performance criteria. Replicate monitoring sites RH2008, RH2008D, RH2010 and RH2018A achieved approximately 47%, 69%, 58% and 77% respectively, of the Leard State Forest analogue benchmark.

Diurnal bird abundance was highest in the 2018 mine rehabilitation age-class (23.0) in comparison to the 2008 and 2010 mine rehabilitation age-classes (14.5 and 13.0 respectively).

Data acquired during the 2021 monitoring event indicate that mean diurnal bird abundance for each mine rehabilitation age-classes sampled generally occurred below the Leard State Forest analogue benchmark of 26.1 for shrubby woodland/forest native ecosystem. Nevertheless, RH2018A achieved 88% of the benchmark and therefore exceeded the RMP performance criteria.

8.4.2.3 Microchiropteran Bats

Microchiropteran bat call sequence files for the surveys conducted during the 2021 reporting period are currently being processed.

8.4.2.4 Passive Infra-red Motion Sensor Cameras

Motion sensing cameras were positioned at each of three mine rehabilitation monitoring site, including RH2008, RH2008D, and RH20210, for a minimum of two nights during the 2021 monitoring event. Native and pest animal species recorded are described in the following sections.

Replicate monitoring sites RH2011, RH2016, RH2017, RH2018A, RH2018B, RH2018C and RH2020 were not sampled during the 2021 reporting period.

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.

8.7 Rehabilitation in 2022

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 2022 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 2022. 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 Conservation 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 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 undertook further revisions to the SIMP during the reporting period which were approved by the DPE in August 2021 (as discussed earlier).

9.1 Community Programs and Investment

BCOPL is committed to supporting the local community in which they operate. Over the 2021 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 \$94,040 to local projects and sponsorships in the 2021 reporting period, as summarised in Table 9-1.

Contributions for the reporting period are about 13% less than the previous year's contributions (\$13,947). This is due to the impacts of Covid-19 on community events were scheduled to occur although did not proceed during the reporting period of 2021.

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 2021

Community group/project	BCO Contribution
Westpac Helicopter Partnership	\$30,270.00
Gunnedah Show Society	\$15,000.00
Maules Creek Campdraft	\$8,000.00
Narrabri Carp Muster	\$5,000.00
Back "n" Blue Youth Centre	\$5,000.00
Boggabri Rotary Club - Pink Up Boggabri	\$5,000.00
Dorothea Mackellar - Poetry Awards	\$5,000.00
Boggabri Rugby League	\$3,500.00
NAIDOC Week	\$3,000.00
Gunnedah AFL	\$2,500.00
GD Kidd School Charity Golf Day	\$2,500.00
Gunnedah Junior Rugby League	\$1,898.70
Gunnedah Ministers Fraternal - Carols in The Park	\$1,000.00
Allawah Cottage	\$1,000.00
Boggabri Historical Society	\$1,000.00
Boggabri Anglican Church - Carols	\$1,000.00
Rising Sun Dojo - Gunnedah	\$889.00
Soldier On Ltd - Donation Mens Health	\$682.04

Community group/project	BCO Contribution
Gunnedah South Public School	\$1,000.00
Gunnedah High School	\$500.00
Sacred Hearts Boggabri	\$200.00
Gunnedah Rotary Club	\$100.00
Total	\$94,039.74

9.2 Community Consultative Committee

In accordance with SSD 09_0182 (Schedule 5 Condition 7), a Community Consultative Committee (CCC) based on the DPE *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:

- 18 February 2021;
- 13 May 2021;
- 9 September 2021; and
- 4 October 2021.

Key topics discussed included:

- Hunter Gas Pipelines;
- Bore water take and offset properties;
- Proposed Modification 8 to BCM;
- Biodiversity offset areas;
- Housing VPA – General Housing;
- Recent correspondence with regulatory agencies;
- Overview of recent activities and reports from BCM;
- Tyre management and waste;
- TREE TROFF water for wildlife drinkers;
- 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

Two community complaints were received by BCOPL during the 2021 reporting period. This is a decrease from 2020 of three, with no complaints being recorded during 2019.

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
19 July 2021	Community Member	Blasting	Complainant contacted NSW EPA who sent an RFI to BCOPL. BCOPL provided requested information to EPA. Ongoing consultation with complainant.
27 July 2021	Community Member	Blasting	Numerous emails and phone calls with complainant. NSW EPA were also contacted by the complainant. Responded to NSW EPA RFI. Ongoing consultation with complainant.

9.4 Workforce Profile

As of 31 December 2021, the total workforce on BCM was 717 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 349 staff, the majority (~77%) 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	48
Gunnedah	152
Curlewis	7
Narrabri	33
Manilla	17
Tamworth	26
Other NSW	60
QLD	5
Other Australia	1
Total	349

9.4.2 Mining Contractors

Expansion project related construction activities concluded in late 2015, at which point the BCM moved to an operational phase. From late 2015, BCM continued to be contractor operated. In 2017 BCOPL took over the operation of BCM with assistance of mining contractor staff. The 2021 reporting period represents the BCM's sixth year of operations since the grant of the SSD 09 0182.

During the reporting period, the major mining contractors on site included Goldings, Orica, Ausdrill, BPA, MPC and One Key.

The largest share of the total contractor workforce at BCM during the 2021 reporting period is attributed to the mine contractor Goldings. At the end of December 2021, the Goldings workforce consisted of 182 personnel, predominantly contract staff, of which around 70% resided locally. The One Key workforce

was 74 personnel, Orica workforce was 40 personnel, BPA workforce was 28, MPC workforce was 24 and Ausdrill had 20 personnel employed at the BCM.

Ninety seven percent (97%) of the BCM contractors resided in NSW and 73% resided within the localities of Boggabri, Baan Baa, Gunnedah, Curlewis, Narrabri, Maules Creek, Manilla and Tamworth (see Table 9-4)

Table 9-4 Residential Locality of Contractor Employees

Locality	Goldings	One Key Resources Pty Ltd	Orica	BPA	MPC	Ausdrill
Boggabri	15	7	7	6	0	1
Narrabri	13	6	3	1	2	3
Gunnedah	55	31	14	5	18	1
Curlewis	5	0	0	4	1	0
Manilla	10	7	1	2	1	1
Tamworth	30	10	3	4	2	1
QLD	5	2	3	0	0	1
Other NSW	49	11	9	6	0	11
Other Australia	0	0	0	0	0	1
Total	182	74	40	28	24	20

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 DPE 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 DPE. This audit also took place during November 2020 and addressed the period since the last Independent Biodiversity Audit 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. BCOPL has developed an action plan in response to the recommendations made as part of the IEAs as shown within Appendix F.

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 of SSD 09_0182. The IEA noted that there is evidence that BCOPL has made efforts to finalise this approval requirement working with Forestry NSW, with a draft report currently with Forestry NSW. It was noted that a significant time had passed since the date of SSD 09_0182 and to avoid future non-compliance ratings, the IEA recommended that this outstanding issue is finalised promptly. BCOPL has continued to consult with Forestry NSW throughout the reporting period to resolve the requirement of Schedule 3, Condition 54 of SSD 09_0182. This matter will continue into the next reporting period.

Overall, the audit found that the management plans, strategies, and programs that have been prepared for BCM 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 DPE Review

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

The DPE 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).

10.2 EPBC Independent Audit (2020)

An independent audit of the approval conditions for the Boggabri Coal Mine Extension (i.e. SSD 09_0182 and EPBC 2009/5256) was undertaken in November 2020 by an approved assessor (Umwelt Australia Pty Limited).

The final audit report was received by BCOPL on 25 March 2021 and submitted to the Department of Agriculture Water and Environment (DAWE) on the same day.

11 INCIDENTS AND NON-COMPLIANCES

All incidents and non-compliances are detailed in Table 1-2 of the Statement of Compliance. Table 11-2 outlines the non-compliances which occurred during the 2021 reporting period and BCOPL’s response relating to sound power levels, air quality management, groundwater management, internal document review, EPL variations and biodiversity offsets. Actions that have resulted from the Independent Environmental Audits can be found in the Response Action Plan in Appendix F.

Two infringement notices and warnings were received by BCOPL during the 2021 reporting period. These have been outlined with BCOPL’s response in Table 11-1.

Table 11-1 Notices and Warnings Received during the Reporting Period

Agency	Date	Correspondence Details	BCOPL response
EPA	30-Jul-21	<p>An Official Caution letter was issued by the NSW EPA in relation to burying 937 end-of-life haul truck tyres, at depth, between 2014 -2020.</p> <p>A S191 was issued to BCOPL on 18 August seeking information about end-of-life haul truck tyre management. BCOPL responded on the 25 September 2020. The EPA issued an Official caution on July 2021 on reasonable grounds that BCOPL had committed a land pollution offence under Clause 109, Protection of Environment Operations (General) Regulation 2009. BCOPL’s Environmental Protection Licence did not at the time of the offence regulate or include conditions relation to the burial of end-of-life haul truck tyres.</p>	EPL varied to contemplate inpit disposal of end-of-life haul truck tyres. Approved by EPA on 5 October 2021.
EPA	23-Aug-21	<p>A Formal Warning letter was issued by the NSW EPA in relation to breaches of Environmental Protection Licence 12407.</p> <p>The EPA notes that it reviewed a blast on the 19 July 2021 after a complaint was lodged. During this assessment it was noted that there were two distinctly separate blasts and were not fired in quick succession nor were separate clearances given prior to each blast being fired. The EPA accused BCOPL of being in breach of EPL12407 condition L4.6.</p>	BCOPL responded to EPA on 2 September 2021. Subsequent discussions occurred between the EPA and BCOPL and no further information has been requested by the EPA.

Table 11-2 Non-Compliances and Exceedances during 2021

Time Period	Condition Description	Relevant approval	Comment
23 and 29 November 2021"	HVAS Air Monitoring	EPL12407	Glenhope HVAS meter couldn't be accessed due to regional flooding on the 23rd & 29th November 2021. Reported in EPL Annual Return submitted March 2021.
Ongoing	Sound Power Levels	SSD 09_0182 & AQGHGMP	Sound power screening during 2021 recorded 13 items of screened plant that recorded exceedances of 3dB or greater. BCO has undertaken extensive consultation with DP&E in relation to this non-compliance. The condition requiring this monitoring to occur is subject of Project Approval Modification Application by BCO.
Ongoing	Implementation of SWMP	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. The NSW DP&E are aware of the non-reinstatement of the clean water drain via BCO's response to a DP&E RFI.
Ongoing	Implementation of GWMP	GWMP	The implementation of the currently approved GWMP is non-compliant as groundwater monitoring was not undertaken at all required bores during the reporting period. Reported in EPL Annual Return submitted March 2020.
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. 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
Jan-21	HVAS Air Monitoring	EPL12407	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 reflecting current monitoring operations at BCM was approved on 5 February 2021.

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 2022
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
Preparation of documentation in accordance with the NSW Rehabilitation Reforms	2 July 2022
Continued implementation of the southern rehab strategy	Ongoing
Undertake exploration activities ahead of mining	Ongoing
Review and update management plans where required by SSD 09_0812	Jun-2022
Persistent weed species control and Cypress Pine monitoring in BOAs and rehabilitation areas	Dec-22
Fauna habitat resources such as salvaged fallen timber and nest boxes will be introduced in rehabilitation areas	Ongoing
Tubestock planting of canopy species in BOAs and rehabilitation areas	Ongoing
Continuation of Project Approval Modification 8	2023
Commence construction of houses in Boggabri	2023

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Appendix A

Annual Review Requirements

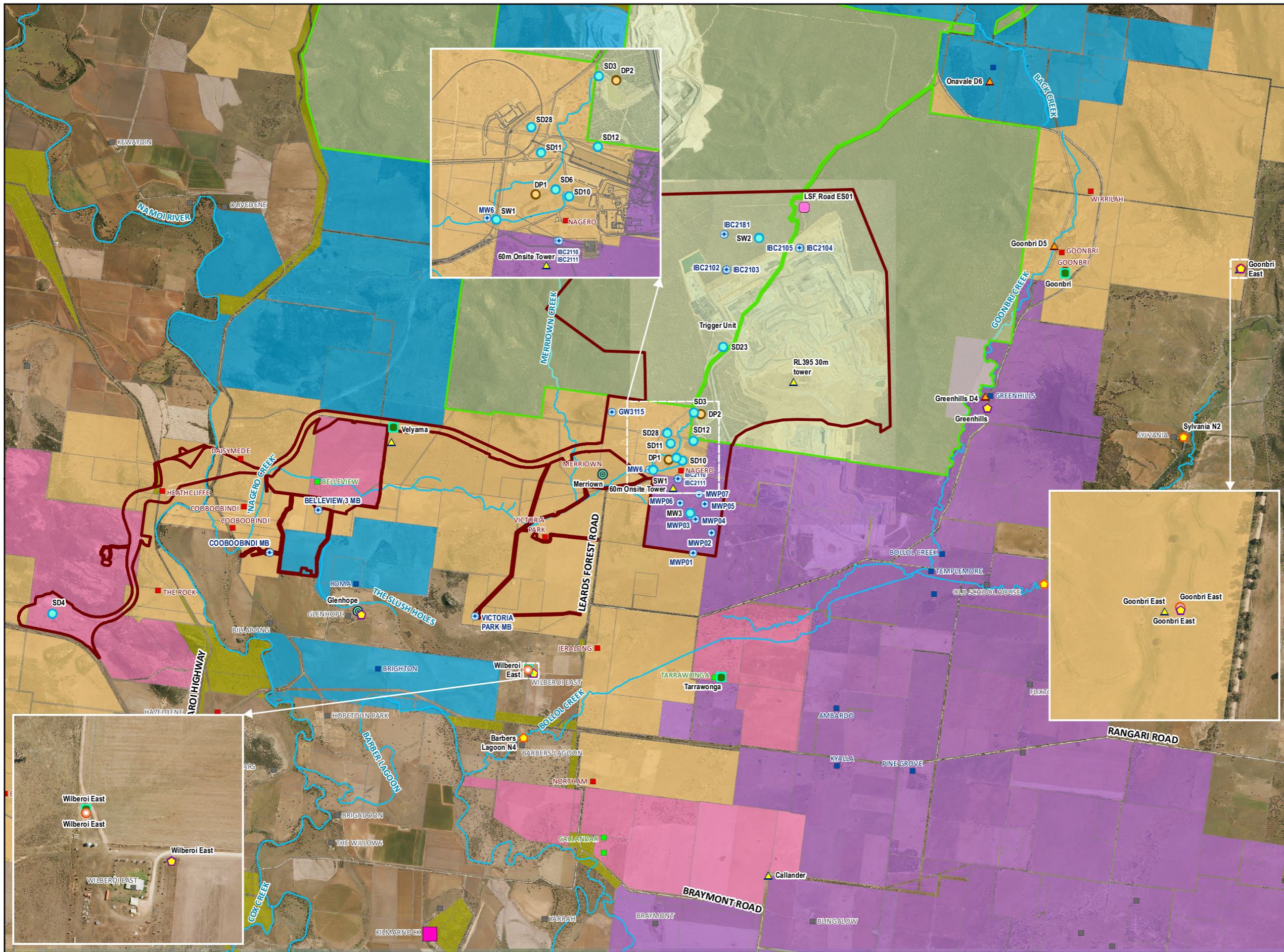
Table A-0-1 Annual Review requirements

Licence, Approval or Guideline	Section Reference	Requirement	Reference in this report
CL 368	Condition 4	<p>(a) The lease holder must lodge Environmental Management Reports (EMRs) with the Director-General annually or at dates otherwise directed by the Director-General.</p> <p>(b) The EMR must:</p> <ol style="list-style-type: none"> 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)	<p>(f) The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must:</p> <ol style="list-style-type: none"> 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. <p>Note: The Rehabilitation Report replaces the Annual Environmental Management Report.</p>	Section 8
Project Approval 09_0182	Schedule 5, Condition 4	<p>Annual Review</p> <p>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:</p> <p>(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;</p>	Section 8
		<p>(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:</p> <ul style="list-style-type: none"> • Relevant statutory requirements, limits or performance measures/criteria; • Monitoring results of previous years; and • Relevant predictions in the EA 	Section 4, Section 9.3
		<p>(c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;</p>	Section 4, Section 8
		<p>(d) Identify any trends in the monitoring data over the life of the project;</p>	Section 4
		<p>(e) Identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and</p>	Section 4
		<p>(f) Describe what measures will be implemented over the next year to improve the environmental performance of the project.</p>	Section 5

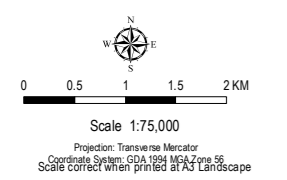
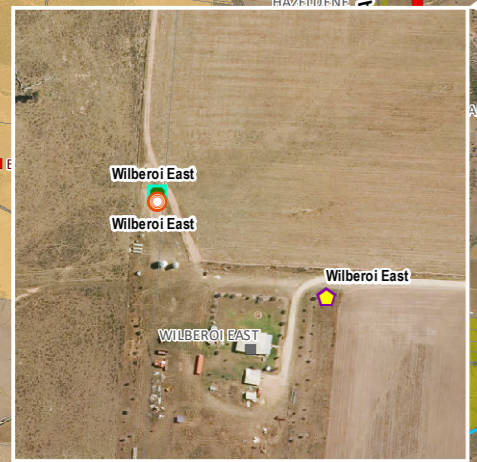
Licence, Approval or Guideline	Section Reference	Requirement	Reference in this report
	Schedule 3, Condition 10	<p>The Proponent shall:</p> <ul style="list-style-type: none"> (a) Conduct an annual testing program of the attenuated plant on site to ensure that the attenuation remains effective; (b) Restore 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	<p>The proponent shall ...</p> <ul style="list-style-type: none"> (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	<p>The Proponent shall:</p> <ul style="list-style-type: none"> (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	<p>The proponent shall prepare and implement a Social Impact Management Plan (which will)</p> <ul style="list-style-type: none"> (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
Maps



- 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



Imagery: BCOPL (2017, Dec 2018);

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DOCUMENT: BC2021_AEMR002_A2_MON

AUTHOR: Victor.Lau

REVIEWED BY: N.Cooper

DATE: 29/03/2021

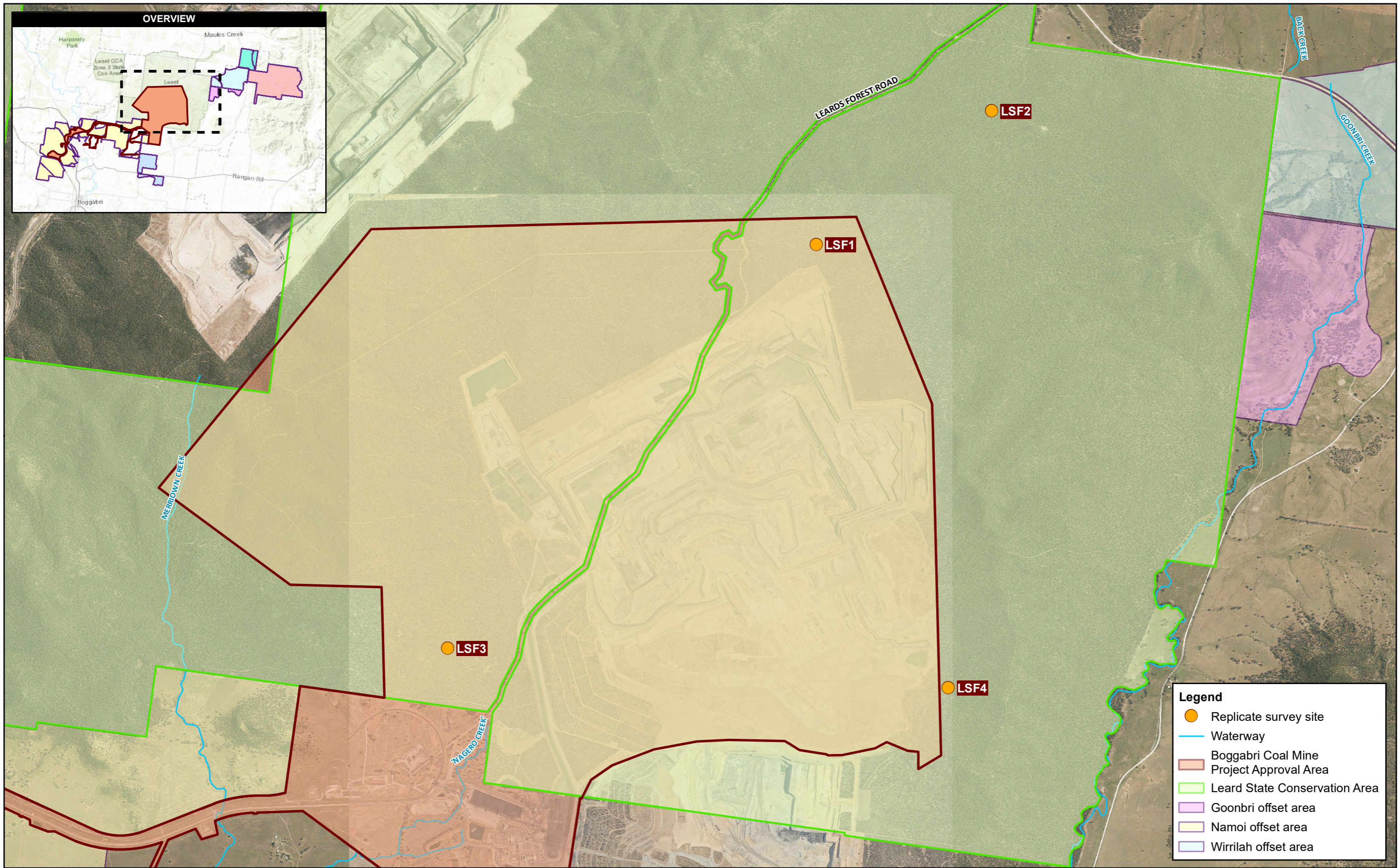


FIGURE: **A-1**

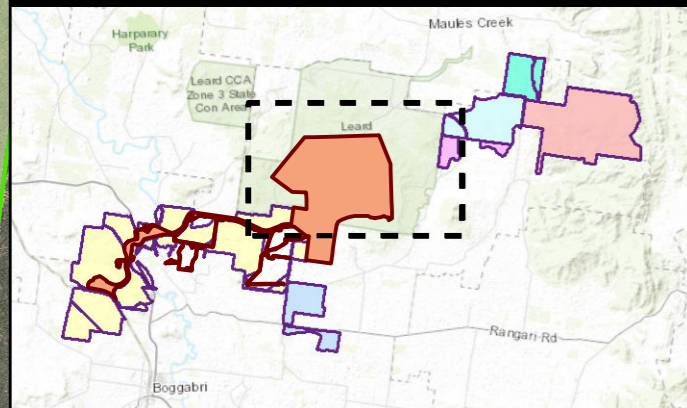
TITLE: **BOGGABRI COAL MINE PROJECT BOUNDARY AND ENVIRONMENTAL MONITORING SITES**

