LIDDELL

GLENCORE

Annual Review

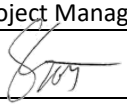
2023

Contents

Title Block

Name of operation	Liddell Coal Operations
Name of operator	Liddell Coal Operations Pty Ltd
Development consent / project approval #	DA-305-11-01
Name of holder of development consent / project approval	Liddell Coal Operations Pty Ltd
Mining lease #	ML1597, CCL708, ML1552, ML1313
Name of holder of mining lease	Liddell Tenements Pty Ltd
Water licence #	Refer to ***Table 3-2***
Name of holder of water licence	Refer to ***Table 3-3***
Annual Review start date	January 1st 2023
Annual Review end date	December 31st 2023

I, Shane Scott, certify that this audit report is a true and accurate record of the compliance status of Liddell Coal Operations Pty Ltd for the period 1st January 2023 to 31st December 2023 and that I am authorized to make this statement on behalf of Liddell Coal Operations Pty Ltd.
Note.
a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.
b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).

Name of authorized reporting officer	Shane Scott
Title of authorized reporting officer	Project Manager
Signature of authorized reporting officer	
Date	28 March 2024

1. Statement of Compliance

During the reporting period, LCO operated as per the approvals listed in ***Section 3***. ***Table 1-1*** and ***Table 1-2*** provide a summary of LCO's compliance with key operational approvals.

Table 1-1 Statement of compliance

Statement of Compliance	
Approval	**Were all conditions of approval complied with?**
DA 305-11-01	Yes
ML #1597	Yes
ML #1313	Yes
CCL #708	Yes
ML #1552	Yes
EPL 2094	No
EPBC 2013/6908	Yes
MOP 2021-2023	Yes
Aboriginal Heritage Impact Permit (AHIP No. 0000623)	Yes
OSSM 3916/2008 (Onsite Sewage Management System)	Yes

Table 1-2 Non-compliances

Non-Compliances					
Approval	**Condition Reference**	**Condition Description**	**Compliance Status**	**Comment**	**Section of AR for detailed response**
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Non-compliant	Monitoring Point 9 failed to achieve PM10 data availability greater than 75% on 11 dates throughout the reporting period due to hardware failures.	Section 6.3.6

Non-Compliances					
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Non-compliant	Monitoring Point 10 failed to achieve PM10 data availability greater than 75% on three dates throughout the reporting period due to hardware failures.	Section 6.3.6
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Non-compliant	Monitoring Point 11 failed to achieve PM10 data availability greater than 75% on five dates throughout the reporting period due to hardware failures.	Section 6.3.6
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Non-compliant	Monitoring Point 12 failed to achieve PM10 data availability greater than 75% on 11 dates throughout the reporting period due to hardware failures.	Section 6.3.6

Table 1-3 Compliance status key

Compliance Status Key		
Risk Level	**Colour Code**	**Description**
High	Non-compliant	Non-compliance with potential significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or

Compliance Status Key		
		• 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

Liddell Coal, located in the Upper Hunter Valley, is operated by Liddell Coal Operations Pty Limited (LCO) under the conditions of development consent DA 305-11-01. This Annual Review (AR) has been prepared in accordance with the *Annual Review Guidelines* (NSW Government, 2015) and Schedule 5, Condition 3 of the DA 305-11-01.

Liddell Coal Operations (LCO) is a former open cut coal mining and processing complex located in Ravensworth NSW that ceased operation in November 2023. The mine site is now in the closure phase with closure activities scheduled to occur until the end of 2026 and consist of bulk push, tailings dam capping, landform rehabilitation, drainage works and infrastructure demolition. All mine closure activities at LCO fall under the management of the Liddell Coal Closure Project (LCCP).

A locality map and aerial photograph of the operation is shown in ***Figure 2-1***.

Mining operations at LCO were continuous since the 1950s until completion of mining in late 2023. Operations prior to the 1950s were intermittent, with underground operations commencing in 1923 and open cut operations in 1946. The open cut mining operation was in operation from 1990 until 2023.

During the reporting period, prior to closure, mining operations were undertaken using the excavator and truck /shovel method of operation. LCO has consent to extract no more than eight million tonnes of run-of-mine (ROM) coal per annum. Product coal, both semi-soft and thermal, was transported to Newcastle Port by rail via the Hunter Valley Rail Loop and Main Northern Railway Line, for sale to the export market. The contact details for the personnel directly responsible for the environmental management of LCO are shown in ***Table 2-1.***

Table 2-1 Mine contacts

Name	Position	Company	Contact Numbers
Shane Scott	Project Manager	Liddell Coal Closure Project	(02) 6570 9900
Ben de Somer	Environment & Community Manager	Liddell Coal Closure Project	(02) 6570 9947

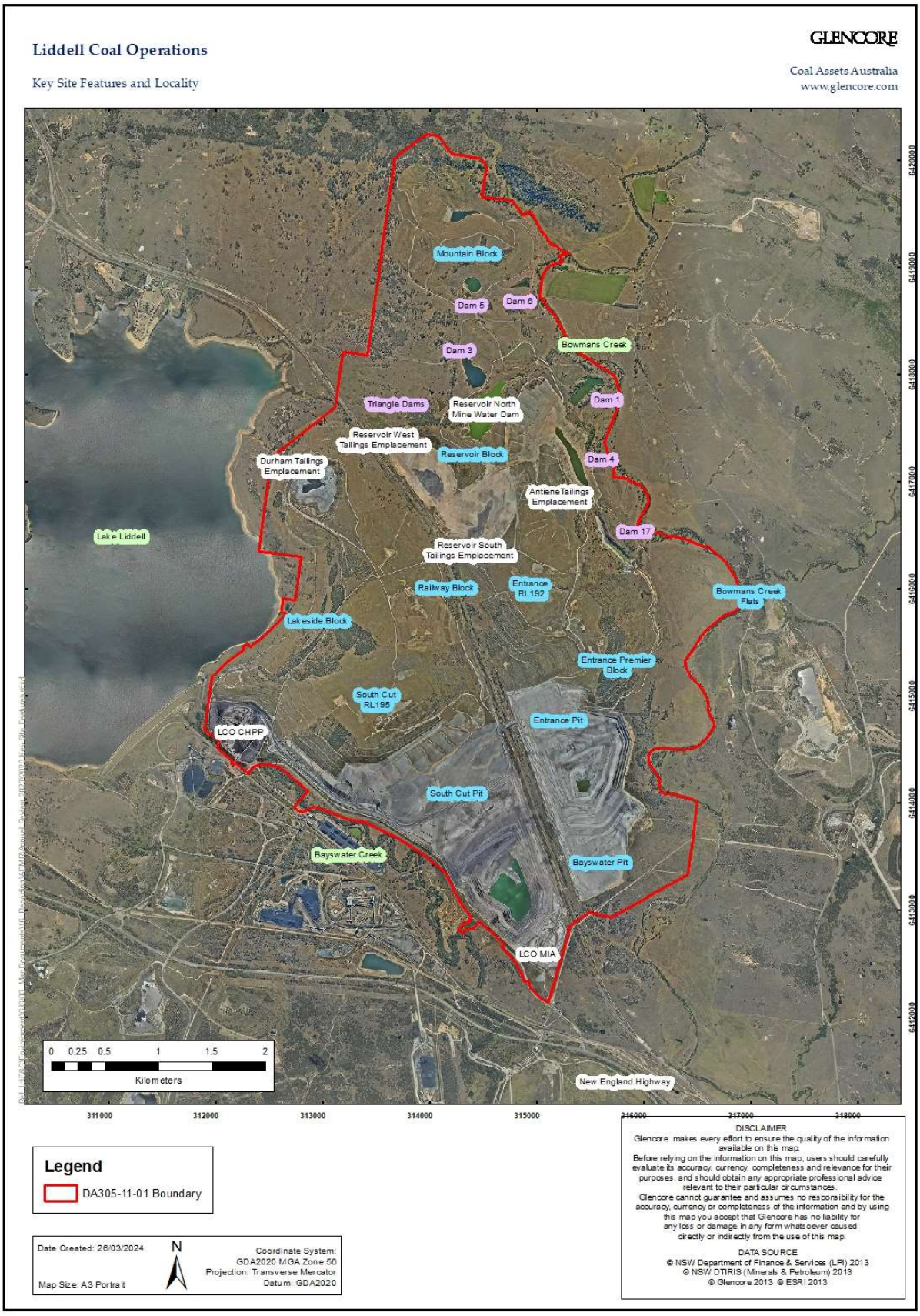


Figure 2-1 Key Site Features and Locality Map

3. Approvals

A number of development approvals, leases, licences and other approvals regulate mining operations at LCO. The status of development consents, licenses, relevant approvals and permits are listed in ***Table 3-1*** to ***Table 3-7*****.**

LCO operates primarily under one consolidated mining lease, ML 1597, as shown in ***Figure 3-1.***

Compliance with the EPL is reported annually to the Environment Protection Authority (EPA) in the EPL Annual Return. LCO's compliance with the EPL is also discussed in ***Section 1*** of this report.

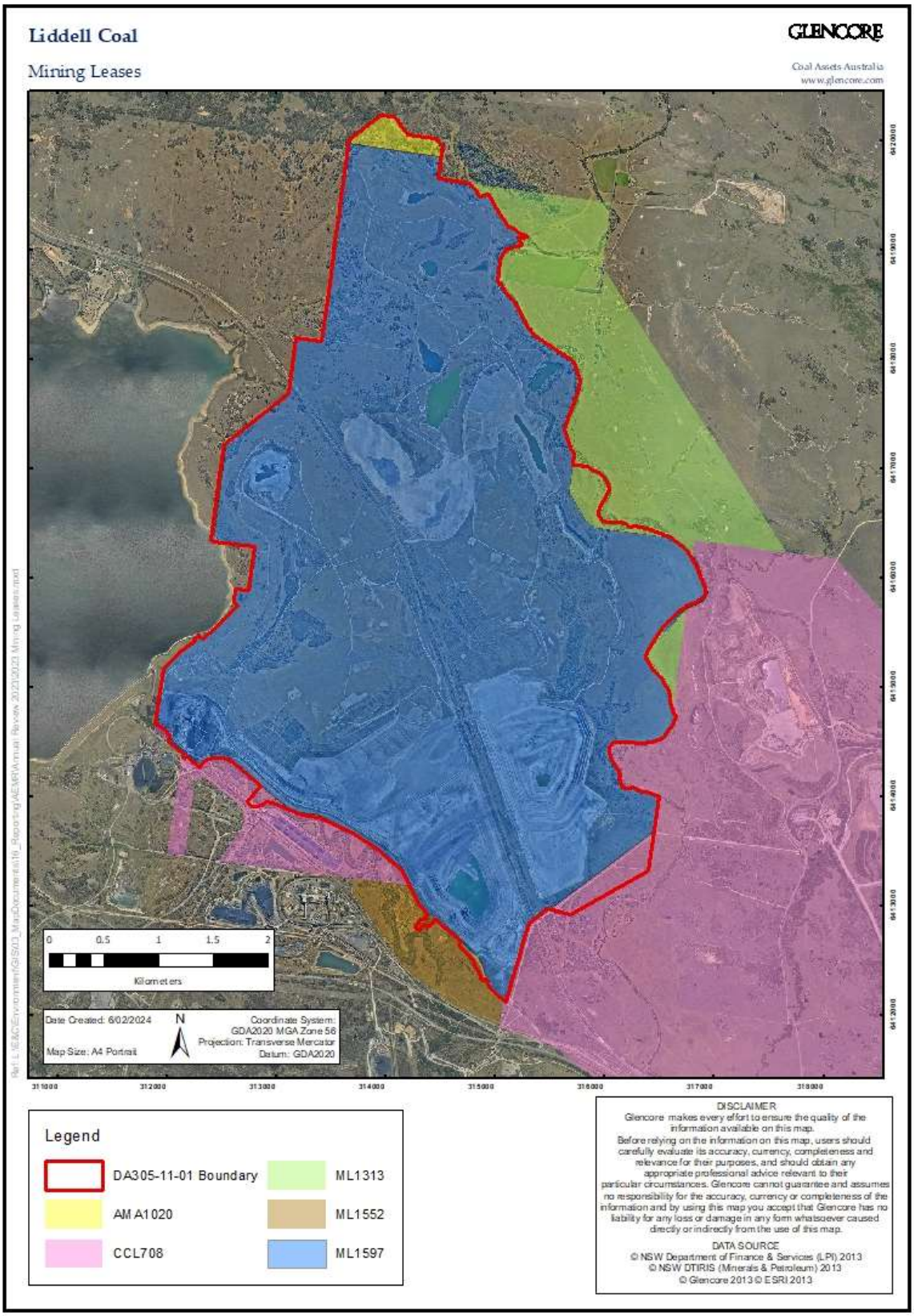


Figure 3-1 Mining Leases

Table 3-1 List of development approvals

Development Approvals			
Approval Number	**Authority**	**Description**	**Expiry Date**
DA 305-11-01	NSW Department of Planning and Environment	Continued operation of the Liddell Colliery	N/a
DA 305-11-01 Modification 2	NSW Department of Planning and Environment	- Increase in the maximum total ROM coal production rate from 4.5 to 8 Mtpa tonnes per annum; - Increase in the mining footprint within the approved South and Barrier Pits by a total of 47 hectares; - Construction and operation of a new preparation section of the Coal Handling and Preparation Plant and minor upgrades to the ROM receival and product coal facility; - Establishment of a new supplementary coal stockpile; - Receival and delivery of up to 1.5 Mtpa of coal to and from Cumnock No. 1 Colliery; - Increase in the maximum transportation rate of reclaimed tailings from 0.3 to 0.5 Mtpa to Macquarie Generation; - Realignment of an already approved access road and services corridor relocation of part of the Old New England Highway; - Relocation and construction of the open cut mining offices, workshops and associated infrastructure to the south eastern portion of the Liddell development consent area; - Construction of a bridge over the Main Northern Railway to provide for more efficient movement of coal and overburden between open cut pits; and - Modifications to the footprint and size of the already approved Dam 13B.	N/a

Development Approvals			
DA 305-11-01 MOD 3	NSW Department of Planning and Environment	- Alterations to the approved intersection layout for the Old New England Highway/mine access road intersection; - Minor realignment of the development consent boundary to accommodate the road works; - Reuse of treated effluent from the office/workshop complex; and - Corrections to numbering in the development consent.	N/a
DA 305-11-01 MOD 4	NSW Department of Planning and Environment	- Additions to the Mining Infrastructure Area including: - Two additional high machinery workshop bays; - Additional relocatable admin & workshop offices; - Fuel farm extension; - Storage shed and compound.	N/a
DA 305-11-01 MOD 5	NSW Department of Planning and Environment	- Extension of the South and Entrance Pits to the south east and, upon completion of mining in these pits, the mining of coal resources under the Mine Infrastructure Area (MIA) during which time the MIA will be relocated to temporary facilities. The extension will enable the recovery of an additional approximate 38 million tonnes (Mt) of Run of Mine (ROM) coal. - The extension of open cut mining activities will lead to an associated extension of the life of mine at LCO from 2023 to 2028. - A tailings emplacement area will be constructed within the final void of the South Pit to dispose of the additional tailings associated with the extension of open cut mining activities. - Minor additional infrastructure including: - Construction and commissioning of a transfer point and conveyor connected to the existing Mt Owen/Glendell/Macquarie Generation conveyor is proposed, enabling LCO to send coal to Ravensworth, and receive coal and crushed gravel from Mt Owen, via the existing conveyor	31 December 2028

Development Approvals			
		system. The new conveyor will deliver/take material to/from a new 50,000 tonne stockpile; and - Infrastructure and ancillary surface disturbance to support the new mining areas will be required, including but not limited to, power lines, water management infrastructure and haul roads.	
DA 305-11-01 MOD 6	NSW Department of Planning and Environment	- Constructing approximately 11 kilometres of tailings pipeline connecting both the Ravensworth Complex and Liddell Colliery Coal Handling and Preparation Plants to the West Pit Void Ravensworth East. - Constructing a flocculent plant near the West Pit Void at Ravensworth East. - Staged emplacement of tailings generated from Ravensworth and Liddell within the Ravensworth East West Pit Void. - Interim utilisation of the Narama Void as a central water storage facility for the Greater Ravensworth Area.	31 December 2028
DA 305-11-01 MOD 7	NSW Department of Planning and Environment	- Changes to conditions of DA 305-11-01 to provide the necessary flexibility for mining operations and the associated final landform outcomes to meet the sites rehabilitation objectives; - Changes to Table 8 of Schedule 3, Condition 37 of DA 301-11-01 to reflect areas available for mine rehabilitation to grassland; - Changes to the Development Application Boundary (DA Boundary) to which DA 305-11-01 applies; and - Administrative amendments to Schedule 2, Conditions 2, Schedule 3, Condition 16 and Schedule 3, Condition 39.	31 December 2028
DA 305-11-01 MOD 8	NSW Department of Planning and Environment	- Changes to conditions of DA 305-11-01 to allow for receipt of tailings from Ravensworth and Mt Owen for emplacement in the Liddell South Void.	Mining operations till 31 December 2028.

Development Approvals			
		- Extension of approval to allow continuation of water and tailings management in accordance with Modification Report (Mod 8) until 31 December 2050. - Administrative amendments to Schedule 5, Conditions 11 and 12 and Schedule 3, Conditions 37 and 39. - Minor amendments to reflect updated Department naming for the Biodiversity and Conservation Division, Heritage NSW and DPE Water.	Water and tailings management till 31 December 2050.
EPBC 2013/6908	Australian Government Department of Climate Change, Energy, Environment and Water	- Approval for controlled action under the EPBC Act 1999 to expand the existing Liddell open cut coal mine operations in the Hunter Valley region in New South Wales, located approximately 25km north-west of Singleton under the following Controlling Provisions: • Listed threatened species and communities (sections 18 & 18A) • Listed migratory species (sections 20 and 20A) • Water resources/trigger (sections 24D and 24 E)	31 December 2044

Table 3-2 List of leases and licences

Mining Leases, Environmental Protection Licence & Mining Operations Plan		
Mining Leases		
Title	**Authority**	**Expiry Date**
Mining Lease 1597	Dept. Of Regional NSW)	5 November 2028
Consolidated Coal Lease No. 708	Dept. of Regional NSW	17 May 2044
Mining Lease No. 1313	Dept. of Regional NSW	5 May 2044
Mining Lease No. 1552	Dept. of Regional NSW	10 March 2025 (Renewal applied for)
Environmental Protection Licence		
Licence	**Description**	**Expiry Date**
EPL 2094	Environmental Protection Licence (File number 27051)	30 June (Anniversary Date)

Table 3-3 List of surface water extraction licences

Surface Water Extraction Licences						
Locality	**Licence No.**	**Holder**	**Use**	**Water Source/ Management Zone/ Type**	**Annual Allocation (ML) (July 2022 – June 2023)**	**Annual Usage (ML) (July 2022 – June 2023)**
Bowmans Creek	WAL18320	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	50	Nil
Bowmans Creek	WAL18304	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	32	Nil
Bowmans Creek	WAL18318	Novacoal Australia Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	55	Nil
Bayswater Creek	WAL18306	Mitsushima Australia Pty Ltd Enex Liddell Pty Ltd Gabume Pty Ltd	Industrial (coal mining)	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	100	Nil
Bowmans Creek Alluvial	WAL18302	Liddell Southern Tenements Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	5	Nil
Bowmans Creek Alluvial	20WA210940 (awaiting WAL allocation)	Enex Foydell Limited	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	5	Nil

Surface Water Extraction Licences						
Hunter River via AGL Macquarie Generation	WAL7815	Liddell Tenements Pty Ltd	Industrial	Hunter Regulated River Water Source/ Zone 1B Regulated River	20	Nil

Table 3-4 List of groundwater licences

Groundwater Licences						
Locality	**Licence No.**	**Holder**	**Lot/DP**	**Purpose**	**Annual Extraction Allocation (ML) (July 2022 – June 2023)**	**Annual Extraction 2023 (ML) (July 2022 – June 2023)**
Haz 6	20BL168066	Liddell Tenements Pty Ltd	81/607296	Monitoring	N/A	N/A
Dur 3	20BL168065	Liddell Tenements Pty Ltd	31/837350	Monitoring	N/A	N/A
LC1	20BL168064	Liddell Tenements Pty Ltd	353/867083	Monitoring	N/A	N/A
Durham 1	WAL41499	Liddell Tenements Pty Ltd	33/862516	Industrial	500	0
8 South 3 & 4	WAL41498	Liddell Tenements Pty Ltd	32/870789	Industrial	6000	0
Durham 2 & 4	WAL41497	Liddell Tenements Pty Ltd	3/237654	Industrial (2 bores)	1000	0
Haz 1&2	WAL39760	Enex Liddell Pty Ltd Mitsui Mitsushima Australia Pty Ltd	81/607296	Industrial (2 bores)	5500	337.5
ALV1, ALV2, ALV3, ALV4,	20BL168053	LCO Pty Ltd	43/654013	Test bore/Monitoring	N/A	N/A

Groundwater Licences						
ALV7, ALV8, ALV9			201/848078 4/255403 81/607296 6/255403 32/545601			
M49	WAL41493	Liddell Southern Tenements Pty Ltd	32/545601	Dewatering	2500	872 (active take)
Mt Owen 1	WAL41493 (previously 20BL168209)	Mt Owen Pty Ltd	353/867083	Stock, domestic, farming and test purposes	2500	0
Mt Owen 2	20BL169544	Mt Owen Pty Ltd	353/867083	Dewatering	2500	0
Middle Liddell	WAL41498	LCO Pty Ltd	1/237766	Dewatering	6000	0

Table 3-5 List of Aboriginal Heritage permits

Aboriginal Heritage Permits			
Licence	**Site**	**Salvage Date**	**Expiry Date**
#2348 (dated 7 August 2007)	Chain of Ponds Site Area (LID 28, 29, 30, 31, 32)	21, 22, 23 November 2006	3 October 2016
S87 #2883 S90 #2896	Bayswater Creek	March/April 2008	18 February 2010 18 March 2020
S90 Permit #c0000623	DA 305-11-01 Modification 5 development consent area	January/February 2015	3 December 2024

Table 3-6 List of radiation management licences

Radiation Management Licence				
Type	**Licence Number**	**Purpose**	**Licence Holder**	**Expiry Date**
Radiation Management Licence	5061082	Sell, possess, store or give away regulated material (including radiation apparatus, radioactive substances or items containing radioactive substances) for one year	Liddell Coal Operations Pty Limited	12 September 2024

Table 3-7 List of effluent treatment permits

Effluent Treatment Permits					
Licence/Permit Reference	**Regulatory Authority**	**Purpose**	**Licence Holder**	**Approval Date**	**Expiry Date**
OSSM 3916/2008	Singleton Shire Council	Permit to Operate Aerated Wastewater Treatment System	Liddell Coal Operations Pty Limited	1 July 2018	30 June 2024

4. Operations Summary

During 2023, there were a number of key activities undertaken in accordance with the RMP and DA 305-11-01. These activities included:

- Continued progression of mining operations in South Pit, Entrance Pit and Bayswater Pit, with last coal mined in South Pit in February 2023 and in Entrance Pit in July 2023;
- Continued processing of coal until November 2023;
- Construction of buttress dump against exposed underground workings in Entrance Pit during August and September 2023;
- Completion of capping and rehabilitation of the Antiene Tailings Storage Facility (TSF) and associated Dam 4; detailed in ***Section 8.2.2;***
- Continuation of capping and rehabilitation of the Reservoir South TSF, detailed in ***Section 8.2.2;***
- Commencement of capping works at the Reservoir West TSF, detailed in ***Section 8.2.2;***
- Completion of 76 hectares of final rehabilitation at the South Pit, Bayswater Pit, Antiene TSF areas and Dam 4, as detailed in ***Section 8***;
- Continued implementation of biodiversity management plan and biodiversity offset management plan commitments including habitat augmentation, weed management and supplementary planting as detailed in ***Section 8.4*** and ***Section 8.5;***
- Implementation of management activities across the South Cut Pasture Rehabilitation area to manage the rehabilitation in accordance with the post mining land use outlined in the Biodiversity Management Plan and RMP; detailed in ***Section 8***; and

4.1 Mining Operations

The open cut mining sequence at LCO includes:

- Removal of overburden;
- Coal extraction, predominantly using excavators and trucks;
- Coal processing and transport.

Mining during 2023 targeted coal from the Lemington, Arties, Liddell, Barrett and Hebden seams. These seams range from 0.7 metres (m) to 9.5 m in thickness, including semi-soft and thermal coal types. Mining operations utilises hydraulic excavators and trucks to recover coal from multiple seams.

No mining was undertaken using dragline or highwall extraction methods during 2023.

Mining ceased in the South Pit in February 2023 and in Entrance Pt in July 2023. Following the completion of last coal in the Entrance Pit, the mining fleet was used to construct a 'buttress dump' against all exposed underground workings in the Entrance Pit.

Key production statistics are summarised in ***Table 4-1*** below. During the reporting period there was no non-compliance with the sites approved production limits.

4.2 Other Operations

Coal is transported from the open cut areas by truck to a ROM stockpile with an approximate capacity of 200,000 tonnes for storage prior to processing in the CHPP.

The CHPP produces both semi soft coking coal and thermal coal. The CHPP, prior to closure operated 24 hours a day, seven days a week, with the exception of downtime due to maintenance (generally 10 to 12 hours each fortnight). The CHPP has a processing capacity of 8 Mtpa.

No ROM coal produced at Mt Owen was processed in the Liddell CHPP, nor was any ROM coal transported to Ravensworth Central Coal Processing Facility in accordance with Schedule 2 Condition 6 b) and 6 c) during 2023.

During the reporting period, 2,562,944 tonnes of product coal including export thermal coal and export semi soft coal were railed to the Port of Newcastle via the Main Northern Railway Line.

In accordance with Schedule 3, condition 33 (a) and (b) of DA 305-11-01, LCO monitored coal haulage movements as part of standard operations. Daily train haulage movements are presented in ***Appendix A.*** There were no sales of tailings during the reporting period and no truck movements for the transportation of tailings along the New England Highway as per condition 32(a).

Table 4-1 Production summary

Production Summary				
Material	**Approved limit**	**2022 actual**	**2023 forecast**	**2023 actual**
Prime Waste Rock / Overburden (bcm)	N/A	28,172,000	10,361,000	8,167,346
ROM Coal / Ore (t)	8,000,000	4,918,000	2,832,000	3,119,480
Coarse reject (t)	N/A	1,215,442	N/A	596,951
Fine reject (Tailings) (t)	N/A	498,185	N/A	272,442
Saleable product (t)	N/A	3,504,000	1,813,000	2,228,230

4.3 Major Activities Proposed in the Next Reporting Period

Key activities planned for 2024 include:

- Ongoing capping and rehabilitation of the Reservoir South and West TSFs in accordance with the tailings emplacement rehabilitation strategy in the RMP;
- Continuation of detailed mine closure planning and execution of the closure plan;
- Commencement of bulk push and rehabilitation of overburden emplacement areas across site as part of mine closure works;
- Commencement of capping and rehabilitation of the Durham TSF in accordance with the tailings emplacement rehabilitation strategy in the RMP;
- Decommissioning and demolition of infrastructure no longer required as part of mine closure works;
- Continued implementation of the rehabilitation monitoring program and completion criteria;

- Continued implementation of Biodiversity management and offsetting commitments;

5. Actions Required at Previous Annual Review

NSW Department of Planning and Environment (DPE) provided written advice on the 2022 Annual Review on the 8 June 2023 and considered it to generally satisfy the requirements of the approval. No further actions were identified.

Additional reporting requirements were requested to be implemented in future Annual Reviews. A summary of the requirements and relevant updated section of the Annual Review is provided in ***Table 5-1***.

Table 5-1 Summary of additional reporting requirements by DPE to the 2023 Annual Review

Topic	Requested by	Action required from previous Annual Review	Annual Review section updated
Water	DPE	Report the water taken in the water year, not calendar year/reporting period.	***3 Approvals and 7.1 – Water Management System***
Regulatory Action	DPE	Provide a summary of any cautions, warning letters, penalty notices or prosecution proceedings by any regulatory agency.	***12 – Cautions, Warnings, Penalties and Prosecutions***
Rehabilitation	DPE	With the cessation of mining operations in the 2023 reporting period, please include a report on how the site is meeting the rehabilitation objectives listed in Table 8 of the consent.	***8.2 – Current Status***

6. Environmental Performance

6.1 Noise

The approved Noise Monitoring Program outlines the noise monitoring required to be undertaken by LCO to ensure compliance with statutory requirements. The program addresses the requirements contained in DA 305-11-01.

Monthly attended noise monitoring is undertaken at representative locations surrounding LCO, shown in ***Figure 6-1.***

LCO has a real-time, directional noise monitoring unit programmed to send an SMS to key operational personnel when a trigger noise level is reached. Alarm conditions are measured and calculated with respect to low frequency noise levels, which is the noise frequency consistent with continuous open cut mining noise. It seeks to target continuous noise output from the mining operation and exclude extraneous noise sources. Trigger levels are set below and at relevant criterion at the nearby sensitive receivers identified in DA 305-11-01.

Noise criteria for LCO are prescribed in Schedule 3, Condition 1 of DA 305-11-01. LCO are required to ensure that noise generated by the development does not exceed the noise impact criteria in ***Table 6-1.***

Table 6-1 Development consent noise impact assessment criteria

Assigned Residential Location Number	Daytime $L_{Aeq\ (15\ minute)}$	Evening $L_{Aeq\ (15min)}$	Night $L_{Aeq\ (15min)}$	Night $L_{A\ (1\ min)}$
1, 5, 6, 7, 8, 9, 10, 11, 12, 14	35	35	35	45
2	35	35	36	45
3	36	35	37	45
4	36	35	36	45
All other privately owned land	35	35	35	45

Noise compliance monitoring is undertaken as per Appendix 6 of DA-305-11-01. The noise emission limits identified in ***Table 6-1*** apply under all meteorological conditions, which are measured from the LCO met station, except the following:

- During periods of rain or hail;
- Average wind speed at microphone height exceeds 5m/s;
- Wind speeds greater than 3m/s measured at 10m above ground level; or
- Temperature inversion conditions greater than 3˚C/100m, or alternatively stability class F & G.

6.1.1 Noise Monitoring Results

Attended compliance noise monitoring during the reporting period was undertaken on a monthly basis by a specialist noise consultant (EMM/Global Acoustics) at two representative neighbouring

residential locations along Hebden Road (see ***Figure 6-1***). $L_{Aeq(15\ minute)}$ and $L_{A1(1\ minute)}$ measurements against compliance criteria are detailed in ***Table 6-2.***

Results of attended noise monitoring during the reporting period show that LCO complied with the noise limits applicable at all monitoring locations.

Table 6-2 Noise monitoring results

Location	Date	Wind Speed (m/s)	LCO $L_{Aeq\ (15min)}$ (dB)	LCO $L_{A1\ (1min)}$ (dB)	Exceedance
January					
1317 Hebden Road	11/01/2023	2.2	IA	IA	Nil
1246 Hebden Road	12/01/2023	1.8	IA	IA	Nil
February					
1317 Hebden Road	14/02/2023	3.9	IA	IA	Nil
1246 Hebden Road	14/02/2023	3.1	IA	IA	Nil
March					
1317 Hebden Road	27/03/2023	1.7	<30	<30	Nil
1246 Hebden Road	27/03/2023	1.3	<30	<30	Nil
April					
1317 Hebden Road	11/04/2023	0.5	<30	34	Nil
1246 Hebden Road	11/04/2023	1.0	<30	<30	Nil
May					
1317 Hebden Road	22/05/2023	1.1	30	32	Nil
1246 Hebden Road	23/05/2023	1.5	30	33	Nil
June					
1317 Hebden Road	27/06/2023	3.1	<25	<25	Nil
1246 Hebden Road	27/06/2023	3.2	<25	<25	Nil
July					
1317 Hebden Road	13/07/2023	2.0	26	29	Nil
1246 Hebden Road	13/07/2023	2.9	30	45	Nil

Location	Date	Wind Speed (m/s)	LCO $L_{Aeq\ (15min)}$ (dB)	LCO $L_{A1\ (1min)}$ (dB)	Exceedance
August					
1317 Hebden Road	23/08/2023	3.1	28	30	Nil
1246 Hebden Road	23/08/2023	2.4	28	30	Nil
September					
1317 Hebden Road	20/09/2023	1.4	IA	IA	Nil
1246 Hebden Road	20/09/2023	2.9	IA	IA	Nil
October					
1317 Hebden Road	09/10/2023	0.5	28	31	Nil
1246 Hebden Road	10/10/2023	0.2	26	27	Nil
November					
1317 Hebden Road	14/11/2023	3.0	<25	<25	Nil
1246 Hebden Road	14/11/2023	2.4	<25	<25	Nil
December					
1317 Hebden Road	19/12/2023	5.1	IA	IA	Nil
1246 Hebden Road	19/12/2023	3.1	IA	IA	Nil

Notes to Table:

1. Atmospheric data is from LCO weather station;
2. These are results for LCO in the absence of all other noise sources;
3. NM denotes audible but not measurable, IA denotes inaudible;
4. NA in exceedance column means atmospheric conditions outside conditions specified in development consent and so criterion is not applicable.

6.1.2 Comparison to EA Predictions and Monitoring Trends

The Liddell Coal EA (2015) proposes that modifications to the development consent would not produce an exceedance of the LCO operational specific noise criteria ($L_{Aeq\ (15min)}$ 35 dB(A)) and ($L_{A1(1\ minute)}$ 45 dB(A)) at any surrounding privately owned residence during the reporting period. All noise monitoring events during 2023 were in accordance with these predictions. The long-term trend of noise results from 2019 to 2023 is compliant with the assessment criteria. Low level noise or inaudible results are generally recorded. The long term trend of results range from <20 to 34 (db) for $L_{Aeq(15\ minute)}$ and <20 to 45 (db) for $L_{A1(1\ minute)}$, with no non-compliances for the period.

During the reporting period, the approved Noise Management Plan was updated to remove the requirement for monthly night-time attended noise monitoring following cessation of night-time operations. A variation of EPL2094 was also approved in December 2023 to remove the requirement

for monthly night-time attended monitoring during periods when no night works occur. As such, no attended monitoring is planned for 2024. If night operations are planned to resume, the noise monitoring program will be reinstated as necessary.

Figure 6-1 Noise monitoring locations

6.2 Blasting

Blasting criteria for LCO are prescribed in ***Schedule 3*** of DA 305-11-01. The consent condition covers criteria for overpressure, ground vibration and vibration limits at designated structures. ***Table 6-3*** below sets out the blasting impact assessment criteria for the reporting year as per DA-305-11-01.

Table 6-3 Blasting impact assessment criteria as per DA-305-11-01

Location	Airblast overpressure level $dBL_{in\ Peak}$	Ground Vibration *mm/s*	Allowable exceedance
Residence on privately owned land (*Scrivens, Burlings*)	115	5	5% of the total number of blasts over a 12 month period
	120	10	0%
Newdell zone substation	N/A		
		Limits applicable 2 April 2020 – present ≤30 for >12 Hz ≤26 for <12 Hz	0%
Other public infrastructure*	N/A	50	0%
Chain of Ponds Inn	150	50	0%

Notes:
*alternate vibration limits for railway infrastructure have been agreed with ARTC as per the approved Blast Management Plan in accordance with DA305-11-01 Schedule 3 Condition 4(a).

Schedule 3, Condition 9 of the DA stipulates that blasting activities can only be undertaken at LCO between 9 am and 5 pm Monday to Saturday, inclusive. No blasting is allowed to be undertaken on Sundays, public holidays, or at any other time without the written approval of the Secretary.

In accordance with ***Schedule 3, Condition 10*** of the DA, LCO can carry out a maximum of 3 blasts per day and 8 blasts per week (average over a calendar year) on the site. However, this condition does not apply to blasts that generate ground vibration of 0.5mm/s or less at any residence on privately owned land, blast misfires or blasts required to ensure the safety of the mine, its workers or the general public.

LCO operates a combined 24 hour blasting information and community response line (1800 037 317).

6.2.1 Chain of Ponds Inn Blast Management Strategy

Additional to the blasting impact criteria specifically identified in the DA, the Chain of Ponds Inn (COPI) is a heritage and sensitive structure located on the Old New England Highway adjacent the operation. In accordance with the ***Schedule 3 Condition 5*** of the DA, LCO developed a Blast Management Strategy for the Inn with specific blasting impact limits.

The adaptive management approach to blasting in the vicinity of COPI includes:

- A staged increase in the vibration level and air blast exposure
- Continual monitoring of vibration and air blast levels and corresponding structural behaviour

Limits for blast overpressure and ground vibration at the Chain of Ponds Inn have been gradually increased since 2015 as a result of the adaptive management process. 2023 blast criteria for maximum PPV was 50mm/s and a corresponding 150 dBL (implemented 4 October 2019 in accordance with the approved Blast Management Strategy). Further detail of management of COPI is in ***Section 6.7.*** This section only examines compliance with applicable limits during the reporting period.

6.2.2 Newdell Zone Substation Blast Management Strategy

Development Approval conditions also required LCO to develop a Blast Management Strategy for the Newdell Zone Substation. In accordance with DA305-11-01 (as modified), the primary objective of this Strategy is to ensure that blasting at LCO has a negligible impact on the structural integrity and does not accelerate the deterioration of electrical equipment efficiency (directly caused by blasting activities and exclusive of normal operational deterioration) of the Newdell Zone substation, compared to the existing condition and structural integrity of the substation at the date that consent was granted to DA305-11-01 MOD 5 (December 2014).

Similar to the Chain of Ponds Inn discussed above, a staged increase in the vibration level at the Newdell Zone Substation, combined with continual monitoring of vibration levels and corresponding structural behaviour, will enable an adaptive management approach to blasting in the vicinity of the substation. The strategy involves at-source management measures (blast design control), particularly within a distance of 350 metres to the substation, combined with an inspection and blast review regime to effectively manage blasting in the vicinity of the substation.

LCO and Ausgrid have developed several agreements related to blasting in proximity to the Newdell Zone Substation. These agreements include:

- Blast Vibration Mitigation Works Agreement – At the time, this related to vibration mitigation measures to be installed at the substation following investigations carried out by Ausgrid. Note that these works have been completed.
- Blast Vibration Consent Deed – This outlines that Ausgrid consents to LCO blasting above the previous vibration limits (20mm/s for 90% of blasts and 25mm/s for 100% of blasts) on the basis that blast mitigation works are completed at the Newdell Zone Substation. It allows for a staged approach to increases in blasting limits.
- Blast Vibration Works Monitoring Agreement – This outlines the respective obligations for Ausgrid to carry out the blast vibration works monitoring and commercial arrangements for Liddell to reimburse Ausgrid for the cost of the monitoring.

In accordance with DA305-11-01 ***Schedule 3 Condition 4a*** and the approved Newdell Zone Substation Blast Management Strategy, LCO reached agreement with Ausgrid to progress an increase of blast vibration limits at the Substation from the 1st November 2017 and subsequently notified the DPIE of the increase in limits on the 2 November 2017. The revised blasting limits are such that blasting does not cause:

a) ground vibration or VPPV that is greater than 30mm/s above 12Hz for any individual blast; and
b) ground vibration or VPPV that is greater than 26mm/s below 12Hz for any individual blast.

On the 15th March 2019 LCO provided notification of implementing a temporary increase in limits for the substation such that blasting does not cause:

a) ground vibration or VPPV that is greater than 34mm/s above 12Hz for any individual blast; and
b) ground vibration or VPPV that is greater than 28mm/s below 12Hz for any individual blast;

OR

c) ground vibration or VPPV that is greater than 36mm/s above 12Hz and ground vibration or VPPV that is greater than 30mm/s below 12Hz on more than two occasions for the period.

The temporary increase agreed to expired on 1 April 2020, at which point the limits reverted back to those agreed in 2017. Blasting activities have since moved well beyond the 350m control zone.

6.2.3 Blast Monitoring Results

Blast monitoring locations are presented in ***Figure 6-2*** and monitoring results for the reporting period are provided in ***Appendix E -.***

Blast monitoring was undertaken at two privately owned residences, the Chain of Ponds Inn and Newdell Substation throughout the reporting period. There were 29 blasts fired throughout the reporting period.

There were no non-compliances with DA305-11-01 ***Schedule 3 Condition 9 or 10*** (pertaining to days of blasting and frequency) during the reporting period. All blasts were conducted within the hours of 09:00 and 17:00 and on Monday to Saturday. No blasts were undertaken on Public Holidays. The blast monitoring system recorded 100% blast data at all sites.

A summary of blasting performance against DA305-11-01 during the reporting period is presented in ***Table 6-4.*** Operational blasting activity ceased in 2023 with the final blast on 23 June 2023.

Table 6-4 Blasting performance summary

Location	Airblast overpressure level *dBL*$_{in\ Peak}$	Ground Vibration *mm/s*	Allowable exceedance	Performance during the reporting period	Key management implications	Proposed management actions
Residence on privately owned land (*Scrivens, Burlings*)	115	5	5% of the total number of blasts over a 12 month period	Compliant	N/A	None required
	120	10	0%			
Newdell Zone Substation	N/A	*Limits applicable 2 April 2020 - present* ≤30 for >12 Hz	≤26 for <12 Hz 0%	Compliant	Blasting operations have moved outside the 350m control zone for the Substation.	None required, blast activities ceased 23 June 2023.
Other public infrastructure	N/A	50	0%	Compliant	N/A	None required
Chain of Ponds Inn	150	50	0%	Compliant	Ongoing periodic inspection program	None required, blast activities

Location	Airblast overpressure level *$dBL_{in\ Peak}$*	Ground Vibration *mm/s*	Allowable exceedance	Performance during the reporting period	Key management implications	Proposed management actions
						ceased 23 June 2023.

6.2.4 Comparison to EA Predictions and Monitoring Trends

The Liddell Coal EA (2015) proposes that modifications to the development consent would see continued compliance with vibration and overpressure criteria at the LCO receptors. Furthermore, blasting was proposed to be unlikely to cause significant damage to the Chain of Ponds Inn and Newdell Zone Substation providing that the blast management strategy developed for the Project is implemented. During 2023, compliance with the EA predictions was observed. The long-term trend of the blast results from 2019 to 2023 is compliant with the assessment criteria.

As of end of mining in 2023, no further blasting is likely required to take place at LCO. As such, the LCO Blast Management Plan, Chain Of Ponds Inn Blast Management Strategy and Newdell Zone Substation Blast Management Strategy was updated in 2023 to retire the ongoing management measures described in each plan. Should a need for blasting be identified (i.e. for highwall treatment shots), then all required monitoring and other management measures would be reinstated as required.

Figure 6-2 Compliance blast monitoring locations

6.3 Air Quality

Air quality monitoring is undertaken in accordance with the Liddell Coal ***Air Quality Management Monitoring Program*** (AQMMP). In addition, the LCO ***Dust Management TARP*** and ***LCO Spontaneous Combustion Management Plan*** are used for the ongoing management of air quality.

The AQMMP was developed in accordance with ***Schedule 3 Condition 19*** of DA-305-11-01. In accordance with this condition, the AQMMP includes a combination of deposited dust gauges, high volume air samplers (HVAS) and continuous PM10 Tapered Element Oscillating Monitors (TEOMs) to monitor any dust emissions, and an air quality monitoring protocol for evaluation of compliance with the air quality impact assessment criteria.

The compliance air quality monitoring network includes Depositional Dust Gauges, paired High Volume Air Samplers (PM10 and TSP) and continuous TEOMs representative of privately owned residences with potential to be impacted and continuous boundary monitoring. The LCO air quality monitoring network is shown in ***Figure 6-3.***

As per the AQMMP and the Dust Management TARP, the control measures undertaken to minimise potential impact on air quality at LCO include:

- Regular dust inspections are carried out and excavation and tipping activities may be ceased or modified if excessive dust is observed;
- Real time dust monitoring is undertaken to assist with the management of dust on-site;
- Disturbance of the minimum area necessary for construction and prompt rehabilitation of construction areas;
- Watering of roads and trafficked areas to minimise the generation of dust; permanent roads are constructed from hard non-friable material and have defined marker posts to prevent vehicle deviations;
- Long term topsoil stockpiles are vegetated to reduce dust generation;
- Dust suppression sprays situated on the rom dump hopper and transfer conveyor points are actuated to reduce potential dust generation; and
- All equipment is maintained in good working order to reduce emissions.

In line with the AQMMP and ***Condition 19, Schedule 3***, LCO operates four relocatable supplementary boundary PM10 air quality monitors. The units are operated to:

- Determine LCO's contribution to local dust levels, based on their upwind and downwind positioning relative to the location of LCO mining activity; and
- Supplement the reactive operational dust management at LCO.

The relocatable boundary monitoring is a solar/battery powered trailer mounted equipment using an EBAM air quality monitor. The unit connects to a live monitoring system and provides for early response to measured air quality impacts. As per the AQMMP, four units were integrated into the existing air quality monitoring network to inform dust management performance.

6.3.1 Air Quality Criteria

The following details the air quality compliance impact criteria applicable during the reporting period.

Schedule 3, Condition 16 of DA 305-11-01 requires that LCO manage their operations to satisfy the relevant air quality criteria for deposited dust and dust concentration emitted to privately owned land not owned by LCO.

Deposited dust levels refer to the quantity of dust particles that settle out from the air as measured in grams per square meter per month (g/m2/month) at a particular location. The LCO Air Quality Impact Assessment Criteria for deposited dust is summarised in ***Table 6-5.***

Table 6-5 Long term impact assessment criteria for deposited dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	[b]2 g/m^2/month	[a]4 g/m^2/month

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources);
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own);
[c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air Determination of Particulate Matter – Deposited Matter – Gravimetric Method; and
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

Dust concentration refers to airborne dust and is measured in micrograms per cubic meter (µg/m3). Dust concentration is measured as total suspended particulate matter (TSP) and particulate matter of less than 10 microns in diameter (PM10). TSP relates to all suspended particles, which are usually in size range of zero to 50 micrometres (µm). TSP measurements include PM10 particles. TSP is compared to long term (annual average) goals and PM10 is compared to both long term (annual average) and short term (24 hour maximum) goals. Particle sizes larger than 50 µm are measured as deposited dust. The LCO Air Quality Impact Assessment Criteria for dust concentration (particulate matter) is summarised in ***Table 6-6***.

Table 6-6 Impact assessment criteria for particulate matter

Pollutant	Averaging Period	[d]Criterion
Total Suspended Particulate Matter (TSP)	Annual	[a]90 µg/m^3
Particulate Matter <10µg (PM_{10})	24 hour	[b]50 µg/m^3
	Annual	[a]30 µg/ m^3

[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources);
[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own);
[c] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS3580.10.1:2016 Methods for Sampling and Analysis of Ambient Air Determination of Particulate Matter – Deposited Matter – Gravimetric Method; and
[d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

Figure 6-3 Air quality monitoring locations

6.3.2 Deposited Dust

The location of LCO's compliance depositional dust gauges are shown on ***Figure 6-3.*** In accordance with the EPL and Air Quality Management and Monitoring Program, monitoring results are collected from all deposited dust gauges on a monthly basis and are shown in ***Figure 6-4*** and ***Figure 6-5***. Deposited dust monitoring results are provided in ***Appendix C***. Two dust gauges maintained by LCO are representative of private residences (D55 and D62). During the reporting period both monitoring sites met the annual average criteria.

