LIDDELL

GLENCORE

Annual Review
2020

Table of Contents

1. Statement of Compliance 6
2. Introduction 12
3. Approvals 15
4. Operations Summary 29
4.1 Mining operations 29
4.2 Other Operations 30
4.3 Major activities proposed in the next reporting period 30
5. Actions Required at Previous Annual Review 32
6. Environmental Performance 33
6.1 Noise 33
6.1.1 Noise Monitoring Results 34
6.1.2 Comparison to EA Predictions 35
6.2 Blasting 37
6.2.1 Chain of Ponds Inn Blast Management Strategy 38
6.2.2 Newdell Zone Substation Blast Management Strategy 38
6.2.3 Blast Monitoring Results 39
6.2.4 Comparison to EA Predictions 42
6.3 Air Quality 44
6.3.1 Air Quality Criteria 45
6.3.2 Deposited Dust 48
6.3.2.1 Deposited Dust - Comparison to EA Predictions 49
6.3.3 High Volume Air Sampling - TSP 49
6.3.4 High Volume Air Sampling – PM10 51
6.3.4.1 High Volume Air Samplers - Comparison to EA Predictions 53
6.3.5 Continuous Monitoring – PM10 53
6.3.5.1 Continuous PM10 Monitoring - Comparison to EA Predictions 58
6.3.6 Continuous PM10 Monitoring - EBAMs 58
6.3.7 Pollution Reduction Programs 61
6.4 Visual and Stray Light 62
6.4.1 Comparison to EA Predictions 62
6.5 Aboriginal Cultural Heritage 63
6.6 Heritage 65
6.6.1 Management Actions During 2020 65
6.6.2 Analysis of Blast Monitoring 65
6.6.3 Visual Inspection Outcomes 67
6.6.4 Trends and compliance issues 67

6.6.5 Comparison to EA Predictions 67
6.6.6 Future Work 68
6.7 Exploration 68
6.8 Spontaneous Combustion 68
6.9 Tailings and Rejects Management 69
6.9.1 Tailings and reject management strategy, operation and disposal 69
6.10 Waste Management 70
7. Water Management 72
7.1 Water Management System 72
8. Surface Water Monitoring 77
8.1.1 Surface Water Monitoring Results Review 79
8.1.1.1 Surface water comparison to EA Predictions 82
8.2 Groundwater Monitoring 83
8.2.1 Monitoring Results Review 87
8.2.1.1 Groundwater Comparison to EA Predictions 100
9. Rehabilitation 103
9.1 Post Mining Land Use 103
9.2 Current Status 103
9.3 Detailed Mine Closure Planning 108
9.4 Biodiversity Management 109
9.4.1 Biodiversity Monitoring Summary 109
9.4.2 Rehabilitation Monitoring Summary 125
9.5 Biodiversity Offset Management 130
9.6 Indirect Offset Management 145
9.6.1 Management Actions during the reporting period 145
9.6.1.1 Task 1 Development of Individual Recognition Software for Quolls 145
9.6.1.2 Task 2 Surveying/Monitoring STQ Populations 146
9.6.1.3 Task 3 Assess Habitat Use by Female STQ 147
9.6.1.4 Management Actions during the next reporting period 147
9.7 Rehabilitation Research and Trials 149
9.7.1 Project 1 149
9.7.2 Project 2 150
9.8 Mountain Block 152
10. Stakeholder Engagement 155
11. Independent Audit 158
12. Incidents and non-compliances during the reporting period 159
13. Activities to be completed in the next reporting period 163
14. References 165

Appendix A - Train Haulage Summary 166
Appendix B - Meteorological Summary 190
Appendix C - Air Quality Monitoring Results 205
Appendix D - Surface Water Monitoring Results..... 212
Appendix E - Groundwater Monitoring Results 219
Appendix F - Blast Monitoring Results..... 229
Appendix G - LCO Rehabilitation MOP Completion Criteria 239
Rehabilitation Detail..... 254

Tables

Table 1-1 Statement of compliance 7
Table 1-2 Non-compliances 7
Table 1-3 Compliance status key 10
Table 2-1 Mine contacts..... 12
Table 3-1 List of development approvals..... 17
Table 3-2 - List of leases, licences and MOP 21
Table 3-3 List of surface water extraction licences..... 22
Table 3-4 List of groundwater licences 24
Table 3-5 List of Aboriginal Heritage permits 26
Table 3-6 List of radiation management licences 27
Table 3-7 List of effluent treatment permits 28
Table 4-1 Production summary..... 30
Table 6-1 Development consent noise impact assessment criteria 33
Table 6-2 Noise monitoring results..... 34
Table 6-3 Blasting impact assessment criteria as per DA-305-11-01 37
Table 6-4 - Blasting performance summary..... 40
Table 6-5 Long term impact assessment criteria for deposited dust 45
Table 6-6 Impact assessment criteria for particulate matter 45
Table 6-7 Extraordinary air quality event dates 2020..... 46
Table 6-8 Annual average depositional dust compliance summary 48
Table 6-9 - Annual average TSP compliance summary 51
Table 6-10 - Annual average HVAS PM10 compliance summary..... 52
Table 6-11 Short-term average HVAS PM10 exceedance summary..... 53
Table 6-12 - Annual average TEOM PM10 compliance summary 53
Table 6-13 Short term average TEOM PM10 compliance summary..... 54
Table 6-14 Failure to meet PM10 data availability instances - TEOMs 55
Table 6-15 Failure to meet PM10 data availability instances - EBAMs 58
Table 6-16 – Summary of 2020 due diligence inspections completed 63
Table 6-17 Maximum displacements recorded in 2020 66
Table 6-18 Tailings emplacement and rehabilitation timeframes..... 70
Table 6-19 Recycling efficiency recorded in 2020 70
Table 7-1 Site water balance..... 73
Table 7-2 Groundwater take..... 74
Table 8-1 WMP trigger values for surface water quality 77

Table 8-2 Bayswater Creek trigger limit summary....79
Table 8-3 Bowmans Creek trigger limit summary....80
Table 8-4 Surface water impact comparison to EA predictions....83
Table 8-5 Groundwater quality impact assessment criteria....85
Table 8-6 Groundwater exceedances for EC in alluvial and shallow bedrock aquifers....87
Table 8-7 ITARP investigations for quality triggers completed in 2020....88
Table 8-8 Groundwater level trigger exceedances....96
Table 8-9 Groundwater level trigger exceedances investigation summary....96
Table 8-10 Groundwater impact comparison to EA predictions....100
Table 9-1 Rehabilitation status....105
Table 9-2 MOP rehabilitation status....105
Table 9-3 BMP performance indicator summary....111
Table 9-4 MOP TARP status - exceptions only....127
Table 9-5 - BOMP performance indicator summary....134
Table 9-6 QIT development progress....145
Table 9-7 - Summary of spotted-tailed quoll camera detections in the Offset areas from October 2019 to May 2020....146
Table 10-1 - Summary of complaints received during 2020....155
Table 10-2 Community investment program recipients....156
Table 12-1 - 2020 LCO incidents and non-compliances....159

Figures

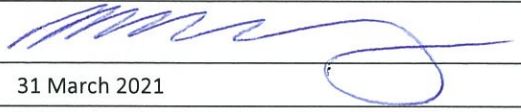
Figure 2-1 Locality Map....13
Figure 2-2 Key Site Features....14
Figure 3-1 Mining Leases....16
Figure 6-1 Noise monitoring locations....36
Figure 6-2 Compliance blast monitoring locations....43
Figure 6-3 Air quality monitoring locations....47
Figure 6-4 Depositional Dust D55 annual results....48
Figure 6-5 Depositional Dust D62 annual results....49
Figure 6-6 Antiene HVAS TSP annual results....50
Figure 6-7 Scrivens HVAS TSP annual results....50
Figure 6-8 - Antiene PM10 (HVAS 21) annual results....51
Figure 6-9 - Scrivens PM10 (HVAS 12) annual results....52
Figure 6-10 SX38-D1 TEOM PM10 results....57
Figure 6-11 SX38-D2 TEOM PM10 results....57
Figure 6-12 Aboriginal archaeological site locations....64
Figure 6-13 - Accelerometer locations at Chain of Ponds Inn....66
Figure 7-1 water balance....76
Figure 8-1 Surface and groundwater monitoring locations....78
Figure 8-2 Groundwater - Alluvial pH....93
Figure 8-3 Groundwater - Shallow Bedrock pH....93
Figure 8-4 Groundwater - Alluvial Electrical Conductivity....94
Figure 8-5 Groundwater - Shallow Bedrock Electrical Conductivity....94
Figure 8-6 – Groundwater - alluvial elevations....98
Figure 8-7 – Groundwater – shallow bedrock elevations....99
Figure 8-8 – Groundwater bore elevations....100

Figure 9-1 2020 completed rehabilitation and 2021 forecast rehabilitation 104
Figure 9-2 – Final Rehabilitation and Post Mining Land Use 106
Figure 9-3 - 2020 Land Status with 10m Contours..... 107
Figure 9-5 - Biodiversity offset areas 131
Figure 9-6 - Camera trap array set in October 2019 of both quoll and prey cameras. Note that prey cameras were removed after February 2020. 148
Figure 9-7 - Camera array at Liddell designed to assess habitat use by female quolls 149
Figure 9-8 – Mountain Block during major earthworks (August 2020) 153
Figure 9-9 – Mountain Block Rehabilitation after completion of earthworks and seeding (February 2021) 154
Figure 10-1 - Complaints summary comparison 155

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 3-3***
Name of holder of water licence	Refer to ***Table 3-3***
MOP/RMP start date	December 2017
MOP/RMP end date	March 2021
Annual Review start date	January 1st 2020
Annual Review end date	December 31st 2020

I, Murray Gregson, 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 2020 to 31st December 2020 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	Murray Gregson
Title of authorized reporting officer	Operations Manager
Signature of authorized reporting officer	
Date	31 March 2021

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	No
ML #1597	Yes
ML #1313	Yes
CCL #708	Yes
ML #1552	Yes
EPL 2094	No
EPBC 2013/6908	Yes
MOP 2018-2020	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
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particulate matter	Non-compliant	Short term impact assessment criterion for particular matter exceeded the 24 hour averaging period PM10 criterion at monitoring unit SX38-D1 on eight occasions.	Section 6.3

Non Compliances					
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Non-compliant	Short term impact assessment criterion for particular matter exceeded the 24 hour averaging period PM10 criterion at monitoring unit SX38-D2 on nine occasions.	Section 6.3
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Non-compliant	Monitoring unit SX38-D1 failed to achieve PM10 data availability greater than 75% on 13 dates throughout the reporting period due to planned maintenance and hardware failures.	Section 6.3
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Non-compliant	Monitoring unit SX38-D2 failed to achieve PM10 data availability greater than 75% on 26 dates throughout the reporting period due to planned maintenance and hardware failures.	Section 6.3
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Non-compliant	Short term impact assessment criterion for particular matter exceeded the 24 hour averaging period PM10 criterion at monitoring unit HVAS 21	Section 6.3

Non Compliances					
				(Antiene) on one occasion.	
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Non-compliant	Short term impact assessment criterion for particular matter exceeded the 24 hour averaging period PM10 criterion at monitoring unit HVAS 12 (Scrivens) on one occasion.	Section 6.3
DA 305-11-01	Schedule 3 Condition 16	Continuous air quality monitoring for PM10	Non-compliant	Monitoring unit HVAS 21 (Antiene) failed to monitor PM10 on two occasions.	Section 6.3
DA 305-11-01	Schedule 3 Condition 16	Continuous air quality monitoring for PM10	Non-compliant	Monitoring unit HVAS 12 (Scrivens) failed to monitor PM10 on three occasions.	Section 6.3
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 8 dates throughout the reporting period due to hardware failures.	Section 6.3
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 11 dates throughout the reporting period	Section 6.3

Non Compliances					
				due to hardware failures.	
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 17 dates throughout the reporting period due to planned maintenance and hardware failures.	Section 6.3
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 25 dates throughout the reporting period due to planned maintenance and hardware failures.	Section 6.3

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 by LCO in accordance with the *Annual Review Guidelines* (NSW Government, 2015) and Schedule 5, Condition 3 of the DA 305-11-01.

LCO is an established open-cut mine located at Ravensworth, approximately 25 kilometres north-west of Singleton in the Upper Hunter Valley of New South Wales. LCO is operated and managed by Liddell Coal Operations Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore), on behalf of a joint venture between Glencore (67.5%) and Mitsui Matsushima Australia (32.5%).

Mining operations at LCO have been continuous since the 1950s. Operations prior to the 1950s were intermittent, with underground operations commencing in 1923 and open cut operations in 1946. The current open cut mining operation has been in operation since 1990.

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

During the reporting period 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, is 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
Murray Gregson	Operations Manager	Liddell Coal Operations	(02) 6570 9919 (M) 0447 886 810
Mark Faulkner	Mining Manager	Liddell Coal Operations	(02) 6570 9937 (M) 0418 630 851
Ben de Somer	Environment & Community Manager	Liddell Coal Operations	(02) 6570 9947 (M) 0427 936 734

Figure 2-1 Locality Map

Figure 2-2 Key Site Features

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.

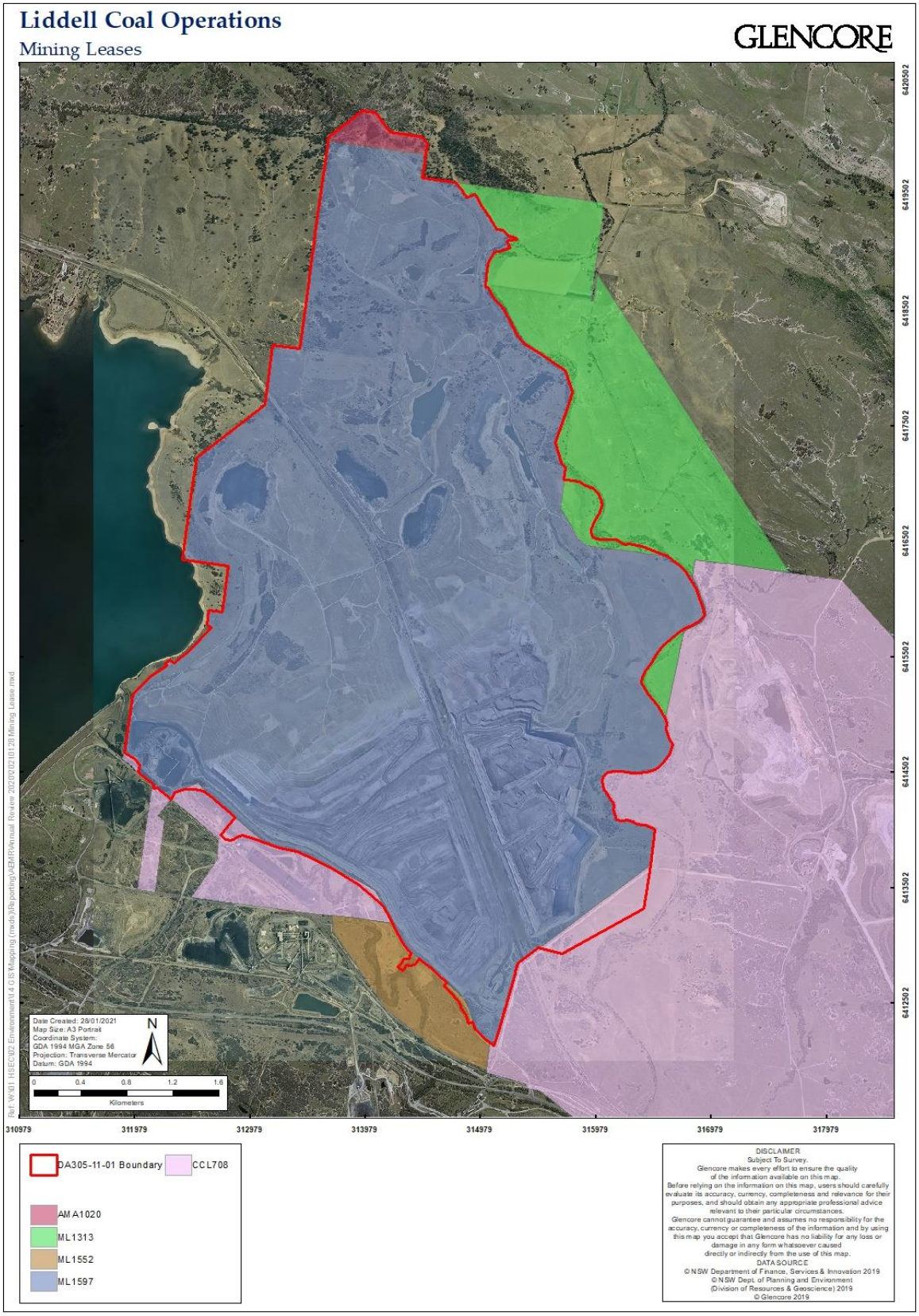


Figure 3-1 Mining Leases

Table 3-1 List of development approvals

Development Approvals			
Approval Number	Authority	Description	Expiry Date
DA 305-11-01	NSW Department of Planning, Infrastructure and Environment	Continued operation of the Liddell Colliery	31 December 2023
DA 305-11-01 Modification 2	NSW Department of Planning, Infrastructure 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	31 December 2023

Development Approvals			
		- Modifications to the footprint and size of the already approved Dam 13B.	
DA 305-11-01 MOD 3	NSW Department of Planning, Infrastructure 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.	31 December 2023
DA 305-11-01 MOD 4	NSW Department of Planning, Infrastructure 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.	31 December 2023
DA 305-11-01 MOD 5	NSW Department of Planning, Infrastructure 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	31 December 2028

Development Approvals			
		conveyor is proposed, enabling LCO to send coal to Ravensworth, and receive coal and crushed gravel from Mt Owen, via the existing conveyor 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, Infrastructure 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, Infrastructure 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
EPBC 2013/6908	Australian Government	- 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	31 December 2044

Development Approvals			
	Department of Agriculture, Water and the Environment	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)	

Table 3-2 - List of leases, licences and MOP

Mining Leases, Environmental Protection Licence & Mining Operations Plan		
Mining Leases		
Title	**Authority**	**Expiry Date**
Mining Lease 1597	DPIE - Resources and Geoscience (NSW)	5 November 2028
Consolidated Coal Lease No. 708	DPIE - Resources and Geoscience (NSW)	30 December 2023
Mining Lease No. 1313	DPIE - Resources and Geoscience (NSW)	13 October 2023
Cumnock Sublease Mining lease No. 1552	DPIE - Resources and Geoscience (NSW)	10 March 2025
Environmental Protection Licence		
Licence	**Description**	**Expiry Date**
EPL 2094	Environmental Protection Licence (File number 27051)	30 June (Anniversary Date)
Mining Operation Plan		
Name	**Commencement Date**	**Expiry Date**
Liddell Colliery Mining Operations Plan 2018 – 2020 (MOP)	1 December 2017	31 March 2021
Mining Operations Plan Addendum	24 October 2018	31 March 2021

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)**	**Annual Usage (ML)**
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)**	**Annual Extraction 2020 (ML)**
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	6000	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	0
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	233
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	75

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 2021

Table 3-7 List of effluent treatment permits

Effluent Treatment Permits					
Licence/Permit Reference	**Regulatory Authority**	**Purpose**	**Licence Holder**	**Approval Date**	**Expiry Date**
WTA 2006-002	Muswellbrook Shire Council	Permit to Operate Aerated Wastewater Treatment System	Liddell Coal Operations Pty Limited	23 April 2019	23 April 2023
OSSM 3916/2008	Singleton Shire Council	Permit to Operate Aerated Wastewater Treatment System	Liddell Coal Operations Pty Limited	1 July 2018	30 June 2021

4. Operations Summary

During 2020, operational activities were conducted generally in accordance with the approved ***Mining Operations Plan (MOP) 2018-2020 Amendment B.***

During the reporting period there were a number of construction projects undertaken in accordance with the approved MOP and DA305-11-01. This included:

- Continued progression of mining operations in a southerly direction in the south pit and entrance pit as well as final clearance and mining in the Bayswater Pit
- Commissioning of the tailings pipeline to Mt Owen Complex (West Pit) as approved by DA305-11-01 Mod 6 to provide for improved LOM tailings emplacement ***Section 6.9***.
- Continued building monitoring and implementation of stabilisation measures at the Chain of Ponds Inn; detailed in ***Section 6.6***.
- Commencement and completion of the earthworks and remediation of the Mountain Block project are; detailed in ***Section 9.8***.
- Continued implementation of biodiversity management plan and biodiversity offset management plan commitments including habitat augmentation, weed management and supplementary planting as detailed in ***Section 9.4*** and ***Section 9.5.***
- Implementation of management activities across the South Cut Pasture Rehabilitation area to control Rhodes Grass and manage the rehabilitation in accordance with the post mining land use outlined in the Biodiversity Management Plan and MOP; detailed in ***Section 9***.
- Continued implementation of Indirect Offset commitments in ***Section 9.6*****.**

4.1 Mining operations

The open cut mining sequence at LCO includes:

- Land preparation including vegetation removal and pre-stripping topsoil;
- Removal of overburden;
- Coal extraction, predominantly using excavators and tucks;
- Coal processing and transport.

Mining will continue in accordance with the MOP targeting coal from the Lemington, Pikes Gully, Arties, Liddell, Barrett and Hebden seams. These seams range from 0.7 metres (m) to 9.5 m in thickness, and include semi-soft and thermal coal types. Mining will generally utilise hydraulic excavators and trucks which are suitable for working in the South Pit and Entrance Pit to recover coal from multiple seams.

No mining was undertaken using dragline or highwall extraction methods during 2020.

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 operates 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.

As per ***Table 4-1*** below, the total ROM coal processed at Liddell's CHPP during the 2020 reporting period was 5,746,444 tonnes. The total product coal produced was 4,084,619 tonnes with 1,283,105 tonnes of coarse and 576,209 tonnes of fine rejects generated.

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 2020.

During the reporting period, 3,904,418 tonnes of product coal including export thermal coal and export semi soft coal were railed to the Port of Newcastle by trains along 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**	**2019 actual**	**2020 forecast**	**2020 actual**
Prime Waste Rock / Overburden (bcm)	N/A	37,529,915	35,564,000	34,882,522
ROM Coal / Ore (t)	8,000,000	5,863,647	5,692,000	5,746,444
Coarse reject (t)	N/A	1,781,738	1,215,278	1,283,105
Fine reject (Tailings) (t)	N/A	593,263	498,112	576,209
Saleable product (t)	N/A	3,488,646	3,981,000	4,084,619

4.3 Major activities proposed in the next reporting period

A MOP for 2021-2023 consistent with DA305-11-01 Mod 7 has been approved by the Resources Regulator outlining operational and rehabilitation activities during the next reporting period. The primary features of the 2021-2023 MOP include:

- 3 year term up till approximately coal extraction cessation;
- Proposed primary overburden emplacement rehabilitation and tailings emplacement rehabilitation;

- A description of tailings emplacement rehabilitation strategy that provides for the specific rehabilitation risk management proposed;
- A description of the mine closure (post mining rehabilitation) planning;
- Revised rehabilitation monitoring program and completion criteria developed with NSW Resource Regulator; and
- A final landform and post mining land use plan providing for habitat connectively and consistent with the DA rehabilitation requirements.
- Forecast major changes to the operation during the next reporting period include:
- Continued mining in Bayswater Pit, Entrance Pit and South Pit as well as rehabilitation activities in accordance with the 2021 - 2023 MOP;
- Rehabilitation of the Antiene Tailings dam;
- Commencement of shaping and rehabilitation of Dam 4
- Continued implementation of Biodiversity Offset commitments;
- Continued implementation of Biodiversity Management commitments; and
- Continued transfer of tailings between LCO and Mt Owen Complex West Pit.

5. Actions Required at Previous Annual Review

NSW Department of Planning, Infrastructure and Environment provided written advice on the 2019 Annual Review on the 27 May 2020 and considered it to generally satisfy the requirements of the approval. However, under the provisions of Schedule 2, Condition 4 of the approval, requested key inputs and outputs that contribute to the site water balance be included in future Annual Reviews.

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 (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	13/01/2020	3.7	IA	IA	NA
1246 Hebden Road	13/01/2020	2.7	IA	IA	Nil
February					
1317 Hebden Road	24/02/2020	1.6	IA	IA	Nil
1246 Hebden Road	24/02/2020	1.8	IA	IA	Nil
March					
1317 Hebden Road	18/03/2020	1.0	31	35	Nil
1246 Hebden Road	18/03/2020	1.2	31	33	Nil
April					
1317 Hebden Road	22/04/2020	2.3	31	37	Nil
1246 Hebden Road	22/04/2020	1.7	31	35	Nil
May					
1317 Hebden Road	19/05/2020	1.2	<25	<25	Nil
1246 Hebden Road	19/05/2020	1.1	28	32	Nil
June					
1317 Hebden Road	09/06/2020	3.2	<20	25	NA
1246 Hebden Road	09/06/2020	2.9	<20	<20	Nil
July					

Location	Date	Wind Speed (m/s)	LCO $L_{Aeq\ (15min)}$ (dB)	LCO $L_{A1\ (1min)}$ (dB)	Exceedance
1317 Hebden Road	20/07/2020	3.0	IA	IA	Nil
1246 Hebden Road	20/07/2020	4.2	IA	IA	NA
August					
1317 Hebden Road	10/08/2020	1.4	34	44	Nil
1246 Hebden Road	10/08/2020	1.5	34	37	Nil
September					
1317 Hebden Road	16/09/2020	1.2	IA	IA	Nil
1246 Hebden Road	16/09/2020	1.6	25	30	Nil
October					
1317 Hebden Road	07/10/2020	1.7	IA	IA	Nil
1246 Hebden Road	07/10/2020	1.4	IA	IA	Nil
November					
1317 Hebden Road	19/11/2020	2.9	IA	IA	Nil
1246 Hebden Road	19/11/2020	2.7	IA	IA	Nil
December					
1317 Hebden Road	17/12/2020	0.8	IA	IA	Nil
1246 Hebden Road	17/12/2020	1.2	NM	NM	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

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 2020 were in accordance with these predictions.

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 1 Jan – 1 April 2020* ≤34 for >12 Hz and ≤28 for <12 Hz OR ≤36 for >12 Hz and ≤30 for <12 Hz	0% for any individual blast 0% on more than 2 occasions during the period
		Limits applicable 2 April – 31 Dec 2020 ≤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).
**vibration limit temporary increases have been agreed between Ausgrid as per the approved Newdell Blast Management Plan. See subsection below for details.

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. 2020 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 6.6.*** 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.

This temporary increase is currently agreed to expire on 1 April 2020, at which point limits will revert back to those agreed in 2017.

As per the approved blast management strategy, the proposed increase in limits is incremental and effectiveness of the mitigation measures will be confirmed by the Ausgrid monitoring program prior to increasing limits further. Conversely, monitoring analysis may also demonstrate that the mitigation measures have not been effective and Ausgrid will notify Liddell that vibration limits will need to revert back to specified in DA305-11-01. In either case LCO will continue to advise the Department when vibration limits are varied in accordance with the approved blast management strategy.

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 F -.***

Blast monitoring was undertaken at two privately owned residences, the Chain of Ponds Inn and Newdell Substation throughout the reporting period. There were 109 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.***

Table 6-4 - Blasting performance summary

Location	Airblast overpressure level *dBLin 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 1 Jan – 1 April 2020* ≤34 for >12 Hz and ≤28 for <12 Hz OR ≤36 for >12 Hz and ≤30 for <12 Hz	0% for any individual blast 0% on more than 2 occasions during the period	Compliant	Continue to liaise with infrastructure owner in order to determine an appropriate ground vibration level increase during the next reporting period	Continued implementation of the approved Strategy and Agreements executed with Ausgrid (refer ***Section 6.2.2***)
		Limits applicable 2 April – 31 Dec 2020 ≤30 for >12 Hz ≤26 for <12 Hz	0%	Compliant		

Location	Airblast overpressure level *$dBL_{in\ Peak}$*	Ground Vibration *mm/s*	Allowable exceedance	Performance during the reporting period	Key management implications	Proposed management actions
Other public infrastructure*	N/A	50	0%	Compliant	N/A	None required
Chain of Ponds Inn	150	50	0%	Compliant		Continued implementation of the approved Strategy (refer ***Section 6.2.1***)

6.2.4 Comparison to EA Predictions

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 2020, compliance with the EA predictions was observed.

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 so as 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/NZS3580.10:2003 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/NZS3580.10:2003 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.

During 2020, a significant amount of extraordinary events occurred at the start of the year associated with large scale bushfires across NSW, which impacted the measured results at the LCO air quality monitoring units. The NSW Department of Planning, Industry and Environment (DPIE) determined there to be 24 days in which were determined to be extraordinary regional conditions. In line with DPIE advice for reporting, those 24 days listed in ***Table 6-7*** are excluded from the annual averages reported in this annual review. It is noted that the data uploaded to the LCO public website each

month was current at the time of reporting and still includes results for the days of retrospectively confirmed extraordinary events. Therefore, annual average air quality results published on the LCO website are slightly higher than those in this annual review.

Table 6-7 Extraordinary air quality event dates 2020

Month	Date	Month	Date
January	01/01/2020	January (continued)	15/01/2020
	02/01/2020		20/01/2020
	03/01/2020		21/01/2020
	04/01/2020		23/01/2020
	05/01/2020		24/01/2020
	06/01/2020		25/01/2020
	07/01/2020	February	01/02/2020
	08/01/2020		02/02/2020
	09/01/2020		04/02/2020
	10/01/2020		19/02/2020
	11/01/2020	August	19/08/2020
	12/01/2020	November	29/11/2020

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 6-8***.

Table 6-8 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

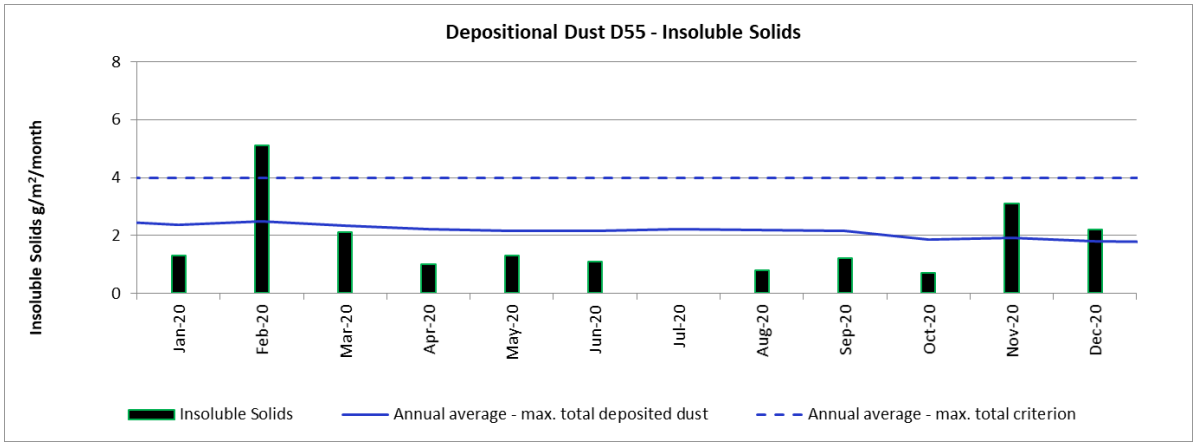


Figure 6-4 Depositional Dust D55 annual results

Note that in ***Figure 6-4***, the results for February and November 2020 were elevated due to high presence of insects, vegetation and arachnids in the samples.

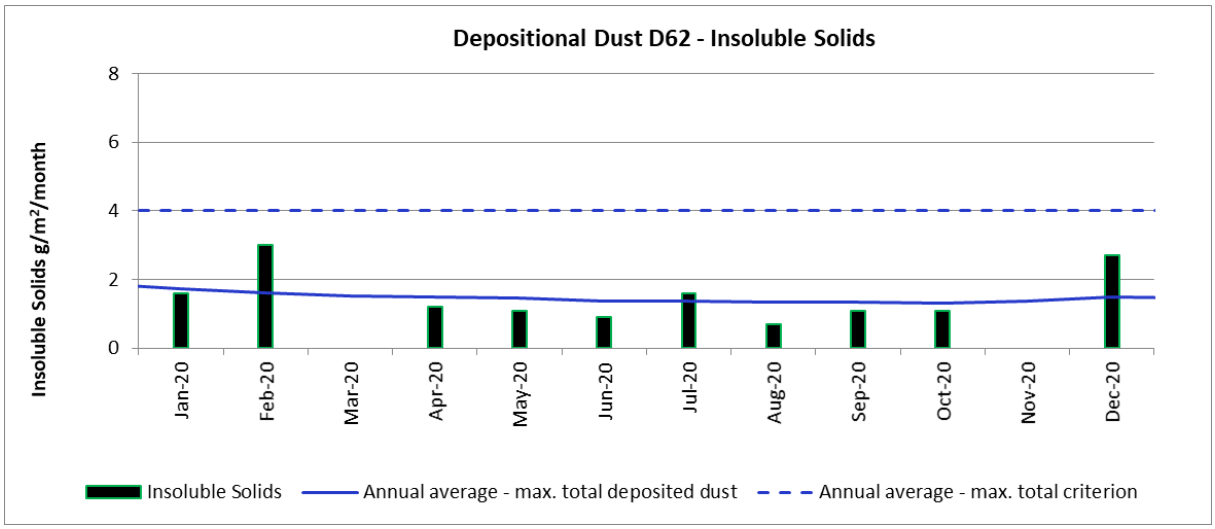


Figure 6-5 Depositional Dust D62 annual results

Note that in ***Figure 6-5***, the results for March and November 2020 were excluded due to contaminated samples.

6.3.2.1 Deposited Dust - Comparison to EA Predictions

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, despite regional conditions being poor at times throughout the year, as identified in ***Table 6-7.***

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 samplers every six days.

As detailed in ***Table 6-7,*** during 2020 there were 24 days in which DPIE has identified as being impacted by extraordinary regional events. Out of the 24 days impacted, five occurred on days where TSP monitoring occurred. Therefore, the results from the five days adversely impacted by extraordinary conditions have been removed from the below figures and results. TSP monitoring results are presented in ***Figure 6-6, Figure 6-7*** and provided in ***Appendix C.***

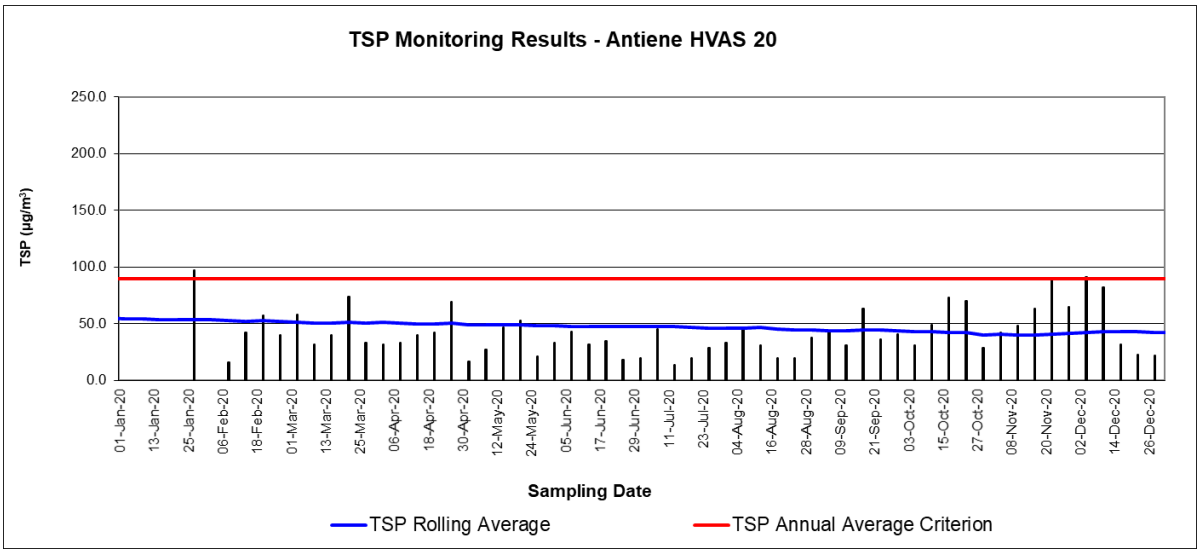


Figure 6-6 Antiene HVAS TSP annual results

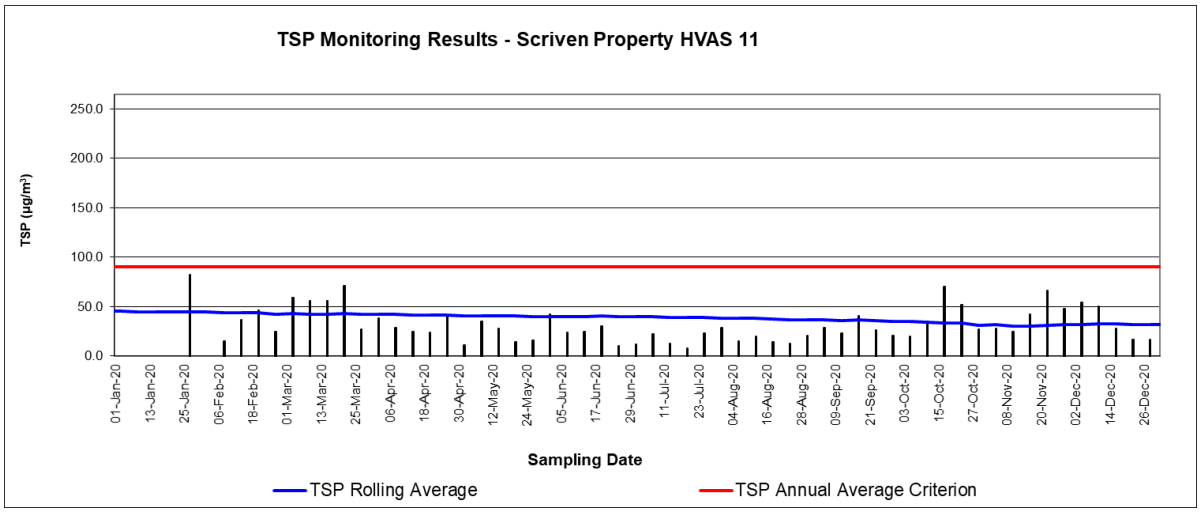


Figure 6-7 Scrivens HVAS TSP annual results

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 6-9.***

Excluding the five days which were impacted by extraordinary conditions, the annual rolling average TSP at the completion of 2020 was:

- 42 µg/m^3 at HVAS 20 (Antiene)
- 32 µg/m^3 at HVAS 11 (Scriven)

Table 6-9 - Annual average TSP compliance summary

Monitoring location	Approval Criteria ($\mu g/m^3$)	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 6-8 and ***Figure 6-9,*** detailed 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.

As detailed in ***Table 6-7,*** during 2020 there were 24 days in which DPIE has identified as being impacted by extraordinary regional events. Out of the 24 days impacted, five occurred on days where TSP monitoring occurred. Therefore, the results from the five days adversely impacted by extraordinary conditions have been removed from the below figures and results. PM_{10} monitoring results are presented in Figure 6-8, ***Figure 6-9*** and provided in ***Appendix C.***

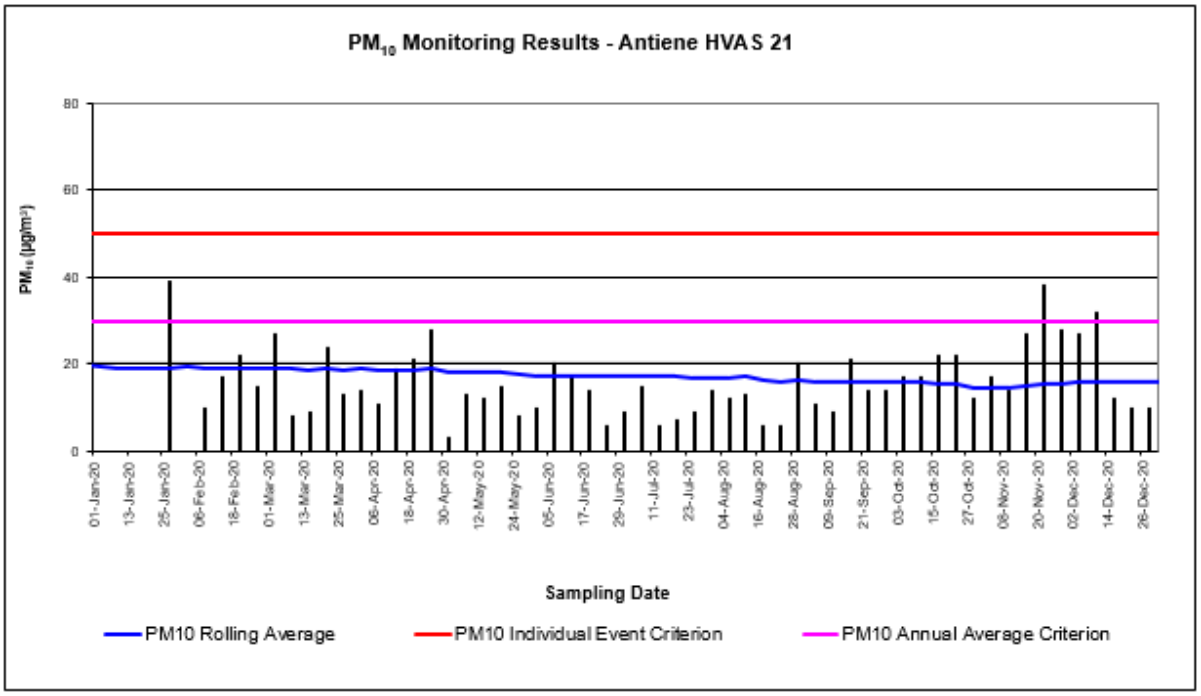


Figure 6-8 - Antiene PM10 (HVAS 21) annual results

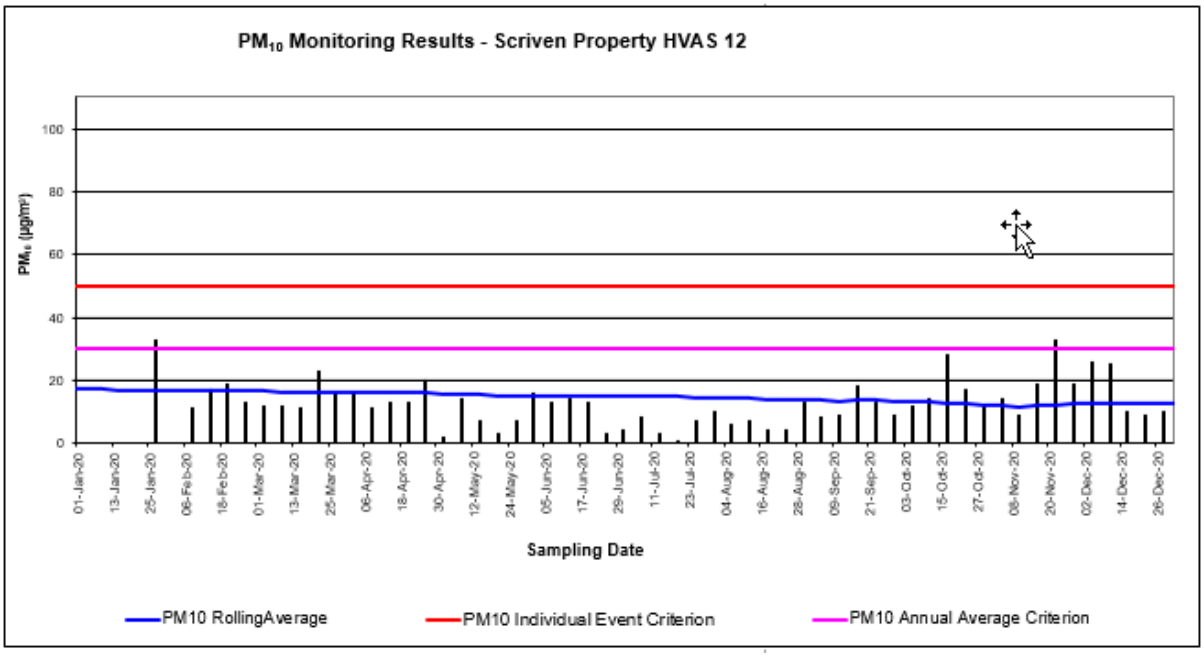


Figure 6-9 - Scrivens PM10 (HVAS 12) annual results

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

During the reporting period there was there were two exceedances of the short term impact assessment criteria which were investigated by LCO. A summary of each exceedance is provided in ***Table 6-11.***

Excluding the five days which were impacted by extraordinary conditions, the annual rolling average PM_{10} at the completion of 2020 was:

- 16 µg/m^3 at HVAS 21 (Antiene)
- 13 µg/m^3 at HVAS 12 (Scriven)

Table 6-10 - 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 6-11 Short-term average HVAS PM10 exceedance summary

Exceedance Date	Unit	Short Term Criterion (ug/m^3)	Monitored Result (ug/m^3)	Investigation Notes
21/01/2020	HVAS 21	50	60	Classified an extraordinary day as described by DPIE
21/01/2020	HVAS 12		58	

Orange shading –monitoring period determined to be impacted by extraordinary regional conditions under Note D of Schedule 3 Condition 16 by DPIE.*denotes exceedance investigation conducted under Note b of Schedule 3 Condition 16 and determined due to predominate wind direction and contribution analysis using nearfield real time monitoring units, the measured results were likely the result of regional conditions opposed to contribution from LCO.

6.3.4.1 High Volume Air Samplers - Comparison to EA Predictions

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. Whilst there was 1 exceedance of the short term impact criteria for HVAS PM_{10}, the result was excluded because it was classified as an extraordinary regional event by DPIE, and not contribution by operations at LCO.

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 key operational personnel and are used as an auxiliary management tool in controlling dust emissions at Liddell.