Appendix C

Biodiversity Monitoring Maps



OVERVIEW



Legend

- Replicate survey site
- Waterway
- Boggabri Coal Mine
- Project Approval Area
- Leard State Conservation Area
- Goonbri offset area
- Namoi offset area
- Wirrilah offset area

0 250 500 750 1,000 M

Scale 1:30,000

Projection: Transverse Mercator
 Coordinate System: GDA 1984 MGA Zone 56
 Scale correct when printed at A3 Landscape

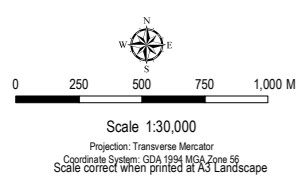
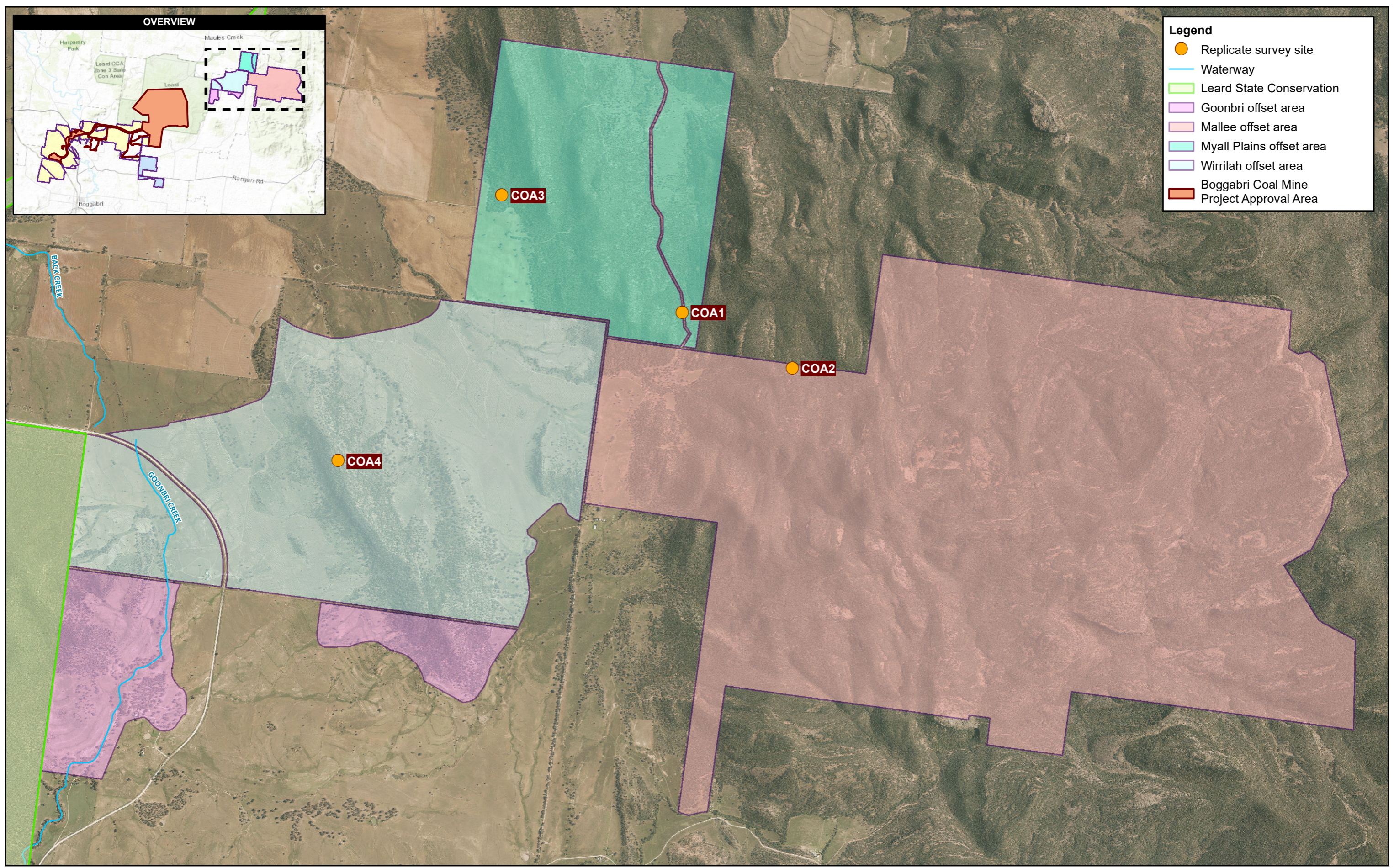
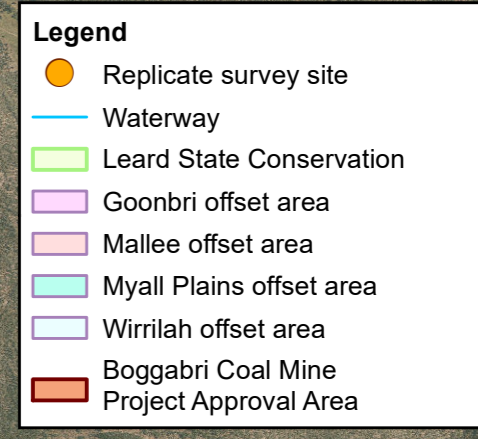
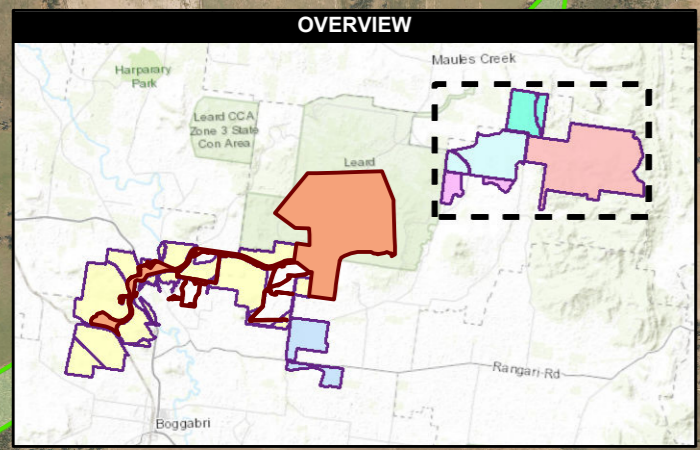
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AUTHOR	suansrir
REVIEWED BY	N.Cooper
DATE	12/03/2021



FIGURE **B-1**

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



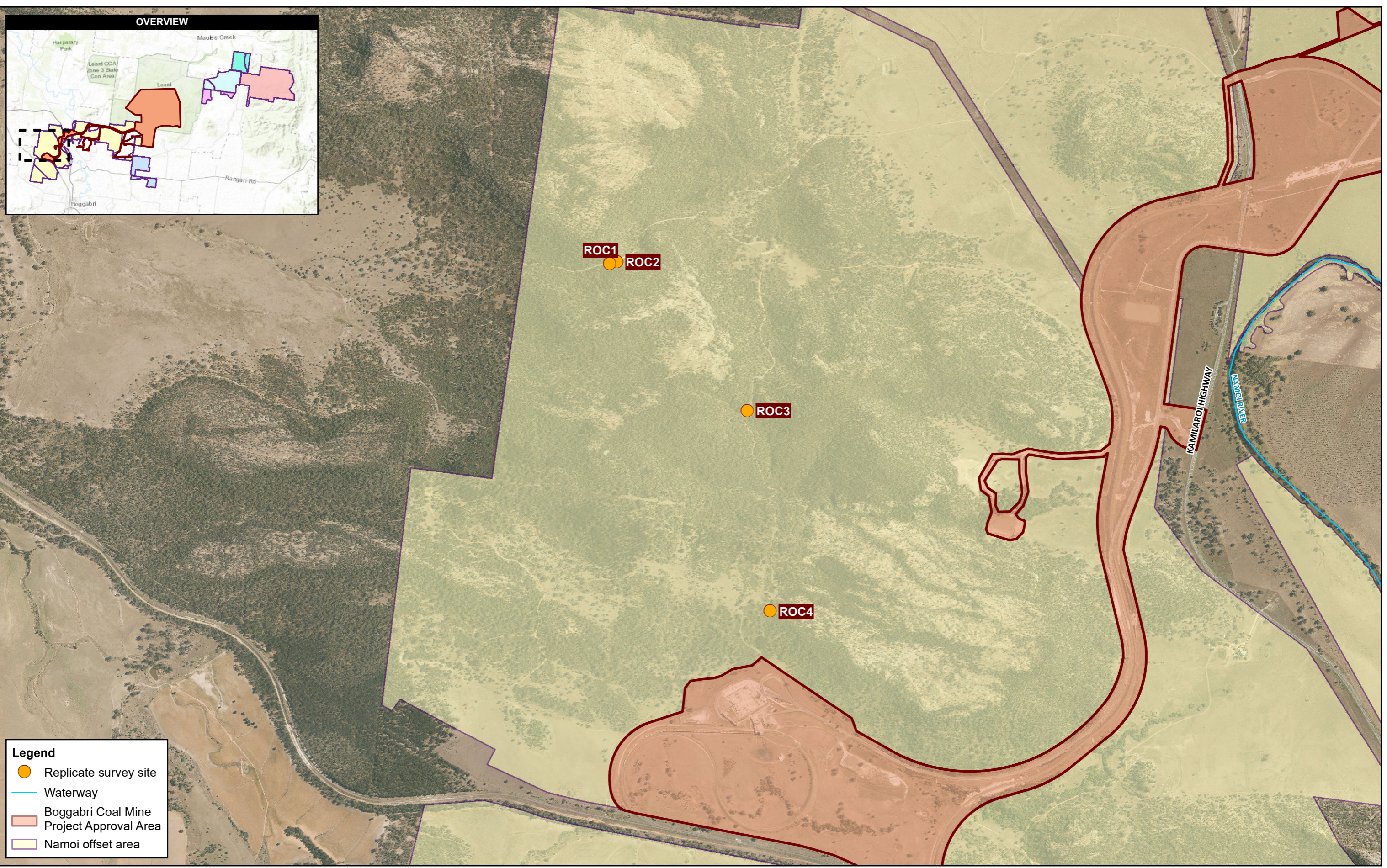
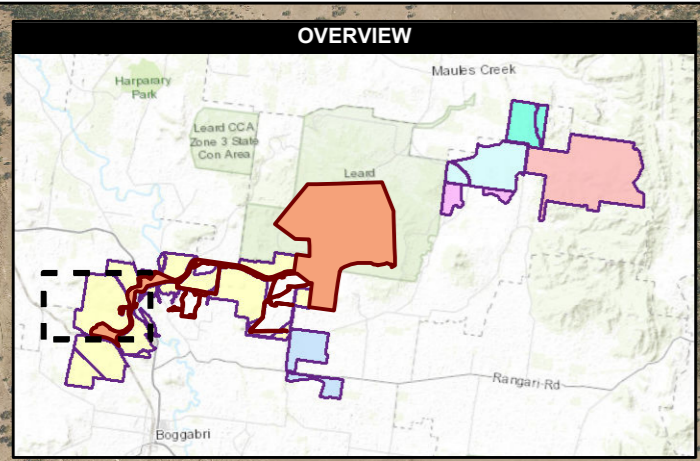
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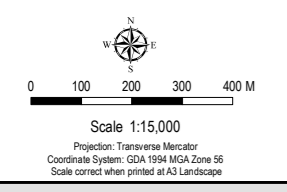
FIGURE **B-2**

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



Legend

- Replicate survey site
- Waterway
- Boggabri Coal Mine Project Approval Area
- Namoi offset area

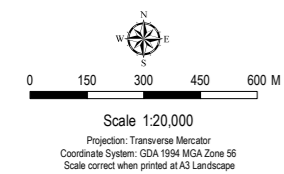
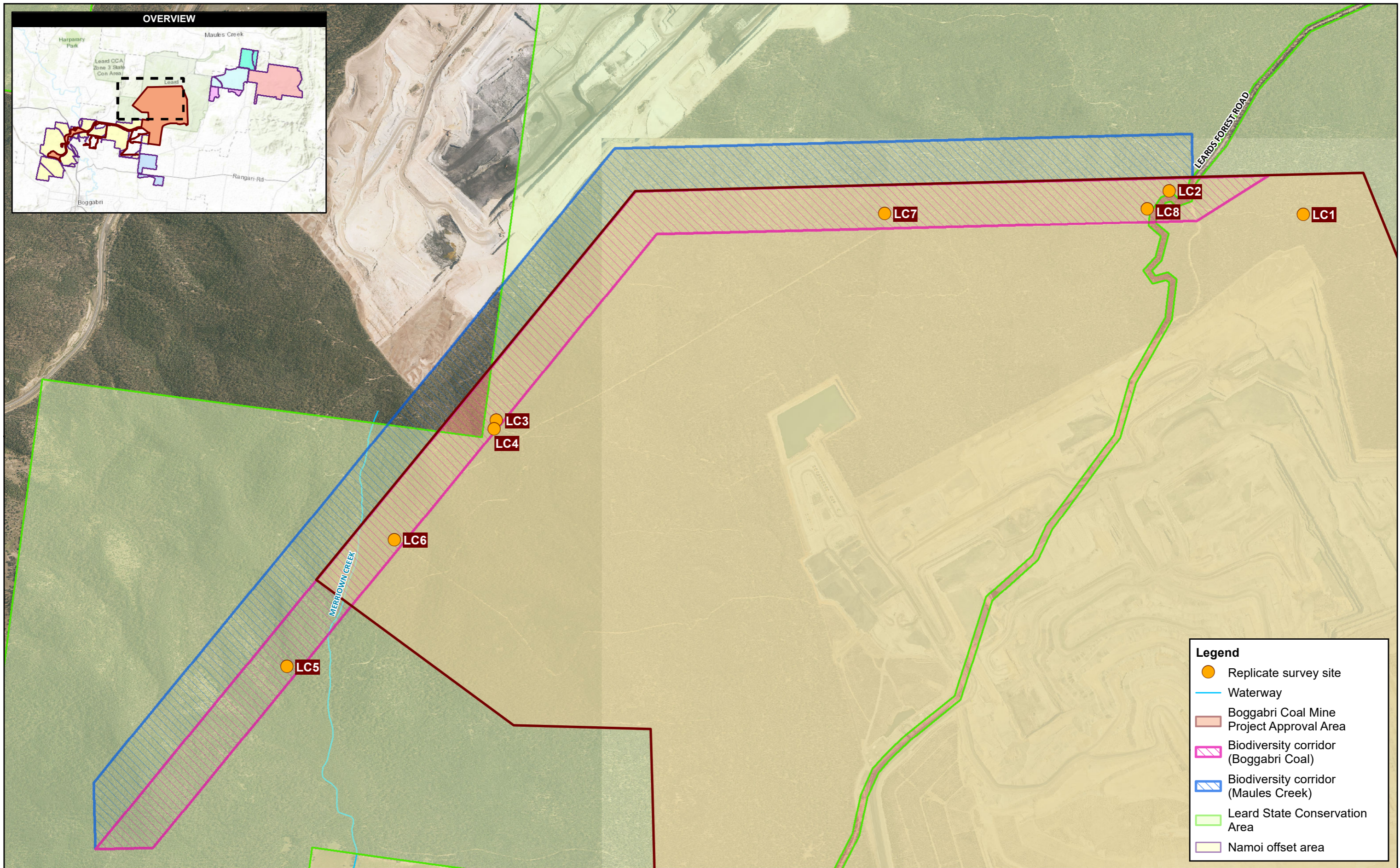


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AUTHOR: suansrir
REVIEWED BY: N.Cooper
DATE: 12/03/2021



FIGURE **B-3**
 TITLE: **LOCATION OF REPLICATE SURVEY SITES - ROCKLEA PROPERTY (NAMOI OFFSETS)**



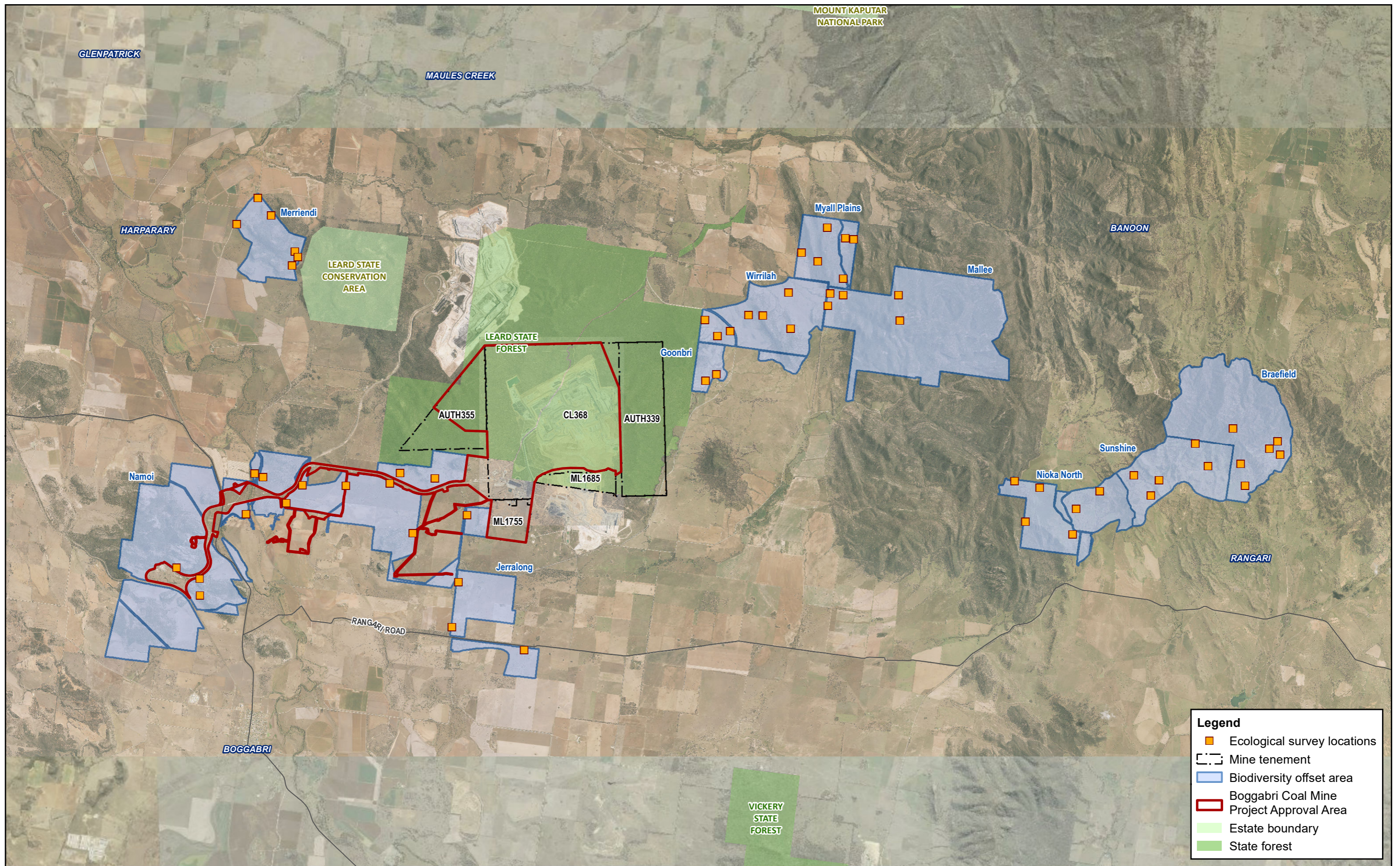
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AUTHOR: suansrir
REVIEWED BY: N.Cooper
DATE: 15/03/2021



FIGURE **B-4**

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



Legend

- Ecological survey locations
- Mine tenement
- Biodiversity offset area
- Boggabri Coal Mine
- Project Approval Area
- Estate boundary
- State forest

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) © WSP Australia Pty Ltd ("WSP") Copyright in the drawings, information and data recorded ("the information") is the property of WSP. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that which it was supplied by WSP. WSP makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information. NCIS Certified Quality System to ISO 9001. © APPROVED FOR AND ON BEHALF OF WSP Australia Pty Ltd

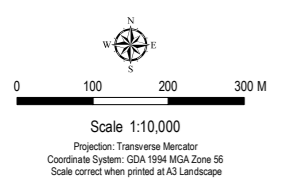
DOCUMENT	BC2021_AEMR007_A1_MON_Replicate
AUTHOR	suansrir
REVIEWED BY	N.Cooper
DATE	12/03/2021



FIGURE **B-5**

LOCATION OF REPLICATE SURVEY SITES

 TITLE: **LOCATIONS OF REPLICATE SURVEY SITES**



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DOCUMENT
BC2021_AEMR011_A1_MON_Rehab

AUTHOR: suansrir

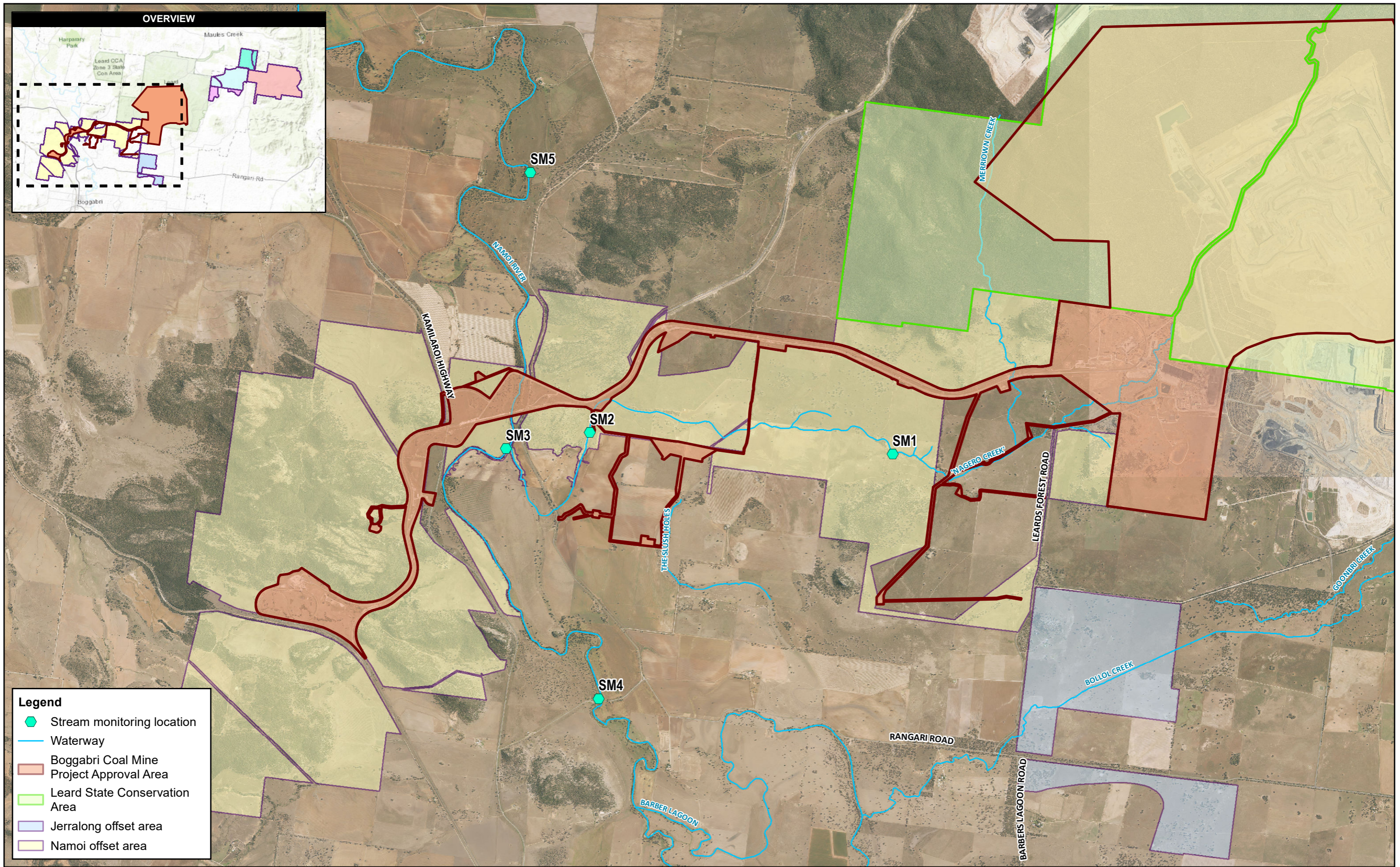
REVIEWED BY: N.Cooper

DATE: 15/03/2021



FIGURE **B-7**

TITLE: **LOCATION OF REPLICATE SURVEY SITES - MINE REHABILITATION AREA**



Legend

- Stream monitoring location
- Waterway
- Boggabri Coal Mine
- Project Approval Area
- Leard State Conservation Area
- Jerralong offset area
- Namoi offset 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:
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DOCUMENT BC2021_AEMR010_A1_MON_Stream
AUTHOR: suansrir
REVIEWED BY: N.Cooper
DATE: 15/03/2021



FIGURE **B-8**

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

Appendix D

Regulator Correspondence



Hamish Russell
Environmental Superintendent
Boggabri Coal Pty Limited

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

13/08/2021

Dear Mr Russell

**Boggabri Coal (MP09_0182)
Annual Review 2020**

Reference is made to the Annual Review (Rev 1) for the period 1 January 2020 to 31 December 2020, submitted to the Department of Planning, Industry and Environment (the Department) as required under Schedule 5 condition 4 of MP09_0182, as modified (the approval).