A summary of LCO's dust deposition gauge performance with compliance criteria is presented in ***Table 6-7***.

Table 6-7 Annual average depositional dust compliance summary

Monitoring location	Annual Average *(g/m2/month)*		Performance during the reporting period	Key management implications	Proposed management actions
	Max. total deposited dust	Max. increase in deposited dust			
D55	4	2	Compliant	N/A	None required
D62			Compliant	N/A	None required

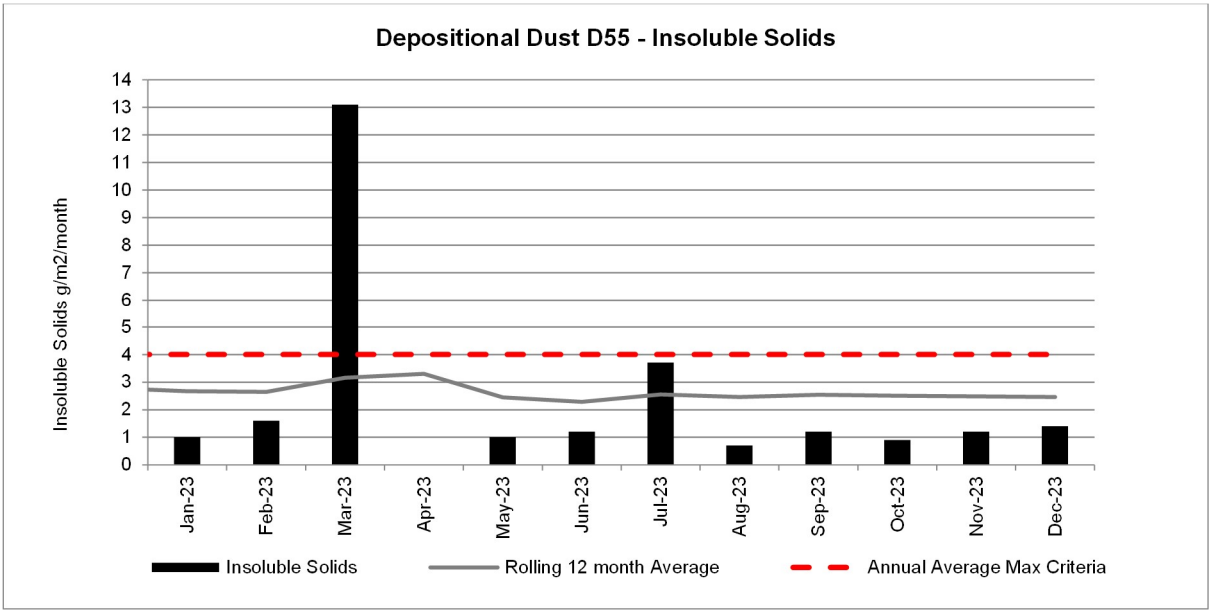


Figure 6-4 Depositional Dust D55 annual results

Note that in ***Figure 6-4***, the results for April 2023 have been excluded due to high levels of contamination from ploughing in the adjacent privately owned paddock. While monthly results vary, depositional dust compliance at monitor D55 is assessed on the annual rolling average which remained under the compliance criteria throughout 2023.

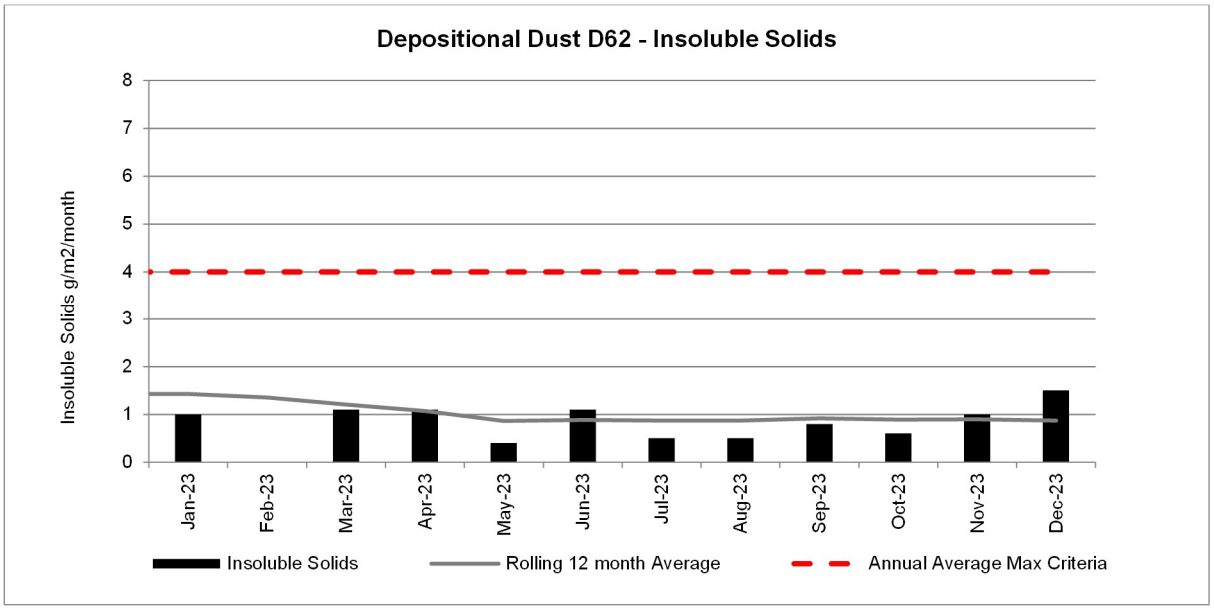


Figure 6-5 Depositional Dust D62 annual results

Figure 6-5 displays variable results at D62, however like D55 compliance is assessed on the annual rolling average which remained under the compliance criteria throughout 2023. The sample for February 2023 was invalid and not analysed due to damage to the monitoring equipment.

6.3.2.1 Deposited Dust - Comparison to EA Predictions and Monitoring Trends

The Liddell Coal Modification to Development Consent Environmental Assessment (EA) (Pacific Environment Limited, 2013) predicted that the modifications alone, or cumulatively, would not result in exceedances of the relevant deposited dust criteria at any private residence in the surrounding area. This is an annual average criterion.

All annual averages at dust gauges representative of private residences were below the maximum annual average deposited dust level of 4 g/m2/month, as the modelling predicted, as identified in ***Table 6-7.*** Long term monitoring trends of depositional dust results are shown in ***Figure 6-6*** and ***Figure 6-7***. Results continue to be below the maximum annual average with some variation in monthly results.

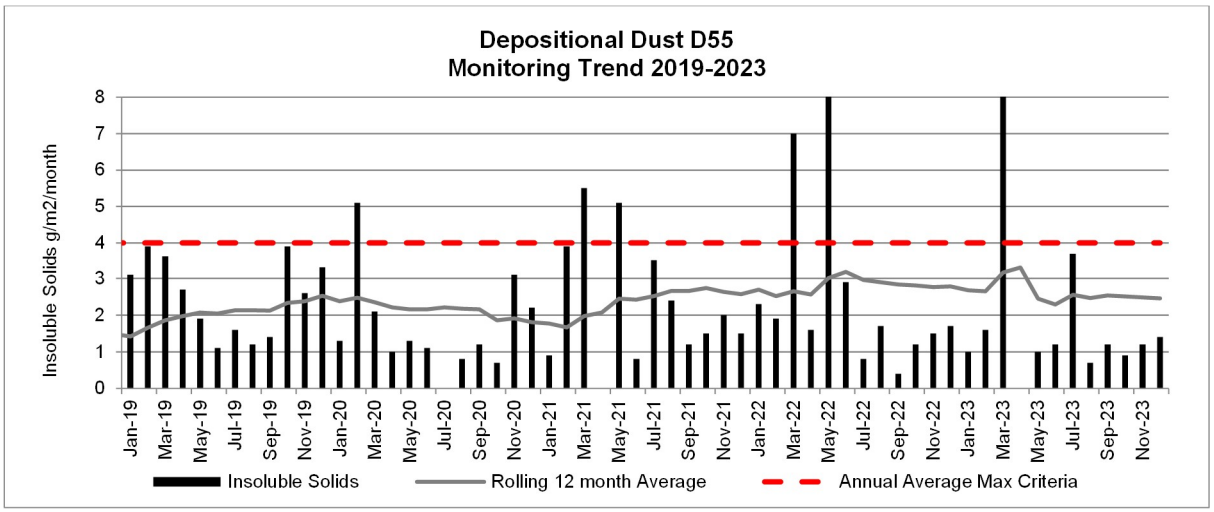


Figure 6-6 Depositional dust D55 monitoring trend 2019-2023

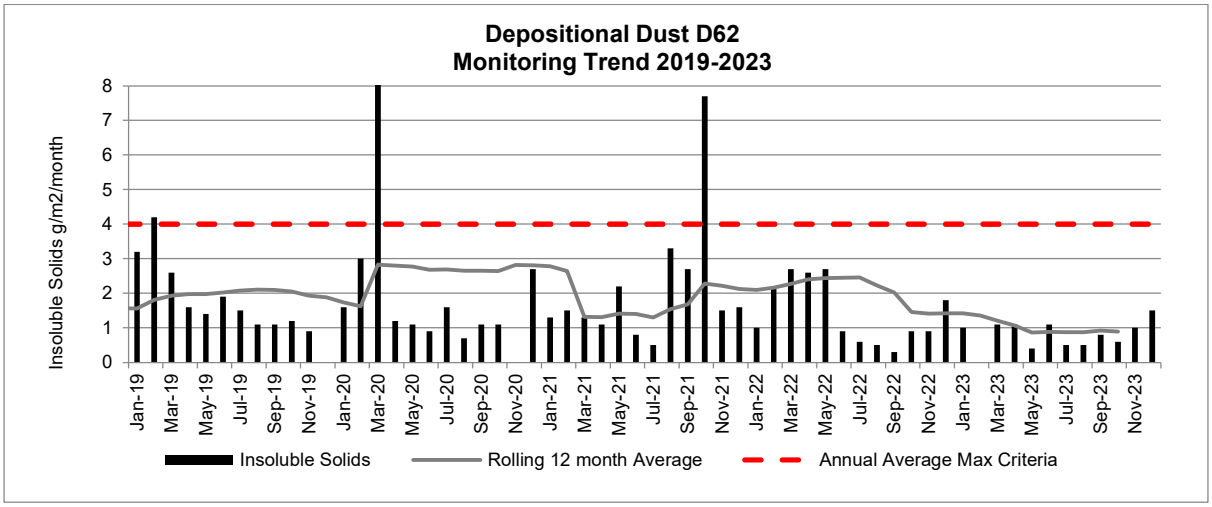


Figure 6-7 - Depositional dust D62 monitoring trend 2019-2023

6.3.3 High Volume Air Sampling - TSP

LCO operates two compliance High Volume Air Samplers (HVAS) which sample Total Suspended Particulates (TSP), as shown in ***Figure 6-3.*** In accordance with the Air Quality Monitoring Program and EPL requirements, TSP is measured by the HVAS every six days. TSP monitoring results are presented in ***Figure 6-8*** and ***Figure 6-9*** and provided in ***Appendix C.***

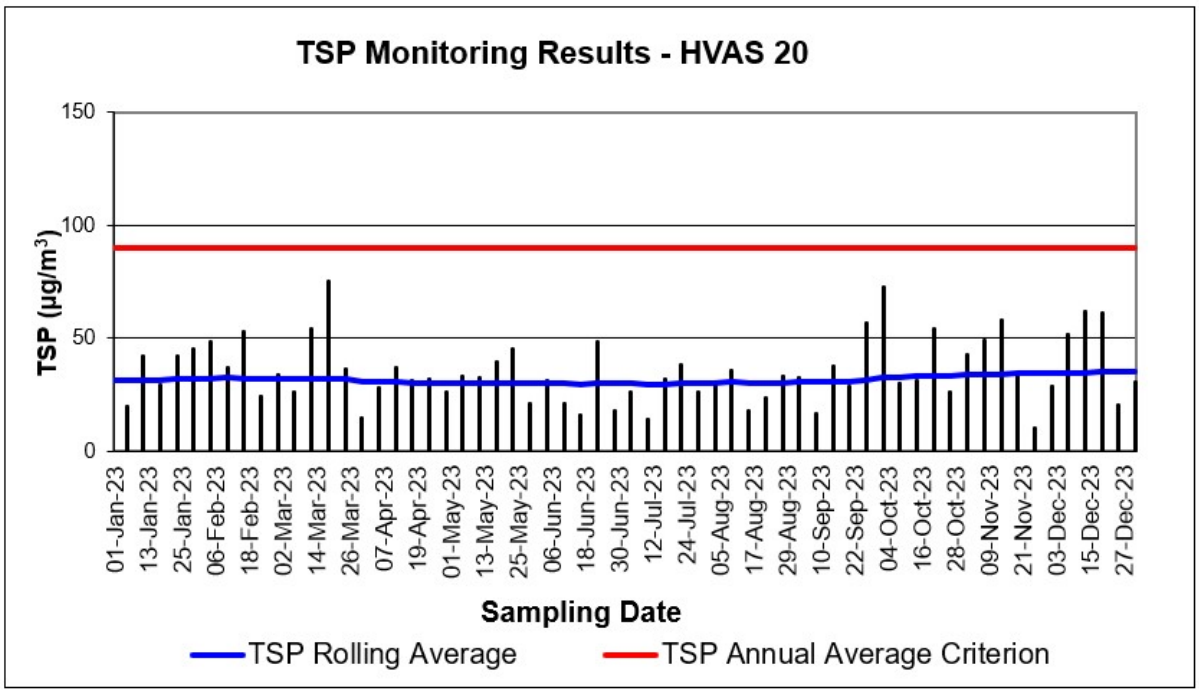


Figure 6-8 Antiene HVAS TSP annual results

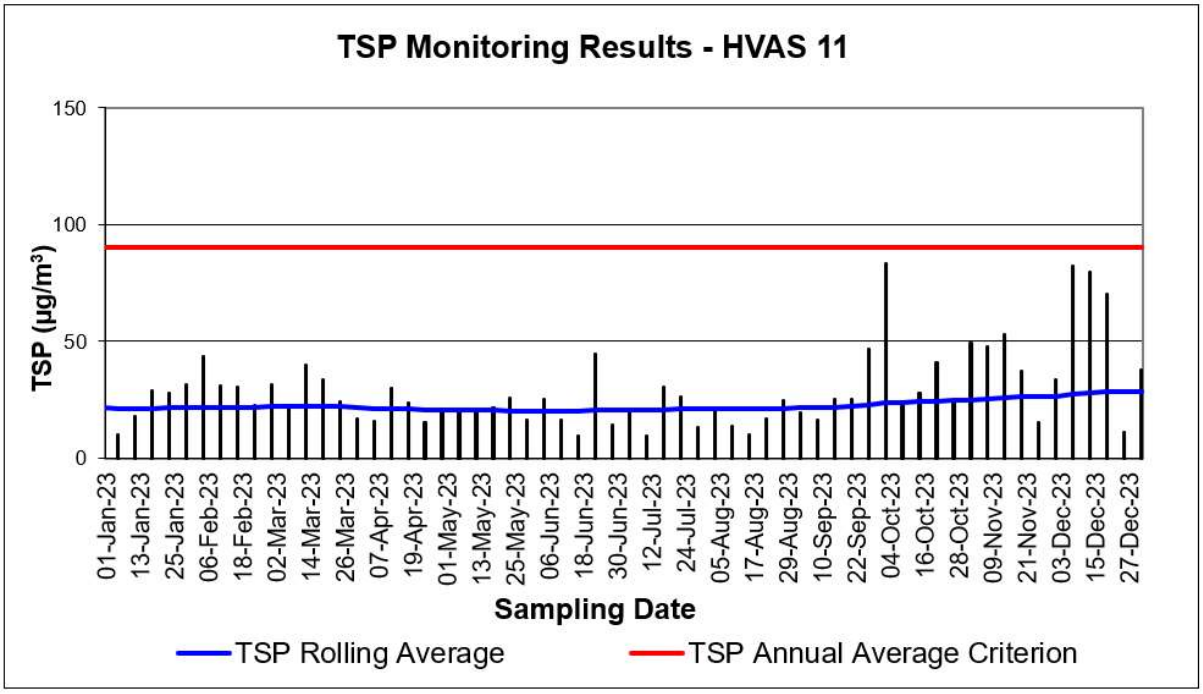


Figure 6-9 Scrivens HVAS TSP annual results

During the reporting period, both monitoring sites complied with the TSP annual average criteria. A summary of LCO's HVAS TSP performance with compliance criteria is presented in ***Table 6-8.***
The annual rolling average TSP at the completion of 2023 was:

- 35 µg/m^3 at HVAS 20 (Antiene)
- 29 µg/m^3 at HVAS 11 (Scriven)

Table 6-8 Annual average TSP compliance summary

Monitoring location	Approval Criteria *(µg/m³)*	Performance during the reporting period	Key management implications	Proposed management actions
HVAS 20 (Antiene)	90	Compliant	N/A	None required
HVAS 11 (Scriven)				

6.3.4 High Volume Air Sampling – PM10

LCO operates two compliance High Volume Air Samplers (HVAS) which sample fine particulates with an aerodynamic diameter of less than 10 microns (PM10), as shown in ***Figure 6-3***. In accordance with the Air Quality Management and Monitoring Program and EPL requirements, PM10 is measured by the samplers every six days. PM10 monitoring results are presented in ***Figure 6-12*** and ***Figure 6-13,*** details results provided in ***Appendix C***. These results are compared against daily meteorological data (wind speed and direction) to determine whether dust levels are attributable to Liddell Coal Operations.

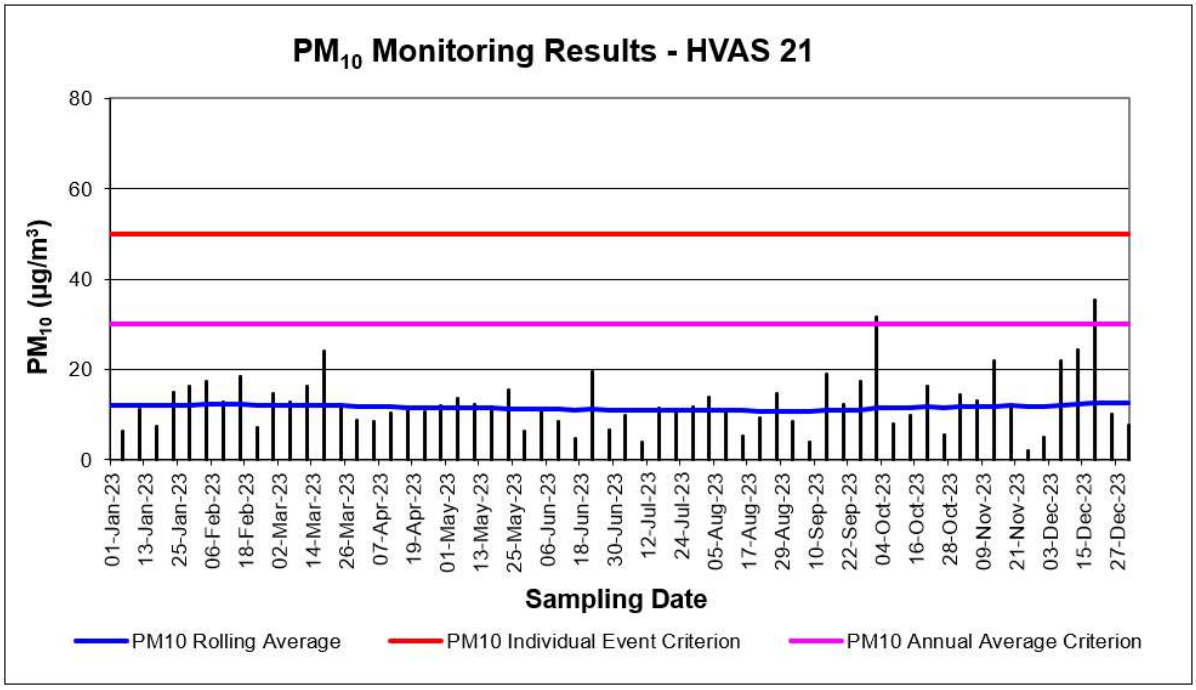


Figure 6-10 Antiene PM10 (HVAS 21) annual results

Figure 6-11 Scriven PM10 (HVAS 12) annual results

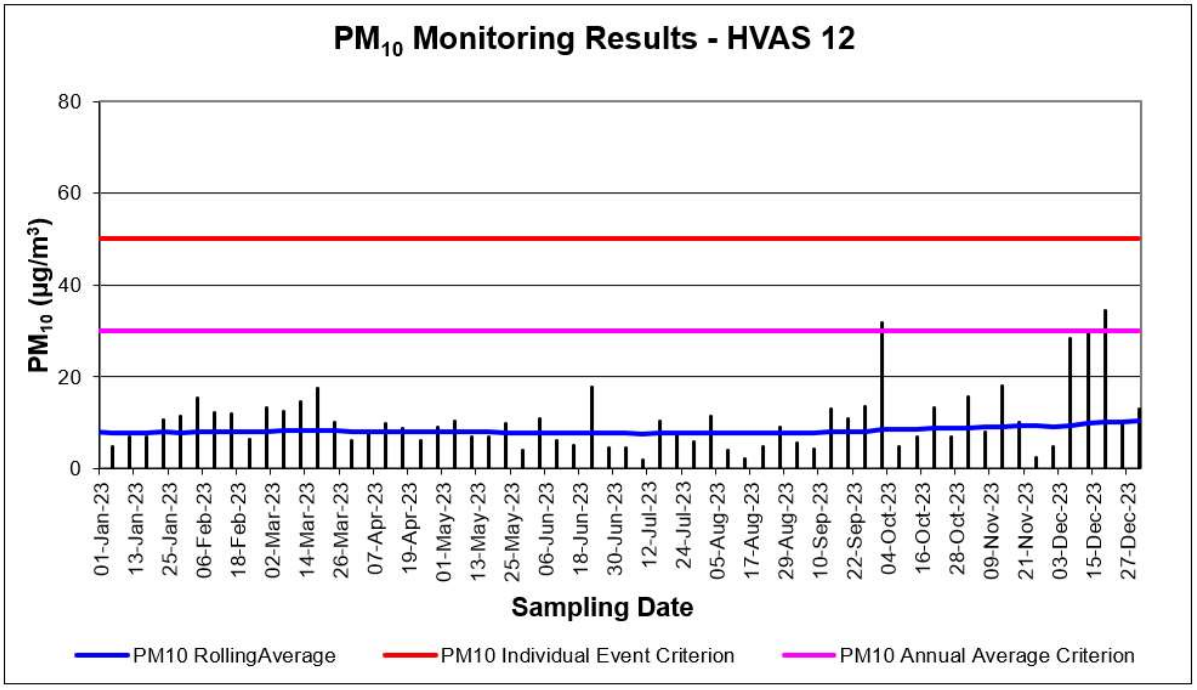


Figure 6-11 Scriven PM10 (HVAS 12) annual results

During the reporting period, LCO complied with the PM_{10} long term (annual rolling average), and short term 24 hour criterion. A summary of LCO's HVAS PM_{10} performance with compliance criteria is presented in ***Table 6-9.***

The annual rolling average PM_{10} at the completion of 2023 was:

- 13 µg/m^3 at HVAS 21 (Antiene)

- 10 µg/m^3 at HVAS 12 (Scriven)

Table 6-9 Annual average HVAS PM10 compliance summary

Monitoring location	Approval Criteria *(µg/m^3)*	Performance during the reporting period	Key management implications	Proposed management actions
HVAS 21 (Antiene)	30	Compliant	N/A	None required
HVAS 12 (Scriven)				

Table 6-10 Short-term average HVAS PM10 compliance summary

Monitoring location	Approval Criteria *(µg/m^3)*	Performance during the reporting period	Key management implications	Proposed management actions
HVAS 21 (Antiene)	50	Compliant	N/A	None required
HVAS 12 (Scriven)				

6.3.4.1 High Volume Air Samplers - Comparison to EA Predictions and Monitoring Trends

The Liddell Coal EA (2013) did not predict any exceedances of the annual average PM_{10}, criteria at any of the nearest receptors. When considering LCO and other sources (including mining and other non-mining sources), none of the nearby privately owned residences were predicted to experience annual average PM10 levels above the relevant criterion, as per ***Table 6-6,*** on an annual basis. All annual averages at high volume air samplers were below the maximum annual average PM_{10} of 30 µg/m^3, as the modelling predicted. Long term monitoring trends of HVAS PM_{10} are shown in ***Figure 6-11*** and ***Figure 12***. Results continue to be below the maximum annual rolling average with only a small number of exceedances of the 24 hours short term criteria during the peak of drought in 2019/20 and bushfire activity.

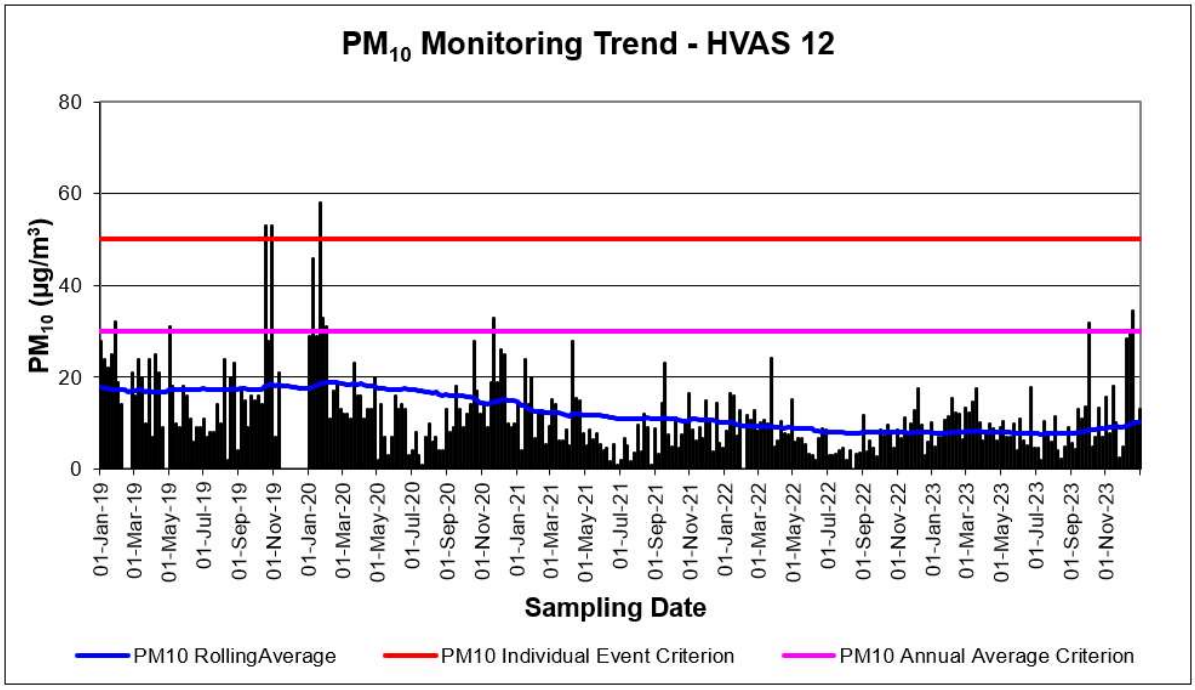


Figure 6-12 Scriven HVAS PM10 monitoring trend 2019-2023

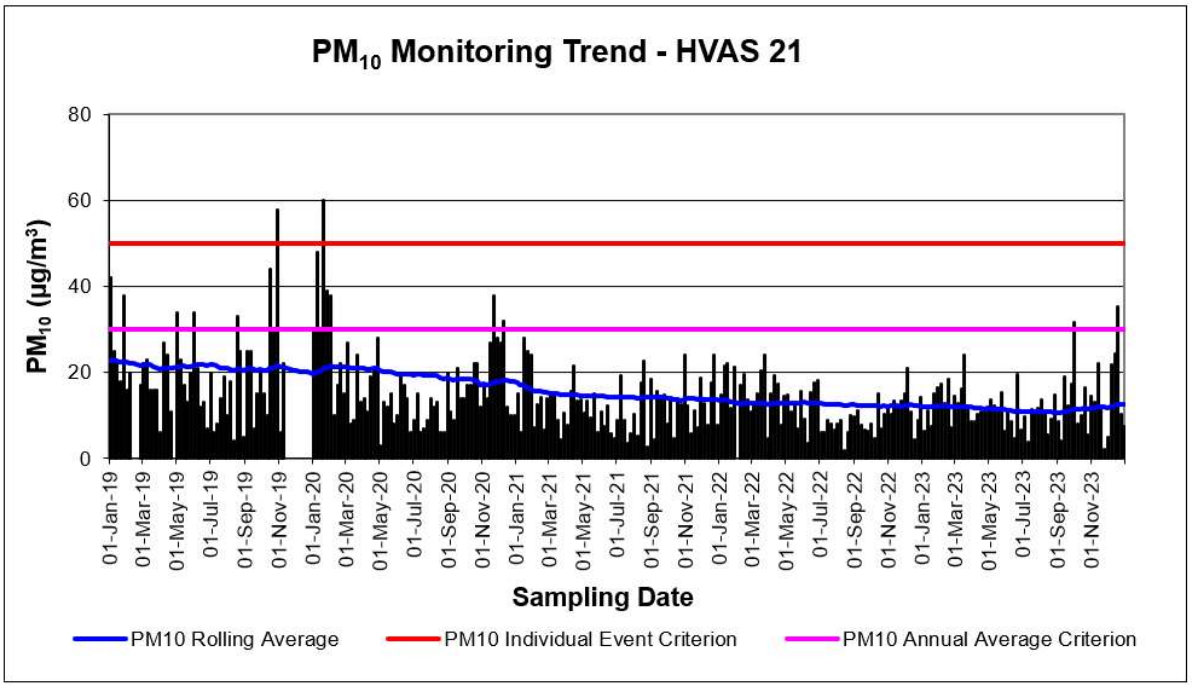


Figure 6-13 Antiene HVAS PM10 monitoring trend 2019-2023

6.3.5 Continuous Monitoring – PM10

LCO operate two continuous Tapered Element Oscillating Microbalance (TEOM) measuring 10µm Particulate Matter dust levels around the site. Air quality and meteorological monitoring data are evaluated against monitor-specific PM10 and meteorological triggers on a real-time basis with dust alarms automatically triggered by LCO's data acquisition system. The alarms are sent to site personnel and are used as an auxiliary management tool in controlling dust emissions at Liddell.

During the reporting period, LCO complied with the PM_{10} long term (annual rolling average) criterion at monitors DX38-D1 (Scrivens) and SX38-D2 (Antiene). A summary of LCO's TEOM PM_{10} performance with compliance criteria is presented in ***Table 6-11.***

Table 6-11 Annual average TEOM PM10 compliance summary

Monitoring location	Approval Criteria *(µg/m³)*	Performance during the reporting period	Key management implications	Proposed management actions
SX38-D1 (Scriven)	30	Compliant	N/A	None required
SX38-D2 (Antiene)				

The annual rolling average PM_{10} at the completion of 2023 was:

- 14.9 µg/m³ at SX38-D1 (Scriven)
- 18.3 µg/m³ at SX38-D2 (Antiene)

During the reporting period there was only one 24hr average recorded over the short term impact assessment criteria of 50µg/m³ which was investigated by LCO. A summary of this result is provided in ***Table 6-12.***

Table 6-12 Air quality exceedance summary

Exceedance Date	Unit	Short Term Criterion (µg/m³)	Monitoring Results µg/m³)	Investigation Results
25/10/2023	SX38-D2	50	54.8	Observations note localised smoke from the Ravensworth fire. Contribution analysis using nearby real time monitoring units was completed for the remaining period. It was determined the calculated LCO contribution to be 11.14µg/m³. The measured results were likely the result of local conditions of heavy smoke from the Ravensworth fire opposed to contribution from LCO.

During the reporting period, continuous monitoring points SX38-D1 and SX38-D2 achieved data availability of 97.2% and 99.1% respectively.

PM10 monitoring results are presented in ***Figure 6-14*** and ***Figure 6-15***.

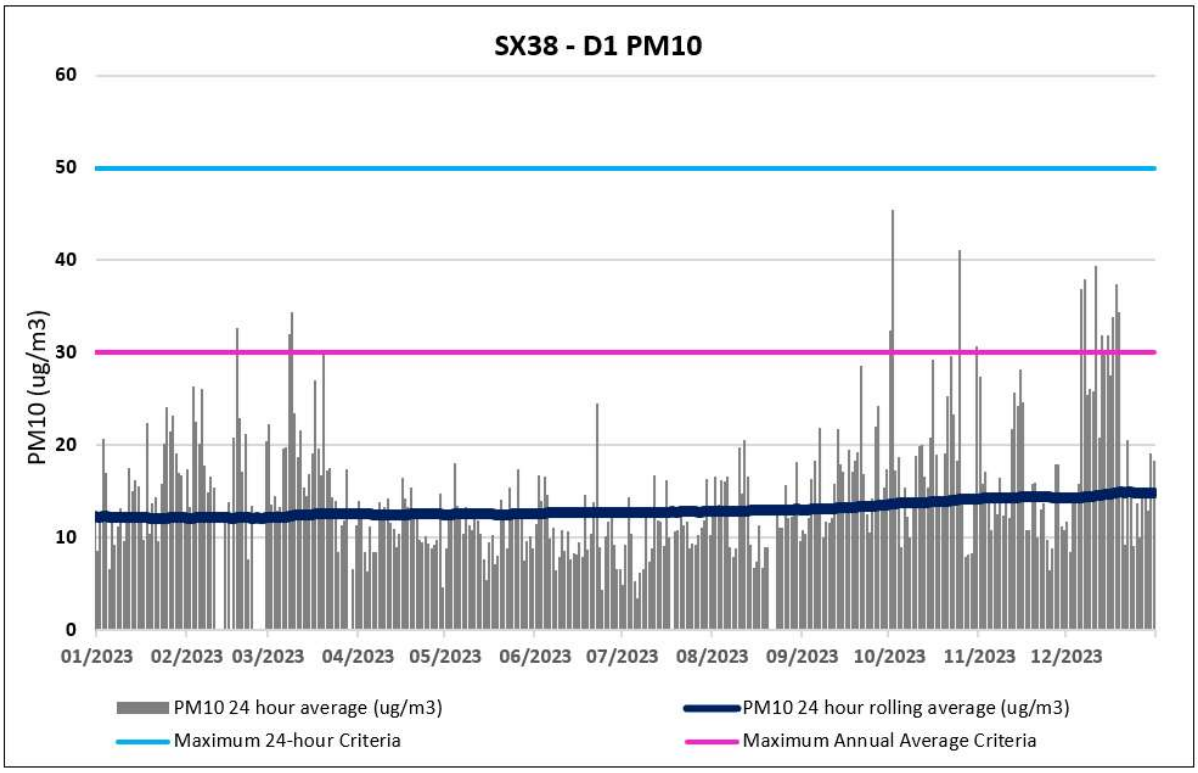


Figure 6-14 SX38-D1 TEOM PM10 results

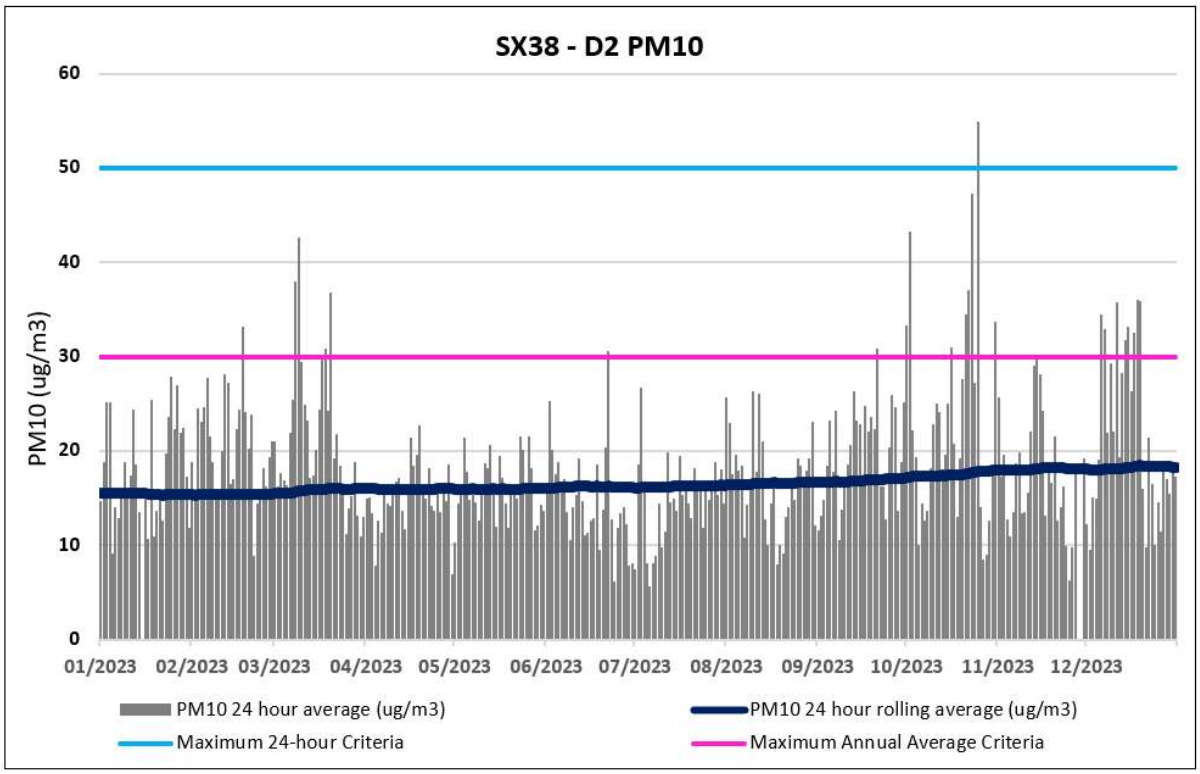


Figure 6-15 SX38-D2 TEOM PM10 results

6.3.5.1 Continuous PM10 Monitoring - Comparison to EA Predictions and Monitoring Trend

The DA 305-11-01 Modification 5 Environmental Assessment (EA) predicted that there was a very minor chance of LCO exceeding the compliance limit of 50 µg/m^3 with the probability of this occurring being less than 0.3%. All annual averages at the TEOM monitors were below the maximum annual average PM_{10} of 30 µg/m^3, as the modelling predicted. Long term monitoring trends supporting predictions are shown in ***Figure 6-16*** and ***Figure 6-17***.

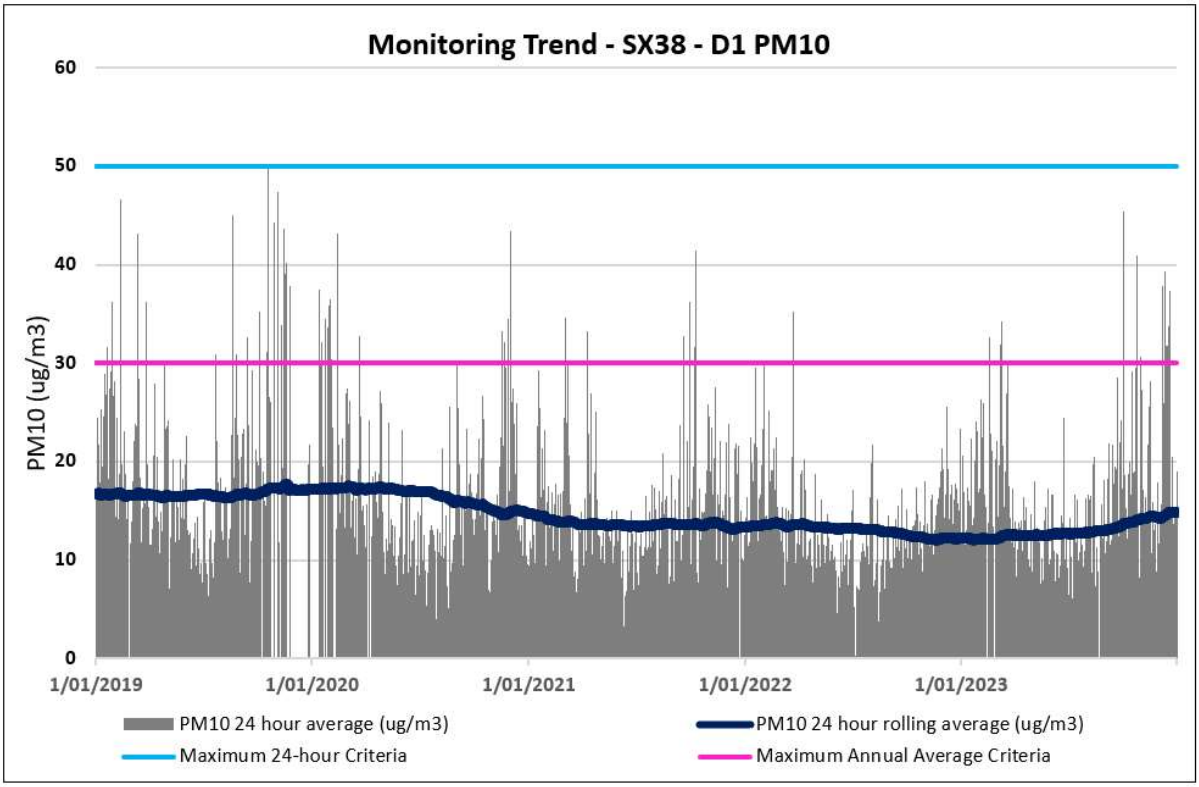


Figure 6-16 SX38 D1 TEOM monitoring trend 2019-2023

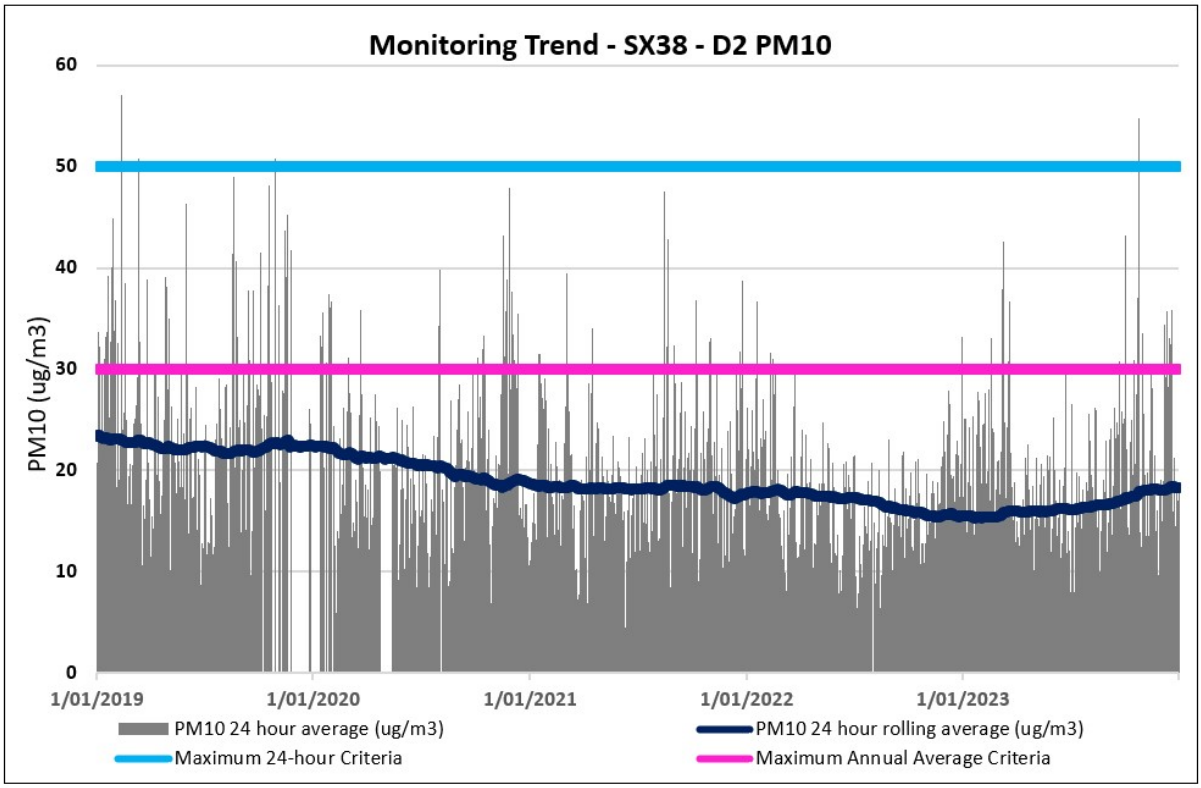


Figure 6-17 SX38 D2 TEOM monitoring trend 2019-2023

6.3.6 Continuous PM10 Monitoring - EBAMs

EPL 2094 Condition M2.2 requires the continuous monitoring of four EBAM boundary monitoring units (as shown in ***Figure 6-3***). For a 24 hour monitoring period measured by these units to be considered valid, Section 4.5 of the ***National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 5 – Data Collection and Handling, 2001*** (Prepared by the National Environment Protection Council Peer Review Committee) identifies an average concentration can only be valid if it is based on at least 75% of the expected samples in the averaging period. Failure to monitor PM10 continuously in accordance with Section 4.4 of the approved LCO AQMMP included:

- SX38-D3 – 11 occasions
- SX38-D4 – 3 occasions
- SX38-D5 – 5 occasions
- SX38-D6 – 11 occasions

Table 6-13 below identifies for each of the four monitoring units the dates in which PM10 data availability greater than 75% was not achieved.

Table 6-13 Failure to meet PM10 data availability instances – EBAMs

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
SX38-D3	1/02/2023 – 2/02/2023	0.0%	Flow failure. Replaced vacuum pump.

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
		54.2%	
	6/04/2023	50.7%	Flow failure.
	30/10/2023 – 3/11/2023	59.0% 0.0% 0.0% 0.0% 50.0%	Flow failure.
	26/12/2023 – 28/12/2023	38.2% 0.0% 45.8%	Beta detector failure.
SX38-D4	22/05/2023 – 23/05/2023	47.2% 50.0%	Zero noise filter.
	24/11/2023	52.1%	Zero flow.
SX38-D5	22/08/2023 – 24/08/2023	50.7% 0.0% 50.0%	Zero noise filter.
	26/11/2023 – 27/11/2023	68.8% 37.5%	Beta count failure.
SX38-D6	9/03/2023	41.7%	Beta count failure.
	29/07/2023 – 31/07/2023	43.8% 0.0% 66.7%	Datataker CF card file corruption.
	24/08/2023 – 25/08/2023	53.5% 50.7%	Zero noise filter.
	21/10/2023 – 23/10/2023	38.9% 0.0% 37.5%	Flow failure.
	30/12/2023 – 31/12/2023	18.1% 0.0%	Beta detector failure.