As detailed in ***Section 6.3.1***, the 24 days determined to be extraordinary regional conditions have been excluded from the results in this annual review. 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 6-10.***

Table 6-12 - Annual average TEOM PM10 compliance summary

Monitoring location	Approval Criteria *(µg/m^3)*	Performance during the reporting period	Key management implications	Proposed management actions
SX38-D1 (Scriven)	30	Compliant	N/A	None required
SX38-D2 (Antiene)				

Excluding the 24 days which were impacted by extraordinary conditions, the annual rolling average PM_{10} at the completion of 2020 was:

- 14.8 µg/m^3 at SX38-D1 (Scriven)
- 18.7 µg/m^3 at SX38-D2 (Antiene)

Table 6-13 summarises each monitoring result higher than the short term criteria, prior to the exclusion of extraordinary events. After excluding results impacted by extraordinary events, the short term 24 hour criterion (50 µg/m^3) was not exceeded during the reporting period at continuous monitoring units SX38-D1 and SX38-D2.

Table 6-13 Short term average TEOM PM10 compliance summary

Exceedance Date	Unit	Short Term Criterion *(µg/m^3)*	Monitored Result *(µg/m^3)*	Investigation Notes
1/01/2020	SX38-D1	50	65.2	Classified an extraordinary day as described by DPIE
1/01/2020	SX38-D2		85.2	
3/01/2020	SX38-D2		53.3	
5/01/2020	SX38-D1		95.7	
5/01/2020	SX38-D2		107.5	
11/01/2020	SX38-D1		73.7	
11/01/2020	SX38-D2		69.6	
12/01/2020	SX38-D1		52.6	
12/01/2020	SX38-D2		52.4	
20/01/2020	SX38-D1		61.3	
20/01/2020	SX38-D2		60.3	
21/01/2020	SX38-D1		62.3	
21/01/2020	SX38-D2		65.1	
23/01/2020	SX38-D1		68.1	
23/01/2020	SX38-D2		71.4	
19/02/2020	SX38-D1		58.6	
19/02/2020	SX38-D2		57.7	

Orange shading – monitoring period determined to be impacted by extraordinary regional conditions under Note D of Schedule 3 Condition 16 by DPIE.
*denotes exceedance investigation conducted under Note b of Schedule 3 Condition 16 and determined due to predominate wind direction and contribution analysis using nearfield real time monitoring units, the measured results were likely the result of regional conditions opposed to contribution from LCO

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 daily averaging period. Continuous monitoring points SX38-D1 and SX38-D2 failed to monitor PM10 continuously on 13 and 26 occasions respectively, in accordance with Section 4.4 of the approved LCO AQMMP. These instances are summarised in ***Table 6-14.***

Table 6-14 Failure to meet PM10 data availability instances - TEOMs

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
SX38-D1	7/01/2020	0.0%	Unit outage due to UPS.
	8/01/2020	41.0%	Unit outage due to UPS replacement.
	10/01/2020	50.0%	3 monthly planned maintenance.
	6/02/2020 to 10/02/2020	72.2% 0.7% 0.0% 0.0% 34.7%	Unit outage due to air conditioner trip.
	3/04/2020 to 4/04/2020	50.0% 72.9%	Unit outage due to flow failures.
	6/04/2020 to 8/04/2020	14.0% 0.0% 53.5%	12 monthly planned maintenance with zero noise filter.
SX38-D2	6/01/2020 to 8/01/2020	29.2% 50.7% 55.6%	Unit outage due to high filter loads. TEOM filter replaced.
	3/02/2020	63.2%	Unit outage due to filter and water trap.
	26/02/2020	70.1%	Unit outage due to power supply interruption.

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
	24/04/2020 to 11/05/2020	45.8% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 36.1%	Data invalidated as inlet seal broken due to install of AC. 3 monthly planned maintenance and corrected broken inlet
	27/07/2020	61.8%	Unit outage due to heater failure.
	3/08/2020 to 4/08/2020	37.5% 51.4%	Planned maintenance and PCB replacements.

Despite the above instances in which SX38-D1 and SX38-D2 failed to achieve PM10 daily availability greater than 75%, the overall valid data availability for each unit during 2020 was 96.9% and 93.3% respectively.

PM10 monitoring results, excluding the 24 days deemed as impacted by extraordinary conditions by DPIE, are presented in ***Figure 6-10*** and ***Figure 6-11***.

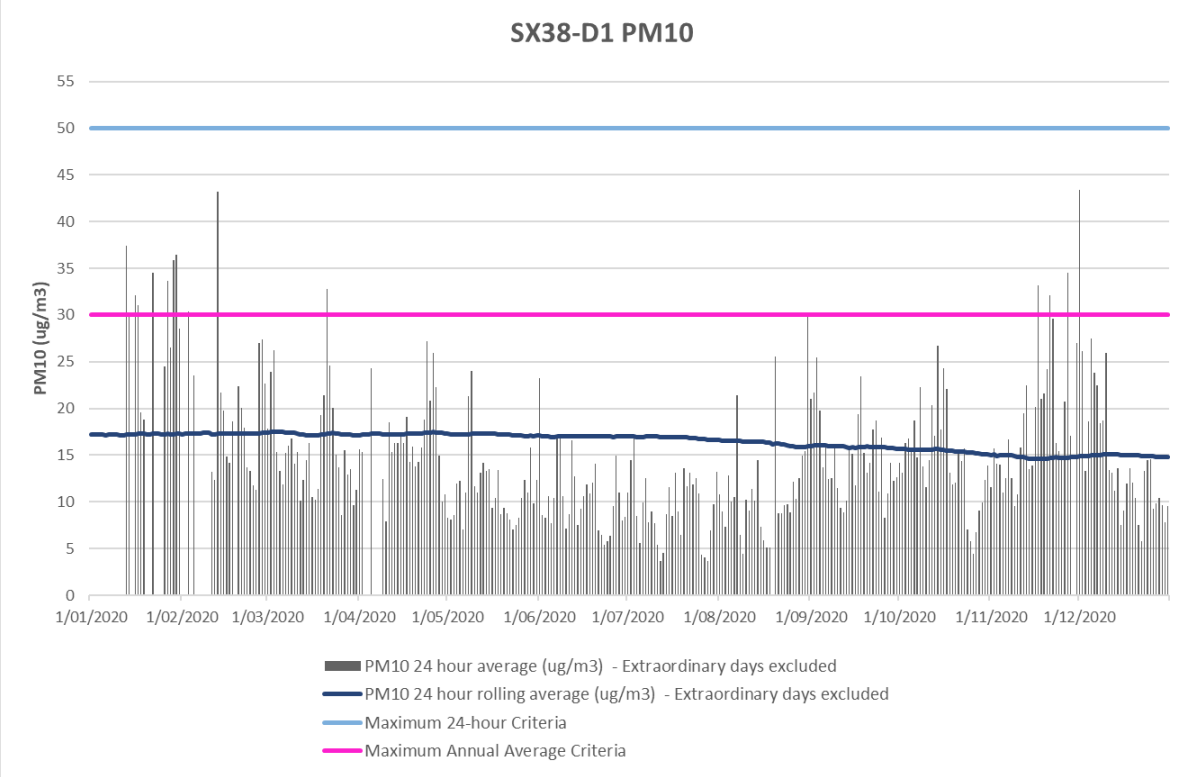


Figure 6-10 SX38-D1 TEOM PM10 results

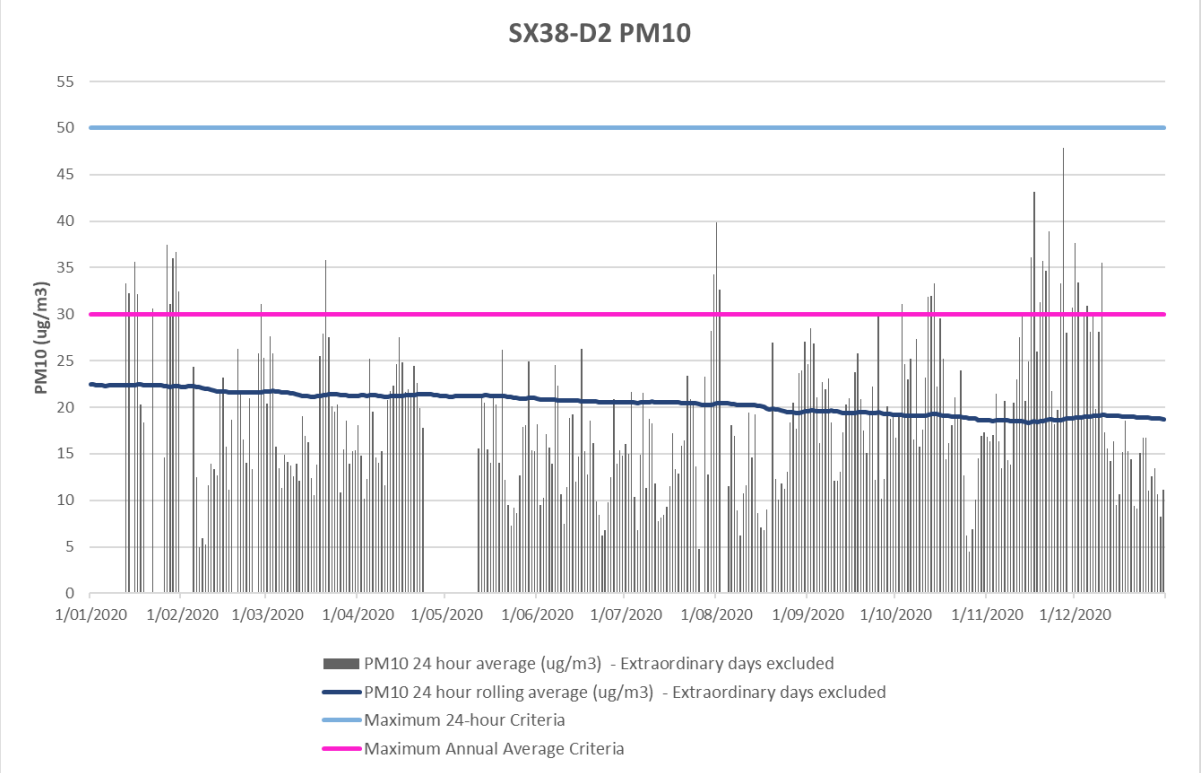


Figure 6-11 SX38-D2 TEOM PM10 results

6.3.5.1 Continuous PM10 Monitoring - Comparison to EA Predictions

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%. While exceedance of this criteria was recorded at private residences (SX38-D1 and SX38-D2) during the reporting period, as predicted, LCOs contribution to these values was not considered significant and attributable to regional conditions.

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 – 8 occasions
- SX38-D4 – 11 occasions
- SX38-D5 – 17 occasions
- SX38-D6 – 25 occasions

Table 6-15 below identifies for each of the four monitoring units the dates in which PM10 data availability greater than 75% was not achieved.

Despite the below instances in which SX38-D3, SX38-D4, SX38-D5, and SX38-D6 failed to achieve PM10 daily availability greater than 75%, the overall valid data availability for each unit during 2020 was 98.4%, 98.0%, 97.4% and 94.9% respectively.

Table 6-15 Failure to meet PM10 data availability instances - EBAMs

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
SX38-D3	27/05/2020	63.9%	Unit outage due to power supply.
	15/06/2020 to 16/06/2020	75.0% 61.1%	Unit outage due to power supply & ant infestation.
	28/07/2020 to 29/07/2020	75.0% 53.5%	Replaced batteries with new.
	5/08/2020 to 7/08/2020	33.3% 0.0% 45.8%	Unit outage due to flow failure. Pump replaced and calibrated.

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
SX38-D4	7/05/2020 to 8/05/2020	45.1% 68.1%	Unit outage due to media card failure. Reset.
	26/05/2020	58.3%	Unit outage due to power supply.
	14/07/2020 to 16/07/2020	64.6% 21.5% 41.7%	Unit outage due to flow failure.
	27/07/2020 to 28/07/2020	64.6% 61.8%	Unit outage due to power supply. Batteries replaced.
	11/08/2020 to 13/08/2020	40.3% 0.0% 37.5%	Unit outage due to voltage error. Wiring and pump replaced.
SX38-D5	18/03/2020 to 19/03/2020	47.9% 45.8%	6 monthly planned maintenance and calibration.
	28/04/20 to 29/04/2020	42.4% 66.0%	Unit outage due to failed media card. Reset.
	03/05/2020 to 04/05/2020	28.5% 68.1%	Unit outage due to media card failure. Reset.
	26/05/2020 to 27/05/2020	57.6% 64.6%	Low battery charge. Recharged via sunlight when weather improved.
	11/06/2020 to 12/06/2020	14.6% 70.8%	Low battery charge. Batteries replaced.
	28/07/2020	50.7%	Low battery charge. Batteries replaced.
	29/10/2020 to 30/10/2020	50.7% 44.4%	Flow failure. Pump replaced.
	02/12/2020 to 03/12/2020	41.0% 46.5%	12 monthly planned maintenance with zero filter.
	23/12/2020 to 24/12/2020	67.4% 63.9%	Unit outage due to data taker and router.

Monitoring Unit	Monitoring Period	Data Availability *(%)*	Comments
SX38-D6	23/01/2020 to 29/01/2020	25.7% 0.0% 0.0% 0.0% 0.0% 0.0% 56.9%	Unit error. Taken off site for repairs.
	31/01/2020 to 2/02/2020	62.5% 43.8% 47.2% 75.0%	Low flows. Corrected flow and recalibrated.
	04/05/2020	69.4%	Flow failure. Updated settings and recalibrated.
	11/05/2020 to 13/05/2020	48.6% 52.1% 64.6%	Flow failures and 1 monthly planned maintenance.
	26/05/2020 to 27/05/2020	0.0% 55.6%	Low battery charge. Recharged via sunlight when weather improved.
	18/07/2020 to 20/07/2020	0.0% 0.0% 41.0%	Pump failure. Replaced with spare.
	27/07/2020 to 29/07/2020	29.2% 0.0% 52.8%	Low battery charge. Recharged via sunlight when weather improved.
	02/12/2020 to 03/12/2020	53.5% 48.6%	12 monthly planned maintenance with zero filter.

6.3.7 Pollution Reduction Programs

During 2020, no new Pollution Reduction Programs were completed. LCO continued to implement Haul Road Dust Monitoring program 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 a 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 is completed in line with the original PRP methodology including the metrological 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 March – 81%
- Q2 May – 97%
- Q3 August – 87%
- Q4 November – 91%

6.4 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 2020, there was one lighting complaint received, detailed in ***Section 0***.

6.4.1 Comparison to EA Predictions

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. It was predicted that no lighting complaints should be received, however one complaint was received as detailed in ***Section 0***.

6.5 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 6-12.***

The LCO ***Aboriginal Cultural Heritage Management Plan*** (ACHMP) was revised during the reporting period to incorporate changes resulting from the approval of Modification 7 to DA 305-11-01. No additional consultation activities were held in 2020 outside of the plan review, annual inspection and meeting.

Two due diligence programs were completed during 2020. Results of the inspections are summarised in ***Table 6-16***, and were incorporated into the most recent ACHMP update.

Table 6-16 – Summary of 2020 due diligence inspections completed

Timing	Location	Sites Identified
March 2020	Buffer land near Hebden Rd	LID34, LID35
June 2020	Buffer land near Bowmans Creek	LTM-IF1, LTM IF2, Bowmans Creek 14 (existing)

The annual inspection and meeting was held with RAPs on 10 November 2020. During this inspection, RAPs visited:

- LID ES1 – blast flyrock
- LID3 – gully erosion
- HAZ2-OS1 – gully erosion
- LTM-F1, LTM-F2, Bowmans Creek 14 – new sites identified during due diligence inspections
- LID34 and LID35 - new sites identified during due diligence inspections

The following actions were discussed and agreed on during the inspection:

1. Site cards to be updated, including new site extents. LCO to extend bunting to revised extents.
2. Install additional temporary erosion control measures within gully at HAZ-OS1 to improve management of area.
3. Assess removal of old fencing material in gully, if required, at 2021 inspection.

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*.

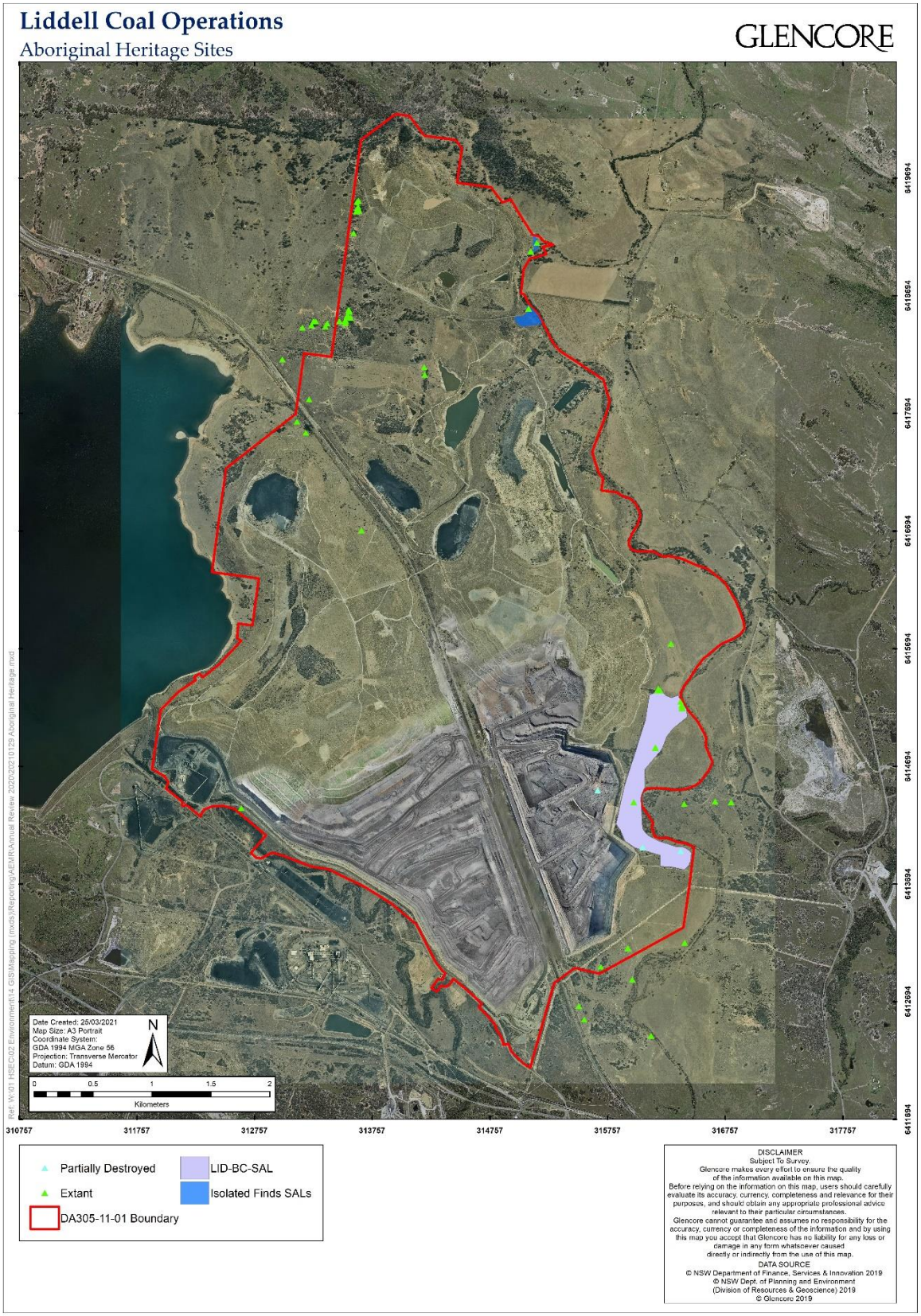


Figure 6-12 Aboriginal archaeological site locations

6.6 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 are 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. This strategy was revised during the reporting period in consultation with NSW Heritage Council and Hunter Valley Operations (owner).

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 a distance of 350 metres to the Inn, combined with an inspection and blast review regime to effectively manage blasting in the vicinity of the Inn.

During the reporting period, no impacts to the Inn Complex have been noted by either building vibration monitoring or visual inspection.

6.6.1 Management Actions During 2020

As per the requirements of the management strategy, continuous monitoring of blasting as well as structure response monitoring occurred during 2020. No further 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 and therefore recommended continuation of the blast management program in accordance with the approved Strategy.

During a blast initiated on 9 July 2020, a PPV of 43.65 mm/s was measured at the COPI Complex. This triggered a dilapidation report to be conducted as per the COPI Strategy. A new methodology for the survey was adopted, which included collection of data using drones, handheld camera, Matterport and RTK rover. The reported data included a virtual 3D capture of the building façade and interior. Despite the event being the highest PPV recorded to date, none of the displacements were greater than previously recorded blasts (of lower PPV). No impacts, cosmetic or otherwise above that reported in previous years, was observed during the dilapidation survey.

6.6.2 Analysis of Blast Monitoring

The structures were monitored with accelerometers on 5 occasions during the year, from 3/03/2020 to 3/12/2020. For each of these events, vibrations were measured at the building locations specified in the strategy. Acceleration measurements were analysed and compared with the in-ground geophone velocity measurements (the site geophone). For both the geophone and the

accelerometers, the analysis yields acceleration, velocity and displacement results, together with frequency analyses for all.

The accelerometer mounting locations chosen to best describe the behaviours of the buildings are shown in ***Figure 6-13***. With the exception of locations Ad and Bc, all are at the tops of the two-storey walls and generally measure the most-damaging in-plane movements. Location Ad is at the top of a chimney and is measuring the movement about its weaker axis; location Bc is at the centre of a two-storey wall which is unsupported by a floor and for which the out-of-plane movement is the most critical.

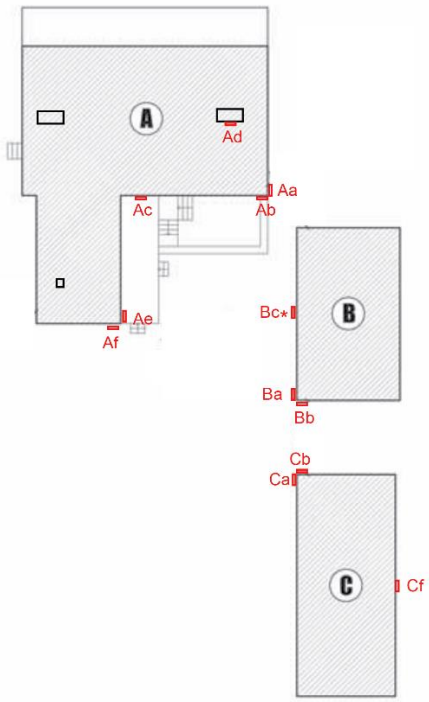


Figure 6-13 - Accelerometer locations at Chain of Ponds Inn

Displacement of a building element is the best indication that damage may be caused, as this relates directly to the strain in the building fabric. In a report prepared by *Bill Jordan & Associates* dated 16 March 2016, the acceptable displacements were tabulated for each of the monitored locations. The most vulnerable locations were shown to be the chimneys and the large unsupported two-storey side wall(s) of the kitchen block (Building B); the responses at these locations are measured by representative accelerometers at locations Ad and Bc.

No results recorded in 2020 suggested that any change was required in these criteria.

The maximum displacements recorded during the year at each location are shown in ***Table 6-17.***

Table 6-17 Maximum displacements recorded in 2020

Location	Max. displacement (mm)	Tolerance	% of tolerance
Aa	0.89	7	12.7
Ab	0.85	7	12.1
Ac	0.89	7	12.7

Location	Max. displacement (mm)	Tolerance	% of tolerance
Ad	0.51	12	4.3
Ae	0.70	7	10
Af	3.16	7	45.1
Ba	0.97	5	19.4
Bb	1.00	5	20
Bc	0.79	3	26.3
Ca	1.48	5	29.6
Cb	1.02	5	20.4
Cc	0.97	5	19.4

Data relating to the effects of groundwave frequencies continued to be gathered during the year and has been used to refine blast design parameters.

6.6.3 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.

6.6.4 Trends and compliance issues

During 2020, there were no exceedances of the compliance limits at the Chain of Ponds Inn nor was there any significant damage as a result of blasting activities.

Blast vibrations are still not reliably predictable. Different factors influence the actual vibration levels for each blast and the predictions will continue to vary from the recordings of the event. A conservative approach/margin is considered in both the prediction models and the building behaviour models and it will continue to be appropriate to continue this into the future.

6.6.5 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 has been applied to South Cut blasting and has not resulted in any significant damage to the Inn in 2020.

6.6.6 Future Work

Continued monitoring of the buildings behaviour as per the strategy will occur to further develop the predictive modelling and provide for the conservation of the structures.

6.7 Exploration

No exploration activities were conducted by LCO in 2020.

6.8 Spontaneous Combustion

Fine coal along the ribs of exposed pillars in old underground workings associated with the Liddell coal seam have been historically linked to spontaneous combustion at LCO. To manage spontaneous combustion the mine plan aims to keep the underground workings submerged with water to limit coal exposure to oxygen for as long as possible. Once exposed, the mine design then incorporates benches for sealing off the high wall, which minimises the ingress of oxygen. Where areas of spontaneous combustion are exposed, the affected material is removed where possible, dumped low in spoil areas and covered with at least 20 m of inert material. If removal is not feasible, care is taken to minimise potential dust generation, and the coal is processed in the CHPP as soon as practicable to minimise ROM stockpile time. Spontaneous combustion of stockpiled product coal at LCO is rare due to the moisture introduced during the washing process and the regular transfer of coal to the Port of Newcastle for export. In the event that stockpiles start to generate heat due to delays in transportation, coal in the stockpiles is spread out and soaked with water to allow the heat to dissipate. Measures to control spontaneous combustion are documented in the LCO Spontaneous Combustion Management Plan, which is reviewed and updated regularly.

Historically, underground workings in the Liddell seam were de-watered a number of months prior to mining. This allowed the coal to be exposed to oxygen, facilitating spontaneous combustion. The mining process was revised and implemented during 2013/2014 and sees a just-in-time methodology, where by an increased pumping network has enabled the workings to be de-watered just prior to excavation. By eliminating the coal's exposure to the atmosphere and propensity to combust, rather than relying on an engineering treatment once exposed, a significant reduction in the environmental hazard has been realised.

Since revising the management practices, the methodology has proven successful with a considerable reduction of spontaneous combustion. Whilst there have been occurrences of spontaneous combustion within working areas, the extent and duration of these affected areas has reduced. LCO did not have any management issues relating to spontaneous combustion resulting in either odour or air quality complaints during the reporting period.

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.

6.9 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.

6.9.1 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.

Coarse rejects generated from the LCO CHPP are in the order of 26% of ROM coal processed, and consist of carbonaceous shale, mudstone and claystone, with minor coarser rocks such as siltstone and sandstone. Coarse rejects will be co-dispersed throughout the overburden dumps in varying levels during dump construction with a final placement to be a minimum of 5m below 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.

Under DA305-11-01, up to 0.5 Mtpa of tailings reclaimed from LCO can be transported to Bayswater Power Station, with the actual annual rate depending 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 2020.

LCO has approval to dispose of tailings in the Antienne, Reservoir West, Reservoir South and the Railway fines (now referred to as the Durham Tailings) emplacement areas.

The Antienne tailings storage facility (TSF) has reached capacity and use of this void as an active tailings emplacement area ceased in August 2009. A strategy for the capping of Antienne TSF was submitted to the NSW Resources Regulator (formerly DRE) in December 2014 and LCO commenced capping of the Southern portion of Antienne TSF during 2016. LCO recommenced capping operations on the Northern portion in late 2020, and is planned to be completed in 2021. At this stage approximately 23ha of the 33ha dam have had an initial capping layer of 1.5m created.

An addendum to the 2018 – 2020 Mining Operations Plan was approved by the Resources Regulator on 24 October 2018 which permitted the alternating emplacement of tailings between both Reservoir TSFs and the active Durham TSF throughout 2020. During Q1 of 2020, LCO rotated deposition between the three TSF's to assist with settlement and meeting final level/capacity. In February 2020, LCO commenced emplacement of tailings into Mount Owen's West Pit void. Deposition will continue into the West Pit void with occasional deposition into the three LCO TSF's until they reach storage capacity. Based on current monitoring and consolidation forecasts, West Pit TSF has sufficient tailings disposal capacity for LCO life of mine.

Table 6-18 below shows indicative timeframes for capping and final rehabilitation for each facility which is subject to technical analysis of consolidation rates in the current MOP term.

Table 6-18 Tailings emplacement and rehabilitation timeframes

Name	2021	2022	2023
RTEA (Reservoir South and West TSF)	Active	Rehabilitation	Rehabilitation
Durham TSF	Active	Rehabilitation	Rehabilitation
Antiene TSF	Rehabilitation	-	-
Mount Owen West Pit TSF	Active	Active	Active

6.10 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 2020, no opportunities for waste minimisation or recycling improvements were identified with the annual recycling target met and exceeded during periods throughout the term. ***Table 6-19*** below shows the total recycling efficiency percentage achieved monthly at LCO in 2020.

Table 6-19 Recycling efficiency recorded in 2020

Month	Total Recycled (%)	Comments
January	94.71%	
February	94.19%	
March	91.47%	
April	91.72%	
May	89.90%	Minor increase in hazardous waste disposed
June	91.36%	
July	89.39%	Minor increase in non-hazardous waste disposed
August	92.09%	

Month	Total Recycled (%)	Comments
September	94.24%	
October	92.92%	
November	92.24%	
December	95.74%	
2020 Total	**92.46%**	

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***. During 2020, LCO consulted with DPIE and NRAR to update the WMP following revision of EPL 2094 however approval of this document has not yet been received.

The water management system at LCO is integrated, that is, the water from both the open cut operations and former underground operations is managed together, in an integrated system. The integrated water management system at LCO is designed around the following operational objectives:

- To maintain a low risk of uncontrolled discharge occurring from the process water (CHPP) or mine water systems over the mine life.
- To minimise the need to export water and salt to the Hunter River by maximising re-use on-site and by transferring excess water to other nearby mining operations.
- To minimise risks of disruption to mining operations by efficient mine and underground workings dewatering.
- To ensure that effective control over generation of airborne particulates is not interrupted due to lack of water by maintaining a reliable water supply.
- To ensure uninterrupted operation of the CHPP by maintaining a reliable water supply.
- To minimise the potential effects of erosion and its associated impacts as a result of mining operations changing flows or conditions downstream.

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 in the CHPP and for dust suppression.

Inflows, which contribute to the LCO water balance, 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, to mitigate 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.

The water uses at LCO 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 consistent with previous reporting periods. Note changes in water consumption are a result of many variables including pit progression, groundwater inflow, rainfall, atmospheric conditions, etc.

LCO also participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing it to discharge from a licensed discharge point located on Bayswater Creek. These discharges take place during high flow periods in compliance with HRSTS regulations. LCO also 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 as well as strategic use of available mine water storages at each operation reducing the requirement for additional dams/voids.

During 2020, LCO completed an annual review of the site water balance as per Section 7.6 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 LCO during the reporting period is shown in ***Figure 7-1***. Further, during the reporting period LCO consulted with DPIE to update the WMP; specifically updates to the training and communication requirements and contextual updates to align of the plan with current operations.

Table 7-1 Site water balance

2020 Site Water Balance		
Total Inputs (ML)	7149	Key inputs – aquifer interception, transfers from Greater Ravensworth sites, rainfall, runoff, potable water and water entrained in ROM coal
Total Outputs (ML)	6698	Key outputs – transfers to Greater Ravensworth sites, evaporation, water entrained in product coal, coarse rejects and tailings slurry.
Inputs minus Outputs (ML)	451	
Storage at Start (ML)	5727	
Storage at End (ML)	6905	
Change in Storage (ML)	1178	
Imbalance (ML)	728	
Total Inputs + Total Outputs equals total flow through site (ML)	13847	
Imbalance Percentage	5.3%	

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 2020 the site water balance model was maintained to reflect current operations. The annual review of model calibration, summarised as the 'imbalance percentage' above, shows a 5.3% imbalance percentage demonstrating that the water balance is well calibrated. The imbalance is expected to be the cumulative effective of minor inaccuracies in storage measurements as well as modelled input/outputs (rainfall/run off inflow, evaporation, groundwater inflows, etc.). During 2021 LCO plan to make improvements to the site water balance model to improve the imbalance percentage by increasing the number of measured inputs and decreasing the number of estimated or simulated values used in the model.

As per the 2019 AR acceptance letter from DPIE, ***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. Furthermore these are highlighted in ***Table 7-1*** above.

In accordance with DA 305-11-01, a 3yearly water balance model validation review was undertaken by Hydro Engineering & Consulting Pty Ltd in 2020 to provide for water balance accuracy. The key conclusions and recommendations from this water balance model validation review were:

- The water balance calibration reported herein indicates that the calibrated model reproduces observed water management system behaviour well;
- Modelled groundwater inflows to former underground storages and open cut pits have been adjusted as part of the calibration and modelling of seepage from the Durham Void to the South Pit added;
- Rainfall runoff model parameters have not changed from those derived in the previous two calibrations. The calibration verifies that the model is fit for use as part of the water management system;
- The model log should be updated whenever the model is updated or changed in any way and be kept in the model to track model versioning; and
- It is understood that the completion of mining operations at Liddell is scheduled for late 2023. Given the requirement for water balance model validation every 3 years, one further model calibration/validation will be required prior to the completion of operations. The model calibration should therefore be reviewed at that time, using additional accumulated monitoring data.

Mine Dewatering

The M49 Bore, Mt Owen Bore, Hazeldene 1 Bore and Middle Liddell 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 2020 from the groundwater licences held by LCO with an extraction allocation. LCO did not take from any surface water licences during the reporting period.

Section 8.2 details groundwater monitoring results (water level and water quality) for the reporting period.

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)	181.80	75	256.8
Middle Liddell Bore	WAL41498 (previously 20BL172588)				

Locality	Water Licence	Entitlement (ML)	Passive take (ML)	Active pumping (ML)	Total take (ML)
Hazeldene 1 & 2	WAL39760 (previously 20BL168060)	5500	0	0	0
Bowman's Creek	WAL18302	5	0	0	0
Bowman's Creek	20WA210940 (previously 20BL017861)	5	0	0	0
M49	WAL41493 (previously 20BL172293)	2500 (Combined)	960.38	233	1193.38
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.

Framework Representation

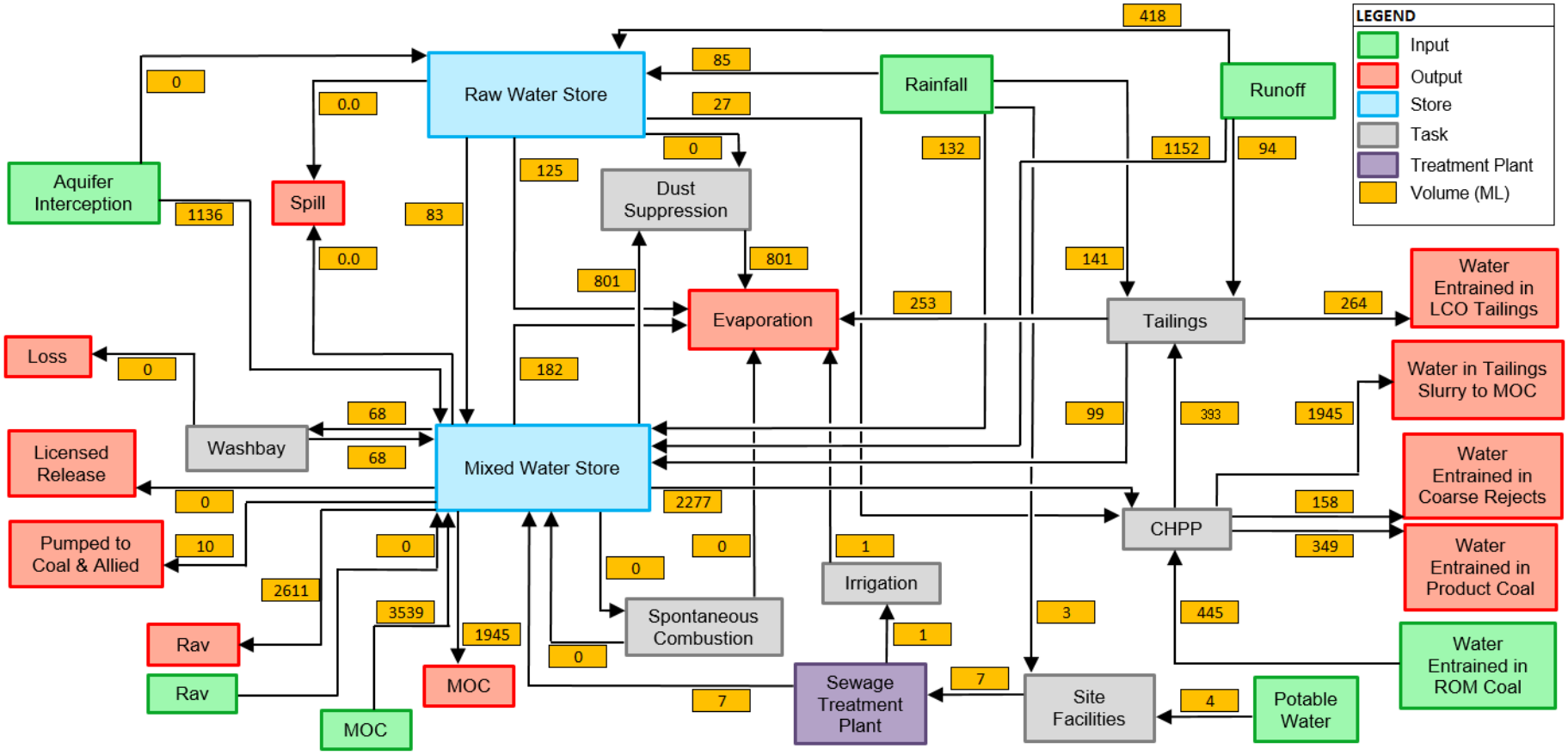


Figure 7-1 water balance

8. 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. This monitoring program utilises specific surface water quality monitoring trigger limits which provide for the identification of potential adverse impacts.

The trigger limits or impact assessment criteria for both Bayswater and Bowmans Creek has been determined based on a statistical analysis of data collected over a 5 year period. In accordance with ANZECC (2000) guidelines a 90th percentile concentration is appropriate for maintaining water quality. Importantly, impact assessment criteria apply based on the flow conditions of the each creek line and monitoring location; due to the disturbed nature of both catchments this is deemed to be an appropriate statistical criterion to adopt whilst mining operations are ongoing. The creek trigger levels are presented in ***Table 8-1***. Noting the acronyms; TSS – Total Suspended Particulate, EC – Electrical Conductivity, TDS – Total Dissolved Solids.

Table 8-1 WMP trigger values for surface water quality

	pH lower limit	pH upper limit		EC		TDS		TSS	
		90th %tile[1]	Max[2]	90th %tile[1]	Max[2]	90th %tile[1]	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

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

Trigger Level when creek is flowing
Trigger Level when no flow in creek

Monitoring during the reporting period was completed as per the applicable approved WMP. The following sections detail exceedances, if any, of applicable WMP trigger levels; full monitoring results are shown in ***Appendix D -.***

The surface water monitoring locations are shown above on ***Figure 8-1***.

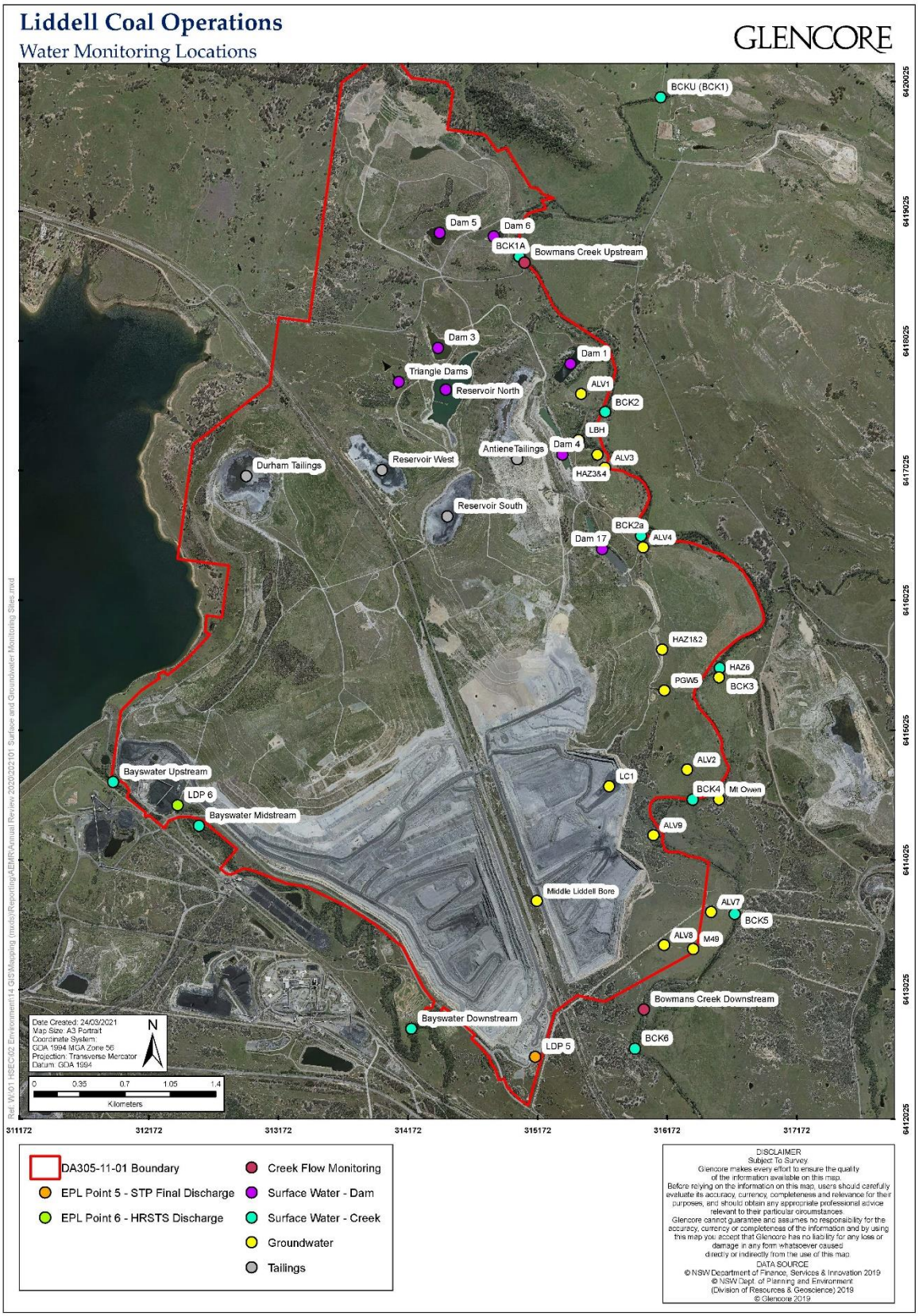


Figure 8-1 Surface and groundwater monitoring locations

8.1.1 Surface Water Monitoring Results Review

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 8-2*** below summarises the monitoring results in Bayswater Creek during the reporting period. There was no exceedances of the criteria, in accordance with the surface water trigger response plan.

Table 8-2 Bayswater Creek trigger limit summary

Month	BWKU (Upstream)				BWKM (Midstream)				BWKD (Downstream)			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
January	7.64	3480	6	2220	7.83	4730	10	3170	Dry			
February	7.47	1960	23	1240	7.78	3220	6	1980				
March	7.64	3100	8	2130	7.89	4030	<5	2540				
April	7.72	3540	<5	2270	7.99	4510	<5	3050				
May	7.68	3320	<5	2040	7.95	4130	<5	3150				
June	7.67	2980	8	1910	8.04	3620	<5	2420				
July	7.76	3390	<5	2320	8.14	4130	<5	2850				
August	7.8	3180	9	2120	8.06	3760	<5	2560				
September	7.83	3420	11	2360	7.91	4560	16	3160				
October	7.94	4620	5	3000	8.02	5800	8	3880				
November	7.96	3310	25	2160	7.89	3920	24	2610				
December	7.59	4620	28	3190	8	6120	11	4270				

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 as detailed above, trigger limits are dependent on the flow conditions at time of monitoring.

Table 8-3 below summarises the trigger limits exceeded in Bowmans Creek during the reporting period.

Table 8-3 Bowmans Creek trigger limit summary

Bowmans Creek – Values Exceeding Trigger Limits																
Month	BCK1 (Upstream)				BCK 1A				BCK2				BCK2A			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
Jan	7.48	1260	207	744	7.38	5840	102	4230								
Feb	7.3	1720	7	1150	7.47	6820	69	4790								
Mar	7.62	1320	20	900	7.54	7050	25	5590								
Apr	7.4	1190	8	695	7.6	1790	10	1030					6.92	1260	6	640
May	7.24	1310	6	756	7.67	2520	<5	1490								
Jun	7.36	1270	7	754	7.81	2300	<5	1180								
Jul	7.69	1260	<5	787	7.82	1740	<5	1070								
Aug	7.88	644	8	396	7.98	670	<5	397	8.59	684	<5	410	8.07	713	<5	434
Sep	7.65	913	8	559	7.83	1060	9	596	7.74	1030	12	626	7.81	1220	12	740
Oct	7.57	1040	<5	555	7.99	1570	<5	919	8.57	1140	9	668	7.19	1430	<5	884
Nov	7.85	694	8	391	8.04	748	7	474	8.26	769	8	460	7.74	820	10	430
Dec	7.55	885	8	561	7.9	1360	12	949	8.66	846	15	557	7.16	1230	<5	826
Month	BCK3				BCK4				BCK5				BCK6 (Downstream)			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
Jan																
Feb	6.92	1180	29	788												
Mar	6.85	1860	22	1390												
Apr	7.62	1880	8	1150	6.84	1540	<5	967	7.35	1560	<5	984	5.89	2780	11	2060
May	7.55	1970	8	1250	7.26	1890	<5	1090								
Jun	7.63	1790	6	1110	7.31	1720	12	1060								
Jul	6.88	1770	5	1280	7.45	1840	<5	1120								
Aug	7.97	753	<5	434	7.92	750	5	446	7.98	763	<5	452	7.91	770	<5	440
Sep	8.39	1180	<5	680	7.96	1120	10	612	7.72	1250	7	709	7.03	1250	19	733
Oct	7.96	1360	<5	722	7.87	1370	12	839	7.95	1600	<5	976	6.92	1240	<5	747

Bowmans Creek – Values Exceeding Trigger Limits																
Nov	7.74	850	12	480	7.7	852	398	462	7.8	884	15	462	7.82	876	10	493
Dec	7.89	1120	34	788	7.82	1130	20	768	7.69	1300	58	874	7.08	1090	18	761

Orange Shading – Denotes an exceedance of the 90%ile trigger limit (applicable when the creek is flowing)

Yellow Shading – Denotes an exceedance of the Max trigger limit (applicable when the creek is not flowing)

During 2020, the Bowmans Creek system continued to be impacted by prolonged drought conditions characterised by below average rainfall and above average evaporation. However during 2020 there was an increase in rainfall which resulted in Bowmans Creek beginning to return to pre-drought conditions. Upstream Bowmans Creek sites BCK1 and BCK1A maintained water throughout 2020 however varied from predominately still or trickle flows with periodic increases in flow associated with rainfall. BCK2, BCK2A, BCK5 and BCK6 remained dry until August except for a minor increase in flow in April in response to rainfall. BCK3 and BCK4 recorded water present in February and April respectively with flows commencing in August. Whilst all of the Bowmans Creek surface monitoring points are no longer dry and showing flows in response to rainfall, this trend is reliant on the continued increase in rainfall to assist offsetting the years of drought conditions impacting the system.