The Department has reviewed the Annual Review (Rev 1) and considers it to satisfy the reporting requirements of the approval and the Department's *Annual Review Guideline* (October 2015). Please make publicly available a copy of the 2020 Annual Review (Rev 1) on the company website.

Please note that the Department's acceptance of this Annual Review is not endorsement of the compliance status of the project. Non-compliances identified in the Annual Review will be assessed in accordance with the Department's Compliance Policy. Further correspondence may be sent in relation to non-compliances.

Should you need to discuss the above, please contact James Epstein, Senior Compliance Officer, on (02) 6575 3419 or email compliance@planning.nsw.gov.au.

Yours sincerely

A handwritten signature in black ink that reads 'H Watters'.

Heidi Watters
Team Leader Northern
Compliance

As nominee of the Planning Secretary



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

A handwritten signature in black ink that reads 'H Watters'.

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

[WARNING: This email originated outside of Our Company.DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.]

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.

Hamish Russell
Environmental Superintendent
Boggabri Coal Operations Pty Ltd

By email only: hamish.russell@boggabrichoal.com.au

17/03/2022

Dear Mr Russell

**Boggabri Coal (MP09_0182)
Annual Review 2021 extension request**

Reference is made to your post approval matter, MP09_0182-PA-32, Annual Review 2021 extension request, submitted to the Department of Planning and Environment (the department) on 14 March 2022.

The department understands that due to unforeseen circumstances, submission of the 2021 Annual Review (AR) to the department will not occur by the end of March 2022 as is required by Schedule 5, Condition 4 of MP09_0182 as modified (the approval). The department further notes Boggabri Coal's request to submit the 2021 AR by 14 May 2022.

Due to the wording of Schedule 5, Condition 4 of the approval, the department is unable to grant an extension of time to submit the 2021 AR, and that submission of the 2021 AR beyond the end of March 2022 will be considered a non-compliance with Schedule 5, Condition 4 of the approval. The department is proposing to 'Record the Breach', as the informal enforcement action for this potential non-compliance, with no further action proposed.

The department considers the proposed submission date for the 2021 AR of 14 May 2022 to be reasonable and under the provisions of Schedule 2, Condition 4 of the approval requests that the 2021 AR be submitted by COB 14 May 2022, or as otherwise agreed by the Planning Secretary.

Should you wish to discuss the matter further, please contact Joel Curran, Senior Compliance Officer on 02 4904 2702 or compliance@planning.nsw.gov.au

Yours sincerely



Heidi Watters
Team Leader Northern
Compliance

As nominee of the Planning Secretary

Hamish Russell
Environmental Superintendent
Boggabri Coal Pty Ltd
Kamilaroi Country

By email only: hamish.russell@boggabrichoal.com.au

01/11/2022

Dear Mr Russell

Boggabri Coal (MP09_0182)
Annual Review 2021 - Request for Additional Information

Reference is made to your post approval matter, MP09_0182-PA-34, Annual Review 2021 (the AR) for the Boggabri Coal Mine, submitted as required by Schedule 5, Condition 4 of MP09_0182 as modified (the approval) to the Department of Planning and Environment (the department) on 16 May 2022.

The department has reviewed the AR and considers more information is required to satisfy the conditions of approval and the department's *Annual Review Guideline* (2015). In accordance with Schedule 2, Condition 4 of the approval the department is requesting an amended report be submitted as a response to this request for information (RFI-49944706) by COB 30 November 2022 (or as otherwise agreed by the Planning Secretary), addressing the below points:

- Correspondence in Appendix D is correspondence relating to the submission of the 2020 Annual Review from the then Department of Planning, Industry and Environment, and the Resources Regulator. Please update the AR Appendix D with correspondence relating to the 2021 AR.
- In accordance with Schedule 3, Condition 10 of the approval, update the AR to include a report on work done restoring the effectiveness of any attenuation found to be defective during the annual sound power testing program.
- Section 6.3.2.1 notes that the 'Day' period is from 7am to 10pm Monday to Saturday. This is incorrect and should be change to 7am to 6pm Monday to Saturday.
- Section 6.9.3 states "*The results of the test pits and open area excavations to the end of December 2022 are summarised as follow.*" This should say December 2021.
- The Traffic Management Plan (TMP) states "Where traffic volume monitoring identify significant discrepancies in the traffic volumes on a given road, amendments to the TMP shall be considered." Update the AR to describe the traffic volumes recorded in the 2021 survey compared to the predicted traffic volumes in the Traffic Management Plan, to meet the requirements of the TMP to identify discrepancies in predicted and actual traffic volumes.
- Update the AR to clarify if non-compliances reported in the AR were reported to the relevant agencies.

Department of Planning and Environment



Should you have any questions regarding the above, please contact Joel Curran, Senior Compliance Officer on 02 4904 2702 or compliance@planning.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads "H Watters".

Heidi Watters
Team Leader Northern
Compliance

Appendix E

BCM 2021 Exploration Drilling

Table E-0-1 Exploration Drilling in 2021

Borehole Name	MGA Easting	MGA Northing	RL(m)	Total Depth (m)	Drill Start	Drill Finish	Borehole status	Purpose
BC2547	228231	6612815	366	273	15/01/2021	25/01/2021	Cemented	Coal Quality
BC2548	228391	6612997	383	223	26/01/2021	10/02/2021	Cemented	Coal Quality
BC2549	228803	6613008	385	247	14/02/2021	4/03/2021	Cemented	Coal Quality
BC2550	229202	6613003	396	243	2/03/2021	18/03/2021	Cemented	Coal Quality
BC2551	229103	6613106	401	265	6/03/2021	9/03/2021	Cemented	Structure
BC2552	228897	6612996	389	252	25/03/2021	27/03/2021	Cemented	Structure
BC2553	229099	6612900	371	216	27/03/2021	29/03/2021	Cemented	Structure
BC2554	229191	6612901	377	216	10/04/2021	12/04/2021	Cemented	Structure
BC2555	229085	6612996	387	240	14/04/2021	15/04/2021	Cemented	Structure
BC2556	228993	6612997	387	249	20/03/2021	29/03/2021	Cemented	Coal Quality
BC2557	225597	6611606	343	263	9/04/2021	18/04/2021	Cemented	Geotechnical
BC2558	228195	6612998	370	370	17/04/2021	12/05/2021	Cemented	Geotechnical
BC2559	224791	6611997	385	246	29/04/2021	7/05/2021	Cemented	Coal Quality
BC2560	224597	6611587	381	171	10/05/2021	19/05/2021	Cemented	Coal Quality
BC2561	224607	6610988	356	117	19/05/2021	25/05/2021	Cemented	Coal Quality
BC2562	224190	6611594	410	165	21/05/2021	25/05/2021	Cemented	Coal Quality
BC2563	224985	6611409	358	159	25/05/2021	5/06/2021	Cemented	Coal Quality
BC2564	225189	6612185	359	225	27/05/2021	8/06/2021	Cemented	Coal Quality
BC2565	225194	6611191	345	171	6/05/2021	19/06/2021	Cemented	Gas
BC2566	224408	6611187	378	111	16/06/2021	19/06/2021	Cemented	Coal Quality
BC2566R	224408	6611183	378	30	9/06/2021	22/06/2021	Cemented	Coal Quality
BC2567	224787	6611597	374	156	20/06/2021	24/06/2021	Cemented	Coal Quality
BC2568	225193	6612003	357	219	23/06/2021	4/07/2021	Cemented	Coal Quality
BC2569	225206	6612807	415	303	30/06/2021	18/07/2021	Cemented	Coal Quality
BC2570	226608	6613000	370	351	5/07/2021	20/07/2021	Cemented	Geotechnical
BC2571	225599	6612804	432	328	19/07/2021	2/08/2021	Cemented	Coal Quality
BC2572	226198	6612997	379	324	22/07/2021	5/08/2021	Cemented	Geotechnical
BC2573	226796	6612803	360	304	17/08/2021	9/09/2021	Cemented	Coal Quality
BC2574	228804	6613201	394	490	9/09/2021	10/10/2021	In progress, hazard in borehole	Coal Quality
BC2575	225804	6613004	427	336	10/09/2021	29/09/2021	In progress	Coal Quality
BC2576	226001	6612804	388	312	11/10/2021	22/10/2021	Cemented	Coal Quality
BC2577	225998	6611605	333	226	12/10/2021	22/10/2021	Cemented, hazard in borehole	Coal Quality
BC2577R	226001	6611603	333	34	27/10/2021	27/10/2021	Cemented	Coal Quality
BC2578	227605	6612803	342	333	24/10/2021	6/11/2021	In progress	Coal Quality
BC2579	225795	6611196	326	187	4/11/2021	17/11/2021	In progress	Coal Quality
BC2580	227598	6612405	337	321	7/11/2021	4/12/2021	In progress	Coal Quality
BC2581	226795	6612003	332	183	18/11/2021	22/11/2021	In progress	Coal Quality
BC2582	226795	6612003	332	255	5/12/2021	16/12/2021	Cemented	Coal Quality
BC2583	225795	6611797	342	229	7/12/2021	16/12/2021	Cemented	Coal Quality

Appendix F

2021 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	<p>The Proponent shall:</p> <p>(a) Ensure that:</p> <ul style="list-style-type: none"> - 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 noise control measures deliver sound power levels that are equal to or better than the sound power levels identified in the EA and that correspond to best practice or the application of best available technology economically achievable. - Where reasonable and feasible, improvements are made to existing noise suppression equipment as technologies become available; and <p>Monitor and report on the implementation of these requirements annually on its website.</p>	Non-Compliant Low Risk	<p>(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.</p> <p><u>Non-compliances</u> of sound power levels for a number of mobile plant were reported in the 2017, 2018 and 2019 Annual Reviews. BCOPPL have been implementing a plant attenuation, monitoring and review program across the audit period which has involved the trial of three sound attenuation kits on six 930E Komatsu trucks. This trial is ongoing.</p> <p>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.</p>	<p>NC REC: continue investigations and dialogue with DPIE regarding sound power level requirements.</p>	BCO will continue to liaise with DPIE regarding sound power level requirements.	30/01/2022																
NC2	Schedule 3 Condition 15	<p>The Proponent shall ensure that the blasting on the site does not cause exceedances of the criteria in Table 6.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Location</th> <th>Airblast overpressure (dB(Lin Peak))</th> <th>Ground vibration (mm/s)</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td>Residence on privately owned land</td> <td>120</td> <td>10</td> <td>0%</td> </tr> <tr> <td></td> <td>135</td> <td>5</td> <td>0% of the total number of blasts over a period of 12 months</td> </tr> <tr> <td>All public infrastructure</td> <td>-</td> <td>50 (or alternatively a specific limit determined to the satisfaction of the Secretary by the structural design methodology in AS 2187.2-2006, or its latest version)</td> <td>0%</td> </tr> </tbody> </table> <p>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.</p>	Location	Airblast overpressure (dB(Lin Peak))	Ground vibration (mm/s)	Allowable exceedance	Residence on privately owned land	120	10	0%		135	5	0% of the total number of blasts over a period of 12 months	All public infrastructure	-	50 (or alternatively a specific limit determined to the satisfaction of the Secretary by the structural design methodology in AS 2187.2-2006, or its latest version)	0%	Non-Compliant (Low Risk)	<p>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.</p> <p>An incident report was prepared which concluded that:</p> <p><i>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.</i></p> <p>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.</p> <p>This exceedance was reported to DPIE on 28 August. BCOPPL 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.</p>	<p>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.</p> <p>NC REC: Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed</p>	<p>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</p> <p>The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances'.</p>	01/08/2021
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All public infrastructure	-	50 (or alternatively a specific limit determined to the satisfaction of the Secretary by the structural design methodology in AS 2187.2-2006, or its latest version)	0%																				
NC3	Schedule 3 Condition 22	<p>The proponent shall prepare and implement a Blast Management Plan for the project to the satisfaction of the Secretary. This plan must:</p> <p>(a) Be submitted to the Secretary for approval within 6 months from the date of project work.</p> <p>(b) be prepared in consultation with the EPA, the CCC and interested members of the local community potentially affected by blasting operations;</p> <p>(c) propose any alternative ground vibration limits for public infrastructure in the vicinity of the site;</p> <p>(d) describe the measures that would be implemented to ensure:</p> <ul style="list-style-type: none"> - best management practice is being employed; and - compliance with the relevant conditions of this approval; <p>(e) include a road closure management plan for blasting within 500 metres of a public road, that has been prepared in consultation with Council;</p> <p>(f) include a specific blast fume management protocol to demonstrate how emissions will be minimised including risk management strategies if blast fumes are generated;</p>	Non-Compliant (Low Risk)	<p>Preparation</p> <p>The latest version of the Blast Management Plan is dated November 2018. Approved by DPIE on 21st February 2019.</p> <ol style="list-style-type: none"> 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 <p>Implementation</p> <p><u>Non-compliant</u> due to 120 dBL exceedance.</p>	<p>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.</p>	<p>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</p>	01/08/2021																

		<p>(g) include a monitoring program for evaluating the performance of the project including:</p> <ul style="list-style-type: none"> - compliance with the applicable criteria; and - minimising fume emissions from the site; and <p>(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 blasting impacts.</p> <p><i>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.</i></p>																												
NC4	Schedule 3 Condition 27	<p>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.</p> <p>Table 9: Long-term criteria for particulate matter</p> <p>Table 9: Long-term criteria for particulate matter</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Averaging Period</th> <th>Criterion</th> </tr> </thead> <tbody> <tr> <td>Total suspended particulate (TSP) matter</td> <td>Annual</td> <td>* 90 µg/m³</td> </tr> <tr> <td>Particulate matter < 10 µm (PM₁₀)</td> <td>Annual</td> <td>* 30 µg/m³</td> </tr> </tbody> </table> <p>Table 10: Short-term criteria for particulate matter</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Averaging Period</th> <th>Criterion</th> </tr> </thead> <tbody> <tr> <td>Particulate matter < 10 µm (PM₁₀)</td> <td>24 hour</td> <td>* 50 µg/m³</td> </tr> </tbody> </table> <p>Table 11: Long-term criteria for deposited dust</p> <p>Table 11: Long-term criteria for deposited dust</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Averaging Period</th> <th>Maximum increase in deposited dust level</th> <th>Maximum total deposited dust level</th> </tr> </thead> <tbody> <tr> <td>Deposited dust</td> <td>Annual</td> <td>* 2 g/m²/month</td> <td>* 4 g/m²/month</td> </tr> </tbody> </table> <p>Notes to Table 9, Table 10 and Table 11:</p> <p>a Total impact (ie incremental increase in concentrations due to the project plus background concentrations due to all other sources);</p> <p>b Incremental impact (ie incremental increase in concentrations due to the project on its own);</p> <p>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.</p> <p>d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity agreed by the Secretary.</p>	Pollutant	Averaging Period	Criterion	Total suspended particulate (TSP) matter	Annual	* 90 µg/m ³	Particulate matter < 10 µm (PM ₁₀)	Annual	* 30 µg/m ³	Pollutant	Averaging Period	Criterion	Particulate matter < 10 µm (PM ₁₀)	24 hour	* 50 µg/m ³	Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level	Deposited dust	Annual	* 2 g/m ² /month	* 4 g/m ² /month	Administrative Non-Compliance	<p>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.</p> <p>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.</p> <p>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.</p> <p>1 Jan 2019 - 31 Dec 2019 - Based on the information provided, the site's compliance could not be established. The Annual 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 BCOPPL emissions.</p> <p><u>Admin non-compliant</u> 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.</p> <p>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 BCOPPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification.</p>	<p>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.</p> <p>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 BCOPPL operations</p> <p>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 BCOPPL operations, evidence of the investigation or data that led to this conclusion should be provided with the notification;</p> <p>NC REC: a standard methodology should be developed for the investigation and reporting of any exceedances recorded by the air quality monitors.</p> <p>Improvement REC: In the interest of transparency it is recommended that:</p> <ol style="list-style-type: none"> 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 	<p>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'.</p> <p>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 BCOPPL operations.</p> <p>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. BCOPPL will report in the Annual Review</p> <ol style="list-style-type: none"> 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
Pollutant	Averaging Period	Criterion																												
Total suspended particulate (TSP) matter	Annual	* 90 µg/m ³																												
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Deposited dust	Annual	* 2 g/m ² /month	* 4 g/m ² /month																											
NC5	Schedule 3 Condition 31	<p>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:</p> <p>(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;</p> <p>(b) integrate the recommendations of a Site Specific Best Management Determination and Reactive Dust</p>	Administrative Non-Compliance	<p>There is evidence of the site not effectively implementing the AQGHGMP as follows:</p> <p>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</p>	<p>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 BCOPPL operations</p> <p>NC REC: DPIE should be informed of any exceedance of the relevant air quality criteria, regardless of the exceedance</p>	<p>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 BCOPPL operations.</p> <p>A standard methodology for the investigation and reporting of any exceedance of relevant air quality</p>	01/08/2021																							

		<p>Management Strategy prepared to the satisfaction of the EPA;</p> <p>(c) describe the measures that would be implemented to ensure:</p> <p>...</p> <p>(d) describe the proposed air quality management system;</p> <p>(e) include a risk/response matrix to codify mine operational responses to varying levels of risk resulting from weather conditions and specific mining activities;</p> <p>(f) include commitments to provide summary reports and specific briefings at CCC meetings on issues arising from air quality monitoring;</p> <p>(g) include an air quality monitoring program that:</p> <p>....</p> <p>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:</p>		<p>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 BCOP operations, evidence of the investigation or data that led to this conclusion should be provided with the notification;</p> <p>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 BCOP Incident Report Forms were not provided. It is also noted that a standard methodology was not adopted for the presentation of the investigation findings.</p>	<p>being a non-compliance or not. If the exceedance is not attributable to BCOP operations, evidence of the investigation or data that led to this conclusion should be provided with the notification;</p> <p>NC REC: a standard methodology should be developed for the investigation and reporting of any exceedances recorded by the air quality monitors.</p>	<p>criteria will be incorporated into the next revision of the AQGHGMP.</p> <p>This will reflect outcomes of consultation with DPIE in relation to the classification of the status of days as 'extraordinary events'.</p>	
NC6	Schedule 3 Condition 38b	<p>A Surface Water Management plan, which includes:</p> <ul style="list-style-type: none"> - 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; <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Clean water diversion system <input checked="" type="checkbox"/> Erosion and sediment controls (dirty water system); <input checked="" type="checkbox"/> Mine water management systems irrigation areas <input checked="" type="checkbox"/> Discharge limits in accordance with EPL requirements <input checked="" type="checkbox"/> Water storages <input checked="" type="checkbox"/> Haul road and Boggabri Rail Spur Line and bridge flood and water diversions; - Detailed plans including design objectives and performance criteria for: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Design and management of final voids <p>Design and management for the emplacement of reject materials, sodic and dispersible soils and acid or sulphate generating materials.</p>	Non-Compliant (Low Risk)	<p>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.</p> <p>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.</p>	<p>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.</p>	<p>BCOP will submit to DPIE revised SWMP's that contemplate the removal of the clean water diversion drain.</p>	01/08/2021
NC7	Schedule 3 Condition 38(c)	<p>(c) a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> - 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: <ul style="list-style-type: none"> 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	<p>"Preparation Approved Groundwater Management Plan (May 2017) reviewed.</p> <ul style="list-style-type: none"> * 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 <p>Implementation</p> <p>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.</p> <p>Based on the results presented in the Annual Reviews, groundwater levels have remained within trigger levels during the audit period.</p>	<p>NC REC: Continue to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.</p>	<p>BCOP will continuing to liaise with EPA regarding EPL variation to ensure that monitoring points in EPL align with those utilised by the site.</p>	01/08/2021