Despite the above instances in which the four EBAM boundary monitors failed to achieve PM10 daily availability greater than 75%, the overall valid data availability for each unit during 2023 is shown in ***Table 6-14.***

Table 6-14 Annual PM10 data availability - EBAMs

Monitoring Unit	Overall data availability
SX38-D3	97.4%
SX38-D4	99.4%
SX38-D5	98.9%
SX38-D6	97.7%

6.3.7 Pollution Reduction Programs

During 2023, no new Pollution Reduction Programs were completed. LCO continued to implement Haul Road Dust Monitoring program up to July 2023, as established from a 2013 PRP for ***Particulate Matter Control Best Practice – Wheel Generated Dust***. The monitoring program includes determining the haul road dust control efficiency achieved across the operation on four occasions throughout the year. Real-time concentrations of PM10 were measured using a DustTrak real time analyser attached to a 4WD vehicle. The mobile dust sampling method has been approved by the US EPA for use in similar pollution reduction programs and the sampler is equivalent to that used in the ACARP project on wheel generated dust monitoring. Emissions were monitored from controlled haul roads (loading circuits), with baseline data collected at an uncontrolled test site; the dust monitored coming off the haul road surface was compared to the uncontrolled section to determine the control efficiency. All monitoring was completed in line with the original PRP methodology including the meteorological conditions leading up to and during the monitoring event, silt sampling and scope of monitoring. As per the AQMMP, LCO aims to achieve greater than 80% control efficiency at all times.

During each monitoring event LCO achieved the target 80% control efficiency with results as follows:

- Q1 January – 83%
- Q2 April – 99%
- Q3 July – 98%

As LCO transitioned into the mine closure phase during the reporting period, the winter Haul Road Dust Monitoring was the final monitoring event as mining and processing activities substantially decreased and finally ceased by November 2023

6.4 Greenhouse Gas Emissions

6.4.1 Reported Greenhouse Gas Emissions

LCO reports greenhouse gas emissions (GHG) in accordance with National Energy and Greenhouse Gases (NGER) legislation. Each financial year, LCO is required to submit to the federal government the emissions from their NGERs registered facility. Also, because LCO emits over 100kt of CO2e- each year, LCO is registered as a Safeguard facility and therefore also had a Safeguard baseline. Emissions above the baseline for that year need to be offset by retiring Australian Carbon Credit Units (ACCUs). The NGERs reporting year is based on a financial year, not a calendar year such as this Annual Review. In

order to prevent incompatible public reporting, the values in this report also cover a financial year. The following ***Table 6-15*** contains the Scope 1 (direct emissions from the mining activities during FY23), and Scope 2 emissions (electricity consumption by the mine during FY23).

Table 6-15 Scope 1 and Scope 2 emissions FY23

Scope 1 **tCO2e**	**Safeguard Baseline** **tCO2e**	**Scope 2** **tCO2e**
166,197	176,827	20,234

6.4.2 Comparison Against Predictions

In LCO's EIA for modification 5 of the development consent predicted Scope 1 emissions to total 270,615 tCO2e- for the calendar year of 2023. As seen in Table 6-14, Scope 1 emissions were well below this at 166,197 tCO2e- for FY23. However, Scope 2 emissions were predicted to be 9,753 tCO2e- for the calendar year of 2023 but were recorded as 20,234 tCO2e- for FY23. Because the time interval in the EIA and NGERs reporting year are different a direct comparison between the two is not possible. It is worth noting that the Mod 5 EIA did not consider water transfers via electric pumps between GRAWTS sites. Furthermore, LCO reported Scope 1 emissions were below the Safeguard Baseline limit.

6.4.3 Steps Taken to Improve Energy Efficiency and Reduce GHG Emissions

LCO is a part of a wider coal assets held by Glencore across Australia. Glencore Coal Assets Australia (GCAA) are themselves a part of the global Glencore mining portfolio. In line with the ambitions of the 1.5^{o}C scenarios set out by the IPCC, Glencore target a short-term reduction of 15% by 2026 and a medium-term 50% reduction of our total (Scope 1, 2 and 3) emissions by 2035 on 2019 levels. Post 2035, Glencore's ambition is to achieve, with a supportive policy environment, net zero total emissions by 2050.

Glencore incorporates energy costs and our carbon footprint into the annual planning process. Commodity departments, such as Glencore Coal Assets Australia, are required to provide energy and GHG emissions forecasts for each asset over the forward planning period and provide details of emissions reduction projects.

In the case of LCO this includes involvement with GCAA when considering available GHG abatement technology and mine planning to optimise efficiency (which usually translates into reduced fuel consumption).

6.5 Visual and Stray Light

Visual impact management is undertaken in accordance with the practices outlined in the LCO MOP (LCO, 2018) and the LCO Lighting Management Procedure. In accordance with these documents, visual impacts are managed through:

- Prompt rehabilitation;
- Prioritisation of rehabilitation, focusing effort on areas that are most visually prominent from off-site private residences and public transport routes; and
- Directing of light away from residences.

During the reporting period, flood lighting in mining areas was located to minimise direct light emitted to Hebden Road, Antiene Road, the New England Highway, the Main Northern Railway, or towards any dwellings. During 2023, no lighting complaints were received.

6.5.1 Comparison to EA Predictions and Long-Term Trends

The DA 305-11-01 Modification 5 Environmental Assessment (EA) predicted that the project would have negligible to low visual impact on surrounding receptors due to open cut pits moving in a southerly direction away from the nearest privately owned receptors. As predicted no lighting complaints were received in 2023.

The long-term trend is generally compliant. Only one lighting complaint was received in 2020.

6.6 Aboriginal Cultural Heritage

Aboriginal Heritage Impact Permit (AHIP) ***C0000623*** (AHIMS Permit ID 3765) was issued by OEH on 3rd December 2014 for the salvage of all sites within the impact footprint of Development Modification 5. Site locations are shown in ***Figure 6-18.*** There was no further salvage of artefacts during the reporting period.

No additional consultation activities were held in 2023 outside of the annual inspection and meeting.

The planned annual inspection and meeting with the RAPs for 2023 was held on 22nd[h] November 2023. Several items regarding archaeological site management were discussed, in summary:

- Sensitive Archaeological Landscape (SAL) exclusion of vehicles and persons;
- An update of closure works, review of heritage permits and management of salvaged artefacts;
- Archaeological site and artefact management including a proposed approach to reburial of artefacts;
- Site remediation investigation of erosion in Mountain Block South.

For further information relating to Aboriginal heritage management at Liddell, refer to the LCO ACHMP, which can be accessed from the Liddell Coal Website at *www.liddellcoal.com.au*.

During 2024, LCO will be undertaking consultation with the RAPs regarding the long-term management of the artefacts held by Liddell. This consultation is focused on the proposed reburial of the artefacts onsite and will be included in an updated ACHMP submission.

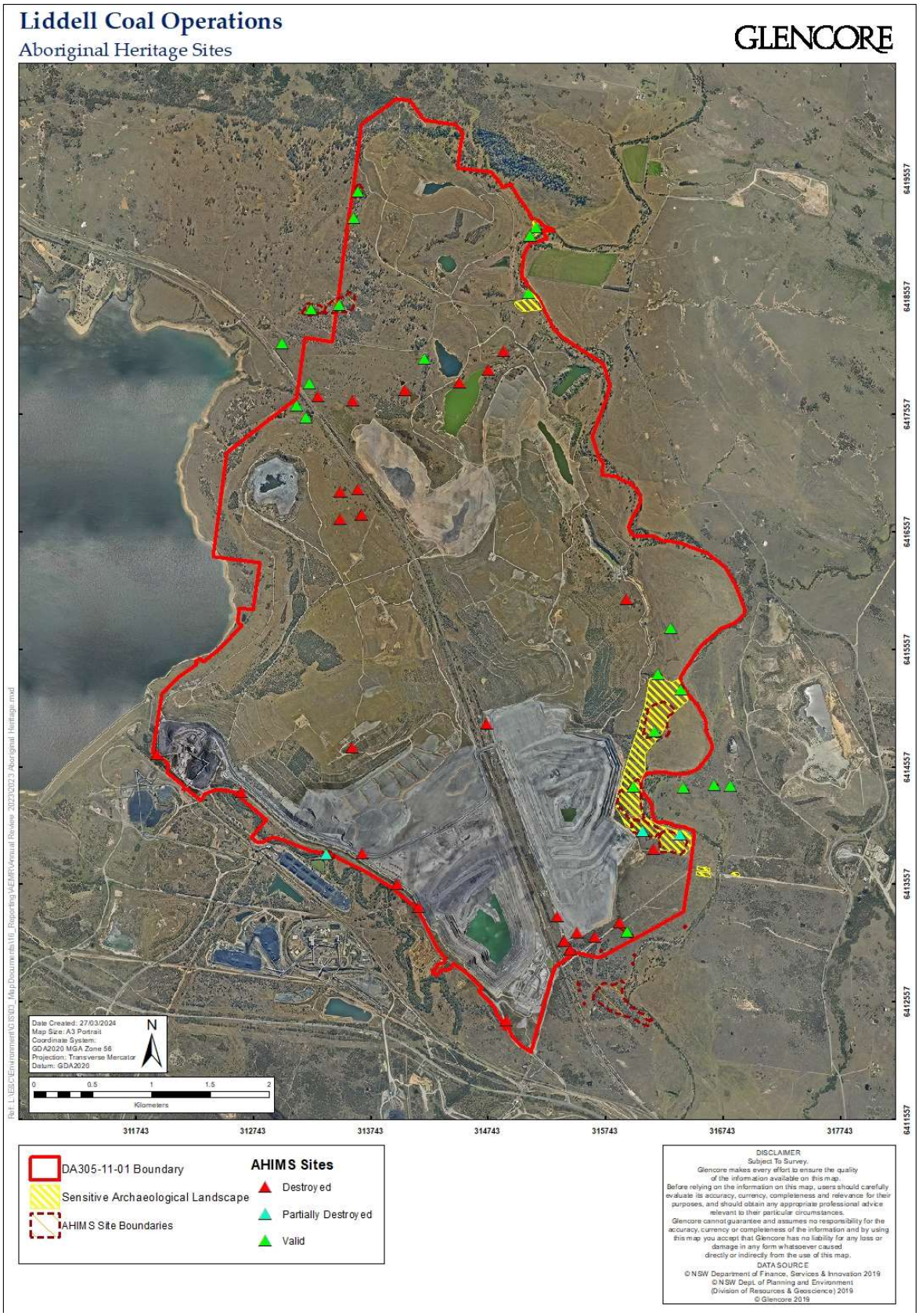


Figure 6-18 Aboriginal archaeological site locations

6.7 Heritage

The Environmental Assessment (EA) prepared for the development consent modification (DA305-11-01 Modification 5) found that mining in the vicinity of the Chain of Ponds Inn (COPI) could proceed without any major risk of damage, provided that blast design control is implemented and a number of defects in the structures within the COPI complex were rectified prior to the commencement of the close-range blasting program.

As required by Condition 15A of DA-305-11-01 (as modified) the ***Chain of Ponds Inn Blast Management Strategy*** (COPI Strategy) has been developed by LCO to document the management of potential blast related impacts on the Chain of Ponds Inn.

In accordance with DA305-11-01, the primary objective of this Strategy is to ensure that blasting at LCO does not cause loss of heritage value, and/or have a negligible impact on the structural integrity of the external fabric of the Inn, compared to the existing condition and structural integrity of the Inn at the date that consent was granted to DA305-11-01 MOD 5 (December 2014).

The COPI Strategy describes a process whereby the staged increase in the vibration level and air blast exposure (trigger levels) at the Chain of Ponds Inn, combined with continual monitoring of vibration and air blast levels and corresponding structural behaviour, will enable an adaptive management approach to blasting in the vicinity of the Inn. The strategy involves both at-receptor mitigation measures (structural stabilisation measures at the Chain of Ponds Inn) and at-source management measures (blast design control), particularly within 350 metres of the Inn, combined with an inspection and blast review regime to effectively manage blasting in the vicinity of the Inn.

During the reporting period there were no blasts within 350 metres of the Inn. Operational blasting has ceased at LCO with the final blast taking place on 26 June 2023.

6.7.1 Management Actions During 2023

No stabilisation mitigation works were identified as being required. A summary of the building response monitoring is outlined below.

In accordance with Section 5.2 the COPI Strategy, *Bill Jordan & Associates* identified that no vulnerable walls or other items required further support.

6.7.2 Visual Inspection Outcomes

Visual inspections were completed through the year on a minimum quarterly basis as per the approved Strategy. The buildings were assessed for damage as per the agreed methodology and no differences could be found in the condition of any of the buildings fabric which are attributable to blasting impacts.

6.7.3 Trends and Compliance

During 2023, there were no exceedances of the compliance limits at the Chain of Ponds Inn nor was there any significant damage resulting from blasting activities.

6.7.4 Comparison to EA Predictions

The Liddell Coal EA (2015) proposes that modifications to the development consent would be unlikely to cause significant damage to the Chain of Ponds Inn provided that the blast management strategy developed for the Project is implemented. A staged and adaptive management approach had been

applied to blasting activities resulting in no structural damage or external fabric of the Inn As discussed in ***Section 6.2.4*** the COPI Strategy has been updated to reflect cessation of blasting activities.

6.8 Exploration

No exploration activities were conducted by LCO in 2023.

6.9 Spontaneous Combustion

Fine coal along the ribs of exposed pillars in old underground workings associated with the Liddell coal seam were historically linked to spontaneous combustion at LCO. Measures to control spontaneous combustion are documented in the ***LCO Spontaneous Combustion Management Plan (SCMP)***.

LCO managed spontaneous combustion in the Entrance Pit during the reporting period. As per the mine plan, underground workings were mined through during pit progression to the lower coal seams. Upon exposure, the workings exhibited spontaneous combustion visible in the highwall. Heat affected material was removed where possible, dumped low in spoil areas and covered with at least 20 m of inert material, as per the SCMP.

The Department was notified of the localised spontaneous combustion in December 2021 as a flare up caused a plume to be visible from the nearby New England Highway. The exposed underground working continued to show signs of spontaneous combustion throughout 2023. There were no odour or air quality complaints relating to spontaneous combustion during the reporting period.

The mine design incorporated benches for sealing off the high wall, which minimises the ingress of oxygen to exposed workings. The sealing of old underground tunnels in the highwall in the Entrance Pit occurred in 2023. This process involves dumping mine spoil and fines against the highwall, and using pit dozers to push the material against the highwall in line with the final landform design.

Following the completion of last coal in the Entrance Pit, the mining fleet was used to construct a ‘buttress dump’ against all exposed underground workings in the Entrance Pit. The purpose of the buttress is to limit the exposure of the workings exposed in the highwall in the long-term.

LCO remains committed to developing and improving environmental management strategies. If the adopted spontaneous combustion strategy exhibits unsatisfactory performance, then the methodology will be reassessed, and an effective strategy implemented to achieve acceptable outcomes.

LCO are undertaking a detailed review of spontaneous combustion risks as part of mine closure planning, with ongoing investigation and preparation of a management strategy during 2024.

6.10 Tailings and Rejects Management

The processing of ROM coal in the CHPP produces both tailings and coarse rejects. This section details the tailings and rejects management strategy employed by LCO during the reporting period.

6.10.1 Tailings and Reject Management Strategy, Operation and Disposal

Tailings and reject production is dependent on a number of factors including the source coal seam, seam section, in-pit mining conditions, out of seam dilution, stockpile weathering prior to washing, and weather conditions during and prior to mining.

6.10.1.1 Course Rejects Disposal

Coarse rejects generated from the LCO CHPP are approximately 32% of ROM coal processed, and consist of carbonaceous shale, mudstone and claystone, with minor coarser rocks such as siltstone and sandstone. Coarse rejects are co-dispersed throughout the overburden dumps with a minimum of 5m cover from the final landform. Capping of coarse reject is undertaken using inert overburden to minimise the risk of spontaneous combustion. Carbonaceous shale in the coarse rejects has a very low spontaneous combustion potential.

6.10.1.2 Reclaimed Tailings Transport

Under DA 305-11-01, up to 0.5 Mtpa of tailings reclaimed from LCO can be transported to Bayswater Power Station. The actual annual rate depends on the moisture content of tailings in situ, and the energy content after mining, recovery, drying and screening. The tailings are to be transported in haul trucks via Pikes Gully Road underpass and a merging lane to the New England Highway to the nearby power station at a rate of no more than 114 truck movements per day (i.e. 57 loaded trucks), 5 days per week. No transportation of tailings to Bayswater Power Station occurred during 2023.

6.10.1.3 Tailings Disposal

LCO has approval to dispose of tailings in the Antiene, Reservoir West, Reservoir South and the Durham emplacement areas at Liddell, and also to transfer tailings to Mount Owen's West Pit.

The Antiene tailings storage facility (TSF) reached capacity and use of the void as an active tailings emplacement area ceased in August 2009. A strategy for the capping of Antiene TSF was submitted to the NSW Resources Regulator (formerly DRE) in December 2014 and LCO commenced capping of the Southern portion of Antiene TSF during 2016. LCO recommenced capping operations in late 2020 after a period of further drying and consolidation. Works were completed 2023 and approximately 110 ha of the TSF project area has been rehabilitated in total (includes adjacent Dam 4).

The Reservoir South TSF commenced capping in 2022. Works completed during the reporting period included ongoing emplacing the capping layer and landform establishment works. Works will continue to progress throughout 2024 with some areas beginning to be rehabilitated.

The Reservoir West TSF commenced capping in 2023. Works completed during the reporting period included site preparation, including removal of topsoil from rehabilitation areas, realignment of infrastructure around the work areas and installation of drainage, and commencement of emplacing the capping layer. Works will continue to progress throughout 2024.

The Durham TSF remained in care and maintenance during 2023. Detailed design and geotechnical assessments are ongoing. Initial works and capping are scheduled to commence during 2024.

LCO commenced emplacement of tailings into Mount Owen's West Pit void in 2020 as approved under DA305-11-01 Modification 6 and this continued throughout 2023 until cessation of coal processing.

MOD 8 approved the use of South Pit for tailings emplacement by neighbouring mining operations until 2050. To date, this this has not been enacted.

6.10.1.4 Capping and Rehabilitation

Table 6-16 below shows indicative timeframes for capping and final rehabilitation for each facility which is subject to technical analysis of consolidation rates.

Table 6-16 Tailings emplacement and rehabilitation timeframes

Name	2023	2024	2025	2026	2027
RTEA (Reservoir South and West TSF)	Rehabilitation	Rehabilitation	Rehabilitation (to be completed in 2025)	Monitoring and Maintenance	Monitoring and Maintenance
Durham TSF	Active (no emplacement in 2023)	Rehabilitation	Rehabilitation	Rehabilitation	Monitoring and Maintenance
Antiene TSF	Rehabilitation	Monitoring and Maintenance	Monitoring and Maintenance	Monitoring and Maintenance	Monitoring and Maintenance
Mount Owen West Pit TSF	Active	Active (LCO no longer emplacing tailings)	Active (LCO no longer emplacing tailings)	Active (LCO no longer emplacing tailings)	Active (LCO no longer emplacing tailings)

6.11 Waste Management

LCO engage a licensed waste management contractor to handle, transport, track and dispose of all waste streams, including special waste and dangerous goods in accordance with EPL 2094, DA 305-11-01, the POEO Act (1997) and other applicable Commonwealth and State legislation.

Waste segregation is a key component of the LCO waste management system to ensure that waste groups are segregated appropriately to allow for treatment separately. The segregation of bins is inspected weekly by the licensed waste management contractor to identify any issues prior to the waste going offsite and to allow for any actions to be implemented as required.

On a monthly basis, LCO review waste statistics and volumes produced by the site. During this review, any events in which the recycling target of 92% is not achieved, the deviation away from the target is reviewed and a determination made whether the event is reasonable or whether a waste minimisation or recycling improvement can be implemented. During 2023, no opportunities for waste minimisation or recycling improvements were identified.

The monthly recycling target was not met during months of 2023 and the annual total was 6.71% less than the target. This was largely a result of a reduction in recyclable waste generation, such as effluent, waste oil and oil filters, following closure of mining operations.

Table 6-17 below shows the total recycling efficiency percentage achieved monthly at LCO in 2023.

Table 6-17 Recycling efficiency recorded in 2023

Month	Total Recycled (%)	Comments
January	85.91%	Mixed solid waste higher for this month, contributing to higher waste volume disposed.
February	85.48%	Mixed solid waste higher for this month, contributing to higher waste volume disposed.

Month	Total Recycled (%)	Comments
March	87.59%	Mixed solid waste higher for this month, contributing to higher waste volume disposed.
April	79.96%	No scrap metal recycled this month, contributing to a reduction in waste recycled overall.
May	90.76%	No lead batteries or tyres were take offsite for recycling. There was also a reduction in oil filters recycled.
June	90.46%	Mixed solid waste higher for this month, contributing to higher waste volume disposed.
July	76.32%	Mixed solid waste higher for this month, contributing to higher waste disposed of. Additionally, there was a reduction in effluent recycled.
August	88.25%	No lead batteries or waste grease was recycled this month. There was also a lower amount of waste oil, oil filters, and effluent recycled.
September	73.72%	Mixed solid waste higher for this month, contributing to higher waste disposed of. Additionally, there was a reduction in waste oil and effluent recycled.
October	88.24%	Reduction in waste oil and effluent for this month, contributing to a lower volume of recycled material.
November	79.94%	Reduction in recycled waste streams such as waste oil and oil filters as a result of closure. Additionally, no effluent waste taken offsite this month.
December	69.91%	Reduction in recycled waste streams such as waste oil, oil filters, paper and cardboard, and effluent as a result of closure.
2023 Total	**85.29%**	

7. Water Management

7.1 Water Management System

Water management is one of the key operational activities at LCO and is managed through the ***LCO Water Management Plan*** (WMP). The WMP documents the processes and responsibilities of all aspects of the site water management system. This WMP has been compiled to satisfy the relevant requirements of DA 305-11-01 (as modified), as well as condition's 12, 13, 14, 15 and 16 of the Australian Government ***EPBC Approval 2013/6908***.

The WMP was updated and approved in the previous reporting period.

The water management system at LCO is integrated between the open cut operations and former underground operations.

The objectives of the WMP are to:

a) minimise the contamination of clean water runoff from catchment areas upstream of the operations by directing clean water around the disturbance footprint where possible;

b) minimise the potential effects of erosion and its associated impacts as a result of mining operations changing flows or conditions downstream;

c) prevent the discharge of pollutants from the disturbed area except where discharges are licenced, or where the discharge will not cause environmental harm such as water suitable for release from rehabilitated areas;

d) manage the mine water drawn from underground workings and maximise the reuse of mine water to meet on site water consumption requirements;

e) manage the disposal of excess water in line with relevant licence and Hunter River Salinity Trading Scheme (HRSTS) conditions when excess water volumes are stored on site beyond projected future requirements.

LCO is guided in its decisions using a life-of-mine water balance model which will enable the prediction of future water supply security and risks of excess open cut pit water. LCO store water on site to maintain supply security during dry conditions and maximise the water reuse for dust suppression.

Inflows to the LCO water balance during 2023 include site rainfall runoff, tailings water reclaim, former underground inflows and water sourced from neighbouring operations. Outflows or usage from the LCO water balance include evaporation, water used in the CHPP, dust suppression, vehicle wash down, mitigation of spontaneous combustion in waste rock emplacements, water exported to neighbouring operations and controlled release of surplus water in accordance with EPL 2094 and the HRSTS.

Water uses at LCO during 2023 include CHPP use, tailings export, dust suppression (haul roads and stockpiles), equipment wash down and potable water usage. The water consumption at LCO was generally lower than previous reporting periods. Note changes in water consumption are a result of many variables including pit progression, groundwater inflow, rainfall, atmospheric conditions, etc.

During 2023 mining operations ceased at LCO and the site moved into mine closure. As a result of this, LCO is currently undertaking a number of key changes to water management infrastructure, including the following:

- Dewatering of key water storages, such as Dam 17 and Reservoir North, to allow for the decommissioning and rehabilitation works to be completed;
- Increasing the automation of pumping infrastructure to reduce the reliance on personnel due to reduced numbers and reduced hours of site presence;
- Realignment of pipelines across site to simplify the water management system and removal of redundant pipelines as part of site decommissioning;
- Changes to drainage and dam overflows to further reduce the risk of offsite discharge.

These works will continue throughout 2024.

LCO participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing discharge from Licensed Discharge Point 6 located on Bayswater Creek. Discharges take place during high flow periods in compliance with HRSTS regulations. LCO utilises pipeline infrastructure between Mt Owen, Liddell and Ravensworth (Greater Ravensworth) to assist in the life of mine water holdings of each operation

and provide better drought proofing ability. The strategic use of available mine water storages at each operation reduces the requirement for additional dams and voids.

During 2023, LCO completed an annual review of the site water balance as per Section 7.5 of the WMP including review of the total water flows within the water management system. ***Table 7-1*** contains a summary of the water balance results. A summary of the water flows onsite at LCO during the reporting period is shown in ***Figure 7-1***.

Table 7-1 Site water balance

2023 Site Water Balance		
Total Inputs (ML)	3,281	Key inputs – aquifer interception, transfers from Greater Ravensworth sites, rainfall, runoff, potable water and water entrained in ROM coal
Total Outputs (ML)	2,780	Key outputs – transfers to Greater Ravensworth sites, evaporation, water entrained in product coal, coarse rejects and tailings slurry.
Inputs minus Outputs (ML)	502	-
Storage at Start (ML)	7,168	-
Storage at End (ML)	7,986	-
Change in Storage (ML)	818	-
Imbalance (ML)	317	-
Total Inputs + Total Outputs equals total flow through site (ML)	6,061	-
Imbalance Percentage	5.2%	-

Water balance model calibration and validation is undertaken by comparing model estimates of total water volume stored in all monitored water storages against water volumes estimated from historical monthly monitoring records as required by ***DA305-11-01 Condition 23*** and the WMP***.***

During 2023 the site water balance model was maintained to reflect current operations. The annual review of model calibration, summarised as the 'imbalance percentage' above, shows an 5.2%% imbalance percentage demonstrating that the water balance is calibrated. The imbalance is expected to be the cumulative effective of minor inaccuracies in storage measurements as well as modelled inputs and outputs (rainfall/run off inflow, evaporation, groundwater inflows, etc.).

Figure 7-1 below reflects the site water balance and the key inputs and outputs that contribute to the overall site water balance at LCO, also listed in ***Table 7-1*** above.

In accordance with DA 305-11-01, the most recent 3-yearly water balance model validation review was completed in 2023 to provide for water balance accuracy.

Mine Dewatering

The M49 Bore and Hazeldene 1 Bore are utilised to manage water levels within the historic underground workings, as required by the mine plan to maintain safe working conditions and water supply for mining operations. ***.***

Table 7-2 provides a summary of the water take in the water year July 2022 to June 2023 from the groundwater licences held by LCO with an extraction allocation. LCO did not take from any surface water licences during the water year.

Section 7.4 details groundwater monitoring results (water level and water quality) for 2023.

Table 7-2 Groundwater take

Locality	Water Licence	Entitlement (ML)	Passive take (ML)	Active pumping (ML)	Total take (ML)
Durham 1	WAL41499 (previously 20BL168063)	500	0	0	0
8 South 3 & 4	WAL41498 (previously 20BL168062)	6000 (Combined)	0	0	0
Middle Liddell Bore	WAL41498 (previously 20BL172588)				
Hazeldene 1 & 2	WAL39760 (previously 20BL168060)	5500	0	337.5	337.5
Bowman's Creek	WAL18302	5	0	0	0
Bowman's Creek	20WA210940 (previously 20BL017861)	5	0	0	0
M49	WAL41493 (previously 20BL172293)	2500 (Combined)	1,012.4	872.0	1,884.4
Mt Owen 1	WAL41493 (previously 20BL168209)				
Mt Owen 2	20BL169544	2500	0	0	0
Durham 2 & 4	WAL41497 (previously 20BL168061)	1000	0	0	0

Note – total take has been calculated by assessing the difference between passive take into the underground workings and the volume actively pumped from the workings. In instances where passive take exceeds the active take volume, the passive take will be reported as the total take due to extraction using pumping infrastructure occurring from the volume passively taken. In instances where active pumping exceeds the passive take into the workings, the total volume reported will be the active pumping volume minus the volume passively taken from the undergrounds.

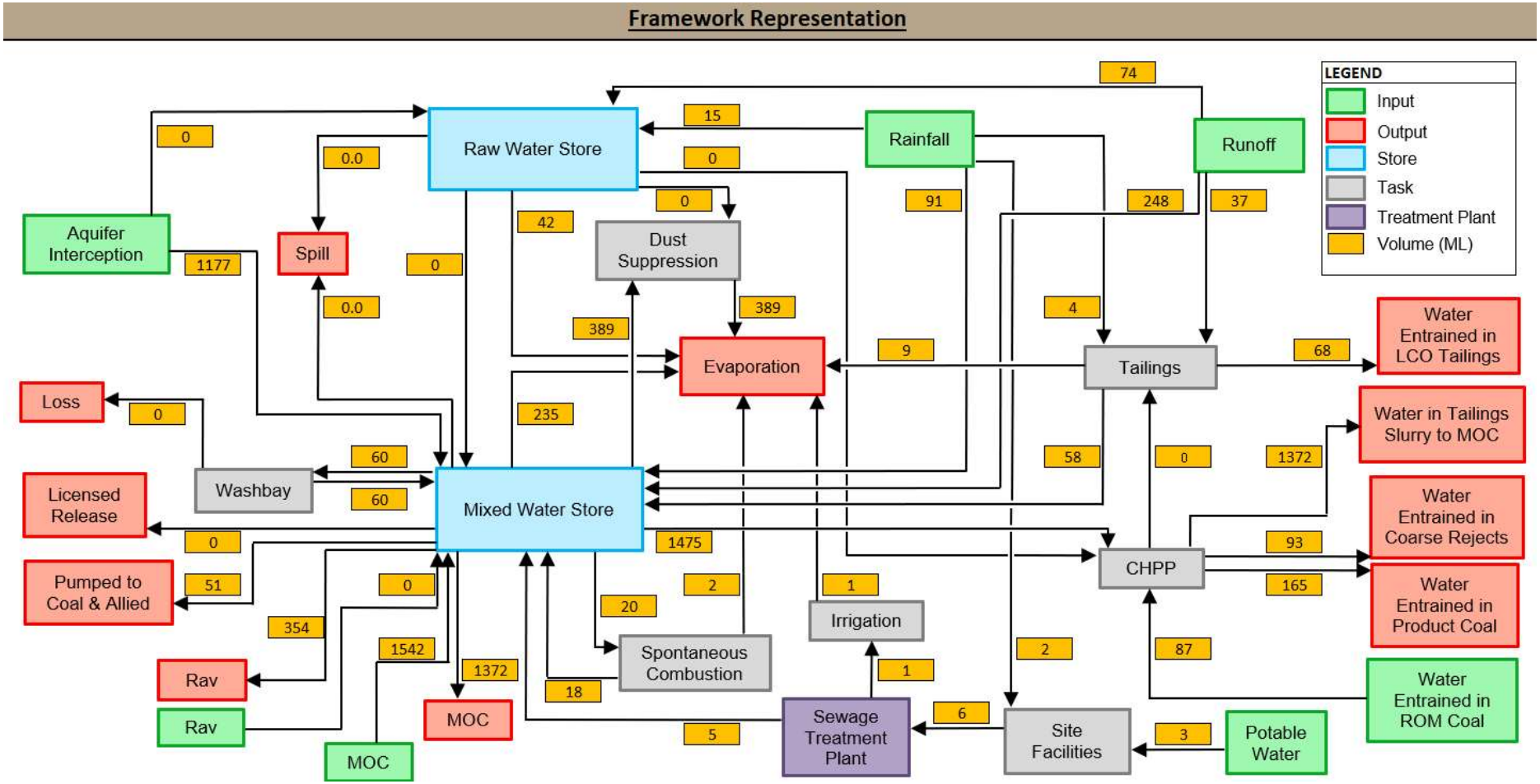


Figure 7-1 Water balance

7.2 Surface Water Monitoring

Surface water monitoring is undertaken along the two creek lines adjacent the operation (Bayswater and Bowmans) as well as at onsite water storages. During the reporting period, LCO undertook the approved WMP surface water monitoring program. This monitoring program utilises specific surface water quality monitoring trigger limits which provide for the identification of potential adverse impacts.

Bayswater Creek is considered to be a highly disturbed system with respect to ANZECC 2000 with low ecological value and a flow regime which is controlled by discharges from Lake Liddell with the remaining catchment not sufficient to maintain flow within the creek adjacent to LCO. Bowmans Creek is considered to be a moderately disturbed system with respect to ANZECC 2000 with moderate ecological value. Based on long term streamflow monitoring, flow within Bowmans Creek is intermittent adjacent to LCO although consistent flow is recorded further downstream nearer to the Hunter River.

The ephemeral nature of flow within the creeks adjacent to LCO means that stagnant pools of water are sometimes monitored which may have higher/atypical concentrations of the key parameters (pH, Total Suspended Solids (TSS) and Electrical Conductivity (EC) and Total Dissolved Solids (TDS)) than during periods of flow. To reflect the natural ponding and varying quality of both creeks, the WMP sets site specific and flow determinant impact assessment criteria for both creeks. This criterion has been determined based on a statistical analysis of data collected over a 5 year period in accordance with ANZECC (2000) guidelines.

LCO's interpretation and response to monitoring results is detailed in the WMP Section 10 Surface Water and Groundwater Response Plan, which has been implemented during the reporting period to investigate exceedances of determined criteria. It is important to note that before an exceedance is to be considered to have been reached, monitoring will continue for up to two observations beyond the initial exceedance measurement (i.e. a total of three consecutive exceedances of a trigger value). This is to check that the exceedance is repeated, ongoing, and not erroneous. Notwithstanding, a decision is made whether the initial exceedance requires immediate investigation.

The creek trigger levels are presented in ***Table 7-3***

Table 7-3 Water Management Plan trigger values for surface water quality

Location	pH lower limit[4]	pH upper limit		EC 90th %tile[1]	EC Max[2]	TDS 90th %tile[1]	TDS Max[2]	TSS 90th %tile[1]	TSS Max[2]
		90th %tile[1]	Max[2]						
Bayswater	6.5	8.3	8.5	5130	7300	3230	5180	50[3]	302
Bowmans Creek	6.5	8.3	8.8	2020	4570	1210	3460	50[3]	97

Notes to table:

Trigger Level when creek is flowing

Trigger Level when no flow in creek

[1] whole creek 90th percentile
[2] maximum recorded value for whole creek
[3] ANZECC criteria for TSS
[4] ANZECC criteria for pH lower limit

TSS Total suspended solids (mg/L)
EC Electrical conductivity (µS/cm)
TDS Total dissolved solids (mg/L)

Monitoring during the reporting period was completed as per the approved WMP. The following sections detail exceedances, if any, of applicable WMP trigger levels.

The surface water monitoring locations are shown below on ***Figure 7-2***.

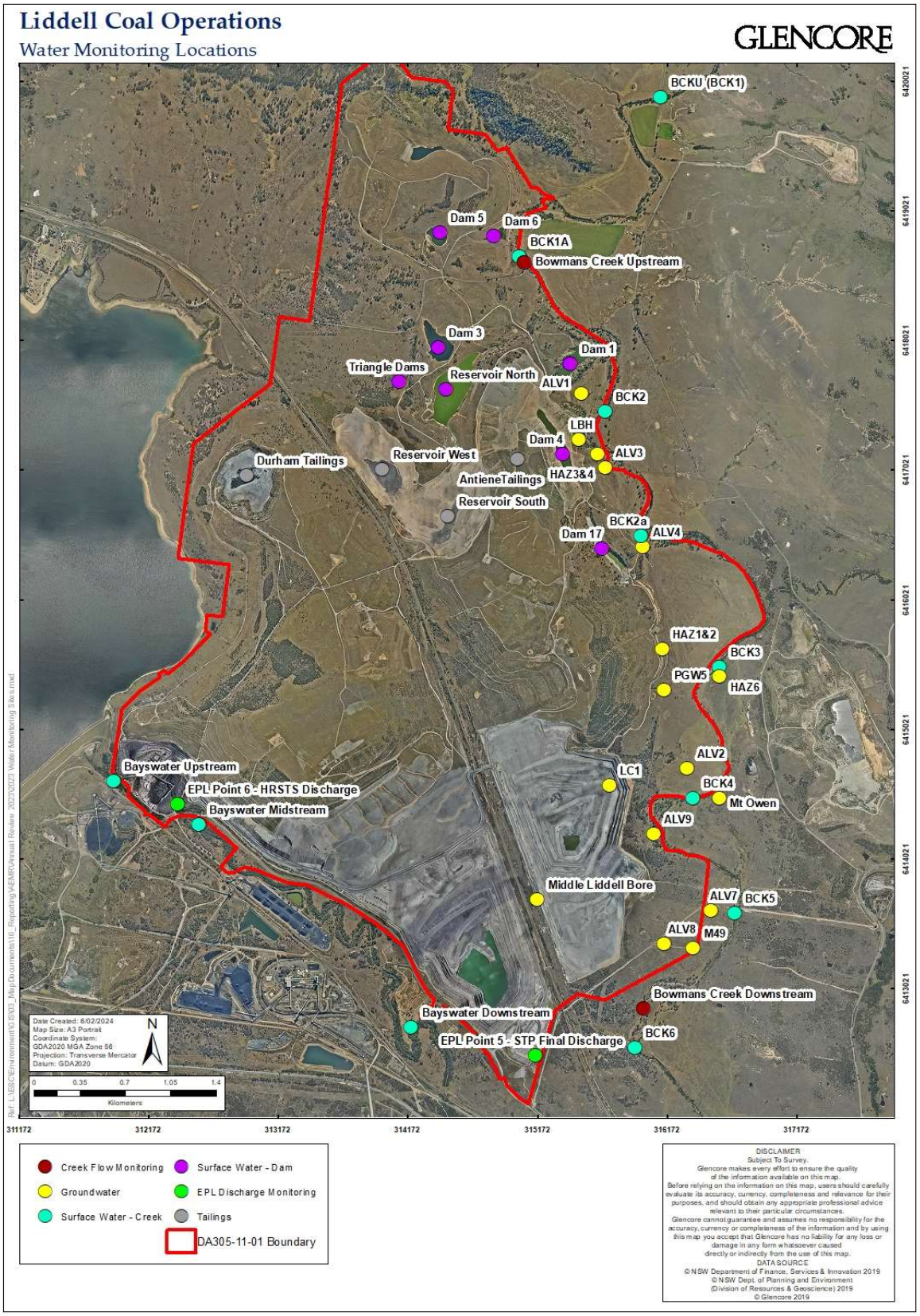


Figure 7-2 Surface and groundwater monitoring locations

7.2.1 Surface Water Monitoring Results Review

7.2.1.1 Bayswater Creek

Monitoring of the three sites within the creek (Upstream, Midstream and Downstream) was completed monthly during the reporting period in accordance with the WMP. Bayswater Creek is a highly modified watercourse and regularly experiences periods of low or no flow. The measured water quality levels were typical of historical results with considerable range due to the infrequent flow and highly modified catchment.

Table 7-4 below summarises the monitoring results in Bayswater Creek during the reporting period. There were no instances of individual water quality results triggering the relevant criteria at the Bayswater Creek Downstream monitoring site.

Table 7-4 Bayswater Creek water quality results

Month	Bayswater Creek Upstream					Bayswater Creek Midstream*					Bayswater Creek Downstream				
	Flow	pH	EC (µS/cm	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm	TDS (mg/L)	TSS (mg/L)
Jan-23	Slow	8.09	7360	5110	<5	Still	8.21	7250	5050	7	Dry	-	-	-	-
Feb-23	Trickle	8.31	7910	5840	7	Still	8.25	7260	5210	22	Dry	-	-	-	-
Mar-23	Still	8.35	7780	4950	13	Still	8.16	7870	4740	18	Dry	-	-	-	-
Apr-23	Trickle	8.09	7040	4640	7	Still	8.12	7580	5030	<5	Dry	-	-	-	-
May-23	Trickle	8.35	7310	5080	17	Still	8.20	7210	5090	<5	Dry	-	-	-	-
Jun-23	Trickle	8.21	7650	5280	18	Still	8.21	7520	5150	<5	Dry	-	-	-	-
Jul-23	Trickle	7.85	7940	5420	6	Still	8.23	8240	5650	<5	Dry	-	-	-	-
Aug-23	Trickle	8.17	7970	5320	16	Trickle	8.19	7700	5180	13	Dry	-	-	-	-
Sep-23	Still	7.91	8310	5580	6	Still	8.34	7530	4970	9	Dry	-	-	-	-
Oct-23	Still	7.95	8320	5720	<5	Still	8.39	5780	3920	25	Dry	-	-	-	-
Nov-23	Still	8.09	8730	5890	<5	Still	8.29	3760	3880	33	Dry	-	-	-	-
Dec-23	Still	8.45	10600	8550	10	Dry	-	-	-	-	Dry	-	-	-	-

Notes to Table:

	Exceedance of the 90%ile trigger limit as applicable when the creek is flowing
	Exceedance of the maximum trigger limit when there is no flow in the creek
-	unable to obtain a sample due to water level being too low to sample
*	Trigger limits apply to Bayswater Creek Downstream monitoring site only

7.2.1.2 Bowmans Creek

Monitoring of the eight sites within the creek (upstream BCK1, BCK1A, BCK2, BCK2A, BCK3, BCK4 BCK5 and downstream BCK6) was completed monthly during the reporting period in accordance with the WMP.

It should be noted sections of Bowmans Creek are ephemeral in nature and often pool or have very low flow leading to potential stagnant conditions which influences water quality. With this consideration trigger limits are dependent on the flow conditions at time of monitoring being either no flow or flowing.

Table 7-5 to ***Table 7-7*** below summarises the monitoring results collected from Bowmans Creek during the reporting period.

Table 7-5 Bowmans Creek trigger limit summary – northern sites

Month	BCK1 (Upstream)					BCK 1A					BCK2				
	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-23	Trickle	7.88	855	429	7	Trickle	7.75	1050	612	6	Trickle	7.67	901	451	12
Feb-23	Slow	7.62	790	421	<5	Trickle	7.88	1220	710	<5	Still	8.00	771	425	12
Mar-23	Trickle	7.64	876	448	<5	Trickle	7.95	1170	653	12	Still	8.13	842	474	28
Apr-23	Slow	7.90	933	543	<5	Steady	8.05	1060	591	<5	Trickle	7.94	931	502	12
May-23	Slow	7.74	959	550	<5	Slow	7.96	1220	704	<5	Still	7.86	985	548	18
Jun-23	Trickle	7.81	972	540	<5	Trickle	7.72	1290	751	25	Still	8.14	972	548	17
Jul-23	Trickle	7.76	980	590	<5	Trickle	7.51	1250	719	<5	Still	8.20	873	496	<5
Aug-23	Trickle	7.38	1030	586	<5	Trickle	7.70	1730	981	<5	Still	7.86	820	436	32
Sep-23	Still	7.55	1110	662	<5	Still	7.61	1640	958	<5	Still	8.18	1070	624	56
Oct-23	Trickle	7.57	1060	656	9	Trickle	7.56	2350	1530	<5	Still	8.14	1120	661	89
Nov-23	Trickle	7.68	1060	770	<5	Trickle	7.57	3230	2250	<5	Still	7.77	1400	936	523
Dec-23	Still	7.81	1090	719	9	Still	7.63	3470	2660	<5	Dry	-	-	-	-

Notes to Table:

Exceedance of the 90%ile trigger limit as applicable for the flow conditions

Exceedance of the maximum trigger limit as applicable for no flow conditions

\- unable to obtain a sample due to water level being too low to sample

Table 7-6 Bowmans Creek trigger limit summary – middle sites

Month	BCK2A					BCK3					BCK4				
	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-23	Slow	8.12	785	434	<5	Slow	7.93	846	460	5	Slow	7.90	889	457	7
Feb-23	Trickle	7.73	714	380	<5	Slow	8.01	808	464	12	Trickle	7.97	884	476	9
Mar-23	Trickle	7.59	806	414	<5	Trickle	7.92	874	458	15	Trickle	7.91	921	466	8
Apr-23	Slow	8.17	836	484	<5	Slow	8.30	873	450	75	Trickle	8.26	910	486	15
May-23	Slow	7.80	886	486	<5	Still	7.96	898	493	6	Still	7.99	940	536	<5
Jun-23	Still	7.62	884	501	<5	Still	7.97	913	504	7	Still	8.04	971	570	<5
Jul-23	Still	7.45	906	522	<5	Trickle	7.77	967	539	<5	Trickle	8.14	1020	593	10
Aug-23	Still	7.50	905	474	5	Trickle	8.01	958	529	<5	Trickle	8.02	1060	531	41
Sep-23	Still	7.34	1000	620	<5	Trickle	8.15	1040	607	<5	Still	8.15	1110	662	6
Oct-23	Still	7.44	989	542	<5	Trickle	7.95	1020	576	<5	Still	8.10	1180	657	<5
Nov-23	Still	7.53	990	629	<5	Still	7.45	990	648	<5	Still	8.16	1180	777	<5
Dec-23	Still	7.56	1050	622	<5	Still	8.22	1090	655	16	Dry	-	-	-	-

Notes to Table:

Exceedance of the 90%ile trigger limit as applicable for the flow conditions

Exceedance of the maximum trigger limit as applicable for no flow conditions

\- unable to obtain a sample due to water level being too low to sample

Table 7-7 Bowmans Creek trigger limit summary – southern sites

Month	BCK5					BCK6 (Downstream)				
	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Flow	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-23	Slow	8.02	940	528	11	Slow	7.51	828	448	<5
Feb-23	Still	7.95	942	544	12	Still	7.27	782	449	6
Mar-23	Slow	7.90	1090	602	5	Still	7.14	907	458	6
Apr-23	Slow	8.02	969	535	<5	Slow	7.47	939	531	<5
May-23	Still	7.96	1040	590	8	Still	7.26	990	550	<5
Jun-23	Still	8.09	1070	586	9	Still	7.47	978	566	14
Jul-23	Trickle	8.00	1100	636	<5	Trickle	7.26	1030	569	<5
Aug-23	Still	7.85	1100	579	8	Still	7.31	1020	536	38
Sep-23	Still	8.13	1180	664	7	Still	7.17	1070	623	<5
Oct-23	Still	8.20	1150	656	8	Still	7.30	1060	635	<5
Nov-23	Still	8.17	1110	734	6	Still	7.34	1050	659	11
Dec-23	Dry	-	-	-	-	Still	7.67	1160	610	48

Notes to Table:

Exceedance of the 90%ile trigger limit as applicable for the flow conditions

Exceedance of the maximum trigger limit as applicable for no flow conditions

\- unable to obtain a sample due to water level being too low to sample

During 2023 LCO experienced lower than average rainfall conditions which was reflected in the flow conditions along Bowmans Creek. Most sites maintained water throughout the year and varied between predominantly still and trickle flows, apart from BCK2, BCK4 and BCK5 which were dry in December.