The measured TDS, TSS and EC levels along Bowmans Creek identified a number of exceedances of flow applicable criteria during the reporting period. As shown by shading in ***Table 8-3*** above, many of the exceedances applied to the flowing 90th%ile limits however, monitored conditions at each event recorded either slow or trickle indicating that no flow trigger levels are nearly applicable. However there were no sustained exceedances of the criteria, in accordance with the surface water trigger response plan and considering the isolated nature of these measurements it is unlikely to be representative of any mining impact and no investigation of these results was required under the provisions of the approved WMP.

BCK1A Investigation TARP

In the 2019 Annual Review LCO reported that exceedances of the 90th%ile trigger limits for EC and TDS has occurred at BCK1A. These exceedances continued into early 2020 as per ***Table 8-3*** above. The investigation findings were reported in the 2019 Annual Review noting that as per the WMP investigation protocol, LCO progressed to undertake further investigations to determine the source of the seep observations by commencing a management/mitigation TARP. Management/mitigation measures occurred including dewatering an adjacent water management structure (Dam 6) to create a local groundwater sink to redirect and capture potential groundwater flow from the historical mining area and conducting further studies in consultation with DPIE.

On the 9 September 2020 LCO submitted a BCK1A Management TARP investigation report detailing the results of management/mitigation investigation TARP. Stage 1 of the investigation comprised of developing a conceptual site model (CSM) to assess the mechanisms that may be causing the elevated salinity. This hydrogeological assessment identified the complexity of the groundwater within with a number of potential mechanisms ('natural' processes and 'man-made stressors') for the elevated salinity and recommended that further works, Stage 2, to confirm or negate potential mechanisms.

Stage 2 work was completed to address the identified knowledge gaps and included installation of a targeted groundwater-monitoring network, testing relative hydraulic conductivity of strata, review of groundwater quality in the area and further refinement of the CSM.

LCO additionally commissioned studies to characterise the ecological health of Bowmans Creek and identify potential impacts to ecological health, which may be associated with observed changes in water quality.

The overall findings of the mitigation TARP studies completed by LCO can be summarised as follows:

- Groundwater within the spoil, alluvium and bedrock is discharging to Bowmans Creek;
- It is expected that pre-mining groundwater flow (or flux) in the area of interest will be the same, post mining;
- Dewatering of Dam 6 has minimised the flow of brackish groundwater to Bowmans Creek;
- Reduced rainfall and increased evaporation also contributes to elevated salinity to Bowmans Creek;
- The elevated salinity within Bowmans Creek is localised;
- Aquatic ecology monitoring has not shown sustained impact to aquatic health of Bowmans Creek; and
- Additional assessment is required to develop a mine closure strategy for the area of concern.

Whilst the studies evidence that 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 to inform mine closure planning and ability to progress this area for mining title relinquishment in the future.

MIA Onsite Sewerage System Discharge Quality

LCO operate a Wastewater Treatment Plant (WWTP) at the Mine Infrastructure Area (MIA) for the treatment of waste water prior to discharge into the mine dirty water containment system. LCO has a 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 limits requiring investigation.

HRSTS Discharge Monitoring

Any discharges from Liddell Coal must be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS). During 2020, LCO did not undertake any HRSTS discharge events.

8.1.1.1 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 8-4*** below. In brief, observations from the monitoring programs demonstrate current impacts are within the EA predictions.

Table 8-4 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.
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 2020. 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 were no discharge events under the HRSTS during the reporting period.

8.2 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 water 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. Accordingly, for groundwater quality, a trigger level of 80th percentile and 100th percentile of the historical record has been adopted. Currently, investigations into potential impacts are conducted if there are three consecutive exceedances of the nominated triggers. The following outlines groundwater trigger level definitions as defined in the WMP.

Groundwater level trigger definition

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.

There are three components to the groundwater level trigger definitions. These are described in detail in the WMP (LCO, 2018) and summarised as follows:

1. Impact trigger – An impact trigger is drawdown of 2m 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.
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 recent 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 quality trigger definition

There are two components to the groundwater quality trigger definitions. These are described in detail in the WMP and summarised as follows:

1. EC investigation trigger – An investigation trigger because of a monthly measurement either below the, baseline (20^{th} percentile) or above the monthly baseline (80^{th} percentile) on three consecutive occasions. Note the 20^{th} percentile triggers 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, and;
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.

Table 8-5 presents the current site specific trigger levels for water level and groundwater quality and shows the data relevant to the reporting period.

Monitoring results observed during the reporting period are summarised in following **Section 7.3.2** with the breakdown of:

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

The groundwater monitoring locations (compliance and management bores) are shown above on ***Figure 8-1***.

Table 8-5 Groundwater quality impact assessment criteria

Groundwater Quality Impact Assessment Criteria							
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	
ALV7	Alluvial aquifer (L)	87.02	86.43	N/A	1780	2310	
	Shallow bed rock (S)	83.56	82.39	N/A	2230	2540	

Groundwater Quality Impact Assessment Criteria							
ALV8	Alluvial aquifer (L)	85.06	83.66	N/A	1310	1880	
	Shallow bed rock (S)	82.99	80.94	1540	1990	2400	
Hard Rock Aquifers (Coal Measures)							
PGW5	Overburden (L)	N/A	N/A	N/A	N/A	N/A	6.5 – 8.5
	Coal Measure (S)	N/A	N/A	N/A	N/A	N/A	

8.2.1 Monitoring Results Review

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 8-2*** to ***Figure 8-5*** and in ***Appendix E*** -; a summary of these results during the reporting period is provided herein.

There were several instances of minor exceedances of the pH however none of which were sustained or triggered a pH investigation trigger. The pH level across both systems appear to have a relatively stable trend that has existed throughout the data collection period as shown in ***Figure 8-2*** and ***Figure 8-3***.

Since 2016 to mid/late 2019, investigations into EC levels determined that EC levels were increasing due to climatic factors rather than a direct impact by mining operations. These climatic factors were driven by above average evaporation and below average rainfall resulting in sustained drought conditions. Since mid/late 2019, recent increases in rainfall have resulted in an increase of measured water levels producing a flushing effect where water is infiltrating the shallow hard rock and therefore increasing interaction with the saline shallow bedrock material. In some of the alluvial bores, an increase in EC has been monitored due to increased interaction with the saline shallow bedrock as a result of an increase in water level with groundwater recharge. ***Table 8-6*** below summarises the EC measurements of groundwater, with comparison to the applicable trigger levels. There have been numerous exceedances of the EC upper limit and one exceedances of the EC lower limit. Long term monitoring results are shown in ***Figure 8-4*** and ***Figure 8-5***.

Table 8-6 Groundwater exceedances for EC in alluvial and shallow bedrock aquifers

Groundwater exceedances for EC (dS/cm) in alluvial and shallow bedrock aquifers													
Site	ALV1L	ALV1S	LBH	ALV3L	ALV3S	ALV4L	ALV4S	ALV2L	ALV2S	ALV7L	ALV7S	ALV8L	ALV8S
Impact assessment Criteria													
Lower Limit	-	-	-	-	-	-	-	-	*2.56*	-	-	-	*1.54*
Upper Limit	*1.37*	*1.56*	*1.55*	*1.39*	*2.80*	*1.92*	*5.31*	*2.83*	*2.82*	*1.78*	*2.23*	*1.31*	*1.99*
Maximum	*2.02*	*1.77*	*3.09*	*3.08*	*4.51*	*3.08*	*6.43*	*4.16*	*3.37*	*2.31*	*2.54*	*1.88*	*2.40*
Jan	1.49	1.50	1.67		1.72	1.72	5.95	2.50	3.26		3.50		
Feb	1.56	1.52	1.60	1.48	1.65	1.65	6.02		3.24		3.53		
Mar	1.40	1.38	1.56	1.40	1.51	1.51	5.48		3.03		3.25		
Apr	1.42	1.28	1.03	1.18	1.30	1.30	4.44	3.16	2.67	1.55	2.83		
May	1.53	1.47	1.37	1.50	1.51	1.51	5.71	3.67	3.09	1.72	3.58		
Jun	1.44	1.37	1.36	1.35	1.40	1.40	5.38	3.71	3.11	1.63	3.19		
Jul	1.62	1.53	1.64	1.70	1.68	1.68	6.56	2.80	3.67		4.12		

Groundwater exceedances for EC (dS/cm) in alluvial and shallow bedrock aquifers													
Aug	1.47	1.40	1.75	1.49	1.46	1.46	5.28	3.40	2.97	1.54	3.38		
Sep	1.64	1.58	2.09	1.39	1.61	1.61	6.15	4.11	3.62	1.60	3.96		
Oct	1.75	1.69	2.21	1.38	1.61	1.61	6.15	4.12	3.81	1.53	3.73		
Nov	1.54	1.08	1.93	1.44	1.50	1.50	6.18	4.07	3.85	1.53	3.75		
Dec	1.57	1.49	1.80	1.30	1.50	1.50	5.66	3.87	3.61	1.21	3.64		1.87

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.

On number occasions the requirement for an investigation has been triggered by three consecutive exceedances of the upper EC limit across the following bores; ALV1L, LBH, ALV4S, ALV2L, ALV2S and ALV7S. The conclusions of these investigations are summarised in ***Table 8-7*** below.

Hard Rock Aquifer (Coal Measures)

Groundwater quality monitoring results for the hard rock aquifers during the reporting period is shown in ***Appendix E***. Monitoring of piezometers at site PGW5 is used as reference information for groundwater pressurisation of the strata between the Bowmans Creek shallow bedrock and lower overburden and underground workings. Monitoring results have not triggered investigation and are consistent with historical trends.

Table 8-7 ITARP investigations for quality triggers completed in 2020

Month of 3rd exceedance	Month exceedance reported	Site	Conclusions
February	March	ALV7S	• The continued decline of the water level and increased EC measured at ALV7S sustains the conclusion of previous three-month, six-month and nine-month trigger exceedance investigation reports of natural climate variability being sustained drought conditions are influencing the heightened EC results at this monitoring site. • Groundwater level trends in ALV7S and ALV7L; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. • During the previous 24 months, climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005. 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. • Further, whilst the maximum reference EC trigger has been exceeded for ALV7S, the potential for environmental harm due to mining activities is low. This conclusion has been drawn as the elevated EC level is considered to be representative of the natural salinity of the coal measures which is not being diluted through recharge seepage from the overlying alluvium which has been measured as dry since

Month of 3rd exceedance	Month exceedance reported	Site	Conclusions
			March 2019. Given the localised groundwater sink, there is no risk to the surrounding alluvial aquifers or downstream environment.
March	April	ALV1L ALV2S ALV4S LBH	• Groundwater level trends in the triggering bores; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. The decline of water levels and increased EC measurement at ALV1L, ALV2S, ALV4S and LBH sustains the conclusion of the previous three month trigger exceedance investigation at ALV1L and ALV2S and previous investigations conducted for LBH and ALV4S that there is a clear link between the reduced rainfall CRD, increased evaporation CRD and the measured groundwater levels. • 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. Noteworthy, measured EC levels are each of the triggering bores have not exceeded reference maximums to date. Hence it is not expected that there is potential for harm to the environment as the system is varying naturally.
May	July	ALV7S	• The continued decline of the water level and increased EC measured at ALV7S sustains the conclusion of previous three-month, six-month, nine-month and 12-month trigger exceedance investigation reports of natural climate variability being sustained drought conditions are influencing the heightened EC results at this monitoring site. • Groundwater level trends in ALV7S and ALV7L; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. During the previous 36 months, climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005. 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. • Further, whilst the maximum reference EC trigger has been exceeded for ALV7S, the potential for environmental harm due to mining activities is low. The demonstrated direct relationship between the alluvium and rainfall, and the low vertical connectivity between the alluvium and underlying fractured rock, reduces the risk of harm to the alluvium (Jacobs, July 2020). The approved depressurisation of the fractured rock aquifers (such as ALV7S) has changed the hydraulic gradient towards the open cut, which further reduces the risk of harm to the environment associated with the ALV7S EC values.
June	July	ALV1L ALV2L	• Groundwater level trends in ALV1L and ALV2L; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. During the previous 36 months, climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005. The direct relationship between these monitoring observations and rainfall; as

Month of 3rd exceedance	Month exceedance reported	Site	Conclusions
			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. • Recent increases in rainfall and subsequent stablisation of the rainfall and evaporation CRD have resulted in a flushing impact to the alluvium and decrease/steadying of the EC results at the triggering bores, ALV1L and ALV2L. These results further implies that the measured results at the triggering bores are in response to climatic variations opposed to mining operations. Noteworthy, measured EC levels are each of the triggering bores have not exceeded reference maximums to date. Hence, it is not expected that there is potential for harm to the environment as the system is varying naturally.
July	August	ALV2S ALV4S	• Groundwater level trends in ALV2S and ALV4S; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. During the previous 36 months, climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005. 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. • Recent increases in rainfall and subsequent stabilisation of the rainfall and evaporation CRD have resulted in an increase of measured water levels producing a flushing effect where water is infiltrating the shallow hard rock and therefore increased interaction with the saline shallow bedrock material is driving elevated salinity for both ALV2S and ALV4S. This implies that the measured results at the triggering bores are in response to climatic variations opposed to mining operations. Whilst, measured EC levels at ALV4S have marginally exceeded reference maximums it is expected that this result is a spike driven from system recovery from the drought through an increase in rainfall. Therefore, it is not expected that there is potential for harm to the environment as the system is varying naturally in response to rainfall recharge.
August	September	ALV7S	• Groundwater level trends in ALV7S and ALV7L; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. During the previous 38 months, climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005. 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. • Further, whilst the maximum reference EC trigger has been exceeded for ALV7S, the potential for environmental harm is low. The demonstrated direct relationship between the alluvium and rainfall, and the low vertical connectivity between the alluvium and underlying fractured rock (being a losing stream), reduces the risk of harm to the alluvium (Jacobs, July 2020). Further, the hydraulic direction at ALV7 remains unchanged from the alluvium to the

Month of 3rd exceedance	Month exceedance reported	Site	Conclusions
			shallow bedrock, and hence reduces the risk of harm to the environment associated with ALV7S EC values.
September	October	ALV1L LBH	• Groundwater level trends in ALV1L and LBH; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. 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. • Recent increases in rainfall and stabilisation of the CRD trends and subsequent rainfall recharge to the alluvium in this location demonstrate the impact that climatic conditions have on the Bowmans Creek network. This recent stabilisation of CRD trends has resulted in a flushing impact to the triggering bores, ALV1L and LBH and are expected to also stabilise as rainfall continues to recharge and re-saturate the alluvium. These results further implies that the measured results at the triggering bores are in response to climatic variations opposed to mining operations. Noteworthy, measured EC levels are each of the triggering bores have not exceeded reference maximums to date. Hence, it is not expected that there is potential for harm to the environment as the system is varying naturally.
October	November	ALV2S ALV2L	• Groundwater level trends in ALV2L and ALV2S; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. 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. • Increases in rainfall and stabilisation of the CRD trends and subsequent rainfall recharge to the alluvium and shallow bedrock in this location demonstrate the impact that climatic conditions have on the Bowmans Creek network. The stabilisation of the CRD has resulted in an increase in interaction between the saline shallow bedrock and fresh alluvium and subsequent increase in measured EC levels as a result of a flushing impact mobilising salts. These results further implies that the measured results at the triggering bores are in response to climatic variations opposed to mining operations. Noteworthy, measured EC levels are each of the triggering bores have not exceeded reference maximums to date. Hence, it is not expected that there is potential for harm to the environment as the system is varying naturally.
November	December	ALV4S ALV7S	• Groundwater level trends in ALV4S and ALV7S; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. 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. • Increases in rainfall and stabilisation of the CRD trends and subsequent rainfall recharge to the alluvium and shallow bedrock in this location demonstrate the impact that climatic conditions have

Month of 3rd exceedance	Month exceedance reported	Site	Conclusions
			on the Bowmans Creek network. Recent increases in rainfall and subsequent stabilisation of the rainfall and evaporation CRD have resulted in an increase of measured water levels producing a flushing effect where water is infiltrating the shallow hard rock and therefore increased interaction with the saline shallow bedrock material is driving elevated salinity for both ALV7S and ALV4S. This implies that the measured results at the triggering bores are in response to climatic variations opposed to mining operations. Whilst, measured EC levels at ALV7S have exceeded reference maximums it is expected that this is driven from long term drought conditions and subsequent commencement of system recovery from the drought through an increase in rainfall. Therefore, it is not expected that there is potential for harm to the environment as the system is varying naturally in response to rainfall recharge.
December	January	ALV1L LBH	• Groundwater level trends in ALV1L and LBH; and generally, in the Bowmans Creek monitoring bore network more widely show a correlation to the rainfall and evaporation CRD trends. 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. • Recent increases in rainfall and stabilisation of the CRD trends and subsequent rainfall recharge to the alluvium in this location demonstrate the impact that climatic conditions have on the Bowmans Creek network. This recent stabilisation of CRD trends has resulted in a flushing impact to the triggering bores, ALV1L and LBH and are expected to also stabilise as rainfall continues to recharge and re-saturate the alluvium. These results further implies that the measured results at the triggering bores are in response to climatic variations opposed to mining operations. Noteworthy, measured EC levels are each of the triggering bores have not exceeded reference maximums to date. Hence, it is not expected that there is potential for harm to the environment as the system is varying naturally.

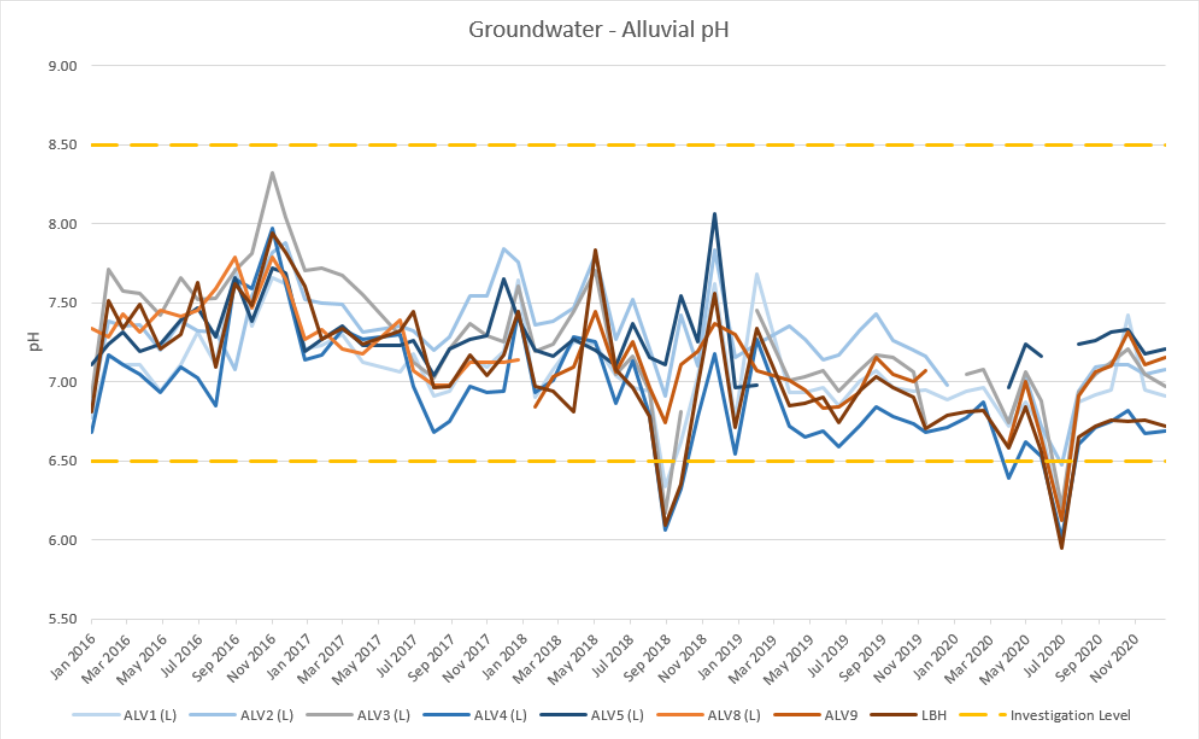


Figure 8-2 Groundwater - Alluvial pH

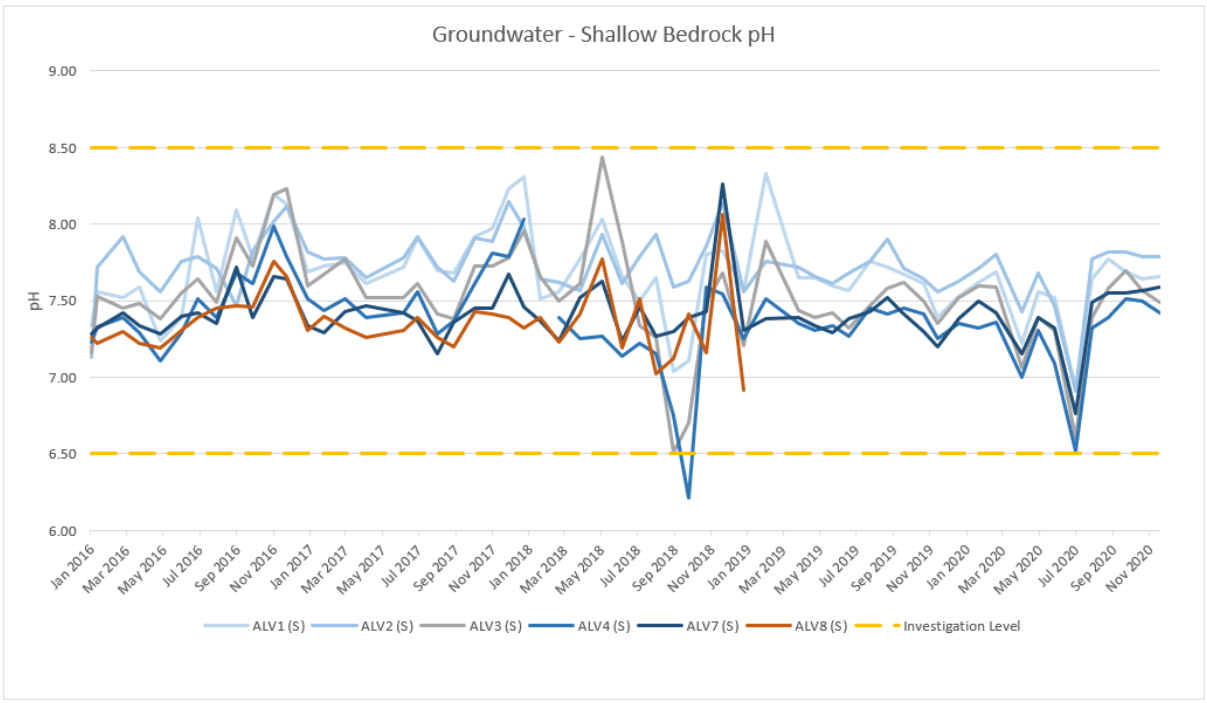


Figure 8-3 Groundwater - Shallow Bedrock pH

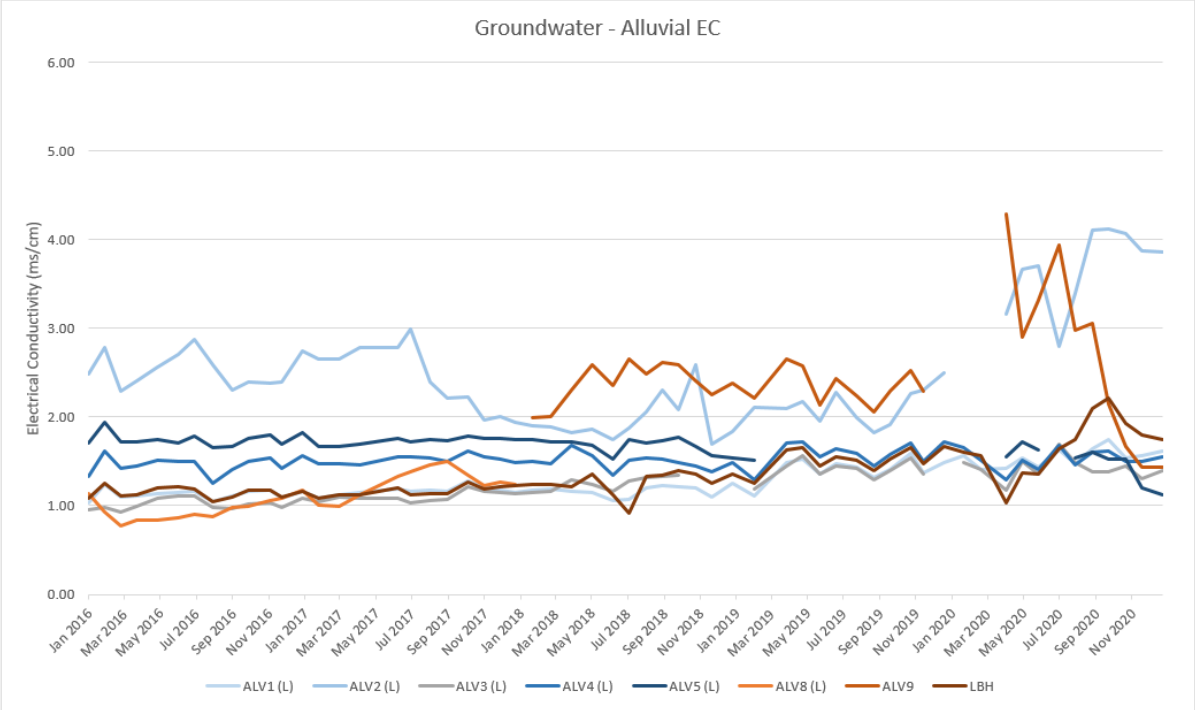


Figure 8-4 Groundwater - Alluvial Electrical Conductivity

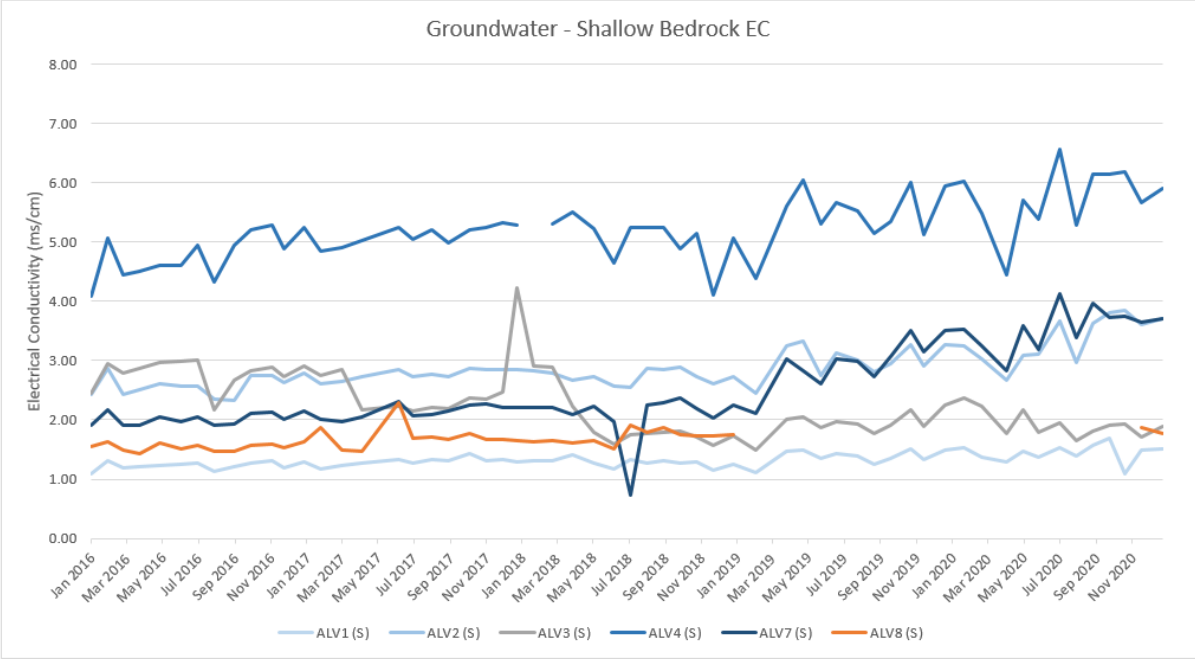


Figure 8-5 Groundwater - Shallow Bedrock Electrical Conductivity

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 ***Figure 8-6*** and ***Figure 8-7*** respectively.

The residual mass curve for rainfall is also presented in ***Figure 8-6*** and ***Figure 8-7***. 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 CRDs 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 CRD indicates measured evaporation greater than long term averages. This was developed from the LCO onsite meteorological station to provide to ensure data is most 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 permeability of aquifer material, differences in propensity for recharge as well as groundwater/surface water interaction.

With reference to full historical monitoring results, the sympathetic response in water levels observed in the paired bores indicate similar processes are driving the recharge for both the alluvial aquifer and shallow bedrock aquifer. The different absolute levels for the paired bores reflect the different hydraulic connectivity between the alluvium and shallow bedrock. Water level relationships show a shift from slight upward pressures (gaining stream) upstream (ALV1), through to equal pressures adjacent to LCO (ALV3, ALV4, ALV2) to slight downward pressures (losing stream) to the south (ALV7, ALV8). 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 for alluvial draw down impact assessment. There were a number of Investigation and Subsequent Investigation (Definition 2 & 3 respectively) trigger level exceedances summarised herein.

During 2020, there were a number of groundwater level exceedances, similar to 2019 due to the response from the sustained drought conditions measured. The decline in residual mass curve (rainfall) coupled with an increasing residual mass curve (evaporation) suggested that below average rainfall and higher than average evaporation conditions prevailed until an increase in rainfall was measured throughout 2020. Increase in rainfall and decrease in evaporation conditions throughout 2020 has resulted in recharge throughout the Bowmans Creek system which is demonstrated through many of the groundwater bores which were dry in 2019 are now recovering. However, due to the extent of the drought conditions experienced, groundwater levels throughout Bowmans Creek have not yet recovered to pre-drought levels and conditions and sustained rainfall recharge is required to continue to achieve this.

Table 8-8 presents recorded exceedances of groundwater level triggers during the 2020 monitoring period. ***Table 8-9*** presents a summary of the ITARP investigations completed in 2020. Noteworthy, in accordance with the WMP, where groundwater levels continuously trigger after the initial investigation (triggered on three consecutive months) & it has been determined not to be a mining

related impact; subsequent investigations occur at 12 consecutive months and then at 24 consecutive months unless otherwise recommended through the investigation findings. ALV9 does not have an applicable Definition #2 investigation trigger as these triggers were developed using historical baseline date and ALV9 is in place to detect potential draw down impacts.

Groundwater investigations completed to date have not concluded that mining activities have resulted in impacts not approved for LCO.

Table 8-8 Groundwater level trigger exceedances

Groundwater level exceedances													
Site	ALV1L	ALV1S	LBH	ALV3L	ALV3S	ALV4L	ALV4S	ALV2L	ALV2S	ALV7L	ALV7S	ALV8L	ALV8S
Impact Assessment Criteria													
10%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	6.18	6.03	6.08	8.30	7.48	6.82	7.60	7.85	9.13	8.45	21.54	8.36	20.28
Feb	6.25	6.21	5.96	7.30	7.50	6.83	7.74	8.40	9.91	8.45	22.11	8.36	20.28
Mar	6.25	6.26	5.93	7.24	7.47	6.87	7.84	8.40	10.67	8.45	20.78	8.36	20.28
Apr	4.46	4.66	4.19	5.14	5.46	5.04	6.02	5.91	4.98	7.90	18.09	8.36	20.28
May	4.58	4.34	4.55	5.38	5.69	5.31	6.12	4.73	4.73	7.86	15.80	8.36	20.28
Jun	4.55	4.23	4.79	5.56	5.90	5.41	6.19	4.68	4.68	7.96	16.84	8.36	20.28
Jul	3.82	3.50	4.11	5.29	5.69	5.40	6.26	4.80	4.86	8.24	18.08	8.36	20.28
Aug	3.09	2.80	3.60	4.64	4.87	4.45	5.39	4.27	4.19	7.64	16.35	8.36	20.28
Sep	3.11	2.80	3.72	4.79	5.03	4.58	5.47	4.21	4.10	7.60	15.09	8.36	20.30
Oct	3.28	3.03	3.78	4.82	5.10	4.71	5.57	4.22	4.09	7.63	14.85	8.36	20.30
Nov	3.19	2.99	3.6	4.69	4.93	4.54	5.31	4.10	3.95	7.52	14.55	8.36	20.30
Dec	3.19	2.85	3.74	4.88	5.14	4.77	5.51	4.24	4.13	7.50	14.27	8.36	18.56

Orange Shading – Denotes an exceedance of the 10%ile investigation limit
Yellow Shading – Denotes an exceedance of the 100%ile maximum investigation limit

Table 8-9 Groundwater level trigger exceedances investigation summary

Month of investigation trigger	Month exceedance reported	Site	Conclusions
January	March	ALV7S ALV7L	• Generally, groundwater level trends in ALV7S, ALV7L and ALV8S, and in the Bowmans Creek are monitoring bores more widely,

Month of investigation trigger	Month exceedance reported	Site	Conclusions
		ALV8S	show a close correlation to the rainfall and evaporation CRD trends. • Since 2017, ALV7S and ALV8S have shown a deviation from historical trends. The more recent ALV7S, ALV7L and ALV8S water levels have been below historic lows, which have coincided with the most recent period of below average rainfall and above average evaporation. • The groundwater depths measured at ALV7L, reflect a natural variability due to climatic factors and it is unlikely that the decline is a mining-related impact. The groundwater decline measured in ALV7S and ALV8S are likely influenced by a combination of the current severe drought conditions and mining in the south-east portion of the Entrance Pit. The mining has caused depressurisation of the surrounding fractured rock aquifer with subsequent vertical drainage of the overlying formations. The depressurisation of the fractured rock aquifer has been approved under the consent to mine. • The absence of groundwater in the ALV7L and ALV8S, precludes further investigation. When there is significant recharge to the alluvium, further investigation could be conducted to determine whether connectivity between the alluvial and fractured rock aquifers has altered. • Since there is direct relationship between the alluvium and rainfall, it is not expected that there is potential for harm to the environment as the system is varying naturally.
July	August	ALV2S	• During the previous 36 months, climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005. • Whilst ALV2S has continued to exceed water depth triggers, recent rainfall recharge has demonstrated a substantial increase in the measured levels indicating that rainfall is the primary driver for the measured level in the shallow bedrock. Noteworthy, weekly groundwater level monitoring, outside of the monthly WMP monitoring program, at LCO conducted in August 2020 has seen ALV2S water level continue to rise with increased rainfall and is no longer triggering as per water level Definition #2 WMP triggers.
September	October	ALV8L	• The sustained, dry alluvium at ALV8L withstands the conclusions of the previous ITARP reports at ALV8L and the Bowmans Creek monitoring network more widely, with a clear correlation to the rainfall and evaporation CRD trends. Climate data shows high evaporation and below average rainfall with significant variation in residual rainfall mass curve that is the longest downward trend since 2005, with a recent reversal commencing in 2020. The direct relationship between these monitoring observations and rainfall implies that the measurements are due to climatic variations rather than a specific mining related impact. • Groundwater decline in ALV8L (and its reference bore, ALV7L) have been observed during previous periods of below average rainfall, including the Millennium Drought, when ALV8L also ran dry. Whilst the ALV bore monitoring system recorded alluvium response during the Millennium Drought, current climatic

Month of investigation trigger	Month exceedance reported	Site	Conclusions
			conditions measured characterise the most severe drought in the monitoring period and is therefore unprecedented in network response. Therefore, whilst recent rainfall in 2020 has begun to show a response in ALV7L, LCO has not measured rainfall comparable to historic flood events breaking previous droughts nor has there been a long period of average or above average rainfall to re-saturate the alluvium.

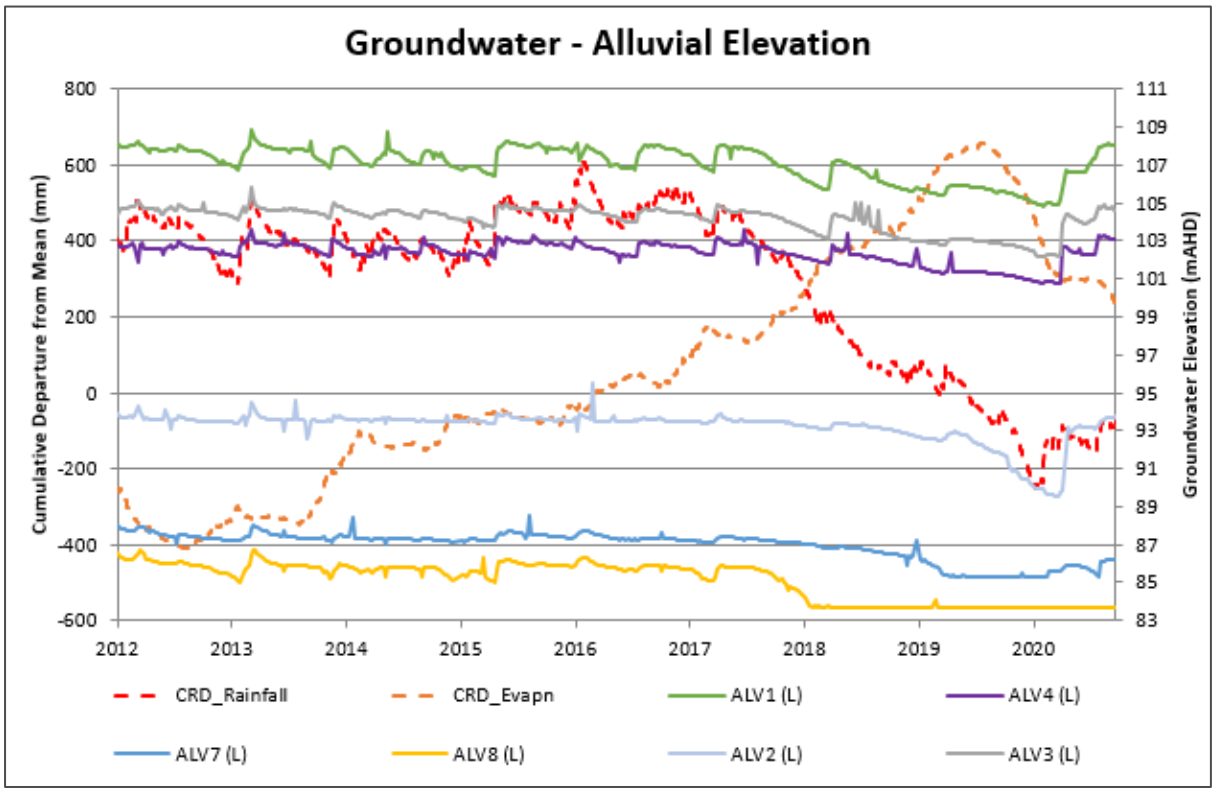


Figure 8-6 – Groundwater - alluvial elevations

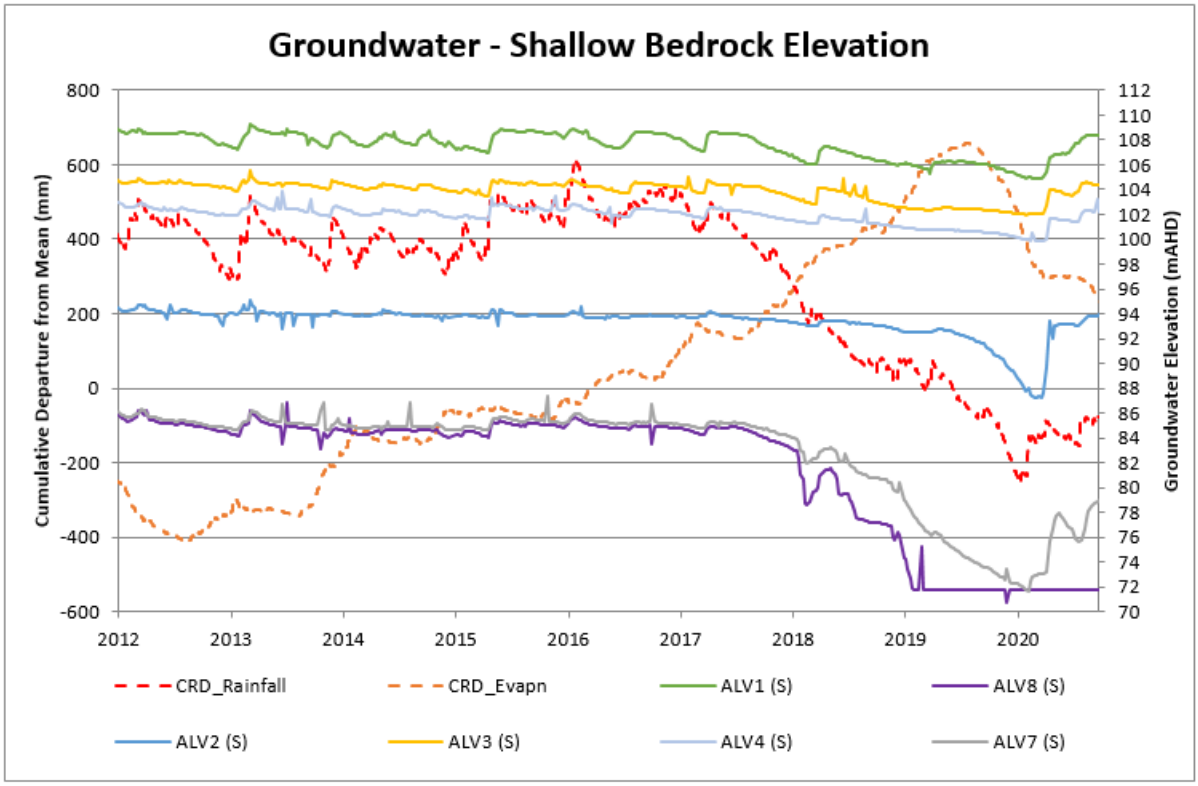


Figure 8-7 – Groundwater – shallow bedrock elevations

Hard Rock Aquifer (Coal Measures)

LCO monitor a number of 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 8-1***. The groundwater elevations vary significantly between the piezometers monitored, reflecting differences in groundwater levels between different stratigraphic layers and as a consequence of recent and historical mining and dewatering operations. There are no investigation groundwater trigger levels for monitoring of these water bodies.

Figure 8-8 shows there is 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 8 South (whilst available), M49 and the Middle Liddell Bore (MLB).

Piezometers PGW5L and PGW5S overlie the Hazeldene workings. As shown in ***Figure 8-8***, there is no groundwater level response at site PGW5S due to changes in groundwater elevation in the Hazeldene monitoring locations (Haz 1 to Haz 6).

Periodic dewatering of underground workings occurs as required for mining operations. In early to mid-2019 as a drought mitigation measure, short term extraction of water from the Hazeldene underground occurred, adjacent to ALV2. There has been no recent extractions from Hazeldene (since 2019) with levels allowed to recover (see ***Figure 8-8*** below). Following this dewatering, groundwater pressures at ALV2 declined as the drought continued to beyond reference maximums; hence is it difficult to differentiate mining and climatic influences on water levels at ALV2. A sustained increase in rainfall and inflows has seen levels at both Hazeldene Underground and ALV2 recover to pre-drought levels.

Groundwater levels in the Liddell underground workings are subject to depressurisation due to dewatering activities to accommodate current open cut mining operations at LCO. Piezometer LC1 has been dry since July 2010 as a result of these dewatering activities and has now been mined through. M49 and Mount Owen 2 have shown an increase in measured levels due to limited dewatering with a pump failure. Dewatering of M49 recommenced in December 2020 and will continue into 2021 as required.