		<p>o the impacts of the project on:</p> <ul style="list-style-type: none"> - 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. <p>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</p> <p>a plan to respond to any exceedances of the performance criteria; and</p>		<p>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.</p> <p>Boggabri, Tarrawonga, Maules Creek Complex Numerical Model Update prepared by AGE dated 17 August 2018. "</p>			
NC8	Schedule 3 Condition 64	<p>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."</p>	Administrative Non-Compliance	<p>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.</p>		NO ACTION REQUIRED	NO ACTION REQUIRED
NC9	Schedule 4 Condition 3	<p>As soon as practicable after obtaining monitoring results showing:</p> <p>(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</p> <p>(b) An exceedance of the relevant air quality criteria in schedule 3, the Proponent shall send a copy of:</p> <ul style="list-style-type: none"> - The NSW Health fact sheet entitled "mine Dust and You" (as may be updated from time to time); and <p>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.</p>	Non-Compliant (Low Risk)	<p>(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.</p> <p>No reportable dust exceedances were recorded in the audit period.</p>	<p>NC REC: Implement changes to the TARP notifications system to distinguish "triggers" from "exceedances" so that reportable exceedances are not missed.</p>	<p>The TARP notification system will be revised to distinguish between 'triggers' and 'exceedances'.</p>	01/08/2021
NC10	Schedule 5 Condition 4	<p>"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:</p> <p>(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;</p> <p>(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:</p> <ul style="list-style-type: none"> relevant statutory requirements, limits or performance measures/criteria; monitoring results of previous years; and relevant predictions in the EA; <p>(c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;</p> <p>(d) identify any trends in the monitoring data over the life of the project;</p> <p>(e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and</p> <p>describe what measures will be implemented over the next year to improve the environmental performance of the project."</p>	Administrative Non-Compliance	<p>"Annual reviews for 2017, 2018 and 2019 were provided. They are also available on the BCOP website. Each were submitted to DPIE prior to the end of March.</p> <p>A) Rehabilitation details are provided in Section 8 of the Annual Review</p> <p>b) Monitoring results and comparison with performance are included in Section. 4. Complaints are summarised in Section 7.3</p> <p>c) non-compliances are summarised in Section 5</p> <p>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.</p> <p>e) discrepancies against predictions (as relevant) are covered in Section 4</p> <p>next years activities and improvements are included in section 5 and 9"</p>	<p>Improvement REC: Include additional information in the annual reviews regarding longer term trends particularly in terms of surface water, noise and air quality</p>	<p>BCOP will include additional information in the annual reviews regarding longer term trends particularly in terms of surface water, noise and air quality.</p>	Annual Review 2021
NC11	Schedule 5 Condition 5	<p>"Within 3 months of the submission of:</p> <p>(a) an annual review under condition 4 above;</p> <p>(b) an incident report under condition 8 below;</p> <p>(c) an audit under condition 10 below; and</p> <p>(d) any modification to the conditions of this approval,</p>	Administrative Non-Compliance	<p>"It is acknowledged that BCOP has been progressively working on updating management plans for several years with revised versions submitted to department.</p> <p>Management plans and strategies have been updated over</p>	<p>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.</p>	<p>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.</p>	01/07/2021

		<p>the Proponent shall review the strategies, plans, and programs required under this approval.</p> <p>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."</p>		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	<p>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.</p> <table border="1"> <thead> <tr> <th colspan="3">Water and land</th> </tr> <tr> <th>EPA Method</th> <th>Type of Monitoring Point</th> <th>Location Description</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Wet weather discharge</td> <td>Wet weather discharge</td> <td>Wet weather discharge</td> </tr> <tr> <td>2</td> <td>Discharge water quality monitoring</td> <td>Discharge water quality monitoring</td> <td>Discharge water quality monitoring</td> </tr> <tr> <td>3</td> <td>Wet weather discharge</td> <td>Wet weather discharge</td> <td>Discharge point from wastewater treatment plant (WWTP) located on the map titled Plan No. 1 EPL, Boundary and Environmental Monitoring locations dated 26.6.16. 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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)	<p>'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.</p> <p>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.</p> <p>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</p>	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																																																																		

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NC16	M2.2	<p>Air Monitoring Requirements</p> <p>POINT 24,25,26</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Units of measure</th> <th>Frequency</th> <th>Sampling Method</th> </tr> </thead> <tbody> <tr> <td>Particulates - Deposited Matter</td> <td>grams per square metre per month</td> <td>Continuous</td> <td>AM-19</td> </tr> </tbody> </table> <p>POINT 45</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Units of measure</th> <th>Frequency</th> <th>Sampling Method</th> </tr> </thead> <tbody> <tr> <td>PM10</td> <td>micrograms per cubic metre</td> <td>Every 6 days</td> <td>AM-18</td> </tr> </tbody> </table>	Pollutant	Units of measure	Frequency	Sampling Method	Particulates - Deposited Matter	grams per square metre per month	Continuous	AM-19	Pollutant	Units of measure	Frequency	Sampling Method	PM10	micrograms per cubic metre	Every 6 days	AM-18	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																																																																																
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pH	pH	Quarterly	In situ																																																																																																				
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	<p>(a) The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director- General.</p> <p>(b) The EMR must:</p> <ul style="list-style-type: none"> (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 <p>have regard to any relevant guidelines adopted by the Director-General.</p>	Administrative Non-Compliance	<p>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.</p> <p>All Annual Reviews for audit period are signed and dated prior to end of March. Also sighted submission confirmation of submission for each year.</p> <p>The annual reviews generally cover these requirements.</p> <p>However, progression towards rehabilitation completion criteria is only mentioned with regard to the species richness analogue benchmark.</p> <p>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.</p> <p>It is noted that the Resources Regulator has recently released proposed amendments to the rehabilitation compliance and reporting requirements</p>	<p>NC REC: Future Annual Reviews must report on progress in respect of rehabilitation completion criteria.</p> <p>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.</p>	<p>BCOP will report on progress in respect of rehabilitation completion criteria in future Annual Reviews.</p> <p>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.</p>	2021 Annual Review																																																																																																
NC21	10	<p>(a) Ground Vibration</p> <p>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.</p> <p>(b) Blast Overpressure</p> <p>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</p>	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.				
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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:	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
	<ul style="list-style-type: none"> • 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 		
	<ul style="list-style-type: none"> • Perform remediation works in established rehabilitation areas affected by erosion 	Areas affected by erosion will be remediated.	December 2021
	<ul style="list-style-type: none"> • Opportunities for rehab planting design improvements/trials 	Rehab planting design improvements/ trials will be incorporated into future rehabilitation areas.	December 2024
	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • 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
2	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
	Recommendations regarding the inadvertent understorey over clearing cleared area:	Regular inspection of the IUO area will be undertaken to detect changes.	Ongoing
	<ul style="list-style-type: none"> • Regular walkover inspections to detect changes 		
	<ul style="list-style-type: none"> • 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
	<ul style="list-style-type: none"> • Erosion areas be appropriately remediated 	Remediation of eroded areas will be undertaken as required.	Ongoing
<ul style="list-style-type: none"> • Ensure signage is effective. 	Signage will be checked and replaced and or moved to ensure it remains effective.	Ongoing	

Appendix G

Proposed 2022 Tree Clearing Areas
Covered by Arch Survey and Salvage
during 2021



REV	REVISIONS	DATE			
<p>Completion of the Quality Record is evidence that the design and drawing have been verified conforming with the requirements of the Quality Plan. Where the Quality Record is incomplete all information on this drawing is intended for preliminary purposes only as it is unchecked.</p>					
<p>Planned Arch Survey and Salvage for Proposed 2022 Tree Clearing</p>			<p>Planned Arch Survey and Salvage for Proposed 2022 Tree Clearing</p>		
<p>FIGURE: PROPOSED 2022 TREE CLEARING AREAS COVERED BY ARCH SURVEY AND SALVAGE DURING 2021</p>			<p>FIGURE: PROPOSED 2022 TREE CLEARING AREAS COVERED BY ARCH SURVEY AND SALVAGE DURING 2021</p>		
<p>FILE REF: Proposed 2022 Tree clearing areas Arch salvage 0106522.dwg</p>			<p>FILE REF: Proposed 2022 Tree clearing areas Arch salvage 0106522.dwg</p>		
<p>PLOT FILE: Proposed 2022 Tree clearing areas Arch salvage 0106522.pdf</p>			<p>PLOT FILE: Proposed 2022 Tree clearing areas Arch salvage 0106522.pdf</p>		
<p>JOB REF: 0045</p>			<p>JOB REF: 0045</p>		
<p>ORIG. FILE SIZE: A4</p>			<p>ORIG. FILE SIZE: A4</p>		
<p>SCALE See Bar Scale</p>			<p>SCALE See Bar Scale</p>		
<p>QUALITY RECORD</p>			<p>QUALITY RECORD</p>		
REVIEW	NAME	SIGNATURE	DATE		
DRAWN	NIC GARDNER		25/22		
DWG CHECKED					

Appendix H

2021 Site Water Balance



Boggabri Coal Operations Pty Ltd
Site Water Balance
3 May 2022

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 (Calendar year 2019)	23/04/2021	M Best, A Wyatt	K Halliday	H Russell
10 (Calendar Year 2020)	30/08/2021	M Best, A Wyatt	K Halliday	H Russell
11 (Calendar Year 2020)	20/04/2021	M Best, A Wyatt	K Halliday	H Russell

Contents

	Page Number
Contents.....	i
1. Introduction	1
1.1 Overview	1
1.2 Related Water Management Documents	2
1.3 Consultation	3
1.4 Environment Protection Licence	3
2. Existing Environment.....	4
2.1 Catchment Description	4
2.2 Climate	4
3. Surface Water Management System	5
3.1 Existing Water Management System.....	5
3.1.1 Key WMS Storages and Features	5
3.1.2 Licensed Discharge Points	6
3.1.3 Water Sources	6
3.2 Proposed WMS	8
3.2.1 Design Criteria	8
3.3 2024 Water Management System	9
3.4 2033 Water Management System	10
4. Site Water Balance	11
4.1 Model Updates	11
4.2 Model Validation.....	11
4.2.1 Water Inventory	12
4.2.2 Water Import	14
4.2.3 Dust Suppression	15
4.2.4 Validation Outcome	16
4.3 Forecast Model Results	16
4.3.1 Model Results	17
4.3.2 Contaminated Water Storage and Pit Availability	18
4.3.3 Water Supply Reliability	20
4.3.4 Modelled Overflows	21
5. Water Efficiency Initiatives	23
6. Improvement and Reporting.....	24
6.1 Review and Improvement	24
6.1.1 Recommended Improvements	24

6.2	Validation Program.....	24
6.3	Annual Review	25
7.	Review and Revision.....	26
7.1	Review.....	26
8.	References.....	27

List of Tables

Table 1-1	Project Approval Conditions – Planning Assessment Commission of NSW	2
Table 1-2	Related Water Management Documents	3
Table 3-1	Summary of Groundwater WALs Currently Held by BCOP	7
Table 3-2	BCOP Water Access Licences for Lower Namoi Regulated River Water Source	8
Table 4-1	Median Site Water Balance for Each of the Snapshot Years	17
Table 4-2	Annual Totals of Imported Water Requirements	21
Table 5-1	Water Balance Initiatives Action Plan	23

List of Figures

Figure 1-1	Document Hierarchy	3
Figure 4-1	Observed vs Modelled Total Site Inventory	12
Figure 4-2	Modelled vs Observed Volumes in MW5	13
Figure 4-3	Modelled vs Observed SD10 Volumes	14
Figure 4-4	Modelled vs Observed Water Import	15
Figure 4-5	Modelled vs Observed Dust Suppression	16
Figure 4-6	Modelled Forecast Total Site Volume	18
Figure 4-7	Simulated Time Series of Water Stored In-Pit	19
Figure 4-8	Simulated Time Series of Water Stored in MW5	19
Figure 4-9	Simulated Time Series of Annual Borewater Imported to Site	20
Figure 4-10	Modelled Annual Additional Import Required	21
Figure 4-11	Modelled Dirty Water Overflows	22

List of Appendices

Appendix A	Climate Data
Appendix B	Water Balance Methodology
Appendix C	Storage Data
Appendix D	Water management system indicative layouts

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	<i>Environmental Planning and Assessment Act, 1979</i>
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)
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

1.1 Overview

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.

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 export.

The mine currently operates under State Significant Development Consent (SSD 09_0182), which allows BCOP to produce 8.6 million tonnes per annum (Mtpa) of run of mine (ROM) coal from BCM until the end of 2033. Approval was 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 and has been subject to a number of modifications.

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 1-1.

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 Agriculture, Water and the Environment (DAWE)) 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 2021, 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.

The Project Approval (PA 09_0182) conditions outlining the requirements for the SWB are provided the WMP and summarised in Table 1-1.

Table 1-1 Project Approval Conditions – 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:	Refer to Section 3 and 4
	▪ includes details of:	
	▪ sources and security of water supply, including contingency for future reporting periods;	Refer to Section 3.1.3 and 4.3.3
	▪ prioritisation strategy for water sources;	Refer to Section 3.1.3.1
	▪ water use on site;	Refer to Section 3.1
	▪ water management on site;	Refer to Section 3.1
	▪ any off-site water discharges;	Refer to Section 4.3.4
	▪ reporting procedures, including the preparation of a site water balance for each calendar year;	Refer to Section 6.3
	▪ 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 4 and 6.2
▪ 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 6.1	
▪ 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 5	
▪ describes the measures that would be implemented to minimise clean water use on site	Refer to Section 3.1.3 and Section 5	

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 1-2. The water management plan (WMP) document hierarchy is shown in Figure 1-1.

Table 1-2 Related Water Management Documents

Document	Description
Boggabri Tarrawonga Maules Creek (BTM) Complex Water Management Strategy	Regional strategy prepared in consultation with Tarrawonga Coal Mine (TCM) 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 and groundwater model validation program
Site Water Balance report	Mine water balance modelling methodology, assumptions, and results, mine water management system operating philosophy

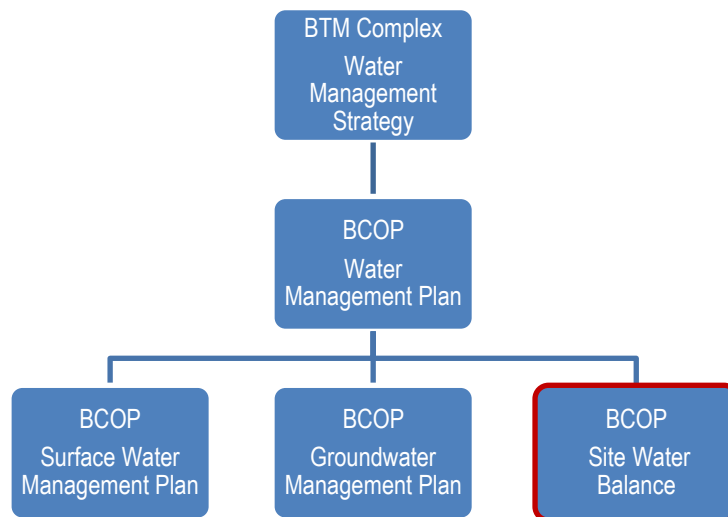


Figure 1-1 Document Hierarchy

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) (now DPIE), 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.

1.4 Environment Protection Licence

The 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. As mining progresses, EPL discharge points will be reviewed and updated in consultation with the EPA. Surface water discharge criteria are specified in the EPL and outlined in the Surface Water Management Plan (SWMP).

2. Existing Environment

2.1 Catchment Description

The BCM is in the catchment area of an unnamed ephemeral drainage line locally referred to as Nagero Creek and partly within the catchment of Bollol Creek. Both are ephemeral tributaries of the Namoi River, which is a part of the Barwon-Darling River system. The BCM site lies north of Tarrawonga Coal Mine (TCPM) which is approved to operate until 2030, and south of Maules Creek Coal Mine (MCCM) which is approved to operate until 2034.

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

2.2 Climate

BCOP maintains a weather station on site with rainfall data available from 2013 to present. There are two operating Bureau of Meteorology (BoM) rainfall gauges in the vicinity of BCM. Appendix A provides a summary of the available rainfall and evaporation data including historic data from several discontinued gauges.

3. Surface Water Management System

The key objectives of the existing water management system (WMS) 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 design objectives for the approved WMS are described in detail in the WMP. Details relevant to the SWB and model parameters are provided in the following sections.

3.1 Existing Water Management System

The existing water management system is described below and shown in Figure D-1 and schematically in Figure D-5, Appendix D. A summary of the existing storage characteristics is provided in Appendix C.

3.1.1 Key WMS Storages and Features

MW5 was completed in late 2018 to cater for predicted pit dewatering requirements and has an approximate capacity of 2200 ML.

MW3 has a capacity of 153.50ML and can be utilised to dewater surplus water from SD10. The total out-of-pit MWD storage in MW3 and MW5 is 2353.5 ML.

Fill points for dust suppression currently operate from SD23. This dam also receives water transfers from in-pit dewatering.

SD10 is used to supply water to the CHPP and also acts as a transfer point from the MIA to the mine water dams and fill points at SD23.

A licensed discharge point (LDP) is located at SD6, which receives overflows and pumped transfers from several MIA dams. Overflows to the external environment occur from SD6 when dirty water dams in the MIA have exceeded the design capacity. A diversion drain diverts discharge from Tarrawonga Coal Mine's Licenced Discharge Point (EPL 12365- LDP 1) around the BCOP's MIA and discharges into SD6.

SD12 was upgraded in 2015 to a capacity of 206.56 ML (previous capacity 25.9 ML). The upgrade to SD12 catered for the expanded MIA and CHPP and haul road catchments.

Sediment dam SD3 was upgraded in 2015 to a capacity of 102.3ML (previous capacity 31.8 ML). This upgrade catered for the expanding overburden catchment from 2015 to 2021. 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. Until late 2020, SD7 was used as a fill point for water trucks for dust suppression usage. As mining has progressed, this fill point is no longer utilised.

Table C-1 in Appendix C provides capacities for all WMS storages and Table C-2 lists pumped transfers between all WMS storages.

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.

3.1.2 Licensed Discharge Points

BCOP currently have three approved LDPs. These are the existing discharge points and types listed in Section P1.3 of the EPL (12407, 5 Feb 2021).

3.1.3 Water Sources

BCM receives water from rainfall/runoff and from licensed water imports (discussed below). Clean water runoff from the undisturbed areas upslope of the mining void is currently intercepted by the pit and transferred to MW5 for re-use on site. Licensing of this runoff is partially covered by Harvestable Rights Provision under the Water Management Act, with the balance to be covered by Water Access Licences, which is currently under review.

3.1.3.1 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, 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.

3.1.3.2 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 3-1.

Table 3-1 Summary of Groundwater WALs Currently Held by BCOP

Source	WAL category	WAL No.	Share (units)	Expiry	Current reliability (%)
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
Gunnedah-Oxley Basin MDB	Aquifer	WAL 29562	700	Perpetuity	100
Gunnedah-Oxley Basin MDB	Aquifer	WAL 29473	142	Perpetuity	95-100

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 depends 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.

No temporary transfers of WALs were required for the 2021 calendar year.

3.1.3.3 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 3-2. 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 depends 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 3-2 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. BCOP can also trade additional water, either temporarily or permanently, to make up shortfalls on a contingency basis. Typically, water from the Namoi River is not used due to a lack of water availability and the reliability of groundwater sources.

3.2 Proposed WMS

The BCOP Mine Operation Plan (MOP) Amendment A forecasts the mine progression to 2024 including land use, overburden progression and forecast coal production. The existing MOP is currently being revised to reflect recent regulatory reforms and will be replaced by a rehabilitation management plan for the site.

The SWB is updated in accordance with the MOP out to 2024. From 2025 to 2033, the mine plan from Year 21 in The Project EA is used to forecast pit and overburden progression and the associated catchments. Sediment dams are proposed based the expected requirement for runoff control or dewatering demands based on this forecast mine plan.

The following sections outline the proposed WMS for years 2024 and 2033. Water management system indicative layout plans for existing, 2024 and 2033 are provided in Figure C-2 to Figure C-4, Appendix C. Schematic diagrams showing the general connectivity between water sources, demands and storages for existing, 2024 and 2033 are also provided in Figure C-5 to Figure C-7, Appendix C.

3.2.1 Design Criteria

3.2.1.1 Dirty Water Sediment Dams

Dams required to manage dirty water runoff 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 criteria require dams to be sized to capture the 90th percentile 5 day rainfall event and the sediment zone be sized at 50% of the settling zone volume.

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.

3.2.1.2 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.

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.

3.2.1.3 Clean water dams

Four clean water highwall dams are proposed to be constructed by 2033 to 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. The 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 2024 Water Management System

An indicative layout of the proposed water management system is shown in Figure D-2 and schematically in Figure D-5, Appendix D.

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).

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 or its replacement). This will be examined as part of the review of the surface water management plan.

3.4 2033 Water Management System

An indicative layout of the proposed water management system is shown in Figure D-3 and schematically in Figure D-6, Appendix D.

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.

4. Site Water Balance

The SWB model is built in the GoldSim software package and was originally developed as part of the Continuation of Boggabri Coal Mine Project Surface Water Assessment (WSP, 2010). The model is updated annually to reflect the mine as it has developed and simulate on-site conditions.

The model is 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.

This section outlines the process of the update of the SWB model, the review of the validation and the forecast model process and results.

A full description of the model parameters and data is provided in Appendix B.

4.1 Model Updates

As part of the SWB annual report update, the following elements are reviewed and updated and the validation reviewed as necessary:

- Catchments;
- Landuse;
- Pump rates and connections;
- Storage data (including capacity and operating levels); and
- AWBM runoff parameters.

During the 2019 SWB review, several model elements were identified to be reviewed and updated in the 2020 review (refer to Section 8.1.1 of the 2019 SWB Report: BCOP, 2020). These updates included:

- Incorporation of a spoil seepage model for the pit backfill;
- Integration of a model dashboard;
- 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; and
- Review of the water import model.

The addition of several of these items, most notably the spoil seepage model and water import model, resulted in the AWBM parameters requiring revision to better reflect modelled inflows, particularly for the pit catchment. Section A.2 in Appendix A summarises the AWBM parameters and the development of the spoil seepage model. These parameters were further refined in this 2021 update.

4.2 Model Validation

This report presents the review of the model validation for the 2021 year.

The validation of the model is undertaken by comparing modelled results against observed results for the following key model elements:

- Total site inventory;
- Inventory at key storages;

- Modelled imported water; and
- Dust suppression demands.

4.2.1 Water Inventory

BCOP survey dam levels on a weekly basis which has been used for the validation of this model. The model was validated against the total observed volume for all major storages.

Figure 4-1 to Figure 4-3 to show the modelled total inventory and inventory at key storages against the observed values at those storages.