There were six instances results above trigger criteria along Bowmans Creek during the reporting period. In accordance with the WMP surface water trigger response plan, these results were transient (i.e. occurred less than 3 consecutive months) and monitoring continued, no additional investigation was required. Note further investigation at the BCK1A sampling location is detailed in the sections below.

7.2.1.3 BCK1A Investigation TARP

In the 2019 Annual Review, LCO reported that exceedances of the 90th percentile trigger limits for EC and TDS occurred at BCK1A. These exceedances continued until mid-2020, with no exceedances in 2021 or 2022. In 2023 EC and TDS increased above the trigger limit from October to December (as per ***Table 7.5***).

Previously, LCO conducted investigations to determine the source of the trigger exceedances by commencing a management/mitigation TARP, in line with the WMP investigation protocol. In response to the TARP, Dam 6, a water management structure, was dewatered to create a local groundwater sink, capturing potential groundwater flow from the historical mining area. Further studies were conducted in consultation with DPE (currently the Department of Climate Change, Energy, the Environment and Water (DCCEEW)).

On 9 September 2020, LCO submitted a BCK1A Management TARP investigation report. Stage 1 of the investigation included the development a conceptual site model (CSM) to assess mechanisms that may be causing the elevated salinity. The assessment identified a complex groundwater system with several potential mechanisms ('natural' processes and 'man-made stressors') for the elevated salinity, and recommended that further works be undertaken, Stage 2, to confirm or negate potential mechanisms.

Stage 2 was undertaken in 2020 to address the identified knowledge gaps and included the installation of a targeted groundwater-monitoring network to test the relative hydraulic conductivity of strata, review groundwater quality and levels, and further refine the CSM. A key finding from this work was that the EC trigger exceedances were anticipated to be predominantly a result of the adverse climatic conditions (below average rainfall and above average evaporation).

Stage 3 included reviews of the monitoring data, which has continued to be collected from June 2020 to December 2023. The data was used to refine the CSM.

The main findings in Stage 3 were as follows:

- The elevated EC in Bowmans Creek persisted until mid-2020 and subsequently reduced to below trigger values.
- The elevated EC was expected to have been a result of groundwater flow discharging to Bowmans Creek, low rainfall resulting in limited surface flow and less dilution of the brackish groundwater discharging to Bowmans Creek, and high evaporation. This conclusion was consistent with the Stage 2 finding, remaining valid.
- In 2023, there has been a return of below average rainfall and an EC increase at BCK1A. From October through to December 2023, the EC was recorded above the trigger limit.

Whilst the studies demonstrate the elevated salinity is not directly linked to historical mining activities and Dam 6, groundwater flows are interacting with soil in backfilled extraction areas and out of pit dumps before exiting to Bowmans Creek. In line with investigation recommendations, LCO intends to

continue monitoring, and undertaking other works such as numerical groundwater modelling, to inform mine closure planning and ability to progress this area for mining title relinquishment in the future.

Additionally, LCO is implementing a Tributary Rehabilitation Monitoring Plan (TRMP), the main aim of which is to establish a baseline of ecological health of Bowman's and Bayswater Creeks before closure and to identify potential impacts to ecological health, which may be associated with observed changes in water quality. The monitoring completed during 2020-2022 has not shown sustained impact to the aquatic health of Bowmans Creek. A round of monitoring under the TRMP was undertaken in late 2023, with results still pending as of March 2024.

Additional assessments and monitoring are being undertaken in the areas of concern as part of detailed mine closure planning.

7.2.1.4 MIA Onsite Sewerage System Discharge Quality

LCO operate a Wastewater Treatment Plant (WWTP) at the Mine Infrastructure Area (MIA) for the treatment of wastewater prior to discharge into the mine dirty water containment system. LCO has water quality limits on the MIA WWTP discharge stated in the Development Consent, Singleton Shire Council OSSM Approval and the Environmental Protection Licence (as Licenced Discharge Point 5).

During the reporting period, there were no exceedances of the MIA WWTP WMP limits requiring investigation.

7.2.1.5 HRSTS Discharge Monitoring

Any discharges from Liddell Coal must be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS). During 2023, LCO did not undertake any HRSTS discharge events.

7.3 Surface Water Comparison to EA Predictions

With reference to the EA predictions from the surface water assessment (Gilbert and Associates, 2013), this part identifies the predictions made with comparison to monitoring findings. The key conclusions of the predictive model simulations and surface water impact assessment have been compared to the findings of the WMP approved monitoring program and detailed in ***Table 7-8*** below. In brief, observations from the monitoring programs demonstrate current impacts are within the EA predictions.

Table 7-8 Surface water impact comparison to EA predictions

Surface Water Impact Comparison to EA Predictions	
Key EA Conclusion	**Comparison to Monitoring Observations**
Changes to flows in local creeks due to expansion and subsequent capture and use of drainage from mine area catchments.	Mining remains within the approved extents hence no impacts to the catchment greater than predictions. Monitoring has not shown significant changes in creek line base flow due to mining operations. Rehabilitation activities aligning with current approved final landform design providing for impacts management in line with the EA.

Surface Water Impact Comparison to EA Predictions	
Potential for export of contaminants (principally sediments and soluble salts) in mine area runoff and accidental spills from containment storages (principally sediments, soluble salts, oils and greases), causing degradation of local and regional water courses.	No breaches of the mine water containment system occurred during 2023. Ongoing study and assessment of groundwater interactions with the rehabilitated Mt Block mining area and Bowmans Creek to inform mine closure planning.
Short term increases in salinity during periods of licensed discharge under the HRSTS.	There was no licenced discharge under HRSTS during the reporting period..

7.4 Groundwater Monitoring

LCO is located within an area of the Upper Hunter Valley subject to extensive underground and open cut mining activities since the early 20th century. Current and historical mining operations have extensively altered the physical features and environmental setting of the local area, including the region's surface water and groundwater systems. Mining operations to the west, south and east of LCO, Lake Liddell to the west, and the major geological feature Hunter Thrust to the north, all have major influence on groundwater levels in the region. Due to such operations and features, regional groundwater levels largely reflect current and past mining activities, with groundwater levels varying with time and location according to local mining activities.

The WMP groundwater monitoring program adopts site specific trigger values for impact investigation and assessment. If monitoring results suggest significant and continuous deviation from historical or background trends in water quality, further investigations into potential impacts are conducted. It is highlighted that, due to changes in land-use in the vicinity of LCO through both mining and agriculture, as well as local variability in groundwater conditions, there is limited opportunity for establishment of groundwater reference sites.

Groundwater triggers were varied with the NSW Government and approved in late May 2023. Revised triggers were applied to the June 2023 monitoring data onwards. Details are provided in ***Section 7.4.2***.

7.4.1 Groundwater Monitoring Program

The groundwater monitoring locations (compliance and management bores) are shown above on ***Figure 7-2.***

Groundwater level monitoring is carried out at least monthly on the shallow, unconfined, water table aquifers of Bowmans Creek alluvium and the underlying shallow bedrock. Water pressure monitoring is carried out at least monthly on the deeper, confined, hard rock aquifers.

Groundwater quality monitoring includes electrical conductivity (EC) and pH, on a monthly basis. In addition, total dissolved solids (TDS), total suspended solids (TSS), heavy metals, and major ions are sampled every six months.

7.4.2 Groundwater Level Trigger Definition

The groundwater level triggers changed in 2023, with the implementation of the updated WMP (LCO, 2023). The historical triggers continued to apply from January to May 2023. The revised triggers apply from June to December 2023, when the WMP 2023 was published.

Groundwater level triggers – January to May 2023

1. Impact trigger – An impact trigger is drawdown of 2 m in the alluvium compared to the local reference site for the northern and southern impact zone as shown in the WMP; only applicable at ALV9 and ALV8L. The reference sites are ALV2L (for ALV9L) and ALV7L (for ALV8L) (***Table 7-9***).

2. Investigation trigger – An investigation trigger and is measurement below the monthly, baseline (10th percentile) water level on three consecutive occasions. The purpose of this trigger is to identify unexpected changes to groundwater level. ALV9 does not have an investigation trigger because these triggers were developed using historical baseline data and ALV9 was a subsequent installation (December 2017) to provide greater coverage for the identification of alluvial groundwater impacts in the northern drawdown area.

3. Subsequent Investigation Trigger - A Subsequent Investigation Trigger is designed to address the potential for harm to listed threatened species, communities, and migratory species of concern to EPBC Approval 2013/6908. Following an investigation of an exceedance of Groundwater Level Trigger Definition #2 that concludes the exceedance is not mining-related, should groundwater levels continue to be measured below the lower 10th percentile for a further nine months, such that the exceedance has continued continuously for 12 months, then a subsequent investigation shall be undertaken to confirm that the exceedance remains unrelated to mining activity.

Groundwater level triggers – June to December 2023

The 2023 WMP recommends a staged trigger approach be adopted using the baseline dataset from Tables 17 and 18 in the WMP (WMP, 2023). Groundwater Level Trigger Definition #1 was not impacted by this change, it remained the same. Trigger values for Groundwater Level Trigger Definition #2 and #3 were updated to use the baseline dataset. The investigation trigger (Groundwater Level Trigger Definition #2) was changed to adopt the staged approach:

2. Investigation trigger:

   - Two consecutive quarterly readings below the 10^{th} percentile (mAHD)
   - One reading below the maximum, and for impact bores (ALV8L and ALV9L) the maximum is set to the predicted maximum.

The subsequent investigation trigger (Groundwater Level Trigger Definition #3) changed as it was applied to the updated baseline dataset (Tables 17 and 18, WMP, 2023). The structure of the trigger remained the same:

3. Subsequent Investigation Trigger - A Subsequent Investigation Trigger is designed to address the potential for harm to listed threatened species, communities, and migratory species of concern to EPBC Approval 2013/6908. Following an investigation of an exceedance of Groundwater Level Trigger Definition #2 that concludes the exceedance is not mining-related, should groundwater levels continue to be measured below the lower 10th percentile for a further nine months, such that the exceedance has continued continuously for 12 months, then a subsequent investigation shall be undertaken to confirm that the exceedance remains unrelated to mining activity.

Table 7-9 presents the January to May 2023 site-specific triggers for groundwater levels and shows the data relevant to the reporting period.

Table 7-10 presents the June to December 2023 site-specific triggers for groundwater levels and shows the data relevant to the reporting period.

7.4.3 Groundwater Quality Trigger Definition

The groundwater quality triggers changed in 2023, with the implementation of the updated WMP (LCO, 2023). The historical triggers continued to apply from January to May 2023. The revised triggers apply from June to December 2023, when the WMP 2023 was published.

Groundwater quality triggers – January to May 2023

The two components to the groundwater quality triggers are described in detail in the 2022 WMP and summarised as follows:

1. EC investigation trigger – An investigation trigger because of a monthly measurement either below the baseline (20th percentile) or above the monthly baseline (80th percentile) on three consecutive occasions. Note the 20th percentile trigger levels are designed to identify downward leakage from the alluvium to the shallow bedrock to provide another mechanism to detect potential alluvial impacts in addition to the water level triggers. For this impact to occur, it needs to be associated with a declining water level in the alluvium that is not climate related.
2. pH investigation trigger - An investigation trigger because of a monthly measurement either above or below the default pH trigger values from ANZECC (2000) for lowland rivers located in NSW on three consecutive occasions. Applies to all ALV series piezometers (except ALV9) and LBH.

Groundwater quality triggers – June to December 2023

The two components to the groundwater quality triggers are described in detail in the 2023 WMP. The pH investigation trigger was not updated in the 2023 WMP. The EC investigation trigger was updated, it is summarised as follows:

1. EC investigation trigger – Can be triggered in one of the following three ways:
    - Two consecutive readings below the 20th percentile for bores ALV2S and ALV8S.
    - Two consecutive readings above the 95th percentile.
    - One reading above the maximum.

    The 20th percentile trigger levels are designed to identify downward leakage from the alluvium to the shallow bedrock to provide another mechanism to detect potential alluvial impacts in addition to the water level triggers. For this impact to occur, it needs to be associated with a declining water level in the alluvium that is not climate related. The assessment also includes a comparison of streamflow between the upstream and downstream gauges in Bowmans Creek. This investigation trigger is only triggered when there has been a measurable loss of streamflow that is not associated with recharging the alluvium or filling of instream storages.

Table 7-9 presents the January to May 2023 site-specific trigger levels for groundwater quality and shows the data relevant to the reporting period.

Table 7-910 presents the June to December 2023 site-specific trigger levels for groundwater quality and shows the data relevant to the reporting period.

Table 7-9 Groundwater quality impact assessment criteria

Groundwater Level and Quality Impact Assessment Criteria for January to May 2023							
Groundwater Level Trigger Definition #1 – 2m drawdown in Bowmans Creek Alluvium							
ALV9L	Groundwater elevation of monitoring piezometer ALV2L minus 5.0m (AHD).						
ALV8L	Groundwater elevation of monitoring piezometer ALV7L minus 4.5m (AHD).						
		Groundwater Elevation (mAHD) – Definition #2 & #3			**EC (µS/cm)**		**pH**
		10th percentile	Ref. Min	20th percentile	80th percentile	Max	
Alluvial and Shallow Bedrock Aquifers							
ALV1	Alluvial aquifer (L)	106.22	104.88	N/A	1370	2020	6.5 – 8.5
	Shallow bed rock (S)	106.44	104.35	N/A	1560	1770	
LBH	Alluvial aquifer (L)	105.74	104.55	N/A	1550	3090	
ALV3	Alluvial aquifer (L)	103.81	102.43	N/A	1390	3080	
	Shallow bed rock (S)	103.52	102.25	N/A	2800	4510	
ALV4	Alluvial aquifer (L)	102.14	100.97	N/A	1920	3080	
	Shallow bed rock (S)	101.42	100.28	N/A	5310	6430	
ALV2	Alluvial aquifer (L)	93.08	91.12	N/A	2830	4160	
	Shallow bed rock (S)	93.21	89.35	2560	2820	3370	

Groundwater Level and Quality Impact Assessment Criteria for January to May 2023							
ALV7	Alluvial aquifer (L)	87.02	86.43	N/A	1780	2310	
	Shallow bed rock (S)	83.56	82.39	N/A	2230	2540	
ALV8	Alluvial aquifer (L)	85.06	83.66	N/A	1310	1880	
	Shallow bed rock (S)	82.99	80.94	1540	1990	2400	

Table 7-10 Groundwater level and quality impact assessment criteria June to December 2023

Groundwater Level and Quality Impact Assessment Criteria for June to December 2023							
Groundwater Level Trigger Definition #1 – 2m drawdown in Bowmans Creek Alluvium							
ALV9L	Groundwater elevation of monitoring piezometer ALV2L minus 5.0m (AHD).						
ALV8L	Groundwater elevation of monitoring piezometer ALV7L minus 4.5m (AHD).						
		Groundwater Elevation (mAHD) – Definition #2 & #3		**EC (µS/cm)**			**pH**
		Lower limit (10th percentile)	Reference Minimum	Lower limit (20th percentile)	Upper limit (95th percentile)	Maximum	
Alluvial and Shallow Bedrock Aquifers							
ALV1	Alluvial aquifer (L)	105.72	104.88	N/A	1700	2020	6.5 – 8.5
	Shallow bedrock (S)	106.05	104.35	N/A	1640	1770	
LBH	Alluvial aquifer (L)	105.21	104.55	N/A	2350	3090	

Groundwater Level and Quality Impact Assessment Criteria for June to December 2023							
ALV3	Alluvial aquifer (L)	103.06	102.21	N/A	1900	3080	
	Shallow bedrock (S)	102.55	102.01	N/A	2940	4510	
ALV4	Alluvial aquifer (L)	101.42	100.83	N/A	2370	3080	
	Shallow bedrock (S)	100.81	99.86	N/A	5480	6430	
ALV2	Alluvial aquifer (L)	93.13	92.00	N/A	3430	4160	
	Shallow bedrock (S)	92.37	91.56	2560	2930	3370	
ALV7	Alluvial aquifer (L)	86.56	85.48	N/A	2010	2310	
	Shallow bedrock (S)	78.73	71.66	N/A	2350	2540	
ALV8	Alluvial aquifer (L)	83.72	83.66	N/A	1490	1880	
	Shallow bedrock (S)	76.70	71.66	1540	1200	2400	

7.4.4 Monitoring Results Review

Monitoring results observed during the reporting period are summarised in this section with the breakdown of:

- Groundwater quality of alluvial and shallow bedrock aquifers including applicable ITARP summaries.
- Groundwater quality of the hard rock aquifer.
- Groundwater levels of alluvial and shallow bedrock aquifers including applicable ITARP summaries.
- Groundwater levels of hard rock aquifers.
- Comparison to EA predictions.

7.4.4.1 Groundwater Quality

Alluvial and Shallow Bedrock Aquifers

Long term groundwater quality monitoring results for the alluvial and shallow bedrock aquifers including the reporting period are shown in ***Figure 7-3*** to ***Figure 7-6*** and in ***Appendix D*** -; a summary of these results during the reporting period is provided herein.

There were no pH exceedances in 2023. ALV8L didn't have enough water to sample from July to December 2023. The pH level across both the alluvial and shallow Permian systems appear to have a relatively stable trend, with some fluctuation, that has existed throughout the data collection period as shown in ***Figure 7-3*** and ***Figure 7-4***.

Table 7-11 summarises the EC measurements of groundwater from January to May 2023, with comparison to the applicable trigger levels.

Table 7-11 2023 Groundwater exceedances for EC in alluvial and shallow bedrock aquifers for January to May 2023

Groundwater exceedances for EC (mS/cm) in alluvial and shallow bedrock aquifers													
Site	ALV1L	ALV1S	ALV2L	ALV2S	ALV3L	ALV3S	ALV4L	ALV4S	ALV7L	ALV7S	ALV8L	ALV8S	LBH
Impact assessment Criteria (three consecutive occurrences)													
Lower Limit	-	-	-	***2.56***	-	-	-	-	-	-	-	***1.54***	-
Upper Limit	***1.37***	***1.56***	***2.83***	***2.82***	***1.39***	***2.80***	***1.92***	***5.31***	***1.78***	***2.23***	***1.31***	***1.99***	***1.55***
Maximum	***2.02***	***1.77***	***4.16***	***3.37***	***3.08***	***4.51***	***3.08***	***6.43***	***2.31***	***2.54***	***1.88***	***2.40***	***3.09***
Jan	1.04	1.25	2.41	2.54	0.71	3.01	5.74	5.42	1.16	2.58	0.72	1.12	0.68
Feb	1.10	1.27	2.55	2.92	0.75	2.69	5.18	5.88	1.30	2.76	0.74	1.25	0.74
Mar	1.08	1.27	3.17	2.80	0.71	2.68	4.48	5.61	1.34	2.69	0.77	1.27	0.72
Apr	1.07	1.31	2.51	2.71	0.74	2.65	4.22	5.72	1.36	2.70	0.79	1.26	0.71
May	0.91	1.09	2.14	2.88	0.69	2.24	2.68	4.08	1.45	2.78	0.90	1.27	0.66

Green Shading – Denotes an exceedance of the 20%ile investigation limit

Orange Shading – Denotes an exceedance of the 80%ile investigation limit
Yellow Shading – Denotes an exceedance of the 100%ile maximum investigation limit.

Table 7-12 summarises the EC measurements of groundwater from June to December 2023, with comparison to the applicable trigger levels.

Table 7-12 2023 Groundwater exceedances for EC in alluvial and shallow bedrock aquifers for June to December 2023

Groundwater exceedances for EC (mS/cm) in alluvial and shallow bedrock aquifers													
Site	**ALV1 (L)**	**ALV1 (S)**	**ALV2 (L)**	**ALV2 (S)**	**ALV3 (L)**	**ALV3 (S)**	**ALV4 (L)**	**ALV4 (S)**	**ALV7 (L)**	**ALV7 (S)**	**ALV8 (L)**	**ALV8 (S)**	**LBH**
Impact assessment Criteria													
Lower Limit	-	-	-	***2.56***	-	-	-	-	-	-	-	***1.54***	-
Upper Limit	1.70	1.64	3.43	2.93	1.90	2.94	2.37	5.48	2.01	2.35	1.49	2.20	2.35
Maximum	2.02	1.77	4.16	3.37	3.08	4.51	3.08	6.43	2.31	2.54	1.88	2.40	3.09
Jun	0.97	1.19	1.89	2.12	0.77	2.47	2.87	4.62	1.30	2.42	0.83	1.17	0.73
Jul	1.11	1.29	1.84	2.88	0.81	2.72	3.57	5.71	1.54	2.82	-	1.34	0.83
Aug	1.12	1.30	1.25	2.91	0.86	2.73	3.52	5.74	1.55	2.59	-	1.35	0.86
Sep	1.05	1.30	1.20	2.85	0.93	2.63	3.30	5.28	1.49	2.68	-	1.37	0.82
Oct	0.95	1.17	1.05	2.59	0.85	2.48	2.85	5.03	1.42	2.60	-	1.18	0.81
Nov	1.07	1.29	1.10	2.84	0.94	2.93	3.11	5.23	1.54	2.81	-	1.28	0.89
Dec	1.03	1.15	1.29	2.69	0.88	2.52	2.53	5.04	1.42	2.75	-	1.22	0.88

Green Shading – Denotes an exceedance of the 20%ile investigation limit
Orange Shading – Denotes an exceedance of the 95%ile investigation limit
Yellow Shading – Denotes an exceedance of the 100%ile maximum investigation limit.

The requirement for an investigation has been triggered at ALV4L, ALV4S, and ALV7S by either three consecutive exceedances above the 80th percentile (January to May 2023), two consecutive exceedances above the 95th percentile EC limits, or one exceedance of the reference maximum (June to December 2023).

ALV8S has been consistently below the 20th percentile EC trigger limit. For this trigger to occur, it needs to be associated with a declining water level in the alluvium that is not climate related. There must also have been a measurable loss of streamflow that is not associated with recharging the alluvium or filling of instream storages.

The conclusions of these investigations are summarised ***Table 7-13*** ITARP investigations for quality triggers completed in 2023. It has been identified that the ITARP was inadvertently missed during the transition to the new investigation triggers for ALV4S being for two consecutive months above the 95th percentile (July and August). It can be noted that following the August 2023 EC result, there has been a downward trend from September onwards that remained below the 95th percentile.

Table 7-13 ITARP investigations for quality triggers completed in 2023

Month of exceedance	Month exceedance reported	Site	Conclusions
February	March	ALV4L	• There has not been any failure of the mine water containment system. • The difference in groundwater levels and water quality between the paired bores at ALV4 indicates there is not likely to be a hydraulic connection between the alluvium and the shallow Permian aquifers. • The ALV4L water quality results were anomalous compared to the historical data set. Since November 2022, EC was trending downward. • Water quality results and visual inspections have not detected a link with Dam 17, and the results do not indicate a seepage pathway between Dam 17 and the Bowmans Creek Alluvium was activated, as suggested by the conceptual model. • LCO will continue to monitor the water quality in ALV4L and Dam 17 monthly, as per the WMP.
February	March	ALV8S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV8S) were evident. However, ALV8 is located within the area of predicted drawdown for approved operations. The groundwater model review confirmed that drawdowns were consistent with the impacts predicted in the project approval. The alluvial drawdown is in line with predictions, and water take from the alluvium is in line with licensing limits. • Since late 2021, EC levels at ALV8S have declined below the 20th percentile trigger limit due to recharge from the overlying alluvial aquifer.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Backfilling of the Baywater Pit commenced in 2021 and is near the natural surface level, as of February 2023. Backfilling lessens likelihood of leakage from the creek to the pit. • The results recorded at ALV8S are not consistent with the rest of the Bowmans Creek alluvium. • LCO is unable to determine the mechanism for ongoing recharge from the alluvium. There is no evidence to support connection of the alluvium to the pit via the Permian. • LCO propose to continue monitoring in accordance with the WMP. A subsequent trigger investigation will be conducted if the EC measurements continue to fall outside the trigger levels for a further three months. • LCO engaged Umwelt to undertake a review of the monitoring network and triggers, including ALV8.
March	April	ALV7S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP. A subsequent investigation will be conducted if the EC observations exceed trigger limits for a following three months.
March	April	ALV4S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • The past 6-8 months saw below average rainfall, resulting in reduced flow in Bowmans Creek and an observed drop in water levels in the alluvium and shallow bedrock bores. • The direct relationship with EC and residual mass curve implies that the measurements are due to climate conditions rather than a specific mining related impact. • The increase in ALV4S does not appear to be related to the EC trigger recorded in ALV4L. • Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the more saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
May	June	ALV4L	• There has not been any failure of the mine water containment system. • There is a difference in groundwater levels and water quality between the paired bores at ALV4. This indicates a hydraulic connection between the alluvial and shallow Permian aquifers is unlikely. • The results in ALV4L are anomalous compared to the historical dataset.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Since the peak in November 2022, EC results at ALV4L are trending downwards. • Water quality analysis and visual inspections have not detected a link with Dam 17. • The results do not indicate that a seepage pathway has been activated between Dam 17 and the Bowmans Creek alluvium, as suggested by the conceptual model. • LCO will continue to monitor the water quality in ALV4L and Dam 17 monthly, as per the WMP.
May	June	ALV8S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV8S) were evident. However, ALV8 is located within the area of predicted drawdown for approved operations. The groundwater model review confirmed that drawdowns were consistent with the impacts predicted in the project approval. The alluvial drawdown is in line with predictions, and water take from the alluvium is in line with licensing limits. • Since late 2021, EC levels at ALV8S have declined below the 20th percentile trigger due to recharge from the fresher overlying alluvium. • Since December 2022, EC levels at ALV8S have been slowly increasing. • Backfilling of the Baywater Pit commenced in 2021 and is near the natural surface level, as of May 2023. Backfilling lessens likelihood of leakage from the creek to the pit. • The results recorded at ALV8S are not consistent with the rest of the Bowmans Creek alluvium. • LCO was unable to determine the mechanism for ongoing recharge from the alluvium. There is no evidence to support connection of the alluvium to the pit via the Permian.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• LCO propose to continue monitoring in accordance with the WMP.
June	July	ALV7S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. Above average rainfall from 2020 resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow rock bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system. • Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
July	August	ALV4L	• EC was observed above the maximum trigger limit at ALV4L. • There has not been any failure of the mine water containment system. • Water levels and water quality results from ALV4S and ALV4L indicated there is unlikely to be a hydraulic connection between the alluvium and the shallow Permian aquifers.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• The ALV4L water quality results were anomalous compared to the historical data set. Since November 2022, EC was trending downward with a slight increase shown from June 2023. • Water quality results and visual inspections have not detected a link with Dam 17. • Results do not indicate a seepage pathway between Dam 17 and the Bowmans Creek Alluvium was activated, as suggested by the conceptual model. • LCO will continue to monitor the water quality in ALV4L and Dam 17 monthly, as per the WMP.
July	August	ALV7S	• EC was observed above the maximum trigger limit at ALV7S. • There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. Above average rainfall from 2020 resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow rock bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the more saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
July	August	ALV8S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV8S) were evident. However, ALV8 is located within the area of predicted drawdown for approved operations. The groundwater model review confirmed that drawdowns were consistent with the impacts predicted in the project approval. The alluvial drawdown is in line with predictions, and water take from the alluvium is in line with licensing limits. • Since late 2021, EC levels at ALV8S have declined below the 20th percentile trigger due to recharge from the fresher overlying alluvium. • Since December 2022, EC levels at ALV8S have been slowly increasing. • Backfilling of the Baywater Pit commenced in 2021 and is near the natural surface level, as of July 2023. Backfilling lessens the likelihood of leakage from the creek to the pit. • The results recorded at ALV8S are not consistent with the rest of the Bowmans Creek alluvium. • LCO was unable to determine the mechanism for ongoing recharge from the alluvium. There is no evidence to support connection of the alluvium to the pit via the Permian. • LCO propose to continue monitoring in accordance with the WMP.

Month of exceedance	Month exceedance reported	Site	Conclusions
August	September	ALV4L	• There has not been any failure of the mine water containment system. • Water levels and water quality results from ALV4S and ALV4L indicated there is unlikely to be a hydraulic connection between the alluvium and the shallow Permian aquifers. • The ALV4L water quality results were anomalous compared to the historical data set. • Since November 2022, EC was generally trending downward. • Water quality results and visual inspections have not detected a link with Dam 17. • Results do not indicate a seepage pathway between Dam 17 and the Bowmans Creek Alluvium was activated, as suggested by the conceptual model. • LCO will continue to monitor the water quality in ALV4L and Dam 17 monthly, as per the WMP.
August	September	ALV7S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. Above average rainfall from 2020 resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow rock bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
September	October	ALV7S	• There has not been any failure of the mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. Above average rainfall from 2020 resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow rock bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. The last twelve months saw an average EC slightly above the maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system. • Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
September	October	ALV4L	• There has not been any failure of mine water containment system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Water levels and water quality results from ALV4S and ALV4L indicated there is unlikely to be a hydraulic connection between the alluvium and the shallow Permian aquifers. • The ALV4L water quality results were anomalous compared to the historical data set. • Since November 2022, EC was generally trending downward. • Water quality results and visual inspections have not detected a link with Dam 17. • Results do not indicate a seepage pathway between Dam 17 and the Bowmans Creek Alluvium was activated, as suggested by the conceptual model. • LCO will continue to monitor the water quality in ALV4L and Dam 17 monthly, as per the WMP.
September	October	ALV8S	• There has not been any failure of mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV8S) were evident. However, ALV8 is located within the area of predicted drawdown for approved operations. The groundwater model review confirmed that drawdowns were consistent with the impacts predicted in the project approval. The alluvial drawdown is in line with predictions, and water take from the alluvium is in line with licensing limits. • Since late 2021, EC levels at ALV8S have declined below the 20th percentile trigger due to recharge from the fresher overlying alluvium. • Since December 2022, EC levels at ALV8S have been slowly increasing. • Backfilling of the Baywater Pit was completed; it lessens the likelihood of leakage from the creek to the pit.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• The results recorded at ALV8S are not consistent with the rest of the Bowmans Creek alluvium. • LCO was unable to determine the mechanism for ongoing recharge from the alluvium. There is no evidence to support connection of the alluvium to the pit via the Permian. • LCO propose to continue monitoring in accordance with the WMP.
October	November	ALV7S	• There has not been any failure of mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. Above average rainfall from 2020 resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow rock bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. The last twelve months saw an average EC slightly above the maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system. • Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
November	December	ALV4L	• There has not been any failure of mine water containment system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Water levels and water quality results from ALV4S and ALV4L indicated there is unlikely to be a hydraulic connection between the alluvium and the shallow Permian aquifers. • The ALV4L water quality results were anomalous compared to the historical data set. • Since November 2022, EC was generally trending downward. • Water quality results and visual inspections have not detected a link with Dam 17. • Results do not indicate a seepage pathway between Dam 17 and the Bowmans Creek Alluvium was activated, as suggested by the conceptual model. • LCO will continue to monitor the water quality in ALV4L and Dam 17 monthly, as per the WMP.
November	December	ALV7S	• There has not been any failure of mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. Above average rainfall from 2020 resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV7S & ALV8S) were evident. However, the groundwater investigations have confirmed that these impacts were consistent with the predicted impacts. • Since late 2020, EC levels at ALV7S have generally declined towards the reference period maximum. The last twelve months saw an average EC slightly above the maximum. • The direct relationship between monitoring observations and rainfall, along with the EC and residual mass curve relationship, implies observations are due to climate variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S were due to the distinctly different climate conditions between the recent years and the baseline/reference period. Investigation trigger limits do not reflect the natural variability within the system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• Potential harm to the environment is not expected, as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the saline shallow bedrock material. • LCO will continue monitoring in accordance with the WMP.
November	December	ALV8S	• There has not been any failure of mine water containment system. • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. The period of 2020 – 2022 was above average rainfall. This resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV8S) were evident. However, ALV8 is located within the area of predicted drawdown for approved operations. The groundwater model review confirmed that drawdowns were consistent with the impacts predicted in the project approval. The alluvial drawdown is in line with predictions, and water take from the alluvium is in line with licensing limits. • Since late 2021, EC levels at ALV8S have declined below the 20th percentile trigger due to recharge from the fresher overlying alluvium. • Since December 2022, EC levels at ALV8S have been slowly increasing. • Backfilling of the Baywater Pit was completed; it lessens the likelihood of leakage from the creek to the pit. • The results recorded at ALV8S are not consistent with the rest of the Bowmans Creek alluvium. • LCO was unable to determine the mechanism for ongoing recharge from the alluvium. There is no evidence to support connection of the alluvium to the pit via the Permian. • LCO propose to continue monitoring in accordance with the WMP.
December	January	ALV7S	• There has not been any failure of mine water containment system.

Month of exceedance	Month exceedance reported	Site	Conclusions
			• The 2017 - 2019 drought climatic conditions were the most severe drought in the monitoring period and is therefore unprecedented during the groundwater monitoring reference period. 2020 - 2022 was a period of above average rainfall. This has resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • In 2021, mining impacts to the shallow bedrock aquifer (ALV7S and ALV8S) were evident. However, the groundwater investigations have confirmed that these are consistent with those predicted for the LCO project. • Since late 2020, EC levels at ALV7S has generally declined steadily towards the reference period maximum. The last 12 months has seen an average EC result of 2.68 mS/cm, slightly above the maximum. • The direct relationship between these monitoring observations and rainfall, as well as the trending relationship with EC and residual mass curves, implies that the measurements are due to climatic variations rather than a specific mining related impact. • Continued exceedances of investigation trigger limits at ALV7S are due to the distinctly different climatic conditions of the recent years to that of the baseline/reference period i.e. average to above average rainfall. Hence, investigation trigger levels adopted in the WMP do not reflect the natural variability within the actual system. • It is not expected that there is potential for harm to the environment as the Bowmans Creek system is varying naturally in response to an increase in groundwater level and interaction with the more saline shallow bedrock material. • LCO propose to continue monitoring in accordance with the WMP.

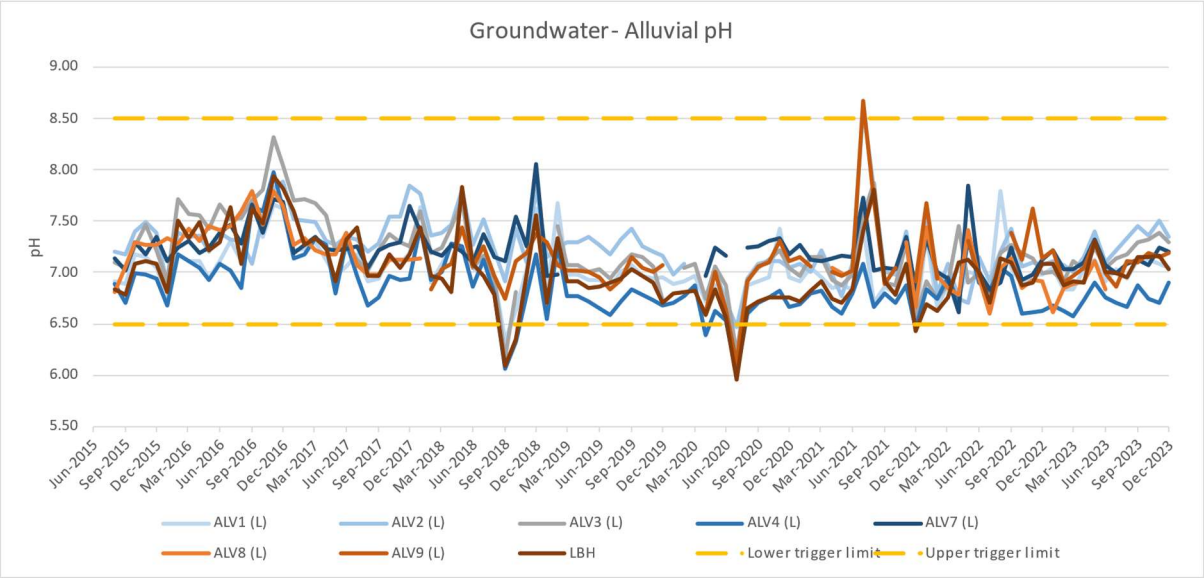


Figure 7-3 Groundwater - Alluvial pH

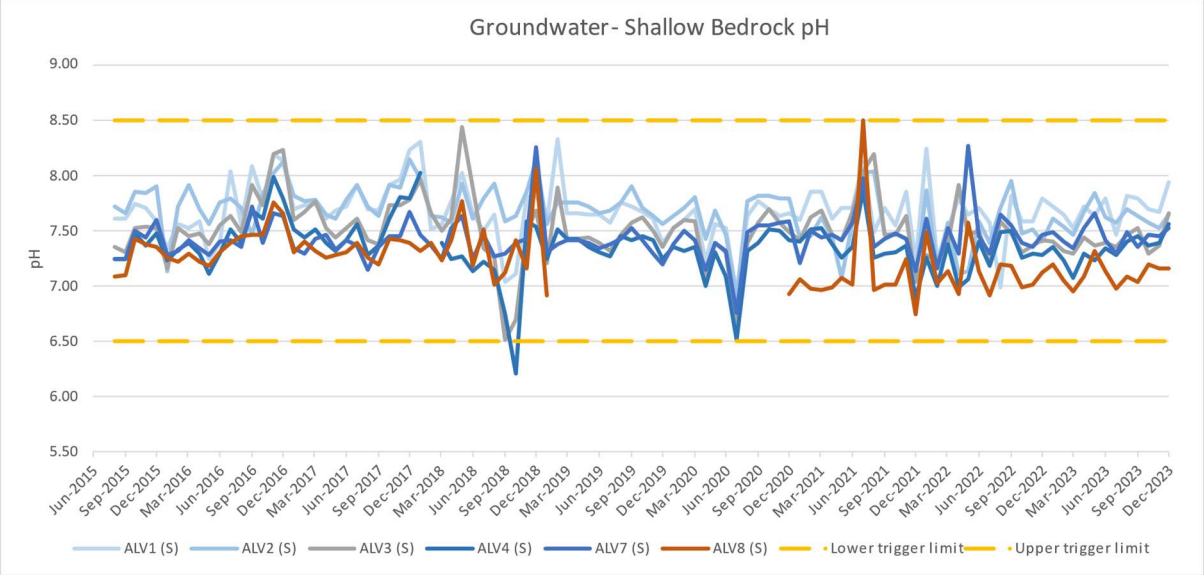


Figure 7-4 Groundwater - Shallow Bedrock pH

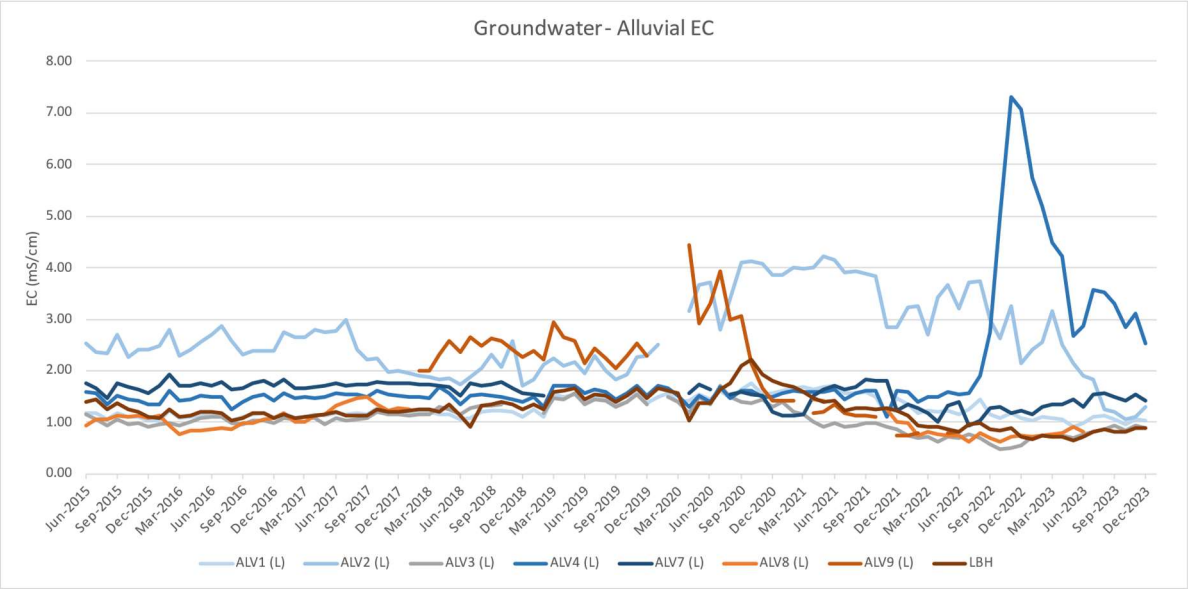


Figure 7-5 Groundwater - Alluvial Electrical Conductivity

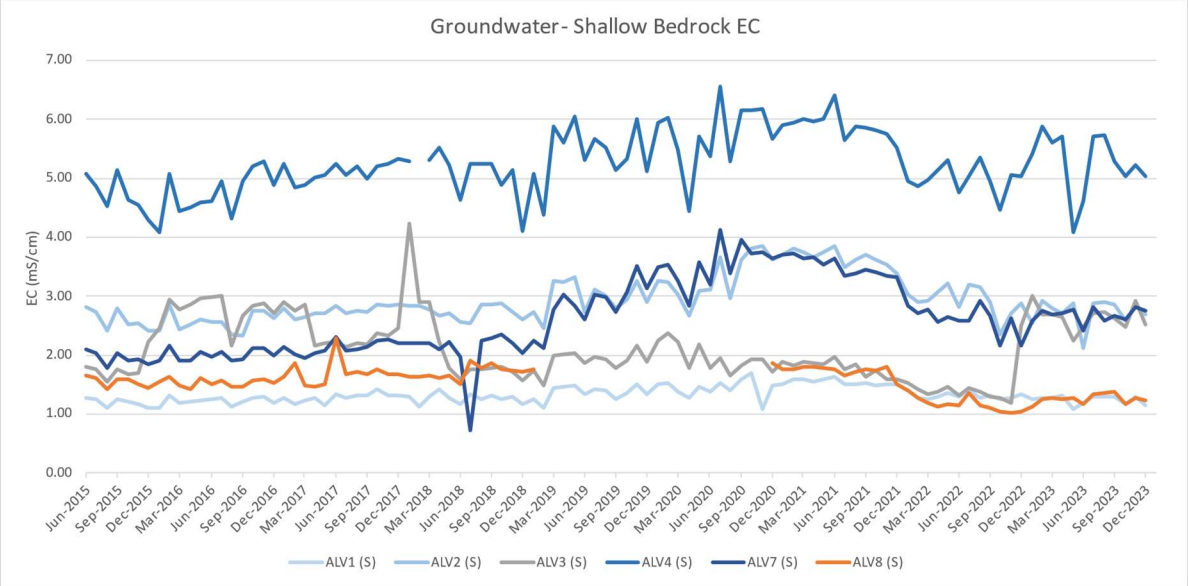


Figure 7-6 Groundwater - Shallow Bedrock Electrical Conductivity

Hard Rock Aquifer (Coal Measures)

Hard Rock Aquifer (Coal Measures)

Groundwater quality monitoring results for the hard rock aquifers during the reporting period is shown in ***Appendix D***.

The piezometer PGW5L (Pikes Gully Seam) is used as a reference for the groundwater pressure of the strata at depth. pH and EC trends within PGW5L have remained relatively stable over the monitoring period.

7.4.4.2 Groundwater Levels

Alluvial and Shallow Bedrock Aquifers

LCO monitor the groundwater level of the Bowmans Creek alluvial and shallow bedrock aquifers to identify any potential impacts from mining such as depressurisation. Hydrographs for piezometers targeting the alluvium and shallow bedrock are displayed in ***Figure 7-7*** and ***Future 7-8*** respectively.

The residual mass curve for rainfall is also presented in ***Figure 7-7*** and ***Figure 7-8***. The residual mass curve for rainfall calculates the difference between observed rainfall and the average amount of rainfall for that time of the year (defined monthly). The CRD trends for rainfall and evaporation provide the information to understand climatic conditions; for instance, a decreasing rainfall CRD trend indicates measured rainfall is below the long-term average and an increasing rainfall CRD indicates measured rainfall is greater than long-term averages. This was developed from the LCO onsite meteorological station to provide representative of conditions on site.

Groundwater elevations within the water table aquifer decrease with distance downstream. This is because the elevation of the water table within a near surface aquifer (for example, the water table aquifer at LCO) is typically a subdued reflection of surface topography, i.e. in the same way that a surface water course flows from high topographic elevation to low topographic elevation. The steepness of the hydraulic gradient (slope of groundwater elevation with distance down-gradient) reflects other factors including the differences in propensity for recharge.

With reference to the full historical monitoring results, the synchronised response in groundwater levels observed in the paired bores indicate similar processes are driving the recharge for both the alluvial aquifer and shallow bedrock aquifer. Rainfall (recharge) appears to be the dominant driver for groundwater level variability for the Bowmans Creek alluvium and underlying shallow bedrock.

With respect to trigger exceedances, there were no exceedances of the Impact Triggers (Definition #1) for alluvial drawdown impact assessment (ALV8L & ALV9L). There was one Investigation trigger (Definition #2) report at ALV8L, and a Subsequent investigation trigger exceedance (Definition #3) at ALV7S and ALV8S.

In 2023, the groundwater level of ALV8L reduced below its accurate monitoring depth. The impact trigger for ALV8L was unable to be determined while the groundwater level was below the monitoring range of the piezometer.

The residual mass curves for rainfall and evaporation suggest below average rainfall and above average evaporation conditions prevailed during 2023. The climatic conditions throughout 2023 have generally resulted a decrease in groundwater levels for the alluvial and shallow bedrock bores.

Table 7-14 and 7-15 present recorded exceedances of groundwater level triggers during the 2023 monitoring period. ***Table 7-16*** presents a summary of the ITARP investigations completed in 2023.

In 2023, mining impacts to the shallow bedrock aquifer at ALV7S and ALV8S continue to be evident. However, groundwater investigations completed to date have not concluded that mining activities have resulted in impacts not approved for LCO. Refer to ***Table 7-17*** for more detail.