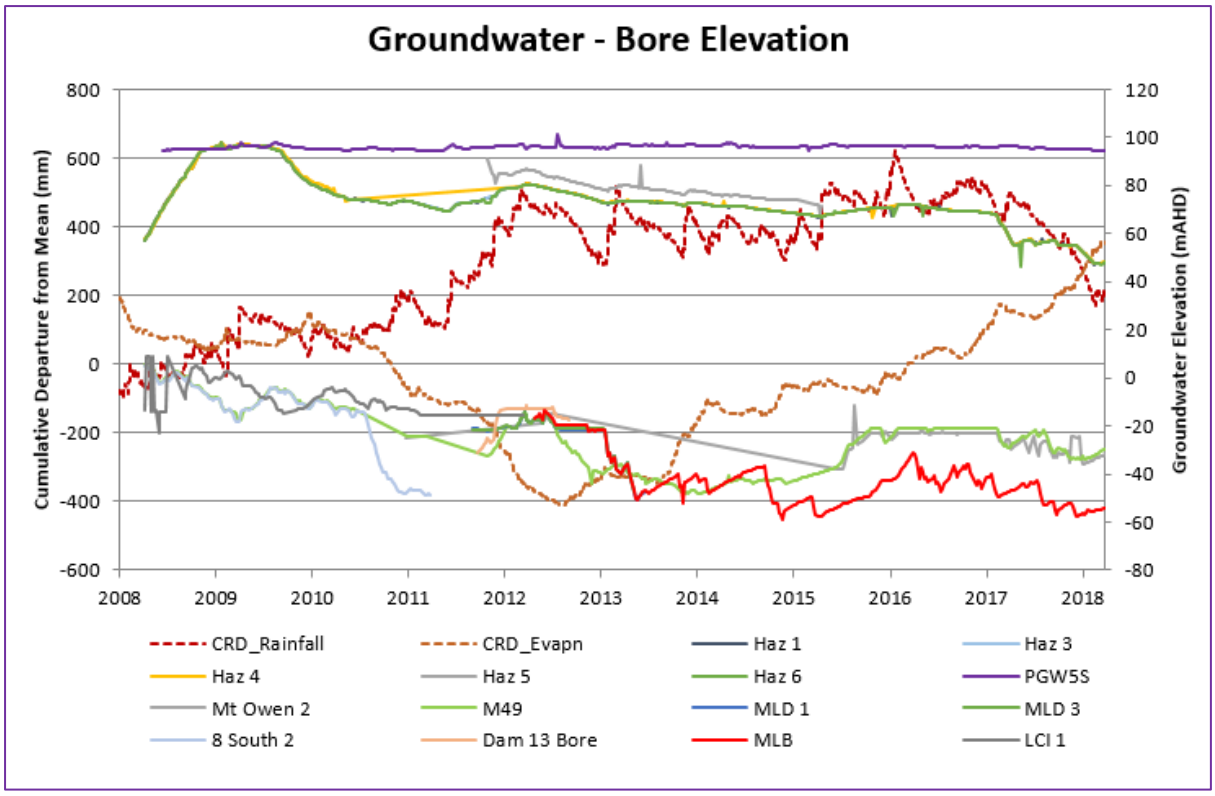


Figure 8-8 – Groundwater bore elevations

8.2.1.1 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. The key conclusions of the predictive model simulations and groundwater impact assessment have been compared to the findings of the WMP approved monitoring program and detailed in ***Table 8-10*** below. In brief, observations from the monitoring programs demonstrate impacts within the EA predictions.

Table 8-10 Groundwater impact comparison to EA predictions

Groundwater Impact Comparison to EA Predictions	
Key EA Conclusion	Comparison to Monitoring Observations
Impacts to Bowmans Creek alluvial aquifer	

Groundwater Impact Comparison to EA Predictions	
With the exception of the final year of the Entrance Pit progression (year 2022), the magnitude of alluvial losses estimated by the model under the proposed is similar to the leakage rates predicted for current mining operations at LCO. These estimated losses from the alluvium amount to between 150 to 180 ML/year up to 2021, and peak at 270 ML/year for 2022.	Monitoring and investigations have not determined there to be unapproved leakage from Bowman's Creek alluvial aquifer to the Entrance Pit. No definition 1 groundwater level impact triggers initiated during 2020.
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 impacts on Bowmans Creek alluvium due to mining in the South Pit. This EA conclusion is considered to be corroborated by monitoring results.
Estimates of historical baseflow contributions to Bowmans Creek streamflow suggest the peak estimated loss of groundwater flow caused by the proposed modification accounts for approximately 4% to 8% of the estimated baseflow component of streamflow and less than 2% of measured annual streamflow.	Alluvium experienced significant decline with prolonged drought conditions. However, alluvium has commenced recharge in 2020 in response to increased rainfall. This EA conclusion is considered to be corroborated by monitoring results.
Recent groundwater monitoring data and predictive model results indicate leakage from the alluvial aquifer induced by previous underground mining and current open cut mining activities at LCO are having negligible impact on groundwater levels within the alluvium. As a result the estimated losses in groundwater flow under the proposed modification are unlikely to have a significant impact on streamflow in Bowmans Creek or on water levels within the associated alluvial aquifer.	Monitoring has not shown mining related impacts on Bowman's Creek alluvial aquifer. This EA conclusion is considered to be corroborated by monitoring results.
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.	Monitoring has not shown mining related impacts on Bowman's Creek alluvial aquifer. This EA conclusion is considered to be corroborated by monitoring results.
Predicted drawdown within the Bowmans Creek alluvial aquifer is expected to be negligible (less than 0.25 m) relative to current water levels up to 2019. When estimated leakage rates peak at the end of mining, drawdown is predicted to peak at less than one meter relative to current water levels. This peak drawdown estimate falls below the minimal impact criteria for aquifer interference activities as defined in the NSW Aquifer Interference Policy (2012).	The southern potential impact monitoring bore and reference alluvial bore were dry until April 2020. The reference alluvial bore has begun to recharge since April 2020 in response to rainfall however no drawdown trigger has been measured. The northern potential impact area showed near equivalent pressures for impact and reference site. This EA conclusion is considered to be corroborated by monitoring results.
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 less than 4,000 ML/year. LCO currently holds extraction licenses totalling 23,500 ML/year for this water source.	Modelled and measured extraction of hard rock aquifers is within licence limits and below the estimated peak of 4,000ML/year estimations.

Groundwater Impact Comparison to EA Predictions	
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 from the South Pit final void when water levels in the void are above approximately 65 m AHD.	Not yet triggered.

9. Rehabilitation

9.1 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 4 of the ***2021 Mining Operations Plan (MOP)*** 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 9-2*** 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***.

The overall objectives of the proposed post-mining land use design are:

- To contribute to effective native corridors through the area which promote fauna movements between Ravensworth Operations, Mt Owen Complex, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area;
- To maintain and provide additional suitable habitat for the spotted-tailed quoll (Dasyurus maculatus maculatus) identified during fauna monitoring programs in 2012, particularly around the Bowmans Creek area;
- To provide opportunities for future agricultural activities such as sustainable grazing;
- To improve the visual amenity of the area; and
- Not to preclude other potential post mining land use options should they be determined to be viable and preferable as part of the detailed mine closure planning process that commences at least five years prior to the planned cessation of mining.

9.2 Current Status

Rehabilitation and disturbance status of the operation as at the end of the reporting period is shown in ***Figure 9-1***. The figure shows the extents of mining related disturbance and rehabilitation completed to date (differentiated between grassland and woodland type) and 10m contours. During the reporting period, LCO completed rehabilitation and disturbance activities as detailed in the MOP.

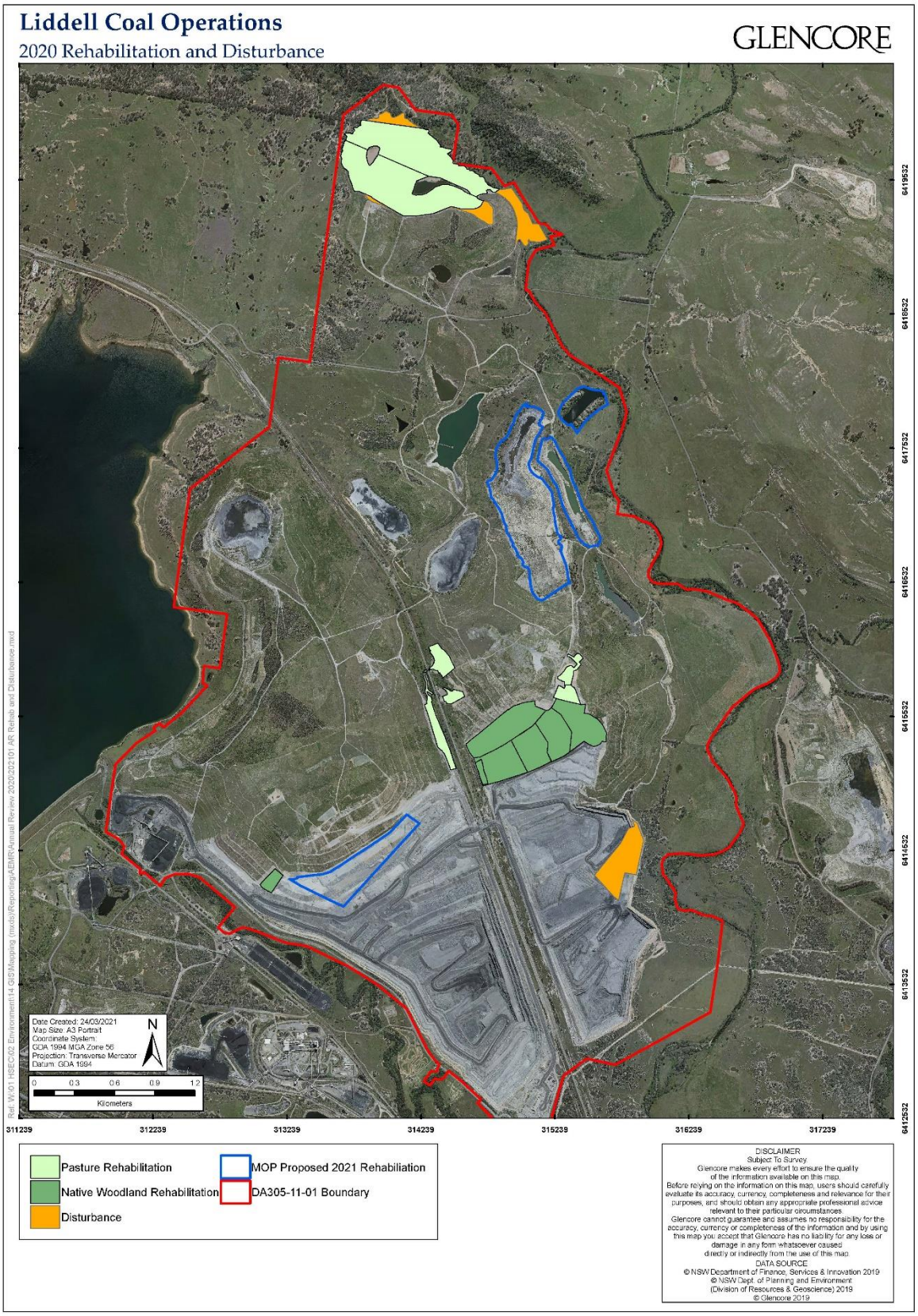


Figure 9-1 2020 completed rehabilitation and 2021 forecast rehabilitation

Table 9-1 Rehabilitation status

Rehabilitation Status			
Mine Area Type [A]	**Previous Reporting Period (Actual ha)**	**This Reporting Period (Actual ha)**	**Next Reporting Period (Forecast ha)**
	2019	**2020**	**2021**
A: Total mine footprint	1628	1637	1637
B: Total active disturbance	706	664	591
C: Land being prepared for rehabilitation	0	0	7
D: Land under active rehabilitation	922	943	1016
E: Completed rehabilitation	0	0	0

[A] – Area types as defined in the NSW Government Annual Return Guidelines.

No rehabilitation areas onsite have been assessed against the MOP completion criteria for the purpose of formal relinquishment to date.

MOP Rehabilitation Commitments

During 2020, LCO was unable to meet the 69.7ha forecasted for rehabilitation due to timing of the release of dumps available to rehabilitate. However LCO submitted a revised MOP in 2020 for 2020-2023 to reforecast the 2020 rehabilitation value to 50ha. Whilst this MOP is awaiting approval in 2021, ***Table 9-2*** below includes the reforecasted numbers. ***Table 9-2*** shows the hectares put forward in the MOP, actuals as well as the variance. Within the next reporting period, LCO forecasts to complete no disturbance activities and 17ha of rehabilitation. As per the EIS, LCO is completing rehabilitation progressively throughout the life of the operation.

Table 9-2 MOP rehabilitation status

	MOP		Full Year Actual		Variance	
	Disturbance (ha)	**Rehabilitation (ha)**	**Disturbance (ha)**	**Rehabilitation (ha)**	**Disturbance (ha)**	**Rehabilitation (ha)**
2017	51	30	51	37	0	+7
2018	40	68.3	39	67	-1	-1
2019	11	48.8	39	67	+1	+1.7
2020	9.4	50	9.4	51.5	0	+1.5
				MOP Cumulative Variance	0	+9.2

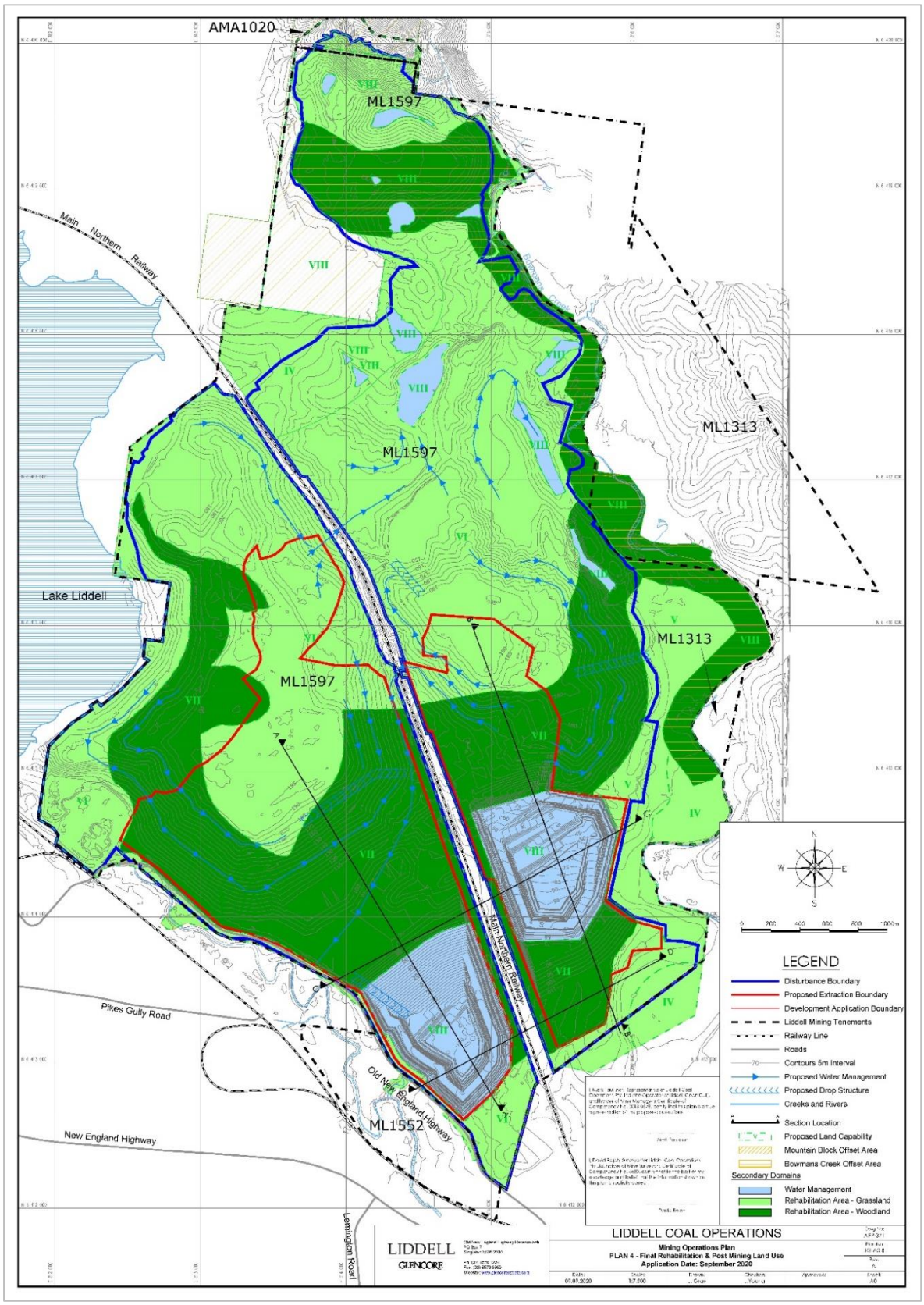


Figure 9-2 – Final Rehabilitation and Post Mining Land Use

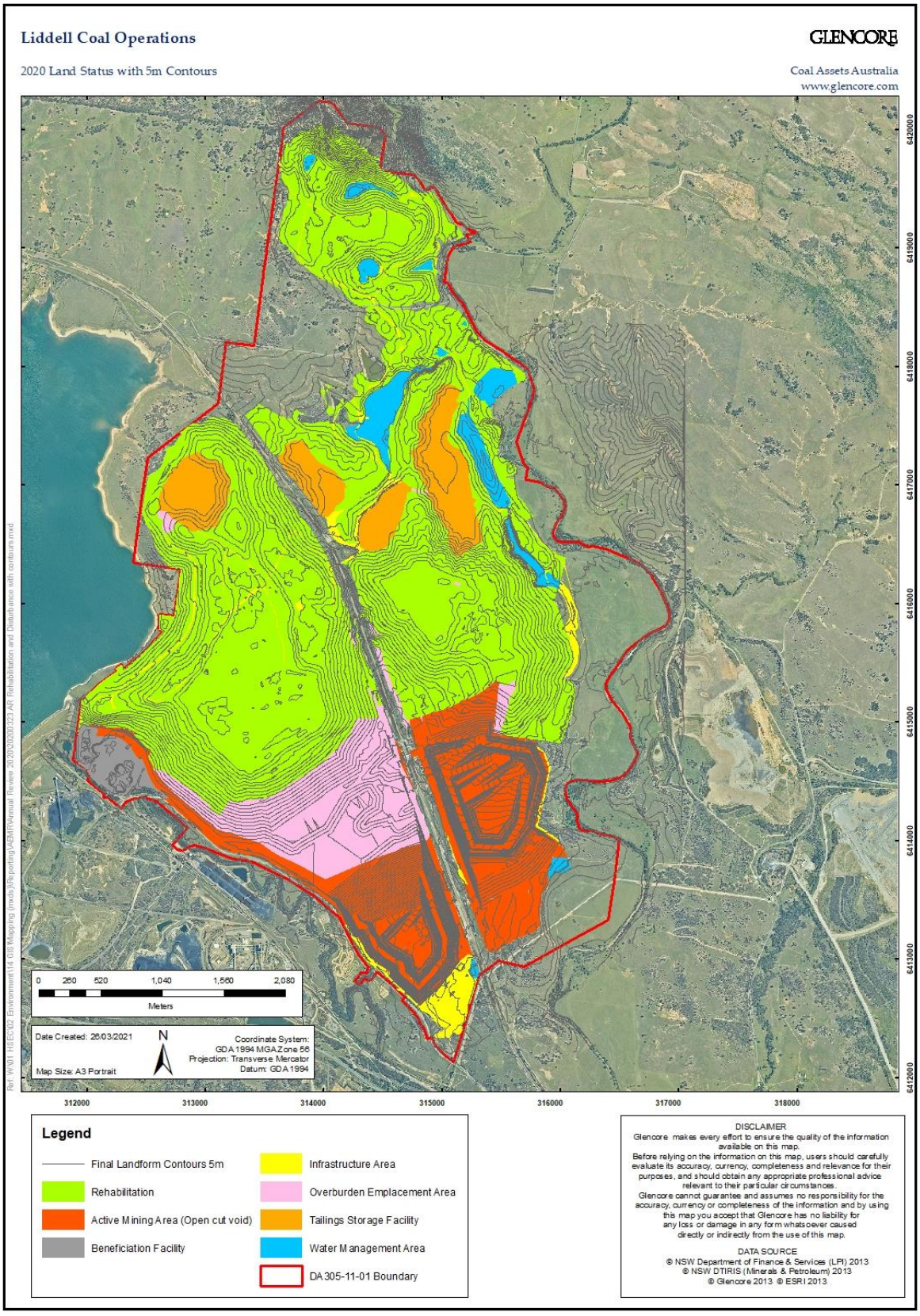


Figure 9-3 - 2020 Land Status with 10m Contours

9.3 Detailed Mine Closure Planning

Current Life of Mine Planning indicates that LCO coal extraction will cease in Q4 2023 and the site transition into 'mine closure' with the continued rehabilitation of the site. Rehabilitation activities for the remaining mine life is detailed in the ***LCO Mining Operations Plan*** (Rehabilitation Management Plan). 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 aims to have 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. This ***Mine Closure Planning Protocol*** has been recently reviewed to meet the requirements of ***Integrated Mine Closure: Good Practice Guide (ICMM 2019)*** which is considered as international best practice for mine closure planning. As LCO approaches closure, mine closure planning will increase in detail to ensure that an executable plans can be readily implemented when required to rehabilitate the site.

During the 2020, LCO commenced mine closure preparedness 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.

During the 2021 and 2022, LCO will be continuing to develop the DMCP by;

- Continuing progressive rehabilitation as mining activities complete in areas including tailings emplacements.
- Undertaking Stakeholder Engagement as per the aforementioned strategy including scheduled briefing of RR regarding progress/timing.
- Undertaking review of the risks to rehabilitation and actioning of appropriate treatment plans and/or controls.

9.4 Biodiversity Management

During 2020, LCO continued to operate in accordance with the approved MOP and BMP which detail the rehabilitation practices/monitoring and biodiversity practices/monitoring respectively. The detailed rehabilitation and biodiversity monitoring was completed in accordance with the MOP and BMP with the findings summarised below. **Appendix H i**ncludes a summary of the rehabilitation establishments works completed during 2020.

The BMP was updated and resubmitted in July 2020 and subsequently approved by the Department of Planning, Industry and Environment on the 29 January 2021.

9.4.1 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 an additional three years performance indicators. LCO's performance tracking towards the objectives is detailed in the section below. The BMP area is defined as all land within the DA305-11-01 consent boundary excluding any biodiversity offset areas and includes rehabilitation areas and remnant vegetation.

In general remnant vegetation sites have maintained broadly consistent vegetation and fauna diversity and abundance since monitoring commenced in 2012 except for decreases in groundcover species and diversity as a result of drought. Rehabilitation site WR01 conversely has undergone significant growth of canopy vegetation. Both provide a range of habitat features that have remained intact and unaltered by mining and mining-related activities. Prolonged drought conditions are considered to have impacted the monitoring results of the BMP area.

The key findings of the 2020 biodiversity monitoring program were as follows:

- Substantial weed and pest management works have been undertaken by LCO throughout 2020, however the rainfall prior to monitoring has encouraged prolific weed growth.
- Remnant vegetation at W02 is generally in a good condition; however, some potentially problematic weed species are present in this area such as galenia (*Galenia pubescens*) and fireweed (*Senecio madagascariensis*).
- Riparian remnant site R01 is dominated by introduced species in the groundcover. This is unlikely to recover to former levels without substantial intervention.
- Rehabilitated vegetation at WR02 has undergone a slight increase in native diversity since baseline.
- There has not been a notable increase in the extent of feral species presence. This appears to be being suppressed by LCO management action.
- No signs consistent with myrtle rust, *Phytophthora cinnamomi* or Chytrid fungus were identified.
- Stygofauna diversity at all sites remains low.

- Rehabilitated vegetation at WR02 is in 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 focus and
    - increasing diversity of native flora species in the groundcover and canopy.

LCO will continue to implement the BMP commitments and recommendations detailed in the 2019 BMP monitoring report. Key recommendations to be implemented during 2021 by LCO will include:

- Continued supplementary plantings to assist in infilling vegetation where gaps in certain strata have been identified.
- Continued weed and feral fauna management.

As per the BMP, LCO will prepare an Annual Ecological Monitoring Report (AEMR), which will document 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 2020 Annual Ecological Monitoring Program is available on the LCO website.

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 are for the first three years of the implementation of this BMP 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/criterion is summarised in ***Table 9-3*** below based on the outcomes of ecological monitoring and inspections across LCO for each year.

Table 9-3 BMP performance indicator summary

Action/Item	Performance Indicator	Compliance	Performance Comment
Year 5 2020			
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 1 month	Compliant	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.	Compliant	
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	Pre-stripping weed control of topsoil is completed, as needed.	Compliant. Weed control is completed prior to topsoil stripping (where required) to minimise future potential impact to rehabilitation success.	Weeds are managed in line with Weed Action Plan. Preclearance survey identifies any weed infestations requiring further management.

Action/Item	Performance Indicator	Compliance	Performance Comment
paint, slashing and other 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.	Compliant	No signs likely to be associated with Phytophthora, myrtle rust or chytrid fungus observed during 2020 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.	Compliant.	Seed resources being collected and substituted in seed mix for rehabilitation as key species are available.
Vegetation Clearing			
Detailed pre-clearing procedure is to be implemented when clearing of woody native vegetation (including	Pre-clearing process is to be implemented as part of Ground Disturbance Permit process.	Compliant.	LCO implements pre-clearing as part of Ground Disturbance Permit

Action/Item	Performance Indicator	Compliance	Performance Comment
shrub, groundcover and isolated trees in grasslands).	Outcomes of pre-clearing process are recorded and recommendations are implemented.		process with outcomes recorded and recommendations implemented.
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.	Compliant.	LCO implements tree-felling as part of Ground Disturbance Permit process, with outcomes recorded and recommendations implemented.
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. Reporting of translocation works and monitoring works is maintained.	Compliant.	One tiger orchid was relocated to the Mountain Block BOA and has been subject to regular monitoring and maintenance. Translocation is thus far deemed successful.
Remnant Vegetation and Habitat Management			

Action/Item	Performance Indicator	Compliance	Performance Comment
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.	Compliant	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. Fence line inspections are undertaken biannually in accordance with commitments of the BMP.
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.	Compliant.	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.
Annual inspections undertaken by suitably qualified personnel to assess the extent of natural regeneration occurring.	Annual inspection undertaken by suitably qualified personnel to	Partially compliant	Annual monitoring included assessing degree of regeneration of native trees. Native regeneration was identified and considered adequate

Action/Item	Performance Indicator	Compliance	Performance Comment
	assess extent of natural regeneration occurring. Appropriate action is undertaken if regeneration is deemed as being inadequate.		at W02 and WR02. R01 is almost entirely dominated by weeds (particularly with increase in rainfall) in the ground cover and regeneration by native trees is unlikely to occur.
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.	Compliant	Inspections being completed as required with appropriate weed priorities actioned.
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.	Compliant.	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. Previously identified weeds being targeted and noted as being effective during monitoring and inspections.
Feral Animal Control			

Action/Item	Performance Indicator	Compliance	Performance Comment
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.	Complete	Inspections for feral fauna are completed every two months.
Develop and implement an effective annual pest animal action plan.	Develop and implement pest animal action plan. Stable or downward trend in population size recorded.	Compliant	Annual Pest Action Plan developed and implemented for 2020. Pest numbers appeared to be stable and low.
Develop a vertebrate pest control register to document when and where each control method is implemented.	Update and maintain vertebrate pest control register.	Compliant	Vertebrate pest control register maintained and updated throughout 2020.
Blue-billed Duck Management			
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.	Partially compliant	Habitat values for Dam 1 and Triangle dams assessed during 2020 monitoring. Both provide moderate habitat value. Water levels were good in 2020. Habitat enhancement recommended however, through planting of aquatic vegetation.
Habitat Enhancement			

Action/Item	Performance Indicator	Compliance	Performance Comment
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.	Compliant	Habitat material is identified during the pre-clearance process and salvaged where possible to reinstate into BMP areas.
Nest boxes are providing habitat value for native fauna.	Biodiversity offset areas, areas of remnant vegetation and suitably established rehabilitated vegetation (not in disturbance areas) will be supplemented with nest boxes as required.	Compliant	Remnant vegetation and suitably established rehabilitation areas have been supplemented with nest boxes. Annual monitoring in accordance with “Year B” conducted in 2020.
Salvaged–reinstated hollows	An indicative sample of salvaged and re-instated hollows are subject to annual monitoring in conjunction with nest boxes.	Compliant	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.

Action/Item	Performance Indicator	Compliance	Performance Comment
Timing of nest box installation	Removed hollows will be replaced (with nest boxes) within six months of each discrete clearing event.	Compliant	Hollows and logs removed during clearing works have been placed in offset and rehabilitation areas.
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), hickory wattle (Acacia implexa) and cooba (Acacia salicina)	Compliant	Continue to undertake plantings that provide foraging resources.
Grazing Management			
Stock rotation	Cattle are grazed within improved pasture areas within mine rehabilitation >3years where practical Stocked will be managed to allow pasture recovery and maintain pasture availability and sufficient groundcover.	Compliant	LCO coordinate a cattle grazing trial and rotate stock between paddocks under supervision of district agronomist
Bushfire Management			
Bushfire Management Plan will be implemented	Implementation of requirements of updated Bushfire Management Plan.	Compliant	Bushfire Management Plan updated in 2019. No signs of bushfire impacts were noted during the 2020 monitoring event.

Action/Item	Performance Indicator	Compliance	Performance Comment
Ecological Monitoring			
Undertake floristic, fauna, LFA, waterbird, nest box, stygofauna and instream/riparian monitoring program throughout LCO	Monitoring program completed and reported.	Compliant	Monitoring completed in 2020. Monitoring to continue to track progress of all aspects.
Undertake annual inspections of LCO rehabilitation areas as per the MOP	Annual inspections completed	Compliant	Annual inspections of LCO rehabilitation areas completed and included in this Annual Review.
Native fauna presence in rehabilitation/regeneration areas	Fauna monitoring completed.	Compliant	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.
Rehabilitation Works (MOP) – Ecosystem Establishment Phase (relevant to WR02 BMP monitoring program only)			
Enhance the productivity and ecological value of rehabilitation areas by effectively managing risks from bushfire, weeds and feral animals	Firefighting resources – adequate access and water resources for firefighting are retained in the final landform for relinquishment.	Compliant	Bushfire management plan in place
	Weed presence – there are no significant weed infestations that are identified as a risk to rehabilitation	Not compliant	Density of exotic species is high in WR02 (with 51% high threat weeds). The highest infestations are

Action/Item	Performance Indicator	Compliance	Performance Comment
			fireweed, Rhodes grass and yellow Lucerne. Spraying of invasive weeds is to occur to reduce risk to rehabilitation.
	Feral animal diversity – feral animal pests are controlled in accordance with legislation and do not present a risk to biodiversity.	Compliant	Weed and pest action plan in place. Monitoring indicates that feral animal activity is low at WR02.
	Fuel loads – fuel loads are assessed and managed as required including maintaining fire breaks.	Compliant	Bushfire management in place with fuel load assessment completed. Fuel loads at time of BMP survey were moderate.
	Access – firefighting access across rehabilitation areas and water sources (dams) is maintained in accordance with the Bushfire Management Plan.	Compliant	Inspections completed on tracks. Access tracks utilised were in good condition at time of BMP survey.
Woodland rehabilitation areas will be self-sustaining and require ongoing management inputs that are appropriate for the final land use	Surface cover – rehabilitation survey confirms ground cover (vegetation, leaf litter, mulch) greater than 70% by Year 5.	Not compliant	Groundcover vegetation, leaf litter and mulch at WR02 is 45% and dominated by exotic species. Spraying of invasive weed species to occur to assist in improving the ground cover at WR02.
	Vegetation health – more than 75% of trees are healthy and growing as	Compliant	More than 75% trees are healthy

Action/Item	Performance Indicator	Compliance	Performance Comment
	indicated by long term rehabilitation monitoring		
	Vegetation health – rehabilitation monitoring confirms canopy cover is in the range of 10% to 30%	Not compliant	Canopy at WR02 is 57% which is a large increase since 2018 (7.5%) This is anticipated to recover unassisted with natural succession.
Vegetation compositions in woodland rehabilitation areas will be comparable with analogue vegetation communities, including areas representative of Central Hunter Box – Ironbark Woodland, specifically adjacent to rehabilitation areas at Ravensworth Operations and Mount Owen Complex	Species presence – revegetation areas contain flor species assemblages characteristic of each strata for the desired native vegetation communities	Partially compliant	WR02 canopy has one of the two recommended species (being *Eucalyptus crebra*, but no *Corymbia maculata*). Continued thinning of lemon scented gums and replacement of spotted gum recommended.
		Not compliant	WR02 midstorey has lower diversity than analogue site W02
		Not compliant	Groundcover vegetation at WR02 comprised of only eight native species in low abundance. This is not within the range of diversity of analogue site W02 which had 15.
	Species presence – rehabilitation monitoring confirms the presence of at least two overstorey and two understorey species at all ages.	Compliant	Monitoring confirms presence of at least two overstorey and two understorey species at WR02

Action/Item	Performance Indicator	Compliance	Performance Comment
	Stem density – minimum total tree/shrub densities for seeded areas to be: Year 1 – 1,000 stems/ha Year 5 – 500 stems/ha Year 10 – 400 stems/ha As confirmed by rehabilitation monitoring	Progressing towards compliant	During 2020, extrapolated tree/shrub density of WR02 was 750. This is greater than that Year 5 stem density and is equal to the 2018 result.
Enhance the productivity and ecological value of rehabilitation areas by effectively managing risks from bushfire, weeds and feral animals	Weed presence – there are no significant weed infestations that are identified as a risk to rehabilitation	Not compliant	Density of exotic species is high in WR02 (with 51% high threat weeds). The highest infestations are fireweed (Senecio madagascariensis), Rhodes grass (Chloris gayana) and yellow lucerne (Medicago sativa). Spraying of invasive weed species to occur to reduce risk to rehabilitation.
Woodland rehabilitation areas will be self-sustaining and require ongoing management inputs that are appropriate for the final land use	Nutrient cycling – inspections confirm evidence of nutrient cycling (e.g. presence of fungi)	Not compliant	Low evidence of nutrient cycling. No presence of fungi and minimal leaf-litter (not decomposing) identified. Bio-turbation (ant activity) is occurring. Anticipated to naturally improve unassisted.
	Surface cover – rehabilitation monitoring confirms ground cover (vegetation, leaf litter, mulch) is in	Not compliant	Groundcover vegetation at WR02 comprised of only eight native species in low abundance. This is not within the range of diversity of

Action/Item	Performance Indicator	Compliance	Performance Comment
	the range of the analogue sites at Year 10		analogue site W02 which had 15. Supplementary planting or seeding of groundcover vegetation at WR02 is scheduled to be completed in 2021 to increase the range of diversity in WR02.
	Vegetation health - more than 75% of trees are healthy and growing as indicated by long term rehabilitation monitoring.	Compliant	More than 75% of trees are healthy
	Species composition - revegetation areas contain flora species assemblages characteristic of the desired native vegetation communities	Partially compliant	Vegetation of WR02 is generally consistent with target vegetation of Lower Hunter Spotted Gum - Ironbark Woodland, however is also dominated by exotic species.
	Reproduction - rehabilitation monitoring confirms second generation tree seedlings are present or likely to be (e.g. presence of flowering).	Not compliant	None observed in 2020. Should occur naturally.
	Structure - rehabilitation monitoring confirms rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs,	Progressing towards compliance	WR02 contains a range of habitat features consistent with remnant vegetation, including eucalypts, shrubs, groundcover. However, there

Action/Item	Performance Indicator	Compliance	Performance Comment
	ground cover, developing litter layer, etc.) to encourage use by native fauna species		is currently an absence of logs, rocks and hollows. Anticipated to naturally improve unassisted. Trees currently too young for installation of nest boxes.
	Native fauna presence - rehabilitation monitoring confirms target native fauna species are recorded utilising rehabilitation areas	Compliant	2020 monitoring confirms use of WR02 vegetation by generalist birds, mammals, and reptiles in the general area. This is generally consistent with analogue site W02.
Woodland rehabilitation corridors will connect with remnant vegetation and rehabilitation at adjacent operations including Ravensworth Operations and Mount Owen Complex, to enhance habitat connectivity	Connectivity - habitat corridors are shown to be successfully established and consistent with desired vegetation community compositions.	Progressing towards compliance	Rehabilitation works form approx. 1.5km north-south corridor. However, this is yet to join areas of remnant vegetation to form a successful corridor.

9.4.2 Rehabilitation Monitoring Summary

LCO also conduct a specific and detailed rehabilitation monitoring program as detailed in the MOP. 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 2020 Rehabilitation Monitoring Reports.

Overall the condition of rehabilitation at LCO is moderate and trending towards the target. Most areas have a good ground coverage which is preventing substantial erosion. However due to a recent substantial increase in rainfall there has been a substantial increase in exotic species throughout the rehabilitation which LCO is actively managing. In the case of woodland vegetation however, ground coverage is provided by non-target species (particularly Rhodes grass (Chloris gayana)) and vegetation has not been established for lengths of time in which substantial soil organic matter (leaf litter) has had the time to accrue. Prolonged drought conditions has additionally hindered the development of rehabilitation. In terms of pasture areas, height and density are typically good for grazing.

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 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 generally still establishing and are not likely to be able to support prolonged grazing at this stage, however, some areas may benefit from short periods of intensive 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 Rhodes grass. Across all pasture areas, a low level of soil carbon was identified 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.

Monitoring has determined that pasture areas are generally trending towards completion criteria across the site.

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 two vegetative layers.

A major threat to woodland rehabilitation area observed has been the establishment of weed species. Dominance of weed species, particularly invasive perennial grasses, kikuyu (Cenchrus clandestinus) and galenia (Galenia pubescens) continues to be a major threat to the establishment of target vegetation in Woodland rehabilitation areas. Weed coverage was very high in 2020 and is likely the result of climatic conditions.

The presence of non-target tree and shrub species in some woodland rehabilitation areas also presents a risk to the progression of these areas removal of these species and replacement with target species where required will be need to progress the rehabilitation towards completion criteria.

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.

Generally, rehabilitation sites are on the correct trajectory for meeting completion criteria. The older rehabilitation sites (planted 2012 or prior) are in fair condition and will continue to improve over time. Similarly, while the younger (planted 2017 or 2018) are not currently providing fauna habitat or an established vegetation community, these sites are likely to improve over time.

Rehabilitation Management Performance Indicators

As per the MOP, rehabilitation requires maintenance and continuous adaptive management to improve the performance of each area; adaptive management is guided by monitoring results where appropriate actions are completed as required. LCO utilise a Trigger Action Response Plan (TARP) to provide a framework for assessing rehabilitation areas performance and identification of maintenance actions as appropriate. The TARP identifies key aspects of rehabilitation (such as landform stability), subsequent key elements (for instance erosion control) and then a condition rating ('green' requires no intervention to 'amber' and 'red' which require some investigation /intervention. ***Table 9-4*** below identifies the TARP elements that as having a status other than 'green'.

As per the MOP, the site progress towards the MOP performance Indictors/Completion Criteria was reviewed as part of the monitoring completed in 2020. ***Appendix G****Error! Reference source not found.* lists all of the completion criteria and comments from the 2020 monitoring.

A rehabilitation summary of areas established during 2020 is provided in ***Appendix H.***

Rehabilitation legacy areas exist within the BMP area, primarily the Mountain Block. This site was subjected to significant earthworks in rehabilitation works in 2020. Further detail on this remediation project is outlines below in ***Section 9.8***. The following table does not include these this areas as they are reported upon specifically in line with a RAP.

Table 9-4 MOP TARP status - exceptions only

Aspect/Category	Key Element	Element Number	2020 Status	MOP Detail		Aspect/ Comment
Landform Stability	Erosion Control	3	Amber	Trigger	Minor gully or tunnel erosion present and/or active rilling >200 mm deep.	Isolated areas identified with remediation required. Ongoing maintenance and monitoring.
				Response	A suitably trained person to inspect the site. Investigate opportunities to install water management infrastructure to address erosion. Remediate as appropriate.	
Topsoil Availability	Topsoil Quantity	8	Amber	Trigger	Topsoil balance indicates a deficiency in topsoil available for rehabilitation over the Life of the Mine.	During 2019 LCO ceased using topsoil alternatives (OGM) due to changes in exemptions. LCO will continue to investigate suitable alternatives with consideration to rehabilitation performance and removal of OGM as a suitable alternative. During 2020 LCO utilised other topsoil alternative products on the Mountain Block project and are monitoring for success.
				Response	Investigate options and alternatives (e.g. OGM) to be able to meet future topsoil requirements Continue direct seeding on spoil where possible and approved.	
Vegetation	Groundcover	9	Amber/Red	Trigger	Amber - Vegetation is not on a timely trajectory of developing groundcover of diversity or density consistent with final landform and/or completion criteria. Red – No target groundcover present	During the 2020 monitoring event 8 woodland sites triggered the amber TARP and 4 triggered the red TARP levels for groundcover. A combination of drought conditions restricting growth and increase in rainfall in 2020 resulting in substantial weed growth has impacted these results. Substantial weed spraying and subsequent infill planting/seeding is planned for 2021 as informed by monitoring results
				Response	Amber – review procedures where required to increase vegetation cover.	

Aspect/Category	Key Element	Element Number	2020 Status	MOP Detail		Aspect/ Comment
					Red - a suitably trained person to inspect the site. Investigate use of appropriate management options to remediate. Remediate as appropriate.	and advice from suitably qualified experts. The groundcover is generally developing well across pasture rehabilitation areas. Areas identified in 2019 monitoring having low ground cover have developed suitable ground cover.
Vegetation	Weed Presence	10	Amber	Trigger	Weeds present a risk to the establishment of the rehabilitation areas.	Some woodland areas have a high cover of weed species that pose particular risk to target vegetation establishment. This has likely been enhanced by climatic conditions. LCO is conducting weed control in these areas and will continue to monitor revegetation performance. LCO regularly monitor weed presence conduct control activities
				Response	Engage weed management contractor to remove introduced species from the site.	
Vegetation	Species composition	11	Amber	Trigger	Woodland vegetation is not on a timely trajectory of developing native tree and shrub species composition consistent with final landform and/or completion criteria.	Half of the woodland rehabilitation monitored in 2020 triggered the amber TARP level. Woodland rehabilitation is broadly consistent with the target vegetation in the tree and shrub layers. Planting/seeding is planned in 2021 to infill areas are previous plantings completed in 2019 had low survival rates due to drough conditions. The woodland seed mix has been adjusted to increase native shrub establishment.
				Response	Review native seed mix and amend accordingly. Consider remedial actions such as tubestock planting, reseeding or other management practices to achieve required species composition.	

Aspect/Category	Key Element	Element Number	2020 Status	MOP Detail		Aspect/ Comment
Vegetation	Species Composition	12	Amber	Trigger	Pasture vegetation is not a timely trajectory developing grass and legumes species consistent with final landform and completion criteria, appropriate to the district and suitable for cattle grazing.	Pasture areas are generally suitable to sustain grazing. Some older pasture areas require maintenance/intervention (such as grazing and supplementary sowing) to improve species diversity. Pasture composition appears to be responding well to trial grazing completed in 2019.
				Response	Investigate additional weeding and re-seeding where required and ensure seed mix utilised is consistent with desired species composition.	
Biodiversity	Habitat Corridors	13	Amber	Trigger	Habitat corridors are successfully established and consistent with the desired vegetation community composition however are not being utilised for fauna species movement.	LCO continually develop and include habitat material into rehabilitation areas. Woodland vegetation corridors are still developing and as such future monitoring events will further inform if any additional actions are required. LCO have undertaken establishment of stag trees throughout older rehabilitation in 2020 to increase habitat features and have installed habitat dams to provide water resources throughout the rehabilitation.
				Response	Investigate whether sufficient habitat features (rock piles, felled hollow bearing trees, nest boxes etc.) are available and have been incorporated into the corridors.	

9.5 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 9-4*** shows LCO biodiversity offset area comprising of Mountain Block, Bowmans Creek Riparian Corridor and Mitchell Hills South Offset Areas. During 2020, LCO completed an 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.

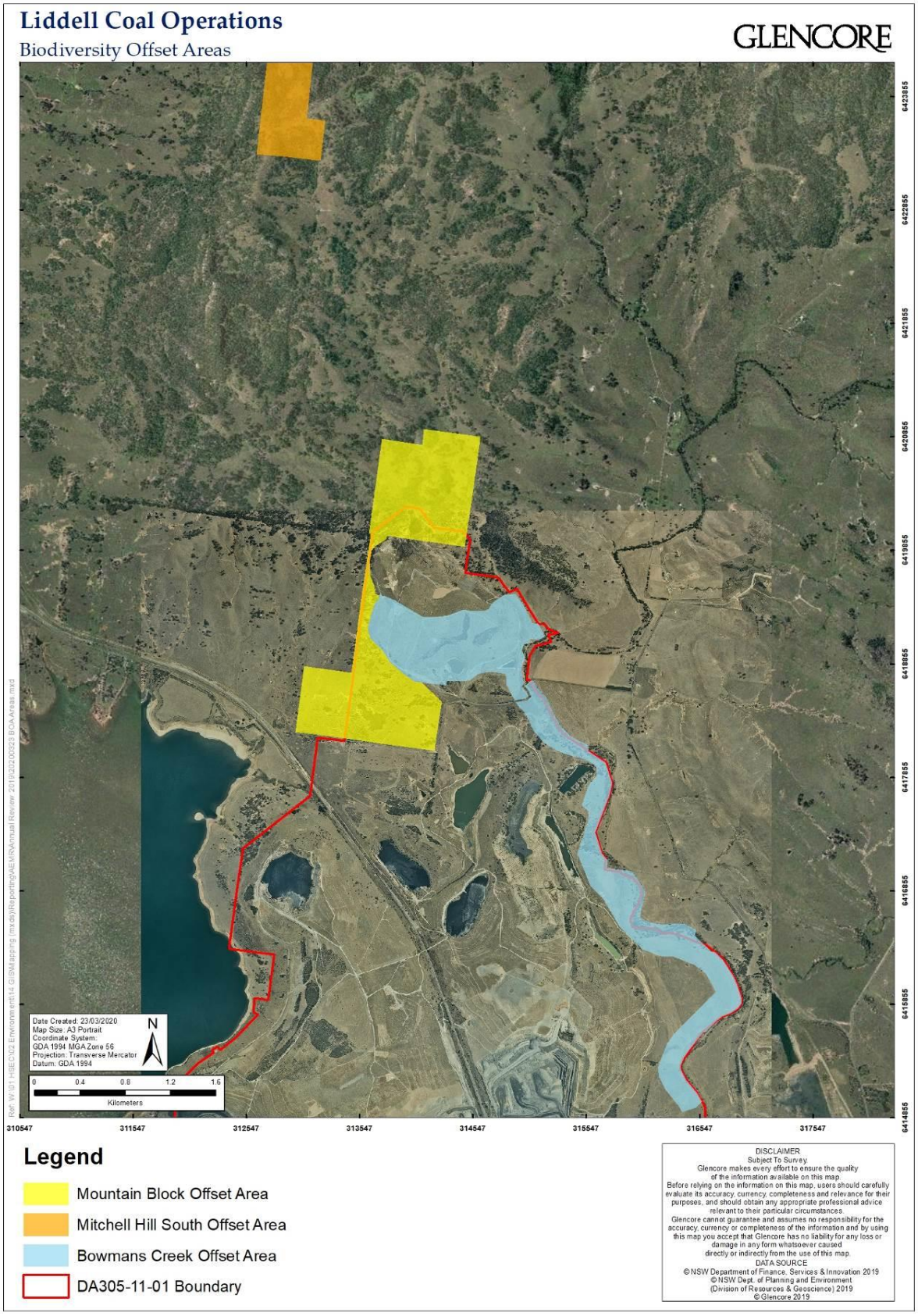


Figure 9-4 - Biodiversity offset areas

Biodiversity Offset Monitoring Summary

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. The aims are to maintain and enhance biodiversity values, particularly those relating to threatened species and threatened ecological communities (TECs) within the LCO biodiversity offset areas. ***Figure 9-4*** shows LCO biodiversity offset areas comprising Mountain Block, Bowmans Creek Riparian Corridor and Mitchell Hills South Offset Areas.