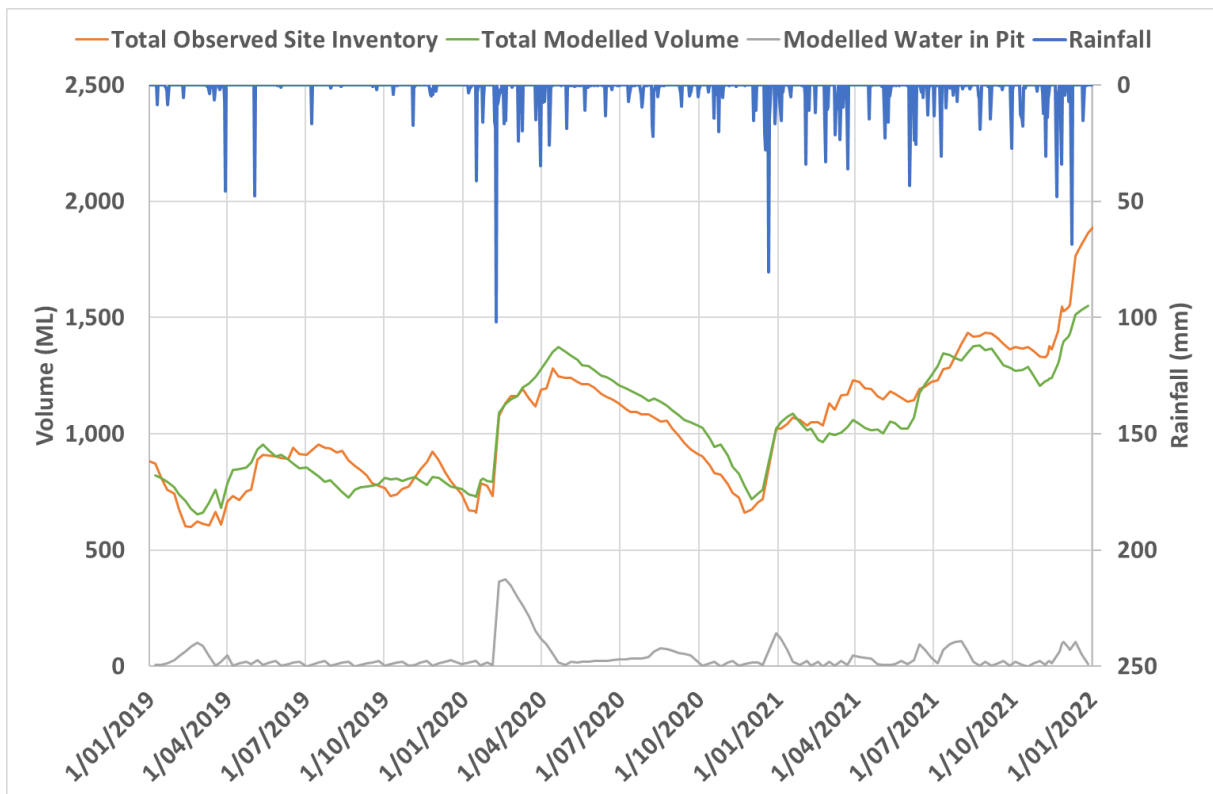


Figure 4-1 Observed vs Modelled Total Site Inventory

Overall, the model shows an acceptable fit for total inventory, with the modelled rate of drawdown after flood events correlating well with the observed data. The magnitude of inflows from flood events is also captured by the runoff model.

During 2019 there are several jumps in total water inventory which the model does not reproduce. These did not occur during large rainfall events and are considered to be as a result of the bulk import of water in a campaign which the model logic (refer to Section A.4) does not replicate.

During several periods, a significant volume of water (up to 400 ML) was estimated to have accumulated in pit following high rainfall periods. This volume has not been accounted for the in weekly water volume surveys but has been anecdotally confirmed by site and is gradually drawn down over time.

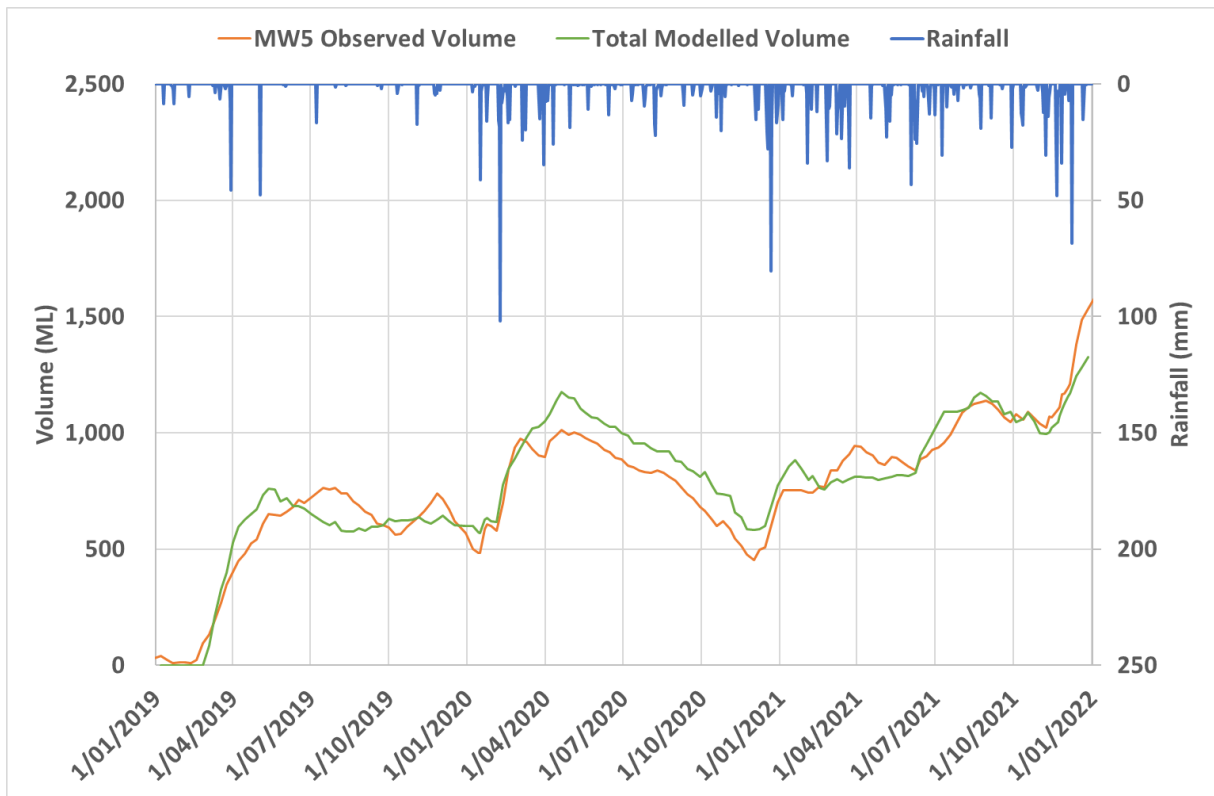


Figure 4-2 Modelled vs Observed Volumes in MW5

SD10 operates as a transfer point for water to and from MW5 as well as supplying water the CHPP. Modelled and observed volumes for SD10 are presented in Figure 4-3. Modelled levels for SD10 are operating within the range of observed levels and it is considered that the modelled operating logic is capturing the operating of SD10 adequately.

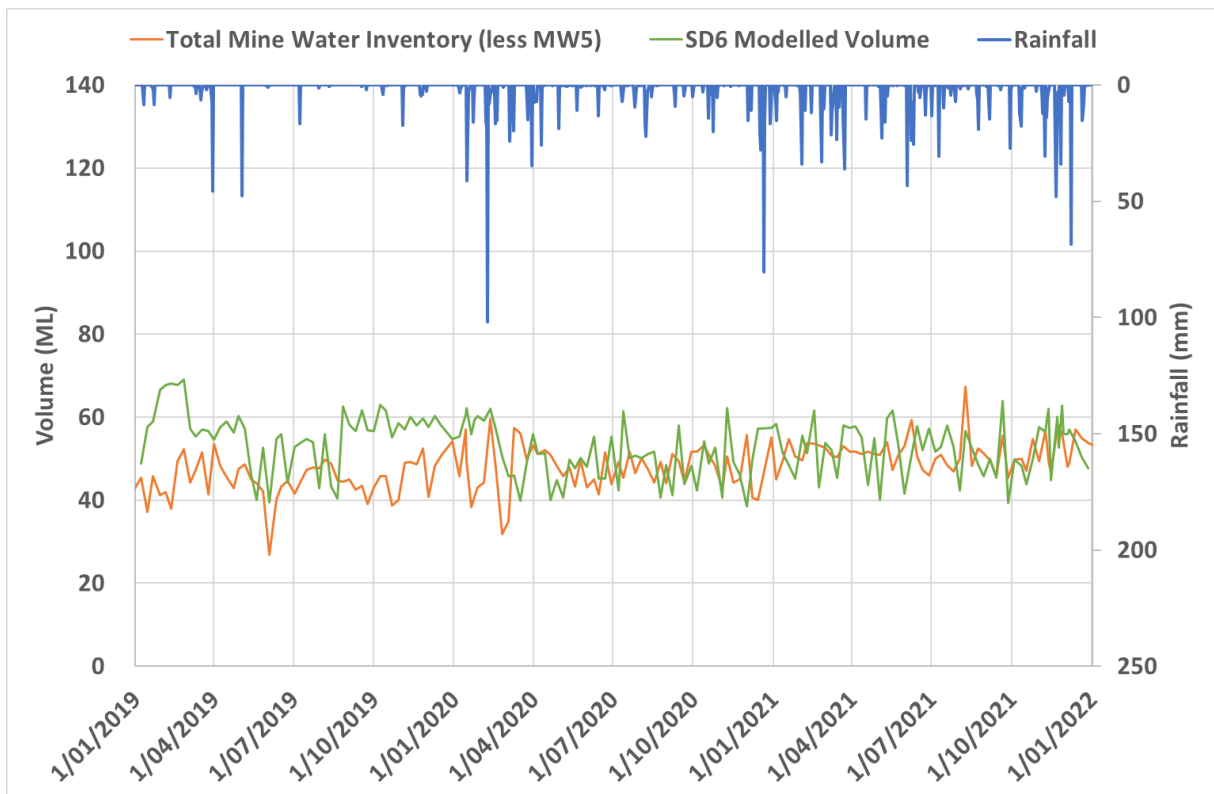


Figure 4-3 Modelled vs Observed SD10 Volumes

Modelled levels in key storages generally match observed levels and the behaviour of dams well. Typically, where modelled results differ from observed results (such as the peak in MW5 not rising to modelled levels), this is due the model operating rules (refer to Appendix B) assuming 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.

4.2.2 Water Import

The model sources water preferentially from groundwater sources and then from the river once this allocation has been exhausted. As discussed in 3.1.3, this allocation is unlikely to be available due to a lack of flow in the Namoi River. As a result, modelled water import has been classified as either groundwater import or additional import, where the additional import is assumed to either be sourced from the purchase of additional temporary groundwater licenses.

Figure 4-4 shows the modelled vs observed imports from external sources.

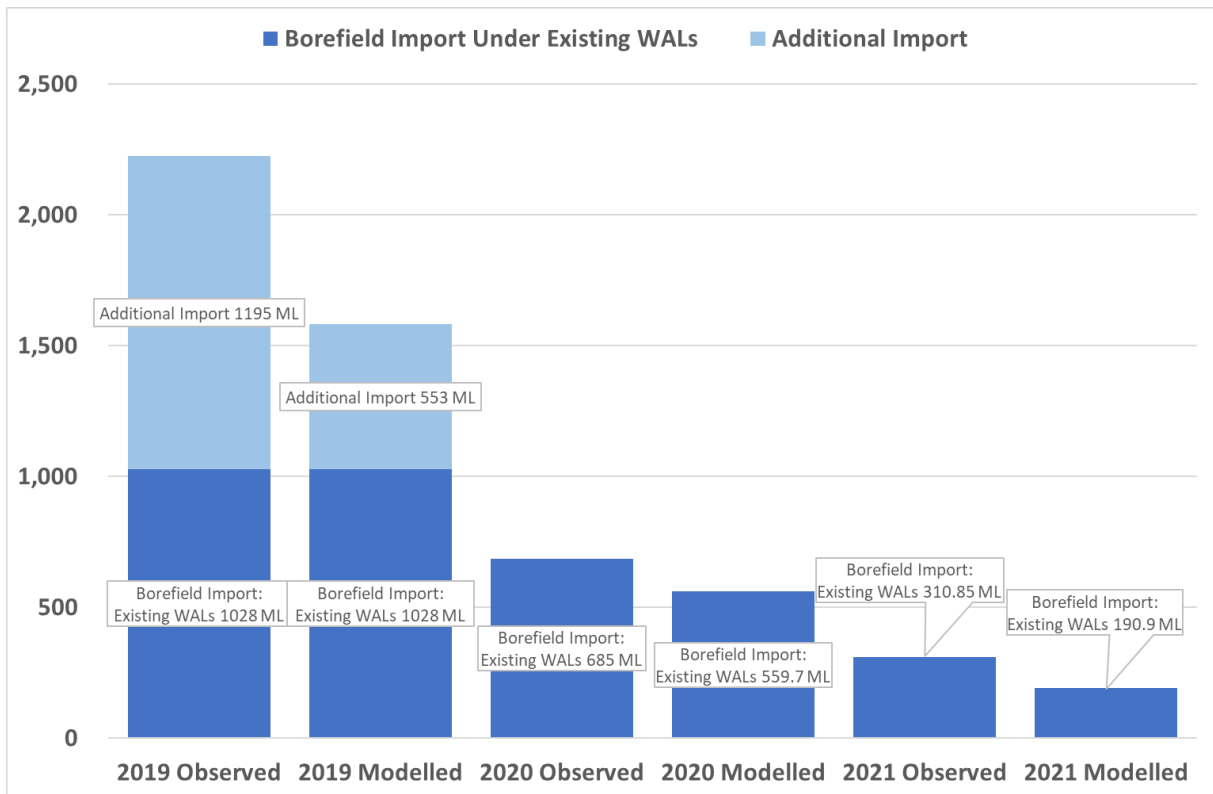


Figure 4-4 Modelled vs Observed Water Import

Generally, the model provides a good estimate for total modelled water import is therefore considered to be suitable for the forecast model. There is a small underestimation of imported water in 2020 and 2021, however, this correlates with the peak in observed volumes in late 2020 that the model does not capture (refer to Water Inventory 4.2.1), this indicates that extra water was imported by BCOPL that wasn't reflected in the modelling. Modelled import for 2021 is within 10% of the observed volume.

4.2.3 Dust Suppression

Modelled dust suppression was compared to observed values for the period from 2019 to 2021. Figure 4-5 shows the comparison between observed and modelled values. The methodology for modelling dust suppression is outlined in Section A.6 of Appendix A.

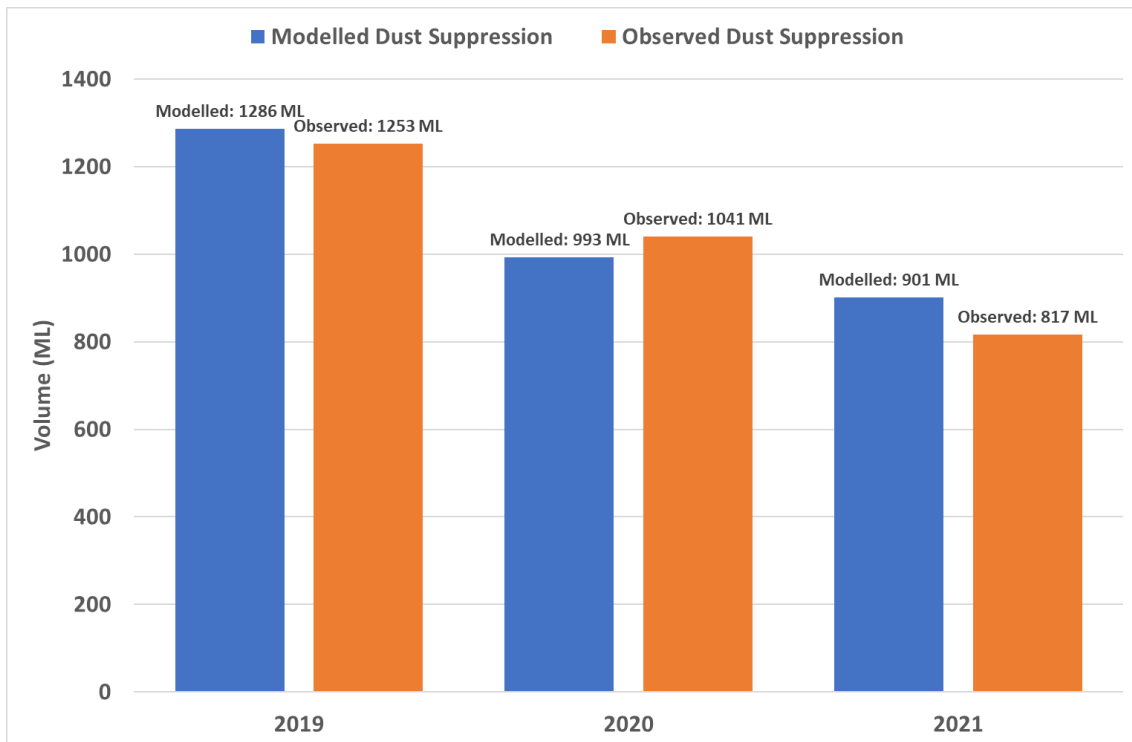


Figure 4-5 Modelled vs Observed Dust Suppression

Modelled dust suppression usage generally shows a good match to observed values. Total modelled usage for 2021 was 10% higher than observed volumes, while total modelled usage for 2020 was 4.6% lower. Total haul road area and the applied evaporation rate both have a degree of uncertainty around them when estimating dust suppression, as such the small variance from observed usage is acceptable for the SWB model.

4.2.4 Validation Outcome

The parameters for the spoil seepage model were updated during the validation review to better capture the increased runoff due to the wetter than average conditions during 2021. This caused the small decrease in modelled water import volumes due to the increased modelled runoff. Even with the increase in the seepage and runoff volumes, the total modelled volume is less than the totalled observed volume on site at the end of 2021. It is not considered that this difference is significant at this stage, however if further divergence is observed during the 2022 SWB review, it is recommended that both the AWBM and spoil seepage model parameters be reviewed further.

The validation of the model against total and key storage volumes, as well as water import, and demands was found to provide a suitable estimation of the observed values. Overall, the SWB model validation, was considered to be adequate and suitable for use to forecast conditions for the different mine horizons.

4.3 Forecast Model Results

Using the validated runoff parameters and model logic, the model was forecast for the life of mine to determine medium term conditions and assess the risk of shortfall or water excess and to allow for mine planning to be undertaken to mitigate potential risks.

The model was run for a total of 127 times using simulated climatic conditions sampled from the historical record (refer to Section A.1). The results of the simulation were statistically summarised and presented in the following sections.

4.3.1 Model Results

The median annual site water balance is provided in Table 4-1 for the 2022, 2023, 2024 and 2033 'snapshot' year landforms.

Table 4-1 Median Site Water Balance for Each of the Snapshot Years

	2022	2023	2024	2033
Inflows (ML)				
Runoff and direct rainfall:				
Clean Water Highwall Dams	-	-	-	6
Dirty water sediment dams	199	207	210	194
Contaminated water dams, MWDs and pit	566	578	576	656
Groundwater make	329	348	355	271
Imported water from borefield	191	778	798	1,028
Import water from additional sources	-	-	-	160
Total Inflows (ML)	1,285	1,911	1,938	2,315
Outflows (ML)				
<i>Demands</i>				
Dust suppression - haul roads	1,076	1,058	1,044	1,417
CHPP	539	539	541	539
MIA and potable water	183	183	183	183
<i>Evaporation:</i>				
Clean Water Highwall Dams	-	-	-	0
Dirty water sediment dams	98	94	95	142
Contaminated water dams, MWDs and pit	260	209	211	195
Uncontrolled Discharges				
Clean Water Highwall Dams	-	-	-	-
Dirty water sediment dams	-	-	-	10
Mine water dams and pit	-	-	-	-
Controlled Discharge of Clean Water	-	-	-	6
Total Outflows (ML)	2,156	2,082	2,072	2,492
Change in storage (ML)	-871	-171	-134	-177

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 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 small decrease in both modelled inflows and outflows from the 2020 SWB Report, this is likely due to the revision of the runoff model parameters (refer to Appendix B). This has resulted in lower total runoff volumes, controlled and uncontrolled discharges, and evaporation from WMS storages.

Modelled total site inventory is predicted to remain relatively stable as the mine progresses. Captured runoff remains steady as the pit progresses and rehabilitated areas are released. In the median modelled results, it is predicted that the maximum entitlement of 1028 ML/year will be required to be imported from the borefield. A small amount of additional import may be required in median years, this volume increases in drier years. Figure 4-6 shows the modelled total site volume.

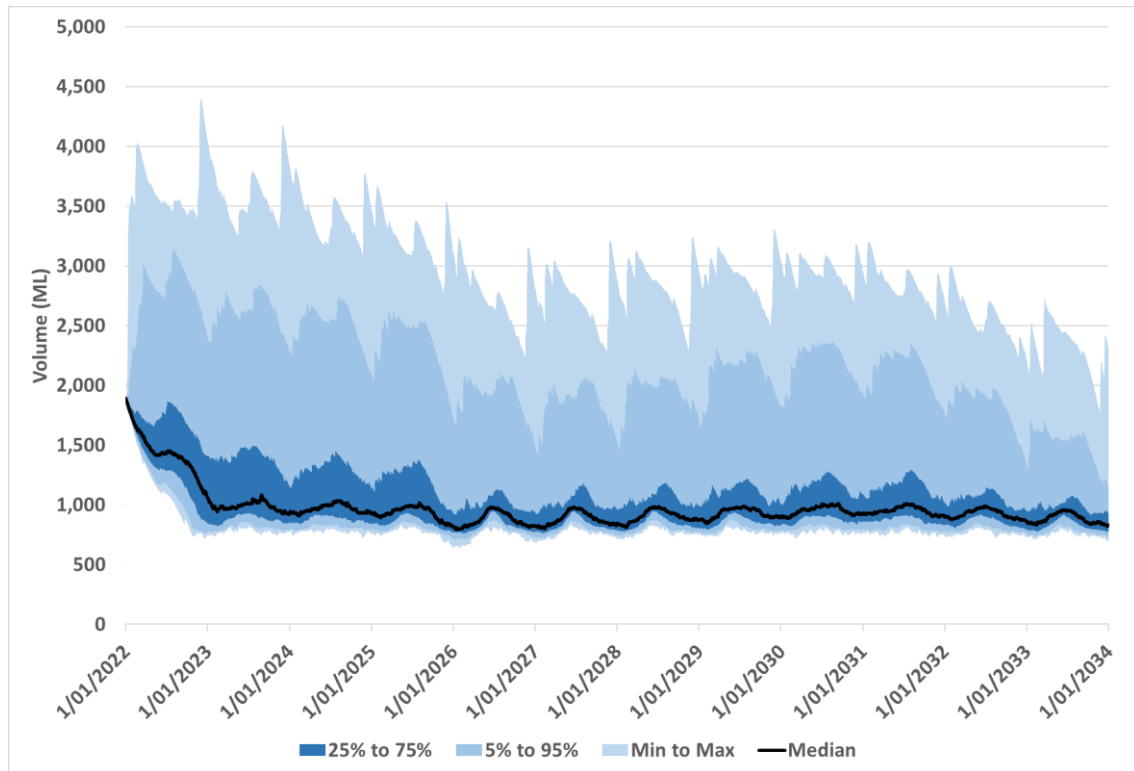


Figure 4-6 Modelled Forecast Total Site Volume

4.3.2 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 are expected over the life of BCM.