Table 7-14 January to May 2023 Groundwater level trigger exceedances (definition #2)

Groundwater level exceedances (m depth to groundwater)													
Site	ALV1L	ALV1S	LBH	ALV3L	ALV3S	ALV4L	ALV4S	ALV2L	ALV2S	ALV7L	ALV7S	ALV8L	ALV8S
Impact Assessment Criteria													
90%ile	4.97	4.75	5.05	5.7	5.99	5.56	6.28	4.8	4.67	6.75	10.21	6.96	9.03
Max	6.31	6.84	6.24	7.08	7.26	6.73	7.42	6.76	8.53	7.34	11.38	8.36	11.08
Jan	3.30	1.25	3.65	3.82	5.23	4.79	5.41	4.33	4.09	6.34	12.48	6.99	16.15
Feb	3.39	1.27	3.72	4.90	5.16	4.83	5.53	4.37	4.14	6.46	12.94	7.10	16.39
Mar	3.50	1.27	3.75	4.93	5.18	4.84	5.57	4.37	4.16	6.57	13.29	7.29	16.59
Apr	3.33	1.31	3.87	4.89	5.15	4.85	5.57	4.36	4.13	6.62	13.47	7.39	16.69
May	3.42	1.09	3.97	4.94	5.22	4.97	5.58	4.36	4.12	6.72	13.72	7.21	16.60

Orange Shading – Denotes an exceedance above the 90%ile investigation limit
Yellow Shading – Denotes an exceedance above the 100%ile maximum investigation limit

Table 7-15 June to December 2023 Groundwater level trigger exceedances (definition #2)

Groundwater level exceedances (m depth to groundwater)													
Site	ALV1L	ALV1S	LBH	ALV3L	ALV3S	ALV4L	ALV4S	ALV2L	ALV2S	ALV7L	ALV7S	ALV8L	ALV8S
Impact Assessment Criteria													
90%ile	**5.47**	**5.14**	**5.58**	**6.45**	**6.96**	**6.28**	**6.89**	**4.75**	**4.51**	**7.21**	**15.04**	**8.30**	**15.32**
Max	**6.31**	**6.84**	**6.24**	**7.30**	**7.84**	**6.87**	**7.84**	**5.88**	**6.32**	**8.29**	**22.11**	**8.36**	**19.13**
Jun	3.65	1.19	3.80	4.98	5.25	5.00	5.64	4.39	4.21	6.78	14.00	7.48	16.78
Jul	3.82	1.29	3.89	5.02	5.31	5.13	5.83	4.43	4.30	6.86	14.39	8.29	17.21
Aug	3.96	1.30	4.02	5.07	5.35	5.18	5.73	4.43	4.30	6.90	14.63	8.31	17.49
Sep	3.75	1.30	3.89	4.99	5.30	5.12	5.89	4.30	4.42	6.98	14.93	8.35	17.39
Oct	4.09	1.17	4.08	5.08	5.40	5.13	5.35	4.46	4.37	7.05	15.20	8.31	18.08
Nov	4.35	1.29	4.31	5.24	5.54	5.31	6.11	4.51	4.42	7.14	15.42	8.31	18.34
Dec	4.68	1.15	4.50	5.46	5.75	5.44	6.24	4.57	4.49	7.16	15.62	8.31	18.53

Orange Shading – Denotes an exceedance above the 90%ile investigation limit
Yellow Shading – Denotes an exceedance above the 100%ile maximum investigation limiy

Table 7-16 Groundwater level trigger exceedances investigation summary, 2023

Month of investigation trigger	Month exceedance reported	Site	Conclusions
January	February	ALV7S ALV8S	• There has been no exceedance of the groundwater drawdown triggers (definition #1). • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. • The 2021 – 2022 period of above average rainfall resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. Groundwater levels at ALV8S remained below the maximum trigger level, after showing some recovery since 2020. The reference bore, ALV7S, periodically recorded above the maximum trigger level, but has since trended below the level. • Mining extraction has not extended beyond its approved limits. Mining is not planned to extend to the full extent of approved depths, lateral limits, or through geological features (Davis Creek fault) associated with modelled peak groundwater impacts. • The groundwater impact model has been updated since the Mod 5 impact assessment to reflect more available information. Both the 2018 and 2021 Groundwater Impact Model Validation assessments indicates the model is fit for purpose and remains conservative. Further, the following key points are noted: - There are no additional drawdown impacts due to mining beyond what has been approved. - The Permian groundwater units that are affected by mining activities are disconnected to the overlying alluvium. - LCO holds a sufficient license quantity to account for the predicted indirect take from the Bowmans Creek Alluvium and Permian Coal Measures. • Continued exceedances of investigation trigger limits are due to the distinctly different climatic conditions of the recent years to that of the baseline/reference period which was average to above average rainfall. Hence, investigation trigger levels adopted in the WMP do not reflect the natural variability within the actual system.

Month of investigation trigger	Month exceedance reported	Site	Conclusions
			• Umwelt's review concluded the degree of depressurisation within the shallow Permian appears to be higher than previously predicted, with respect to ALV7S and ALV8S. This was possibly due to localised influence of the multi-seam longwall mining and/or dewatering increasing a downward gradient. • Streamflow monitoring indicates Bowmans Creek continues to be influenced by climatic conditions and does not appear to be unduly impacted by mining operations. • LCO will continue to monitor groundwater levels at ALV7S and ALV8S for a further twelve months in accordance with the WMP.
March	April	ALV8L	• There has been no exceedance of the groundwater drawdown triggers (definition #1). • The 2017 – 2019 climatic conditions recorded the most severe drought in the monitoring period. It was unprecedented during the groundwater monitoring reference period. • The 2021 – 2022 period of above average rainfall resulted in recovery of groundwater levels in the alluvium and shallow bedrock systems. • The late-2022 to early-2023 period showed below average rainfall, with groundwater levels in ALV8L declining in response. • Mining extraction has not extended beyond its approved limits. The observed drawdown at ALV8 in within the approved limits. • Streamflow monitoring indicates Bowmans Creek continues to be influenced by climatic conditions and does not appear to be unduly impacted by mining operations. • The March 2023 trigger levels are higher than the revised levels submitted as part of the WMP update in April 2023. • LCO will continue to monitor groundwater levels at ALV8L for a further twelve months in accordance with the WMP.

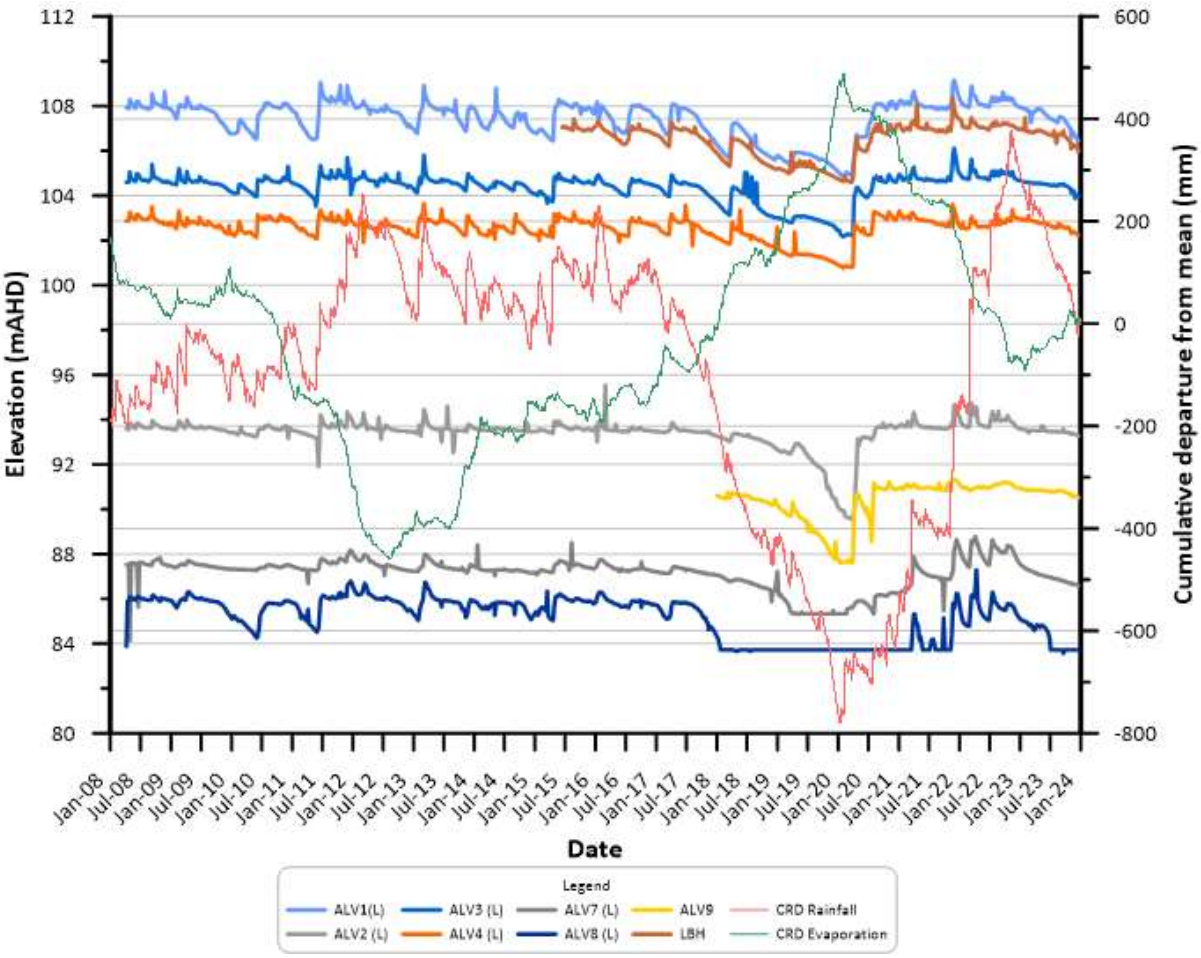


Figure 7-7 Groundwater - alluvial elevations

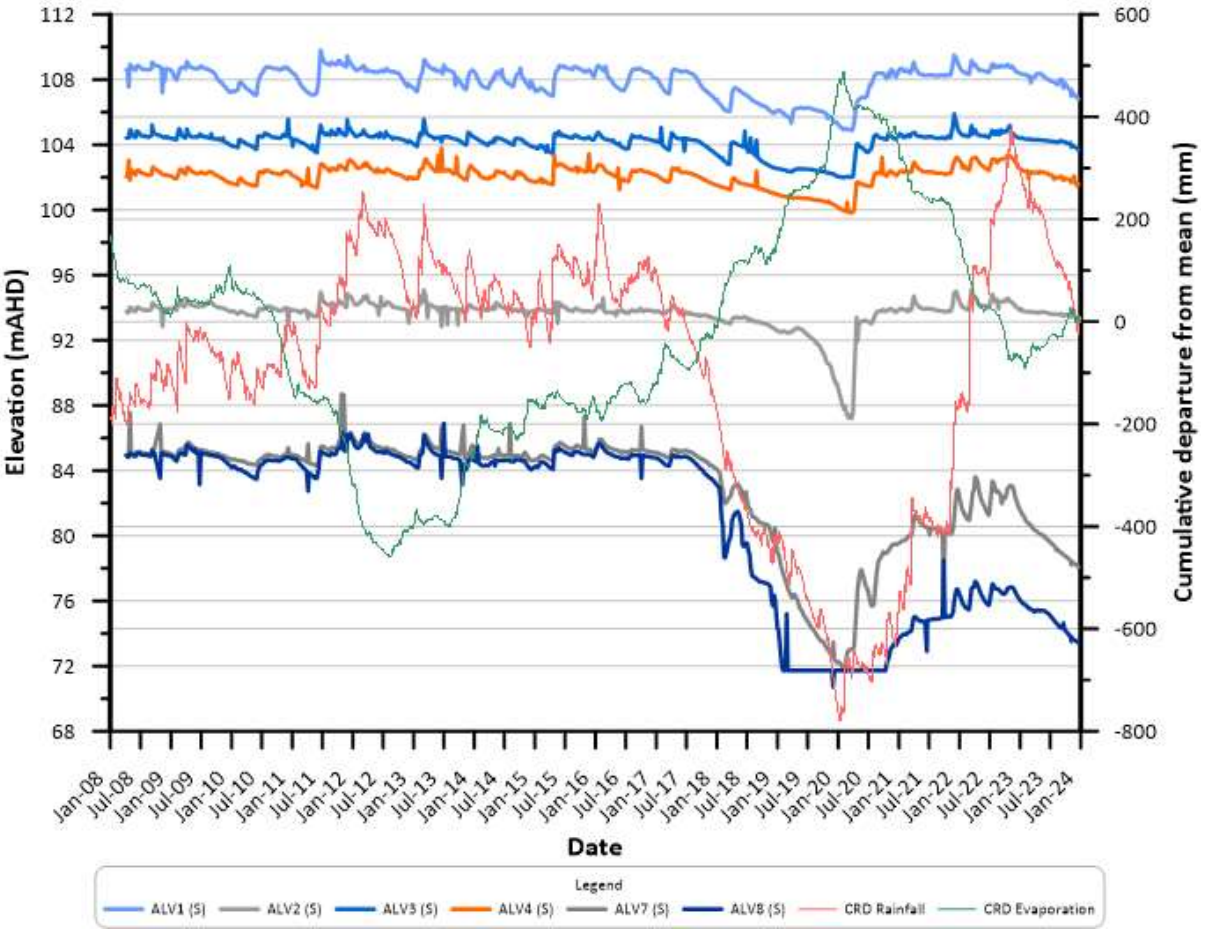


Figure 7-8 Groundwater – shallow bedrock elevations

Hard Rock Aquifer (Coal Measures)

LCO monitor several hard rock aquifers to provide for the ongoing water management onsite. Hydrographs for piezometers targeting the regional hard rock aquifer associated with the coal measures are shown in ***Figure 7-9***. The groundwater elevations vary significantly between the piezometers monitored, reflecting differences in groundwater levels between different stratigraphic layers due to recent and historical mining and dewatering operations. There are no investigation groundwater trigger levels for monitoring of these aquifers.

Figure 7-9 shows a significant difference in groundwater elevation between the alluvial and shallow bedrock water table piezometers and the groundwater elevations maintained in the previous underground workings, as indicated by bores such as 8 South (whilst available), M49 and the Middle Liddell Bore (MLB).

Piezometer PGW5S overlies the Hazeldene workings. As shown in ***Figure 7-9***, there is no groundwater level response at PGW5S due to changes in groundwater elevation in the Hazeldene monitoring locations (Haz 1 to Haz 6).

Groundwater levels in the Liddell underground workings are subject to change due to dewatering activities associated with open cut mining operations at LCO. M49 and Mount Owen 2 increased in measured levels in 2020 due to limited dewatering with a pump failure. Dewatering of the underground workings by intermittent pumping of M49 and Mount Owen 2 recommenced in

December 2020 and will continue as required, with groundwater levels fluctuating between about -21 and -32 m AHD.

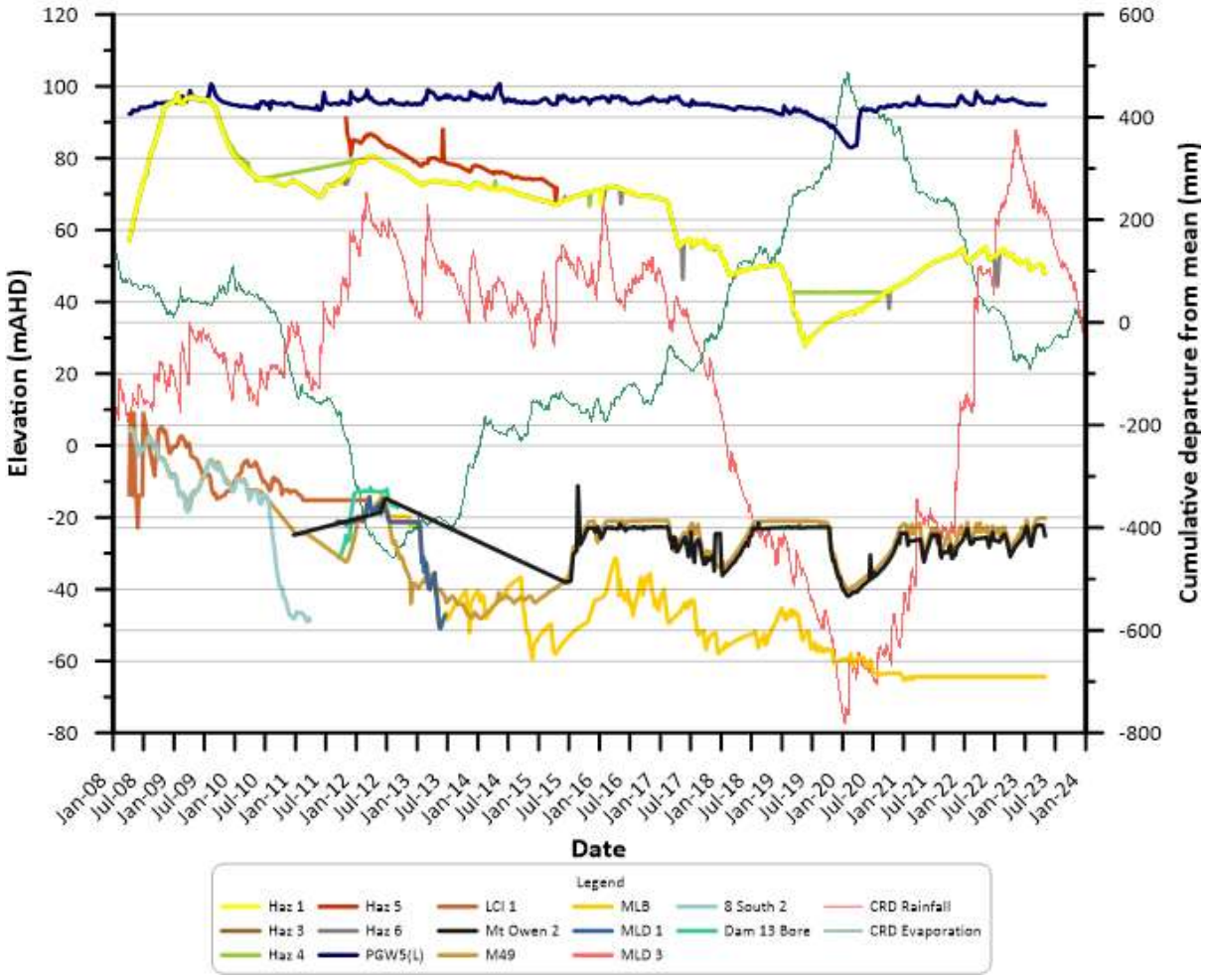


Figure 7-9 Groundwater - bedrock elevations

7.4.4.3 Groundwater Comparison to EA Predictions

With reference to the EA predictions from the groundwater assessment (SKM, 2013), this section identifies the predictions made with comparison to monitoring findings and the review of groundwater model predictions undertaken in 2021, as detailed in ***Table 7-17*** below.

Table 7-17 Groundwater impact comparison to EA predictions

Groundwater Impact Comparison to EA Predictions	
Key EA Conclusion	**Comparison to Monitoring Observations and Model Verification**
Impacts to Bowmans Creek alluvial aquifer (Quaternary Alluvium)	
Prior to 2019, the magnitude of alluvial losses estimated by the model under the proposal are similar to the leakage rates predicted for current mining operations at LCO. The estimated losses from the alluvium amount to between 30 to 40 ML/year up to 2021, and peak at 65 ML/year in	Indirect or passive water take occurs where flow of water to adjacent aquifers is influenced by adjacent mining activities. For LCO, indirect water take can occur from the alluvial aquifer in Bowmans Creek if the flow of Permian water to the alluvium is reduced. The corrected simulated indirect alluvial groundwater take in 2022/2023 was estimated at

Groundwater Impact Comparison to EA Predictions	
2021. In 2022, losses are predicted to reduce to approximately 50 ML/year.	approximately 47 ML (AGE, 2021). LCO holds sufficient licences to account for the predicted take in AGE (2021).
Under the proposed modification, model results predict that the progression of the South Pit has negligible impact on the Bowmans Creek alluvial aquifer in terms of increased leakage or drawdown.	Monitoring and investigations have not determined there to be increased impacts to the Bowmans Creek alluvium due to mining the South Pit.
Estimates of historical baseflow contributions to Bowmans Creek streamflow suggest the peak estimated loss of groundwater flow (65 ML/year) caused by the proposed modification accounts for approximately 1% to 3% of the estimated baseflow component of streamflow and <1% of median annual streamflow for Bowmans Creek.	The predicted peak annual leakage rate of 65 ML/year from the alluvium in 2021 (from MOD 5) is lower than the corrected simulated indirect alluvial groundwater take in 2022/2023 (peak amount) at approximately 47 ML (AGE, 2021).
Predicted drawdown of water tables in alluvial aquifers associated with Bowmans Creek does not exceed the 2 m trigger for more than minimum harm outlined in the NSW Aquifer Interference Policy (2012). The predicted drawdown is localised to two small areas of the estimated alluvial extents.	The 2 m trigger for alluvial bores was not exceeded in 2023. During 2023 ALV8L became dry and its 2 m trigger limit could not be determined.
Historical monitoring of groundwater within the Bowmans Creek alluvium suggests minimal impact of mining operations on groundwater quality, and model simulations provide no indication that the proposed modification will alter the hydrogeologic regime in a manner that would adversely affect groundwater quality.	There were no pH exceedances in 2023. There have been numerous exceedances of the EC investigation trigger. From the trigger investigations, the exceedances are expected to be predominantly due to climatic conditions rather than a mining related impact. LCO will continue to monitor in accordance with the WMP.
Impacts to hard rock aquifers	
Estimated total groundwater extraction from the regional hard rock aquifer, determined as the sum of pit inflows and dewatering requirements, needed to accommodate the proposed modification peaks at about 5,500 ML/year. LCO currently holds extraction licenses totalling 27,000 ML/year for this water source.	The information provided in the review of groundwater model predictions undertaken in 2021 indicates that the modelled and measured extraction of hard rock aquifers is within licence limits and below the estimated peak of about 5,500 ML/year. As shown in ***Table 7-2***, the sum of passive and active takes during the reporting period was 1,012.4ML and 2,221.9 ML respectively; a total of 3,234.3ML.
Post mining equilibrium simulations predict the Entrance Pit final void will act as a sink and the South Pit will act as a source for groundwater flow from and to the regional hard rock aquifer. Predicted increases in salinity in the South Pit final void (G&A, 2013) result in potential long-term impacts to groundwater quality in the hard rock aquifer due to leakage of increasingly saline water	Liddell Coal Modification 8 (DA 305-11-01 MOD 8), approved in May 2023, involves the placement of tailings in the South Pit void and storage of water in the Entrance Pit void. With these changes, the water level was predicted to equilibrate at around: • -12 mAHD for the base case scenario for the South Pit void

Groundwater Impact Comparison to EA Predictions	
from the South Pit final void when water levels in the void are above approximately 65 mAHD. Full recovery water level in the voids is currently modelled to be to 67 mAHD based on historic rainfall records.	• -10 mAHD for the partially filled with tailings scenario for the South Pit void • -3 mAHD for the base case scenario for the Entrance Pit void. These levels are well below the EA predictions (Mod 5). As stated in MOD 8 "The predicted water levels indicate that the water bodies within the final voids will form a sink within the groundwater regime at the water table. However, at depth within the voids there is the potential for some outflow of waters towards the Glendell Continued Operations Project final void, particularly through the Middle Liddell seam." This is a similar conclusion as reached for the EA (Mod 5), with the Entrance Pit final void will act as a sink for groundwater flow and the South Pit final void will act as a source of groundwater flow to the hard rock aquifer. Water level comparisons to the EA predictions are yet to be triggered, as mining has only recently ceased.

7.4.4.4 Review of Groundwater Model Predictions

In 2013, LCO applied to modify the DA to extend the footprint of the two onsite open pits. This modification was termed MOD5 and a numerical groundwater model of the LCO region was developed to evaluate potential groundwater impacts as part of the Environmental Assessment. The Department of Planning granted approval for MOD5 on 1 December 2014 and stipulated that the groundwater model be validated every three years by comparing measured groundwater levels to model simulated levels (Environmental Condition 3.23.v). To address this condition, a model validation review was completed in 2018 and a subsequent validation was undertaken in 2021.

The validity of the numerical model predictions were assessed by comparing observed water levels and inflows to model predictions. Overall, the model performed well compared to observed measurements. Observed declines in the ALV bores within the Bowmans Creek alluvium over the three-year period between 2018 and 2021 were generally in the order of 2 m. The model generally predicted a similar or slightly larger drawdown than was observed in several alluvial bores. The model validation review found that the model over-predicted the impacts in several alluvial wells and is considered fit-for-purpose. Generally, predicted impacts are less than or consistent with impacts predicted in MOD5 and observed impacts do not exceed the approved impacts. LCO holds a sufficient licensed quantity to account for the predicted indirect take from the Bowmans Creek alluvium.

No substantial (and detrimental) deviation from the predicted water table and pressure surfaces was seen and the model does not require additional refinement. While climate induced oscillations were observed, there were no systematic declining trends that could be attributed to mining at this stage in the monitoring data. The effect of mining is unclear because both mining and climatic conditions impact the groundwater levels, but the significant climatic variability masks the mining effects. Despite this modelling indicates that mining is having, and has had, some impact consistent with approved predicted impacts on the Bowmans Creek alluvium where mining is located in close proximity.

The numerical model generally predicts trends within the Permian coal measures or over-predicts impacts, indicating the model is conservative. The review also indicates the revised model provides a conservative estimate of direct and indirect water take. The volume of licensing held by LCO is sufficient to account for the predicted direct and indirect water take from each water source. The revised groundwater model is therefore considered suitable for ongoing use to assess impacts from the Liddell mine.

8. Rehabilitation

LCO has completed an Annual Rehabilitation Report for 2023 in accordance with the requirements of the NSW Resources Regulator.

LCO prepared a Rehabilitation Management Plan (RMP), in accordance with the NSW Resources Regulator rehabilitation reforms.

8.1 Post Mining Land Use

Post mining land use options for LCO were reviewed and assessed for the preparation of the Rehabilitation Strategy included in the ***MOD 5 EA (Umwelt, 2013).*** The proposed final landform and final land uses are depicted on Plan 1 of the Rehabilitation Management Plan (RMP) and are outlined in the sections below. Features of the proposed final landform and final land uses are described below.

The proposed final landform and land use for LCO is shown in ***Figure 8-1*** and includes woodland habitat corridors that connect with proposed native vegetation rehabilitation at Ravensworth Operations, Mount Owen Complex and the Ravensworth Operations Hillcrest Offset Area. Additionally, habitat enhancement will be undertaken along Bowmans Creek to enhance habitat specifically for the Spotted-tailed Quoll. Regeneration works associated with Bowmans Creek are documented in the ***Biodiversity Management Plan (BMP)***.

The overall post-mining land use goals are to:

- establish a mix of grasslands capable of supporting sustainable grazing, and native vegetation corridors to enhance habitat connectivity.
- establish a landform, natural resources and vegetation suitable for the post mining land uses and to achieve the requirements of the development consent; specifically 731ha of Central Hunter Box-Ironbark Woodland and grassland for sustainable agriculture.
- Progressive rehabilitation activities occur throughout the life of mine to allow minimisation of environmental impacts (dust emissions, habitat disruption) and maximisation of opportunities for the development of vegetation prior to mine closure.

Rehabilitation objectives are the set of objectives required to achieve the final land use for the mining area. Rehabilitation completion criteria set out the criteria which demonstrate the achievement of the rehabilitation objectives. Rehabilitation objectives for LCO were submitted via the Regulator Portal and approved by the Resources Regulator as Rehabilitation Objectives Statement (ROBJ0001176) in February 2023. Proposed completion criteria were submitted via the Regulator Portal on 26 April 2023. The initial application was made with proposed completion criteria, indicators and validation methods provided for the majority of rehabilitation and objectives. Where further investigation and refinement of the proposed completion criteria and indicators, the following statement was provided against those criteria: 'Further refinement of this rehabilitation completion criteria is required before an amended rehabilitation completion criteria statement can be approved.'

LCO is required to prepare a Final Landuse and Rehabilitation Plan(s) (FLRP) in accordance with Clauses 9 and 12 of Schedule 8A, to the Mining Regulation 2016. To achieve this, the following spatial themes have been submitted via the Mine Rehabilitation Portal:

- Final land use;
- Final landform features;
- Project approval boundary; and

- Final landform contours.

The FLRP shows a spatial depiction of the 'final land use' as defined under clause 6(4) of the Mining Regulation 2016. The submission FLRP0001134 was approved by the Resources Regulator on 17 February 2023.

8.2 Current Status

Rehabilitation and disturbance status of the operation as at the end of the reporting period is shown in ***Figure 8-1***. The figure shows the extents of mining related disturbance and rehabilitation completed to date (differentiated between grassland and woodland type) and 5m contours. During the reporting period, LCO completed rehabilitation and disturbance activities, as described in ***Table 8-1***.

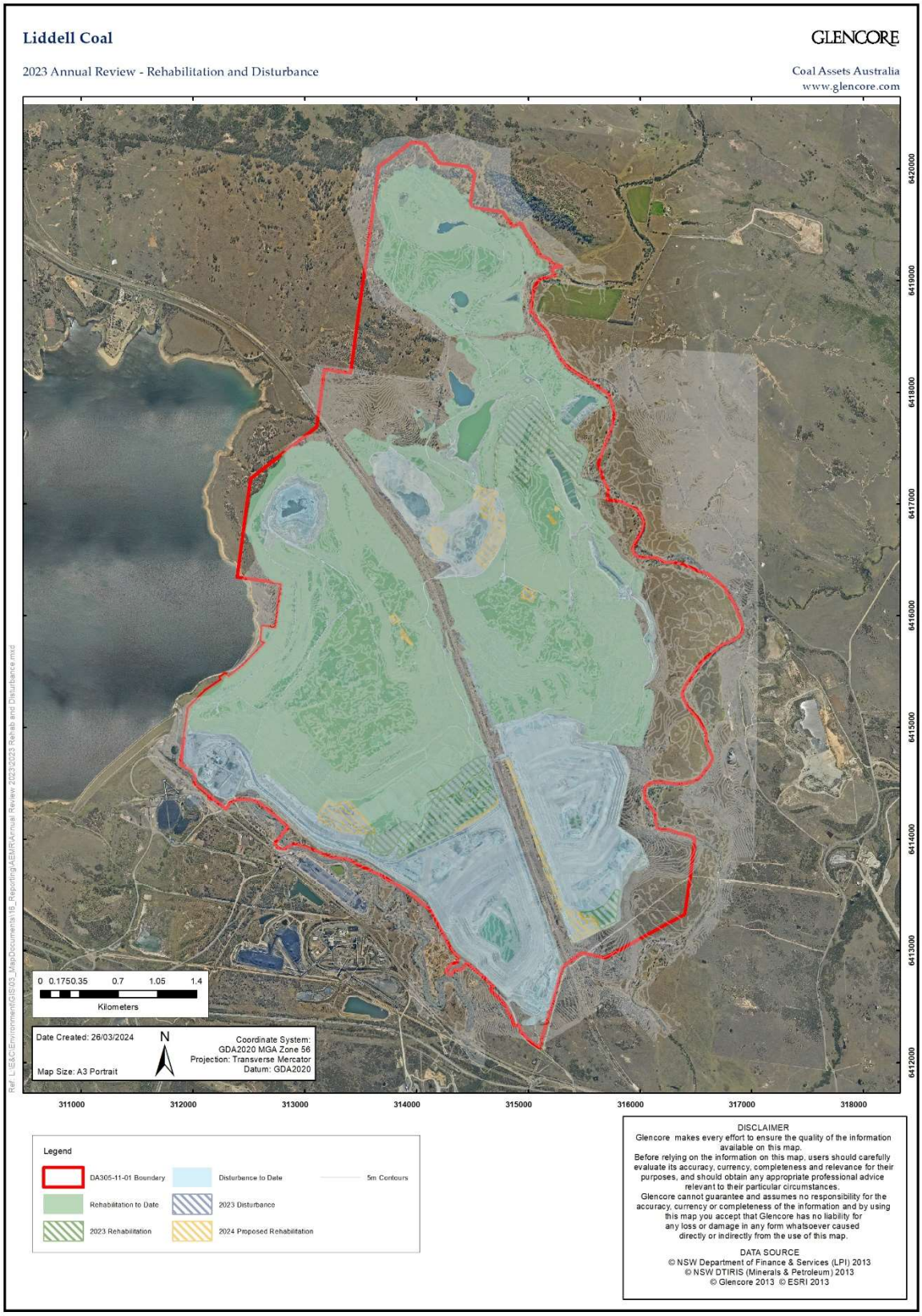


Figure 8-1 Rehabilitation completed 2023 and rehabilitation forecast

Table 8-1 2023 Rehabilitation Summary

2023 Rehabilitation Detail					
South Pit (RL 130)					
Domain	3	**Re-vegetation Date:**	December 2023	**Area:**	40 ha
Land Use: Woodland Seed/Plant Mix: Native woodland and cover crop Rehabilitation area is on the southern extent of the South Pit overburden emplacement facing south towards the New England Highway. Bulk shaping of material was completed in November 2023 with slopes generally 0 – 12 degrees, with minor areas >18 degrees to tie into drainage lines. Surface water drainage includes a main drain and a number of rock armoured drains all directing flow south towards the south pit void. Gypsum was applied at 10 tonne per hectare. Topsoil was placed approximately 10m either side of the rock armoured drains and in the main drain at an approximate depth of 100 mm. Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Biomix was applied at 100t/ha where there was no topsoil. Ameliorants were ripped 400 mm into the soil along the contour, with rocks brought to the surface during this process selectively left on the surface. Additional habitat material was constructed including installation of rock piles and stag trees for native fauna. Seeding was completed by drone, in two stages, following site preparation with woodland species seed mix consistent with target vegetation, Central Hunter Box Ironbark Woodland. Status at the end of 2023 was partial germination of cover crop. No surface erosion has occurred and deep ripping should mitigate rill occurrence. It is expected that the area will change significantly as it develops over the first 3 years.					
Bayswater Pit (RL 100)					
Domain	6	**Re-vegetation Date:**	December 2023	**Area:**	5 ha
Land Use: Woodland Seed/Plant Mix: Native woodland and cover crop Rehabilitation area is on the southern extent of the Bayswater Pit overburden emplacement facing south towards the New England Highway. Bulk shaping of material was completed in November 2023 with slopes generally 0 – 12 degrees. There is no formal construction of drainage as per the design Gypsum was applied at 10 tonne per hectare. Topsoil was placed across the entire area at an approximate depth of 100 mm. Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Ameliorants were harrowed 300-400 mm into the soil. Additional habitat material was constructed including installation of rock piles and stag trees for native fauna. Seeding was completed by drone, in one stage, following site preparation with woodland species seed mix consistent with target vegetation, Central Hunter Box Ironbark Woodland. Status at the end of 2023 was partial germination of cover crop. No surface erosion has occurred and deep ripping should mitigate rill occurrence. It is expected that the area will change significantly as it develops over the first 3 years.					
Antiene Tailings Storage Facility Rehabilitation Project					

2023 Rehabilitation Detail					
Domain	**7**	**Re-vegetation Date:**	January – May 2023	**Area:**	32 ha
Land Use: Pasture Seed/Plant Mix: Pasture and cover crop This area covers a portion of the former decommissioned Antiene Tailings Storage Facility (TSF) and Dam 4 void, partially visible from Hebden Road. Overburden capping for the TSF was won from the adjacent rehabilitation area. Shaping was completed in comprising of approximately 10 degree slopes constructed to a natural landform design. Surface water drainage includes a number of rock armoured drains directing flow to the north and east (subsequently to Dam 4). Topsoil was also won from the adjacent rehabilitation areas and applied at an approximate thickness of 100 mm. Other ameliorants applied included liquid gypsum, biosolids, biomix, fertilisers and wood fibre mulch. Surface preparation of the area included ripping to 400 mm and along the contour. Seeding was completed using a combination of hydromulch and drone application, with pasture species seed mix consistent with the RMP.					

Table 8-2 Rehabilitation status

Rehabilitation Status			
	Previous Reporting Period (Actual ha)	**This Reporting Period (Actual ha)**	**Next Reporting Period (Forecast ha)**
	2022	**2023**	**2024**
A: Total disturbance footprint – surface disturbance	1643	1644	1644
B: Total active disturbance	621	561	348
C: Rehabilitation – land preparation	70	0	179
D: Ecosystem and land use establishment	1022	296	330
E: Ecosystem and land use development	0	787	737
F: Rehabilitation completion	0	0	50

Table 8 in Condition 37, Schedule 3 of DA 305-11-01 MOD 8 provides the Rehabilitation Objectives that LCO must comply with.

Table 8-3 - DA 305-11-01 Rehabilitation Objectives

Feature	Objective	2023 Status
Mine Site (as a whole)	Safe, stable and non-polluting	Annual rehabilitation monitoring includes an assessment of erosion and drainage issues, any issues identified are put into a maintenance plan and remediated. In 2023, some minor areas of erosion were repaired in South Cut and Mt Block.
	Final landforms designed to incorporate micro-relief and integrate with surrounding natural landforms	All new landform designs include natural landform principles. All landforms constructed in 2023 incorporated these principles.
	Constructed landforms drain to the natural environment (excluding the final voids)	With exception of some catchments associated with the South and Entrance Pit low-walls, all other catchments drain externally, including via pit lakes which are designed to eventually spill into the surrounding environment. During 2023 LCO undertook further assessment to determine how runoff from rehabilitated landforms can be returned to the natural environment, including installing monitoring devices to capture runoff and development of a clean water release strategy.
	Minimise visual impact of final landforms as far as reasonable and feasible	All externally facing landforms are suitably vegetated to minimise visual impacts.
	Ensure there are no adverse flood impacts to privately owned properties	There has been no identified changes to the flood behaviour of Bowmans or Bayswater Creeks as a result of rehabilitation works at LCO.
Final voids	Minimise to the greatest extent practicable: • the size and depth of final voids • the drainage catchment of final voids	Landform designs for the low-walls associated with the final voids are revised to maximise the catchment which will report offsite. Rehabilitation completed in 2023 in South Cut, Bayswater and Antiene TSF will all drain offsite in the future once deemed suitable for release.

Feature	Objective	2023 Status
Surface infrastructure	To be decommissioned and removed, unless the Secretary agrees otherwise	Decommissioning and demolition strategies are being prepared as part of mine closure works. During 2023, redundant water management infrastructure and hardstand areas were removed from site.
Revegetation	Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprising: • at least 731 hectares of Central Hunter Box-Ironbark Woodland • habitat for threatened flora and fauna species including habitat connectivity for the Spotted-tailed Quoll	LCO is progressing with rehabilitation to reach the required 731 hectares of woodland vegetation across the site, which includes rehabilitation areas, offset areas and buffer lands within the Project Area. An additional 49 hectares of woodland vegetation was completed in 2023 at LCO. These rehabilitation areas include habitat features, such as logs and rock piles, for the Spotted-tailed Quoll and other fauna species. Maintenance works, such as weed spraying and infill planting, continued through 2023.
	Maintain, establish and/or restore grassland areas with pockets of native vegetation to support sustainable agricultural activities, as shown conceptually in Appendix 3	27 hectares of pasture rehabilitation was planted in 2023. An ESF2 application for Rehabilitation Completion was lodged in April 2023 with the Resources Regulator for 50 hectares of pasture woodland.
Community	Ensure public safety	A Public Safety Risk Assessment was undertaken in 2023 as part of mine closure planning. Controls form this risk assessment, such as improving security measures and highwall safety treatments, are being implemented as part of mine closure works.
	Minimise the adverse socio-economic effects associated with mine closure	A Social Impact Assessment was undertaken to identify measures to minimise the impact on the local community as part of mine closure at LCO. The workforce was either redeployed, took voluntary redundancy or stayed on for the closure project. LCO worked with site community investment partners to manage the transition to other sites within GCAA for future

Feature	Objective	2023 Status
		funding.. In general due to Liddell being one of the first to reach closure in the Hunter Valley, it is considered that the socio-economic effects or impacts have been low as the rest of the local mining industry continues to function.
Final land use	Restore or maintain land capability generally as described in the EA and as shown conceptually in Appendix 3.	Land capability of agricultural areas meets the minimum requirements of the EA and consent requirements.

No rehabilitation areas onsite have been signed off against the RMP completion criteria for the purpose of formal relinquishment to date. Liddell has submitted an ESF2 Rehabilitation Completion Application for approx. 50ha of pasture rehabilitation in 2023.

8.2.1 Rehabilitation Commitments

Table 8-4 shows the hectares put forward in the Forward Work Program, for rehabilitation and disturbance, with progress to date. Within the next reporting period, LCO forecasts to complete no disturbance activities and 33.5 ha of rehabilitation. As per the EIS, LCO is completing rehabilitation progressively throughout the life of the operation.

Table 8-4 RMP rehabilitation status

	Forward Work Program		Full Year Actual		Variance	
	Disturbance (ha)	**Rehabilitation (ha)**	**Disturbance (ha)**	**Rehabilitation (ha)**	**Disturbance (ha)**	**Rehabilitation (ha)**
2023	0	45	1.3	76.7	+1.3	+31.7
2024	0	33.5	-	-	-	-

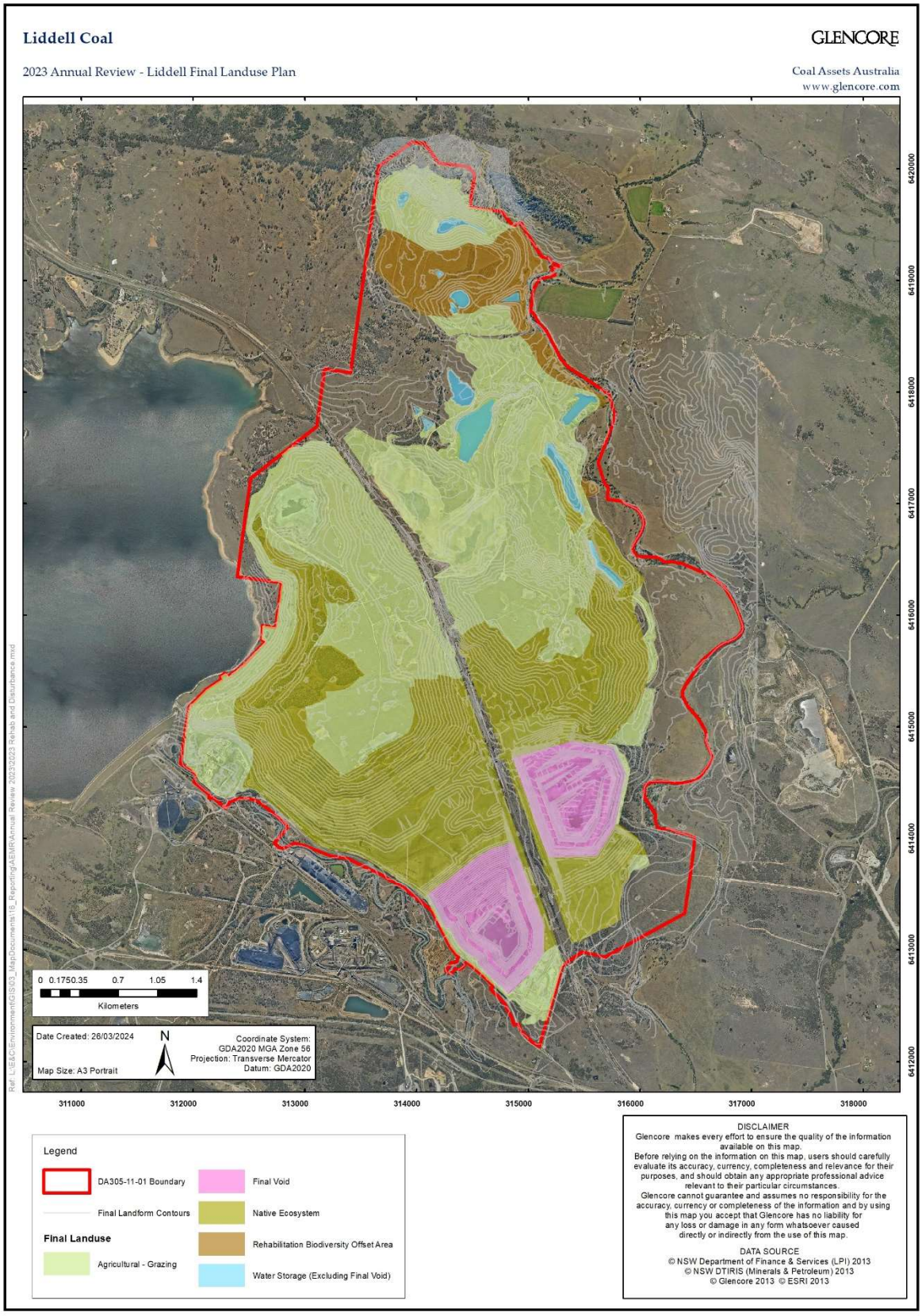


Figure 8-2 Final Rehabilitation and Post Mining Land Use

8.2.2 Tailings Emplacement Rehabilitation Strategy

Rehabilitation execution works were undertaken on Antiene, Reservoir South and Reservoir West TSFs during 2023 in line with site Tailings Rehabilitation Strategy. LCO utilises suitable materials from surrounding overburden emplacements to construct a minimum of 1.5m cap across the tailings surface. Additional material is placed over the tailings surface to achieve the designed free draining landform. Fluvial rehabilitation design has been implemented for the surrounding slopes where material has been borrowed for capping. During the reporting period the final capping and rehabilitation of Antiene TSF was completed as shown in ***Figure 8-3***. Capping and rehabilitation also progressed during 2023 at the Reservoir South and West TSFs as shown in ***Figure 8-4***.

Figure 8-3 - Completed Antiene and Dam 4 Rehabilitation

Figure 8-4 - Aerial image of Reservoir South (foreground) and Reservoir West TSFs in February 2024

Planning and design is also underway for Durham TSF, with rehabilitation and capping planned to commence during 2024. Further details are included in ***Section 6.10***

8.3 Mine Closure Planning and Execution

LCO coal extraction ceased in Q3 2023 and the site has transitioned into 'mine closure' with the continued rehabilitation of the site. Rehabilitation activities for the remaining mine life is detailed in the LCO RMP.

Detailed Mine Closure Planning (DMCP) refers to the planning of rehabilitation activities outstanding once coal extraction has been completed (e.g. decommission and rehabilitation of CHPP areas) to achieve the rehabilitation objectives. Further, consideration of the socio-economic impacts and particular stakeholder consultation is also provided for. LCO has taken a proactive approach to mine closure planning and progressive implementation of decommissioning and rehabilitation works concurrently with mining to provide for efficient delivery of the required rehabilitated landform.

Glencore Coal Assets Australia Mine Closure Planning Protocol provides for a framework for clear, well planned and executable process that will provide for a sustainable post-mining land use and ultimately allow mining tenements to be relinquished. The ***Mine Closure Planning Protocol*** meets the requirements of ***Integrated Mine Closure: Good Practice Guide (ICMM 2019)*** which is considered as international best practice for mine closure planning. As LCO enters closure, mine closure planning has been undertaken, and is ongoing, to ensure that an executable plan can be implemented to rehabilitate the site.