During 2020, LCO completed ecological monitoring in accordance with the BOMP and various management actions relating to the performance indicators.

Key findings of the 2020 biodiversity offset monitoring program include:

- Some declines were evident in floristic and fauna diversity in 2020 from baseline events, however these declines are not likely to be long- term or significant.
- Substantial revegetation and weed control works have been undertaken in 2020 in Bowmans Creek Riparian Corridor. With an increase in rainfall in 2020, weed coverage has increased substantially, and ongoing weed control works will be necessary.
- Remnant vegetation is generally in good condition, however some potentially problematic weed species are encroaching in these areas (particularly riparian vegetation and grassland areas which has particularly high occurrence of exotic grass in patches (despite management activities).
- Substantial increases in the occurrence of the introduced house mouse (*Mus musculus*) were recorded in 2020, likely in response to increased rainfall and resource availability. These numbers are likely to reduce again in response to climatic conditions and no management is recommended at this stage.
- The threatened spotted-tailed quoll (*Dasyurus maculatus*) was recorded again in 2020.
- Feral cat (*Felis catus*) was recorded at all three offsets during 2020. This is a highly destructive predator that may impact upon the recovery of the spotted- tailed quoll. Management is recommended.
- Substantial nest box installation has been undertaken in all three offsets. Preliminary monitoring of these nest boxes are promising for colonisation by local hollow-dependent fauna, including threatened species the brush-tailed phascogale (*Phascogale tapoatafa*), recorded in 2018 and 2019.
- No signs of pathogens, myrtle rust, *Phytophthora cinnamomi* or chytrid fungus were identified.

LCO has been undertaking management actions within the Mountain Block, Mitchell Hills South and Bowmans Creek Riparian Corridor since 2017. A summary of management actions completed in 2020 include:

- Active regeneration works in Bowmans Creek Riparian Corridor, including strip seeding approximately 10 ha and tubestock (400 plants).
- Supplementary tubestock planting of target vegetation in existing Bowmans Creek Riparian Corridor (3,320 plants) and Mitchell Hills South (5,400 plants).

- Weed and pest management throughout all BOAs.
- Seed collection to supplementary seeding resources for regeneration purposes.
- Installation of nest boxes
- Future monitoring will determine whether revegetation in these areas is successful.

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 four to six 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 9-5*** below, based on the outcomes of ecological monitoring and inspections across LCO for each year.

Table 9-5 - BOMP performance indicator summary

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance 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.	Compliant	No signs likely to be associated with Phytophthora, myrtle rust or chytrid fungus observed in any of the BOAs. Sampling for *Phytophthora cinnamomi* undertaken by Umwelt in 2020 with none detected.
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.	Compliant	Boundary fences and gates appeared secure during monitoring event. Fences are additionally monitored during BOMP inspections completed by LCO.
All biodiversity offset areas	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	New fences are installed without barbed wire on upper strands and an elevated plain wire bottom strand.	Not applicable	No new fences installed.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
	allow faunal passage (while maintaining cattle exclusion).			
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.	Compliant	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.	Compliant	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.	Compliant	Planning and due diligence surveys completed where required.
All biodiversity offset areas	Implement protocols for identification of potential cultural heritage issues, including how to avoid or mitigate impacts.	Implement protocol.	Compliant	Implemented as per the approved ACHMP.
Grazing Management				
All BOAs	All stock to be removed from BOAs	No stock grazing unless required based on monitoring results.	Compliant	No evidence of cattle grazing was evident during 2020 in any BOA.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
All BOAs	Minimum bi-monthly inspections to determine presence of rogue stock and assess condition of fences.	To be completed bi-monthly.	Compliant	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.	Compliant	No rogue stock removed.
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.	Not applicable	To be assessed on an ongoing basis. No new tracks installed.
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.	Compliant	Access track inspections undertaken bi-annually in accordance with commitments of the BOMP.
All BOAs	Rehabilitation of unnecessary access tracks.	Tracks no longer required will be rehabilitated.	Not applicable	All tracks present are considered necessary.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
Pest Management				
All biodiversity offset areas	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.	Compliant	Feral animal inspections undertaken every two months in accordance with commitments of the BOMP. Feral cats and dogs were identified in low numbers and will be key species for management in 2021.
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.	Compliant	Annual pest action plan developed and implemented during 2020.
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.	Compliant	Feral fauna identified in low numbers and not appear to be significantly increasing in abundance. Feral dogs, foxes and cats were observed throughout the year and during monitoring. Control activities undertaken included two 1080 dog/fox baiting rounds, one soft jaw trapping event and one shooting control event

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
				Further implementation of control measures to occur during 2021 as per annual action plan.
All biodiversity offset areas	Presence of pest animals	As evidenced by monitoring, pest animal presence in revegetation/ rehabilitation areas does not pose a risk to establishment of vegetation.	Compliant	Feral rabbit, hare, black rat and house mouse were identified in all BOAs. Further control measures for these species to be implemented during 2021 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.	Compliant	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.	Compliant	Inspections completed in accordance with the BOMP. Weeds identified in all BOAs. Evidence of spraying and wick wiping that appeared successful.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
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.	Compliant	Regenerating areas appear to be progressing. Mapping to be completed in future after additional growth to capture recent plantings.
Mountain Block and Mitchell Hills South	Management of regeneration progress is responsive to monitoring outcomes.	Monitoring of regeneration areas.	Compliant	Monitoring of regeneration progress occurred in 2020 and appear to be progressing.
Assisted Regeneration				
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.	Compliant	Natural regeneration was identified in BOAs. Undertake supplementary plantings in areas of poor revegetation success (as identified in monitoring report).
Rehabilitation				
Mountain Block	Modification 7 Area transferred back under BOMP management	-	Not applicable	Rehabilitation completed in 2020. Transfer back under BOMP management will occur once further

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
				monitoring deems rehabilitation of this area a success.
Bowmans Creek Riparian Corridor Mountain Block Offset Area	Develop detailed performance criteria for all management zone types.		Not applicable	2019 monitoring results reviewed and no changes to performance criteria for 2020.
Bowmans Creek Riparian Corridor Mountain Block Offset Area	Implement rehabilitation / revegetation program.	Implementation of plan.	Compliant	Additional plantings (tubestock and seed) occurred in Bowmans Creek Riparian Corridor and Mitchell Hills South. Continue to feed in results of monitoring of supplementary planting into ongoing vegetation establishment and maintenance program.
Bowmans Creek Riparian Corridor	Positive feedback loop from monitoring results.	Feedback from monitoring is incorporated into ongoing review and improvement of plan.	Compliant	To be updated in response to these works.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
Habitat Augmentation				
Bowmans Creek Riparian Corridor	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 den habitat.	Compliant	Little clearing occurred in 2020 so no salvaged habitat trees installed in the offsets. Additional nest boxes installed. Additional boulder piles installed in Bowmans Creek Riparian Corridor and Mountain Block.
Bowmans Creek Riparian Corridor	Nest boxes are providing habitat value for native fauna.	Established nest boxes are subject to regular monitoring.	Compliant	Nest box installation conducted. Signs of presence and actual occupation of nest boxes is occurring.
All biodiversity offset areas	Habitat and hollow augmentation will occur in Mountain Block and Mitchell Hills South offset areas if monitoring identifies a dearth of	Habitat augmentation, if required.	Compliant	Additional boulder piles installed in Bowmans Creek Riparian Corridor and Mountain Block.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
	key habitat features such as log piles or 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.	Compliant	No translocations conducted. Orchid translocated in 2018 monitored and alive.
Creek and Drainage Line Protection				
Bowmans Creek Riparian Corridor	Fencing / protection of LCO controlled side of riparian corridor.	Riparian corridor will be fenced from human and livestock access.	Compliant	Offsets remain fenced and stock excluded.
Bowmans Creek Riparian Corridor	Rehabilitation works to address stabilisation and erosion issues, as necessary.	Implementation, as needed.	Compliant	
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. Seeds are collected, stored and handled according to appropriate program.	Compliant	Seed collection occurred early 2020 in Mitchell Hills South.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
	revegetation/rehabilitation works.	Collected seed resources are used in revegetation/rehabilitation works.		
Erosion Sedimentation and Salinity				
Mountain Block	Control of erosion in southern paddocks	Continue hydromulching of remainder of eroded areas if trials are successful.	Compliant	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.	Compliant	2019 trial area monitored. No additional substantial erosion although limited seed strike.
Bushfire Management				
All BOAs	Bushfire Management Plan implementation	The current Bushfire Management Plan will be updated to address the approved modification. Implementation of requirements of updated Bushfire Management Plan.	Compliant	Bushfire Management Plan implemented.
Monitoring				
All BOAs	Undertake floristic, fauna, LFA and nest box monitoring program	Monitoring program completed and reported	Compliant	Monitoring program completed. Summary of monitoring provided in ***Section 9.4.1***.

Relevant Offset Area	Action	2020 Performance Indicator (Year 5/6)	Compliance	Performance Comment
All BOAs	Undertake annual inspections of LCO rehabilitation and active regeneration areas	Annual inspections completed	Compliant	Monitoring program completed. Summary of monitoring provided in ***Section 9.4.1***.
All BOAs	Native fauna presence in rehabilitation/regeneration areas	Fauna monitoring completed	Compliant	Monitoring program completed. Summary of monitoring provided in ***Section 9.4.1***.

9.6 Indirect Offset Management

Liddell Coal Operations (LCO) received approval for the extension of Liddell Open Cut Coal Mining Operations under the ***State Environmental Planning and Assessment Act 1979*** (EPA Act) on 1 December 2014 (DA 3015-11-01 Modification 5) and approval under the ***Commonwealth Environment Protection Biodiversity Conservation Act 1999*** (EPBC Act) on 24 December 2014 (EPBC Approval 2013/6908).

The State and Commonwealth approvals both require the provision of an indirect offset to augment the agreed land-based biodiversity offsets to address the impacts of the project. This indirect offset was agreed to be a financial contribution towards recovery actions for the spotted-tailed quoll (Dasyurus maculatus maculatus) as part of the:

- Final Draft National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus (Long and Nelson 2008); and/or
- Management actions identified for the spotted-tailed quoll as part of the Office of Environment and Heritage (OEH) Saving Our Species Project Species Action Statement.

An Indirect Offset Plan (IOP) has been prepared to satisfy the conditions of the State and Commonwealth approvals relating to this financial contribution. .

9.6.1 Management Actions during the reporting period

9.6.1.1 Task 1 Development of Individual Recognition Software for Quolls

Task 1 involves the development and sharing of computer software that enables the identification of individual quolls from remote camera data. The 2017 Annual Report LCO advised that the software development was successful, with the initial build of the Quoll Identification Toolkit (QIT) completed, utilising $80,000 funds provided by LCO under research agreement with Invasive Animals Limited (IAL).

During the 2020 reporting period, further work was completed to refine the identification algorithm in the Quoll Identification Toolkit (QIT). IAL have reported that the software is ready for release in in a MATLAB™ format; a freely available software platform. The task summary provided below in ***Table 9-6*** provides an updated list of actions.

Table 9-6 QIT development progress

Action	Status
Continue to refine Matlab based version (address issues raised in initial testing).	Complete
Conduct user testing with NSW OEH Saving our Species and UNE/NSW Dept. Primary Industries project groups.	Complete
Undertake refinements to QIT once testing is complete	Complete
Prepare scientific paper for publication	In progress
Develop user manual	In progress
Release of QIT for use	In progress

9.6.1.2 Task 2 Surveying/Monitoring STQ Populations

Middle Foybrook Area

A PHD student has been engaged since early 2019 to oversee the completion of the project and successfully implemented the camera trapping program throughout the reporting year. The program was condensed to the Glencore Hillcrest/Mitchells Hill/Mt Block offset areas. There were 19 individual quolls detected from 505 camera events detailed in ***Table 9-7***. Unfortunately, during the surveys (October 2019 to February 2020) two cameras traps (LC13 and LC39) were stolen with the data lost as a result. Camera array is shown in ***Figure 9-5.***

Each existing camera was paired with an additional lured camera to provide additional information about local prey species and additional opportunities to detect quolls. Information from these additional, in-kind cameras will be presented in future reports as further data is collected.

A PHD student was engaged and employed to oversee the completion of the project. Camera trapping network installations continued in 2018. The camera trapping program was successfully implemented at the Middle Foy Brook area with over 30 individuals being identified (~90% of the total camera sightings could be assigned to unique individuals) as described in the following

Table 9-7 - Summary of spotted-tailed quoll camera detections in the Offset areas from October 2019 to May 2020

Survey period / cameras used		Quoll camera events/detections	% of images ID to individual quolls	Individuals quolls identified
Survey 1 (Oct 2019 – Feb 2020)	Quoll cameras	258	94%	12
Survey 2 (Feb – May 2020)	Quoll cameras	182	92%	16
Total		505	93%	19 (cumulative)

During May 2020, the camera trapping program was expanded into adjacent private property with 42 cameras now deployed.

Cage trapping was also completed throughout the Offset areas to collect additional demographic data as per the IOMP objectives. Since June 2019, trapping has been completed over 24 nights, with 56 captures of 19 individual quolls.

Deployment of the program into the Mt Royal and Wollemi National Parks was delayed during the reporting period whilst awaiting Scientific Licence approval from OEH. A Scientific Licence (SL102237) granted has been granted for Mt Royal NP and the camera network has been installed and data collected. This data is still undergoing analysis at the time of writing this report and further update will be made in the mid-year report prepared for the IOMP.

Mt Royal National Park

As reported last year, the camera trapping program was successfully implemented in Mt Royal National Park in August 2019. Results to date have 946 camera detections. The data is still being processed, with 30 individual quolls identified to date.

A cage trapping program was also implemented in June 2020, with 10 nights completed. This resulted in 24 captures and release of 13 individual quolls.

Wollemi National Park

Deployment of the program into Wollemi National Park was delayed by bushfire activity and more recently COVID-19 restrictions.

9.6.1.3 Task 3 Assess Habitat Use by Female STQ

Following successful capture and collaring six female quolls reported last year, the GPS/VHF collars have proven unreliable with little useful data collected. As discussed above, the camera trapping has been expanded as an alternative means to assess habitat use by female quolls. The cameras have been proportionally allocated across various habitat types to assess use and preference. Camera configurations are shown in ***Figure 9-6.***

9.6.1.4 Management Actions during the next reporting period

Task 1: QIT Toolkit

Finalisation of QIT software for free distribution and publication of the associated scientific paper as detailed in Appendix A.

Year 5 Implementation – Tasks 2 and 3

The projects will continue as outlined above for Year 5. It is planned to deploy cameras to Wollemi National Park during Spring 2020. Further Cage trapping for Middle Foybrook and Mt Royal National Park is planned in August 2020 to coincide with breeding season.

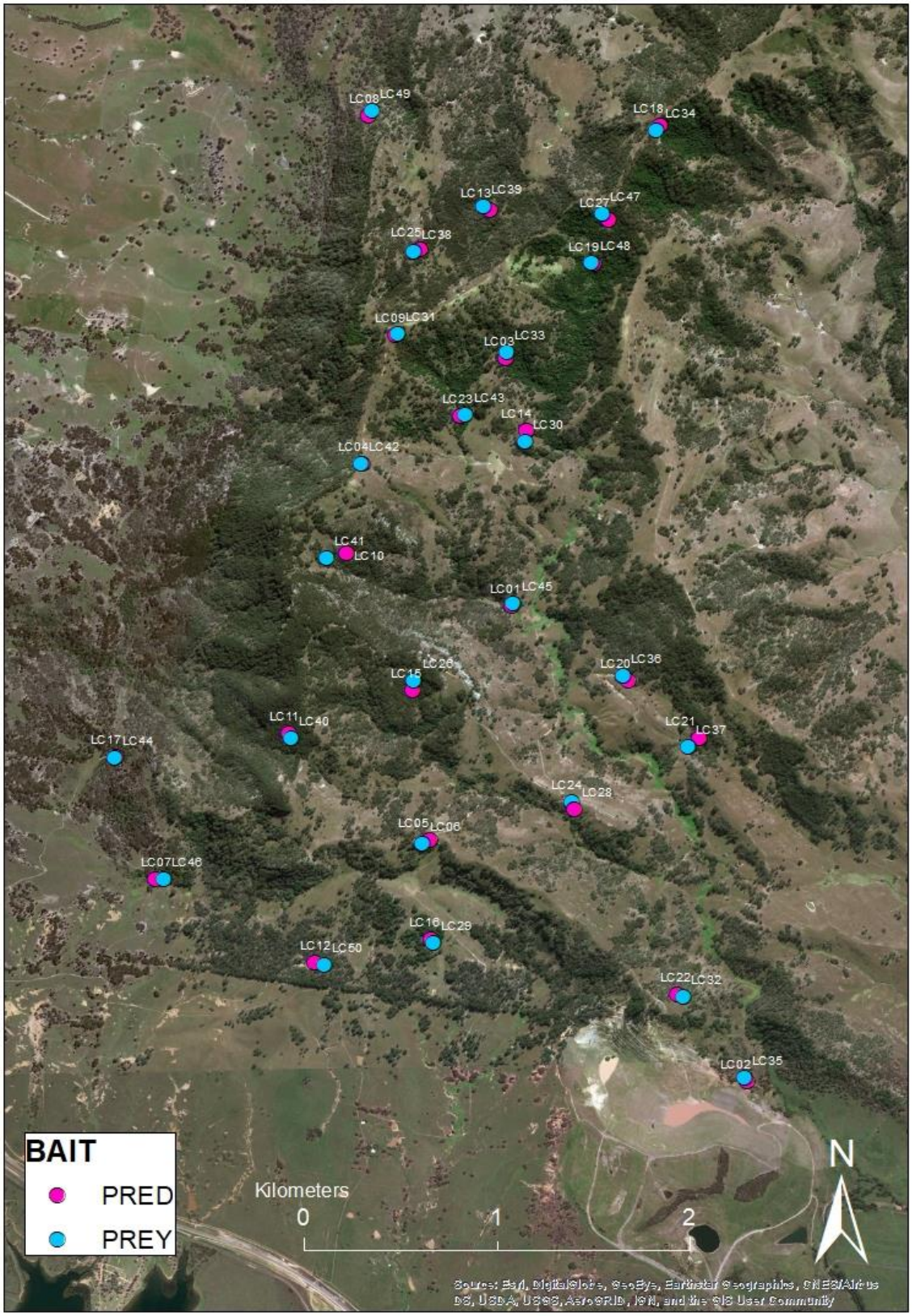


Figure 9-5 - Camera trap array set in October 2019 of both quoll and prey cameras. Note that prey cameras were removed after February 2020.

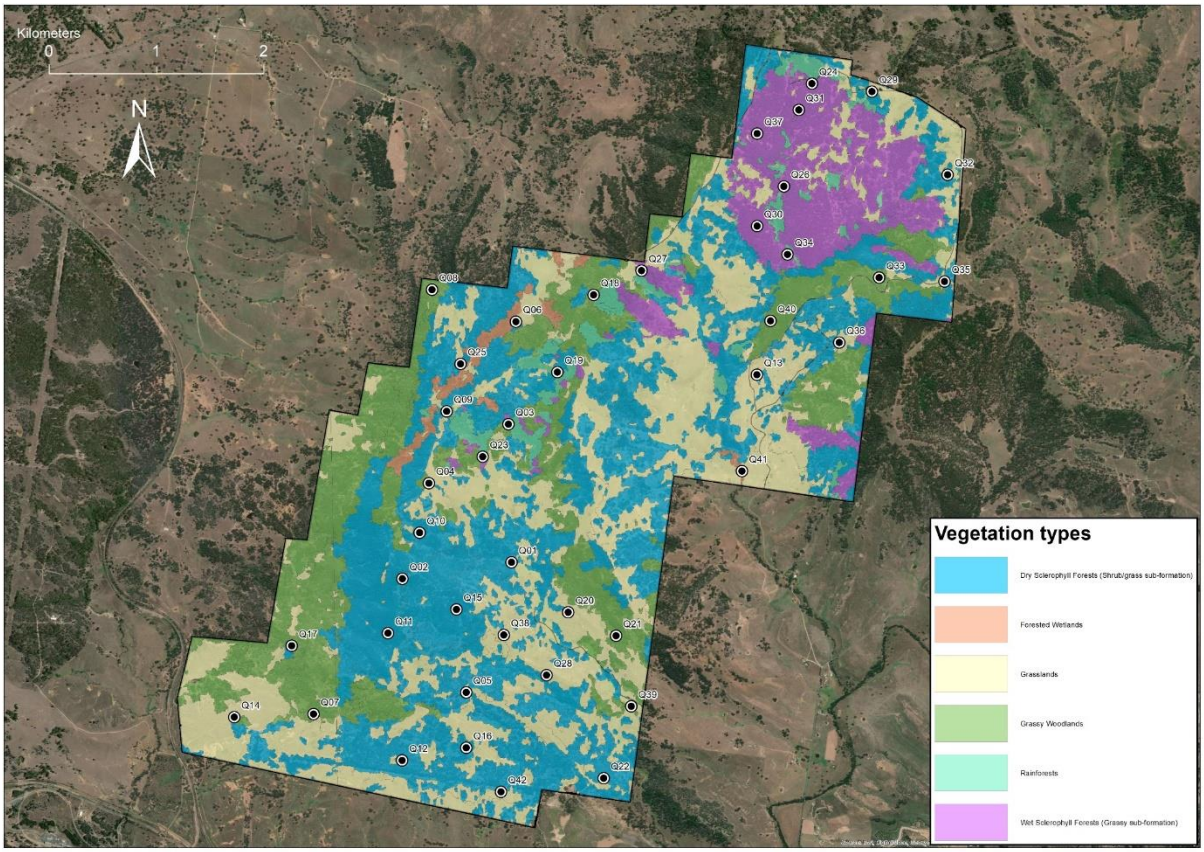


Figure 9-6 - Camera array at Liddell designed to assess habitat use by female quolls

9.7 Rehabilitation Research and Trials

9.7.1 Project 1

LCO currently operates a rehabilitation project which aims to establish two ecological communities over a 16 ha area of overburden. Of the 16 ha, 8 ha was seeded with a Central Ironbark, Spotted Gum, Grey Box Forest community seed mix (Area 1). The second 8 ha was seeded with a Central Hunter Grey Box, Ironbark Woodland community seed mix (Area 2). Both areas received the same preparation treatments which included the application of 5 t/ha of Gypsum, 2 t/ha of Cal-S, 2 t/ha of lime and 120 t/ha of the composted soil conditioner Organic Growth Medium (OGM). Initial monitoring of the rehabilitation areas conducted in 2012 and follow-up monitoring conducted annually; below summarises current status of each area.

For Area 1, the canopy layer in Trial Plot 1 (referred to as Woodland 14 in rehabilitation monitoring reports) is patchy but developing well in most areas. It occurs at approximately 1400 stems per hectare and 40% cover and between approximately 5m and 8m in height. The canopy is dominated by grey box (*Eucalyptus moluccana*) and narrow-leaved ironbark (*Eucalyptus crebra*). Rough-barked apple (*Angophora floribunda*) is present throughout. The mid layer is patchy and dominated by weeping myall (*Acacia pendula*) and sticky hop-bush (*Dodonaea viscosa*). Shrub species occur at densities of approximately 400 stems per hectare.The ground layer has a cover of around 30% and is dominated by Rhodes Grass (*Chloris gayana*) and galenia (*Galenia pubescens*). Some native ground layer species were present in low numbers including; shorthair plumegrass (*Dichelachne micrantha*), barbed wire

grass (*Cymbopogon refractus*) and bluegrass (*Dichanthium sericeum*). Species from the family Chenopodeaceae including; ruby saltbush (*Enchylaena tomentosa*) and climbing saltbush (*Einadia nutans*) were common under weeping myall (*Acacia pendula)*.A thin litter layer consisting of the leaves and bark of eucalypts and exotic grasses is present across the Woodland 14 area. Topsoil development remains minimal at this stage. Three weed species that are limiting the establishment of rehabilitation are present throughout Woodland 14. These species are; galenia (*Galenia pubescens*) and Rhodes grass (*Chloris gayana*) and golden wreath wattle (*Acacia saligna*). One species that is not consistent with the target vegetation community being silver leaved ironbark (*Eucalyptus melanophloia*) was identified as occurring sporadically throughout the Woodland 14 area. The results of the 2020 inspection were broadly consistent with previous years monitoring.

For Area 2, the canopy layer in Trial Plot 2 (referred to as Woodland 16 in rehabilitation monitoring reports) is dense (approximately 1000 stems per hectare and 60% cover) and between approximately 5m and 10m in height. The canopy is dominated by spotted gum (*Corymbia maculata*) with narrow-leaved ironbark (*Eucalyptus crebra*), rough-barked apple (*Angophora floribunda*) and grey box (*Eucalyptus moluccana*) present throughout. One species that is not consistent with the target vegetation community being lemon-scented gum (*Corymbia citriodora*) is also present in low numbers throughout the Woodland 16 area. The mid layer is sparse, consisting of isolated shrubs at densities of less than 100 stems per hectare. Species present include sickle wattle (*Acacia falcata*), hickory wattle (*Acacia implexa*) and blackthorn (*Bursaria spinosa*). The ground layer has a reduced cover of around 20% and includes Rhodes Grass (*Chloris gayana*) and galenia (*Galenia pubescens*). Some native ground layer species were present in low numbers including; ruby saltbush (*Enchylaena tomentosa*) and climbing saltbush (*Einadia nutans*). A thin litter layer consisting of the leaves and bark of eucalypts, particularly spotted gum (*Corymbia maculata*) is present. Topsoil development remains minimal at this stage. Lemon scented gum (*Corymbia citriodora*) is not a local species to the Hunter and not consistent with the target vegetation community (grey box-ironbark woodland). Two weed species that are limiting the establishment of rehabilitation are present throughout Woodland 16. These species are; galenia (*Galenia pubescens*) and Rhodes grass (*Chloris gayana*). Thinning of canopy species and weed control in the ground layer has occurred in this area which is dominated by spotted gum with a sparse ground layer. The results of the 2020 inspection were broadly consistent with previous years monitoring.

Over the course of the trial, the areas have changed significantly with both exhibiting challenges in developing ground cover and mid story. However, in 2020 inspection results were broadly consistent with previous years monitoring suggesting climatic impacts on the growth of the vegetation and exotic cover. Notably, it highlights the consistent evolution of the vegetation and maintenance works required to achieve the target communities as well as the staging of vegetation development; i.e. as canopy develops the mid and ground cover changes significantly.

9.7.2 Project 2

Project Overview

LCO has commenced a new rehabilitation trial during 2016 to further investigate weed load issues arising in recent woodland rehabilitation areas which were the subject of a separate rehabilitation trial.

The initial trial involved changing from the standard woodland rehabilitation ground preparation being sowing into deep ripped overburden and implementing an alternate technique of sowing into a layer of topsoil and Organic Growth Medium (OGM) deep ripped into overburden.

The hypothesis predicted improved strike rates of native species, in particular native grasses which have been identified in previous monitoring events as typically deficient in all woodland rehabilitation areas. The topsoil was to provide the soil structure/medium conducive to plant establishment and the OGM (applied at light rates) to supplement the organic carbon lacking in the soil and overburden. Unfortunately, the 2016 rehabilitation monitoring of native woodland areas in the Entrance Pit confirmed the regular inspection findings; that there was a significant emergence of weed presence occurring. This is likely due to the presence of weed seeds dormant in the topsoil benefiting from the additional organic material load provided by the OGM. LCO are managing the weed presence with increased weed management resource efforts and monitoring within the affected area. This area has become the first case of the rehabilitation trial – a) OGM, topsoil and overburden ripped surface.

In response to the rehabilitation performance in the Entrance Pit woodland areas, LCO have since revised the ground preparation techniques and extended to a new trial area on the South Cut western batter and established two new cases. This trial extension involves two 4ha plots comparing woodland development when sown into: b) OGM and overburden ripped surface; c) topsoil and overburden ripped surface. Hence, the trial now comprises three cases.

Project Findings

2020 monitoring results of the Entrance Premier Pit woodland areas (OGM, topsoil and seed area referred to in 2020 monitoring as Woodland 3) found a patchy distribution of shrubs and canopy species and an understorey dominated by couch and exotic pasture grasses. On the northern side of the drop structure Woodland 3 canopy species occur at very low densities (less than 25 stems per hectare), however, a small number of isolated patches have good numbers of native species in all layers. Target canopy species are present south of the drop structure. Mid story species also had a patchy distribution across the area; however these species were more common than those in the canopy and occurred across the area at densities of approximately 400-500 stems per hectare. The mid story comprised both target and non-target species. Small cooba (Acacia ligulata) was present throughout the Woodland 3 rehabilitation area. Small cooba is not consistent with the target vegetation. Target vegetation species present in the Woodland 3 rehabilitation area include Cooba (Acacia salicina) was the dominant species in the shrub layer, other common mid story species include blue bush (Maireana microphylla), western silver wattle (Acacia decora), fan wattle (Acacia amblygona) and sickle wattle (Acacia falcata). The ground layer in the woodland 3 rehabilitation block is dominated by native couch grass (Cynodon dactylon) and exotic species including; coolah grass (Panicum coloratum), galenia (Galenia pubescens) and kikuyu (Cenchrus clandestinus). A diversity of native ground layer species is present in low densities. Commonly encounter native ground layer species include; barbed wire grass (Cymbopogon refractus), spear grass (Austrostipa scabra), ruby salt bush (Enchylaena tomentosa) and climbing salt-bush (Einadia nutans).

The monitoring results of the two 4ha plots have shown clearly observable differences. The distribution of canopy species in the Woodland 10 rehabilitation area is patchy but they are generally present at 500-600 stems per hectare. Spotted gum (*Corymbia maculata*) is the dominant canopy species with grey box (*Eucalyptus moluccana*) and narrow leaved iron bark (*Eucalyptus crebra*) also present. The mid layer is dominated by a diversity of pioneer shrubs including wattles (*Acacia* spp.) and sticky hop bush (*Dodonaea viscosa*). Understory species were also distributed patchily across the rehabilitation block but were generally present at around 500 stems per hectare. The ground layer was dominated by couch (*Cynodon dactylon*). Weed species Kikuyu (*Cenchrus clandestinus*) and galenia (*Galenia pubescens*) were also common in the ground layer. Increases in weed species across all trial areas in response to rainfall may have influenced the recorded results during the 2020 monitoring.

As OGM is no longer permitted to use in mining rehabilitation, the use of this trial to inform future rehabilitation practices is limited. However, this trail has determined that the combination of topsoil and a growth medium such as OGM typically results in high weed loads during the early establishment of vegetation and should be used separately. Therefore future implementation/trials of topsoil alternative products at LCO are required due to the known topsoil deficit and requirement to determine a suitable alternative.

9.8 Mountain Block

As per the current MOP/RMP approved November 2017, the following design development process was completed during early 2018:

- Obtaining soil samples for flume testing in the laboratory, in order to quantify the materials erosion risk of the material to be used in the outer slopes;
- Analysis of the materials, using the Water Erosion Prediction Project (WEPP) analysis software to determine sustainable flow lengths and slopes;
- Updating the conceptual designs of the final landform by incorporating "Applied Geofluv™" and Geographic information Systems (GIS) erosion risk analysis, to optimise the conceptual design. It will include a constructability analysis in 3D for consultation and initial costing;
- Final design for the final landform, incorporating issues raised from the conceptual landform reviews;
- Analysis of the proposed final landform, using the SIBERIA erosion model to quantify the short and long term erosion risk (with and without vegetation);
- Providing engineering details for tender that include construction drawings, together with a Bill of Quantities and technical specifications; and
- Final reporting to summarise the design details and any residual risks.

The outcomes of the design process presented to NSW DPE and Resources Regulator (formerly DRG) on the 23 April 2018. It was agreed that LCO would progress the remediation design ready for release as construction tender by end Q3 2018.

In parallel it was also identified that LCO required DA305-11-01 approval boundary to address areas of rehabilitation legacy and instability across the entire slope. DA Modification 7 was prepared and submitted in August 2018 to meet this requirement. LCO received approval for Modification 7 on 12 February 2019.

The construction tender for the remediation works was released in early November 2018, after a short delay to conduct a constructability peer review with the assistance of the NSW Soil Conservation Service to further inform the design and tender specification. Tender submission period closed mid December 2018 with a preferred tender selected in 2019.

Post the approval of Modification 7, LCO progressed an Ancillary Mining Lease Application to add the extension area to ML1597. In the interim until this approval was granted in late 2019, LCO commenced the construction of infrastructure for the remediation project and commenced disturbance activities where extension was not required.

The Mountain Block Remediation Project works commenced early 2020 and were completed November 2020. Activities included:

- Bulk shaping

- Soil amelioration
- Rock drain construction
- Revegetation
- Surface erosion protection
- Follow up maintenance
- Establishment of ongoing monitoring program.

Figure 9-7 – Mountain Block during major earthworks (August 2020)

Figure 9-8 – Mountain Block Rehabilitation after completion of earthworks and seeding (February 2021)

Management Actions during the next reporting period

In 2021 LCO will continue to monitor the success of the Mountain Block rehabilitation involving soil sampling program, photo monitoring program and regular inspections. The outcomes from these monitoring programs and inspections will assist LCO in determining the success of the project as well as implement any corrective action as necessary.

10. 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 in the community newsletter and on the LCO public website.

One complaint was received during the reporting period which is summarised in ***Table 10-1.***

Table 10-1 - Summary of complaints received during 2020

Date	Time	Complaint Type	Residential Area	Complaint Details	Corrective Action
17/09/2020	20:00	Lighting	Hebden Community	A large static light had been shining in the direction of the Hebden residence and was causing nuisance.	Mining operations immediately reviewed and changed. All lighting plants potentially visible to the Hebden area shut down. Entrance Pit RL180 Dump design and lightning arrangement adjusted to mitigate further impacts.

An annual comparison of the complaints received at LCO is shown in ***Table 10-1.***

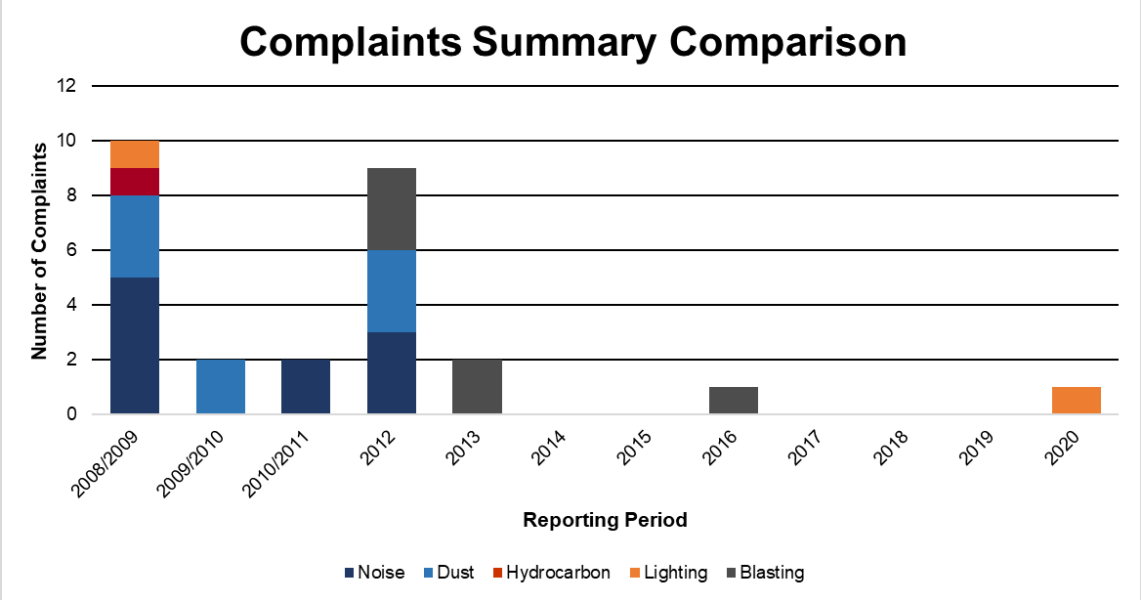


Figure 10-1 - Complaints summary comparison

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. The CCC information was sent out via email on 12th June 2020 as government health advice in response to COVID-19 prevented a face-to-face meetings at the time. The CCC also met face-to-face on 27th November 2020.

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 following organisations and charities listed in ***Table 10-2***.

Table 10-2 Community investment program recipients

Community Investment Projects	
Hebden Rural Fire Service	Music Conservatorium
Hunter Sustainability Landcare	NSW Fire & Rescue
Hunter Valley Fly Fishing Club	SATS Musical (postponed)
Lake Liddell Recreation Area	Singleton Gymkhana Club
Little Wings	Singleton Legacy
Local schools	Singleton Toy Library
Mark Hughes Foundation	Starlight Foundation Golf Day

Community Investment Projects	
Mens Health Education Rural Van	Upper Hunter Community Services

11. Independent Audit

The last independent environmental audit undertaken for the Department of Planning & Environment was for the period of 31 December 2015 to 07 February 2019. The audit was completed over the period of 4 – 7 February 2019 by AECOM.

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

All audit non-compliance opportunities for improvement and actions to address were completed prior to the 2020 reporting period**.**

The next Independent Environmental Audit is scheduled for February 2022.

12. Incidents and non-compliances during the reporting period

During the reporting period LCO had a number of incidents and non-compliances during the reporting period and are outlined below in ***Table 12-1***.

Table 12-1 - 2020 LCO incidents and non-compliances

Approval	Condition Reference	Condition Description	Description	Action taken
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Short term impact assessment criterion for particular matter exceeded the 24 hour averaging period PM10 criterion at monitoring unit SX38-D1 on eight occasions (1/01/2020, 5/01/2020, 11/01/2020, 12/01/2020, 20/01/2020, 21/01/2020, 23/01/2020, and 19/02/2020).	Each exceedance of short term impact assessment criterion was investigated and determined extraordinary events or regional conditions resulted in the exceedances opposed to contribution by LCO operations.
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Short term impact assessment criterion for particular matter exceeded the 24 hour averaging period PM10 criterion at monitoring unit SX38-D2 on nine occasions (1/01/2020, 3/01/2020, 5/01/2020, 11/01/2020, 12/01/2020, 20/01/2020, 21/01/2020, 23/01/2020, and 19/02/2020).	Each exceedance of short term impact assessment criterion was investigated and determined extraordinary events or regional conditions resulted in the exceedances opposed to contribution by LCO operations.
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Monitoring unit SX38-D1 failed to achieve PM10 data availability greater than 75% on 13 dates throughout the reporting period due to planned maintenance and hardware failures (7/01/2020, 8/01/2020, 10/01/2020, 6/02/2020, 7/02/2020, 8/02/2020,	Hardware failures were actioned and repaired by suitably qualified technicians.

Approval	Condition Reference	Condition Description	Description	Action taken
			9/02/2020, 10/02/2020, 3/04/2020, 4/04/2020, 6/04/2020, 7/04/2020, 8/04/2020).	
DA 305-11-01	Schedule 3 Condition 16	Short term impact assessment criterion for particular matter	Monitoring unit SX38-D2 failed to achieve PM10 data availability greater than 75% on 26 dates throughout the reporting period due to planned maintenance and hardware failures (6/01/2020, 7/01/2020, 8/01/2020, 3/02/2020, 26/02/2020, 24/04/2020, 25/04/2020, 26/04/2020, 27/04/2020, 28/04/20202, 29/04/2020, 30/04/2020, 1/05/20202, 2/05/2020, 3/05/2020, 4/05/2020, 5/05/2020, 6/05/2020, 7/05/2020, 8/05/2020, 9/05/2020, 10/05/2020, 11/05/2020, 27/05/2020, 3/08/2020, 4/08/2020).	Hardware failures were actioned and repaired by suitably qualified technicians.
DA 305-11-01	Schedule 3 Condition 16	Continuous air quality monitoring for PM10	Monitoring unit HVAS 12 (Scrivens) failed to monitor PM10 on 26/02/2020	PM10 monitoring occurred at the same location using another compliance monitor. Equipment repaired.
DA 305-11-01	Schedule 3 Condition 16	Continuous air quality monitoring for PM10	Monitoring units HVAS 21 (Antiene) and HVAS 12 (Scriven) failed to monitor PM10 on two occasions: 18/08/2020 and 24/08/2020)	PM10 monitoring occurred at the same locations using other compliance monitors. Equipment repaired.
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Monitoring Point 9 failed to achieve PM10 data availability greater than 75% on 8 dates throughout the reporting period due to hardware failures (27/05/2020,	Hardware failures were actioned and repaired by suitably qualified technicians.

Approval	Condition Reference	Condition Description	Description	Action taken
			15/06/2020, 16/06/2020, 29/07/2020, 5/08/2020, 6/08/2020 and 7/08/2020).	
EPL 2094	Condition M2.2	Continuous air quality monitoring for PM10	Monitoring Point 10 failed to achieve PM10 data availability greater than 75% on 11 dates throughout the reporting period due to hardware failures (7/05/2020, 8/05/2020, 26/05/2020, 14/07/2020, 15/07/2020, 16/07/2020, 27/07/2020, 27/07/2020, 28/07/2020, 11/08/2020, 12/08/2020 and 13/08/2020).	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 17 dates throughout the reporting period due to planned maintenance and hardware failures (18/03/2020, 19/03/2020, 28/04/2020, 29/04/2020, 3/05/2020, 4/05/2020, 26/05/2020, 27/05/2020, 11/06/2020, 12/06/2020, 28/07/2020, 28/07/2020, 30/10/2020, 2/12/2020, 3/12/2020, 23/12/2020 and 24/12/2020).	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 25 dates throughout the reporting period due to planned maintenance and hardware failures (23/01/2020, 24/01/2020, 25/02/2020, 26/01/2020, 27/01/2020,	Hardware failures were actioned and repaired by suitably qualified technicians.

Approval	Condition Reference	Condition Description	Description	Action taken
			28/01/2020, 29/01/2020, 31/01/2020, 1/02/2020, 2/02/2020, 4/05/2020, 11/05/2020, 12/05/2020, 13/05/2020, 26/05/2020, 27/05/2020, 14/06/2020, 18/07/2020, 19/07/2020, 20/07/2020, 27/07/2020, 28/07/2020, 29/07/2020, 2/12/2020 and 3/12/2020).	

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

13. Activities to be completed in the next reporting period

All activities proposed in the next Annual Review period will be consistent with the approved LCO MOP, 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:

- LCO's mining operations will continue to progress in both mining areas. No further clearing for mining progression is planned. Clearing in the Entrance Pit was completed in 2020
- LCO will continue consultation and seek approval for the next MOP term 2021-2023.
- Implementation of tailings dam remediation works.
- ***Section 6.2.1*** discussed the Chain of Ponds Inn and the implementation of stabilisation measures in accordance with the COPI Strategy. LCO will continue to implement these stabilisation measures and monitoring regime as required during 2021.
- ***Section 6.2.2*** discussed the blasting performance and specific management actions required at the Newdell Sub Station. Implementation of the blast management strategy and incremental increase in vibration limits in consultation with Ausgrid will continue in 2021.
- ***Section 6.9.1*** discussed the decreasing onsite tailings capacity, LCO to continue transfer of tailings through pipeline to Mt Owen Complex (West Pit) as approved by DA305-11-01 Mod 6.
- ***Section9.4.1*** 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 9.4.2*** outlined the current status of rehabilitation areas, monitoring results and management actions completed during 2020. LCO will continue to implement the BMP and MOP 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 further develop and implement grazing strategy throughout South Cut pasture rehabilitation to control Rhodes grass and further develop pasture rehabilitation.
- ***Section 9.5*** outlined the current status of Offset areas, monitoring results and management actions completed during 2020. 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

- ***Section 9.6*** detailed the progress of the Indirect Offset Management program. During 2021, LCO will work to progress the quoll monitoring project in conjunction with the UNE.