Summaries of the simulated daily time series of water stored in the mining void (pit sumps) and MW5 over the life of BCM are provided in Figure 4-7 and Figure 4-8, 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 4-1 is the percentile ranks of the annual results.

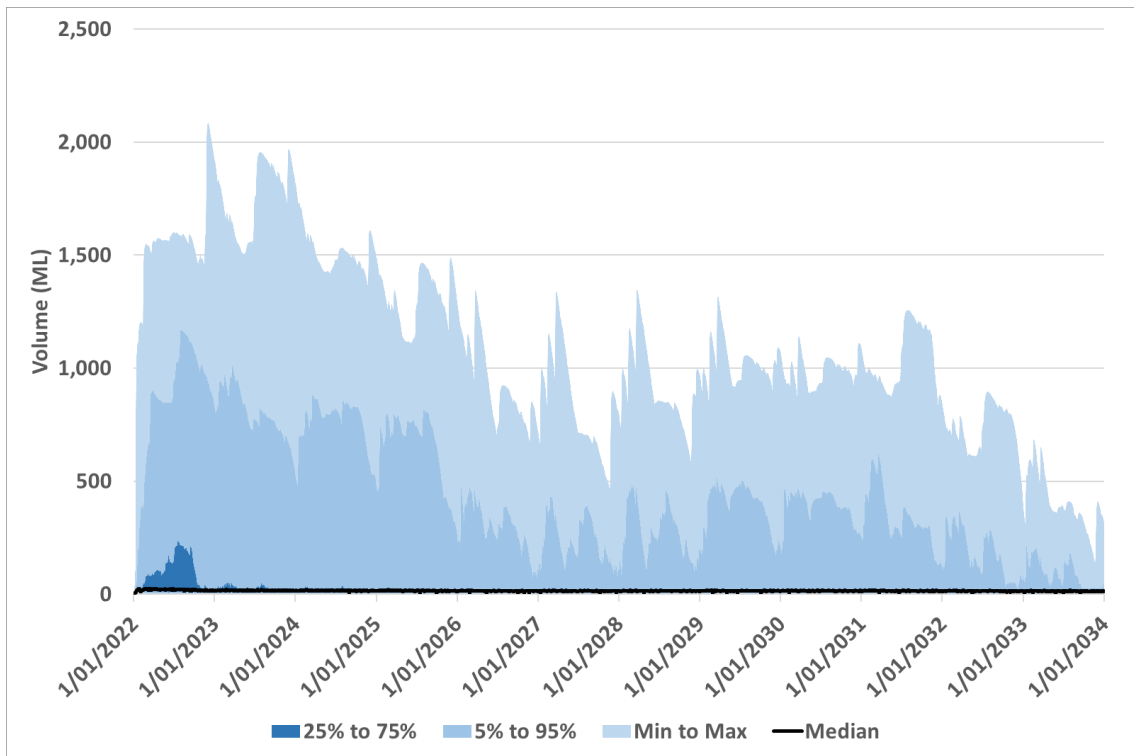


Figure 4-7 Simulated Time Series of Water Stored In-Pit

Figure 4-7 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 1,500 ML. This maximum volume may reduce following 2024 as the catchment area reporting to the pit void is reduced.

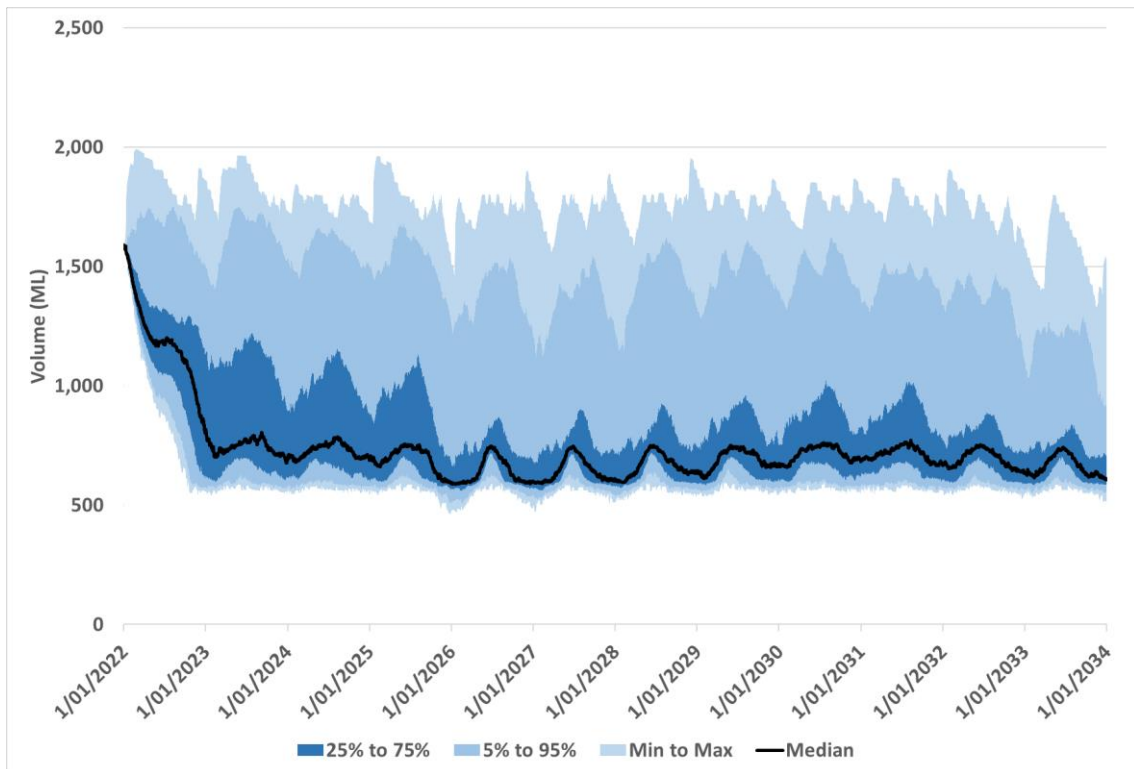


Figure 4-8 Simulated Time Series of Water Stored in MW5

Due to above average recent rainfall, the starting volume in MW5 is approximately 1,500 ML. Figure 4-8 shows that the volume stored in MW5, in median modelled rainfall conditions, is predicted to gradually reduce over the course of a year and then remains close to the assumed normal minimum operating volume of 700 ML but may fluctuate the low and high operating volume depending on rainfall conditions.

4.3.3 Water Supply Reliability

A summary of the simulated water imported to site over the life of the Mine is provided in Figure 4-9 and Figure 4-10. And a summary table for the snapshot years is provided in Table 4-2. Note that the values in Figure 4-9 and Figure 4-10 are not limited by the existing entitlements held by BCOP and the additional modelled supply is potentially required to avoid shortfalls in supply to on site demands.

Predicted import for 2022 and some of 2023 is lower than subsequent years due to the large amount of water currently stored in MW5. The model uses this water in preference to imported borewater (aside from the 0.5 ML/day required in the CHPP). Once this volume has been drawn down, modelled imported water requirements increase.

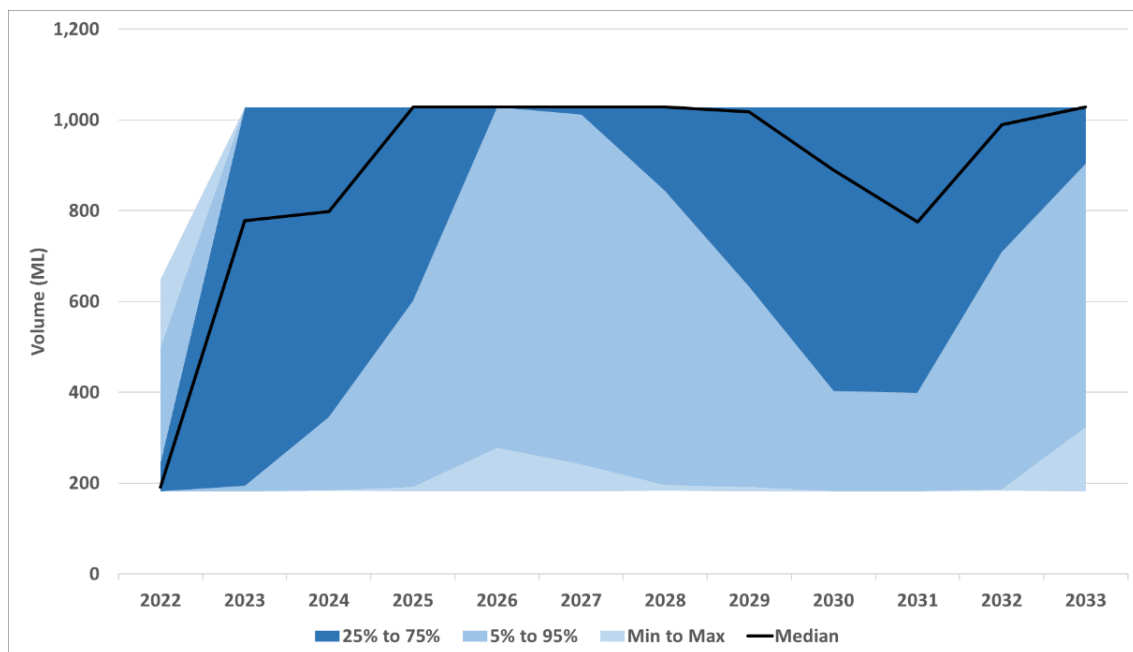


Figure 4-9 Simulated Time Series of Annual Borewater Imported to Site

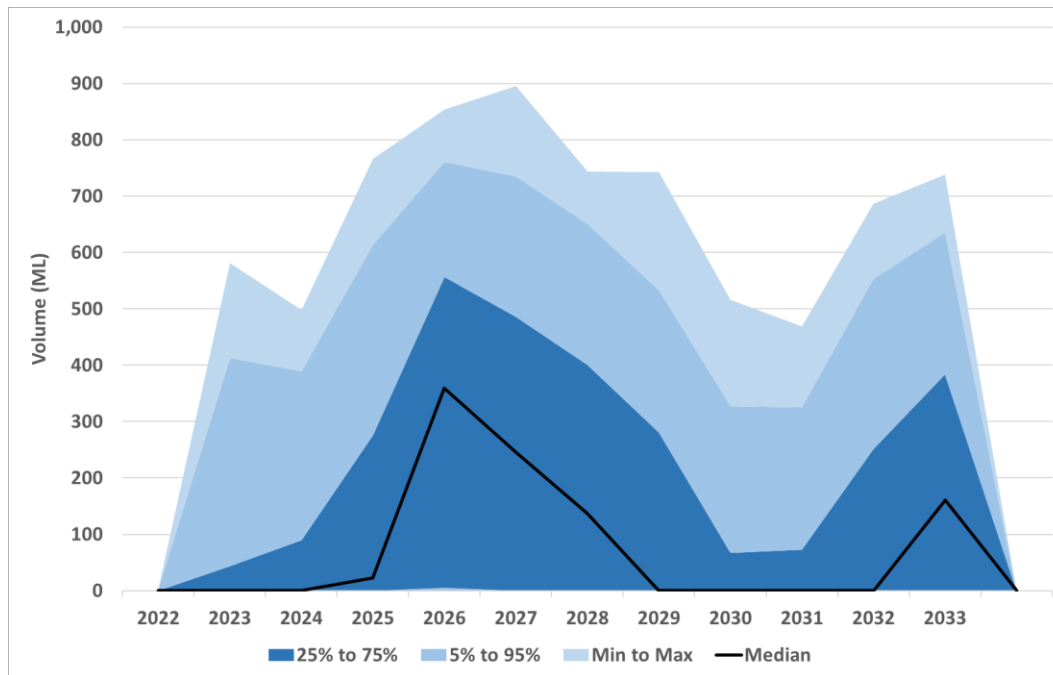


Figure 4-10 Modelled Annual Additional Import Required

Table 4-2 Annual Totals of Imported Water Requirements

	Annual total (ML)			
	2022	2023	2024	2033
5th percentile (wet)	183	183	183	323
25th percentile	183	194	345	904
50th percentile (median)	191	778	798	1,188
75th percentile	247	1,071	1,117	1,411
95th percentile (dry)	500	1,441	1,417	1,662
Greatest result (driest on record)	649	1,609	1,526	1,766

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, washbay demands and fire water tanks for the CHPP.

4.3.4 Modelled Overflows

Figure 4-11 show the modelled overflows from dirty water sediment dams. There were no modelled overflows in the median modelled results until 2033 where 6.5 ML was discharged. This is largely due to the design capacity of MW5 and the ability to store water there as flood storage in larger rainfall events.

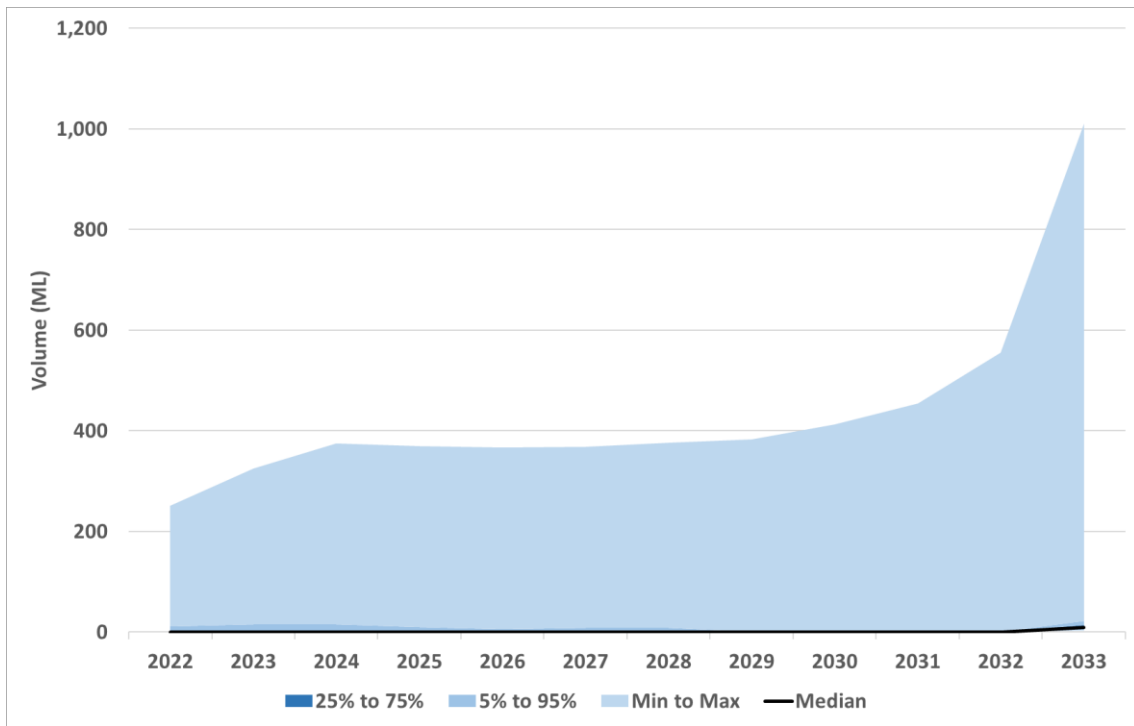


Figure 4-11 Modelled Dirty Water Overflows

5. 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 5-1.

Table 5-1 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
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.	Completed
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
Collect moisture content data for all coal flows associated with the CHPP to permit full water balance accounting	In progress
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.	In progress
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
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 6.3

6. Improvement and Reporting

6.1 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.

6.1.1 Recommended Improvements

It is recommended that the following elements of the water balance are reviewed as part of the 2022 SWB review:

- Model calibration;
- Review of AWBM parameters; and
- Review of the spoil seepage model – against observed data (e.g. estimated volumes in pit and dewatering).

Input data improvements including:

- Review and update the water use data for the CHPP to use metered data; and
- Staging and operational improvements including review the staging of previously recommended upgrades to dams (e.g. SD3).
- Metering of dewatering from the pit to inform spoil seepage estimation.

6.2 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 4.2, to identify the source of the discrepancy. The updated SWB model will be used to update predictions described in Section 4.3.

A summary of the validation will be incorporated into the annual revision of the SWB presented as part of the Annual Review.

6.3 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 a summary 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/).

7. Review and Revision

7.1 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.

8. References

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Appendix A:

Climate Data

A.1 Climate Data

BCOPL maintains a rainfall gauge on site with data available from 2013 to present. There are 2 operating Bureau of Meteorology (BoM) rainfall gauges within the vicinity of the Project area and several discontinued gauges. Table A.-1 shows the available rainfall data for key rainfall gauges in close proximity to the. Typical rainfall and evaporation rates are included in Figure A-1 and Figure A-2.

Table A.-1- BCM Nearby Weather Stations

Gauge	Owner	Type	Period of Record	Distance from Site (km)
Site	BCOP	Rainfall	8 years	-
Boggabri Post Office (055007)	BoM	Rainfall	137 years	15.1 km
Boggabri (Kanownda) (055076)	BoM	Rainfall	122 years	12.8 km
Boggabri (Mayfield) (055033)	BoM	Rainfall	52 years (1934 – 1986)	8.7 km
Gunnedah Research Station (055024)	BoM	Evaporation	71 years (1948 - 2019)	42 km

Site rainfall data is considered to be the most suitable for use in the model. Prior to the site gauge data becoming available, rainfall data from the Boggabri Post Office gauge was used due to the length of the data record and proximity to site. Where data from the Boggabri Post Office Gauge was not available, SILO Data Drill (1889 to 2022) was used to represent the long term evaporation data set. The SILO data drill is a derived data set from a combination of interpolated recorded data between weather stations and derived long-term average values. A comparison of nearby gauged rainfall mean to the Silo Data Drill mean is presented in Figure A-1.

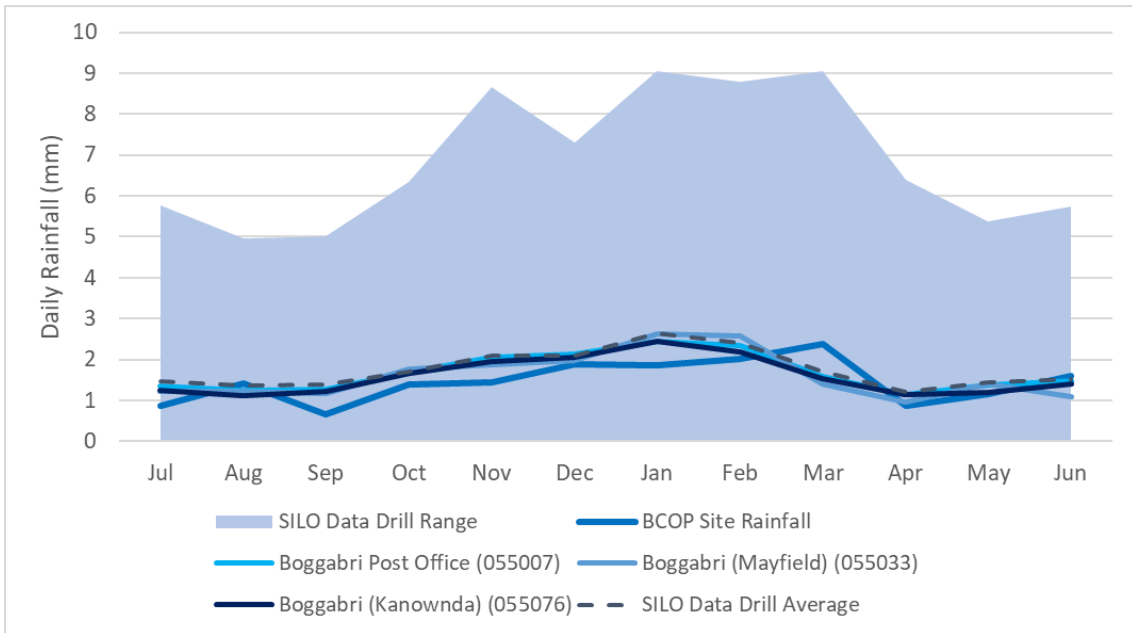


Figure A- 1- Daily Rainfall comparison (range and mean)

Due to the limited distribution of evaporation monitoring stations near the BCM, there is a potential that the interpolated evaporation data at the location of BCM may be inaccurate. To address this the long-term pan evaporation derived from the SILO data drill has been compared against the average daily recorded data from the Gunnedah Research Station (055024) (nearest station available) to validate the SILO data, presented in Figure A-2. The long-term average data from the SILO data drill matches well with the data recorded at Gunnedah Research Station (055024) for the period 1948 to 2019.

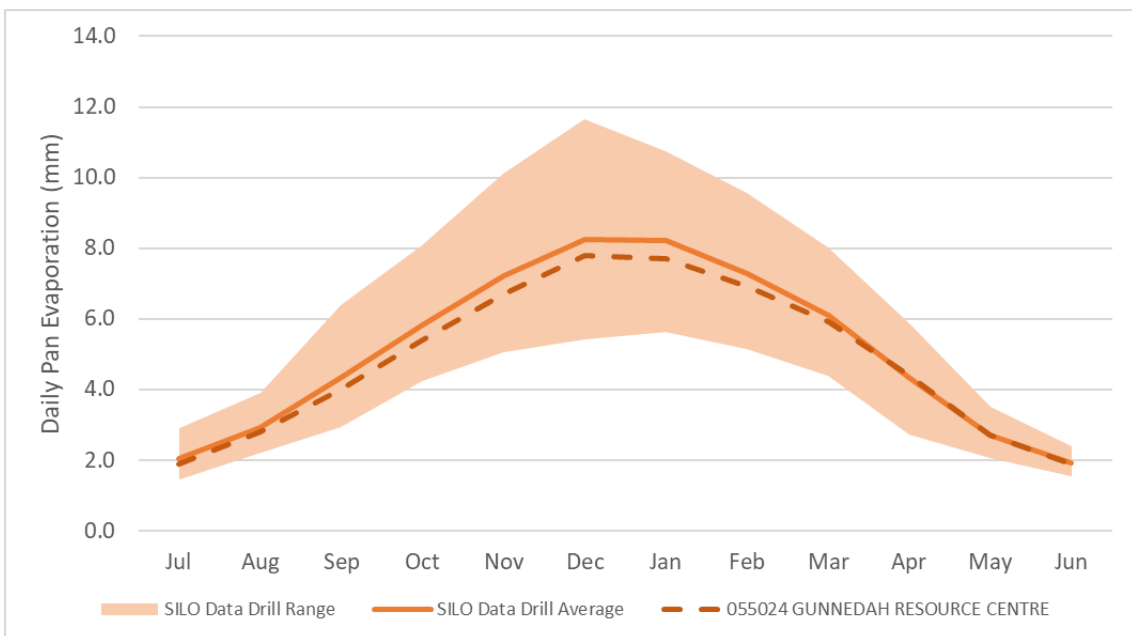


Figure A- 2 - Daily evaporation (range and mean)

Appendix B:

Water Balance Methodology

B.1 Modelling Assumptions and Methodologies

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, this will be reviewed and confirmed as part of the next revision of the surface water management plan.
- 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 2025 and the capacity of SD3 is increased from 100 ML to 209 ML at 1 January 2022 or MW5 if additional capacity is not provided.
- The borefield, as approved as part of MOD 5, was commissioned on 1 July 2017.