LCO engaged with a number of stakeholders throughout the reporting period including, but not limited to, the NSW Department of Planning & Environment (DPE), NSW DPE Water, NSW Resources Regulator and the Environment Protection Agency.

A summary of mine closure planning themes which underwent continued assessment during 2023 included:

- Review of risks to rehabilitation and development of treatment plans

- Refinement of the final surface landform and rehabilitation completion criteria
- Development of detailed designs and scopes of works for rehabilitation execution
- Tailings rehabilitation strategy refinement
- Groundwater regime investigation and water balance for final landform and voids
- Final landform surface water management and creek stream health
- Borehole and underground mining sealing and rehabilitation
- Spontaneous combustion
- Geotechnical assessments, including final highwalls and rail pillar stability assessment
- Budgeting and provision review

To date, LCO progressed mine closure preparedness as summarised in the following:

- An Initial Closure Broad Brush Risk Assessment with risks individually assigned to a closure domain or where deemed appropriate, applied to the whole site.
- Legal and Other Obligations Register with consideration of the State/Commonwealth legislation, guidelines, standards, permits, agreements and planning requirements that are applicable to the site that require consideration when preparing the DMCP
- A Constrains and Opportunities analysis commensurate to the risks and opportunities relating to closure of the site.
- A Mine Closure Stakeholder Engagement Strategy has been prepared to ensure that all relevant internal and external stakeholders who have an interest or role in the preparation of the DMCP are consulted at the appropriate times throughout the process. It is intended that this be a "live" document that will be revised and updated at regular milestones.
- A Knowledge Base Report to define the Environmental and Socio-Economic Baseline and to provide for a systematic ‘gap analysis’ of information required to prepare the detailed mine closure plan. Outcomes of this gap analysis were then used to further detail the Closure Risk Assessment and scope the technical studies required.
- A review of the Mine Closure Risk Assessment in September 2023 to assess the residual risk leading into the cessation of operations. This included Public Safety and Climate Change risk assessments being completed in 2023.
- Development of the internal Mine Closure Plan for Liddell. The key outcomes from this plan have been incorporated into the Liddell Rehabilitation which was updated post closure and is available on the LCO website
- Technical studies and assessments to address knowledge gaps identified above to minimise risks identified in the Closure Risk Assessment. During 2023 the following key study areas were addressed:
    - Detailed final landform designs to incorporate natural landforms into the final dump profiles;
    - Final landform water management detailed designs, such as spillways and drainage
    - Hydrogeological assessments focusing on prediction of seepage into Bowmans Creek alluvium post recovery of pit lake water levels
    - Final voids water balance assessment and optimisation
    - Demolition, waste and mineral waste management;

- Archaeological artefact management, including consultation with RAPs regarding artefact reburial and long-term management of sites;
- Biodiversity and rehabilitation completion criteria
- Tailings Emplacement Rehabilitation
- Geotechnical assessments, including final highwall stability, highwall treatment options, and spontaneous combustion.

During 2023, LCO will continue to refine and implement the DMCP by:

- Development of a Mine Closure Water Management Plan, incorporating the following assessments and strategies:
  - Seepage assessment - modelling of predicted groundwater flows between Liddell and the adjacent Bowmans Creek and Permian groundwater aquifers and prediction of potential flux's from Liddell into the adjacent aquifers including a review of potential impacts
  - Final landform water balance - modelling of long-term water recovery and water quality in voids and water storages across the site
  - Tributary Health / Stream Health Monitoring Program - Development of baseline criteria of ecological health in Bowmans and Bayswater Creeks to assess future impacts in terms of stream health
  - Clean water release strategy - Identify legislative requirements relating to the release of water from previously rehabilitated areas and identify key criteria and processes to enable the release of water from site
  - Closure water monitoring program - Revision of water monitoring program to change the focus from monitoring impacts of mining to monitoring impacts of recovery
- Implementation of treatments plans following risk review.
- Execution of rehabilitation activities, including bulk push, drainage, revegetation and including tailings emplacements.
- Ongoing quarterly schedule briefing session with the NSW Resources Regulator updating progress and timing.
- Development of a detailed internal rehabilitation scope of works.
- Revision of the Rehabilitation Management Plan to detail activities occurring post mining.

8.4 Biodiversity Management

During 2023, LCO continued to operate in accordance with the approved RMP and BMP in regard to rehabilitation and biodiversity practices and monitoring. The detailed rehabilitation and biodiversity monitoring were completed in accordance with the RMP and BMP with the findings summarised below.

The BMP was updated in 2023 following closure of mining operations and modification of DA305-11-01. The BMP was approved by the Department of Planning and Environment in October 2023.

8.4.1 Biodiversity Monitoring Summary

As part of the approved DA305-11-01 Mod 5, LCO developed a ***Biodiversity Management Plan*** (BMP). The objectives of the BMP are to provide direction for the short to long term management and enhancement of the biodiversity values of the BMP Area, as well as to provide a detailed description

of the measures to be implemented to achieve this over the next three years (as per the State requirements).

Since its original development, the BMP has been subsequently revised to include additional three yearly performance indicators. LCO's performance tracking towards the objectives is detailed in this section. The BMP area is defined as all land within the DA305-11-01 consent boundary; including rehabilitation areas and remnant vegetation, excluding biodiversity offset areas.

Based on the outcomes of the 2023 BMP monitoring, it appears that LCO are effectively managing their existing biodiversity values and are improving values of areas previously lacking in habitat value. LCO have been responsive to the management actions suggested in previous monitoring reports.

The key findings of the 2023 biodiversity monitoring program were as follows:

- Lower-than-average rainfall and therefore poor growth conditions have led to lower-than-average native species richness at all sites except for rehabilitation woodland site WR01.
- The vegetation structure, vegetation health and habitat features have all remained in a very similar state to that at the commencement of monitoring (except WR01 which has undergone significant growth of canopy vegetation from 20 cm height to approximately 8 metres in height).
- R02 (Remnant Riparian – River Oak Riparian Woodland) has shown a substantial decline in native flora richness since baseline because of weed species in the groundcover thriving and are suppressing native diversity. Although recent works (in the form of slashing of the exotic grass layer) have recently been undertaken, these will likely need to be ongoing to make a substantial change.
- Canopy defoliation was observed at remnant riparian site R02 likely due to prolonged drought conditions in previous years, though appears to be recovering (albeit slowly).
- An increase in native species diversity at rehabilitation site WR01 correlates with declines in exotic grass species, particularly Rhodes grass (*Chloris gayana*). Although it should be noted that weed levels in these rehabilitation areas remain high.
- Fauna results at remnant sites were generally within the range of those observed since baseline, however, were also generally lower than average (apart from W02 which had a higher-than-average bird diversity this year). This correlates with poor general fruiting, and flowering of the native vegetation due to lower-than-average rainfall.
- Fauna species diversity at rehabilitation site WR01 has improved since baseline, however, may be plateauing due to a lack of increased habitat value in the past few years. Fauna niche diversity in the rehabilitation remains lower than that of remnant areas.
- There has not been a notable increase in the extent of feral species presence, however continued management of predators (particularly the fox (*Vulpes vulpes*) that was observed at all sites) will increase the value of all areas for the spotted-tailed quoll (*Dasyurus maculatus*).
- No threatened fauna was observed during the 2023 monitoring program.
- Rehabilitated vegetation at WR01 is in a moderate condition (species diversity and plant health). However, could be assisted in becoming more compatible with reference vegetation by:
    - reducing weed levels/ maintaining weed management efforts and
    - increasing diversity of native flora species in the groundcover and midstorey.
- Stygofauna diversity at ALV4 was absent, however this was consistent with most previous monitoring events and baseline.
- Stygofauna diversity levels continue to be low at ALV2 and ALV3.

- Stygofauna levels appear to be improving at ALV7 and ALV9, where no stygofauna were observed during baseline.
- No signs consistent with myrtle rust, *Phytophthora cinnamomi* or Chytrid fungus were identified during the 2023 BMP surveys.

As per the BMP, LCO prepare an Annual Biodiversity Monitoring Report, which documents the monitoring methods and results from the winter monitoring period through to the autumn monitoring period. The intent of this report will be to provide a comparison of the data collected with previous monitoring event and to provide (where necessary) ongoing management recommendations and ameliorative methods to ensure the biodiversity within the BMP area is subject to a positive feedback loop. The full report summarising the method and results of the 2023 Biodiversity Monitoring Report is made available on the LCO website.

8.4.2 Biodiversity Management Performance Indicators

The performance indicators and completion criteria for the short and medium term biodiversity management are identified in the BMP. Completion criteria are objective target levels or values assigned to a variety of indicators (i.e. slope, species diversity, groundcover etc.), which can be measured against to demonstrate progress and ultimate success of rehabilitation. As such, they provide a defined end point, at which point in time rehabilitation can be deemed successful and the lease relinquishment process can proceed.

The performance indicators developed for three years periods of the implementation of the BMP are used to assist demonstrating how management actions are progressing towards achieving completion criteria.

The completion of and performance against each of these indicators/criterion is summarised in ***Table 8-5*** below, based on the outcomes of ecological monitoring and inspections across LCO for each year.

Table 8-5 BMP performance indicator summary

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
Year 9 2023			
Fencing, Signage and Access Control			
Minimum twice-yearly inspections of fences and signage to identify any works required. Fencing and signage of relevant parts of BMP area should be as per Section 4.1	Inspections undertaken nominally in March and September. Damaged critical fences to be repaired within 1 week (temporary if needed), final repairs and non-critical repairs to be completed in one month.	All fences in functional condition. Riparian areas are adequately fenced/protected against damage from uncontrolled human or livestock access.	Inspections completed. Signage installed and maintained as required.
Access Track Maintenance			
Minimum twice a year BMP Area inspections to identify track conditions, any works required and any unnecessary tracks to be remediated	Inspections undertaken nominally in March and September. Action and repair track damage or remediation where applicable.	Tracks maintained in good usable condition and unnecessary tracks are remediated	Inspections completed.
Topsoil Management			
Areas containing weeds that may pose a threat to rehabilitation are targeted using appropriate weed control methods prior to topsoil stripping. Methods may include, foliar spraying, basal bark spaying, cut and paint, slashing and other	Pre-stripping weed control of topsoil is completed, as needed.	Weed control is completed prior to topsoil stripping (where required) to minimise future potential impact to rehabilitation success.	Pre-clearance survey identifies any weed infestations requiring further management.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
mechanical methods as deemed appropriate.			
Pathogen Management			
If reasonable potential for pathogens is identified in the BMP Area, appropriate pathogen monitoring and management protocols are developed and implemented.	If reasonable potential is identified, pathogens are considered in design and implementation of monitoring works. If identified (or potential identified), management actions for specific pathogens are developed and implemented.	Methods to identify potential pathogens are considered in monitoring program design (if reasonable potential of pathogen presence is identified onsite. Signs of pathogen presence (or potential presence) are immediately reported. If suspected to be onsite, detailed management actions are developed and implemented. There is no onsite infestation of Phytophthora cinnamomi, Myrtle rust or Chytridiomycosis.	No signs likely to be associated with *Phytophthora cinnamomi*, myrtle rust or chytrid fungus observed during 2023 BMP monitoring.
Seed Collection			
Where suitable remnant vegetation is available, implementation of seed collection and handling program for use in revegetation/rehabilitation works.	Pre-clearing surveys identify potential seed sources. Seeds are collected, stored and handled according to appropriate program. Collected seed resources are used in revegetation/rehabilitation works.	Rehabilitation/revegetation works use seeds collected onsite, thus maintaining as much genetic similarity (local provenance) as possible.	Seed resources were collected in 2023 and substituted in seed mix for rehabilitation as key species are available.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
Vegetation Clearing			
Detailed pre-clearing procedure is to be implemented when clearing of woody native vegetation (including shrub, groundcover and isolated trees in grasslands).	Pre-clearing process is to be implemented as part of Ground Disturbance Permit process. Outcomes of pre-clearing process are recorded and recommendations are implemented.	Pre-clearing process has been followed. Recommendations from pre-clearing process have been implemented, prior to tree felling if necessary. Outcomes of pre-clearing procedure are recorded and readily accessible.	Pre-clearing completed throughout year as part of Ground Disturbance Permit process. Note most clearing associated with re-disturbance of rehabilitation areas for maintenance works or tailings capping borrow material.
Detailed tree-felling process is to be implemented when clearing areas of woody native vegetation (including shrub, groundcover and isolated trees in grasslands).	Tree felling process is to be implemented as part of the Ground Disturbance Permit process. Outcomes of tree-felling process are recorded and recommendations are implemented.	Tree felling process has been followed when required. Recommendations from tree felling process have been implemented.	Tree-felling completed as part of Ground Disturbance Permit process.
Translocation Works			
Translocation of tiger orchids or other threatened flora species (if encountered during pre-clearing process) to biodiversity offset areas.	Tiger orchids identified during pre-clearing process are salvaged during the tree felling process and are translocated into biodiversity offset areas. Any translocated individuals are subject to regular monitoring and maintenance works, if required.	Tiger orchids (or other threatened flora species if encountered) are salvaged from Approved Modification Area and translocated into biodiversity offset areas. Detailed records are kept on the process, including regular	One tiger orchid was relocated to the Mountain Block BOA in 2018 and has been subject to annual monitoring and maintenance. Translocation is thus far deemed successful.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
	Reporting of translocation works and monitoring works is maintained.	monitoring and maintenance works as required. No completion criterion is proposed regarding condition due to uncertainty of plant response.	
Remnant Vegetation and Habitat Management			
Remnant vegetation is to be protected from accidental impact.	Areas to be disturbed will be clearly defined in the field to prevent accidental impact to remnant vegetation.	No areas of remnant vegetation are impacted unnecessarily.	Remnant monitoring sites are in areas of undisturbed vegetation which are fenced to prevent unauthorised access. No accidental damage or removal of remnant vegetation was evident during BMP inspections.
Remnant vegetation is protected from disturbance.	Remnant vegetation will be fenced or sign-posted as necessary to protect from disturbance. Annual inspections are completed to assess condition of fences and signs, areas of erosion concern, weeds or feral animals requiring control. Management works will be conducted, as necessary.	Remnant vegetation is protected from disturbance such as accidental clearing, unauthorised access, erosion, weeds and feral animals.	Remnant monitoring sites are in areas of undisturbed vegetation which are fenced to prevent unauthorised access. No accidental damage or removal of remnant vegetation was evident. Annual monitoring included assessment of areas of erosion concern and introduced species. Fence line inspections are undertaken biannually in accordance with commitments of the BMP.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
Annual inspections undertaken by suitably qualified personnel to assess the extent of natural regeneration occurring.	Annual inspection undertaken by suitably qualified personnel to assess extent of natural regeneration occurring. Appropriate action is undertaken if regeneration is deemed as being inadequate.	Areas where natural recruitment is not occurring have been identified and assisted regeneration is occurring if considered appropriate.	Annual monitoring included assessing degree of regeneration of native trees. Native regeneration was identified and considered adequate at all sites. Regeneration is adequate but is being impeded by dense groundcover weed at R02 and WR01.
Weed Control			
Complete weed inspections of BMP area every two months to document diversity and abundance of noxious weed records. This will then inform ongoing control actions (as needed), including timing, frequency, target species and methods to be used.	Inspections completed every two months, followed by implementation of required control methods, as required.	Regular inspections are undertaken for weed inspections and outcomes documented.	Inspections being completed as required with appropriate weed priorities actioned. Land management contractor provides regular reports.
Weed inspections of remnant and rehabilitation areas	Annual inspections are undertaken of remnant vegetation to identify areas of weed infestation. Weed management actions of infestations are undertaken in accordance with current or other best practice approaches.	Annual inspections are undertaken for weed inspections and outcomes documented. Weed densities in rehabilitation/regeneration areas are no worse than those in remnant vegetation (analogue) sites or as specified in the RMP. There are no significant weed infestations that are identified as a	Inspections being completed as required with appropriate weed priorities actioned. Annual Weed Action Plan completed and implemented. Annual monitoring undertaken and management recommendations to be actioned.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
		risk to rehabilitation or regeneration areas.	
Feral Animal Control			
Complete feral animal inspections of BMP area every two months to document sighting and abundance records. This will then inform ongoing control actions (as needed), including timing, frequency, target species and methods to be used.	Inspections completed every two months, followed by implementation of required control methods.	BMP area is inspected for feral animal diversity and abundance every two months. Control measures are implemented in response to outcomes of the inspections. Measures are being taken to control feral animals in the BMP area.	Inspections for feral fauna are completed every two months. Fox (*Vulpes vulpes*) were identified at all sites (but W01) and will continue to be key species for management in 2024.
Develop and implement an effective annual pest animal action plan which details adaptive control measures as required.	Develop and implement pest animal action plan which details adaptive control measures as required.	Strategies from action plans are implemented.	Annual Pest Action Plan developed and implemented for 2023. Pest numbers appeared to be stable and low. During October and November 2023, LCO conducted a wild dog and fox baiting program.
Develop a vertebrate pest control register to document when and where each control method is implemented.	Update and maintain vertebrate pest control register.	Pest animal control register is maintained and up to date.	Vertebrate pest control register maintained and updated throughout 2023.
Blue-billed Duck Management			

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
Complete habitat enhancement, maintenance and monitoring works (as required) for the blue-billed duck	Ongoing enhancement and management works within Dam 3 and two Triangle Dams. Monitoring works as required.	Monitoring shows appropriate habitat for the blue-billed duck is maintained is provided in Dam 3 and two Triangle Dams.	Habitat values for Dam 3 assessed during 2023 monitoring. It was identified that this dam provides moderate habitat value. It is noted that seeding was conducted around this dam in spring and these numbers may not reflect in the data collected. Habitat enhancement recommended however, through planting of native aquatic vegetation as fringing aquatic vegetation levels are low.
Habitat Enhancement			
Salvage of habitat features (particularly for the spotted-tailed quoll) such as hollow-bearing trees, logs, stumps, large rocks and boulders.	Suitable habitat features identified during the pre-clearing process are salvaged. Salvaged features are either re-instated into areas with low levels of habitat features or stockpiled appropriately for later use. Timber or boulder piles will be constructed in riparian areas and areas of regeneration, revegetation and/or rehabilitation (as appropriate) to provide potential quoll denning habitat.	Appropriate habitat features have been salvaged. Salvaged habitat features are re-instated into areas of remnant vegetation lacking in habitat features or into rehabilitated vegetation. Appropriate spotted-tailed quoll habitat has been salvaged and placed into onsite rehabilitation areas. Habitat features that have been salvaged and are yet to be re-instated are in appropriate storage.	Habitat material was identified during the pre-clearance process and salvaged where possible to reinstate into BMP areas.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
		Appropriate documentation is available of any habitat features salvaged.	
Nest boxes are providing habitat value for native fauna.	Continue staged installation of nest boxes. Established nest boxes are subject to annual inspection and maintenance.	Nest boxes densities appropriate. Boxes are monitored and maintained.	Remnant vegetation and suitably established rehabilitation areas have been supplemented with nest boxes. Nest boxes were subject to monitoring in 2023, some of which were identified with or signs of native occupation.
Salvaged–reinstated hollows	An indicative sample of salvaged and re-instated hollows are subject to annual monitoring in conjunction with nest boxes.	All salvaged re-instated hollows are monitored and maintained.	Habitat features suitable for salvage are stockpiled or directly placed into rehabilitation and offset areas. Ongoing habitat augmentation works will continue as per recommendation from monitoring events.
Timing of nest box installation	Removed hollows will be replaced (with nest boxes) within six months of each discrete clearing event.	Seasonal breeding opportunities are not lost due to delay in nest box installation.	Hollows and logs removed during clearing works have been placed in offset and rehabilitation areas. There were no new nest box installation during 2023.
Foraging specific plant resources	Rehabilitation and revegetation plantings undertaken include bulloak (*Allocasuarina luehmannii*), swamp oak (*Casuarina glauca*), broom bitter pea (*Daviesia genistifolia*), sickle wattle (*Acacia falcata*),	Rehabilitation areas include plant species that are specific foraging resources.	Seed supplied for rehabilitation areas include plant species that are specific foraging resources. Continue to undertake plantings

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
	hickory wattle (*Acacia implexa*) and cooba (*Acacia salicina*).		that provide foraging resources, as per species list in BMP.
Grazing Management			
Stock rotation	Cattle are grazed within improved pasture areas within mine rehabilitation >3years where practical. Stock will be managed to allow pasture recovery and maintain pasture availability and sufficient groundcover.	Refer to the RMP, pasture rehabilitation will be managed to achieve the RMP rehabilitation completion criteria.	LCO routinely coordinate cattle grazing and stock between paddocks.
Bushfire Management			
Bushfire Management Plan will be implemented	Implementation of requirements of updated Bushfire Management Plan.	Bushfire risk is managed according to a Bushfire Management Plan which allows for appropriate protection of life and property, as well as identified significant ecological features.	No signs of bushfire impacting biodiversity values.
Ecological Monitoring			
Undertake floristic, fauna, LFA, waterbird, nest box, stygofauna and instream/riparian monitoring program throughout LCO	Monitoring program completed and reported.	Monitoring programs completed and results reported.	Floristic, fauna, waterbird, nest box, stygofauna and instream/riparian monitoring program throughout LCO completed in 2023 and reported on.

Action/Item	Management Measure	Performance Indicator / Completion Criteria	Performance Comment
Undertake annual inspections of LCO rehabilitation areas as per the RMP	Annual inspections completed	Annual inspections completed as per the RMP	Annual inspections of LCO rehabilitation areas completed and summary included in this Annual Review.
Native fauna presence in rehabilitation/regeneration areas	Fauna monitoring completed.	Fauna monitoring confirms that native fauna species are recorded within rehabilitation/regeneration areas.	2023 fauna monitoring completed and indicates native fauna is present in rehabilitated vegetation. Introduced fauna are also present including foxes, rabbits and hares. Ongoing control should be continued to prevent population increases. Increased structural and vegetation diversity in rehabilitation areas will increase native fauna diversity in these areas with time. Maintain current pest control programs. Ongoing placement of habitat features such as log and rock piles as well as small retention dams and vegetated corridors in rehabilitation areas will also increase the niche availability for native fauna colonisation.

8.4.3 Rehabilitation Monitoring Summary

LCO also conduct a detailed rehabilitation monitoring program as detailed in the RMP. Due to the age of the operation, LCO has established rehabilitation areas which are distinctly different reflecting the evolving rehabilitation objectives and practices. Each area has unique challenges for progressing towards the final land uses of pasture and woodland which are being managed by LCO. Further detail is provided in the below from the 2023 Rehabilitation Monitoring Reports.

The overall condition of rehabilitation at LCO is moderate and generally trending towards the target. Most areas have a good ground coverage which is preventing substantial erosion. In the woodland areas, ground coverage is generally provided by non-target species and vegetation has not been established for long enough to provide substantial soil organic matter (leaf litter).

Pasture areas are typically of good height and density for grazing, which has been employed in a number of rehabilitation areas in the reporting period. LCO continue to manage exotic species throughout the rehabilitation.

8.4.3.1 Pasture Rehabilitation

The two broad pasture rehabilitation types have been established across the LCO site being the pre-2013 pasture areas that are dominated by Rhodes grass (*Chloris gayana*) and the post-2013 pasture areas that are dominated by a higher diversity of species including Green Panic (*Panicum maximum*), Premier Digit (*Digitania smutsii*, Kikuyu (*Cenchrus clandestinus*) and Lucerne (*Medicago sativa*).

The older pasture areas have a higher overall biomass but contain a lower diversity of species and generally consist of lower quality pasture species. Paddocks consisting of this pasture type that have been managed through the site grazing program by grazing and over sowing have a much-improved pasture composition and structure. This has been demonstrated as an effective management process for older pastures.

The newly established pasture areas are establishing well, and older areas established using the new pasture mix may be suitable for light grazing. These pastures should be managed to maintain and increase the diversity of high-quality pasture species, increase cover and biomass and to limit the establishment of lower quality species such as Rhode's grass. Across all pasture areas, a low level of soil carbon was identified and this is a factor that will potentially limit the productivity and sustainability of pastures. Managing pastures to increase soil carbon will be a critical step in maintaining pastures that are consisted with the completion criteria with minimal inputs.

Pasture areas are generally trending towards completion criteria across the site.

8.4.3.2 Woodland Rehabilitation

Woodland rehabilitation areas are more variable and each of the woodland rehabilitation blocks face unique challenges. Most areas, however, contain suitable species in at least two vegetative layers.

Planting and seeding augmentation work undertaken into date are showing mixed results. Works undertaken in cooler months with good soil moisture and follow-up rainfall have been successful and are showing good establishment of seedlings and good survival of planted species. works undertaken in warmer months or without good soil moisture or follow-up rainfall have not been successful.

A major threat to woodland rehabilitation areas observed has been the establishment of weed species. Dominance of weed species, particularly invasive perennial grasses; Coolatai (*Hyparrhenia hirta*) Rhodes grass (*Chloris gayana*), setaria (*Setaria sphacelata*) and green panic (*Megathyrus maximus*) and kikuyu (*Cenchrus clandestinus*), and Galenia (*Galenia pubescens*) continues to be a

major threat to the establishment of target vegetation in Woodland rehabilitation areas. Ongoing works including continued augmentation of mid and ground layer vegetation with species selected from target vegetation communities and weed control works will be required to continue progressing woodland rehabilitation areas towards closure criteria. If erosion control is needed a higher rate of cover crop including couch grass (*Cynodon dactylon*) should be used.

Ongoing improvements have been made to the methodology for establishing new rehabilitation. Woodland rehabilitation areas established since 2018 have included increased diversity within the seed mix and the installation of habitat features such as stag trees and water retention features. Other ongoing improvements include seeding of water retention features with aquatic species and increased weed control in establishing rehabilitation areas.

Two critical steps in progressing rehabilitation towards closure criteria will be;

- Augmentation of older rehabilitation areas through seeding and planting of species from the *Central Hunter Grey Box – Ironbark Woodland* EEC. And
- Management of invasive species with the potential to out compete native species. especially weedy perennial grasses Coolatai (*Hyparrhenia hirta*) Rhodes (*Chloris gayana*) and African love grass (*Eragrostis curvula*).

While continued works are required, particularly in woodland rehabilitation blocks, the commitment to adaptive management and incremental gains in rehabilitation quality at Liddell Coal should be commended.

8.5 Biodiversity Offset Management

As part of the approved DA305-11-01 Mod 5, LCO developed a **Biodiversity Offset Management Plan** (BOMP) to guide ongoing management of the LCO biodiversity offset areas to maintain and enhance biodiversity values, particularly those relating to threatened species and threatened ecological communities (TECs) within the LCO biodiversity offset areas ***Figure 8-5*** shows LCO biodiversity offset area comprising of Mountain Block, Bowmans Creek Riparian Corridor and Mitchell Hills South Offset Areas. ***Table 8-7*** provides the Conservation Agreement details. During 2023, LCO completed ecological monitoring in accordance with the BOMP as well as commenced various management actions relating to the performance indicators; both of which are detailed below.

Four Conservation Agreements (CAs) are registered on title for the BOAs. A CA is a legal agreement under section 69 of the NPW Act for an area of land with significant conservation value. These CAs are legally binding for both current and future landholders and is registered on the land title. The CAs document:

- Conservation values present
- Management arrangements and costings
- Monitoring arrangements

Table 8-6 BOA Conservation Agreements

Agreement Name	Agreement No.	Date Executed	Date registered on title	Approximate Area
Mitchell Hills South Conservation Area	VC00505	7/05/2019	8/08/2019	40
Mountain Block Conservation Area	VC0525	13/05/2019	1/10/2019	168
Bowmans Creek Riparian Corridor	VC00506	7/05/2019	1/10/2019	183
Bowmans Creek Riparian Corridor East	VC00516	9/05/2019	6/08/2019	3

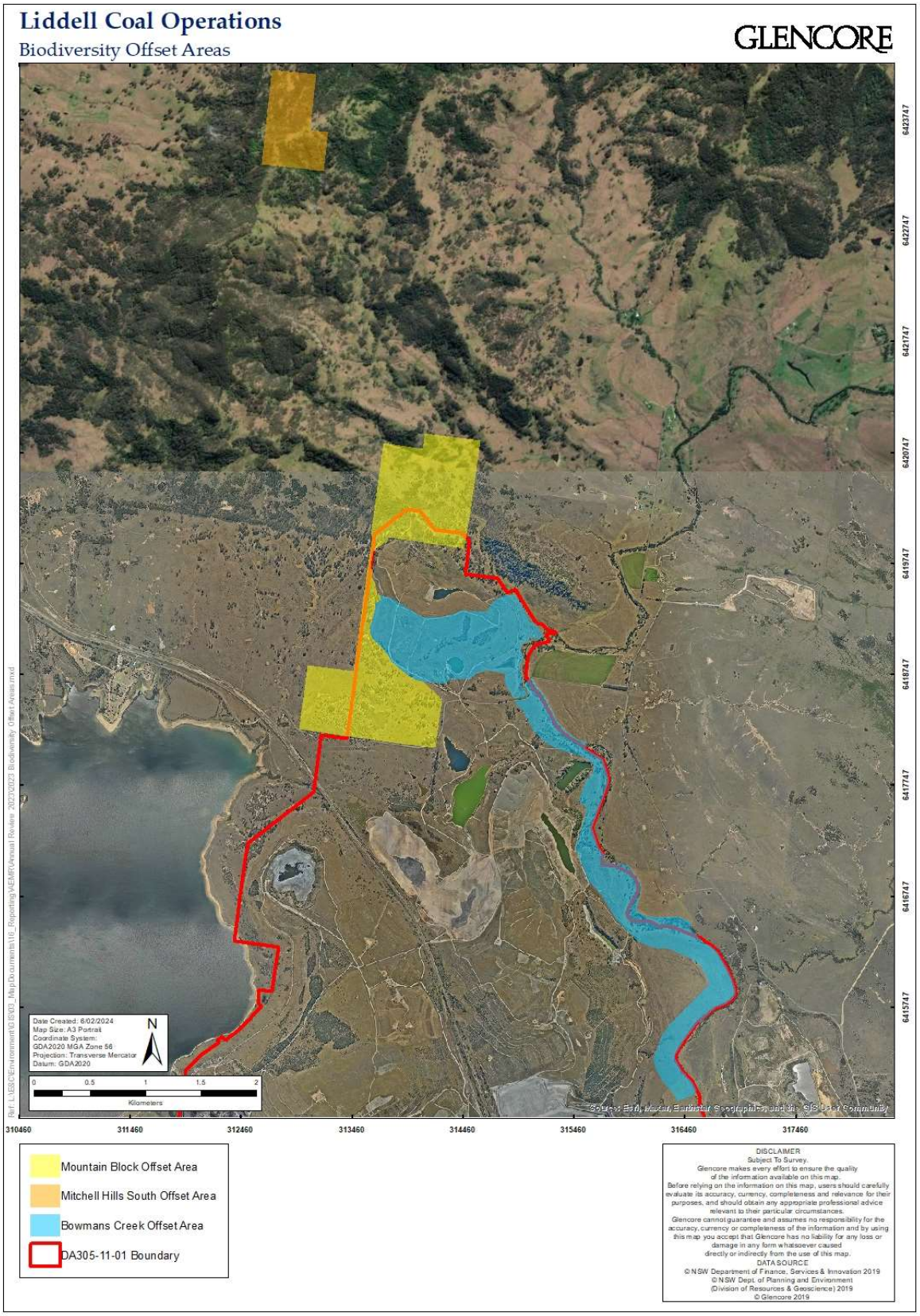


Figure 8-5 Biodiversity offset areas

8.5.1 Biodiversity Offset Monitoring Summary

During 2023, LCO completed ecological monitoring in accordance with the BOMP and various management actions relating to the performance indicators.

Key findings of the 2023 biodiversity offset monitoring program include:

Mountain Block

- o Vegetated connectivity has strengthened between formerly disconnected or poorly connected vegetation fragments in the southern and northern paddocks.
- o Natural recruitment in this BOA is strong and gradually infilling canopy gaps in both the northern and southern areas of remnant vegetation.
- o Substantial revegetation works have been completed since 2018, with some supplementary planting undertaken of formerly unsuccessful areas of the north in 2023. These works have overall been moderately successful.
- o Habitat value has been improved for a range of hollow-dependent fauna species by approximately 100 nest boxes.
- o Vertebrate pest fauna management works continue to be completed and appear to be keeping most pest species numbers low throughout. Pigs (*Sus scrofa*), foxes (*Vulpes vulpes*), cats (*Felis catus*) and wild dogs (*Canis lupus familiaris*) are of greatest concern to native fauna and rabbit (*Oryctolagus cuniculus*)/hare (*Lepus capensis*) populations are of greatest concern to revegetation areas.
- o Weed control works continue to be a focus across the year in this BOA and these works are showing positive results, particularly in reducing abundance of exotic grasses.
- o Maintenance of fencing, signs, gates and access tracks is currently adequate.

Key challenges in this BOA remain the control of exotic species in general (albeit being effectively suppressed in 2023), particularly prior to and following revegetation activities. Vertebrate pest management works will continue to be implemented, as will ongoing works to manage erosion in select creek lines in the centre and south.

Mitchell Hills South

- o Natural recruitment, particularly of native shrubby vegetation has been strong in former grassland areas, particularly in the north-east.
- o Natural recovery of canopy species has been gradual but has been assisted through targeted weed management and revegetation in areas of grassland in the south.
- o Habitat value has been improved for a range of hollow-dependent fauna species by the installation of 75 nest boxes that have shown occupation by native fauna including threatened species.
- o Exotic flora species are low throughout most of this Conservation Area, however, will require ongoing management in grasslands (particularly on the southern ridgelines) prior to any further revegetation activities.
- o Observed levels of pest species were low, however presence of foxes (*Vulpes vulpes*), pigs (*Sus scrofa*) and cats (*Felis catus*) are of greatest concern.

Maintaining the currently low levels of weed and vertebrate pest species should be an ongoing focus of this BOA. This has been assisted by track improvement works in 2023 which will assist in access for ongoing required tasks and emergency vehicle access. This will include consultation with neighbours where access to the BOA runs through non-LCO properties.

Bowmans Creek Riparian Corridor

- Revegetation works undertaken during former drought years 2018 and 2019 were largely unsuccessful. However, revegetation taken since this time has shown greater success, including recent revegetation in northern areas of Zone 3 in 2023.
- Revegetation has resulted in some minor connectivity in the width of the riparian corridor in the central areas of this BOA.
- Habitat value has been improved for a range of hollow-dependent fauna species by the installation of approximately 200 nest boxes.
- Vertebrate pest fauna management works appear to be keeping general pest numbers low throughout and should be continued. Of greatest concern are presence of foxes (*Vulpes vulpes*), pigs (*Sus scrofa*) and cats (*Felis catus*).

The key threat to the recovery of vegetation in this BOA remains the management of exotic grasses, primarily that of introduced grasses in grassland areas, particularly prior to undertaking further revegetation activities.

Bowmans Creek Riparian Corridor East

- Planting of 500 tube stock was undertaken in this BOA in 2023, however the success of this is yet to be determined due to planting being undertaken after the completion of monitoring surveys. Weed management surrounding these plantings will be key to their success.
- Natural recruitment is occurring in the form of canopy infilling in areas of remnant vegetation.
- Fencing and signage of this offset remains intact and is minimising potential for visitor impacts.
- The main maintenance task that has been undertaken in this BOA has been weed management, particularly this year prior to tube stock planting occurring, however both treed and grassland areas remain largely modified habitats.
- In 2023, exotic vines were a focus of weed management actions and have resulted in a substantial reduction and improvement of value of this BOA. Follow-up treatment will likely be required of these areas to prevent recursion.
- Habitat value has been improved via the installation of 11 nest boxes which have shown presence of native fauna occupation.

8.5.2 Biodiversity Offset Performance Indicators

The BOMP includes objectives which are to provide direction for the short to long term management and enhancement of the biodiversity values of the LCO biodiversity offset areas, as well as to provide a description of the measures to be implemented to achieve this over the next three years.

The performance indicators are for years nine to eleven of the implementation of this BOMP are used to assist in demonstrating how management actions are progressing towards achieving completion criteria.

The completion of and performance against each of these indicators is summarised in ***Table 8-8***Table 8-7 below, based on the outcomes of ecological monitoring and inspections across LCO for each year.

Table 8-7 BOMP Performance indicator summary

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
Pathogen Management				
All BOAs	If reasonable potential for pathogens is identified in the BOAs, appropriate pathogen monitoring and management protocols are developed and implemented.	If reasonable potential is identified, pathogens are considered in design and implementation of monitoring works. If identified (or potential identified), management actions for specific pathogens are developed and implemented.	Methods to identify potential pathogens are considered in monitoring program design (if reasonable potential of pathogen presence is identified onsite. Signs of pathogen presence (or potential presence) are immediately reported. If suspected to be onsite, detailed management actions are developed and implemented. There is no onsite infestation of Phytophthora cinnamomi, Myrtle rust or Chytridiomycosis.	No signs likely to be associated with Phytophthora, myrtle rust or chytrid fungus observed in any of the BOAs.
Fencing and Signage				
All BOAs	Repair boundary fences, restricting unauthorised access to property and controlling livestock movements.	All boundary fences in place and gates are secured.	All biodiversity offset areas will have boundary fencing of appropriate design and condition.	Boundary fences and gates appeared to be intact and secure during monitoring event. Fences are additionally monitored during BOMP inspections completed by LCO.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
All BOAs	Any new fencing does not have barbed wire on upper strands and as little barbed wire generally as possible. The bottom strand will be plain wire and elevated to allow faunal passage (while maintaining cattle exclusion).	New fences are installed without barbed wire on upper strands and an elevated plain wire bottom strand.	New fences are constructed with as little barbed wire as possible, with none on upper strands and an elevated plain wire bottom strand.	No new fences installed.
All BOAs	Inspections of fences every two months to identify condition.	Inspections every two months. Damaged critical fences to be repaired within one week (temporary if needed), final repairs and non-critical repairs to be completed in one month.	All fences in functional condition.	Fence inspections undertaken every two months in accordance with commitments of the BOMP.
All BOAs	Information signage for the spotted-tailed quoll.	Informational signage (for the spotted-tailed quoll) is maintained.	Information signage for the spotted-tailed quoll is maintained.	Signage is installed and in good condition.
Cultural Heritage				
Bowmans Creek Riparian Corridor	Detailed rehabilitation planning for the Bowmans Creek Riparian Corridor managing outcomes of cultural heritage assessment.	Implement plan as required.	Cultural heritage is appropriately considered within rehabilitation works in Bowmans Creek Riparian Corridor.	Planning and due diligence surveys completed where required.
All BOAs	Implement protocols for identification of potential cultural heritage issues,	Implement protocol.	Protocol developed and implemented.	Implemented as per the approved ACHMP.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
	including how to avoid or mitigate impacts.			
Grazing Management				
All BOAs	All stock to be removed from BOAs	No stock grazing unless required based on monitoring results.	Grazing has not occurred in biodiversity offset areas unless determined as needed by monitoring results.	No evidence of cattle grazing was evident during 2023 in any of the BOAs.
All BOAs	Minimum bi-monthly inspections to determine presence of rogue stock and assess condition of fences.	To be completed bi-monthly.	Completion of inspection reports that include records of stock grazing.	Cattle inspections undertaken bi-monthly in accordance with commitments of the BOMP.
All BOAs	Remove reported rogue stock and repair damaged fences.	Action and remove reported rogue stock and repair damaged fences.	No rogue stock in biodiversity offset areas and fences in functional condition.	No rogue stock identified in any of the BOAs during the 2023 monitoring event. However, cattle were sighted during the January and May 2023 bi-monthly inspections at Bowmans Creek and Mountain Block. The cattle were removed and fences repaired.
Track Maintenance				
All BOAs	New access tracks (only where necessary) are subject to due diligence assessments.	Complete due diligence assessments for new access tracks to minimise impact on biodiversity, where possible.	New access tracks are only constructed where necessary, and are subject to due diligence inspections	To be assessed on an ongoing basis. No new tracks installed.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
All BOAs	Minimum twice yearly (nominally in March and September) inspections to identify track conditions.	Inspections undertaken nominally in March and September. Action and repair track damage.	Tracks maintained in good usable condition.	Access track inspections undertaken bi-annually in accordance with commitments of the BOMP. Track maintenance was completed at Mitchelle Hills, Mountain Block and Bowmans Creek during the reporting period.
All BOAs	Rehabilitation of unnecessary access tracks.	Tracks no longer required will be rehabilitated.	Unnecessary access tracks are rehabilitated.	All tracks present are considered necessary.
Pest Management				
All BOAs	Complete feral animal inspections of BOAs every two months to document sighting and abundance records. This will then inform ongoing control actions (as needed), including timing, frequency, target species and methods to be used.	Inspections completed every two months, followed by implementation of required control methods, as required.	Biodiversity offset areas are inspected for feral animal diversity and abundance every two months. Control measures are implemented in response to outcomes of the inspections. Measures are being taken to control feral animals in the biodiversity offset areas.	Feral animal inspections undertaken every two months in accordance with commitments of the BOMP. Wild dogs, foxes, hares and rabbits were identified and subsequently should be key species for management in 2024. House mouse were also identified, but not considered cause for concern.
All BOAs	Develop and implement an annual pest animal action plan.	Develop and implement pest animal action plan. Stable or downward trend in population size recorded.	Strategies from action plans are implemented and targets are achieved. Stable or downward trend in population size recorded.	Pest numbers appeared to be generally low and stable. Annual pest action plan developed and implemented during 2023.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
All BOAs	Particular action is paid to managing foxes, feral cats and feral dogs in order to protect the spotted-tailed quoll population in this area.	Implementation of favoured fox, feral cat and feral dog control measures.	Monitoring demonstrates that fox, feral cat, feral dog and pig control methods are being effective in managing target species.	Feral fauna identified in low numbers and do not appear to be increasing in abundance. Further implementation of control measures to occur during 2024 as per annual action plan.
All BOAs	Presence of pest animals	As evidenced by monitoring, pest animal presence in revegetation/ rehabilitation areas does not pose a risk to establishment of vegetation.	Feral fauna diversity of revegetation/ rehabilitation areas is commensurate with remnant vegetation	Hares, house mice, rabbits, and foxes have been identified although appear to be generally low in numbers. Further control measures for these species to be implemented during 2024 as per annual action plan.
All BOAs	Develop a vertebrate pest control register to document when and where each control method is implemented.	Update and maintain vertebrate pest control register.	Pest animal control register is maintained and up to date.	Existing vertebrate pest control register implemented.
Weed Management				
All BOAs	Complete weed inspections every two months to document diversity and abundance of noxious weed records.	Inspections completed every two months, followed by implementation of required control methods, as required.	Weed densities in rehabilitation/regeneration areas are no worse than those in remnant vegetation (analogue) sites. There are no significant weed infestations that are identified as a risk to rehabilitation or regeneration areas.	Inspections completed in accordance with the BOMP.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
			Regular inspections are undertaken for weed species inspections and outcomes are documented.	
Natural Regeneration				
Mountain Block and Mitchell Hills South	Mapping of areas naturally regenerating and subject to revegetation works to track if natural/assisted regeneration is on track to meet final hectare goals.	Revised in ongoing monitoring works, as needed.	Accurate mapping of regeneration areas.	Mapping of targets undertaken in Mountain Block, Bowmans Creek Riparian Corridor and Mitchell Hills South.
Mountain Block and Mitchell Hills South	Management of regeneration progress is responsive to monitoring outcomes.	Monitoring of regeneration areas.	Monitoring results are used to inform ongoing regeneration planning, including implementation of assisted regeneration if natural regeneration is not progressing sufficiently.	Monitoring of regeneration progress occurred in 2023 and areas appear to be progressing.
Mountain Block and Mitchell Hills South	Review need for assisted regeneration where outcomes of natural regeneration is deemed lacking.	Assess progress/outcomes of natural regeneration and assess and implement assisted regeneration measures as required.	Assisted regeneration is implemented if natural regeneration is deemed lacking.	Natural regeneration was assessed and remains low in the southern paddocks, particularly surrounding WR05 in Mountain Block and WR10 in Mitchell Hills South.
Assisted Regeneration				
Mountain Block and	Review need for assisted regeneration where outcomes	Assess progress/outcomes of natural regeneration and	Assisted regeneration is implemented if natural	Natural regeneration was identified in BOAs.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
Mitchell Hills South	of natural regeneration is deemed lacking.	assess and implement assisted regeneration measures as required.	regeneration is deemed lacking.	Undertake supplementary plantings in areas of poor revegetation success (as identified in monitoring report).
Rehabilitation				
Bowmans Creek Riparian Corridor Mountain Block Offset Area	Develop detailed performance criteria for all management zone types.	Refine criteria developed based on annual monitoring of analogue sites if necessary.	Not applicable	
Bowmans Creek Riparian Corridor Mountain Block Offset Area	Implement rehabilitation / revegetation program.	Implementation of plan.	Rehabilitation and revegetation plan implemented.	Rehabilitation Plan is being implemented.
Bowmans Creek Riparian Corridor	Positive feedback loop from monitoring results.	Feedback from monitoring is incorporated into ongoing review and improvement of plan.	Monitoring outcomes considered in continual review and improvement of plan.	Rehabilitation Plan is being implemented.
Habitat Augmentation				
All BOAs	Nest boxes present to improve habitat value for native fauna	Established nest boxes are subject to regular monitoring as identified in Section 4.3.8 and maintenance.	Nest boxes are monitored and maintained.	Nest boxes present in all BOAs and subject to regular monitoring

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
Mountain Block and Mitchell Hills South	Habitat and hollow augmentation will occur in Mountain Block and Mitchell Hills South offset areas if monitoring identifies a dearth of key habitat features such as log piles or boulder piles.	Habitat augmentation, if required.	All biodiversity offset areas have suitable levels of key habitat features, when compared (through monitoring) to remnant vegetation features.	Mitchell Hills South is generally considered to have adequate fauna habitat. Paddocks of south Mountain Block require augmentation (logs and boulder piles).
Translocation				
All BOAs	Translocation of tiger orchids or other threatened flora species (if identified in pre-clearing process) to BOAs. Methods to be adopted are detailed within the BMP.	Tiger orchids are salvaged and translocated according to the process in the BMP as needed.	Tiger orchids (or other threatened flora species if encountered) are salvaged and translocated into biodiversity offset areas in accordance with the Biodiversity Management Plan.	No translocations conducted in 2023. Orchid translocated in 2018 monitored and alive.
Creek and Drainage Line Protection				
Bowmans Creek Riparian Corridor	Rehabilitation works to address stabilisation and erosion issues, as necessary.	Implementation, as needed.	Creek bank is stable and erosion issues are addressed.	No stabilisation works of Bowmans Creek Riparian Corridor needed in 2023.
Seed Collection				
All BOAs	Where suitable remnant vegetation is available, implementation of seed collection and handling program for use in	Pre-clearing surveys identify potential seed sources.	Rehabilitation/revegetation works use seeds collected onsite, thus maintaining as much genetic similarity	Seed collection occurred in 2023 across Mountain Block and Mitchell Hills South.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
	revegetation/rehabilitation works.	Seeds are collected, stored and handled according to appropriate program. Collected seed resources are used in revegetation/rehabilitation works.	(local provenance) as possible.	
Erosion Sedimentation and Salinity				
Mountain Block	Control of erosion in southern paddocks	Continue hydromulching of remainder of eroded areas if trials are successful.	Eroded southern gullies were controlled by way of hydromulch application.	2019 trial area monitored. No additional substantial erosion although limited seed strike.
Mountain Block	Monitor completed erosion works and action repairs if required.	Monitor completed erosion works and action repairs if required.	Erosion control works are stable and successful.	2019 trial area monitored. No additional substantial erosion although limited seed strike.
Bushfire Management				
All BOAs	Bushfire Management Plan implementation	Implementation of requirements of updated Bushfire Management Plan.	Bushfire risk is managed according to an updated Bushfire Management Plan which allows for appropriate protection of life and property, as well as identified significant ecological features	Bushfire Management Plan implemented.