14. References

NSW Government (2015) Annual Review Guideline

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

AS/NZS 5667.1 (1998) Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples

AS/NZS 5667.6 (1998) Water Quality – Sampling – Guidance on the Sampling of Rivers and Streams

Department of Environmental and Climate Change (DECC) (2007) Approved Methods for Sampling of Air Pollutants in New South Wales

Department of Environment, Climate Change and Water (DECCW) (2004) Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales

Department of Mineral Resources (1999) Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW

Department of Trade & Investment (undated) EDG003 Guidelines to the Mining, Rehabilitation, and Environmental Management Process

Umwelt 2020 Biodiversity Monitoring Report. Prepared for Liddell Coal Operations Pty. Ltd**

Umwelt 2020 Biodiversity Offset Monitoring Report Prepared for Liddell Coal Operations Pty Ltd**

Umwelt 2020 Annual Rehabilitation Monitoring Report Prepared for Liddell Coal Operations Pty Ltd**

Umwelt 2020 Conservation Agreement Monitoring Report Prepared for Liddell Coal Operations Pty Ltd**

Future Harvest 2020 Annual Rehabilitation Monitoring Report Liddell Coal Operations**

Landcom (2004) Managing Urban Stormwater: Soils and Construction Manual

LCO (2020) Noise Monitoring Management Plan*

LCO (2020) Spontaneous Combustion Management Plan**

LCO (2021) Air Quality Management and Monitoring Program*

LCO (2020) Land Clearing and Topsoil Stripping Procedure**

LCO (2020) Liddell Dust Management TARP**

LCO (2020) Waste Management Plan**

LCO (2021) Environmental Management Strategy*

LCO (2020) Aboriginal Cultural Heritage Management Plan*

LCO (2019) Water Management Plan*

LCO (2021) Blast Management Strategy – Chain of Ponds Inn*

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

Hansen Bailey (2018) Liddell Coal Operations Environmental Assessment Modification 7 to DA 305-11-01

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

**LCO document not publicly available

Appendix A - Train Haulage Summary

Glencore Coal

COAL RECEIVALS

Report Period 01/01/2020 12:00 am to 31/12/2020 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	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
Genesee Wyoming Australia	Thursday 31 December 2020	LD216	NSU Zenith	31 December 2020				8,995.00								8,995.00
		Summary of Thursday 31 December 2020						8,995.00								8,995.00
	Summary of Genesee Wyoming Australia							8,995.00								8,995.00
Pacific National	Wednesday 01 January 2020	LD162	Santa Lucia	1 January 2020					8,588.20							8,588.20
		LD248	Corona Majesty	1 January 2020		6,473.47							2,593.53			9,067.00
		LD380	Santa Lucia	1 January 2020								0.00	9,042.00			9,042.00
		Summary of Wednesday 01 January 2020				6,473.47			8,588.20			0.00	11,635.53			26,697.20
	Thursday 02 January 2020	LD190	Corona Queen	2 January 2020					9,202.00							9,202.00
		LD262	Corona Queen	3 January 2020		1,060.94				7,696.06						8,757.00
		Summary of Thursday 02 January 2020				1,060.94			9,202.00	7,696.06						17,959.00
	Friday 03 January 2020	LD256	Tsukuba Maru	3 January 2020			8,432.60					0.00				8,432.60
		Summary of Friday 03 January 2020					8,432.60					0.00				8,432.60
	Saturday 04 January 2020	LD102	Tsukuba Maru	4 January 2020			8,466.00					0.00				8,466.00
		Summary of Saturday 04 January 2020					8,466.00					0.00				8,466.00
	Tuesday 07 January 2020	LD174	NSU Responsibility	7 January 2020		0.00				8,564.20						8,564.20
		Summary of Tuesday 07 January 2020				0.00				8,564.20						8,564.20
	Wednesday 08 January 2020	LD118	Cape Rainbow	8 January 2020						9,070.00		0.00				9,070.00
		LD288	Cape Rainbow	8 January 2020						9,133.60		0.00				9,133.60
		Summary of Wednesday 08 January 2020								18,203.60		0.00				18,203.60
	Thursday 09 January 2020	LD274	Cape Rainbow	10 January 2020		9,204.60										9,204.60
		LD354	NSU Responsibility	9 January 2020			8,678.60									8,678.60

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Thursday 09 January 2020				9,204.60	8,678.60									17,883.20
	Saturday 11 January 2020	LD372	Cape Rainbow	11 January 2020			1,678.05						7,308.15			8,986.20
		Summary of Saturday 11 January 2020					1,678.05						7,308.15			8,986.20
	Sunday 12 January 2020	LD354	NSU Responsibility	12 January 2020			4,543.22		4,507.38							9,050.60
		Summary of Sunday 12 January 2020					4,543.22		4,507.38							9,050.60
	Monday 13 January 2020	LD348	NSU Responsibility	13 January 2020			8,975.00									8,975.00
		Summary of Monday 13 January 2020					8,975.00									8,975.00
	Tuesday 14 January 2020	LD322	Ishizuchi	15 January 2020			8,965.00									8,965.00
		LD344	NSU Responsibility	14 January 2020		1,023.00	8,080.40					0.00				9,103.40
		Summary of Tuesday 14 January 2020				1,023.00	17,045.40					0.00				18,068.40
	Wednesday 15 January 2020	LD288	Cape Vanguard	16 January 2020			9,170.00									9,170.00
		LD386	Ishizuchi	15 January 2020			9,160.80									9,160.80
		Summary of Wednesday 15 January 2020					18,330.80									18,330.80
	Thursday 16 January 2020	LD148	Cape Vanguard	16 January 2020					9,185.20							9,185.20
		LD246	Cape Vanguard	16 January 2020			6,964.11						1,365.89			8,330.00
		LD344	Cape Vanguard	16 January 2020			9,188.00									9,188.00
		Summary of Thursday 16 January 2020					16,152.11		9,185.20				1,365.89			26,703.20
	Friday 17 January 2020	LD132	Kaiyo	17 January 2020			9,069.60									9,069.60
		Summary of Friday 17 January 2020					9,069.60									9,069.60
	Saturday 18 January 2020	LD314	Kaiyo	19 January 2020			9,214.60									9,214.60
		LD360	Cape Vanguard	18 January 2020			6,062.28			3,105.52						9,167.80
		Summary of Saturday 18 January 2020					15,276.88			3,105.52						18,382.40
	Monday 20 January 2020	LD214	Tenwa Maru	20 January 2020		9,051.00										9,051.00
		Summary of Monday 20 January 2020				9,051.00										9,051.00
	Thursday 23 January 2020	LD346	NSU Obelisk	23 January 2020			9,022.20									9,022.20
		Summary of Thursday 23 January 2020					9,022.20									9,022.20
	Friday 24 January 2020	LD116	NSU Obelisk	24 January 2020			2,599.69					0.00		6,061.71		8,661.40

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Friday 24 January 2020					2,599.69					0.00		6,061.71		8,661.40
	Sunday 26 January 2020	LD332	Shin Sekiyo	26 January 2020			9,162.00									9,162.00
		Summary of Sunday 26 January 2020					9,162.00									9,162.00
	Monday 27 January 2020	LD258	Dyna Camellia	28 January 2020			8,475.60									8,475.60
		Summary of Monday 27 January 2020					8,475.60									8,475.60
	Wednesday 29 January 2020	LD118	Shin Sekiyo	29 January 2020				4,400.57	4,644.83							9,045.40
		LD316	Kagara	30 January 2020				9,095.40								9,095.40
		Summary of Wednesday 29 January 2020						13,495.97	4,644.83							18,140.80
	Thursday 30 January 2020	LD366	Kagara	30 January 2020				5,111.39						4,006.01		9,117.40
		Summary of Thursday 30 January 2020						5,111.39						4,006.01		9,117.40
	Friday 31 January 2020	LD288	Kagara	1 February 2020				3,764.25	5,490.95							9,255.20
		Summary of Friday 31 January 2020						3,764.25	5,490.95							9,255.20
	Saturday 01 February 2020	LD172	Sakura Glory	1 February 2020				9,195.20				0.00				9,195.20
		LD230	Sakura Glory	1 February 2020		5,258.69								3,237.51		8,496.20
		Summary of Saturday 01 February 2020				5,258.69		9,195.20				0.00		3,237.51		17,691.40
	Monday 03 February 2020	LD166	Sakura Glory	3 February 2020				5,192.85	3,735.15							8,928.00
		LD216	NSU Keystone	3 February 2020		2,924.52		6,315.68								9,240.20
		LD286	NSU Keystone	4 February 2020		2,815.14		5,580.46								8,395.60
		Summary of Monday 03 February 2020				5,739.66		17,088.99	3,735.15							26,563.80
	Wednesday 05 February 2020	LD130	Mizunagi II	5 February 2020				9,173.60								9,173.60
		LD228	FPMC B 108	5 February 2020										8,730.00		8,730.00
		Summary of Wednesday 05 February 2020						9,173.60						8,730.00		17,903.60
	Thursday 06 February 2020	LD176	FPMC B 108	6 February 2020		9,197.60										9,197.60
		LD302	FPMC B 108	6 February 2020										9,000.00		9,000.00
		Summary of Thursday 06 February 2020				9,197.60								9,000.00		18,197.60
	Friday 07 February 2020	LD310	Mizunagi II	8 February 2020					9,282.00							9,282.00

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Friday 07 February 2020							9,282.00							9,282.00
	Sunday 09 February 2020	LD102	Sincere Pisces	9 February 2020				8,720.20								8,720.20
		LD288	FPMC B 108	9 February 2020		4,155.38			4,403.42							8,558.80
		Summary of Sunday 09 February 2020				4,155.38		8,720.20	4,403.42							17,279.00
	Monday 10 February 2020	LD144	Sea Pearl	10 February 2020		4,170.06			4,213.74							8,383.80
		LD234	Sea Pearl	10 February 2020					8,663.20							8,663.20
		LD336	Santa Isabel	10 February 2020				8,491.00								8,491.00
		Summary of Monday 10 February 2020				4,170.06		8,491.00	12,876.94							25,538.00
	Friday 14 February 2020	LD234	Tachibana	15 February 2020		9,233.80										9,233.80
		Summary of Friday 14 February 2020				9,233.80										9,233.80
	Saturday 15 February 2020	LD124	Tachibana	15 February 2020					9,140.60							9,140.60
		LD226	Tachibana	16 February 2020										9,254.60		9,254.60
		Summary of Saturday 15 February 2020							9,140.60					9,254.60		18,395.20
	Sunday 16 February 2020	LD224	Energia Centaurus	16 February 2020			7,814.47	1,242.13								9,056.60
		LD278	Energia Centaurus	17 February 2020			9,201.20									9,201.20
		LD344	Century Wave	16 February 2020				9,202.20								9,202.20
		Summary of Sunday 16 February 2020					17,015.67	10,444.33								27,460.00
	Monday 17 February 2020	LD120	New Expedition	17 February 2020			3,955.24	4,276.16								8,231.40
		LD206	New Expedition	17 February 2020			9,194.60									9,194.60
		Summary of Monday 17 February 2020					13,149.84	4,276.16								17,426.00
	Tuesday 18 February 2020	LD130	Tachibana	18 February 2020		7,134.88	2,037.52									9,172.40
		LD188	New Expedition	18 February 2020			8,451.00									8,451.00
		LD282	New Expedition	19 February 2020			8,959.00									8,959.00
		Summary of Tuesday 18 February 2020				7,134.88	19,447.52									26,582.40
	Wednesday 19 February 2020	LD212	New Expedition	20 February 2020			8,521.00									8,521.00
		Summary of Wednesday 19 February 2020					8,521.00									8,521.00

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Thursday 20 February 2020	LD234	Couga	20 February 2020			8,641.00									8,641.00
		Summary of Thursday 20 February 2020					8,641.00									8,641.00
	Friday 21 February 2020	LD148	W-Star	21 February 2020										8,556.00		8,556.00
		LD252	W-Star	21 February 2020										9,154.00		9,154.00
		LD302	W-Star	22 February 2020			9,139.00									9,139.00
		LD362	New Expedition	21 February 2020			9,150.80									9,150.80
		Summary of Friday 21 February 2020					18,289.80							17,710.00		35,999.80
	Saturday 22 February 2020	LD114	W-Star	22 February 2020			9,134.60									9,134.60
		LD166	W-Star	22 February 2020			9,226.60									9,226.60
		LD258	W-Star	23 February 2020										8,456.00		8,456.00
		Summary of Saturday 22 February 2020					18,361.20							8,456.00		26,817.20
	Sunday 23 February 2020	LD102	W-Star	23 February 2020		1,300.81	3,419.65							3,606.34		8,326.80
		LD178	W-Star	23 February 2020										9,167.00		9,167.00
		LD240	W-Star	23 February 2020										8,278.40		8,278.40
		LD284	W-Star	24 February 2020			4,748.07							3,650.73		8,398.80
		Summary of Sunday 23 February 2020				1,300.81	8,167.72							24,702.47		34,171.00
	Monday 24 February 2020	LD220	Azul Horizonte	24 February 2020			8,513.80									8,513.80
		LD306	Azul Horizonte	25 February 2020			8,557.00									8,557.00
		Summary of Monday 24 February 2020					17,070.80									17,070.80
	Tuesday 25 February 2020	LD240	Azul Horizonte	25 February 2020			7,176.31		1,851.69							9,028.00
		Summary of Tuesday 25 February 2020					7,176.31		1,851.69							9,028.00
	Wednesday 26 February 2020	LD260	Eny	26 February 2020			8,523.20									8,523.20
		LD330	Asahi Maru	26 February 2020			9,281.00									9,281.00
		Summary of Wednesday 26 February 2020					17,804.20									17,804.20
	Thursday 27 February 2020	LD124	Asahi Maru	27 February 2020			8,541.80									8,541.80
		Summary of Thursday 27 February 2020					8,541.80									8,541.80

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Friday 28 February 2020	LD166	Asahi Maru	28 February 2020			9,131.00									9,131.00
		LD348	Eny	28 February 2020			1,855.79		6,604.01							8,459.80
		Summary of Friday 28 February 2020					10,986.79		6,604.01							17,590.80
	Saturday 29 February 2020	LD142	Cape Eagle	29 February 2020			8,674.80									8,674.80
		Summary of Saturday 29 February 2020					8,674.80									8,674.80
	Sunday 01 March 2020	LD194	Cape Eagle	1 March 2020			8,476.60									8,476.60
		Summary of Sunday 01 March 2020					8,476.60									8,476.60
	Monday 02 March 2020	LD182	Cape Eagle	2 March 2020			8,573.60									8,573.60
		LD354	Cape Eagle	2 March 2020			9,111.20									9,111.20
		Summary of Monday 02 March 2020					17,684.80									17,684.80
	Tuesday 03 March 2020	LD286	Ever Imperial	4 March 2020			8,639.40									8,639.40
		Summary of Tuesday 03 March 2020					8,639.40									8,639.40
	Wednesday 04 March 2020	LD164	Nanakura	4 March 2020					8,688.20							8,688.20
		LD230	Ever Imperial	4 March 2020			9,324.60									9,324.60
		LD324	Nanakura	4 March 2020										9,256.40		9,256.40
		Summary of Wednesday 04 March 2020					9,324.60		8,688.20					9,256.40		27,269.20
	Thursday 05 March 2020	LD198	Nanakura	5 March 2020			4,529.55		4,697.65							9,227.20
		LD308	Ever Imperial	5 March 2020			9,016.40									9,016.40
		Summary of Thursday 05 March 2020					13,545.95		4,697.65							18,243.60
	Sunday 08 March 2020	LD132	HL Pride	8 March 2020										8,212.60		8,212.60
		LD214	HL Pride	8 March 2020										8,393.40		8,393.40
		Summary of Sunday 08 March 2020												16,606.00		16,606.00
	Monday 09 March 2020	LD166	Rin Yo	9 March 2020			9,148.60									9,148.60
		LD254	HL Pride	10 March 2020			1,675.76							7,176.24		8,852.00
		LD386	Navios Taurus	9 March 2020					9,217.40							9,217.40
		Summary of Monday 09 March 2020					10,824.36		9,217.40					7,176.24		27,218.00
	Friday 13 March 2020	LD144	Donau K	13 March 2020										8,257.00		8,257.00
		Summary of Friday 13 March 2020												8,257.00		8,257.00
	Monday 16 March 2020	LD384	Donau K	16 March 2020										9,159.80		9,159.80
		Summary of Monday 16 March 2020												9,159.80		9,159.80
	Wednesday 18 March 2020	LD154	Kagara	18 March 2020			9,184.80									9,184.80
		LD248	Kagara	19 March 2020			9,199.00									9,199.00
		Summary of Wednesday 18 March 2020					18,383.80									18,383.80
	Thursday 19 March 2020	LD174	NSU Ambitious	19 March 2020					7,496.14			1,059.86				8,556.00
		LD266	NSU Ambitious	20 March 2020					7,976.19			1,018.41				8,994.60
		Summary of Thursday 19 March 2020							15,472.33			2,078.27				17,550.60

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Friday 20 March 2020	LD132	Kagara	20 March 2020			7,295.67							1,223.13		8,518.80
		LD216	Kagara	20 March 2020			9,182.60									9,182.60
		LD348	Kagara	20 March 2020			8,637.20									8,637.20
		Summary of Friday 20 March 2020					25,115.47							1,223.13		26,338.60
	Sunday 22 March 2020	LD348	Kagara	22 March 2020			9,047.00		0.00							9,047.00
		Summary of Sunday 22 March 2020					9,047.00		0.00							9,047.00
	Monday 23 March 2020	LD308	Mizunagi II	24 March 2020					8,300.00							8,300.00
		Summary of Monday 23 March 2020							8,300.00							8,300.00
	Sunday 29 March 2020	LD160	Energia Centaurus	29 March 2020			7,764.16					1,039.44				8,803.60
		Summary of Sunday 29 March 2020					7,764.16					1,039.44				8,803.60
	Monday 30 March 2020	LD122	Energia Centaurus	30 March 2020			8,204.18					1,027.42				9,231.60
		LD254	Energia Centaurus	31 March 2020			6,561.96					2,168.84				8,730.80
		LD344	Energia Centaurus	30 March 2020			8,145.84					1,050.56				9,196.40
		Summary of Monday 30 March 2020					22,911.98					4,246.82				27,158.80
	Monday 06 April 2020	LD220	Corona Nature	6 April 2020		8,928.00										8,928.00
		Summary of Monday 06 April 2020				8,928.00										8,928.00
	Tuesday 07 April 2020	LD210	New Delight	7 April 2020			9,131.00									9,131.00
		LD320	New Delight	7 April 2020			9,207.40									9,207.40
		Summary of Tuesday 07 April 2020					18,338.40									18,338.40
	Thursday 09 April 2020	LD132	Ocean Leo	9 April 2020								8,657.60				8,657.60
		Summary of Thursday 09 April 2020										8,657.60				8,657.60
	Friday 10 April 2020	LD214	China Steel Team	10 April 2020			6,542.50		2,657.50							9,200.00
		LD322	Tai Keystone	10 April 2020			8,722.00									8,722.00
		Summary of Friday 10 April 2020					15,264.50		2,657.50							17,922.00
	Sunday 12 April 2020	LD154	Tai Keystone	12 April 2020				5,303.51	3,246.49							8,550.00
		Summary of Sunday 12 April 2020						5,303.51	3,246.49							8,550.00
	Saturday 18 April 2020	LD332	Spring Brave	19 April 2020				9,138.00								9,138.00
		Summary of Saturday 18 April 2020						9,138.00								9,138.00
	Sunday 19 April 2020	LD128	Nirai	19 April 2020				9,185.00								9,185.00
		LD292	Spring Brave	20 April 2020					9,026.60							9,026.60
		Summary of Sunday 19 April 2020						9,185.00	9,026.60							18,211.60
	Monday 20 April 2020	LD226	Medi Matsuura	20 April 2020				8,617.00								8,617.00
		LD302	Spring Brave	21 April 2020				9,341.40								9,341.40
		LD378	Nirai	20 April 2020				8,699.40								8,699.40
		Summary of Monday 20 April 2020						26,657.80								26,657.80

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Tuesday 21 April 2020	LD120	Medi Matsuura	21 April 2020					8,665.40							8,665.40
		LD208	Medi Matsuura	21 April 2020				9,202.00								9,202.00
		LD304	Medi Matsuura	22 April 2020				9,313.00								9,313.00
		Summary of Tuesday 21 April 2020						18,515.00	8,665.40							27,180.40
	Wednesday 22 April 2020	LD176	Spring Brave	22 April 2020		5,059.10	4,194.50									9,253.60
		LD224	Medi Matsuura	22 April 2020				8,858.60								8,858.60
		Summary of Wednesday 22 April 2020				5,059.10	4,194.50	8,858.60								18,112.20
	Thursday 23 April 2020	LD360	Spring Brave	23 April 2020			2,256.84			7,033.16						9,290.00
		Summary of Thursday 23 April 2020					2,256.84			7,033.16						9,290.00
	Friday 24 April 2020	LD262	Medi Matsuura	25 April 2020				1,694.76	6,482.33	1,032.31						9,209.40
		Summary of Friday 24 April 2020						1,694.76	6,482.33	1,032.31						9,209.40
	Saturday 25 April 2020	LD142	Cemtex Honor	25 April 2020				8,219.75		1,108.45						9,328.20
		LD224	Cemtex Honor	25 April 2020			5,956.36					3,237.64				9,194.00
		Summary of Saturday 25 April 2020					5,956.36	8,219.75		1,108.45		3,237.64				18,522.20
	Sunday 26 April 2020	LD142	Cape Sasanqua	26 April 2020				7,066.53				1,374.07				8,440.60
		LD210	Cape Sasanqua	26 April 2020				7,863.09				1,310.51				9,173.60
		LD274	Cape Sasanqua	27 April 2020			9,316.00									9,316.00
		LD320	Cemtex Honor	27 April 2020					8,899.60							8,899.60
		Summary of Sunday 26 April 2020					9,316.00	14,929.62	8,899.60			2,684.58				35,829.80
	Wednesday 29 April 2020	LD316	Cape Sasanqua	29 April 2020					9,042.60							9,042.60
		Summary of Wednesday 29 April 2020							9,042.60							9,042.60
	Saturday 09 May 2020	LD364	Kachidoki	10 May 2020			8,997.80									8,997.80
		Summary of Saturday 09 May 2020					8,997.80									8,997.80
	Sunday 10 May 2020	LD106	Ocean Road	10 May 2020					8,974.40							8,974.40
		LD220	Kachidoki	11 May 2020			8,909.40									8,909.40
		Summary of Sunday 10 May 2020					8,909.40		8,974.40							17,883.80
	Monday 11 May 2020	LD126	Kachidoki	11 May 2020			4,252.29			4,382.71						8,635.00
		LD344	Kachidoki	11 May 2020			9,205.20									9,205.20
		Summary of Monday 11 May 2020					13,457.49			4,382.71						17,840.20
	Wednesday 13 May 2020	LD276	Aquarange	13 May 2020								9,219.20				9,219.20
		Summary of Wednesday 13 May 2020										9,219.20				9,219.20
	Thursday 14 May 2020	LD192	Cape Midori	14 May 2020				9,060.00								9,060.00
		LD338	Aquarange	14 May 2020								9,138.40				9,138.40
		LD384	Aquarange	14 May 2020								8,880.00				8,880.00
		Summary of Thursday 14 May 2020						9,060.00				18,018.40				27,078.40

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Friday 15 May 2020	LD146	Cape Midori	15 May 2020				8,890.00								8,890.00
		LD198	Cape Midori	15 May 2020					9,138.60							9,138.60
		LD272	Aquabridge	16 May 2020								9,051.40				9,051.40
		Summary of Friday 15 May 2020						8,890.00	9,138.60			9,051.40				27,080.00
	Saturday 16 May 2020	LD150	Cape Midori	16 May 2020				9,103.20								9,103.20
		LD216	Cape Midori	17 May 2020				8,545.80								8,545.80
		Summary of Saturday 16 May 2020						17,649.00								17,649.00
	Sunday 17 May 2020	LD128	Aquarange	17 May 2020								8,428.20				8,428.20
		LD222	Aquabridge	18 May 2020								9,195.60				9,195.60
		LD286	Cape Midori	17 May 2020					9,190.00							9,190.00
		LD372	Aquabridge	17 May 2020								8,542.80				8,542.80
		Summary of Sunday 17 May 2020							9,190.00			26,166.60				35,356.60
	Monday 18 May 2020	LD198	Asahi Maru	18 May 2020			9,056.00									9,056.00
		LD230	Kashima Maru	18 May 2020			9,155.20									9,155.20
		LD272	Cape Rainbow	22 May 2020			8,286.00									8,286.00
		Summary of Monday 18 May 2020					26,497.20									26,497.20
	Tuesday 19 May 2020	LD288	Kashima Maru	22 May 2020					4,500.70	4,500.70						9,001.40
		Summary of Tuesday 19 May 2020							4,500.70	4,500.70						9,001.40
	Friday 22 May 2020	LD210	JR Summer	22 May 2020								9,343.00				9,343.00
		LD254	JR Summer	23 May 2020								8,164.00				8,164.00
		Summary of Friday 22 May 2020										17,507.00				17,507.00
	Saturday 23 May 2020	LD130	JR Summer	23 May 2020								8,402.40				8,402.40
		LD150	Donau K	23 May 2020			2,461.00									2,461.00
		LD240	Donau K	23 May 2020			8,996.20									8,996.20
		LD364	Cape Rainbow	23 May 2020						8,243.80						8,243.80
		Summary of Saturday 23 May 2020					11,457.20			8,243.80		8,402.40				28,103.40
	Sunday 24 May 2020	LD210	Cape Rainbow	24 May 2020					8,987.80							8,987.80
		LD292	Cape Rainbow	25 May 2020						4,814.20				3,162.40		7,976.60
		LD386	Cape Rainbow	24 May 2020						8,446.00						8,446.00
		Summary of Sunday 24 May 2020							8,987.80	13,260.20				3,162.40		25,410.40
	Monday 25 May 2020	LD230	Asahi Maru	25 May 2020			8,724.60									8,724.60
		LD278	Asahi Maru	26 May 2020						9,120.60						9,120.60
		LD388	Asahi Maru	25 May 2020					8,514.40							8,514.40
		Summary of Monday 25 May 2020					8,724.60		8,514.40	9,120.60						26,359.60
	Tuesday 26 May 2020	LD148	Juno Horizon	26 May 2020			9,224.60									9,224.60
		LD250	Isuzu Maru	27 May 2020			8,515.80									8,515.80
		Summary of Tuesday 26 May 2020					17,740.40									17,740.40
	Wednesday 27 May 2020	LD138	Juno Horizon	28 May 2020			6,906.51			1,850.09						8,756.60

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		LD386	Juno Horizon	27 May 2020			9,219.00									9,219.00
		Summary of Wednesday 27 May 2020					16,125.51			1,850.09						17,975.60
	Thursday 28 May 2020	LD354	Santa Graciela	28 May 2020						9,050.40						9,050.40
		Summary of Thursday 28 May 2020								9,050.40						9,050.40
	Friday 29 May 2020	LD114	Juno Horizon	29 May 2020						9,162.00		0.00				9,162.00
		LD188	Cape Rainbow	29 May 2020						8,540.60						8,540.60
		Summary of Friday 29 May 2020								17,702.60		0.00				17,702.60
	Monday 01 June 2020	LD220	Ocean Trinity	1 June 2020					8,990.00							8,990.00
		LD326	Ocean Trinity	2 June 2020										8,319.80		8,319.80
		Summary of Monday 01 June 2020							8,990.00					8,319.80		17,309.80
	Thursday 04 June 2020	LD320	Ocean Trinity	4 June 2020										7,959.20		7,959.20
		Summary of Thursday 04 June 2020												7,959.20		7,959.20
	Friday 05 June 2020	LD172	Pacific Oak	5 June 2020										8,538.80		8,538.80
		LD242	Pacific Oak	5 June 2020										8,251.00		8,251.00
		LD272	Pacific Oak	6 June 2020						7,956.05		506.95				8,463.00
		LD364	Ocean Trinity	5 June 2020					5,394.46					2,816.14		8,210.60
		Summary of Friday 05 June 2020							5,394.46	7,956.05		506.95		19,605.94		33,463.40
	Saturday 06 June 2020	LD334	Pacific Oak	6 June 2020						8,547.14		515.66				9,062.80
		LD388	Pacific Oak	6 June 2020						8,591.00						8,591.00
		Summary of Saturday 06 June 2020								17,138.14		515.66				17,653.80
	Sunday 07 June 2020	LD146	Key Knight	7 June 2020						5,567.07				2,729.53		8,296.60
		LD220	Ocean Opal	7 June 2020										8,756.00		8,756.00
		LD302	Pacific Oak	8 June 2020			8,558.61					521.59				9,080.20
		Summary of Sunday 07 June 2020					8,558.61			5,567.07		521.59		11,485.53		26,132.80
	Tuesday 09 June 2020	LD306	Corona Brave	10 June 2020										9,129.00		9,129.00
		Summary of Tuesday 09 June 2020												9,129.00		9,129.00
	Wednesday 10 June 2020	LD320	Ocean Opal	11 June 2020										8,826.80		8,826.80
		LD376	Corona Brave	10 June 2020						9,052.20						9,052.20
		Summary of Wednesday 10 June 2020								9,052.20				8,826.80		17,879.00
	Thursday 11 June 2020	LD108	Corona Brave	11 June 2020						8,621.00		0.00				8,621.00
		LD230	Corona Brave	11 June 2020						9,026.00		0.00				9,026.00
		LD308	Corona Brave	11 June 2020										8,207.40		8,207.40
		Summary of Thursday 11 June 2020								17,647.00		0.00		8,207.40		25,854.40
	Friday 12 June 2020	LD154	FPMC B 102	12 June 2020										8,513.00		8,513.00
		LD190	Blue Ridge	12 June 2020			8,423.60									8,423.60
		LD362	Corona Brave	12 June 2020			9,157.60									9,157.60
		Summary of Friday 12 June 2020					17,581.20							8,513.00		26,094.20
	Saturday 13	LD174	Blue Ridge	13 June 2020			8,552.80					0.00				8,552.80

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	June 2020	LD286	Shin Sanyo Maru	14 June 2020										8,148.80		8,148.80
		LD328	Blue Ridge	13 June 2020						9,204.20		0.00				9,204.20
		Summary of Saturday 13 June 2020					8,552.80			9,204.20		0.00		8,148.80		25,905.80
	Sunday 14 June 2020	LD220	China Steel Prestige	14 June 2020										8,993.00		8,993.00
		Summary of Sunday 14 June 2020												8,993.00		8,993.00
	Monday 15 June 2020	LD130	Shin Sanyo Maru	15 June 2020										9,174.20		9,174.20
		LD288	China Steel Prestige	16 June 2020			4,507.63							4,337.97		8,845.60
		Summary of Monday 15 June 2020					4,507.63							13,512.17		18,019.80
	Tuesday 16 June 2020	LD132	Robin Wind	16 June 2020			8,991.40					0.00				8,991.40
		LD362	Robin Wind	16 June 2020						8,397.80		0.00				8,397.80
		Summary of Tuesday 16 June 2020					8,991.40			8,397.80		0.00				17,389.20
	Wednesday 17 June 2020	LD116	China Steel Prestige	17 June 2020			0.00							8,255.20		8,255.20
		LD290	Robin Wind	18 June 2020						8,877.20		0.00				8,877.20
		Summary of Wednesday 17 June 2020					0.00			8,877.20		0.00		8,255.20		17,132.40
	Thursday 18 June 2020	LD178	NSU Young Star	18 June 2020								1,619.65		7,197.55		8,817.20
		Summary of Thursday 18 June 2020										1,619.65		7,197.55		8,817.20
	Friday 19 June 2020	LD230	Kiyo	20 June 2020						8,480.80		0.00				8,480.80
		Summary of Friday 19 June 2020								8,480.80		0.00				8,480.80
	Sunday 21 June 2020	LD242	China Steel Innovator	22 June 2020			4,222.15							4,764.85		8,987.00
		Summary of Sunday 21 June 2020					4,222.15							4,764.85		8,987.00
	Monday 22 June 2020	LD132	NSU Quest	22 June 2020			8,950.00									8,950.00
		LD162	NSU Quest	22 June 2020			8,490.40									8,490.40
		LD298	China Steel Innovator	22 June 2020										8,722.20		8,722.20
		LD306	China Steel Innovator	23 June 2020					4,530.79					4,375.21		8,906.00
		Summary of Monday 22 June 2020					17,440.40		4,530.79					13,097.41		35,068.60
	Tuesday 23 June 2020	LD228	NSU Young Star	23 June 2020			9,222.00									9,222.00
		LD344	Star Nina	23 June 2020						1,741.02				6,539.58		8,280.60
		LD378	NSU Quest	23 June 2020			8,812.00									8,812.00
		Summary of Tuesday 23 June 2020					18,034.00			1,741.02				6,539.58		26,314.60
	Wednesday 24 June 2020	LD104	NSU Young Star	24 June 2020			8,463.00									8,463.00
		Summary of Wednesday 24 June 2020					8,463.00									8,463.00

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Thursday 25 June 2020	LD102	NSU Young Star	25 June 2020			2,670.49		5,623.11							8,293.60
		LD308	NSU Young Star	25 June 2020					8,644.40							8,644.40
		Summary of Thursday 25 June 2020					2,670.49		14,267.51							16,938.00
	Friday 26 June 2020	LD152	Kachidoki	26 June 2020			8,463.00									8,463.00
		LD226	New Admire	26 June 2020						9,072.00						9,072.00
		Summary of Friday 26 June 2020					8,463.00			9,072.00						17,535.00
	Saturday 27 June 2020	LD128	Kachidoki	27 June 2020					7,904.24	1,198.76						9,103.00
		LD200	New Admire	27 June 2020					1,169.86					7,652.14		8,822.00
		LD270	Corona Ace	28 June 2020			0.00			8,351.80						8,351.80
		LD326	Kachidoki	27 June 2020			8,517.60									8,517.60
		Summary of Saturday 27 June 2020					8,517.60		9,074.10	9,550.56				7,652.14		34,794.40
	Sunday 28 June 2020	LD112	Brilliant Jupiter	28 June 2020						8,525.60						8,525.60
		LD154	Brilliant Jupiter	28 June 2020			5,095.32							3,968.28		9,063.60
		LD214	New Admire	29 June 2020						9,047.40						9,047.40
		LD294	Hisui Horizon	29 June 2020			8,531.60									8,531.60
		Summary of Sunday 28 June 2020					13,626.92			17,573.00				3,968.28		35,168.20
	Monday 29 June 2020	LD258	Hisui Horizon	30 June 2020			5,999.35			3,225.05						9,224.40
		Summary of Monday 29 June 2020					5,999.35			3,225.05						9,224.40
	Tuesday 30 June 2020	LD128	Century Wave	30 June 2020										8,917.20		8,917.20
		Summary of Tuesday 30 June 2020												8,917.20		8,917.20
	Wednesday 01 July 2020	LD216	Hisui Horizon	1 July 2020			3,839.87		5,256.33							9,096.20
		LD264	Century Wave	2 July 2020			8,167.00									8,167.00
		LD320	New Admire	1 July 2020			3,021.35			5,906.65						8,928.00
		Summary of Wednesday 01 July 2020					15,028.22		5,256.33	5,906.65						26,191.20
	Thursday 02 July 2020	LD106	Shoryu	2 July 2020						9,201.40						9,201.40
		LD346	Brilliant Jupiter	2 July 2020			2,110.88		4,470.24	2,476.27						9,057.40
		Summary of Thursday 02 July 2020					2,110.88		4,470.24	11,677.67						18,258.80
	Friday 03 July 2020	LD278	Century Wave	4 July 2020			5,015.46			3,204.14						8,219.60
		LD358	Century Wave	3 July 2020			4,996.45			3,966.35						8,962.80
		Summary of Friday 03 July 2020					10,011.91			7,170.49						17,182.40
	Saturday 04 July 2020	LD134	Orange Truth	4 July 2020						9,229.00						9,229.00
		Summary of Saturday 04 July 2020								9,229.00						9,229.00
	Sunday 05 July 2020	LD240	Orange Truth	5 July 2020			9,107.60									9,107.60
		LD294	Orange Truth	6 July 2020			9,199.40									9,199.40
		Summary of Sunday 05 July 2020					18,307.00									18,307.00
	Tuesday 07 July 2020	LD360	Orange Truth	7 July 2020						4,929.79				4,132.41		9,062.20
		Summary of Tuesday 07 July 2020								4,929.79				4,132.41		9,062.20

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Sunday 12 July 2020	LD268	Golden Kathrine	13 July 2020						9,105.20						9,105.20
		Summary of Sunday 12 July 2020								9,105.20						9,105.20
	Monday 13 July 2020	LD118	Golden Kathrine	13 July 2020			3,770.13			5,434.07						9,204.20
		LD372	Global Venus	13 July 2020			2,687.66			6,499.34						9,187.00
		Summary of Monday 13 July 2020					6,457.79			11,933.41						18,391.20
	Wednesday 15 July 2020	LD220	Pacific Maru	15 July 2020			8,121.20									8,121.20
		LD288	Pacific Maru	16 July 2020			9,188.80									9,188.80
		Summary of Wednesday 15 July 2020					17,310.00									17,310.00
	Thursday 16 July 2020	LD278	Pacific Maru	16 July 2020			4,461.01			4,548.39						9,009.40
		LD370	Pacific Maru	16 July 2020			8,328.20									8,328.20
		Summary of Thursday 16 July 2020					12,789.21			4,548.39						17,337.60
	Sunday 19 July 2020	LD348	Pacific Maru	19 July 2020			6,071.08			3,019.52						9,090.60
		Summary of Sunday 19 July 2020					6,071.08			3,019.52						9,090.60
	Monday 20 July 2020	LD260	Pacific Oak	21 July 2020			9,029.40									9,029.40
		LD348	Unta	20 July 2020			8,515.00									8,515.00
		Summary of Monday 20 July 2020					17,544.40									17,544.40
	Tuesday 21 July 2020	LD254	Unta	21 July 2020						9,246.20						9,246.20
		LD382	Pacific Oak	21 July 2020			9,045.80									9,045.80
		Summary of Tuesday 21 July 2020					9,045.80			9,246.20						18,292.00
	Wednesday 22 July 2020	LD150	Pacific Oak	23 July 2020			9,165.80									9,165.80
		Summary of Wednesday 22 July 2020					9,165.80									9,165.80
	Thursday 23 July 2020	LD258	Pacific Oak	24 July 2020						9,061.60						9,061.60
		Summary of Thursday 23 July 2020								9,061.60						9,061.60
	Friday 24 July 2020	LD224	Pacific Oak	24 July 2020						9,080.60						9,080.60
		Summary of Friday 24 July 2020								9,080.60						9,080.60
	Saturday 25 July 2020	LD122	Pacific Oak	25 July 2020						9,067.20						9,067.20
		Summary of Saturday 25 July 2020								9,067.20						9,067.20
	Sunday 26 July 2020	LD142	Pacific Oak	26 July 2020			9,171.00									9,171.00
		Summary of Sunday 26 July 2020					9,171.00									9,171.00
	Friday 31 July 2020	LD120	Ocean Tianbo	31 July 2020										8,721.80		8,721.80
		LD288	Ormond	31 July 2020				8,447.20								8,447.20
		LD302	Pacific Oak	1 August 2020					8,561.60							8,561.60
		Summary of Friday 31 July 2020						8,447.20	8,561.60					8,721.80		25,730.60
	Saturday 01 August 2020	LD150	Tachibana II	1 August 2020						8,763.00						8,763.00
		LD274	Tachibana II	2 August 2020				8,928.00								8,928.00
		LD336	Ocean Tianbo	1 August 2020				4,161.11						4,446.49		8,607.60
		Summary of Saturday 01 August 2020						13,089.11		8,763.00				4,446.49		26,298.60

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Sunday 02 August 2020	LD364	Ormond	2 August 2020				7,182.48						1,151.92		8,334.40
		Summary of Sunday 02 August 2020						7,182.48						1,151.92		8,334.40
	Thursday 13 August 2020	LD132	Orange Truth	13 August 2020			7,117.61			1,904.79						9,022.40
		LD310	NSU Young Star	13 August 2020			4,372.17			4,144.43						8,516.60
		Summary of Thursday 13 August 2020					11,489.78			6,049.22						17,539.00
	Friday 14 August 2020	LD276	Orange Truth	15 August 2020			4,285.10			4,252.70						8,537.80
		LD322	Orange Truth	14 August 2020			4,223.31			4,316.29						8,539.60
		LD368	Orange Truth	14 August 2020			4,105.80			4,525.60						8,631.40
		Summary of Friday 14 August 2020					12,614.21			13,094.59						25,708.80
	Saturday 15 August 2020	LD134	NSU Keystone	15 August 2020			9,032.00									9,032.00
		LD216	Orange Truth	15 August 2020			4,263.64		4,234.76	0.00						8,498.40
		Summary of Saturday 15 August 2020					13,295.64		4,234.76	0.00						17,530.40
	Sunday 16 August 2020	LD130	NSU Keystone	16 August 2020			8,609.20									8,609.20
		LD180	China Steel Integrity	16 August 2020			8,538.00									8,538.00
		LD292	NSU Keystone	17 August 2020				9,048.40								9,048.40
		LD346	Orange Truth	16 August 2020					3,745.55	4,713.65						8,459.20
		Summary of Sunday 16 August 2020					17,147.20	9,048.40	3,745.55	4,713.65						34,654.80
	Monday 17 August 2020	LD130	Kachidoki	17 August 2020					8,073.10			1,027.90				9,101.00
		LD226	Kachidoki	17 August 2020			7,377.65					1,087.95				8,465.60
		LD306	Kachidoki	18 August 2020				6,779.84				1,069.16				7,849.00
		LD346	NSU Keystone	17 August 2020					8,429.20							8,429.20
		Summary of Monday 17 August 2020					7,377.65	6,779.84	16,502.30			3,185.02				33,844.80
	Tuesday 18 August 2020	LD126	Kachidoki	18 August 2020					8,008.79			1,020.01				9,028.80
		LD190	Pan Dangjin	18 August 2020						9,136.20						9,136.20
		LD306	Pan Dangjin	19 August 2020						8,303.60						8,303.60
		LD372	Kachidoki	18 August 2020				4,267.55		4,151.25						8,418.80

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Tuesday 18 August 2020						4,267.55	8,008.79	21,591.05		1,020.01				34,887.40
	Sunday 23 August 2020	LD168	Ishizuchi II	23 August 2020				9,142.00								9,142.00
		Summary of Sunday 23 August 2020						9,142.00								9,142.00
	Wednesday 26 August 2020	LD246	Adonis	27 August 2020					4,613.97	4,401.43						9,015.40
		LD364	Adonis	26 August 2020						8,722.60						8,722.60
		Summary of Wednesday 26 August 2020							4,613.97	13,124.03						17,738.00
	Thursday 27 August 2020	LD108	Western Marine	27 August 2020						9,174.80						9,174.80
		LD230	Hyundai Komipo	27 August 2020						9,037.60						9,037.60
		LD364	Hyundai Komipo	27 August 2020						8,551.80						8,551.80
		Summary of Thursday 27 August 2020								26,764.20						26,764.20
	Saturday 29 August 2020	LD196	Western Marine	29 August 2020						8,711.60						8,711.60
		Summary of Saturday 29 August 2020								8,711.60						8,711.60
	Sunday 30 August 2020	LD154	Hille Oldendorff	30 August 2020	2,862.13					4,909.67						7,771.80
		LD226	Hille Oldendorff	30 August 2020			8,498.60									8,498.60
		LD280	Hille Oldendorff	31 August 2020			9,089.60									9,089.60
		Summary of Sunday 30 August 2020			2,862.13		17,588.20			4,909.67						25,360.00
	Monday 31 August 2020	LD246	Hille Oldendorff	1 September 2020	2,122.19				6,353.81							8,476.00
		Summary of Monday 31 August 2020			2,122.19				6,353.81							8,476.00
	Tuesday 01 September 2020	LD132	Hille Oldendorff	1 September 2020						9,210.20						9,210.20
		LD368	Hille Oldendorff	1 September 2020					9,021.40							9,021.40
		Summary of Tuesday 01 September 2020							9,021.40	9,210.20						18,231.60
	Wednesday 02 September 2020	LD138	Hille Oldendorff	2 September 2020						9,167.40						9,167.40
		LD286	Hille Oldendorff	3 September 2020	8,837.00					0.00						8,837.00
		Summary of Wednesday 02 September 2020			8,837.00					9,167.40						18,004.40
	Thursday 03 September 2020	LD262	Hille Oldendorff	3 September 2020						8,605.40						8,605.40
		Summary of Thursday 03 September 2020								8,605.40						8,605.40

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Friday 04 September 2020	LD108	Cemtex Diligence	4 September 2020			8,578.00									8,578.00
		LD278	Panasiatic	4 September 2020						9,083.80						9,083.80
		LD326	Panasiatic	4 September 2020						8,220.60						8,220.60
		Summary of Friday 04 September 2020					8,578.00			17,304.40						25,882.40
	Sunday 06 September 2020	LD274	Corona Utility	7 September 2020						9,186.40						9,186.40
		Summary of Sunday 06 September 2020								9,186.40						9,186.40
	Friday 11 September 2020	LD106	Sea Hope	11 September 2020			8,244.40									8,244.40
		LD188	Juno Horizon	11 September 2020			1,384.02		7,755.58							9,139.60
		Summary of Friday 11 September 2020					9,628.42		7,755.58							17,384.00
	Saturday 12 September 2020	LD226	Juno Horizon	12 September 2020	2,710.68				0.00	6,361.92						9,072.60
		Summary of Saturday 12 September 2020			2,710.68				0.00	6,361.92						9,072.60
	Sunday 13 September 2020	LD160	Sea Hope	13 September 2020		1,364.24			7,059.16							8,423.40
		LD242	Juno Horizon	13 September 2020						7,338.00		1,098.40				8,436.40
		Summary of Sunday 13 September 2020				1,364.24			7,059.16	7,338.00		1,098.40				16,859.80
	Monday 14 September 2020	LD148	Corona Ace	14 September 2020						8,527.60						8,527.60
		LD320	Juno Horizon	14 September 2020						9,158.80						9,158.80
		Summary of Monday 14 September 2020								17,686.40						17,686.40
	Tuesday 15 September 2020	LD170	Corona Ace	15 September 2020		1,295.28				7,193.12						8,488.40
		LD324	Corona Ace	15 September 2020						8,455.20						8,455.20
		Summary of Tuesday 15 September 2020				1,295.28				15,648.32						16,943.60
	Wednesday 16 September 2020	LD156	Corona Ace	16 September 2020		8,456.60										8,456.60
		Summary of Wednesday 16 September 2020				8,456.60										8,456.60
	Thursday 17 September 2020	LD214	United Future	18 September 2020					9,194.20							9,194.20
		LD306	Corona Ace	17 September 2020						8,558.60						8,558.60
		Summary of Thursday 17 September 2020							9,194.20	8,558.60						17,752.80

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Friday 18 September 2020	LD154	GL Iguazu	18 September 2020	8,624.00											8,624.00
		LD230	GL Iguazu	18 September 2020			9,159.40									9,159.40
		LD318	United Future	18 September 2020					8,330.00							8,330.00
		LD382	United Future	18 September 2020	9,234.40											9,234.40
		Summary of Friday 18 September 2020			17,858.40		9,159.40		8,330.00							35,347.80
	Saturday 19 September 2020	LD258	GL Iguazu	19 September 2020					8,712.80							8,712.80
		LD332	GL Iguazu	19 September 2020	8,534.20											8,534.20
		Summary of Saturday 19 September 2020			8,534.20				8,712.80							17,247.00
	Sunday 20 September 2020	LD118	United Future	20 September 2020					9,125.40							9,125.40
		LD288	GL Iguazu	21 September 2020			6,339.02		2,193.78							8,532.80
		Summary of Sunday 20 September 2020					6,339.02		11,319.18							17,658.20
	Monday 21 September 2020	LD186	NSU Zenith	21 September 2020					8,576.40							8,576.40
		LD226	NSU Zenith	21 September 2020		7,139.00						1,273.00				8,412.00
		LD364	United Future	21 September 2020					2,202.79	6,889.21						9,092.00
		Summary of Monday 21 September 2020				7,139.00			10,779.19	6,889.21		1,273.00				26,080.40
	Tuesday 22 September 2020	LD264	NSU Zenith	22 September 2020						4,356.41		1,433.79				5,790.20
		Summary of Tuesday 22 September 2020								4,356.41		1,433.79				5,790.20
	Saturday 26 September 2020	LD204	Tachibana II	26 September 2020			8,479.40									8,479.40
		Summary of Saturday 26 September 2020					8,479.40									8,479.40
	Sunday 27 September 2020	LD178	Sakura Wave	27 September 2020					8,490.40							8,490.40
		LD314	Energia Centaurus	28 September 2020						9,175.80						9,175.80
		Summary of Sunday 27 September 2020							8,490.40	9,175.80						17,666.20
	Monday 28 September 2020	LD216	Asahi Maru	28 September 2020			8,606.20									8,606.20
		LD278	SBI Ursa	29 September 2020					8,601.20							8,601.20
		LD360	Asahi Maru	28 September 2020			5,531.93	3,575.07								9,107.00