B.2 Model Inflows

B.2.1 Modelled 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 from licenced discharge points (if EPL 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 A.1) and area of water storages, calculated from the surveyed stage-storage-area relationship. The volume of catchment runoff was calculated as the product of the catchment area (refer to Section C.2.2) and the runoff depth calculated using the AWBM runoff model.

B.2.2 AWBM Runoff Model

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.

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 B-1.

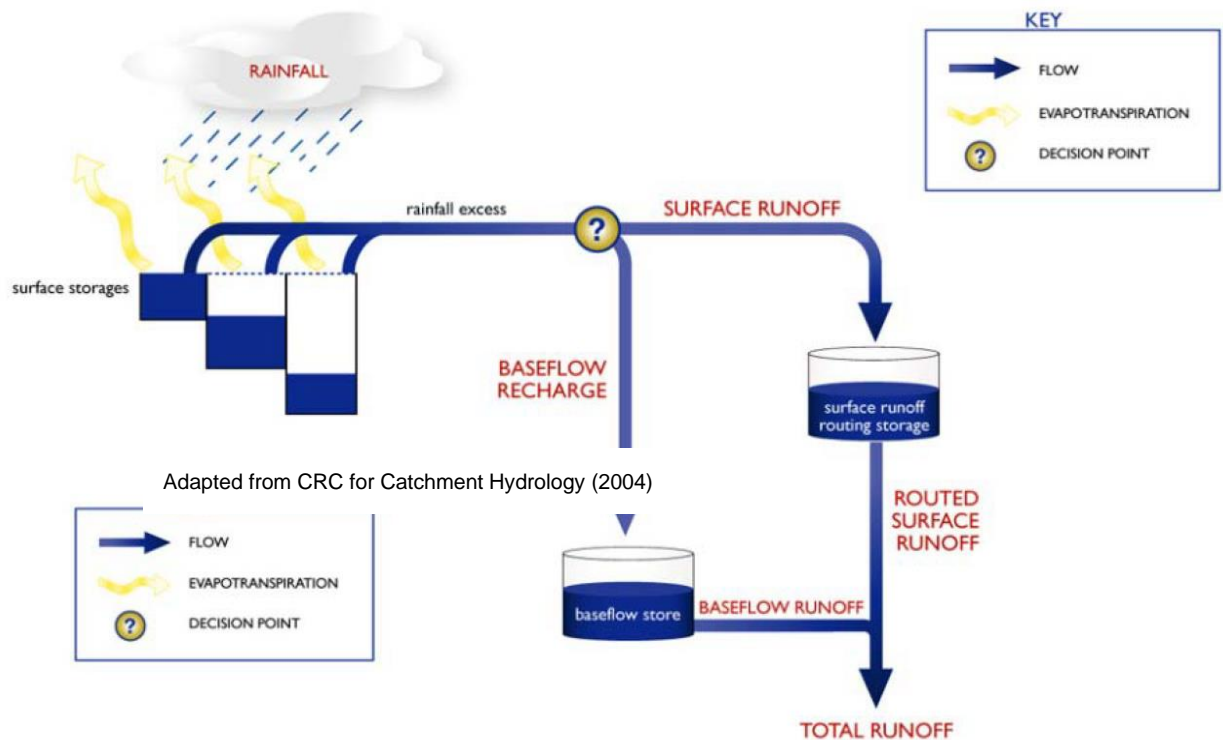


Figure B- 1 - Schematic Layout of the AWBM Rainfall-Runoff Model

To implement the AWBM in a given catchment, a set of nine parameters must be defined as summarised in Table B-1. 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 4.2.

Table B- 1 - 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

Table B-2 shows the calibrated AWBM parameters used for this model.

Table B- 2 - Model 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

B.2.3 Spoil Seepage Model

A spoil seepage model was incorporated into the SWB model to account for seepage through overburden and rehabbed areas into the mining void. The seepage model captures infiltration from other surface catchments which reports to the pit. A conceptual representation of the model is presented in Figure 8.4.

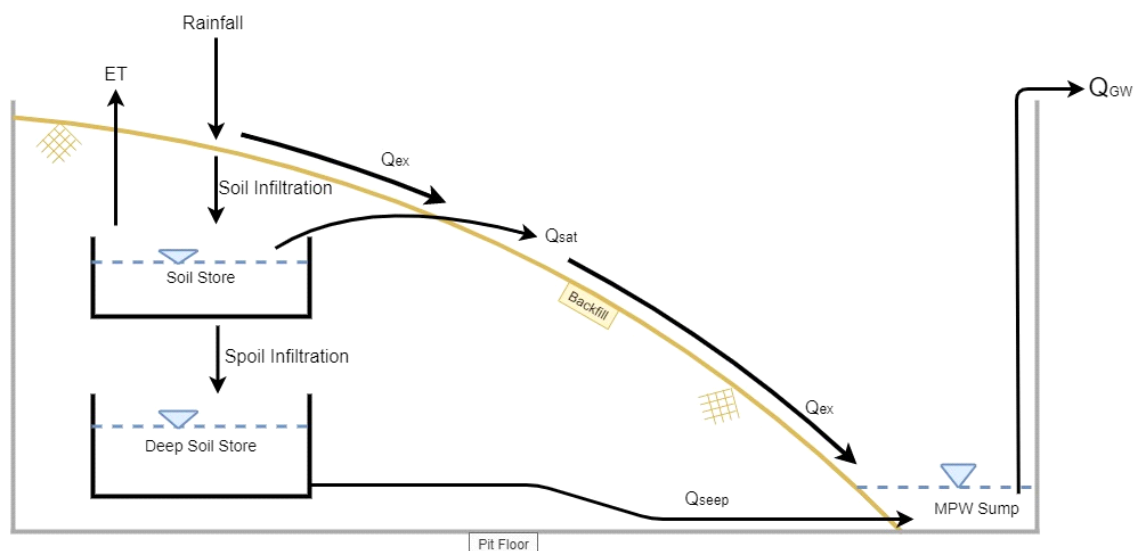


Figure B- 2 - Conceptual Spoil Seepage Model

The key model assumptions and parameters are summarised below:

- Seepage occurs from the historical footprint of the mining void extent.
- Allowance for a pseudo infiltration excess overland flow by including a soil infiltration capacity (P_i) – a limit to how much rain can enter the soil storage zone. The remaining enters the pit as runoff (Q_{ex}):
- Soil Infiltration = Minimum of rainfall or P_i allowance.
- Infiltration from the soil storage to the deep storage is defined as a fraction (K_i) of the soil store depth:
- Spoil Infiltration = Soil Store Depth * K_i .
- Allowance for a pseudo saturation excess overland flow by including a soil storage capacity (C_s) – soil storage zone “spills” back to the surface when full and enters the pit as runoff (Q_{sat}):
- Q_{sat} = Soil Store Depth + Soil Infiltration – Pan ET – Spoil Infiltration – Soil Store Capacity (C_s).
- Daily site seepage flow to the mining void is calculated as a fraction (K_s) of the deep soil store, limited by the saturated conductivity of the spoil material (K_{sat}). This is in line with the initial spoil seepage model methodology:
- Seepage = minimum of Deep Soil Store Depth * K_s or K_{sat} .

The seepage model parameters are shown in Table B-3.

Table B- 3 - Spoil Seepage Model Parameters

Parameter	Description	Value
Infiltration Excess Runoff Coefficient (P_i)	Any rainfall more than P_i immediately becomes runoff (Q_{ex})	90 mm/day
Soil Store Capacity (C_s)	Soil moisture more than C_s immediately becomes runoff (Q_{sat})	102 mm
Minimum Soil Store Moisture (C_{sm})	No infiltration occurs below this level	0 mm
Infiltration Fraction (K_i)	Fraction of soil moisture storage that migrates to the deep soil store, per time step	0.89 1/day
Seepage Fraction (K_s)	Fraction of the deep soil storage that reports as seepage to the open pit, per time step	0.007 1/day
Recharge Fraction (K_d)	Fraction of seepage that recharges to groundwater, per time step	0.13 1/day
Saturated Recharge Rate (K_{sat})	Maximum spoil seepage rate	44.3 mm/day

B.2.4 Water Imports

Due to the approximations required to model the importation of water into the site, 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.

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.

B.2.5 Groundwater

Seepage rates of groundwater into the mining void have been estimated 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 B-3.

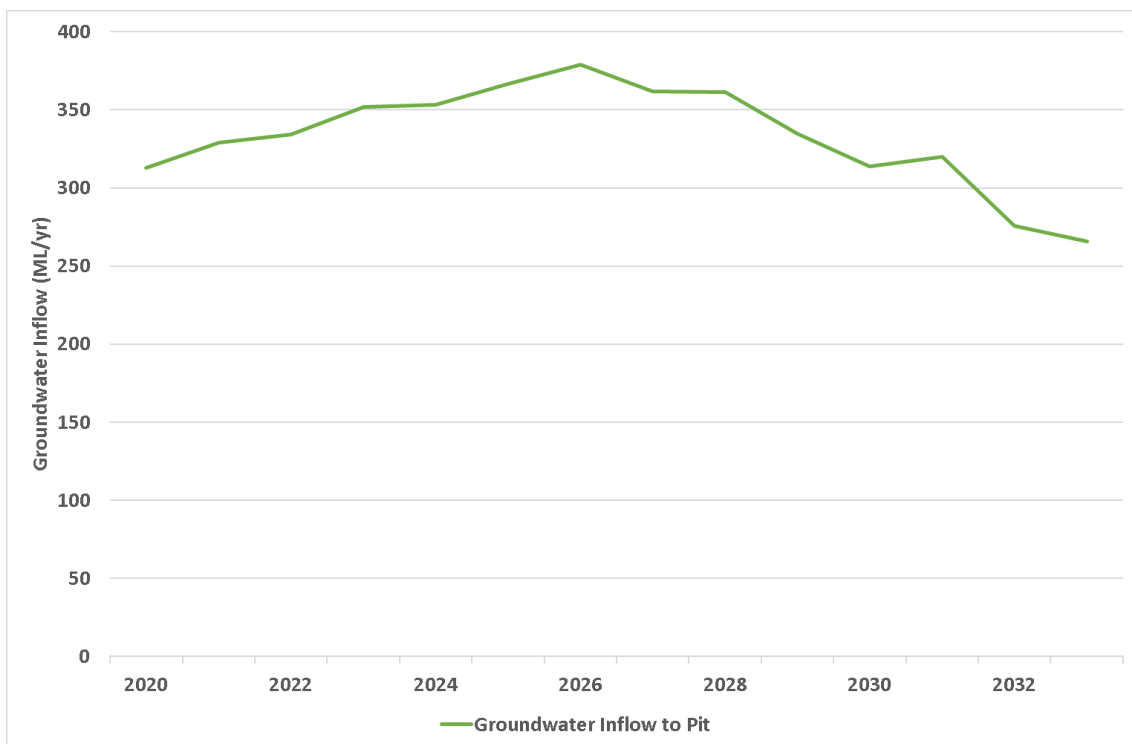


Figure B- 3 - Estimated Groundwater Inflows to Mining Void

From Figure B-3 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.

B.3 Model Outflows

B.3.1 Evaporation

Evaporative losses from storages were calculated as the product of the evaporation depth for open water, as described in above, and the water surface area of the storage (refer to stage area curves in Appendix C).

B.3.2 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 (see below).

Daily modelled dust suppression is calculated as a factor of haul road surface area multiplied by the daily evaporation rate. An effective width of 50 m was assumed for all haul roads and historic and forecast haul road length was supplied by BCOP in GIS format.

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.

Water used for dust suppression at the mine site is sourced as a priority from recycled contaminated water from various mine water dams depending on the mine progression. Currently, there are fill points at MW8 and SD23. There is also a fill point located at SD7 which is not currently being utilised.

Observed historical dust suppression usage is presented below in Figure B-4.

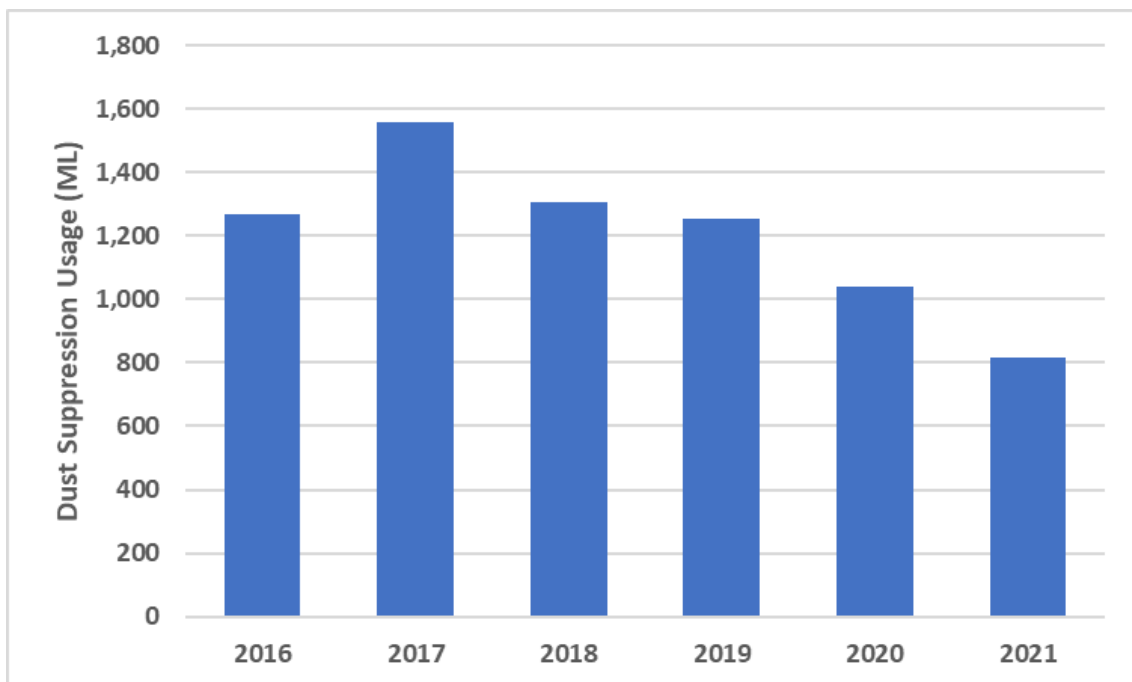


Figure B- 4 - Observed Annual Dust Suppression Usage

B.3.3 MIA and Potable

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 0.5 ML/day of water will be required for the MIA and potable water. This net demand is simulated in the model as a constant flow rate to account for drawdown against the groundwater WALs annual entitlement.

B.3.4 CHPP Usage

The CHPP was commissioned in 2015 and processes up to 4.2 Mtpa of coal from Boggabri Coal Mine.

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.

B.3.5 Seepage

Typically, losses from seepage are minor compared to evaporation and pumped outflows. Therefore, 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).

Appendix C:

Storage Data

C.1 Storage Summary

Table C-1 provides a summary of all site storages and their key operating volumes. The in pit MWD corresponds to several in pit storages located in the pit void. These storages are relatively temporary and vary with open cut mining operations whilst largely operating in a similar fashion. As such they have been grouped as a nominal storage which include all other such storages that may exist in the future as the open cut pit void develops.

Table C- 1 - Storage Summary

Storage		Dead Storage Volume (ML)	LOV (ML)	HOV (ML)	Capacity (ML)
Existing Storages					
MW3		1.0	5.0	131.0	153.5
MW5		1.0	600.0	1,961	2,200
In pit MWD		1.0	87.7	166.1	52.93
Pit		1.0	5.0	10.0	
SD3		16.7	33.3	34.3	102.5
SD6		8.7	17.4	18.4	55.20
SD7		11.7	23.3	24.3	95.1
SD8		1.6	3.3	4.3	13.39
SD10		9.7	19.4	61.7	116.40
SD11		1.4	2.7	3.7	16.40
SD12		17.2	34.4	35.4	206.56
SD23		1.6	3.2	4.2	16.96
SD28		1.0	0.6	1.6	3.5
Proposed Storages					
Clean Water Highwall Dams	2030	1.0	0.0	1.0	166.5
SD19	2033	30.0	60.0	61.0	179.9
SD20	2033	7.0	13.9	14.9	41.8
SD21	2033	9.3	18.5	19.5	55.6
SD22	2033	1.0	0.8	1.8	2.4
SD24	2033	1.2	2.4	3.4	7.3

C.2 Pump Transfers

C.2.1 Operating Rules

The modelled rules for the operation of the pumps and outlets are summarised in **Table C-2**. 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 8-6. These operating volumes do not include the 1000 ML of total freeboard required by the EPL to cater for a 5 day 90 percentile rainfall event.

The dewatering and release of sediment basins was subject to the following condition:

- *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.

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 (calibration runs only) and afterwards to the pit.

Table C- 2 - 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
Dewater Pit to MWD	5.0 (10.0 if pit volume exceeds 200 ML)	Pit greater than HOV	Pit less than LOV	MWD less than HOV
Dewater Pit to SD23	5.0 (10.0 if pit volume exceeds 200 ML)	Pit greater than HOV	Pit less than LOV	SD23 less than HOV
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

Pump / Valve	Pump rate (ML/day)	On trigger	Off trigger	Conditions
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

C.2.2 Catchment Areas

Catchment areas adopted in the water balance model are provided in Table C-3. The study catchment was Nagero Creek to the point where the creek meets the floodplain approximately 1 km downstream of Boggabri Coal Mine.

Table C- 3 - Catchment Areas (ha)

System	Storage	2021	2024	2033
BCM contaminated water dams ¹	MW3	10.7	10.7	10.7
	MW5	208.1	208.1	-
	SD10	31.4	31.4	31.4
	SD11	3.9	3.9	3.9
	SD12	46.2	46.2	173.8
	SD28	0.7	0.7	0.7
	Pit	1,414.2	1,259.8	438.0
	<i>Subtotal</i>	<i>1715</i>	<i>1560.8</i>	<i>658.5</i>
BCM dirty water dams	SD3	194.6	314	639.9
	SD6	65.1	65.1	65.1
	SD7	210	245.1	-
	SD8	11.2	11.2	31.4
	SD19	-	-	357.2
	SD20	-	-	95.2
	SD21	-	-	116.4
	SD22	-	-	7.0
	SD23	51.5	51.5	70.7
	SD24	-	-	16.5
	<i>Subtotal</i>	<i>532</i>	<i>687</i>	<i>1,399</i>
<i>BCM Clean Water Dams</i>	<i>Clean water</i>	-	-	<i>162.1</i>
	<i>highwall Dams</i>			
Undisturbed Nagero Creek catchment		1,540	1,540	1,364
Total		4,795	4,641	3,387

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.

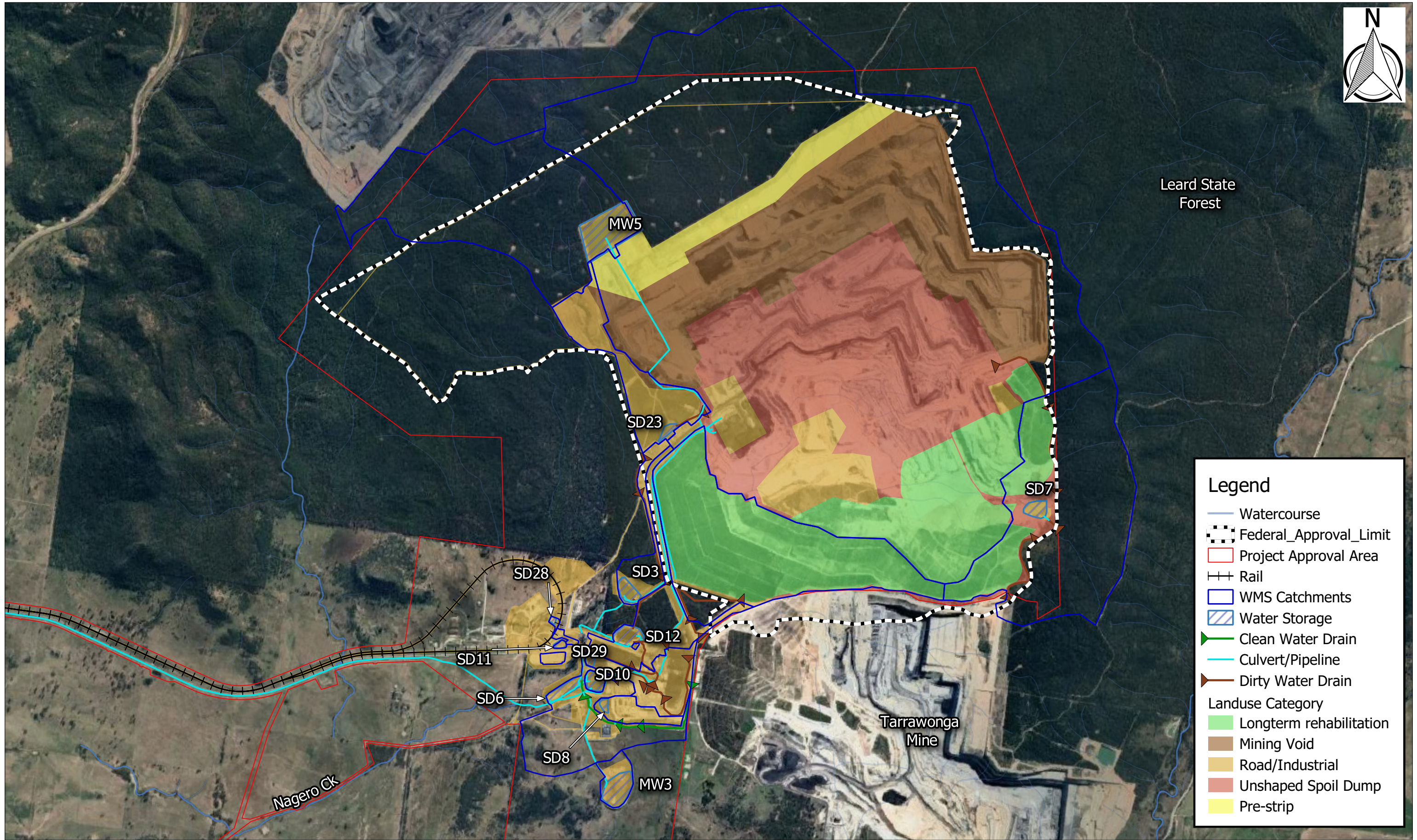
The area of rehabilitated catchment increases from existing conditions to 2033. Progressive rehabilitation is undertaken and where the landform is stable with no sediment laden or otherwise polluted runoff, then runoff from catchment areas is returned to the natural system. While some of the rehabilitated 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.