Relevant Offset Area	Action	2023 Performance Criteria	Completion Criteria	Performance / Completion Comment
Monitoring				
All BOAs	Undertake floristic, fauna, LFA and nest box monitoring program	Monitoring program completed and reported	Monitoring programs completed and results reported	Monitoring program completed. Summary of monitoring provided in ***Section 8.5.1***.
All BOAs	Undertake annual inspections of LCO rehabilitation and active regeneration areas	Annual inspections completed	Annual monitoring completed.	Monitoring program completed. Summary of monitoring provided in ***Section 8.5.1***.
All BOAs	Native fauna presence in rehabilitation/regeneration areas	Fauna monitoring completed	Fauna monitoring confirms that native fauna species are recorded within rehabilitation/regeneration areas.	Monitoring program completed. Summary of monitoring provided in ***Section 8.5.1***

9. Stakeholder Engagement

Community Complaints

The management of complaints is undertaken in accordance with EMS, LCO's ***Stakeholder Engagement Strategy*** and Schedule 5, Condition 1 of DA 305- 11-01. LCO operates a combined 24 hour community complaints and blasting information hotline (1800 037 317) which is advertised on the LCO public website.

No complaints were received during the reporting period. An annual comparison of the complaints received at LCO since 2008 is shown in ***Figure 9-1.***

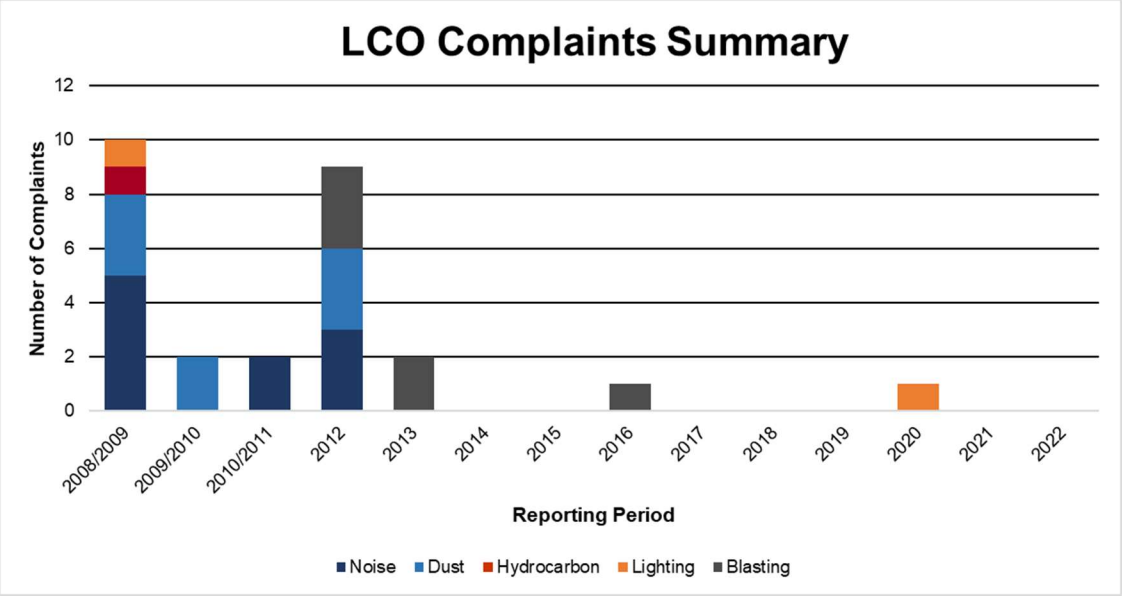


Figure 9-1 Complaints summary

Stakeholder Engagement

LCO undertakes stakeholder engagement activities in accordance with the ***Stakeholder Engagement Strategy*** (the strategy) which includes the Community Engagement, Community Development and Community Investment Plans. The strategy identifies the objectives for consultation and stakeholder engagement, methods of consultation for the various stakeholder groups and priorities for community development.

LCO personnel regularly liaise with the local community in person, over the phone, through the Greater Ravensworth Area community newsletters and via email correspondence. A copy of newsletters sent out to the community and are also available on our public website.

Community Consultative Committee

LCO maintains a CCC in accordance with ***Schedule 5 Condition 7*** of ***DA 305-11-01.***

The LCO CCC provides a forum for local community, local government and mine management to meet and discuss key environmental and community interests and concerns. CCC meetings are held every six months. During the reporting period, CCC meetings were held on:

- 24th May 2023
- 21st November 2023

CCC Meeting Minutes are available for download from the LCO website.

Liddell Coal Operations Website

In accordance with ***Schedule 5, Condition 9*** of ***DA 305-11-01***, LCO maintains a website (www.liddellcoal.com.au) to provide access to information on the operation including environmental, community and operational updates.

Community Investment

LCO aims to provide support for local projects relating to the community, health, education and the environment, in the form of cash donations, sponsorship, and in-kind support for a range of community, educational and environmental initiatives.

During the reporting period LCO made donations to the organisations and charities listed in ***Table 9-1***.

Table 9-1 Community investment program recipients

Community Investment Projects	
Fire and Rescue NSW	Beyond Blue
Hebden Community Hall	Gresford and District Community Group
Muswellbrook South Public School	Little Wings
Lake Liddell Recreation Area	Singleton Public School
Hunter Valley Fly Fishing Club	Muswellbrook Public School
Muswellbrook High School	Gresford Billy Cart Derby

10. Independent Audit

The last independent environmental audit undertaken for the Department of Planning & Environment was for the period of 07 February 2019 to 08 February 2022. The audit was completed over the period of 8 – 11 February 2022 by AECOM.

The audit assessed compliance against Development Consent DA 305-11-01 (as modified) and assessed compliance with the conditions of Environmental Protection Licence 2094, key mining authorities and other licence documents.

All audit opportunities for improvement and actions have been completed and were reported in the 2022 Annual Review.

The next Independent Environmental Audit is scheduled to take place in 2025.

11. Incidents and Non-Compliances During the Reporting Period

During the reporting period LCO recorded no reportable incidents and a number of non-compliances which are outlined below in ***Table 11-1.***

Table 11-1 - 2023 LCO non-compliances

Approval	Condition Reference	Condition Description	Description	Action taken
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Monitoring Point 9 failed to achieve PM10 data availability greater than 75% on 11 dates throughout the reporting period due to hardware failures (01/02/2023 – 02/02/2023, 06/04/2023, 30/10/2023 – 03/11/2023, 26/12/2023 – 28/12/2023).	Hardware failures were actioned and repaired by suitably qualified technicians.
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Monitoring Point 10 failed to achieve PM10 data availability greater than 75% on three dates throughout the reporting period due to hardware failures (22/05/2023 – 23/05/2023, 24/11/2023).	Hardware failures were actioned and repaired by suitably qualified technicians.
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Monitoring Point 11 failed to achieve PM10 data availability greater than 75% on five dates throughout the reporting period due to hardware failures (22/08/2023 – 24/08/2023, 26/11/2023 – 27/11/2023).	Hardware failures were actioned and repaired by suitably qualified technicians.
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Monitoring Point 12 failed to achieve PM10 data availability greater than 75% on 11 dates throughout the reporting period due to hardware failures (09/03/2023,	Hardware failures were actioned and repaired by suitably qualified technicians.

Approval	Condition Reference	Condition Description	Description	Action taken
			29/07/2023 – 31/07/2023, 24/08/2023 – 25/08/2023, 21/10/2023 – 23/10/2023, 30/12/2023 – 31/12/2023).	

* Compliance status as per the ***Compliance status key Table 3*** of the NSW Government Annual Review Guideline.

12. Cautions, Warnings, Penalties and Prosecutions

Details of any cautions, warning letters, penalty notices or prosecution proceedings by any regulatory agencies are summaries below.

- A warning letter was issued by DPE on 30 January 2023 in relation to breach of Section 4.2 of the *Environmental Planning and Assessment Act 1979*. It was identified that LCO failed to implement the Water Management Plan in accordance with Schedule 3, Condition 23 of DA305-11-01. The Water Management Plan was revised and resubmitted to DPE, and subsequently approved 26 May 2023. No further action is required.
- LCO received a penalty notice dated 9 March 2023 in the amount of $15,000. The penalty notice was for a Level 4C blast fume that was generated from blast ART_1674_E0601 on 11 June 2021.

13. Activities to be Completed in the Next Reporting Period

All activities proposed in the next Annual Review period will be consistent with approvals and specific management plans. The following summarises a number of key activities and proposed environmental performance improvement measures to be completed in the next reporting period:

- Ongoing capping and rehabilitation of the Reservoir South and West TSFs in accordance with the tailings emplacement rehabilitation strategy in the RMP;
- Continuation of detailed mine closure planning and execution of the closure plan;
- Commencement of bulk push and rehabilitation of overburden emplacement areas across site as part of mine closure works;
- Commencement of capping and rehabilitation of the Durham TSF in accordance with the tailings emplacement rehabilitation strategy in the RMP;
- Decommissioning and demolition of infrastructure no longer required as part of mine closure works;
- ***Section 6.2.1.*** discussed the Chain of Ponds Inn and the implementation of stabilisation measures in accordance with the COPI Strategy. Once blasting has moved beyond the control zone LCO will

seek to finalise management commitments in consultation with the building owner, Heritage NSW and DPE.

- ***Section 8.4*** identifies the rehabilitation, biodiversity and offset monitoring results and performance which will continue to drive management actions. LCO will continue maintenance works, weed and pest control actions, and implement the BOMP through the commencement of active regeneration works, particularly in Bowman's Creek Riparian Corridor.
- ***Section 8*** outlined the current status of rehabilitation areas, monitoring results and management actions completed during 2023. LCO will continue to implement the BMP and RMP management commitments including but not limited to:
  - Augment the habitat resource to encourage fauna diversity;
  - Conduct maintenance (weed control, erosion repairs, tree thinning, etc.) works as required;
  - Complete supplementary planting to improve species diversity; and
  - Continue to implement grazing strategy throughout South Cut pasture rehabilitation to further develop pasture rehabilitation.
  - Propose selected pasture rehabilitation at the South Cut for certification
- ***Section 8.5*** outlined the current status of offset areas, monitoring results and management actions completed during 2023. LCO will continue to implement the BOMP management commitments including but not limited to:
  - Refine and implement the Offset Remediation Strategy using results from monitoring results, rehabilitation trials and in consultation with appropriate experts;
  - Continue to conduct maintenance works such as targeted feral fauna and flora management;
  - Continued implementation of active regeneration works in all offset areas; and

14. References

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Future Harvest (2024) 2023 Liddell Coal Operations Annual Rehabilitation Monitoring Report

Gilbert & Associates (2013) Liddell Coal Mine Modification 5 Surface Water Assessment

Glencore Coal Assets Australia (2022) Mine Closure Planning Protocol**

Hansen Bailey (2015) Greater Ravensworth Area Tailings Pipeline Modification Environmental Assessment

ICMM (2019) Integrated Mine Closure Good Practice Guide

LCO (2020) Liddell Dust Management TARP**

LCO (2021) Spontaneous Combustion Management Plan**

LCO (2021) Stakeholder Engagement Strategy**

LCO (2021) Aboriginal Cultural Heritage Management Plan*

LCO (2022) Air Quality Management and Monitoring Program*

LCO (2023) Biodiversity Management Plan*

LCO (2023) Blast Management Plan*

LCO (2023) Blast Management Strategy – Chain of Ponds Inn*

LCO (2023) Blast Management Strategy – Newdell Zone Substation*

LCO (2023) Land Clearing and Topsoil Stripping Procedure**

LCO (2023) Noise Monitoring Program Management Plan*

LCO (2023) Rehabilitation Management Plan*

LCO (2023) Water Management Plan*

LCO (2024) Biodiversity Offset Management Plan*

LCO (2024) Bushfire Management Plan**

LCO (2024) Lighting Management Procedure**

NSW Government (2012) NSW Aquifer Interference Policy

NSW Government (2015) Annual Review Guideline

National Environment Protection Council Peer Review Committee (2001) National Environment Protection (Ambient Air Quality) Measure Technical Paper No. 5 Data Collection and Handling

Pacific Environment Limited (2013) Air Quality and Greenhouse Gas Assessment – Liddell Coal Operations Modification 5

SKM (2013) Liddell Coal Operations Modification 5 to Development Consent DA 305-11-01

SLR (2013) Liddell Coal Operations Modification to Development Consent Environmental Assessment

Standards Australia (2016) Methods for Sampling and Analysis of Ambient Air Determination of Particulate Matter – Deposited Matter – Gravimetric Method. AS/NZS3580.10.1:2016.

Umwelt (2013) Rehabilitation Strategy Liddell Coal Operations Extension Project. Prepared for Liddell Coal Operations Pty. Ltd

Umwelt (2024) 2023 Biodiversity Monitoring Report Liddell Coal Operations

Umwelt (2024) 2023 Biodiversity Offset Area Monitoring Report Liddell Coal Operations

Umwelt (2024) 2023 Conservation Agreement Monitoring Report Liddell Coal Operations

Umwelt (2024) 2023 Rehabilitation Monitoring Report Liddell Coal Operations

**LCO document available on public website (www.liddellcoal.com.au)*

***LCO document not publicly available*

Appendix A - Train Haulage Summary

COAL RECEIVALS

Report Period 01/01/2023 12:00 am to 31/12/2023 12:00 am

CoalMan Site : Liddell Coal Marketing Pty Ltd

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
Genesee Wyoming Australia	1 January 2023	LD154	Sakura Century	1 January 2023				9,128.01				9,128.01
		LD206	Sakura Century	1 January 2023				4,660.96	4,490.32			9,151.28
		LD366	Sakura Century	1 January 2023				9,236.21				9,236.21
		Summary of Sunday 01 January 2023						23,025.18	4,490.32			27,515.50
	2 January 2023	LD250	NC Crystal	3 January 2023			9,050.61					9,050.61
		Summary of Monday 02 January 2023					9,050.61					9,050.61
	3 January 2023	LD182	NC Crystal	3 January 2023							8,884.80	8,884.80
		LD218	Ishizuchi II	3 January 2023				4,708.56	4,566.83			9,275.39
		LD330	NC Crystal	3 January 2023			5,104.61					5,104.61
		Summary of Tuesday 03 January 2023					5,104.61	4,708.56	4,566.83		8,884.80	23,264.80
	4 January 2023	LD174	NC Crystal	4 January 2023			9,083.61					9,083.61
		LD226	NC Crystal	4 January 2023							9,045.87	9,045.87
		LD352	NC Crystal	4 January 2023							8,967.39	8,967.39
		LD382	NC Crystal	4 January 2023							9,165.79	9,165.79
		Summary of Wednesday 04 January 2023					9,083.61				27,179.05	36,262.66
	5 January 2023	LD266	Cape Midori	6 January 2023				4,439.14			4,698.65	9,137.79
		Summary of Thursday 05 January 2023						4,439.14			4,698.65	9,137.79
	6 January 2023	LD216	Elettra	6 January 2023				9,202.80				9,202.80
		Summary of Friday 06 January 2023						9,202.80				9,202.80
	7 January 2023	LD108	Elettra	7 January 2023					9,430.61			9,430.61
		LD288	Elettra	7 January 2023				6,596.43	2,670.77			9,267.20
		LD344	Elettra	7 January 2023				9,117.94				9,117.94
		Summary of Saturday 07 January 2023						15,714.37	12,101.38			27,815.75
	8 January 2023	LD102	Orange Truth	8 January 2023				4,842.96	4,441.56			9,284.52
		LD224	Orange Truth	8 January 2023				9,103.19				9,103.19
		LD254	Orange Truth	9 January 2023				9,185.80				9,185.80
		Summary of Sunday 08 January 2023						23,131.95	4,441.56			27,573.51
	9 January 2023	LD106	Tsukuba Maru	9 January 2023	9,317.79							9,317.79
		LD182	Orange Truth	9 January 2023				6,390.20	2,733.54			9,123.74
		LD346	Tsukuba Maru	9 January 2023	9,334.39							9,334.39
		Summary of Monday 09 January 2023			18,652.18			6,390.20	2,733.54			27,775.92

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	10 January 2023	LD270	Tsukuba Maru	11 January 2023			9,123.91					9,123.91
		LD298	Poro Nupuri Maru	11 January 2023			9,124.60					9,124.60
		Summary of Tuesday 10 January 2023					18,248.51					18,248.51
	11 January 2023	LD326	Poro Nupuri Maru	11 January 2023			9,094.59					9,094.59
		Summary of Wednesday 11 January 2023					9,094.59					9,094.59
	18 January 2023	LD190	Osaka Star	18 January 2023				9,186.01				9,186.01
		LD356	Osaka Star	18 January 2023			9,122.81					9,122.81
		Summary of Wednesday 18 January 2023					9,122.81	9,186.01				18,308.82
	19 January 2023	LD108	Osaka Star	19 January 2023			9,189.07					9,189.07
		LD330	Osaka Star	19 January 2023				9,183.61				9,183.61
		Summary of Thursday 19 January 2023					9,189.07	9,183.61				18,372.68
	20 January 2023	LD254	Jasper Dream	21 January 2023			9,235.50					9,235.50
		LD346	NSU Responsibility	20 January 2023				9,260.59				9,260.59
		Summary of Friday 20 January 2023					9,235.50	9,260.59				18,496.09
	22 January 2023	LD274	United Grace	22 January 2023			9,069.79					9,069.79
		Summary of Sunday 22 January 2023					9,069.79					9,069.79
	23 January 2023	LD130	United Grace	23 January 2023	4,520.04			4,620.01				9,140.05
		LD220	Jasper Dream	23 January 2023	4,612.76			4,588.63				9,201.39
		Summary of Monday 23 January 2023			9,132.80			9,208.64				18,341.44
	25 January 2023	LD240	United Grace	25 January 2023	9,325.72			0.00				9,325.72
		Summary of Wednesday 25 January 2023			9,325.72			0.00				9,325.72
	27 January 2023	LD278	Energy Prometheus	28 January 2023				9,218.79				9,218.79
		Summary of Friday 27 January 2023						9,218.79				9,218.79
	29 January 2023	LD108	Energy Prometheus	29 January 2023				7,265.47	1,996.32			9,261.79
		LD258	Corona Ace	29 January 2023				9,238.19				9,238.19
		Summary of Sunday 29 January 2023						16,503.66	1,996.32			18,499.98
	30 January 2023	LD374	Corona Ace	30 January 2023				4,622.87	4,584.47			9,207.34
		Summary of Monday 30 January 2023						4,622.87	4,584.47			9,207.34
	3 February 2023	LD202	Rising Sun	3 February 2023			4,827.41	4,277.87				9,105.28
		Summary of Friday 03 February 2023					4,827.41	4,277.87				9,105.28
	4 February 2023	LD372	Rising Sun	4 February 2023			4,634.45	4,634.45				9,268.90
		Summary of Saturday 04 February 2023					4,634.45	4,634.45				9,268.90
	5 February 2023	LD254	Woolloomooloo	5 February 2023				9,093.08				9,093.08
		LD344	Rising Sun	5 February 2023			4,487.06	4,752.53				9,239.59
		LD372	C.S.Princess	5 February 2023			2,194.10		7,233.20			9,427.30
		Summary of Sunday 05 February 2023					6,681.15	13,845.61	7,233.20			27,759.97
	6 February 2023	LD188	Rising Sun	6 February 2023				6,236.82	3,148.39			9,385.21

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Monday 06 February 2023						6,236.82	3,148.39			9,385.21
	10 February 2023	LD198	Taihakusan	10 February 2023			9,196.82					9,196.82
		Summary of Friday 10 February 2023					9,196.82					9,196.82
	11 February 2023	LD266	Santa Isabel	12 February 2023				9,185.10				9,185.10
		Summary of Saturday 11 February 2023						9,185.10				9,185.10
	12 February 2023	LD254	Santa Isabel	12 February 2023				9,153.08				9,153.08
		Summary of Sunday 12 February 2023						9,153.08				9,153.08
	13 February 2023	LD290	Taihakusan	14 February 2023			8,052.36	1,130.84				9,183.20
		Summary of Monday 13 February 2023					8,052.36	1,130.84				9,183.20
	14 February 2023	LD210	Santa Isabel	14 February 2023				9,286.28				9,286.28
		LD344	Santa Isabel	14 February 2023				9,225.85				9,225.85
		Summary of Tuesday 14 February 2023						18,512.13				18,512.13
	15 February 2023	LD332	CSC Preeminence	15 February 2023			9,059.08					9,059.08
		Summary of Wednesday 15 February 2023					9,059.08					9,059.08
	16 February 2023	LD240	Great Perseus	17 February 2023							8,907.10	8,907.10
		LD352	CSC Preeminence	16 February 2023							8,846.34	8,846.34
		LD378	CSC Preeminence	16 February 2023			4,548.10				4,465.35	9,013.45
		Summary of Thursday 16 February 2023					4,548.10				22,218.79	26,766.89
	17 February 2023	LD164	CSC Preeminence	17 February 2023				0.00			9,160.92	9,160.92
		Summary of Friday 17 February 2023						0.00			9,160.92	9,160.92
	18 February 2023	LD150	Sfakia Wave	18 February 2023				9,191.72				9,191.72
		LD254	Pedhoulas Cedrus	18 February 2023				7,074.27	2,126.38			9,200.65
		Summary of Saturday 18 February 2023						16,265.99	2,126.38			18,392.37
	19 February 2023	LD184	Sfakia Wave	19 February 2023				9,157.10				9,157.10
		LD248	Sfakia Wave	20 February 2023					9,338.83			9,338.83
		Summary of Sunday 19 February 2023						9,157.10	9,338.83			18,495.93
	20 February 2023	LD156	Sfakia Wave	20 February 2023				9,209.05				9,209.05
		LD184	Sfakia Wave	21 February 2023					9,428.77			9,428.77
		LD348	Sfakia Wave	20 February 2023				9,196.79				9,196.79
		Summary of Monday 20 February 2023						18,405.84	9,428.77			27,834.61
	21 February 2023	LD254	Orange Tiger	22 February 2023				9,101.63				9,101.63
		LD370	Sfakia Wave	21 February 2023				9,232.99				9,232.99
		Summary of Tuesday 21 February 2023						18,334.62				18,334.62
	22 February 2023	LD210	Orange Tiger	23 February 2023			3,680.81				5,532.95	9,213.76
		LD282	Orange Tiger	23 February 2023					9,500.48			9,500.48
		LD322	Orange Tiger	22 February 2023				9,261.62				9,261.62
		LD374	Orange Tiger	22 February 2023				9,316.30				9,316.30

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Wednesday 22 February 2023					3,680.81	18,577.92	9,500.48		5,532.95	37,292.16
	23 February 2023	LD304	Sfakia Wave	24 February 2023					9,217.44			9,217.44
		LD346	Sfakia Wave	23 February 2023					9,319.92			9,319.92
		Summary of Thursday 23 February 2023							18,537.36			18,537.36
	24 February 2023	LD326	Hokuriku Maru	25 February 2023				9,394.54				9,394.54
		Summary of Friday 24 February 2023						9,394.54				9,394.54
	25 February 2023	LD196	Century Wave	25 February 2023				9,227.32				9,227.32
		Summary of Saturday 25 February 2023						9,227.32				9,227.32
	26 February 2023	LD274	Century Wave	26 February 2023				4,719.47	4,520.58			9,240.05
		Summary of Sunday 26 February 2023						4,719.47	4,520.58			9,240.05
	27 February 2023	LD122	Cape Hope	27 February 2023				9,211.65				9,211.65
		LD220	Corona Kingdom	27 February 2023				4,503.56			4,609.23	9,112.79
		LD250	Cape Hope	27 February 2023					9,320.99			9,320.99
		Summary of Monday 27 February 2023						13,715.21	9,320.99		4,609.23	27,645.43
	28 February 2023	LD210	Cape Hope	28 February 2023				9,253.59				9,253.59
		LD354	Cape Hope	28 February 2023				9,309.72				9,309.72
		Summary of Tuesday 28 February 2023						18,563.31				18,563.31
	1 March 2023	LD126	Cape Hope	1 March 2023				9,339.84				9,339.84
		LD214	Cape Hope	1 March 2023				9,203.36				9,203.36
		LD254	Cape Hope	2 March 2023					9,350.00			9,350.00
		LD346	Corona Kingdom	1 March 2023			9,254.00					9,254.00
		Summary of Wednesday 01 March 2023					9,254.00	18,543.20	9,350.00			37,147.20
	2 March 2023	LD108	NSU Zenith	2 March 2023							9,148.32	9,148.32
		Summary of Thursday 02 March 2023									9,148.32	9,148.32
	3 March 2023	LD218	NSU Zenith	3 March 2023	1,864.27						7,323.40	9,187.67
		LD324	Pan Clover	4 March 2023				9,201.96				9,201.96
		LD336	Cape Hope	3 March 2023				9,209.30				9,209.30
		LD360	Cape Hope	3 March 2023				4,644.44	4,656.28			9,300.72
		Summary of Friday 03 March 2023			1,864.27			23,055.70	4,656.28		7,323.40	36,899.65
	5 March 2023	LD130	Pan Clover	5 March 2023					9,314.03			9,314.03
		Summary of Sunday 05 March 2023							9,314.03			9,314.03
	6 March 2023	LD214	Pan Clover	6 March 2023			6,579.29		2,698.87			9,278.16
		Summary of Monday 06 March 2023					6,579.29		2,698.87			9,278.16
	10 March 2023	LD126	Spring Nexus	10 March 2023			9,168.95					9,168.95
		Summary of Friday 10 March 2023					9,168.95					9,168.95
	12 March 2023	LD116	Spring Nexus	12 March 2023							8,857.11	8,857.11
		Summary of Sunday 12 March 2023									8,857.11	8,857.11

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	14 March 2023	LD274	Grand Sakura	14 March 2023			9,193.11					9,193.11
		Summary of Tuesday 14 March 2023					9,193.11					9,193.11
	15 March 2023	LD338	Grand Sakura	15 March 2023			7,848.56	1,347.80				9,196.36
		Summary of Wednesday 15 March 2023					7,848.56	1,347.80				9,196.36
	17 March 2023	LD320	Grand Sakura	18 March 2023					9,346.16			9,346.16
		LD358	NSU Keystone	17 March 2023							8,763.10	8,763.10
		Summary of Friday 17 March 2023							9,346.16		8,763.10	18,109.26
	20 March 2023	LD112	NSU Keystone	20 March 2023							9,102.60	9,102.60
		Summary of Monday 20 March 2023									9,102.60	9,102.60
	23 March 2023	LD178	Double Pride	23 March 2023				9,087.30				9,087.30
		Summary of Thursday 23 March 2023						9,087.30				9,087.30
	25 March 2023	LD150	Double Pride	25 March 2023				9,137.97				9,137.97
		Summary of Saturday 25 March 2023						9,137.97				9,137.97
	27 March 2023	LD332	Double Pride	27 March 2023				0.00	9,267.70			9,267.70
		Summary of Monday 27 March 2023						0.00	9,267.70			9,267.70
	1 April 2023	LD218	Golden Courage	1 April 2023	9,234.80							9,234.80
		Summary of Saturday 01 April 2023			9,234.80							9,234.80
	2 April 2023	LD154	Golden Courage	2 April 2023				3,440.19			5,505.18	8,945.37
		LD208	Brilliant Sakura	2 April 2023				9,235.23				9,235.23
		LD324	Brilliant Sakura	3 April 2023				9,131.76				9,131.76
		LD364	Golden Courage	2 April 2023	6,368.28			3,019.86				9,388.14
		Summary of Sunday 02 April 2023			6,368.28			24,827.04			5,505.18	36,700.50
	10 April 2023	LD116	Dhun	10 April 2023				9,361.57				9,361.57
		LD208	Dhun	10 April 2023				9,350.82				9,350.82
		Summary of Monday 10 April 2023						18,712.39				18,712.39
	12 April 2023	LD366	Dhun	12 April 2023					9,305.96			9,305.96
		Summary of Wednesday 12 April 2023							9,305.96			9,305.96
	13 April 2023	LD188	Dhun	13 April 2023				9,186.44				9,186.44
		Summary of Thursday 13 April 2023						9,186.44				9,186.44
	24 April 2023	LD212	NSU Katsura	24 April 2023							8,730.77	8,730.77
		Summary of Monday 24 April 2023									8,730.77	8,730.77
	28 April 2023	LD286	Rising Sun	29 April 2023				9,162.06				9,162.06
		Summary of Friday 28 April 2023						9,162.06				9,162.06
	1 May 2023	LD326	Rising Sun	1 May 2023				9,255.64				9,255.64
		Summary of Monday 01 May 2023						9,255.64				9,255.64
	2 May 2023	LD144	Amoy Progress	2 May 2023							8,786.17	8,786.17
		Summary of Tuesday 02 May 2023									8,786.17	8,786.17

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	3 May 2023	LD130	Amoy Progress	3 May 2023							8,848.00	8,848.00
		LD180	Spring Progress	3 May 2023			9,209.60					9,209.60
		LD270	Spring Progress	3 May 2023			9,246.00					9,246.00
		Summary of Wednesday 03 May 2023					18,455.60				8,848.00	27,303.60
	4 May 2023	LD250	Spring Progress	4 May 2023			9,246.00					9,246.00
		Summary of Thursday 04 May 2023					9,246.00					9,246.00
	5 May 2023	LD108	Spring Progress	5 May 2023					9,452.20			9,452.20
		LD250	Amoy Progress	6 May 2023							8,647.80	8,647.80
		LD374	Spring Progress	5 May 2023			9,195.00					9,195.00
		Summary of Friday 05 May 2023					9,195.00		9,452.20		8,647.80	27,295.00
	6 May 2023	LD134	Spring Progress	6 May 2023			9,210.17					9,210.17
		LD260	Kagura	6 May 2023			9,286.58					9,286.58
		Summary of Saturday 06 May 2023					18,496.75					18,496.75
	7 May 2023	LD132	Kagura	7 May 2023			9,234.48					9,234.48
		LD222	Spring Progress	7 May 2023					9,428.72			9,428.72
		Summary of Sunday 07 May 2023					9,234.48		9,428.72			18,663.20
	8 May 2023	LD102	Hui Sheng Hai	8 May 2023	9,126.45							9,126.45
		LD246	Hui Sheng Hai	9 May 2023					9,385.25			9,385.25
		Summary of Monday 08 May 2023			9,126.45				9,385.25			18,511.70
	9 May 2023	LD208	Spring Progress	9 May 2023					9,368.66			9,368.66
		LD258	Hui Sheng Hai	10 May 2023			9,317.86					9,317.86
		Summary of Tuesday 09 May 2023					9,317.86		9,368.66			18,686.52
	10 May 2023	LD220	Hui Sheng Hai	11 May 2023					9,346.92			9,346.92
		LD256	Hui Sheng Hai	11 May 2023			9,204.80					9,204.80
		LD380	Hui Sheng Hai	10 May 2023	9,246.40							9,246.40
		Summary of Wednesday 10 May 2023			9,246.40		9,204.80		9,346.92			27,798.12
	11 May 2023	LD258	Hui Sheng Hai	11 May 2023					9,375.66			9,375.66
		LD362	Hui Sheng Hai	11 May 2023	9,183.46							9,183.46
		Summary of Thursday 11 May 2023			9,183.46				9,375.66			18,559.12
	12 May 2023	LD354	Hui Sheng Hai	12 May 2023			9,186.66					9,186.66
		Summary of Friday 12 May 2023					9,186.66					9,186.66
	13 May 2023	LD164	Pegasus Island	13 May 2023					9,372.88			9,372.88
		LD380	Pegasus Island	13 May 2023					9,429.60			9,429.60
		Summary of Saturday 13 May 2023							18,802.48			18,802.48
	14 May 2023	LD306	Pegasus Island	15 May 2023					9,368.08			9,368.08
		Summary of Sunday 14 May 2023							9,368.08			9,368.08
	19 May 2023	LD240	NSU Trust	19 May 2023					9,375.68			9,375.68
		Summary of Friday 19 May 2023							9,375.68			9,375.68

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	20 May 2023	LD194	NSU Trust	20 May 2023				9,161.06				9,161.06
		LD366	NSU Trust	20 May 2023	9,405.30							9,405.30
		Summary of Saturday 20 May 2023			9,405.30			9,161.06				18,566.36
	21 May 2023	LD160	NSU Trust	21 May 2023				9,256.73				9,256.73
		LD196	NSU Trust	21 May 2023				9,156.40				9,156.40
		LD230	NSU Trust	22 May 2023					9,429.46			9,429.46
		LD362	NSU Trust	21 May 2023	9,310.06							9,310.06
		Summary of Sunday 21 May 2023			9,310.06			18,413.13	9,429.46			37,152.65
	22 May 2023	LD164	NSU Trust	22 May 2023	9,276.30							9,276.30
		LD186	NSU Trust	22 May 2023				9,207.20				9,207.20
		Summary of Monday 22 May 2023			9,276.30			9,207.20				18,483.50
	30 May 2023	LD334	Leading Bravery	31 May 2023							8,528.39	8,528.39
		Summary of Tuesday 30 May 2023									8,528.39	8,528.39
	31 May 2023	LD198	Leading Bravery	31 May 2023							8,597.50	8,597.50
		LD260	Leading Bravery	31 May 2023							8,598.08	8,598.08
		LD384	Leading Bravery	31 May 2023				9,098.96				9,098.96
		Summary of Wednesday 31 May 2023						9,098.96			17,195.58	26,294.54
	1 June 2023	LD114	Leading Bravery	1 June 2023							8,678.48	8,678.48
		LD282	Leading Bravery	2 June 2023	9,390.90							9,390.90
		Summary of Thursday 01 June 2023			9,390.90						8,678.48	18,069.38
	4 June 2023	LD108	Cape Hope	4 June 2023					9,479.76			9,479.76
		LD194	Cape Hope	4 June 2023				9,139.37				9,139.37
		LD316	Cape Hope	5 June 2023					9,515.00			9,515.00
		Summary of Sunday 04 June 2023						9,139.37	18,994.76			28,134.13
	5 June 2023	LD166	Cape Hope	5 June 2023							8,868.80	8,868.80
		Summary of Monday 05 June 2023									8,868.80	8,868.80
	7 June 2023	LD320	Cape Hope	7 June 2023				2,220.10	7,174.03			9,394.13
		Summary of Wednesday 07 June 2023						2,220.10	7,174.03			9,394.13
	9 June 2023	LD108	Midnight Dream	9 June 2023	9,198.00							9,198.00
		LD348	Midnight Dream	9 June 2023	9,350.00							9,350.00
		Summary of Friday 09 June 2023			18,548.00							18,548.00
	10 June 2023	LD166	Midnight Dream	10 June 2023					9,372.20			9,372.20
		Summary of Saturday 10 June 2023							9,372.20			9,372.20
	11 June 2023	LD126	Midnight Dream	11 June 2023				9,152.00				9,152.00
		LD314	Midnight Dream	12 June 2023				9,144.80				9,144.80
		LD358	Midnight Dream	11 June 2023				9,116.80				9,116.80
		Summary of Sunday 11 June 2023						27,413.60				27,413.60
	12 June 2023	LD118	Midnight Dream	12 June 2023					9,403.15			9,403.15

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		LD252	Shandong Peng Cheng	12 June 2023					9,336.53			9,336.53
		Summary of Monday 12 June 2023							18,739.68			18,739.68
	15 June 2023	LD174	Cape Sapphire	15 June 2023	9,353.93							9,353.93
		Summary of Thursday 15 June 2023			9,353.93							9,353.93
	16 June 2023	LD120	Cape Sapphire	16 June 2023				9,059.73				9,059.73
		LD320	Cape Sapphire	16 June 2023				9,270.00				9,270.00
		Summary of Friday 16 June 2023						18,329.73				18,329.73
	17 June 2023	LD224	Cape Sapphire	17 June 2023	9,312.53							9,312.53
		Summary of Saturday 17 June 2023			9,312.53							9,312.53
	18 June 2023	LD132	New Ascent	18 June 2023				9,162.60				9,162.60
		Summary of Sunday 18 June 2023						9,162.60				9,162.60
	19 June 2023	LD154	New Ascent	19 June 2023				3,299.46	6,034.31			9,333.77
		Summary of Monday 19 June 2023						3,299.46	6,034.31			9,333.77
	22 June 2023	LD230	Maritime Longevity	23 June 2023							8,891.17	8,891.17
		Summary of Thursday 22 June 2023									8,891.17	8,891.17
	23 June 2023	LD256	NSU Katsura	24 June 2023	9,376.66							9,376.66
		Summary of Friday 23 June 2023			9,376.66							9,376.66
	24 June 2023	LD328	NSU Katsura	24 June 2023				9,158.74				9,158.74
		Summary of Saturday 24 June 2023						9,158.74				9,158.74
	25 June 2023	LD376	NSU Katsura	25 June 2023				9,100.80				9,100.80
		Summary of Sunday 25 June 2023						9,100.80				9,100.80
	26 June 2023	LD322	NSU Katsura	27 June 2023	3,302.41				6,108.59			9,411.00
		Summary of Monday 26 June 2023			3,302.41				6,108.59			9,411.00
	2 July 2023	LD316	Oratorio	2 July 2023				9,154.17				9,154.17
		Summary of Sunday 02 July 2023						9,154.17				9,154.17
	3 July 2023	LD386	Oratorio	3 July 2023				4,634.81	4,692.93			9,327.74
		Summary of Monday 03 July 2023						4,634.81	4,692.93			9,327.74
	4 July 2023	LD128	Ototachibana	4 July 2023				9,229.13				9,229.13
		LD254	Ototachibana	5 July 2023				9,220.93				9,220.93
		Summary of Tuesday 04 July 2023						18,450.06				18,450.06
	5 July 2023	LD202	Ototachibana	6 July 2023					9,425.16			9,425.16
		Summary of Wednesday 05 July 2023							9,425.16			9,425.16
	6 July 2023	LD104	Ototachibana	6 July 2023	9,364.83							9,364.83
		LD198	Ototachibana	6 July 2023				9,208.32				9,208.32
		LD228	Ototachibana	7 July 2023				9,153.16				9,153.16
		LD332	Ototachibana	6 July 2023	9,363.92							9,363.92

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Thursday 06 July 2023			18,728.75			18,361.48				37,090.23
	7 July 2023	LD360	Ototachibana	7 July 2023	4,705.60			4,658.34				9,363.94
		Summary of Friday 07 July 2023			4,705.60			4,658.34				9,363.94
	9 July 2023	LD176	Unta	9 July 2023				9,220.63				9,220.63
		Summary of Sunday 09 July 2023						9,220.63				9,220.63
	10 July 2023	LD274	Unta	10 July 2023				9,048.88				9,048.88
		LD354	Unta	10 July 2023				9,181.17				9,181.17
		Summary of Monday 10 July 2023						18,230.05				18,230.05
	11 July 2023	LD274	Unta	11 July 2023					9,335.08			9,335.08
		Summary of Tuesday 11 July 2023							9,335.08			9,335.08
	15 July 2023	LD216	China Steel Challenge	15 July 2023							8,742.92	8,742.92
		Summary of Saturday 15 July 2023									8,742.92	8,742.92
	16 July 2023	LD298	China Steel Challenge	17 July 2023				8,987.28				8,987.28
		LD332	China Steel Challenge	16 July 2023							8,754.48	8,754.48
		Summary of Sunday 16 July 2023						8,987.28			8,754.48	17,741.76
	17 July 2023	LD302	China Steel Challenge	18 July 2023				9,020.72				9,020.72
		LD354	China Steel Challenge	17 July 2023							8,865.92	8,865.92
		Summary of Monday 17 July 2023						9,020.72			8,865.92	17,886.64
	18 July 2023	LD214	China Steel Challenge	18 July 2023							8,888.83	8,888.83
		LD368	China Steel Challenge	18 July 2023							8,607.50	8,607.50
		Summary of Tuesday 18 July 2023									17,496.33	17,496.33
	19 July 2023	LD248	NSU Young Star	20 July 2023	9,231.28							9,231.28
		LD338	China Steel Challenge	19 July 2023				8,969.88				8,969.88
		Summary of Wednesday 19 July 2023			9,231.28			8,969.88				18,201.16
	20 July 2023	LD108	NSU Young Star	20 July 2023				9,077.83				9,077.83
		LD250	NSU Young Star	20 July 2023				4,611.89	4,557.54			9,169.43
		LD290	NSU Young Star	20 July 2023				9,099.22				9,099.22
		Summary of Thursday 20 July 2023						22,788.94	4,557.54			27,346.48
	23 July 2023	LD102	Asanagi	23 July 2023	9,339.72							9,339.72
		LD178	Asanagi	23 July 2023					9,491.23			9,491.23
		LD264	Asanagi	23 July 2023	9,317.92							9,317.92
		Summary of Sunday 23 July 2023			18,657.64				9,491.23			28,148.87
	24 July 2023	LD106	Asanagi	24 July 2023					9,422.85			9,422.85

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Monday 24 July 2023							9,422.85			9,422.85
	25 July 2023	LD358	Asanagi	25 July 2023	4,716.20			4,553.63				9,269.83
		Summary of Tuesday 25 July 2023			4,716.20			4,553.63				9,269.83
	30 July 2023	LD336	Asahi Maru	30 July 2023				9,078.72				9,078.72
		Summary of Sunday 30 July 2023						9,078.72				9,078.72
	31 July 2023	LD332	Asahi Maru	31 July 2023				9,060.52				9,060.52
		Summary of Monday 31 July 2023						9,060.52				9,060.52
	1 August 2023	LD386	Asahi Maru	1 August 2023					9,414.05			9,414.05
		Summary of Tuesday 01 August 2023							9,414.05			9,414.05
	11 August 2023	LD112	Shandong Civilization	11 August 2023				9,123.64				9,123.64
		LD242	Shandong Civilization	11 August 2023				9,209.97				9,209.97
		Summary of Friday 11 August 2023						18,333.61				18,333.61
	12 August 2023	LD372	Shandong Civilization	12 August 2023				9,247.37				9,247.37
		Summary of Saturday 12 August 2023						9,247.37				9,247.37
	13 August 2023	LD210	CMB Medoc	13 August 2023	9,332.46							9,332.46
		LD384	Shandong Civilization	13 August 2023	9,410.17							9,410.17
		Summary of Sunday 13 August 2023			18,742.63							18,742.63
	14 August 2023	LD332	CMB Medoc	14 August 2023				9,167.23				9,167.23
		Summary of Monday 14 August 2023						9,167.23				9,167.23
	15 August 2023	LD358	CMB Medoc	15 August 2023				9,170.12				9,170.12
		Summary of Tuesday 15 August 2023						9,170.12				9,170.12
	16 August 2023	LD274	CMB Medoc	17 August 2023				9,194.82				9,194.82
		LD364	CMB Medoc	16 August 2023				9,143.32				9,143.32
		Summary of Wednesday 16 August 2023						18,338.14				18,338.14
	17 August 2023	LD156	CMB Medoc	17 August 2023					9,379.52			9,379.52
		Summary of Thursday 17 August 2023							9,379.52			9,379.52
	21 August 2023	LD130	Dhun	21 August 2023				9,173.64				9,173.64
		LD182	Dhun	21 August 2023				9,200.86				9,200.86
		Summary of Monday 21 August 2023						18,374.50				18,374.50
	22 August 2023	LD232	NSU Challenger	22 August 2023	9,312.48							9,312.48
		Summary of Tuesday 22 August 2023			9,312.48							9,312.48
	23 August 2023	LD144	NSU Challenger	23 August 2023				9,239.46				9,239.46
		LD224	Dhun	23 August 2023					9,374.24			9,374.24
		LD338	NSU Challenger	23 August 2023	9,379.68							9,379.68
		Summary of Wednesday 23 August 2023			9,379.68			9,239.46	9,374.24			27,993.38

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	24 August 2023	LD312	Dhun	25 August 2023					9,256.82			9,256.82
		Summary of Thursday 24 August 2023							9,256.82			9,256.82
	25 August 2023	LD286	NSU Challenger	26 August 2023	7,075.75			2,267.50				9,343.25
		Summary of Friday 25 August 2023			7,075.75			2,267.50				9,343.25
	27 August 2023	LD104	BBG Tieshan	27 August 2023				7,187.28	1,970.98			9,158.26
		Summary of Sunday 27 August 2023						7,187.28	1,970.98			9,158.26
	6 September 2023	LD208	Kagawa Maru	6 September 2023	676.35							676.35
		Summary of Wednesday 06 September 2023			676.35							676.35
	8 September 2023	LD184	Kagawa Maru	8 September 2023	9,415.38							9,415.38
		Summary of Friday 08 September 2023			9,415.38							9,415.38
	11 September 2023	LD250	United Adventure	11 September 2023				9,101.05				9,101.05
		LD388	United Adventure	11 September 2023	9,401.77							9,401.77
		Summary of Monday 11 September 2023			9,401.77			9,101.05				18,502.82
	12 September 2023	LD154	United Adventure	12 September 2023				9,077.34				9,077.34
		LD274	Kagawa Maru	13 September 2023				9,150.97				9,150.97
		LD336	United Adventure	12 September 2023				9,022.82				9,022.82
		Summary of Tuesday 12 September 2023						27,251.13				27,251.13
	13 September 2023	LD132	Kagawa Maru	13 September 2023				9,105.84				9,105.84
		Summary of Wednesday 13 September 2023						9,105.84				9,105.84
	14 September 2023	LD120	United Adventure	14 September 2023					9,271.41			9,271.41
		LD274	Kagawa Maru	14 September 2023	4,654.10				4,627.82			9,281.92
		Summary of Thursday 14 September 2023			4,654.10				13,899.23			18,553.33
	15 September 2023	LD166	United Adventure	15 September 2023				9,144.68				9,144.68
		LD302	NSU Quest	16 September 2023	9,365.61							9,365.61
		Summary of Friday 15 September 2023			9,365.61			9,144.68				18,510.29
	16 September 2023	LD124	NSU Quest	16 September 2023				9,150.12				9,150.12
		LD258	NSU Quest	16 September 2023	8,325.35			1,204.17				9,529.52
		Summary of Saturday 16 September 2023			8,325.35			10,354.29				18,679.64
	17 September 2023	LD138	NSU Quest	17 September 2023				9,144.32				9,144.32
		LD212	NSU Quest	17 September 2023				9,095.57				9,095.57
		LD268	NSU Quest	17 September 2023	9,248.13							9,248.13
		LD352	United Adventure	17 September 2023	4,646.64				4,662.90			9,309.54
		Summary of Sunday 17 September 2023			13,894.77			18,239.89	4,662.90			36,797.56
	18 September 2023	LD230	NSU Quest	18 September 2023	9,048.60			0.00				9,048.60
		Summary of Monday 18 September 2023			9,048.60			0.00				9,048.60
	19 September 2023	LD328	NSU Quest	19 September 2023					9,487.34			9,487.34
		Summary of Tuesday 19 September 2023							9,487.34			9,487.34