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Monday 28 September 2020					14,138.13	3,575.07	8,601.20							26,314.40
	Tuesday 29 September 2020	LD168	Asahi Maru	29 September 2020						8,351.20						8,351.20
		LD262	SBI Ursa	29 September 2020					9,157.00							9,157.00
		LD288	Asahi Maru	30 September 2020				6,880.82		2,180.98						9,061.80
		Summary of Tuesday 29 September 2020						6,880.82	9,157.00	10,532.18						26,570.00
	Wednesday 30 September 2020	LD248	Pan Dangjin	30 September 2020					8,582.80							8,582.80
		Summary of Wednesday 30 September 2020							8,582.80							8,582.80
	Thursday 01 October 2020	LD168	Pan Dangjin	1 October 2020					9,067.80							9,067.80
		LD258	Pan Dangjin	1 October 2020					8,236.40							8,236.40
		LD374	Pan Dangjin	1 October 2020					9,117.00							9,117.00
		Summary of Thursday 01 October 2020							26,421.20							26,421.20
	Friday 02 October 2020	LD126	Ishizuchi II	2 October 2020				8,159.00								8,159.00
		LD258	Pan Dangjin	2 October 2020					9,216.60							9,216.60
		LD282	Pan Dangjin	3 October 2020					8,498.00							8,498.00
		LD338	Ishizuchi II	2 October 2020					8,582.60							8,582.60
		Summary of Friday 02 October 2020						8,159.00	26,297.20							34,456.20
	Saturday 03 October 2020	LD158	HL Richards Bay	3 October 2020					6,684.31			2,004.49				8,688.80
		LD240	HL Richards Bay	3 October 2020					7,027.61			2,079.79				9,107.40
		LD344	Star Piera	3 October 2020				9,039.80								9,039.80
		Summary of Saturday 03 October 2020						9,039.80	13,711.92			4,084.28				26,836.00
	Sunday 04 October 2020	LD156	Nirai	4 October 2020				4,932.62		3,634.78						8,567.40
		LD254	Lowlands Comfort	4 October 2020				9,069.20								9,069.20
		LD326	Corona Zenith	4 October 2020					9,201.20							9,201.20
		Summary of Sunday 04 October 2020						14,001.82	9,201.20	3,634.78						26,837.80
	Monday 05 October 2020	LD184	Lowlands Comfort	5 October 2020				9,135.40								9,135.40

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		LD254	Medi Tokyo	5 October 2020				8,540.60								8,540.60
		LD310	Corona Zenith	6 October 2020					9,220.40							9,220.40
		Summary of Monday 05 October 2020						17,676.00	9,220.40							26,896.40
	Tuesday 06 October 2020	LD108	Lowlands Comfort	6 October 2020				9,070.00								9,070.00
		LD230	Lowlands Comfort	6 October 2020				993.60		8,048.20						9,041.80
		LD282	Medi Tokyo	7 October 2020				9,061.00								9,061.00
		Summary of Tuesday 06 October 2020						19,124.60		8,048.20						27,172.80
	Wednesday 07 October 2020	LD108	Santa Isabel	7 October 2020				9,075.80								9,075.80
		LD168	Medi Tokyo	8 October 2020				9,110.00								9,110.00
		Summary of Wednesday 07 October 2020						18,185.80								18,185.80
	Friday 09 October 2020	LD132	Shin Sanyo Maru	9 October 2020		8,663.00										8,663.00
		LD192	Shin Sanyo Maru	9 October 2020		4,952.85			4,228.15							9,181.00
		LD230	Corona Youthful	9 October 2020		9,292.20										9,292.20
		LD344	Santa Isabel	9 October 2020		4,416.30			4,295.10							8,711.40
		Summary of Friday 09 October 2020				27,324.35			8,523.25							35,847.60
	Saturday 10 October 2020	LD124	Shin Sanyo Maru	10 October 2020			9,200.00									9,200.00
		LD220	Brilliant Jupiter	10 October 2020		8,632.60										8,632.60
		LD272	CSC Victor	11 October 2020		4,000.97		5,249.23								9,250.20
		LD344	Hyundai Samcheonpo	10 October 2020					8,526.40							8,526.40
		Summary of Saturday 10 October 2020				12,633.57	9,200.00	5,249.23	8,526.40							35,609.20
	Sunday 11 October 2020	LD156	Hyundai Samcheonpo	11 October 2020					6,934.46			1,560.34				8,494.80
		LD252	Brilliant Jupiter	11 October 2020				8,145.08				1,070.32				9,215.40
		LD348	Shin Sanyo Maru	11 October 2020					8,673.00							8,673.00
		Summary of Sunday 11 October 2020						8,145.08	15,607.46			2,630.66				26,383.20
	Monday 12 October 2020	LD274	Brilliant Jupiter	12 October 2020				3,251.81	4,359.47			1,074.73				8,686.00

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		LD346	Brilliant Jupiter	12 October 2020			4,466.98			4,643.42						9,110.40
		Summary of Monday 12 October 2020					4,466.98	3,251.81	4,359.47	4,643.42		1,074.73				17,796.40
	Tuesday 13 October 2020	LD134	Pacific Maru	13 October 2020					9,168.40							9,168.40
		LD240	Sincere Pisces	13 October 2020			9,224.80									9,224.80
		LD322	Adonis	14 October 2020					8,570.60							8,570.60
		LD348	Sincere Pisces	13 October 2020						9,174.40						9,174.40
		Summary of Tuesday 13 October 2020					9,224.80		17,739.00	9,174.40						36,138.20
	Wednesday 14 October 2020	LD138	Adonis	14 October 2020					9,220.60							9,220.60
		LD216	CSC Victor	14 October 2020		7,802.38			1,259.62							9,062.00
		LD272	Sincere Pisces	15 October 2020				979.45		6,873.15						7,852.60
		Summary of Wednesday 14 October 2020				7,802.38		979.45	10,480.22	6,873.15						26,135.20
	Thursday 15 October 2020	LD138	Pacific Maru	15 October 2020				9,203.00								9,203.00
		LD374	Pacific Maru	15 October 2020				5,566.22				3,458.78				9,025.00
		Summary of Thursday 15 October 2020						14,769.22				3,458.78				18,228.00
	Saturday 17 October 2020	LD298	Pacific Maru	18 October 2020		8,496.00										8,496.00
		Summary of Saturday 17 October 2020				8,496.00										8,496.00
	Monday 19 October 2020	LD132	Jia May	19 October 2020				9,209.80								9,209.80
		LD184	Metis Horizon	19 October 2020			8,963.40									8,963.40
		LD252	Golden Crown	19 October 2020		8,747.20										8,747.20
		LD298	Jia May	20 October 2020			4,532.09	4,652.71								9,184.80
		Summary of Monday 19 October 2020				8,747.20	13,495.49	13,862.51								36,105.20
	Tuesday 20 October 2020	LD152	Golden Crown	20 October 2020			4,287.63			4,316.17						8,603.80
		Summary of Tuesday 20 October 2020					4,287.63			4,316.17						8,603.80
	Wednesday 21 October 2020	LD102	Metis Horizon	21 October 2020					2,987.37	2,879.80		2,824.43				8,691.60
		Summary of Wednesday 21 October 2020							2,987.37	2,879.80		2,824.43				8,691.60

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Thursday 22 October 2020	LD232	Golden Crown	22 October 2020						7,480.23		1,706.17				9,186.40
		LD360	Jia May	22 October 2020				3,531.94		5,691.06						9,223.00
		Summary of Thursday 22 October 2020						3,531.94		13,171.29		1,706.17				18,409.40
	Sunday 25 October 2020	LD132	Oceanic Power	25 October 2020							8,316.00					8,316.00
		Summary of Sunday 25 October 2020									8,316.00					8,316.00
	Monday 26 October 2020	LD122	Oceanic Power	26 October 2020				8,698.20								8,698.20
		LD328	Oceanic Power	27 October 2020				8,410.80								8,410.80
		Summary of Monday 26 October 2020						17,109.00								17,109.00
	Wednesday 28 October 2020	LD168	Oceanic Power	28 October 2020				9,200.80								9,200.80
		LD224	Oceanic Power	29 October 2020							8,531.60					8,531.60
		LD304	Oceanic Power	29 October 2020			3,620.06				4,715.34					8,335.40
		Summary of Wednesday 28 October 2020					3,620.06	9,200.80			13,246.94					26,067.80
	Monday 02 November 2020	LD250	United Future	3 November 2020						5,987.06		2,512.14				8,499.20
		Summary of Monday 02 November 2020								5,987.06		2,512.14				8,499.20
	Tuesday 03 November 2020	LD108	United Future	3 November 2020					8,592.80							8,592.80
		Summary of Tuesday 03 November 2020							8,592.80							8,592.80
	Thursday 05 November 2020	LD188	United Future	5 November 2020				2,855.42	1,772.33		3,840.05					8,467.80
		LD346	Pegasus Island	5 November 2020				5,213.58	3,886.42							9,100.00
		Summary of Thursday 05 November 2020						8,069.00	5,658.75		3,840.05					17,567.80
	Friday 06 November 2020	LD150	Sea Pearl	6 November 2020							9,144.60					9,144.60
		LD282	Pegasus Island	7 November 2020				4,467.21		1,855.92	2,056.87					8,380.00
		Summary of Friday 06 November 2020						4,467.21		1,855.92	11,201.47					17,524.60
	Saturday 07 November 2020	LD156	Sincere Pisces	7 November 2020			3,357.15			5,651.85						9,009.00
		Summary of Saturday 07 November 2020					3,357.15			5,651.85						9,009.00
	Tuesday 10 November 2020	LD282	Anikitos	11 November 2020		9,197.80										9,197.80
		Summary of Tuesday 10 November 2020				9,197.80										9,197.80

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
	Wednesday 11 November 2020	LD160	Louisiana Mama	11 November 2020			8,436.80									8,436.80
		Summary of Wednesday 11 November 2020					8,436.80									8,436.80
	Thursday 12 November 2020	LD172	Anikitos	12 November 2020		4,402.38	4,252.62									8,655.00
		LD382	Louisiana Mama	12 November 2020			8,523.80									8,523.80
		Summary of Thursday 12 November 2020				4,402.38	12,776.42									17,178.80
	Friday 13 November 2020	LD234	Corona Infinity	13 November 2020			9,134.00									9,134.00
		LD386	Louisiana Mama	13 November 2020			8,525.60									8,525.60
		Summary of Friday 13 November 2020					17,659.60									17,659.60
	Saturday 14 November 2020	LD186	Scarlet Albatross	14 November 2020											8,526.40	8,526.40
		LD360	Scarlet Albatross	14 November 2020			9,053.20									9,053.20
		Summary of Saturday 14 November 2020					9,053.20								8,526.40	17,579.60
	Sunday 15 November 2020	LD110	Scarlet Albatross	15 November 2020						9,098.20						9,098.20
		LD306	Scarlet Albatross	16 November 2020		7,106.49									2,063.11	9,169.60
		Summary of Sunday 15 November 2020				7,106.49				9,098.20					2,063.11	18,267.80
	Sunday 22 November 2020	LD142	Shin Sanyo Maru	22 November 2020			9,050.00									9,050.00
		Summary of Sunday 22 November 2020					9,050.00									9,050.00
	Wednesday 25 November 2020	LD116	Chloe	25 November 2020			9,055.40									9,055.40
		LD130	Chloe	26 November 2020											9,073.40	9,073.40
		LD346	Chloe	25 November 2020			9,142.00									9,142.00
		Summary of Wednesday 25 November 2020					18,197.40								9,073.40	27,270.80
	Monday 30 November 2020	LD142	Hokuriku Maru	30 November 2020											8,882.20	8,882.20
		Summary of Monday 30 November 2020													8,882.20	8,882.20
	Tuesday 01 December 2020	LD120	Hokuriku Maru	1 December 2020			9,044.80									9,044.80
		Summary of Tuesday 01 December 2020					9,044.80									9,044.80
	Wednesday 02 December 2020	LD130	Corona Wisdom	2 December 2020			9,018.20									9,018.20

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Wednesday 02 December 2020					9,018.20									9,018.20
	Friday 04 December 2020	LD112	Akatsuki	4 December 2020			8,528.00									8,528.00
		LD232	Energia Centaurus	4 December 2020						4,164.26					4,115.54	8,279.80
		Summary of Friday 04 December 2020					8,528.00			4,164.26					4,115.54	16,807.80
	Saturday 05 December 2020	LD120	Dream Star	5 December 2020											9,071.80	9,071.80
		Summary of Saturday 05 December 2020													9,071.80	9,071.80
	Sunday 06 December 2020	LD154	Akatsuki	6 December 2020			6,866.16								2,189.24	9,055.40
		LD346	Dream Star	6 December 2020			8,975.80									8,975.80
		Summary of Sunday 06 December 2020					15,841.96								2,189.24	18,031.20
	Monday 07 December 2020	LD132	Dream Star	7 December 2020					8,291.40							8,291.40
		LD250	Dream Star	8 December 2020			3,133.77		3,278.97	2,053.66						8,466.40
		Summary of Monday 07 December 2020					3,133.77		11,570.37	2,053.66						16,757.80
	Thursday 17 December 2020	LD234	Global Talent	17 December 2020		4,574.65		93.50							4,574.65	9,242.80
		LD386	Global Talent	17 December 2020											8,824.20	8,824.20
		Summary of Thursday 17 December 2020				4,574.65		93.50							13,398.85	18,067.00
	Friday 18 December 2020	LD108	Global Talent	18 December 2020						8,909.60						8,909.60
		LD278	Global Talent	19 December 2020			4,560.52		4,512.48							9,073.00
		Summary of Friday 18 December 2020					4,560.52		4,512.48	8,909.60						17,982.60
	Monday 21 December 2020	LD322	Global Talent	21 December 2020		8,941.40										8,941.40
		Summary of Monday 21 December 2020				8,941.40										8,941.40
	Sunday 27 December 2020	LD194	Mineral Yangfan	27 December 2020				8,939.40								8,939.40
		Summary of Sunday 27 December 2020						8,939.40								8,939.40
	Tuesday 29 December 2020	LD332	Shandong Peng Cheng	29 December 2020			8,480.00									8,480.00
		Summary of Tuesday 29 December 2020					8,480.00									8,480.00
	Wednesday 30 December 2020	LD156	NSU Zenith	30 December 2020		8,846.40										8,846.40
		LD252	NSU Zenith	31 December 2020		8,943.20										8,943.20

Freight Company	Depart Mine	Train No	Vessel Name	Arrive Port	LID10	LID10.5	LID11	LID12	LID12.5	LID14	LID14.5	LID22	LID8	LID9	LID9.5	Total
					Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	
		Summary of Wednesday 30 December 2020				17,789.60										17,789.60
	Thursday 31 December 2020	LD370	NSU Zenith	31 December 2020		8,205.00										8,205.00
		Summary of Thursday 31 December 2020				8,205.00										8,205.00
	Summary of Pacific National				42,924.60	230,466.93	1,232,620.00	480,129.79	627,630.97	690,515.63	36,604.46	139,774.60	20,309.57	337,544.74	57,320.53	3,895,841.80
Summary of Liddell Coal Marketing Pty Ltd					42,924.60	230,466.93	1,232,620.00	489,124.79	627,630.97	690,515.63	36,604.46	139,774.60	20,309.57	337,544.74	57,320.53	3,904,836.80
Grand Total					42,924.60	230,466.93	1,232,620.00	489,124.79	627,630.97	690,515.63	36,604.46	139,774.60	20,309.57	337,544.74	57,320.53	3,904,836.80

COAL UNLOADED DELTA

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

Coal Receivals total	3,904,836.80
Coal Unloaded delta Total:	
Adj Total:	3,904,836.8

unknown Thu Mar 11 2021 10:29:53 GMT+1100 (AEDT)

Appendix B - Meteorological Summary

Meteorological Summary			
Date Sampled	Average Air Temperature at 2m (°C)	Average Air Temperature at 10m (°C)	Daily Rain (mm)
01/01/2020	26.3	25.5	0.6
02/01/2020	23.9	22.9	0.4
03/01/2020	28.6	27.7	0
04/01/2020	35.0	34.5	0
05/01/2020	27.5	26.5	0
06/01/2020	22.9	21.8	0.6
07/01/2020	28.1	27.3	0
08/01/2020	28.3	27.4	3.8
09/01/2020	23.1	22.3	0
10/01/2020	30.8	30.0	0
11/01/2020	25.4	24.7	0.6
12/01/2020	22.0	21.0	0
13/01/2020	23.7	22.6	0
14/01/2020	25.1	24.1	0
15/01/2020	25.8	24.8	0
16/01/2020	23.5	23.0	8
17/01/2020	22.5	21.8	1.2
18/01/2020	20.8	20.1	19.4
19/01/2020	22.7	21.9	0.8
20/01/2020	27.0	26.4	8.6

Meteorological Summary			
21/01/2020	28.1	27.5	0
22/01/2020	28.9	28.3	0
23/01/2020	32.6	32.1	2.8
24/01/2020	27.6	27.0	8.6
25/01/2020	26.8	25.9	0
26/01/2020	29.0	28.3	0
27/01/2020	28.2	27.4	0
28/01/2020	29.8	29.2	0.8
29/01/2020	26.5	25.6	0
30/01/2020	27.2	26.2	0
31/01/2020	31.5	30.9	0
01/02/2020	35.3	34.8	0
02/02/2020	35.4	34.7	13.4
03/02/2020	28.5	27.8	0.2
04/02/2020	21.3	20.4	0
05/02/2020	22.5	21.7	0
06/02/2020	20.9	20.2	26
07/02/2020	20.9	20.1	19.4
08/02/2020	21.6	20.9	17.2
09/02/2020	21.9	21.3	35.8
10/02/2020	23.1	22.4	20.2
11/02/2020	25.0	24.3	0.2
12/02/2020	25.0	24.1	0
13/02/2020	24.3	23.5	0.4
14/02/2020	24.0	23.3	0

Meteorological Summary			
15/02/2020	23.9	23.3	15
16/02/2020	23.1	22.3	0.2
17/02/2020	22.1	21.4	7.4
18/02/2020	26.5	25.8	0
19/02/2020	25.7	25.1	3
20/02/2020	22.1	21.7	0
21/02/2020	22.4	21.6	0
22/02/2020	21.7	20.9	0
23/02/2020	22.5	21.7	0
24/02/2020	21.3	20.7	1.6
25/02/2020	24.4	23.8	0.2
26/02/2020	24.9	24.3	1
27/02/2020	22.1	21.5	0
28/02/2020	22.7	22.1	0
29/02/2020	22.5	21.8	0
01/03/2020	25.4	24.9	0
02/03/2020	28.5	28.1	0
03/03/2020	21.2	20.5	2.6
04/03/2020	22.8	22.1	0
05/03/2020	21.7	20.9	26.2
06/03/2020	25.2	24.4	3.2
07/03/2020	20.5	19.8	0.2
08/03/2020	19.6	18.9	0
09/03/2020	19.4	18.6	0
10/03/2020	19.8	19.1	0

Meteorological Summary			
11/03/2020	19.5	18.8	0
12/03/2020	20.0	19.3	0
13/03/2020	19.9	19.5	0
14/03/2020	16.9	16.3	5.4
15/03/2020	17.6	16.8	0
16/03/2020	18.3	17.4	1.8
17/03/2020	18.4	17.7	1
18/03/2020	19.4	19.2	0.2
19/03/2020	23.2	22.7	0
20/03/2020	26.5	25.8	0
21/03/2020	23.4	22.6	0
22/03/2020	23.3	22.6	0
23/03/2020	20.4	19.7	0
24/03/2020	20.5	19.8	0
25/03/2020	19.3	19.0	18.6
26/03/2020	17.9	17.2	14.8
27/03/2020	18.9	18.2	0
28/03/2020	17.8	17.2	0
29/03/2020	21.5	20.7	0
30/03/2020	20.0	19.5	5
31/03/2020	22.2	21.6	0
01/04/2020	21.9	21.2	0
02/04/2020	20.4	19.7	8.6
03/04/2020	21.6	21.0	26.2
04/04/2020	22.0	21.3	21.8

Meteorological Summary			
05/04/2020	18.9	18.2	0
06/04/2020	18.9	18.3	0
07/04/2020	18.2	17.5	0
08/04/2020	17.9	17.1	0
09/04/2020	18.0	17.3	0
10/04/2020	18.5	17.8	9.6
11/04/2020	20.5	19.9	0
12/04/2020	16.5	16.1	0
13/04/2020	16.4	16.2	0
14/04/2020	18.4	18.2	0
15/04/2020	21.2	20.8	0
16/04/2020	23.4	22.8	0
17/04/2020	23.0	22.5	6.6
18/04/2020	17.8	17.4	0
19/04/2020	16.1	16.0	0
20/04/2020	17.8	17.2	0
21/04/2020	20.6	20.0	0
22/04/2020	21.0	20.4	0
23/04/2020	18.9	18.4	0
24/04/2020	21.6	20.9	0
25/04/2020	20.3	20.0	0
26/04/2020	21.9	21.3	0
27/04/2020	19.2	18.5	0
28/04/2020	18.8	18.2	0.2
29/04/2020	22.0	21.5	0

Meteorological Summary			
30/04/2020	16.9	16.5	12.6
01/05/2020	13.5	12.7	0
02/05/2020	14.7	13.9	0
03/05/2020	14.2	13.7	0
04/05/2020	13.5	13.0	0
05/05/2020	14.4	13.9	0
06/05/2020	15.9	15.3	0
07/05/2020	17.0	16.3	0
08/05/2020	19.3	18.9	0
09/05/2020	18.6	18.2	0
10/05/2020	14.7	14.0	0
11/05/2020	11.5	11.2	0
12/05/2020	12.3	12.0	0
13/05/2020	13.6	13.1	0
14/05/2020	12.6	12.4	0
15/05/2020	14.4	13.7	0
16/05/2020	14.9	14.4	0.2
17/05/2020	14.6	14.3	0.2
18/05/2020	15.0	14.4	0
19/05/2020	14.9	14.4	0.2
20/05/2020	17.5	17.0	0
21/05/2020	16.0	15.4	7.4
22/05/2020	13.4	12.6	0
23/05/2020	11.8	11.0	2.2
24/05/2020	14.0	13.4	1.2

Meteorological Summary			
25/05/2020	14.1	13.4	12
26/05/2020	15.0	14.5	1.4
27/05/2020	14.7	14.2	0.2
28/05/2020	15.2	14.7	0.2
29/05/2020	14.9	14.4	0
30/05/2020	14.2	13.8	0
31/05/2020	15.9	15.6	0
01/06/2020	17.0	16.5	0
02/06/2020	11.0	10.1	0
03/06/2020	13.7	13.1	0
04/06/2020	12.2	11.9	0
05/06/2020	12.7	12.1	0
06/06/2020	12.4	12.0	0
07/06/2020	11.8	11.4	0
08/06/2020	13.5	13.1	0
09/06/2020	14.1	13.3	3
10/06/2020	15.5	14.7	2.6
11/06/2020	16.3	15.6	0.2
12/06/2020	15.3	14.7	0
13/06/2020	15.3	14.7	0
14/06/2020	16.0	15.3	21.8
15/06/2020	14.2	13.5	0
16/06/2020	14.5	13.7	0
17/06/2020	14.2	13.3	4.2
18/06/2020	14.2	13.6	0.2

Meteorological Summary			
19/06/2020	12.0	11.8	0.2
20/06/2020	13.2	12.8	0.2
21/06/2020	13.5	13.1	7.4
22/06/2020	12.6	11.9	0
23/06/2020	11.9	11.1	0
24/06/2020	12.9	12.1	0
25/06/2020	13.2	12.3	0
26/06/2020	12.6	12.0	0
27/06/2020	12.2	11.5	0
28/06/2020	12.7	12.1	0
29/06/2020	11.2	10.9	0
30/06/2020	11.4	11.3	0
01/07/2020	13.2	12.6	0
02/07/2020	17.4	16.8	0
03/07/2020	15.8	15.1	0
04/07/2020	11.9	11.1	0.4
05/07/2020	12.2	11.3	0
06/07/2020	10.9	10.5	0
07/07/2020	11.3	11.1	0
08/07/2020	12.9	12.2	1.4
09/07/2020	12.0	11.7	0
10/07/2020	13.0	12.5	1.8
11/07/2020	14.6	13.9	6.8
12/07/2020	14.6	13.9	1
13/07/2020	11.4	10.6	0

Meteorological Summary			
14/07/2020	12.1	11.4	1.6
15/07/2020	13.9	13.5	0
16/07/2020	12.6	12.1	0
17/07/2020	13.6	13.2	0
18/07/2020	13.5	13.0	0
19/07/2020	14.2	13.4	0
20/07/2020	14.4	13.7	0
21/07/2020	11.1	10.5	0
22/07/2020	10.5	10.0	0
23/07/2020	12.5	12.0	0
24/07/2020	11.5	11.0	0
25/07/2020	12.7	12.0	3.6
26/07/2020	13.6	12.8	27.2
27/07/2020	14.3	13.5	22.6
28/07/2020	12.8	12.1	20.2
29/07/2020	15.6	14.9	0
30/07/2020	13.9	13.4	0
31/07/2020	13.1	12.6	0
01/08/2020	11.9	11.5	0
02/08/2020	13.4	12.9	0
03/08/2020	14.1	13.4	0
04/08/2020	15.6	14.9	0
05/08/2020	11.6	10.8	0
06/08/2020	10.3	9.7	0
07/08/2020	10.3	9.6	5.2

Meteorological Summary			
08/08/2020	12.4	11.6	1
09/08/2020	11.2	10.3	5.2
10/08/2020	11.8	11.1	17.2
11/08/2020	13.3	12.6	0.2
12/08/2020	14.0	13.6	0
13/08/2020	17.1	16.7	1.2
14/08/2020	13.5	13.0	5.2
15/08/2020	14.9	14.2	0.2
16/08/2020	14.7	13.9	0
17/08/2020	14.2	13.4	0
18/08/2020	14.9	14.2	0
19/08/2020	16.2	15.7	0
20/08/2020	13.6	12.8	0
21/08/2020	14.0	13.3	0.6
22/08/2020	11.6	10.7	0.4
23/08/2020	11.5	10.6	0
24/08/2020	12.4	11.5	0
25/08/2020	10.4	9.8	0
26/08/2020	11.2	10.6	0
27/08/2020	13.7	12.9	0
28/08/2020	15.1	14.5	0
29/08/2020	13.3	13.2	0
30/08/2020	16.4	15.8	0
31/08/2020	17.7	17.1	0
01/09/2020	14.7	14.0	0

Meteorological Summary			
02/09/2020	16.3	15.9	0
03/09/2020	21.6	21.1	0
04/09/2020	23.1	22.5	1.8
05/09/2020	18.8	18.2	2.2
06/09/2020	15.3	14.9	1.2
07/09/2020	15.6	15.4	0
08/09/2020	17.5	17.3	0
09/09/2020	15.3	14.6	13.6
10/09/2020	13.7	12.9	4.8
11/09/2020	15.0	14.2	0
12/09/2020	15.2	14.8	0
13/09/2020	18.2	17.5	0
14/09/2020	18.8	18.0	0
15/09/2020	18.1	17.3	0
16/09/2020	19.5	19.1	0
17/09/2020	21.9	21.3	0
18/09/2020	17.2	16.4	0
19/09/2020	20.2	19.4	0
20/09/2020	17.7	17.1	8.6
21/09/2020	20.5	19.9	16.4
22/09/2020	21.6	21.0	0.2
23/09/2020	18.8	18.0	0
24/09/2020	16.4	15.7	0
25/09/2020	15.5	14.8	0.6
26/09/2020	12.4	11.5	0

Meteorological Summary			
27/09/2020	13.6	12.9	0
28/09/2020	14.4	13.9	0
29/09/2020	14.2	13.7	0
30/09/2020	14.5	14.2	0
01/10/2020	18.8	18.1	0.2
02/10/2020	18.6	18.4	0
03/10/2020	20.3	20.1	0
04/10/2020	21.9	21.9	0
05/10/2020	23.7	23.2	0
06/10/2020	19.1	18.4	0
07/10/2020	19.9	19.1	0
08/10/2020	23.1	22.5	0
09/10/2020	19.5	18.7	0
10/10/2020	19.5	19.0	0
11/10/2020	19.7	19.4	0
12/10/2020	20.0	19.6	0
13/10/2020	21.1	20.8	0
14/10/2020	19.5	18.7	0
15/10/2020	21.7	20.9	0
16/10/2020	21.5	20.7	0
17/10/2020	23.4	22.8	0
18/10/2020	20.8	20.1	1
19/10/2020	17.7	16.9	0.6
20/10/2020	18.2	17.3	0
21/10/2020	19.3	18.7	0

Meteorological Summary			
22/10/2020	21.8	21.1	0
23/10/2020	22.5	21.9	0
24/10/2020	20.2	19.8	54
25/10/2020	15.5	14.7	21.8
26/10/2020	14.6	13.9	15.4
27/10/2020	16.2	15.4	0
28/10/2020	15.9	15.1	15.8
29/10/2020	17.4	16.7	4
30/10/2020	17.4	16.7	0.2
31/10/2020	19.6	18.9	0
01/11/2020	18.1	17.4	4.8
02/11/2020	18.5	17.7	0.2
03/11/2020	18.0	17.4	0
04/11/2020	21.1	20.7	0
05/11/2020	18.7	18.1	12
06/11/2020	17.4	16.7	2
07/11/2020	17.3	16.6	0
08/11/2020	17.4	16.5	1.2
09/11/2020	17.0	16.3	0
10/11/2020	17.9	17.3	0
11/11/2020	21.5	21.2	0
12/11/2020	24.7	24.4	0
13/11/2020	21.3	20.8	5.8
14/11/2020	22.4	21.8	0
15/11/2020	23.7	23.6	0

Meteorological Summary			
16/11/2020	27.4	27.3	0
17/11/2020	22.4	21.6	0
18/11/2020	20.8	19.9	0
19/11/2020	21.8	21.2	0
20/11/2020	26.6	26.2	0
21/11/2020	23.4	22.5	0
22/11/2020	23.4	22.9	0
23/11/2020	24.9	24.3	0
24/11/2020	21.4	20.5	0
25/11/2020	21.9	21.0	0
26/11/2020	25.1	24.6	0
27/11/2020	25.4	24.6	0
28/11/2020	31.0	30.6	0
29/11/2020	33.2	32.7	0
30/11/2020	21.0	20.1	0
01/12/2020	27.1	26.6	7
02/12/2020	22.1	21.4	0.2
03/12/2020	21.1	20.2	0
04/12/2020	26.6	26.0	0
05/12/2020	22.6	22.1	13.4
06/12/2020	26.2	25.5	0.6
07/12/2020	25.1	24.5	0
08/12/2020	20.8	20.0	0
09/12/2020	20.4	20.0	0
10/12/2020	21.8	21.2	0

Meteorological Summary			
11/12/2020	18.1	17.3	0.8
12/12/2020	19.3	18.4	0
13/12/2020	20.3	19.4	0
14/12/2020	20.7	19.8	1.2
15/12/2020	21.5	20.8	20
16/12/2020	25.2	24.4	4.4
17/12/2020	26.0	25.4	0.4
18/12/2020	24.8	24.4	10.6
19/12/2020	20.7	19.9	1
20/12/2020	20.3	19.5	0.8
21/12/2020	20.0	19.2	32.4
22/12/2020	22.8	22.1	7.2
23/12/2020	21.4	20.6	0
24/12/2020	22.3	21.7	0
25/12/2020	22.1	21.3	0
26/12/2020	22.3	21.4	0
27/12/2020	25.4	24.7	1
28/12/2020	25.5	24.8	23.6
29/12/2020	20.2	19.4	1.4
30/12/2020	21.3	20.3	1
31/12/2020	20.1	19.3	5.2

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 Average *(g/m²/month)*	Insoluble Solids *(g/m²/month)*	Annual Average *(g/m²/month)*
Jan-20	4	1.3	2.4	1.6	1.7
Feb-20	4	5.1 c	2.5	3	1.6
Mar-20	4	2.1 c	2.4	15.9 c	2.8
Apr-20	4	1	2.2	1.2	2.8
May-20	4	1.3	2.2	1.1	2.8
Jun-20	4	1.1	2.2	0.9	2.7
Jul-20	4	10.4 c	2.2	1.6	2.7
Aug-20	4	0.8	2.2	0.7	2.7
Sep-20	4	1.2	2.2	1.1	2.7
Oct-20	4	0.7	1.9	1.1	2.6
Nov-20	4	3.1 c	1.9	5.2 c	2.8
Dec-20	4	2.2	1.8	2.7	2.8

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)*
03/01/2020	EE	45	EE	54	90
09/01/2020	EE	45	EE	54	90
15/01/2020	EE	45	EE	54	90
21/01/2020	EE	45	EE	54	90
27/01/2020	82	45	97	54	90
02/02/2020	EE	45	EE	54	90
08/02/2020	15	44	16	53	90
14/02/2020	37	44	42	52	90
20/02/2020	46	44	57	52	90
26/02/2020	25	43	40	52	90
03/03/2020	59	43	58	52	90
09/03/2020	56	42	32	51	90
15/03/2020	56	42	40	51	90
21/03/2020	71	43	74	51	90
27/03/2020	27	42	33	51	90
02/04/2020	38	43	32	51	90
08/04/2020	29	42	33	50	90
14/04/2020	25	42	40	50	90
20/04/2020	24	42	42	50	90
26/04/2020	41	42	69	50	90
02/05/2020	11	41	17	49	90

High Volume Air Sampling Compliance Monitoring Results – TSP					
08/05/2020	35	41	27	49	90
14/05/2020	28	41	47	49	90
20/05/2020	14	40	53	49	90
26/05/2020	16	40	21	49	90
01/06/2020	42	40	33	48	90
07/06/2020	24	40	43	48	90
13/06/2020	25	40	32	48	90
19/06/2020	30	40	35	48	90
25/06/2020	10	40	18	48	90
01/07/2020	12	40	20	47	90
07/07/2020	22	40	45	48	90
13/07/2020	13	39	14	47	90
19/07/2020	8	39	20	47	90
25/07/2020	23	39	29	46	90
31/07/2020	29	39	33	46	90
06/08/2020	15	38	46	46	90
12/08/2020	20	38	31	46	90
18/08/2020	14	38	20	45	90
24/08/2020	13	37	20	44	90
30/08/2020	21	37	38	44	90
05/09/2020	29	36	44	44	90
11/09/2020	23	36	31	43	90
17/09/2020	41	36	63	44	90
23/09/2020	26	36	36	44	90
29/09/2020	21	35	41	44	90
05/10/2020	20	35	31	43	90

High Volume Air Sampling Compliance Monitoring Results – TSP					
11/10/2020	35	34	49	43	90
17/10/2020	70	34	73	42	90
23/10/2020	52	33	70	43	90
29/10/2020	27	31	29	40	90
04/11/2020	28	31	42	41	90
10/11/2020	25	30	48	40	90
16/11/2020	42	31	63	40	90
22/11/2020	66	31	88	41	90
28/11/2020	48	32	65	42	90
04/12/2020	54	32	91	43	90
10/12/2020	50	32	82	43	90
16/12/2020	28	32	32	43	90
22/12/2020	17	32	23	43	90
28/12/2020	17	32	22	42	90

Notes:
"EE" cells indicate days where air quality was determined to have been impacted by extraordinary events, confirmed by DPIE

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)*
3-Jan-20	EE	17	EE	19	30
9-Jan-20	EE	17	EE	19	30
15-Jan-20	EE	17	EE	19	30
21-Jan-20	EE	17	EE	19	30
27-Jan-20	33	17	39	19	30
2-Feb-20	EE	17	EE	19	30
8-Feb-20	11	17	10	19	30
14-Feb-20	17	17	17	19	30
20-Feb-20	19	17	22	19	30
26-Feb-20	13	17	15	19	30
3-Mar-20	12	17	27	19	30
9-Mar-20	12	16	8	19	30
15-Mar-20	11	16	9	19	30
21-Mar-20	23	16	24	19	30
27-Mar-20	16	16	13	19	30
2-Apr-20	16	16	14	19	30
8-Apr-20	11	16	11	19	30
14-Apr-20	13	16	19	19	30
20-Apr-20	13	16	21	19	30
26-Apr-20	20	16	28	19	30
2-May-20	2	15	3	18	30
8-May-20	14	15	13	18	30

High Volume Air Sampling Compliance Monitoring Results – PM_{10}					
14-May-20	7	15	12	18	30
20-May-20	3	15	15	18	30
26-May-20	7	15	8	18	30
1-Jun-20	16	15	10	17	30
7-Jun-20	13	15	20	17	30
13-Jun-20	14	15	17	17	30
19-Jun-20	13	15	14	17	30
25-Jun-20	3	15	6	17	30
1-Jul-20	4	15	9	17	30
7-Jul-20	8	15	15	17	30
13-Jul-20	3	15	6	17	30
19-Jul-20	1	15	7	17	30
25-Jul-20	7	15	9	17	30
31-Jul-20	10	15	14	17	30
6-Aug-20	6	14	12	17	30
12-Aug-20	7	14	13	17	30
18-Aug-20	4	14	6	17	30
24-Aug-20	4	14	6	16	30
30-Aug-20	13	14	20	16	30
5-Sep-20	8	14	11	16	30
11-Sep-20	9	14	9	16	30
17-Sep-20	18	14	21	16	30
23-Sep-20	13	14	14	16	30
29-Sep-20	9	14	14	16	30
5-Oct-20	12	13	17	16	30
11-Oct-20	14	13	17	16	30

High Volume Air Sampling Compliance Monitoring Results – PM_{10}					
17-Oct-20	28	13	22	16	30
23-Oct-20	17	13	22	16	30
29-Oct-20	12	12	12	15	30
4-Nov-20	14	12	17	15	30
10-Nov-20	9	12	14	15	30
16-Nov-20	19	12	27	15	30
22-Nov-20	33	12	38	15	30
28-Nov-20	19	12	28	16	30
4-Dec-20	26	13	27	16	30
10-Dec-20	25	13	32	16	30
16-Dec-20	10	13	12	16	30
22-Dec-20	9	13	10	16	30
28-Dec-20	10	13	10	16	30

Notes:
"EE" cells indicate days where air quality was determined to have been impacted by extraordinary events, confirmed by DPIE

Appendix D - Surface Water Monitoring Results

Water Quality - Bowmans Creek															
Month	BCK1 (Bowmans Creek Upstream)					BCK 1A					BCK2				
	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)
Jan-20	7.48	1260	207	744	N/a*	7.38	5840	102	4230	N/a*	Dry				
Feb-20	7.3	1720	7	1150		7.47	6820	69	4790						
Mar-20	7.62	1320	20	900		7.54	7050	25	5590						
Apr-20	7.4	1190	8	695		7.6	1790	10	1030						
May-20	7.24	1310	6	756		7.67	2520	<5	1490						
Jun-20	7.36	1270	7	754		7.81	2300	<5	1180						
Jul-20	7.69	1260	<5	787		7.82	1740	<5	1070						

Aug-20	7.88	644	8	396	2.6	7.98	670	<5	397	2.6	8.59	684	7.97	753	2
Sep-20	7.65	913	8	559	0.8	7.83	1060	9	596	0.7	7.74	1030	8.39	1180	1
Oct-20	7.57	1040	<5	555	1.4	7.99	1570	<5	919	0.6	8.57	1140	7.96	1360	7
Nov-20	7.85	694	8	391	1.8	8.04	748	7	474	2	8.26	769	7.74	850	2
Dec-20	7.55	885	8	561	3.3	7.9	1360	12	949	3.4	8.66	846	7.89	1120	3

*Turbidity monitoring not required by EPL2094 prior to August 2020.

Water Quality – Bowmans Creek															
	BCK2A					BCK3					BCK4				
Month	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)
Jan-20	Dry					Dry					Dry				
Feb-20						6.92	1180	29	788	N/a *					
Mar-20						6.85	1860	22	1390						
Apr-20	6.92	7.62	1880	8	1150	7.62	1880				6.84	1540	<5	967	N/a*

Water Quality – Bowmans Creek														
May-20	Dry					7.55	1970	8	1250		7.26	1890	<5	1090	
Jun-20						7.63	1790	6	1110		7.31	1720	12	1060	
Jul-20						6.88	1770	5	1280		7.45	1840	<5	1120	
Aug-20	8.07	713	<5	434	1.7	7.97	753	<5	434	2.3	7.92	750	5	446	2
Sep-20	7.81	1220	12	740	0.6	8.39	1180	<5	680	1	7.96	1120	10	612	1
Oct-20	7.19	1430	<5	884	0.4	7.96	1360	<5	722	1.1	7.87	1370	12	839	4

Water Quality – Bowmans Creek															
Nov-20	7.74	820	10	430	2.2	7.74	850	12	480	5.2	7.7	852	382	462	194
Dec-20	7.16	1230	<5	826	0.4	7.89	1120	34	788	12.7	7.82	1130	20	768	8

Water Quality – Bowmans and Bayswater Creek										
Month	BCK5					BCK6 (Bowmans Ck Downstream)				
	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)
Jan-20	Dry					Dry				
Feb-20										
Mar-20										
Apr-20	7.35	1560	7.72	3540	N/a*	5.89	2780	11	2060	N/a*
May-20	Dry					Dry				
Jun-20										
Jul-20										
Aug-20	7.98	763	7.8	452	2	7.91	770	<5	440	2
Sep-20	7.72	1250	7.83	709	1	7.03	1250	19	733	1.2
Oct-20	7.95	1600	7.94	976	2	6.92	1240	<5	747	6.8
Nov-20	7.8	884	7.96	462	3	7.82	876	10	493	2.5
Dec-20	7.69	1300	7.59	874	40	7.08	1090	18	761	5.6

*Turbidity monitoring not required by EPL2094 prior to August 2020.