Appendix D:

Water Management System Plans and
Schematics



Leard State Forest



Legend

- Watercourse
- Federal_Approval_Limit
- Project Approval Area
- Rail
- WMS Catchments
- Water Storage
- Clean Water Drain
- Culvert/Pipeline
- Dirty Water Drain

Landuse Category

- Longterm rehabilitation
- Mining Void
- Road/Industrial
- Unshaped Spoil Dump
- Pre-strip

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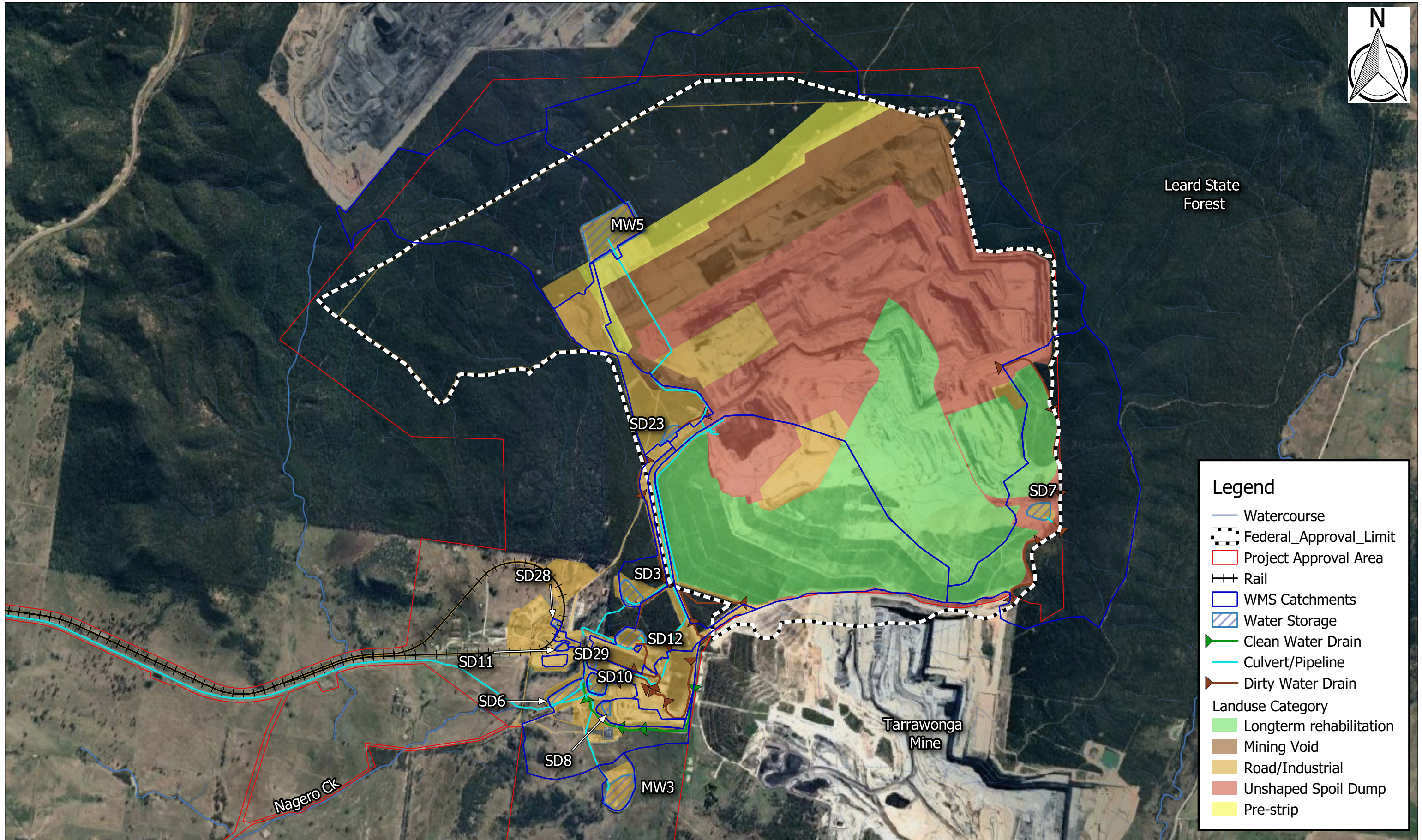
700 0 700 m

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

BCOPL Site Water Balance 2021

Figure D.1 - Existing Water Management System - 2021

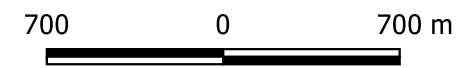
Job Number: N1003_010
Revision: 0
Drawn: GC
Checked: MB
Date: 7/4/2022



Legend

- Watercourse
- Federal Approval Limit
- Project Approval Area
- Rail
- WMS Catchments
- Water Storage
- Clean Water Drain
- Culvert/Pipeline
- Dirty Water Drain
- Landuse Category**
- Longterm rehabilitation
- Mining Void
- Road/Industrial
- Unshaped Spoil Dump
- Pre-strip

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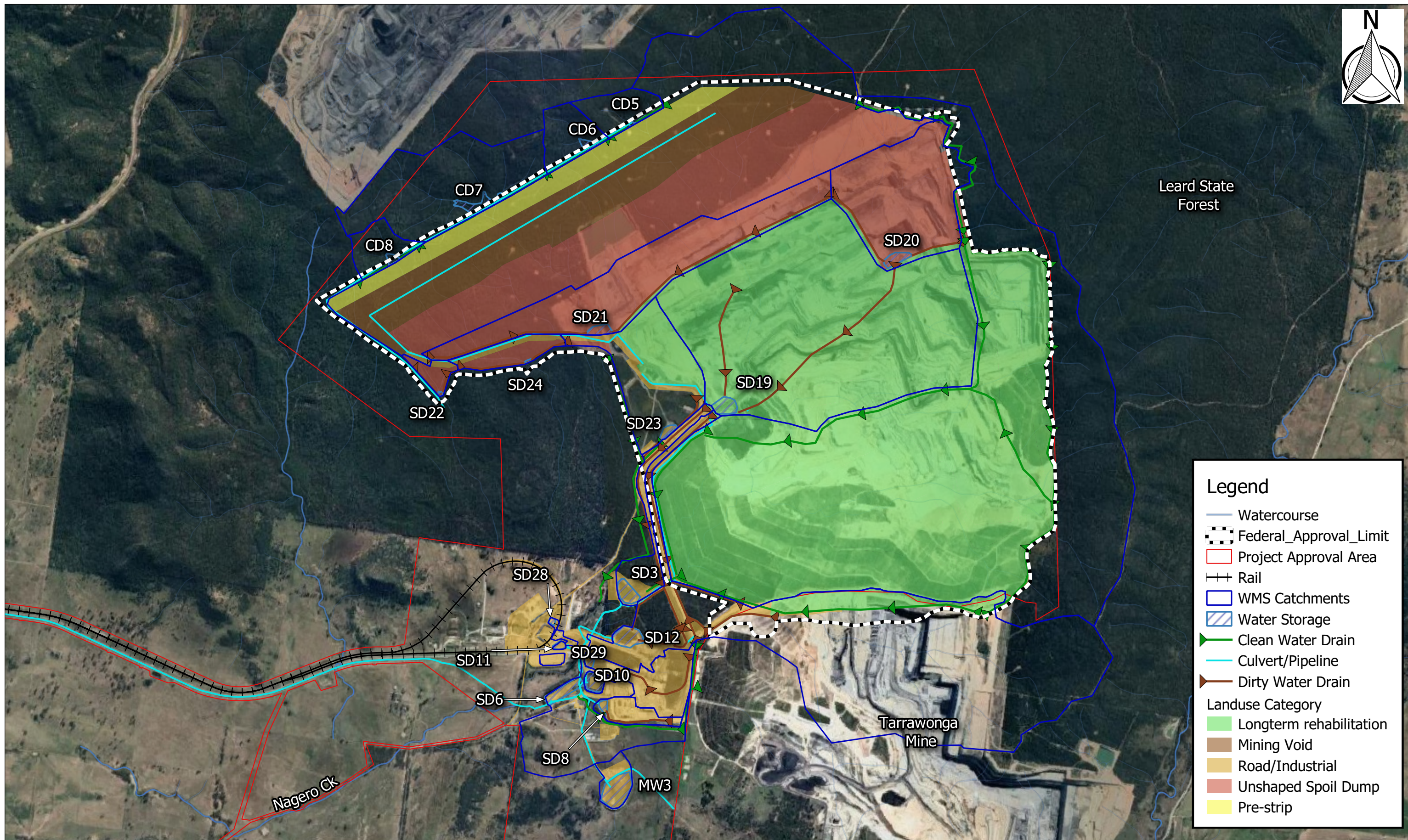


Map Projection: Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia
 Vertical Datum: Australia Height Datum
 Grid: Map Grid of Australia, Zone 56

BCOPL Site Water Balance 2021

Figure D.2 - Water Management System Indicative Layout - 2024

Job Number: N1003_010
 Revision: 0
 Drawn: GC
 Checked: MB
 Date: 7/4/2022



Legend

- Watercourse
- Federal_Approval_Limit
- Project Approval Area
- Rail
- WMS Catchments
- Water Storage
- Clean Water Drain
- Culvert/Pipeline
- Dirty Water Drain
- Landuse Category**
- Longterm rehabilitation
- Mining Void
- Road/Industrial
- Unshaped Spoil Dump
- Pre-strip

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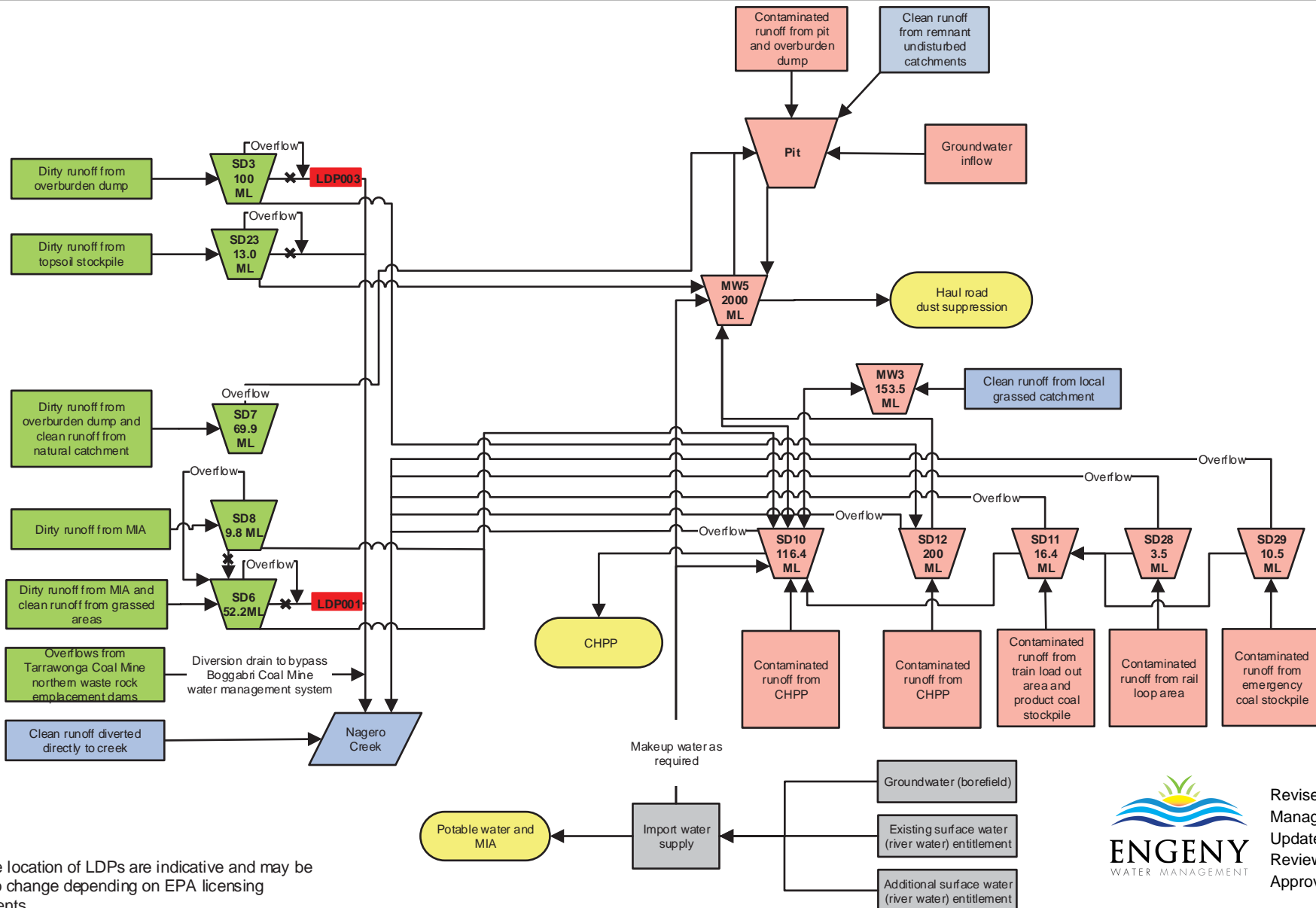
700 0 700 m

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

BCOPL Site Water Balance 2021

Figure D.3 - Water Management System Indicative Layout - 2033

Job Number: N1003_010
Revision: 0
Drawn: GC
Checked: MB
Date: 7/4/2022

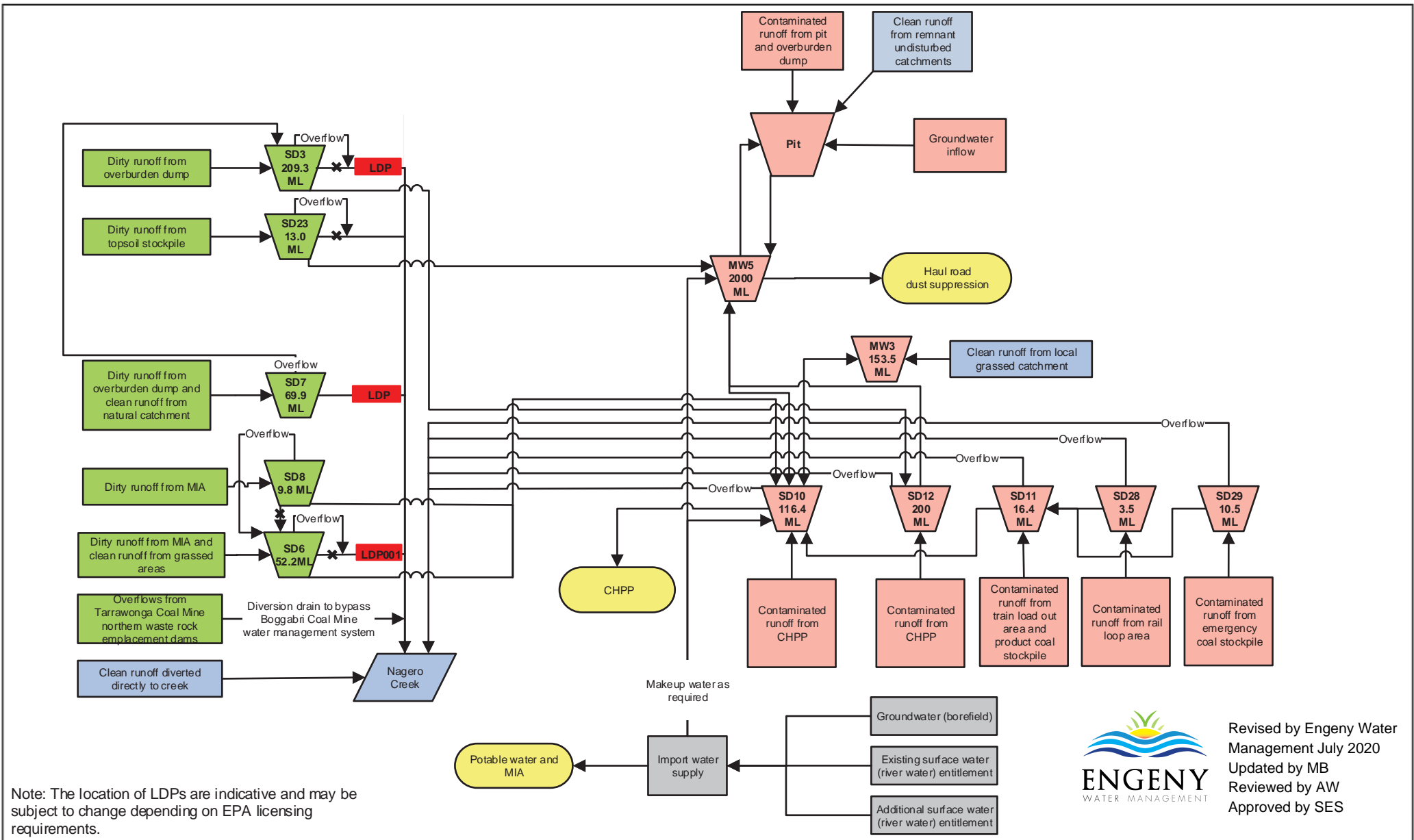


Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.











Revised by Engeny Water Management July 2020
 Updated by MB
 Reviewed by AW
 Approved by SES

	LEGEND	Import water system Dirty water system Contaminated water system Clean water system Usage	© 2018. With all every care has been taken to prepare this figure, GHD make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the figure being inaccurate, incomplete or unusable in anyway and for any reason.	LOCATION	BCM	Boggabri Coal Operations Pty Ltd Boggabri Coal Mine Site Water Balance Water balance model schematic (2021)		
	Surface Water Transfer Storage Manually operated valve	DRAWN TT CHECKED AW APPROVED SG SCALE NTS		DATE	15 Jun 2018			Figure D4



Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.


 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

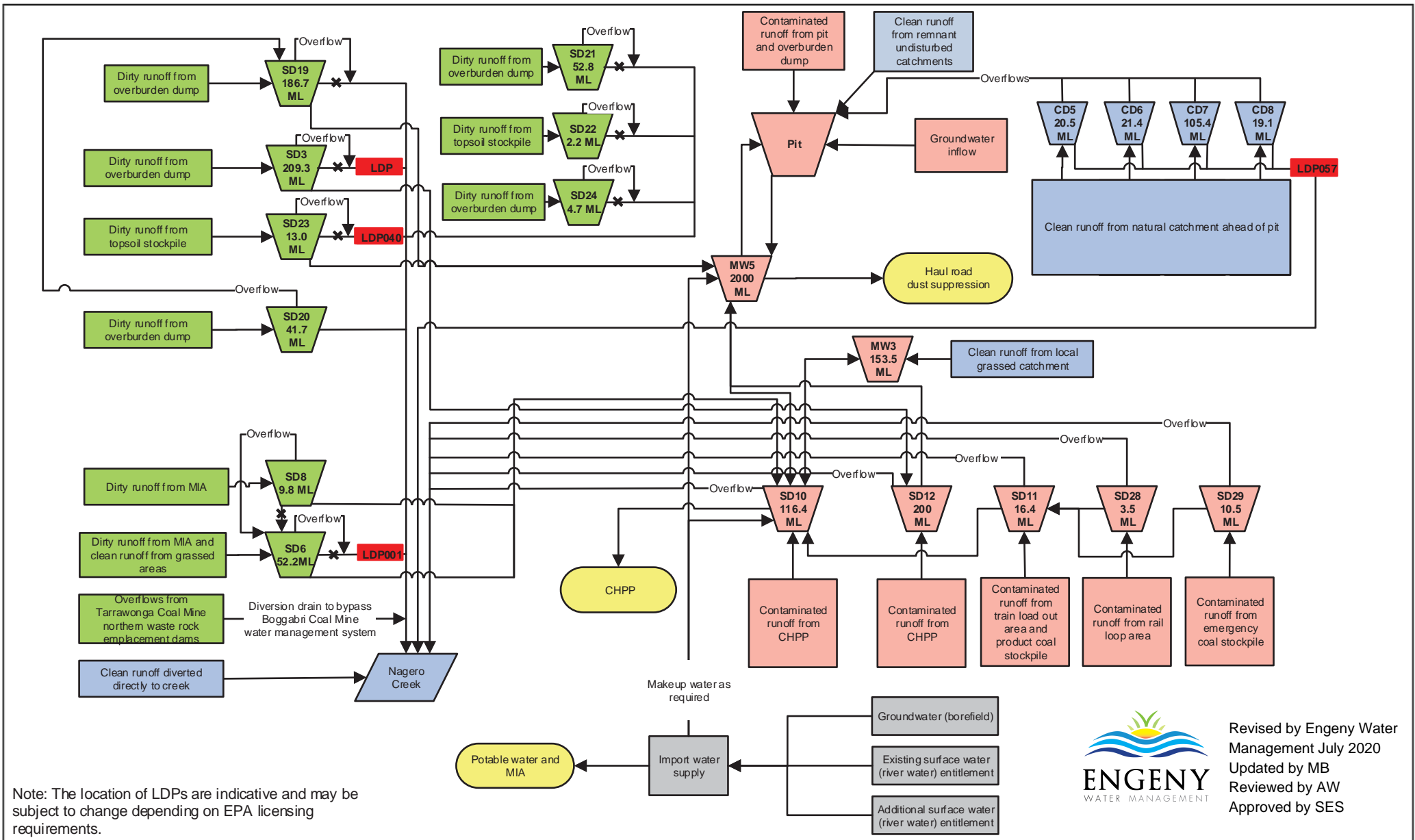
© 2018. With all every care has been taken to prepare this figure, GHD make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the figure being inaccurate, incomplete or unsuitable in anyway and for any reason.

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)


 DATE 15 Jun 2018 Figure D5



Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.

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

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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)

DATE	15 Jun 2018
	Figure D6