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	23 September 2023	LD220	Oratorio	23 September 2023	1,118.32			6,448.12	1,633.50			9,199.94
		Summary of Saturday 23 September 2023			1,118.32			6,448.12	1,633.50			9,199.94
	2 October 2023	LD142	Cape Verde	2 October 2023		4,903.65		4,424.35				9,328.00
		LD290	Cape Verde	3 October 2023		4,555.40		4,564.60				9,120.00
		Summary of Monday 02 October 2023				9,459.05		8,988.95				18,448.00
	9 October 2023	LD204	Cape Verde	9 October 2023				9,060.95				9,060.95
		LD230	Cape Verde	9 October 2023		4,680.31			4,750.18			9,430.49
		Summary of Monday 09 October 2023				4,680.31		9,060.95	4,750.18			18,491.44
	10 October 2023	LD182	Pioneer Eternity	10 October 2023		4,613.67					4,510.53	9,124.20
		LD260	Cape Verde	11 October 2023		4,679.63			4,673.54			9,353.17
		LD320	Cape Verde	11 October 2023		4,665.19			4,554.08			9,219.27
		Summary of Tuesday 10 October 2023				13,958.49			9,227.62		4,510.53	27,696.64
	11 October 2023	LD126	Pioneer Eternity	11 October 2023					9,366.17			9,366.17
		LD222	Pioneer Eternity	11 October 2023					9,297.44			9,297.44
		Summary of Wednesday 11 October 2023							18,663.61			18,663.61
	12 October 2023	LD262	Pioneer Eternity	13 October 2023				4,453.93			4,553.96	9,007.89
		Summary of Thursday 12 October 2023						4,453.93			4,553.96	9,007.89
	13 October 2023	LD148	Greneta	13 October 2023				9,222.70				9,222.70
		Summary of Friday 13 October 2023						9,222.70				9,222.70
	20 October 2023	LD124	Linda Fortune	20 October 2023		4,750.75		4,571.21				9,321.96
		Summary of Friday 20 October 2023				4,750.75		4,571.21				9,321.96
	23 October 2023	LD192	Linda Fortune	23 October 2023				9,061.73				9,061.73
		Summary of Monday 23 October 2023						9,061.73				9,061.73
	24 October 2023	LD344	Linda Fortune	24 October 2023				4,654.65	4,479.30			9,133.95
		Summary of Tuesday 24 October 2023						4,654.65	4,479.30			9,133.95
	25 October 2023	LD308	Linda Fortune	25 October 2023				4,653.66	4,545.34			9,199.00
		Summary of Wednesday 25 October 2023						4,653.66	4,545.34			9,199.00
	26 October 2023	LD350	Linda Fortune	26 October 2023		4,768.10			4,621.44			9,389.54
		Summary of Thursday 26 October 2023				4,768.10			4,621.44			9,389.54
	2 November 2023	LD174	Key Guardian	2 November 2023				8,948.88				8,948.88
		Summary of Thursday 02 November 2023						8,948.88				8,948.88
	3 November 2023	LD226	Corona Wisdom	3 November 2023		4,670.53			4,633.04			9,303.57
		Summary of Friday 03 November 2023				4,670.53			4,633.04			9,303.57
	6 November 2023	LD212	Cape Green	6 November 2023		3,946.98		3,908.95	1,300.31			9,156.24
		LD286	Wattle Tiger	7 November 2023					9,342.83			9,342.83
		LD344	Wattle Tiger	6 November 2023				8,909.24				8,909.24
		Summary of Monday 06 November 2023				3,946.98		12,818.19	10,643.14			27,408.31

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID14	LID14.5	LID9	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	7 November 2023	LD298	Cape Green	8 November 2023		9,378.43			0.00			9,378.43
		LD360	Wattle Tiger	7 November 2023				6,777.86	2,264.78			9,042.64
		Summary of Tuesday 07 November 2023				9,378.43		6,777.86	2,264.78			18,421.07
	9 November 2023	LD118	Ocean Treasure	9 November 2023		2,915.70			6,382.71	0.00		9,298.41
		LD200	Wattle Tiger	9 November 2023		4,690.38			4,640.43			9,330.81
		Summary of Thursday 09 November 2023				7,606.08			11,023.14	0.00		18,629.22
	10 November 2023	LD198	Ocean Treasure	10 November 2023		4,703.82			4,703.82			9,407.63
		LD256	Cape Green	11 November 2023				1,760.39	7,556.02			9,316.41
		LD272	Cape Green	11 November 2023					4,797.85			4,797.85
		Summary of Friday 10 November 2023				4,703.82		1,760.39	17,057.69			23,521.89
	14 November 2023	LD210	Jacob Oldendorff	14 November 2023		6,430.76			2,820.65			9,251.41
		Summary of Tuesday 14 November 2023				6,430.76			2,820.65			9,251.41
	15 November 2023	LD214	Energia Centaurus	15 November 2023					4,337.00			4,337.00
		Summary of Wednesday 15 November 2023							4,337.00			4,337.00
	7 December 2023	LD220	Xing Le Hai	8 December 2023					8,285.22			8,285.22
		Summary of Thursday 07 December 2023							8,285.22			8,285.22
	Summary of Genesee Wyoming Australia				335,860.71	74,353.27	272,260.36	1,054,266.42	555,120.61	0.00	271,083.40	2,562,944.77
Summary of Liddell Coal Marketing Pty Ltd					335,860.71	74,353.27	272,260.36	1,054,266.42	555,120.61	0.00	271,083.40	2,562,944.77
Grand Total					335,860.71	74,353.27	272,260.36	1,054,266.42	555,120.61	0.00	271,083.40	2,562,944.77

COAL UNLOADED DELTA

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	Total
Grand Total					

Coal Receivals total	2,562,944.77
Coal Unloaded delta Total:	
Adj Total:	2,562,944.77

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Appendix B - Meteorological Summary

Meteorological Summary			
Date Sampled	Average Air Temperature at 2m (°C)	Average Air Temperature at 10m (°C)	Daily Rain (mm)
1/01/2023	23.4	23.0	0
2/01/2023	23.2	22.9	0
3/01/2023	25.4	25.1	5.6
4/01/2023	23.2	22.9	3.6
5/01/2023	18.3	18.2	0.4
6/01/2023	18.6	18.3	0
7/01/2023	19.1	18.9	0
8/01/2023	20.9	20.6	0
9/01/2023	22	22.1	0
10/01/2023	21.7	21.6	0
11/01/2023	22.8	22.4	0
12/01/2023	23.0	22.7	0
13/01/2023	23.1	22.8	0
14/01/2023	23.2	22.9	0
15/01/2023	25.1	24.9	0
16/01/2023	23.8	23.4	0
17/01/2023	23.9	23.5	0
18/01/2023	25.9	25.9	5.6
19/01/2023	19.8	19.8	0.2
20/01/2023	18.5	18.3	0
21/01/2023	20.9	20.5	4.4
22/01/2023	18.9	18.8	0

Meteorological Summary			
23/01/2023	21.0	20.7	0
24/01/2023	24.0	23.7	0
25/01/2023	25.3	25.1	2.2
26/01/2023	27.1	26.9	0
27/01/2023	25.2	25.0	0
28/01/2023	27.6	27.5	0.4
29/01/2023	27.0	26.9	7
30/01/2023	22.2	22.2	3.4
31/01/2023	23.3	23.1	0
1/02/2023	24.6	24.5	0
2/02/2023	27.6	27.3	0
3/02/2023	26.8	26.6	0
4/02/2023	22.8	22.5	0
5/02/2023	23.2	22.9	0
6/02/2023	23.6	23.7	0
7/02/2023	24.6	24.3	0
8/02/2023	23.9	23.5	9.4
9/02/2023	21.3	21.3	0
10/02/2023	24.1	24.1	0
11/02/2023	27.3	27.6	0
12/02/2023	27.3	27.2	0
13/02/2023	23.2	22.8	0
14/02/2023	20.8	20.6	0
15/02/2023	22.4	22.1	0
16/02/2023	23.6	23.8	0
17/02/2023	25.7	25.8	8.8
18/02/2023	26.1	26.2	0

Meteorological Summary			
19/02/2023	24.1	23.8	0
20/02/2023	25.7	25.7	0
21/02/2023	24.2	24.2	54.6
22/02/2023	18.6	18.6	0.2
23/02/2023	19.4	19.2	0
24/02/2023	20.5	20.4	0
25/02/2023	20.6	20.7	0
26/02/2023	24.3	24.8	10
27/02/2023	25.5	25.6	0
28/02/2023	23.6	23.3	0
1/03/2023	24.6	24.5	0
2/03/2023	23.0	22.9	0
3/03/2023	22.3	22.2	0
4/03/2023	21.7	21.6	0
5/03/2023	23.4	23.6	0
6/03/2023	29.7	29.8	0
7/03/2023	31.0	31.1	0
8/03/2023	26.9	26.9	0
9/03/2023	23.3	23.3	0
10/03/2023	21.6	22.0	0
11/03/2023	23.9	24	0.6
12/03/2023	23.9	23.7	8.2
13/03/2023	20.3	20.3	0.8
14/03/2023	21.0	20.9	0
15/03/2023	23.4	23.3	0
16/03/2023	27.2	27.2	0
17/03/2023	26.7	26.6	0

Meteorological Summary			
18/03/2023	25.3	25.5	0
19/03/2023	28.1	28.8	0
20/03/2023	22.5	22.8	0
21/03/2023	20.1	19.9	3.2
22/03/2023	21.3	21.3	8.4
23/03/2023	23.1	23.2	0
24/03/2023	22.2	22.0	12.2
25/03/2023	20.2	20.1	0
26/03/2023	21	20.9	14.4
27/03/2023	19.2	19.3	5.8
28/03/2023	21.3	21.3	10.8
29/03/2023	21.3	21.4	0.2
30/03/2023	19.8	19.8	0
31/03/2023	19.1	19.0	0
1/04/2023	18.3	18.2	0
2/04/2023	18	17.9	0
3/04/2023	18.5	18.4	0.2
4/04/2023	18.9	18.9	0
5/04/2023	18.2	18.6	0
6/04/2023	18	18.2	4.2
7/04/2023	18.1	18.4	0
8/04/2023	19.5	19.4	0
9/04/2023	17.4	17.3	0
10/04/2023	15.4	15.3	0
11/04/2023	15.7	15.8	1.2
12/04/2023	16.2	16.3	1.6
13/04/2023	16.8	16.9	1.4

Meteorological Summary			
14/04/2023	16.8	17.0	0.4
15/04/2023	17.8	18.1	0
16/04/2023	20.4	20.7	0
17/04/2023	16.4	16.6	0
18/04/2023	16.6	16.8	0
19/04/2023	16.9	17.5	9.8
20/04/2023	15.4	15.6	0.2
21/04/2023	16.5	16.7	0
22/04/2023	16.2	16.4	0
23/04/2023	16.5	16.8	0.2
24/04/2023	17.7	17.7	0
25/04/2023	17.4	17.6	0
26/04/2023	16.0	16.5	0
27/04/2023	16.5	17.1	0
28/04/2023	18.3	19.0	17.6
29/04/2023	17.7	17.9	0.2
30/04/2023	16.1	15.9	0
1/05/2023	14.5	14.4	0
2/05/2023	16.9	16.8	0
3/05/2023	18.4	18.4	0
4/05/2023	14.4	14.7	0
5/05/2023	12.9	13.5	0
6/05/2023	14.4	14.8	0
7/05/2023	11.8	11.8	0
8/05/2023	11.2	11.0	0
9/05/2023	12.1	12.3	0
10/05/2023	12.7	13.0	0

Meteorological Summary			
11/05/2023	13.1	13.6	0
12/05/2023	14.1	14.8	0
13/05/2023	13.6	14.1	0
14/05/2023	14.7	14.9	0
15/05/2023	14.6	14.8	0
16/05/2023	14.7	15.1	0.2
17/05/2023	12.2	12.8	0
18/05/2023	11.7	11.9	0.2
19/05/2023	11.7	11.8	0
20/05/2023	12.5	12.4	0
21/05/2023	14.3	14.3	0
22/05/2023	13.1	13.2	0
23/05/2023	12.8	13.2	0
24/05/2023	13.2	13.5	0
25/05/2023	15.9	15.9	0.8
26/05/2023	14.8	15.1	0
27/05/2023	11.1	11.1	0
28/05/2023	10.7	10.7	0
29/05/2023	15.1	15.0	0
30/05/2023	15.1	15.0	0
31/05/2023	16.2	16.1	0
1/06/2023	18.1	18.1	0
2/06/2023	15	15.4	0
3/06/2023	16.8	16.9	0
4/06/2023	15.4	15.5	0.2
5/06/2023	14.7	14.7	0
6/06/2023	12.5	13.1	0

Meteorological Summary			
7/06/2023	12.4	12.8	1.4
8/06/2023	13.3	13.5	0
9/06/2023	13.8	13.8	0
10/06/2023	13.0	13.2	0
11/06/2023	10.6	11.0	0
12/06/2023	12.3	12.7	1
13/06/2023	12.8	13.1	0
14/06/2023	12.8	12.7	0
15/06/2023	11.6	11.5	0
16/06/2023	10.7	10.8	0
17/06/2023	11.4	11.4	0
18/06/2023	13.2	13.2	0
19/06/2023	11.4	11.3	0
20/06/2023	9.97	10.1	0
21/06/2023	8.13	8.33	1.2
22/06/2023	8.88	9.14	4
23/06/2023	12.9	12.9	0
24/06/2023	13.1	13.1	0
25/06/2023	14.5	14.7	0
26/06/2023	14.1	14	0
27/06/2023	13.5	13.4	1
28/06/2023	11.6	11.5	0
29/06/2023	11.0	10.8	0
30/06/2023	10.7	10.5	0
1/07/2023	12.0	11.9	0
2/07/2023	10.8	11.1	0
3/07/2023	10.9	11.1	7.6

Meteorological Summary			
4/07/2023	11.7	11.7	0
5/07/2023	14.9	14.8	0.2
6/07/2023	13.2	13.1	0
7/07/2023	13.0	12.9	0
8/07/2023	13.9	13.8	0
9/07/2023	14.0	13.9	0
10/07/2023	13.4	13.3	0
11/07/2023	10.6	10.7	0
12/07/2023	9.73	10.3	0
13/07/2023	12.5	12.6	0
14/07/2023	14.1	14.0	0
15/07/2023	15.5	15.6	0
16/07/2023	14.3	14.4	0
17/07/2023	13.8	13.9	0
18/07/2023	14.0	14.0	0
19/07/2023	11.5	11.9	0
20/07/2023	10.1	10.2	0
21/07/2023	12.1	12.1	0
22/07/2023	9.45	9.85	0
23/07/2023	9.58	9.76	0.2
24/07/2023	12.0	12.2	0.2
25/07/2023	11.6	12.0	0
26/07/2023	11.9	12.3	0
27/07/2023	12.8	13.0	0
28/07/2023	15.8	15.8	0
29/07/2023	17.5	17.4	0
30/07/2023	17.7	17.6	0

Meteorological Summary			
31/07/2023	17.6	17.5	0
1/08/2023	14.8	14.8	0
2/08/2023	13.2	13.6	0
3/08/2023	12.6	13.1	0
4/08/2023	14.5	14.8	0
5/08/2023	15.0	15.1	0.6
6/08/2023	12.9	13.1	0
7/08/2023	13.2	13.2	0
8/08/2023	12.3	12.7	0
9/08/2023	12.3	12.7	0
10/08/2023	16.0	16.1	0
11/08/2023	13.3	13.5	0
12/08/2023	15.5	15.4	1
13/08/2023	13.7	14.1	7.6
14/08/2023	12.4	12.5	0.2
15/08/2023	13.0	13.1	0
16/08/2023	12.3	12.6	6
17/08/2023	13.5	13.7	8.8
18/08/2023	14.0	13.9	0
19/08/2023	12.3	12.1	0
20/08/2023	15.5	15.4	0
21/08/2023	14.8	15.0	0
22/08/2023	16.8	16.8	0
23/08/2023	15.7	15.7	0
24/08/2023	14.5	14.6	0
25/08/2023	13.7	13.9	0
26/08/2023	13.1	13.5	0

Meteorological Summary			
27/08/2023	13.5	13.7	0
28/08/2023	13.8	14.1	0
29/08/2023	15.3	15.7	7
30/08/2023	17.1	17.1	0
31/08/2023	14.9	14.9	0
1/09/2023	14.0	13.9	0
2/09/2023	12.7	13.0	0
3/09/2023	13.5	13.6	0
4/09/2023	14.6	15.1	0
5/09/2023	18.4	18.6	0
6/09/2023	15.5	15.7	0
7/09/2023	19.3	19.7	7
8/09/2023	16.0	16.0	0
9/09/2023	12.7	12.5	0
10/09/2023	11.3	11.7	0
11/09/2023	12.2	12.5	0
12/09/2023	13.9	14.1	3.2
13/09/2023	15.6	15.9	0
14/09/2023	16.5	16.9	0
15/09/2023	18.8	19.1	0
16/09/2023	22.4	22.4	0
17/09/2023	23.8	24.0	0
18/09/2023	23.2	23.5	0
19/09/2023	24.9	24.8	0
20/09/2023	25.8	25.8	0
21/09/2023	21.4	21.2	0
22/09/2023	14.7	14.6	0

Meteorological Summary			
23/09/2023	13.1	13.4	0
24/09/2023	14.4	14.6	0
25/09/2023	17.4	17.8	0.4
26/09/2023	19.9	19.7	1
27/09/2023	19.4	19.3	0.2
28/09/2023	18.2	18.1	0
29/09/2023	21.0	21.0	0
30/09/2023	22.3	22.4	0
1/10/2023	25.9	26.1	0
2/10/2023	22	21.8	0
3/10/2023	24.6	24.9	13.6
4/10/2023	21.6	21.7	0
5/10/2023	15.9	15.7	0
6/10/2023	16.0	15.7	0
7/10/2023	15.1	14.9	0
8/10/2023	15.2	15.2	0
9/10/2023	17.6	17.8	0
10/10/2023	18.2	18.3	0
11/10/2023	20.7	20.6	0.2
12/10/2023	23.0	23.1	0
13/10/2023	18.5	18.4	0
14/10/2023	20.5	20.4	0
15/10/2023	22.9	22.7	0
16/10/2023	20.3	20.3	0
17/10/2023	15.2	15.1	0.4
18/10/2023	15.8	15.6	0
19/10/2023	17.6	17.4	0

Meteorological Summary			
20/10/2023	20.2	20.2	0
21/10/2023	23.6	23.6	0
22/10/2023	24.7	24.7	0
23/10/2023	21.9	21.7	0
24/10/2023	23.7	23.9	0
25/10/2023	25.6	25.4	17
26/10/2023	13.3	13.3	5
27/10/2023	12.9	12.9	0.4
28/10/2023	14.8	14.7	0
29/10/2023	18.3	18.4	0
30/10/2023	23.4	23.6	0
31/10/2023	24.4	24.3	0
1/11/2023	18.8	18.4	0
2/11/2023	18.6	18.4	0
3/11/2023	19.1	18.9	0
4/11/2023	19.9	19.6	0
5/11/2023	17.1	17	0
6/11/2023	17.4	17.1	0
7/11/2023	18.7	18.7	0
8/11/2023	20.3	20.3	4.8
9/11/2023	20.2	20.3	0
10/11/2023	21.7	21.5	0
11/11/2023	25.2	25.2	0
12/11/2023	29.6	29.5	0
13/11/2023	21.4	21	0
14/11/2023	22.6	22.5	0
15/11/2023	23.3	23.2	0.2

Meteorological Summary			
16/11/2023	23.1	22.8	0.6
17/11/2023	18.6	18.5	0
18/11/2023	19.2	18.9	0
19/11/2023	22.1	22.0	1.8
20/11/2023	20.1	20.2	0.4
21/11/2023	21.2	21	0
22/11/2023	21.5	21.2	0
23/11/2023	20.8	20.7	10.4
24/11/2023	20.7	20.6	3.8
25/11/2023	20.4	20.3	0
26/11/2023	24.3	24	0
27/11/2023	23.7	23.4	2.6
28/11/2023	21.2	21.1	0.2
29/11/2023	22.4	22.3	0
30/11/2023	25	24.8	0
1/12/2023	25.7	25.4	1
2/12/2023	23.1	22.9	0
3/12/2023	23.9	23.8	0
4/12/2023	22.1	21.7	0
5/12/2023	26.4	26.3	0
6/12/2023	27.9	27.5	0
7/12/2023	25.7	25.3	0
8/12/2023	29.8	29.5	0
9/12/2023	33.5	33.4	0
10/12/2023	26.4	26.0	0
11/12/2023	26.7	26.3	0
12/12/2023	25.0	24.6	0

Meteorological Summary			
13/12/2023	27.9	27.6	0
14/12/2023	32.2	32.0	0
15/12/2023	26.3	25.9	0
16/12/2023	27.2	27	0
17/12/2023	24.9	24.4	0
18/12/2023	28	27.6	3.2
19/12/2023	26.6	26.7	24.4
20/12/2023	19.3	19.3	0
21/12/2023	19.4	19.2	0
22/12/2023	20.9	20.6	13.6
23/12/2023	21.1	21.0	12.2
24/12/2023	20.3	20.2	1.4
25/12/2023	22.4	22.2	0
26/12/2023	25.4	25.4	0
27/12/2023	24.8	24.6	0
28/12/2023	25.8	25.6	0
29/12/2023	24.9	24.9	0
30/12/2023	25.5	25.1	0
31/12/2023	19.8	19.6	0

Appendix C - Air Quality Monitoring Results

Depositional Dust Compliance Monitoring Results					
Month	**Criteria**	**D55**		**D62**	
	Annual Average *(g/m²/month)*	Insoluble Solids *(g/m²/month)*	Annual Rolling Average *(g/m²/month)*	Insoluble Solids *(g/m²/month)*	Annual Rolling Average *(g/m²/month)*
Jan-23	4	1.0	2.7	1.0	1.4
Feb-23	4	1.6	2.7	Invalid	1.4
Mar-23	4	13.1	3.2	1.1	1.2
Apr-23	4	36.9c	3.3	1.1	1.1
May-23	4	1.0	2.4	0.4	0.9
Jun-23	4	1.2	2.3	1.1	0.9
Jul-23	4	3.7	2.6	0.5	0.9
Aug-23	4	0.7	2.5	0.5	0.9
Sep-23	4	1.2	2.5	0.8	0.9
Oct-23	4	0.9	2.5	0.6	0.9
Nov-23	4	1.2	2.5	1.0	0.9
Dec-23	4	1.4	2.5	1.5	0.9

Notes:
c - Indicates a contaminated sample, this is often due to bird droppings, insects and similar.

High Volume Air Sampling Compliance Monitoring Results – TSP					
Date	Scrivens (HVAS 11)		Antiene (HVAS 20)		Criteria
	TSP *(µg/m³)*	Annual Rolling Average *(µg/m³)*	TSP *(µg/m³)*	Annual Rolling Average *(µg/m³)*	Annual Rolling Average *(µg/m³)*
5/01/2023	10	21	20	31	90
11/01/2023	18	21	42	32	90
17/01/2023	29	21	30	32	90
23/01/2023	28	21	42	32	90
29/01/2023	32	21	45	32	90
4/02/2023	44	22	49	32	90
10/02/2023	31	22	37	33	90
16/02/2023	31	22	53	32	90
22/02/2023	23	22	24	32	90
28/02/2023	32	22	34	32	90
6/03/2023	23	22	26	32	90
12/03/2023	40	22	54	32	90
18/03/2023	34	22	76	32	90
24/03/2023	24	22	36	32	90
30/03/2023	17	21	15	31	90
5/04/2023	16	21	28	31	90
11/04/2023	30	21	37	31	90
17/04/2023	24	21	31	30	90
23/04/2023	16	21	32	30	90
29/04/2023	21	21	27	30	90
5/05/2023	21	21	33	30	90
11/05/2023	20	21	33	30	90

High Volume Air Sampling Compliance Monitoring Results – TSP					
17/05/2023	22	21	40	30	90
23/05/2023	26	20	45	30	90
29/05/2023	17	20	22	30	90
4/06/2023	25	20	32	30	90
10/06/2023	16	20	21	30	90
16/06/2023	10	20	16	30	90
22/06/2023	45	21	49	30	90
28/06/2023	14	20	18	30	90
4/07/2023	21	21	26	30	90
10/07/2023	10	21	14	30	90
16/07/2023	31	21	32	30	90
22/07/2023	27	21	38	30	90
28/07/2023	14	21	27	30	90
3/08/2023	20	21	31	30	90
9/08/2023	14	21	36	31	90
15/08/2023	10	21	18	31	90
21/08/2023	17	21	24	31	90
27/08/2023	25	21	33	30	90
2/09/2023	20	21	33	31	90
8/09/2023	17	22	17	31	90
14/09/2023	26	22	38	31	90
20/09/2023	25	22	29	31	90
26/09/2023	47	23	57	32	90
2/10/2023	83	24	73	33	90
8/10/2023	23	24	30	33	90
14/10/2023	28	24	32	33	90
20/10/2023	41	25	55	34	90

High Volume Air Sampling Compliance Monitoring Results – TSP					
26/10/2023	25	25	27	34	90
1/11/2023	49	25	43	34	90
7/11/2023	48	25	49	34	90
13/11/2023	53	26	58	34	90
19/11/2023	37	26	33	35	90
25/11/2023	16	26	10	34	90
1/12/2023	34	26	29	34	90
7/12/2023	82	27	52	35	90
13/12/2023	80	28	62	35	90
19/12/2023	71	29	62	36	90
25/12/2023	11	29	21	36	90
31/12/2023	38	29	31	35	90

High Volume Air Sampling Compliance Monitoring Results – PM_{10}					
Date	Scrivens (HVAS 12)		Antiene (HVAS 21)		Criteria
	PM_{10} *(µg/m³)*	Annual Rolling Average *(µg/m³)*	PM_{10} *(µg/m³)*	Annual Rolling Average *(µg/m³)*	Annual Rolling Average *(µg/m³)*
5-Jan-23	5	8	6	12	30
11-Jan-23	7	8	11	12	30
17-Jan-23	7	8	7	12	30
23-Jan-23	11	8	15	12	30
29-Jan-23	11	8	16	12	30
4-Feb-23	15	8	17	12	30
10-Feb-23	12	8	13	12	30
16-Feb-23	12	8	18	12	30
22-Feb-23	7	8	7	12	30
28-Feb-23	13	8	15	12	30
6-Mar-23	12	8	13	12	30
12-Mar-23	15	8	16	12	30
18-Mar-23	18	8	24	12	30
24-Mar-23	10	8	12	12	30
30-Mar-23	6	8	9	12	30
5-Apr-23	8	8	9	12	30
11-Apr-23	10	8	10	12	30
17-Apr-23	9	8	11	12	30
23-Apr-23	6	8	11	12	30
29-Apr-23	9	8	12	12	30
5-May-23	10	8	14	12	30
11-May-23	7	8	12	12	30
17-May-23	7	8	12	11	30

High Volume Air Sampling Compliance Monitoring Results – PM_{10}					
23-May-23	10	8	15	11	30
29-May-23	4	8	7	11	30
4-Jun-23	11	8	11	11	30
10-Jun-23	6	8	9	11	30
16-Jun-23	5	8	5	11	30
22-Jun-23	18	8	20	11	30
28-Jun-23	5	8	7	11	30
4-Jul-23	5	8	10	11	30
10-Jul-23	2	8	4	11	30
16-Jul-23	10	8	11	11	30
22-Jul-23	7	8	11	11	30
28-Jul-23	6	8	12	11	30
3-Aug-23	12	8	14	11	30
9-Aug-23	4	8	11	11	30
15-Aug-23	2	8	5	11	30
21-Aug-23	5	8	9	11	30
27-Aug-23	9	8	15	11	30
2-Sep-23	6	8	9	11	30
8-Sep-23	4	8	4	11	30
14-Sep-23	13	8	19	11	30
20-Sep-23	11	8	12	11	30
26-Sep-23	14	8	17	11	30
2-Oct-23	32	8	32	11	30
8-Oct-23	5	8	8	11	30
14-Oct-23	7	8	10	11	30
20-Oct-23	13	8	16	12	30
26-Oct-23	7	8	6	12	30

High Volume Air Sampling Compliance Monitoring Results – PM_{10}					
1-Nov-23	16	9	15	12	30
7-Nov-23	8	9	13	12	30
13-Nov-23	18	9	22	12	30
19-Nov-23	10	9	12	12	30
25-Nov-23	3	9	2	12	30
1-Dec-23	5	9	5	12	30
7-Dec-23	28	9	22	12	30
13-Dec-23	30	10	24	12	30
19-Dec-23	35	10	36	13	30
25-Dec-23	10	10	10	13	30
31-Dec-23	13	10	8	13	30

Appendix D - Groundwater Monitoring Results

Water Quality – Groundwater Monthly Monitoring Results																		
Month	ALV1 Large						ALV1 Small						ALV2 Large					
	pH	EC (mS/cm)[1]	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-23	7.04	1.04	3.30	Brown	Nil	Slight	7.72	1.25	3.86	Colourless	Nil	Clear	7.11	2.41	4.33	Colourless	Nil	Clear
Feb-23	6.84	1.10	3.39	Orange	Nil	Slight	7.65	1.27	3.96	Colourless	Nil	Clear	7.07	2.55	4.37	Colourless	Nil	Clear
Mar-23	6.83	1.08	3.50	Colourless	Nil	Clear	7.53	1.27	3.05	Colourless	Nil	Clear	7.00	3.17	4.37	Colourless	Nil	Clear
Apr-23	7.03	1.07	3.33	Colourless	Nil	Clear	7.72	1.31	2.85	Colourless	Nil	Clear	7.15	2.51	4.36	Colourless	Nil	Clear
May-23	7.12	0.91	3.42	Orange	Nil	Turbid	7.64	1.09	2.93	Colourless	Nil	Slight	7.40	2.14	4.36	Colourless	Nil	Clear
Jun-23	6.91	0.97	3.65	Brown	Nil	Slight	7.79	1.19	3.16	Colourless	Nil	Clear	7.10	1.89	4.39	Brown	Nil	Slight
Jul-23	7.03	1.11	3.82	Orange	Nil	Turbid	7.47	1.29	3.35	Colourless	Nil	Clear	7.21	1.84	4.43	Colourless	Nil	Clear
Aug-23	6.94	1.12	3.96	Orange	Nil	Turbid	7.82	1.30	3.52	Colourless	Nil	Clear	7.34	1.25	4.43	Colourless	Nil	Clear
Sep-23	7.12	1.05	3.75	Orange	Nil	Turbid	7.79	1.30	3.71	Colourless	Nil	Clear	7.45	1.20	4.30	Colourless	Nil	Clear
Oct-23	7.12	0.95	4.09	Orange	Nil	Turbid	7.70	1.17	3.66	Colourless	Nil	Clear	7.36	1.05	4.46	Colourless	Nil	Clear
Nov-23	7.09	1.07	4.35	Orange	Nil	Slight	7.67	1.29	4.00	Colourless	Nil	Clear	7.50	1.10	4.51	Colourless	Nil	Clear
Dec-23	7.04	1.03	4.68	Orange	Nil	Turbid	7.94	1.15	4.31	Colourless	Nil	Clear	7.35	1.29	4.57	Colourless	Nil	Clear

Water Quality – Groundwater Monthly Monitoring Results																		
Month	ALV2 Small						ALV3 Large						ALV3 Small					
	pH	EC (mS/cm)[1]	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-23	7.61	2.54	4.09	Colourless	Nil	Clear	7.00	0.71	3.82	Colourless	Nil	Clear	7.40	3.01	5.23	Colourless	Nil	Clear
Feb-23	7.54	2.92	4.14	Colourless	Nil	Clear	6.91	0.75	4.90	Colourless	Nil	Clear	7.32	2.69	5.16	Colourless	Nil	Clear
Mar-23	7.47	2.80	4.16	Colourless	Nil	Clear	7.11	0.71	4.93	Colourless	Nil	Clear	7.29	2.68	5.18	Colourless	Nil	Clear
Apr-23	7.67	2.71	4.13	Colourless	Nil	Clear	7.03	0.74	4.89	Colourless	Nil	Clear	7.44	2.65	5.15	Colourless	Nil	Clear
May-23	7.84	2.88	4.12	Colourless	Nil	Slight	7.24	0.69	4.94	Colourless	Nil	Slight	7.37	2.24	5.22	Colourless	Nil	Slight
Jun-23	7.62	2.12	4.21	Colourless	Nil	Slight	7.05	0.77	4.98	Colourless	Nil	Slight	7.39	2.47	5.25	Colourless	Yes	Slight
Jul-23	7.57	2.88	4.30	Colourless	Nil	Clear	7.14	0.81	5.02	Brown	Nil	Slight	7.36	2.72	5.31	Colourless	Nil	Clear
Aug-23	7.70	2.91	4.30	Colourless	Nil	Clear	7.17	0.86	5.07	Colourless	Nil	Clear	7.47	2.73	5.35	Grey	Yes	Slight
Sep-23	7.64	2.85	4.42	Colourless	Nil	Clear	7.29	0.93	4.99	Colourless	Nil	Clear	7.53	2.63	5.30	Colourless	Nil	Clear
Oct-23	7.58	2.59	4.37	Colourless	Nil	Clear	7.32	0.85	5.08	Colourless	Nil	Clear	7.30	2.48	5.40	Colourless	Nil	Clear
Nov-23	7.53	2.84	4.42	Colourless	Nil	Clear	7.38	0.94	5.24	Colourless	Nil	Clear	7.37	2.93	5.54	Colourless	Nil	Clear
Dec-23	7.65	2.69	4.49	Colourless	Nil	Clear	7.30	0.88	5.46	Colourless	Nil	Clear	7.66	2.52	5.75	Colourless	Nil	Slight

Water Quality – Groundwater Monthly Monitoring Results																		
Month	ALV4 Large						ALV4 Small						PGW5 Large					
	pH	EC (mS/cm)[1]	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-23	6.68	5.74	4.79	Colourless	Nil	Clear	7.35	5.42	5.41	Grey	Nil	Slight	7.71	4.83	10.97	Colourless	Nil	Clear
Feb-23	6.62	5.18	4.83	Brown	Nil	Slight	7.23	5.88	5.53	Colourless	Nil	Slight	7.37	5.17	10.84	Colourless	Nil	Clear
Mar-23	6.57	4.48	4.84	Grey	Nil	Slight	7.08	5.61	5.57	Colourless	Nil	Clear	7.34	5.12	10.87	Colourless	Nil	Clear
Apr-23	6.73	4.22	4.85	Colourless	Nil	Clear	7.29	5.72	5.57	Colourless	Nil	Clear	7.52	4.92	11.00	Colourless	Nil	Clear
May-23	6.90	2.68	4.97	Colourless	Nil	Clear	7.23	4.08	5.58	Colourless	Nil	Clear	7.73	5.37	10.90	Colourless	Nil	Clear
Jun-23	6.76	2.87	5.00	Colourless	Nil	Clear	7.34	4.62	5.64	Colourless	Nil	Clear	7.39	4.19	11.53	Colourless	Nil	Clear
Jul-23	6.71	3.57	5.13	Colourless	Nil	Clear	7.28	5.71	5.83	Colourless	Nil	Clear	7.27	5.05	11.84	Colourless	Nil	Clear
Aug-23	6.67	3.52	5.18	Colourless	Nil	Clear	7.40	5.74	5.73	Colourless	Nil	Clear	7.50	5.27	11.91	Colourless	Nil	Clear
Sep-23	6.87	3.30	5.12	Brown	Nil	Slight	7.45	5.28	5.89	Colourless	Nil	Clear	7.42	5.21	11.97	Colourless	Nil	Clear
Oct-23	6.74	2.85	5.13	Brown	Nil	Turbid	7.37	5.03	5.35	Colourless	Nil	Clear	7.36	4.79	11.99	Colourless	Nil	Clear
Nov-23	6.71	3.11	5.31	Brown	Nil	Slight	7.39	5.23	6.11	Colourless	Nil	Clear	7.44	5.07	12.07	Colourless	Nil	Clear
Dec-23	6.90	2.53	5.44	Colourless	Nil	Clear	7.56	5.04	6.24	Colourless	Nil	Clear	7.56	4.81	12.23	Colourless	Nil	Clear

Water Quality – Groundwater Monthly Monitoring Results																		
Month	PGW5 Small						ALV7 Large						ALV7 Small					
	pH	EC (mS/cm)[1]	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-23	7.18	5.23	10.01	Brown	Nil	Slight	7.21	1.16	6.34	Brown	Nil	Slight	7.49	2.58	12.48	Colourless	Nil	Clear
Feb-23	7.04	5.12	10.05	Brown	Nil	Slight	7.03	1.30	6.46	Brown	Nil	Slight	7.40	2.76	12.94	Colourless	Nil	Clear
Mar-23	6.89	5.46	10.15	Brown	Nil	Slight	7.03	1.34	6.57	Grey	Nil	Slight	7.34	2.69	13.29	Grey	Yes	Slight
Apr-23	7.07	5.63	10.24	Brown	Nil	Turbid	7.10	1.36	6.62	Grey	Nil	Slight	7.52	2.70	13.47	Colourless	Nil	Clear
May-23	7.26	5.85	10.27	Brown	Nil	Turbid	7.32	1.45	6.72	Colourless	Nil	Clear	7.66	2.78	13.72	Colourless	Nil	Clear
Jun-23	7.07	4.48	10.57	Brown	Nil	Slight	7.07	1.30	6.78	Colourless	Nil	Slight	7.41	2.42	14.00	Colourless	Yes	Slight
Jul-23			10.81				6.99	1.54	6.86	Brown	Nil	Slight	7.29	2.82	14.39	Colourless	Yes	Clear
Aug-23			10.85				7.08	1.55	6.90	Grey	Nil	Clear	7.49	2.59	14.63	Colourless	Yes	Clear
Sep-23			10.91				7.13	1.49	6.98	Colourless	Nil	Clear	7.36	2.68	14.93	Colourless	Nil	Clear
Oct-23			11.00				7.07	1.42	7.05	Grey	Nil	Slight	7.47	2.60	15.20	Colourless	Nil	Clear
Nov-23			11.02				7.24	1.54	7.14	Colourless	Nil	Clear	7.45	2.81	15.42	Colourless	H2S	Clear
Dec-23			11.52				7.20	1.42	7.16	Colourless	Nil	Clear	7.53	2.75	15.62	Colourless	H2S	Slight

Water Quality – Groundwater Monthly Monitoring Results																		
Month	ALV8 Large						ALV8 Small						ALV9 Large					
	pH	EC (mS/cm)[1]	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity	pH	EC (mS/cm)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-23	6.61	0.72	6.99	Grey	Nil	Slight	7.20	1.12	16.15	Colourless	Nil	Clear	7.21	0.70	3.62	Grey	Nil	Turbid
Feb-23	6.85	0.74	7.10	Brown	Nil	Slight	7.05	1.25	16.39	Colourless	Yes	Slight	6.90	0.89	3.65	Brown	Nil	Turbid
Mar-23	6.89	0.77	7.29	Grey	Nil	Clear	6.95	1.27	16.59	Grey	Nil	Slight	6.97	0.97	3.63	Grey	Nil	Slight
Apr-23	6.91	0.79	7.39	Grey	Nil	Slight	7.09	1.26	16.69	Colourless	Nil	Clear	7.04	1.01	3.64	Brown	Nil	Turbid
May-23	7.11	0.90	7.21	Grey	Nil	Slight	7.32	1.27	16.60	Colourless	Nil	Clear	7.31	1.07	3.67	Black	Nil	Turbid
Jun-23	6.83	0.83	7.48	Colourless	Nil	Slight	7.13	1.17	16.78	Colourless	Yes	Slight	6.99	0.98	3.73	Black-Brown	Nil	Turbid
Jul-23							6.98	1.34	17.21	Colourless	Nil	Clear	6.86	1.13	3.73	Grey	Nil	Turbid
Aug-23							7.09	1.35	17.49	Grey	Nil	Clear	7.11	1.21	3.72	Grey	Nil	Turbid
Sep-23			8.35				7.04	1.37	17.39	Colourless	Nil	Clear	7.10	1.26	3.72	Brown	Nil	Turbid
Oct-23							7.20	1.18	18.08	Colourless	Nil	Clear	7.19	1.16	3.81	Brown	Nil	Turbid
Nov-23							7.16	1.28	18.34	Colourless	Nil	Clear	7.15	1.33	3.87	Brown	Nil	Turbid
Dec-23							7.16	1.22	18.53	Colourless	H2S	Slight	7.19	1.26	4.00	Black	Nil	Turbid

Water Quality – Groundwater Monthly Monitoring Results						
Month	LBH					
	pH	EC (mS/cm)[1]	Depth to Water (m)	Colour	Odour	Turbidity
Jan-23	7.09	0.68	3.65	Colourless	Nil	Clear
Feb-23	6.87	0.74	3.72	Colourless	Nil	Clear
Mar-23	6.92	0.72	3.75	Colourless	Nil	Clear
Apr-23	6.90	0.71	3.87	Colourless	Nil	Clear
May-23	7.31	0.66	3.97	Colourless	Nil	Slight
Jun-23	7.00	0.73	3.80	Colourless	Nil	Slight
Jul-23	6.99	0.83	3.89	Colourless	Nil	Clear
Aug-23	6.95	0.86	4.02	Colourless	Nil	Clear
Sep-23	7.15	0.82	3.89	Grey	Nil	Slight
Oct-23	7.15	0.81	4.08	Colourless	Nil	Clear
Nov-23	7.16	0.89	4.31	Colourless	Nil	Clear
Dec-23	7.03	0.88	4.50	Colourless	Nil	Clear

Notes: mS/cm - millisiemens per centimetre (electrical conductivity)

Appendix E - Blast Monitoring Results

Date	Time	Blast Location	Monitoring Point							
			Chain of Ponds		Burlings		Scrivens		Substation	
			Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration
			dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s
4/01/2023	9:02:29	Entrance Pit	101.1	0.61	90.3	0.11	93.6	0.09	102.8	1.16
9/01/2023	15:32:54	Entrance Pit	111.1	12.05	84.4	0.09	89.7	0.05	109.2	2.93
11/01/2023	9:10:42	Entrance Pit	98.1	1.22	94.3	0.13	89.4	0.08	98.7	1.04
13/01/2023	12:26:07	Entrance Pit	100.0	0.45	101.0	0.10	90.3	0.06	99.7	0.59
13/01/2023	12:25:03	Entrance Pit	106.2	0.25	100.0	0.05	98.1	0.04	106.3	0.13
19/01/2023	9:09:51	South Pit	120.4	7.13	94.1	0.07	99.1	0.04	118.3	3.48
24/01/2023	13:04:27	Entrance Pit	98.4	2.66	88.6	0.18	95.1	0.09	99.6	1.68
27/01/2023	12:43:34	Entrance Pit	97.5	1.81	95.1	0.11	92.1	0.06	96.3	1.33
2/02/2023	12:59:41	Entrance Pit	102.4	0.52	97.1	0.05	102.8	0.05	98.0	0.65
2/02/2023	13:02:21	Entrance Pit	95.2	0.17	93.8	0.02	91.5	0.02	93.2	0.10
9/02/2023	13:09:50	Entrance Pit	99.9	1.05	81.9	0.10	92.9	0.05	97.5	0.96
16/02/2023	12:59:35	Entrance Pit	100.3	1.96	88.1	0.21	93.5	0.10	97.6	2.15
17/02/2023	11:30:35	Entrance Pit	101.8	0.58	90.3	0.10	91.3	0.08	100.8	0.39

Date	Time	Blast Location	Monitoring Point							
			Chain of Ponds		Burlings		Scrivens		Substation	
			Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration
			dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s
21/02/2023	12:38:22	Entrance Pit	100.5	0.48	82.7	0.08	86.8	0.08	96.0	0.48
27/02/2023	15:29:26	Entrance Pit	105.9	1.00	98.7	0.08	99.0	0.05	101.6	0.87
9/03/2023	12:59:32	Entrance Pit	102.9	1.14	95.0	0.12	102.4	0.06	100.6	0.73
15/03/2023	12:11:19	Entrance Pit	80.0	0.44	94.7	0.07	86.8	0.05	94.5	0.40
4/04/2023	9:55:36	Entrance Pit	102.2	0.39	96.9	0.05	87.0	0.04	91.4	0.27
17/04/2023	12:54:48	Entrance Pit	82.2	1.23	84.2	0.13	94.3	0.09	97.3	1.16
20/04/2023	9:09:26	Entrance Pit	85.4	0.86	98.3	0.05	100.3	0.04	103.7	0.51
24/04/2023	12:58:03	Entrance Pit	108.7	0.51	101.1	0.05	89.9	0.05	100.5	0.53
29/04/2023	9:06:29	Entrance Pit	107.1	3.32	87.2	0.27	95.9	0.11	100.1	1.88
4/05/2023	9:01:21	Entrance Pit	108.8	1.40	94.0	0.26	90.3	0.17	98.5	0.85
8/05/2023	12:58:01	Entrance Pit	112.9	1.01	99.2	0.09	96.9	0.10	102.7	0.95
11/05/2023	12:53:30	Entrance Pit	108.3	0.42	96.8	0.04	96.5	0.03	100.6	0.37
22/05/2023	12:52:57	Entrance Pit	102.6	0.49	90.1	0.06	84.8	0.06	93.8	0.41
30/05/2023	15:28:17	Entrance Pit	102.0	1.03	85.8	0.14	89.4	0.12	96.2	1.21
16/06/2023	9:01:29	Entrance Pit	105.6	0.82	96.7	0.11	86.9	0.08	94.3	0.72
23/06/2023	11:27:10	Entrance Pit	113.8	1.04	104.6	0.11	111.2	0.11	103.7	0.96

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