Water Quality – Bayswater Creek															
Month	BWKU (Bayswater Ck Upstream)					BWKM (Bayswater Ck Midstream)					BWKD (Bayswater Ck Downstream) 1				
	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)
Jan-20	7.64	3480	6	2220		7.83	4730	10	3170		Dry				
Feb-20	7.47	1960	23	1240		7.78	3220	6	1980						
Mar-20	7.64	3100	8	2130		7.89	4030	<5	2540						
Apr-20	3050	3540	<5	2270		7.99	4510	<5	3050						
May-20	7.68	3320	<5	2040		7.95	4130	<5	3150						
Jun-20	7.67	2980	8	1910		8.04	3620	<5	2420						
Jul-20	7.76	3390	<5	2320		8.14	4130	<5	2850						
Aug-20	7.8	3180	9	2120	9.3	8.06	3760	<5	2560	1					
Sep-20	7.83	3420	11	2360	3	7.91	4560	16	3160	0.4					
Oct-20	7.94	4620	5	3000	4.5	8.02	5800	8	3880	1.2					
Nov-20	7.96	3310	25	2160	1.6	7.89	3920	24	2610	1.4					
Dec-20	7.59	4620	28	3190	9.2	8.0	6120	11	4270	2.2					

Appendix E - Groundwater Monitoring Results

Water Quality - Groundwater Monthly Monitoring Results																		
Month	ALV1 Large						ALV1 Small						ALV2 Large					
	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-20	6.89	1.49	6.18	Brown	Nil	Slight	7.53	1.50	6.03	Clear	Yes	Clear	6.98	2.50	7.85	Brown	Nil	Turbid
Feb-20	6.94	1.56	6.25	Orange	Yes	Turbid	7.62	1.52	6.21	NR	Yes	NR	Dry					
Mar-20	6.96	1.40	6.25	Orange	Nil	Slight	7.69	1.38	6.26	Clear	Yes	Slight						
Apr-20	6.72	1.42	4.46	Clear	Nil	Clear	7.22	1.28	4.66	Clear	Nil	Clear	6.75	3.16	5.91	Clear	Nil	Slight
May-20	6.87	1.53	4.58	Grey	Nil	Slight	7.56	1.47	4.34	Grey	Nil	Slight	7.03	3.67	4.73	Grey	Nil	Slight
Jun-20	6.71	1.44	4.55	Clear	Nil	Slight	7.52	1.37	4.23	Clear	Yes	Clear	6.72	3.71	4.68	Clear	Nil	Clear
Jul-20	6.12	1.62	3.82	Light orange	Nil	Slight	6.93	1.53	3.50	Clear	Nil	Clear	6.47	2.80	4.80	Clear	Nil	Clear
Aug-20	6.87	1.47	3.09	Light orange	Nil	Slight	7.64	1.40	2.80	Clear	Nil	Clear	6.94	3.40	4.27	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results																		
Sep-20	6.92	1.64	3.11	Orange	Nil	Slight	7.77	1.58	2.80	Clear	Nil	Clear	7.09	4.11	4.21	Clear	Nil	Clear
Oct-20	6.95	1.75	3.28	Orange	Nil	Slight	7.69	1.69	3.03	Clear	Nil	Clear	7.11	4.12	4.22	Clear	Nil	Clear
Nov-20	7.42	1.54	3.19	Brown	Nil	Slight	7.64	1.08	2.99	Clear	Nil	Clear	7.11	4.07	4.10	Clear	Nil	Clear
Dec-20	6.95	1.57	3.19	Orange	Nil	Turbid	7.66	1.49	2.85	Clear	Nil	Clear	7.05	3.87	4.24	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results																		
Month	ALV2 Small						ALV3 Large						ALV3 Small					
	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-20	7.63	3.26	9.13	Clear	Yes	Clear	Dry						7.52	2.25	7.48	Clear	Yes	Clear
Feb-20	7.71	3.24	9.91	Clear	Yes	Clear	7.05	1.48	7.30	Clear	Yes	Clear	7.60	2.37	7.50	Clear	Yes	Clear
Mar-20	7.80	3.03	10.67	Grey	Yes	Slight	7.08	1.40	7.24	Clear	Nil	Clear	7.59	2.23	7.47	Clear	Yes	Clear
Apr-20	7.43	2.67	4.98	Clear	Nil	Clear	6.74	1.18	5.14	Clear	Nil	Slight	7.06	1.78	5.46	Clear	Yes	Slight
May-20	7.68	3.09	4.73	Grey	Nil	Slight	7.06	1.50	5.38	Grey	Nil	Slight	7.39	2.17	5.69	Grey	Nil	Slight
Jun-20	7.47	3.11	4.68	Clear	Nil	Clear	6.88	1.35	5.56	Clear	Nil	Slight	7.31	1.79	5.90	Clear	Nil	Clear
Jul-20	6.91	3.67	4.86	Clear	Nil	Clear	6.21	1.70	5.29	Clear	Nil	Clear	6.60	1.96	5.69	Clear	Nil	Clear
Aug-20	7.77	2.97	4.19	Clear	Nil	Clear	6.93	1.49	4.64	Clear	Nil	Clear	7.39	1.65	4.87	Clear	Nil	Clear
Sep-20	7.82	3.62	4.10	Clear	Nil	Clear	7.05	1.39	4.79	Clear	Nil	Clear	7.58	1.82	5.03	Clear	Nil	Clear
Oct-20	7.82	3.81	4.09	Clear	Nil	Clear	7.12	1.38	4.82	Clear	Nil	Clear	7.70	1.92	5.10	Clear	Nil	Clear
Nov-20	7.79	3.85	3.95	Clear	Nil	Clear	7.21	1.44	4.69	Clear	Nil	Clear	7.57	1.92	4.93	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results																		
Dec-20	7.79	3.61	4.13	Clear	Nil	Clear	7.05	1.30	4.88	Clear	Nil	Clear	7.49	1.71	5.14	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results																		
Month	ALV4 Large						ALV4 Small						PGW5 Large					
	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-20	6.71	1.72	6.82	Clear	Nil	Clear	7.35	5.95	7.60	Clear	Yes	Clear	7.04	7.70	20.97	Clear	Nil	Slight
Feb-20	6.77	1.65	6.83	Grey	Yes	Slight	7.32	6.02	7.74	NR	Yes	NR	7.11	7.78	22.82	Clear	Nil	Clear
Mar-20	6.87	1.51	6.87	Clear	Nil	Clear	7.36	5.48	7.84	Clear	Yes	Clear	7.16	7.13	22.41	Clear	Nil	Clear
Apr-20	6.39	1.30	5.04	Clear	Nil	Slight	7.00	4.44	6.02	NR	Nil	Slight	6.96	4.92	12.27	Clear	Nil	Clear
May-20	6.62	1.51	5.31	Grey	Nil	Slight	7.31	5.71	6.12	Grey	Yes	Slight	7.21	6.31	12.39	Clear	Nil	Clear
Jun-20	6.53	1.40	5.41	Clear	Nil	Clear	7.09	5.38	6.19	Clear	Yes	Clear	6.99	5.93	12.31	Clear	Nil	Clear
Jul-20	6.01	1.68	5.40	Clear	Nil	Clear	6.52	6.56	6.26	Clear	Yes	Clear	6.44	7.33	12.97	Clear	Nil	Clear
Aug-20	6.60	1.46	4.45	Light orange	Nil	Slight	7.32	5.28	5.39	Clear	Yes	Clear	7.24	5.76	11.61	Clear	Nil	Clear
Sep-20	6.71	1.61	4.58	Orange	Nil	Slight	7.39	6.15	5.47	Clear	Yes	Clear	7.29	6.80	11.74	Clear	Nil	Clear
Oct-20	6.75	1.61	4.71	Clear	Nil	Slight	7.51	6.15	5.57	Clear	Nil	Clear	7.31	6.42	11.39	Clear	Nil	Clear
Nov-20	6.82	1.50	4.54	Clear	Nil	Clear	7.50	6.18	5.31	Clear	Nil	Clear	7.61	6.09	11.15	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results																		
Dec-20	6.67	1.50	4.77	Orange	Nil	Turbid	7.42	5.66	5.51	Clear	Nil	Clear	7.26	6.07	11.52	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results																		
Month	PGW5 Small						ALV7 Large						ALV7 Small					
	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-20	Dry						Dry						7.38	3.50	21.54	Clear	Nil	Clear
Feb-20													7.50	3.53	22.11	Grey	Nil	Slight
Mar-20													7.42	3.25	20.78	Clear	Nil	Clear
Apr-20							6.96	1.55	7.90	Clear	Nil	Slight	7.15	2.83	18.09	Clear	Nil	Clear
May-20							7.24	1.72	7.86	Brown	Nil	Turbid	7.39	3.58	15.80	Grey	Nil	Slight
Jun-20							7.16	1.63	7.96	Brown	Nil	Slight	7.32	3.19	16.84	Clear	Nil	Slight
Jul-20							Too low to sample		8.24	Too low to sample			6.76	4.12	18.08	Clear	Yes	Slight
Aug-20							7.24	1.54	7.64	Brown	Nil	Slight	7.49	3.38	16.35	Clear	Nil	Clear
Sep-20							7.26	1.60	7.60	Clear	Nil	Slight	7.55	3.96	15.09	Clear	Nil	Slight
Oct-20							7.31	1.53	7.63	Clear	Nil	Slight	7.55	3.73	14.85	Clear	Nil	Clear
Nov-20							7.33	1.53	7.52	Clear	Nil	Clear	7.57	3.75	14.55	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results														
Dec-20		7.18	1.21	7.50	Brown	N	Slight	7.59	3.64	14.27	Clear	Nil	Slight

Water Quality - Groundwater Monthly Monitoring Results																	
Month	ALV8 Large						ALV8 Small						ALV9 Large					
	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-20															6.79			
Feb-20													Dry					
Mar-20																		
Apr-20													6.61	4.29	3.85	Grey	Nil	Slight
May-20	Dry						Dry						7.00	2.91	4.20	Brown	Nil	Turbid
Jun-20													6.64	3.31	4.68	Grey	Nil	Slight
Jul-20													6.12	3.94	5.97	Brown	Nil	Turbid
Aug-20													6.91	2.98	3.43	Grey	Nil	Slight

Water Quality - Groundwater Monthly Monitoring Results													
Sep-20								7.06	3.06	3.62	Brown	Nil	Slight
Oct-20								7.10	2.15	3.62	Brown	Nil	Slight
Nov-20								7.31	1.67	3.45	Clear	Nil	Clear
Dec-20		6.93	1.87	18.56	Brown	Nil	Slight	7.11	1.43	3.63	Grey	Nil	Turbid

Water Quality - Groundwater Monthly Monitoring Results						
Month	LBH (Coal Measures)					
	pH	Conductivity (mS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-20	6.79	1.67	6.08	Clear	Nil	Clear
Feb-20	6.81	1.60	5.94	NR	Nil	NR
Mar-20	6.82	1.56	5.93	Clear	Nil	Clear
Apr-20	6.58	1.03	4.19	Clear	Nil	Clear
May-20	6.84	1.37	4.55	Clear	Nil	Clear
Jun-20	6.56	1.36	4.79	Clear	Nil	Clear
Jul-20	5.95	1.64	4.11	Clear	Nil	Clear
Aug-20	6.65	1.75	3.60	Clear	Nil	Clear
Sep-20	6.72	2.09	3.72	Clear	Nil	Clear

Water Quality - Groundwater Monthly Monitoring Results						
Oct-20	6.76	2.21	3.78	Clear	Nil	Clear
Nov-20	6.75	1.93	3.60	Clear	Nil	Clear
Dec-20	6.76	1.80	3.74	Clear	Nil	Clear

Appendix F - Blast Monitoring Results

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
02/01/2020	12:58	Entrance Pit	0.1	106.6	0.05	93.1	0.93	102.8	0.71	100.3
06/01/2020	12:58	Entrance Pit	0.02	115.0	0.02	105.8	0.48	108.1	0.31	107.7
08/01/2020	12:52	Entrance Pit	0.02	89.5	0.04	100.3	0.45	109.2	0.23	107.6
14/01/2020	13:11	Entrance Pit	0.12	100.4	0.12	98.1	7.33	114.1	3.71	115.7
16/01/2020	11:03	Entrance Pit	0.03	100.1	0.03	108.7	0.66	112.5	0.54	111.9
22/01/2020	15:39	Entrance Pit	0.01	90.7	0.02	85.7	1.06	115.6	0.32	110
22/01/2020	15:43	Entrance Pit	0.08	92.1	0.07	106.4	2.59	108.9	1.46	108.9
24/01/2020	12:41	Entrance Pit	0.02	91.5	0.02	101.1	0.31	109.4	0.18	109.8
24/01/2020	12:50	Entrance Pit	0.03	101.1	0.04	101.3	1.12	103.6	0.58	100.8

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
28/01/2020	12:55	Entrance Pit	0.02	80	0.03	87.1	0.45	95.4	0.26	94.7
29/01/2020	12:55	Entrance Pit	0.09	98.3	0.04	98.1	0.78	109.3	0.73	107.5
31/01/2020	12:29	Entrance Pit	0.01	92.7	0.02	91.9	0.16	102.1	0.1	102.3
05/02/2020	12:59	Entrance Pit	0.16	92.6	0.08	102.1	1.67	104.3	0.7	103.8
07/02/2020	12:38	Entrance Pit	0.06	95.2	0.04	95.3	1.11	109.7	0.67	108.3
14/02/2020	12:24	South Pit	0.17	91.3	0.08	92.8	11.5	114.3	5.12	114.8
20/02/2020	12:36	South Pit	0.04	86.7	0.05	85.2	4.46	116.6	2.37	112.4
21/02/2020	12:57	Bayswater Pit	0.04	90.7	0.03	93.8	0.65	102.8	0.40	102.4
28/02/2020	12:40	Bayswater Pit	0.04	96.8	0.04	105.2	0.55	109.4	0.30	107.0
03/03/2020	13:03	South Pit	0.1	97.6	0.08	90.9	17.23	119.5	9.83	117.5
04/03/2020	12:53	Entrance Pit	0.14	94.7	0.09	100.9	1.16	107	0.69	106.1
05/03/2020	15:30	South Pit	0.03	85.0	0.03	87.4	2.67	117.2	0.75	112.5

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
10/03/2020	12:55	Bayswater Pit	0.01	95.0	0.02	89.2	0.17	96.9	0.08	94.9
12/03/2020	13:01	Entrance Pit	0.04	98.5	0.03	105.4	0.60	109.7	0.33	105.6
13/03/2020	12:31	South Pit	0.11	88.2	0.08	87.6	11.65	114.5	3.35	108.9
18/03/2020	12:59	South Pit	0.05	91.1	0.04	95.5	19.48	118.9	4.07	114.3
26/03/2020	12:36	Entrance Pit	0.20	105.1	0.07	108.2	0.89	102.3	0.64	100.6
02/04/2020	15:37	Entrance Pit	0.07	80.7	0.04	90.1	1.24	105.5	0.65	103.5
06/04/2020	12:57	Entrance Pit	0.01	85.0	0.02	89.5	0.21	102.7	0.19	104.3
09/04/2020	12:52	Entrance Pit	0.03	96.3	0.02	103.2	0.61	106.4	0.28	106.1
17/04/2020	12:25	Entrance Pit	0.15	106.0	0.07	93.4	1.69	106.3	0.99	103.0
22/04/2020	14:58	Bayswater Pit	0.03	91.7	0.03	101.1	0.36	106.8	0.21	104.8
27/04/2020	13:18	Entrance Pit	0.09	100.4	0.04	99.2	1.82	106.5	0.45	107.0
28/04/2020	12:32	South Pit	0.18	98.4	0.05	99.9	5.14	118.8	1.42	120.6

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
29/04/2020	13:00	Bayswater Pit	0.06	92.7	0.04	93.2	0.99	108.9	0.64	106.6
30/04/2020	9:01	Bayswater Pit	0.02	98.6	0.03	93.2	0.28	100.8	0.20	96.8
04/05/2020	12:30	Bayswater Pit	0.10	91.7	0.06	99.7	1.75	107.9	0.62	105.5
06/05/2020	12:59	Entrance Pit	0.15	86.0	0.07	100.0	1.11	103.8	0.74	103.4
12/05/2020	12:52	Entrance Pit	0.06	85.2	0.04	93.4	0.72	103.4	0.41	100.3
14/05/2020	12:58	Entrance Pit	0.08	93.1	0.05	99.3	0.66	105.4	0.68	105.4
19/05/2020	12:51	Bayswater Pit	0.10	91.7	0.07	94.5	1.48	111.9	1.15	110.2
22/05/2020	12:30	Entrance Pit	0.12	101	0.06	99.9	2.04	111.3	0.90	109.9
28/05/2020	12:25	Entrance Pit	0.03	85.2	0.02	87.1	0.48	95.4	0.29	96.1
29/05/2020	12:28	Bayswater Pit	0.12	96.4	0.09	98.4	2.11	112.4	0.64	109.7
03/06/2020	12:37	Entrance Pit	0.03	96.2	0.02	94.9	0.46	107.9	0.29	105.6
04/06/2020	12:55	South Pit	0.07	95.2	0.04	91.3	3.47	117.1	1.62	113.9

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
05/06/2020	12:22	Bayswater Pit	0.08	91.2	0.05	92.6	1.64	104.9	0.86	101.4
09/06/2020	12:54	Bayswater Pit	0.05	89.5	0.03	93.7	0.65	103.5	0.35	100.0
12/06/2020	12:26	Bayswater Pit	0.39	95.5	0.06	92.2	1.04	105.8	0.56	103.6
18/06/2020	15:34	South Pit	0.18	86.8	0.08	92.2	20.43	117.0	9.48	114.6
23/06/2020	12:34	Entrance Pit	0.04	89.5	0.04	101.6	0.58	106.4	0.34	107.4
25/06/2020	12:55	Entrance Pit	0.06	101.9	0.03	93.0	0.82	105.9	0.52	102.7
29/06/2020	13:07	Bayswater Pit	0.11	89.5	0.06	91.5	1.66	106.9	0.85	103.9
01/07/2020	12:57	Entrance Pit	0.04	90.9	0.03	98.4	0.92	110.7	0.47	111.7
07/07/2020	12:54	Bayswater Pit	0.11	92.9	0.07	87.7	1.66	102.8	1.06	100.5
09/07/2020	13:37	South Pit	0.26	100.4	0.12	98.1	43.65	131.2	7.02	126.0
10/07/2020	12:24	Entrance Pit	0.04	88.8	0.03	93.3	0.62	102.9	0.30	101.7
16/07/2020	13:10	South Pit	0.17	94.0	0.14	92.9	6.51	120.0	3.15	113.6

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
21/07/2020	12:59	Bayswater Pit	0.18	101.2	0.12	92.7	2.85	102.7	1.91	101.1
23/07/2020	12:56	Entrance Pit	0.09	85.6	0.09	92.7	0.8	96.5	0.53	96.9
27/07/2020	13:32	Entrance Pit	0.10	102.6	0.06	100	0.67	100.2	0.39	97.2
04/08/2020	11:38	Bayswater Pit	0.02	108.9	0.03	110.1	0.53	111.5	0.28	109.1
06/08/2020	15:25	Bayswater Pit	0.10	84.6	0.07	96.3	1.03	106.3	0.71	102.7
07/08/2020	12:16	Entrance Pit	0.03	102.8	0.03	106.9	0.53	110.8	0.36	110.7
13/08/2020	12:26	Entrance Pit	0.01	100.2	0.02	89.7	0.21	99.2	0.07	96.7
14/08/2020	12:28	Entrance Pit	0.02	92.9	0.02	98.7	0.55	111.8	0.25	110
18/08/2020	9:10	South Pit	0.10	92.4	0.10	89.7	4.6	120.8	2.39	120.1
21/08/2020	9:11	Entrance Pit	0.02	104.3	0.02	101.4	0.22	109.9	0.15	108.3
21/08/2020	9:13	South Pit	0.04	107.5	0.03	101.6	1.79	112.8	0.65	109.7
25/08/2020	13:02	Entrance Pit	0.17	88.8	0.08	93	1.74	105.3	0.82	100.7

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
28/08/2020	12:29	Bayswater Pit	0.08	87	0.09	96	1.36	103.3	0.81	103.4
01/09/2020	15:32	Bayswater Pit	0.01	90.3	0.02	92.2	0.26	100.9	0.11	101.5
02/09/2020	9:02	Entrance Pit	0.02	97.6	0.02	100	0.61	107.2	0.3	105
07/09/2020	12:53	Bayswater Pit	0.11	86.8	0.09	95.8	1.38	101.1	0.65	100.8
08/09/2020	13:18	Entrance Pit	0.05	81.9	0.03	83	0.37	94.6	0.16	93.6
10/09/2020	13:01	South Pit	0.05	99.9	0.03	97.5	8.72	122.8	1.36	123
14/09/2020	12:59	Entrance Pit	0.05	91.6	0.05	88.3	0.51	99	0.38	96.8
18/09/2020	12:25	South Pit	0.11	98.6	0.06	97.2	3.17	116.8	1.95	116.4
21/09/2020	9:02	Entrance Pit	0.15	86	0.09	92.7	0.8	102.9	0.96	101.5
24/09/2020	9:00	Bayswater Pit	0.03	91.8	0.03	99.4	0.55	106.5	0.36	109.7
29/09/2020	13:03	Bayswater Pit	0.07	96	0.05	106.4	1.51	110.3	0.85	110.7
30/09/2020	12:56	Entrance Pit	0.01	100.2	0.02	84.8	0.27	97.4	0.1	96.4

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
02/10/2020	12:34	Entrance Pit	0.08	88.5	0.05	98	0.8	110.2	0.73	110.6
06/10/2020	13:01	South Pit	0.21	96.1	0.11	97.2	7.52	126.9	11.23	129.1
07/10/2020	13:09	Bayswater Pit	0.03	86.5	0.02	90.8	0.76	108.9	0.39	105.8
13/10/2020	13:01	Entrance Pit	0.05	91.6	0.04	97.5	0.78	110.6	0.62	108.8
15/10/2020	12:55	South Pit	0.2	97.1	0.13	101.2	8.86	113	14.36	114.7
23/10/2020	9:03	Bayswater Pit	0.07	91.5	0.05	99.8	0.84	110.5	0.63	108.2
23/10/2020	9:07	South Pit	0.22	82.7	0.13	89.8	2.7	111.7	2.81	112.9
28/10/2020	9:03	Entrance Pit	0.18	98.4	0.07	102.9	1.06	100.6	0.78	102.6
03/11/2020	12:52	South Pit	0.12	95.5	0.13	91.8	3.29	115.9	1.96	116
05/11/2020	11:11	Bayswater Pit	0.1	85.8	0.07	93.9	1.11	107.7	0.81	105.5
06/11/2020	12:27	Bayswater Pit	0.01	98.8	0.02	104.2	0.26	115.8	0.12	114.2
10/11/2020	12:57	South Pit	0.12	90.7	0.08	90.6	15.76	116.7	3.42	111.9

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
12/11/2020	15:40	Bayswater Pit	0.06	98.1	0.05	89.3	1.19	106.4	0.77	104.5
17/11/2020	9:03	South Pit	0.02	95.9	0.02	94.9	1.6	113.1	0.35	111.6
18/11/2020	13:04	Entrance Pit	0.04	102.6	0.03	95.9	0.64	102.8	0.34	100.1
20/11/2020	9:13	South Pit	0.12	84	0.08	86.7	5.54	114.2	2.47	112.6
25/11/2020	12:58	Entrance Pit	0.19	99.2	0.11	103.7	1.45	110.8	1.15	108.2
26/11/2020	13:08	Entrance Pit	0.06	84	0.05	92.2	0.6	107.3	0.49	107.4
27/11/2020	12:30	South Pit	0.1	96.1	0.06	94	7.42	116.9	3.17	117.7
02/12/2020	12:55	Entrance Pit	0.11	110.7	0.05	100.5	0.9	105.5	0.63	105.4
03/12/2020	13:03	Entrance Pit	0.1	85.8	0.07	95.5	0.56	100.6	0.46	98.7
03/12/2020	13:05	Bayswater Pit	0.02	94.4	0.02	95.1	0.29	101.4	0.14	101.1
03/12/2020	13:06	South Pit	0.08	88.1	0.04	87.3	16.5	111.6	5.17	109.3
10/12/2020	15:47	Entrance Pit	0.03	83.7	0.03	92.5	0.56	96.6	0.19	95.5

Date	Time	Blast Location	Monitoring Point							
			Burlings		Scrivens		Chain of Ponds		Substation	
			Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Over pressure	Ground Vibration	Overpressure
			mm/s	dBL	mm/s	dBL	mm/s	dBL	mm/s	dBL
11/12/2020	12:32	South Pit	0.02	109.5	0.02	100.5	3.36	126.2	0.8	118.6
15/12/2020	13:09	Bayswater Pit	0.06	93.5	0.04	100.2	0.91	106.1	0.48	104.7
15/12/2020	13:11	Entrance Pit	0.07	95.5	0.06	103.4	0.65	99.4	0.61	99
15/12/2020	13:16	Entrance Pit	0.13	91.7	0.06	98.1	0.87	102.1	0.68	101.1

Appendix G - LCO Rehabilitation MOP Completion Criteria

The below table lists the identified rehabilitation completion criteria as specified in the MOP. Focussing on the reporting period, TARP status have been identified and comments included where appropriate.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
Decommissioning Phase						
Domain 1 – Domain 5						
No decommissioning activities any of the five domains.						
Landform Establishment Phase						
Domain Objective	**Performance Indicator**	**Completion Criteria**	**Justification/ Source**	**Complete (Yes/No)**	**TARP Element(s)/ Status**	**Comment**
All Domains						
Post mining landforms will be safe, stable and non-polluting	Slopes	Survey confirms rehabilitated slopes are generally 10 degrees and less than 18 degrees (unless otherwise approved); as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	EA Section 3.15 & Section 7.16.9	No	1,2/green	Ongoing rehabilitation surveyed confirmed as compliant.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
	Surface rock density	Visual inspections confirm surface spoils are (generally) rock free and provide a friable substrate. Large rocks are removed and placed into habitat piles on rehabilitated areas; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	EA Section 3.15	No	n/a	Ongoing rehabilitation surveyed confirmed as compliant.
	Free draining landforms	Landforms are graded to be generally free draining; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	EA Section 7.16.9	No	4/green	Ongoing rehabilitation surveyed confirmed as compliant.
	Stability	Visual inspections confirm rehabilitated landforms exhibit an absence of slumping; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	1/green	Ongoing rehabilitation surveyed confirmed as compliant.
	Spontaneous Combustion	Visual monitoring indicates no evidence of spontaneous combustion; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	6/green	Ongoing monitoring confirmed as compliant.
	Dispersive Spoils	Testing confirm dispersive spoils are not present in the surface layer or are appropriately ameliorated; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	7/green	Ongoing monitoring confirmed as compliant.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
	ESC	Suitable erosion control measures (e.g. silt fences, mulches etc.) are installed in rehabilitation areas in accordance the Blue Book to minimise soil loss from areas undergoing rehabilitation; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	DECC 2008 EA Section 3.15 & 7.16.9	No	na	Ongoing rehabilitation surveyed confirmed as compliant.
	Gullying	Monitoring demonstrates there are no areas of active gully erosion; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	3/green	Ongoing rehabilitation surveyed confirmed as compliant.
	Rilling	Visual inspections confirm rill erosion is limited to isolated areas of minor rilling up to 200mm deep; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	3/amber	Isolated areas identified with remediation required
Domain 2 – Water Management Area						
Surface water management structures will be designed and constructed in accordance with the Blue Book to minimise	Final landform drainage	Final landform drainage structures including drains, banks, drop structures and dams have been constructed in accordance with Blue Book requirements; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	DECC 2008	No	4/green	Drainage structures constructed in accordance with the blue book.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
erosion and enhance stability	Geomorphic stability	Drainage structures are assessed to be stable with no evidence of overtopping or significant scouring, loss of freeboard or channel capacity; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	DECC 2008	No	4/green	Ongoing rehabilitation surveyed confirmed as compliant. No landform drainage issues within rehabilitation areas
Surface water runoff from the final landform will be non-polluting	Discharge water quality	Dirty water is captured and discharged in accordance with the EPL. Analytes measured in accordance with EPL 2094 include; conductivity, pH and TSS.	EPL 2094 Water Management Plan	No	5/green	Water discharge in accordance with EPL. No discharges in 2020
	Runoff water quality	Runoff water quality from rehabilitation areas is within the range of water quality data recorded from analogue sites and does not pose a threat to downstream water quality; as supported by monitoring results undertaken in accordance with LCO SD PLN 0032 - Environmental Monitoring Program. Analytes measured include pH, TSS, TDS and Conductivity.	EA Section 7.16.9	No	5/green	Ongoing monitoring in accordance with the Water Management Plan showing compliance.
Domain 4 – Overburden Emplacement						
Overburden emplacements will be shaped with generally informal profiles and maximum heights that complement the local topography	Landform compatibility	Landforms are assessed to be generally compatible with the surrounding landscape, as shown on MOP Plan 4.	EA Section 7.16.9	No	na	Landform constructed to current approved landform design.
	Height	Survey confirms the South Pit emplacement is no higher than RL 195 m.	EA Section 4.11	No	na	Ongoing rehabilitation height surveyed as compliant

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
	Informal undulations	Elements such as drainage paths, contour drains, ridgelines, and emplacements are shaped into undulating informal profiles in keeping with natural landforms of the surrounding environment and allowing for a greater diversity of plant species over time	EA Section 3.15	No	na	Ongoing rehabilitation constructed to incorporate informal undulations.
Domain 5 – Tailings Storage Area						
Rehabilitated tailings emplacements will be capped and shaped to produce free draining landforms.	Capping	Tailings will be capped with at least 3 m of inert material including select inert overburden, subsoils and topsoils.	Sect 100 Report EA Section 7.16.9	No	15/green	Initial tailing capping layer of 1.5m has commenced on the Antiene Tailings Dam in 2016. Capping continuing in 2021. No other dams ready for capping.
	Ponding	Tailings emplacement areas will be shaped to be free draining and exhibit an absence of ponding.	Sect 100 Report EA Section 7.16.9	No	4/green	Initial tailing capping layer of 1.5m has commenced on the Antiene Tailings Dam in 2016. Capping continuing in 2021. No other dams ready for capping.
Domain A – Final Void						
The South Pit and Entrance Pit final voids will be designed and constructed to produce	Water Balance	The water balance confirms the final voids have been designed and constructed to produce an equilibrium water level of approximately 67 m AHD in both voids.	EA Section 7.3.4	No	16/green	Operations ongoing, no final voids constructed

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
non-spilling permanent water storage bodies.						
Final voids will be made safe by: **Constructing highwalls and battering back lowwalls to be geotechnically stable; and** **Constructing perimeter fencing and safety bunds to restrict public access**	Carbonaceous materials	All coal and carbonaceous material is capped with a minimum of 5 meters of inert overburden.	MOP	No	na	Operations ongoing.
	Stability	Highwalls and lowwalls have been assessed by a qualified geotechnical engineer to validate long term stability.	EA Section 7.16.9	No	2/green	Operations ongoing, no final high/low walls constructed
	Safety	Safety features (e.g. safety berm and fence) are installed at the crest of highwalls to restrict public access.	MOP	No	na	Operations ongoing, no final high/low walls constructed
Growth Medium Development Phase						
Domain Objective	**Performance Indicator**	**Completion Criteria**	**Justification/ Source**	**Complete (Yes/No)**	**TARP Element(s)/ Status**	**Comment**
All Domains						
Soils (or soil substitutes) will be reinstated on rehabilitation areas with characteristics that are appropriate for the final landuse.	Soil Depth	Topsoil and/or subsoils are spread uniformly at the depth of 100mm; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	8/amber	Topsoil deficit known. Substitute materials utilised as per rehabilitation strategy. Ongoing maintenance and rehabilitation operations to achieve target vegetation.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
	Compaction	Soils are ripped to produce a friable surface prior topsoil spreading; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	na	Ongoing rehabilitation surveyed as compliant. No areas identified as having issues from compaction.
	Ameliorants	Ameliorants (such as gypsum, organics and fertilisers) are spread at the recommended rate per hectare; as supported by site record form XCN SD FRM 0596 - Rehabilitation establishment and methodology record form.	MOP	No	7/green	Ongoing rehabilitation surveyed as compliant
	Temporary ESC	Temporary ESCs are installed prior to topsoil re-spreading. Temporary ESCs will be installed in accordance with the Bluebook such as silt fences, catch drains and sediment basins down slope of rehabilitation areas.	DECC 2008	No	3/green	Ongoing rehabilitation surveyed as compliant
Domain D – Rehabilitation Area – Woodland						
Woodland rehabilitation areas will provide habitat augmentation features (such as rock piles and felled logs and woody debris) for target native species including the Spotted Quoll	Habitat features	Rehabilitation monitoring confirms habitat features are incorporated into woodland rehabilitation areas (including rock piles, felled hollow bearing logs and coarse woody debris).	MOP EA Section 3.15	No	14/green	Operations ongoing, habitat augmentation included in rehabilitation
		Habitat features include structure suitable for Spotted-tailed Quoll den making.	EA Section 4.11 and 7.4.6	No	14/green	Operations ongoing, habitat augmentation included in rehabilitation

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
Ecosystem Establishment Phase						
Domain Objective	**Performance Indicator**	**Completion Criteria**	**Justification/ Source**	**Complete (Yes/No)**	**TARP Element(s)/ Status**	**Comment**
All Domains						
Enhance the productivity and ecological function of rehabilitation areas by effectively managing risks from bushfire, weeds and feral animals	Weed presence	The density of weeds in rehabilitated areas is no worse than analogue sites. All measurements will be undertaken in accordance with the Department of Agriculture, Fisheries and Forestry (2008) *Field Manual for surveying and Mapping Nationally Significant Weeds.*	EA Section 7.16.9	No	11/overall amber – red in some areas	Operations ongoing, monitoring results included in annual weed action plan. Weed management contractors engaged throughout the year to control invasive species.
	Feral animal density	Feral animal pests are controlled in accordance with legislation and the MOP.	EA Section 7.16.9 MOP	No	na	Operations ongoing, monitoring results show no significant issues
	Fuel loads	Fuel loads are assessed and managed as required including, maintaining fire-breaks.	EA Section 7.16.9	No	15/green	Operations ongoing. Bushfire Hazard Assessment completed in 2020.
	Access	Firefighting access across rehabilitation areas and water sources (dams) is maintained in accordance with the Bushfire Management Plan.	EA Section 7.16.9	No	15/green	Operations ongoing

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
Domain B – Water Management						
Surface water runoff from the final landform will be non-polluting.	Discharge water quality	Water quality testing confirms discharge water quality meets EPL requirements. Analytes measured in accordance with EPL 2094 include; conductivity, pH and TSS.	EPL 2094	No	n/a	Operations ongoing, compliant with EPL
Domain C – Rehabilitation Area – Grassland						
At least 1247 ha of grassland will be established that can be demonstrated to be capable of supporting sustainable grazing.	Hectares	Survey confirms that a minimum of 1247 ha of Grassland has been established.	DA 305-11-01 Schedule 3 Condition 37	No	na	Operations ongoing
	Soil Quality	Soil testing indicates that soil pH, ESP and EC are trending toward the range of analogue sites after 5 years.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	7/green	Operations ongoing, no issues identified in monitoring
	Species composition	Pasture species to consist of grasses and legumes appropriate to the district and recognised as suitable for beef cattle grazing.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	12, 13 / amber	Operations ongoing, species sown as per approved list. LCO is implementing rotational grazing where practical to continue pasture improvement. See detailed results in Section 8.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
	Ground cover	Rehabilitation survey confirms at least 80% vegetative cover over a minimum of 95% of areas treated after one year.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	na	Operations ongoing, no issues identified in monitoring
Domain D – Rehabilitation Area - Woodland						
At least 731 ha of woodland will be established on areas disturbed by mining including the slopes of overburden emplacement areas	Hectares	Survey confirms that a minimum of 731 ha of Woodland have been established.	DA 305-11-01 Schedule 3 Condition 37	No	na	Operations ongoing,
Woodland rehabilitation areas will be self-sustaining and require ongoing management inputs that are appropriate for the final land use	Surface cover	Rehabilitation survey confirms ground cover (vegetation, leaf litter, mulch) greater than 70% by Year 5.	This MOP	No	9/green	Operations ongoing. Monitoring determined that weed maintenance and infill planting/seeding required in some rehabilitation areas which have been impacted by drought conditions followed by rainfall to meet target vegetation requirements.
	Soil Quality	Soil testing indicates soil characteristics (pH, EC, ESP) vary by no more than 20% from relevant analogue site after 5 years.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	7/green	Operations ongoing, no significant issues identified in monitoring

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
			EA Section 7.16.9			
Vegetation compositions in woodland rehabilitation areas will be comparable with analogue vegetation communities, including areas representative of Central Hunter Box – Ironbark Woodland, specifically adjacent to rehabilitation areas at Ravensworth Operations and Mount Owen Complex	Vegetation health	More than 75 per cent of trees are healthy and growing as indicated by long term rehabilitation monitoring.	EA Section 7.16.9	No	na	Operations ongoing, no significant issues identified in monitoring
		Rehabilitation monitoring confirms canopy cover is in the range of 10 per cent to 30 per cent.	EA Section 7.16.9	No	na	Operations ongoing, no significant issues identified in monitoring
	Species presence	Revegetation areas contain flora species assemblages characteristic of each strata for the desired native vegetation communities.	EA Section 7.16.9	No	12/amber in some areas	Operations ongoing, no significant issues identified in monitoring. Supplementary planting and seeding works planned for 2021
		Rehabilitation monitoring confirms the presence of at least two overstorey and two understorey species at all ages.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	12/amber in some areas	Operations ongoing, no significant issues identified in monitoring
	Stem density	Minimum total tree/shrub densities for seeded areas to be: Year 1 – 1,000 stems/ha Year 5 – 500 stems/ha Year 10 – 400 stems/ha As confirmed by rehabilitation monitoring.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	na	Operations ongoing, no significant issues identified in monitoring. Supplementary planting or tree thinning works planned in 2021.
Ecosystem Sustainability Phase – no rehabilitation in this phase						

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
All Secondary Domains						
Enhance the productivity and ecological value of rehabilitation areas by effectively managing risks from bushfire, weeds and feral animals	Firefighting resources	Adequate access and water resources for firefighting are retained in the final landform for relinquishment.	EA Section 7.16.9	No	15/ N/A	Operations ongoing
	Weed presence	There are no significant weed infestations that are identified as a risk to rehabilitation.	EA Section 7.16.9	No	11/ N/A	Operations ongoing, monitoring results included in annual weed action plan.
	Feral animal density	Feral animal pests are controlled in accordance with legislation and do not present a risk to biodiversity.	EA Section 7.16.9	No	na	Operations ongoing
Soils (or soil substitutes) will be reinstated on rehabilitation areas with characteristics that are appropriate for the final landuse	Soil chemistry	Soil testing indicates soil N, P, K and S levels are within 20% of levels of analogue site after 10 years.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	7/ N/A	Operations ongoing, no significant issues identified in monitoring
	Organic carbon	Soil testing indicates soil total organic carbon is no less than 20% of levels in adjacent analogue site after 10 years.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	7/ N/A	Operations ongoing, no significant issues identified in monitoring
	Soil profile development	Soil cores demonstrate a developing A and B horizon.	This MOP	No	na	Operations ongoing
Domain A – Water Management Area						

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
At least 1247 ha of grassland will be established that can be demonstrated to be capable of supporting sustainable grazing by: • **Having a pasture species mix representative of the district** • **Providing a mix of land capability suitable for agriculture (Rural Land Capability Class IV, V and VI);** • **having a carrying capacity comparable to suitable analogue sites; and** **Requiring management inputs comparable to suitable analogue sites**	Species composition	At least 75% of species surveyed consist of grasses and legumes appropriate to the district and recognised as species suitable for grazing.	EA Section 7.16.9	No	10/ N/A	Operations ongoing, trending towards target. Management of pasture required once appropriate.
	Natural regeneration	Evidence of second generation pasture plants present during rehabilitation monitoring.	LCO Rehabilitation Monitoring Strategy (GSSE)	No	na	Operations ongoing, trending towards target. Management of pasture required once appropriate.
	Fertiliser and ameliorants	Fertiliser and amelioration are no longer required.	This MOP	No	na	Operations ongoing, trending towards target. Management of pasture required once appropriate.
	Weed and pest management	Weed and pest management inputs are no more than those of analogue sites.	This MOP EA Section	No	na	Operations ongoing, trending towards target. Management of pasture required once appropriate.
	Yields	Pasture production is comparable to similarly managed analogue site yields within 5 years. .	This MOP EA Section 7.16.9	No	na	Operations ongoing, trending towards target. Management of pasture required once appropriate.
	Stock water availability	Water storage and access to water are suitable to support low intensity grazing activities.	This MOP	No	na	Operations ongoing, trending towards target. Management of pasture required once appropriate.
Woodland rehabilitation areas will be self-sustaining and require	Nutrient recycling	Inspections confirm evidence of nutrient recycling (e.g. presence of fungi).	This MOP	No	na	Operations ongoing, trending towards target.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
ongoing management inputs that are appropriate for the final land use	Surface cover	Rehabilitation monitoring confirms ground cover (vegetation, leaf litter, mulch) is in the range of analogue sites at Year 10.	This MOP	No	9/ N/A	Operations ongoing, trending towards target.
	Vegetation health	More than 75 per cent of trees are healthy and growing as indicated by long term rehabilitation monitoring.	EA Section 7.16.9	No	na	Operations ongoing, trending towards target.
	Species composition	Revegetation areas contain flora species assemblages characteristic of the desired native vegetation communities.	This MOP EA Section 7.16.9	No	12/ N/A	Operations ongoing, trending towards target, works to ensure composition is trending towards target ongoing
	Reproduction	Rehabilitation monitoring confirms second generation tree seedlings are present or likely to be (e.g. presence of flowering).	EA Section 7.16.9	No	na	Operations ongoing, trending towards target.
	Structure	Rehabilitation monitoring confirms rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer, etc.) to encourage use by native fauna species.	EA Section 7.16.9	No	14/ N/A	Operations ongoing, works to ensure composition is trending towards target ongoing
	Native fauna presence	Rehabilitation monitoring confirms target native fauna species are recorded utilising rehabilitation areas.	This MOP	No	na	Operations ongoing, trending towards target.
Woodland rehabilitation corridors will connect with remnant vegetation and rehabilitation at	Connectivity	Habitat corridors are shown to be successfully established and consistent with desired vegetation community compositions.	This MOP	No	14/ N/A	Operations ongoing, trending towards target.

Domain Objective	Performance Indicator	Completion Criteria	Justification/ Source	Complete (Yes/No)	TARP Element(s) / Status	Comment
adjacent operations including Ravensworth Operations and Mount Owen Complex, to enhance habitat connectivity		Woodland corridors are assessed to provide contiguous structural habitat.	EA Section 7.16.9	No	14/ N/A	Operations ongoing, trending towards target.

Rehabilitation Detail

2020 Rehabilitation Detail					
Mountain Block					
Domain	4	**Re-vegetation Date:**	September 2020 November 2020	**Area:**	31.074 ha
Land Use: Grassland Seed/Plant Mix: Grassland with pockets spotted gum/ironbark woodland PCT 1602 This area is the remediation project, Mountain Block, in which previously unstable rehabilitation was subjected to substantial rework involving bulk shaping, soil amelioration, rock drains, revegetation, surface erosion protection and follow up maintenance. The Mountain Block area is in the Northern extent of the DA boundary and the slope is predominately facing south. A combination of excavated natural material, biomix (composted biosolids) and two different hydromulch products were utilised as soil ameliorants, growth medium and slope stabiliser. Seeding was completed through hydromulching via truck and helicopter due to slope steep and difficult access. Seeding mix is consistent with grassland rehabilitation with pockets of spotted gum/ironbark woodland PCT 1602 where the rehabilitation meets the northern Mountain Block Offset. Status/Progress: Initial strike by cover crop at the time of seeding. Monitoring program to continue to determine success and development of ameliorated soil and vegetation. Monitoring and inspections to date give appearance to the slope being stable with no major rills or erosion developing with recent rainfall. It is expected that the area will change significantly as it develops over the first 3 years.					
South Pit RL150					
Domain	4	**Re-vegetation Date:**	July 2020	**Area:**	1.522ha
Land Use: Woodland Seed/Plant Mix: Native woodland and cover crop This area is on the western extents of the South Pit overburden emplacement facing the New England Highway. Shaping was completed in May 2020 comprising of a 10 degree south facing slope adjoining neighbouring rehabilitation completed in 2019. Surface water drainage includes graded contour drains directing flow east towards the south pit void downslope. Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Topsoil was applied at 120mm as well as gypsum at 10t/ha. Surface preparation of the area included ripping to 400mm and 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 stag trees, logs and/or rock piles for native fauna. Seeding was completed by hand immediately following site preparation with woodland species seed mix consistent with target vegetation, Central Hunter Box Ironbark Woodland. Status/Progress: Good strike of cover crop and initial strike of natives with increase in rainfall in 2020. 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.					
Entrance Pit RL180 E04 Stage 1					
Domain	4	**Re-vegetation Date:**	October 2020	**Area:**	10.7266 ha
Land Use: Woodland Seed/Plant Mix: Native woodland and cover crop					

2020 Rehabilitation Detail

This area is on the western extents of the Entrance Pit overburden emplacement facing the railway. Shaping was completed in June 2020 comprising of a 10 degree west facing slope adjoining neighbouring rehabilitation completed in 2019. Surface water drainage includes graded contour drains directing flow to both the north (to tunnels to culverts and subsequently south pit) and south (to entrance pit void).

Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Topsoil was applied at 120mm as well as gypsum at 10t/ha. Surface preparation of the area included ripping to 400mm and 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 stag trees, habitat dam, logs and/or rock piles for native fauna. Seeding was completed by drone immediately following site preparation with woodland species seed mix consistent with target vegetation, Central Hunter Box Ironbark Woodland.

Status/Progress: Good strike of cover crop and initial strike of natives with increase in rainfall in 2020. 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.

Entrance Pit RL180 E04 Stage 2 – Woodland

Domain	4	**Re-vegetation Date:**	October 2020 December 2020	**Area:**	7.46ha

Land Use: Woodland

Seed/Plant Mix: Native woodland and cover crop

This area is on the western extents of the Entrance Pit overburden emplacement facing the railway. Shaping was completed in July 2020 comprising of a 10 degree west facing slope adjoining neighbouring rehabilitation completed in 2019. Surface water drainage includes graded contour drains directing flow to both the north (to tunnels to culverts and subsequently south pit) and south (to entrance pit void).

Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Topsoil was applied at 120mm as well as gypsum at 10t/ha. Surface preparation of the area included ripping to 400mm and 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 stag trees, logs and/or rock piles for native fauna. Seeding was completed by drone immediately following site preparation with woodland species seed mix consistent with target vegetation, Central Hunter Box Ironbark Woodland.

Status/Progress: Good strike of cover crop and initial strike of natives with increase in rainfall in 2020. 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.

Entrance Pit RL180 E04 Stage 2 – Pasture

Domain	4	**Re-vegetation Date:**	December 2020	**Area:**	3.48ha

Land Use: Pastoral/grazing

Seed/Plant Mix: Liddell summer pasture seed mix

Landform shaping completed in July 2020 for the northern section and October 2020 for the southern section comprising flat top of emplacement area with a clay stockpile in the centre providing visual microrelief. The area was ripped to reduce compaction, rock raked and gypsum applied at 10T/ha (50% recycled and 50% natural mined). Additionally fertilizer application of 250 kg/ha of DAP was applied post recommendation from a local agronomist. Chisel ploughed surface prior to seeding which was undertaken immediately following site preparation. Liddell summer pasture seed mix applied using locally sourced seed.

Status/Progress: Good strike of cover cross with increase in rainfall in 2020. Continue monitor and apply maintenance measures as necessary.

Entrance Pit RL180 E04 Stage 3 – Woodland

Domain	4	**Re-vegetation Date:**	September 2020 November 2020	**Area:**	7.51ha

2020 Rehabilitation Detail

			December 2020		

Land Use: Woodland

Seed/Plant Mix: Native woodland and cover crop

This area is on the western extents of the Entrance Pit overburden emplacement facing the railway. Shaping was completed in August and October 2020 comprising of a 10 degree west facing slope. Surface water drainage includes graded contour drains directing flow to both the north (to tunnels to culverts and subsequently south pit) and south (to entrance pit void).

Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Topsoil was applied at 120mm as well as gypsum at 10t/ha. Additionally a trial of application of a green waste mulch complying with the Compost Order 2016 was applied in various sections of this slope at rates 80t/ha and 50t/ha. Surface preparation of the area included ripping to 400mm and 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 stag trees, logs and/or rock piles for native fauna. Seeding was completed by drone immediately following site preparation with woodland species seed mix consistent with target vegetation, Central Hunter Box Ironbark Woodland.

Status/Progress: Good strike of cover crop and initial strike of natives with increase in rainfall in 2020. 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.

Tunnels to Culverts

Domain	4	**Re-vegetation Date:**	September 2019	**Area:**	2.48ha

Land Use: Grassland

Seed/Plant Mix: Grassland consistent with the MOP pasture mix

This area included bulk shaping, soil ameloriation, rock drains, revegetation and surface erosion protection. The project predominately involved the contruction of two drains intercepting the Entrance rehabilitation under the rail corridor through tunnels filled to the size of culverts to a large drain constructed in south pit, draining towards the void.

Topsoil was sourced from stockpiles from areas previously cleared for mining advancement. Hydromulch was also applied over the top of the topsoil (also containing seed) to provide stability and quick establishment and protection of slopes.

Status/Progress: Initial strike by cover crop at the time of seeding. It is expected that the area will change significantly as it develops over the first 3 years.

GLENCORE