

LEGEND

- Stage 1 Project Approval Boundary
- Stage 2 Project Approval Boundary
- Surface Disturbance Boundary (Life of Mine)
- Mining Lease Boundary
- Roads
- Rail
- Watercourses
- Drainage Line
- Contours (5m)
- POWERLINE 66KV
- POWERLINE 330KV
- National Parks and Reserves

Primary Domains

- 1. Active Mining (Open Cut)
- 1. Active Mining (Underground / Previous Workings)
- 2. Operational Water Management Area
- 3. Coal Processing and Handling Facilities
- 4. General Infrastructure
- 5. Overburden Emplacement Area
- 6. Subsidence Limit

Secondary Domains

- A. Rehabilitation Area - Woodland
- B. Rehabilitation Area - Forest
- C. Rehabilitation Area - Grassy Woodland
- D. Rehabilitation Area - Agricultural
- E. Post Mining Water Management Area
- F. Final Void
- G. Biodiversity Offset Area

Rehabilitation Phases

- Landform Establishment
- Ecosystem and Land Use Establishment
- Growth Medium Development
- Temporary Rehabilitation

0 250 500 750 1000

I, Steve Archinal, the General Manager, Moolarben Coal Operations, certify that the information on this plan is a true indication of the proposed development.



4250 Ulan Road
Ulan NSW 2850
Phone: 02 6376 1500
Fax: 02 6376 1599

Moolarben Coal Complex Mining Operations Plan
Mining and Rehabilitation (Dec 2017)
Plan 3A

Drawing No. MOP-2016-003A
Revision No. 0

Date	Scale	Drawn	Checked	Coordinate System	Sheet Size
31/10/2016	1:12,000	CH	GC	MGA Zone 55	A0

5.0 ACTIONS REQUIRED FROM PREVIOUS REPORTING PERIOD

Actions in response to the 2013-2014 Annual Review are provided in **Table 7**.

Table 7 : Actions from Previous Annual Review

Action Required from previous Annual Review	Requested by	Action Taken by MCO	Section of AR addressing this action
Review and revise as necessary all environmental management plans	MCO	Action Completed. Management plans reviewed and updated as required.	6, 7 and 8
Review real-time validation monitoring results following 12 months of data collection	MCO	Action Completed	6.2
Modify Ulan School blast monitor to include mains power connection	MCO	Action Partially Completed	6.3
Relocation of TEOM05 further north, including updated EPL	MCO	Action Partially Completed	6.4
Update the Energy Savings Action Plan	MCO	Action Completed	6.4
Baseline weed and feral mapping of vegetation management zones 1 & 2	MCO	Action Completed	6.5
Continued monitoring, including autumn baseline monitoring of EPBC (2007/3297) offsets	MCO	Action Completed	6.5
Assist NPWS with the proposed hazard reduction burn	MCO	Action Completed	6.5.4
Review and revise the groundwater monitoring triggers	MCO	Action Completed	7.0
The future monitoring network reviewed for the conceptual life of the mine	MCO	Action Completed	7.0
Investigate and repair as necessary out of service piezometers	MCO	Action Partially Completed	7.4
Baseline monitoring of PZ201, PZ202 and PZ203 to establish triggers	MCO	Action Completed	7.4
Spring and seep census including the upper reaches of Eastern Creek and Goulburn River around the northern and north-western boundary of UG4	MCO	Action Partially Completed	7.4.3
Survey of the Powers Creek Conservation Area by June 2017	MCO	Action Completed	6.6

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.0 ENVIRONMENTAL PERFORMANCE

In accordance with the Project Approvals of the site, MCO have developed in consultation with the relevant government agencies, a series of site Management Plans. Currently approved plans are available for review via the MCO website - <http://www.moolarbencoal.com.au/page/licences-and-approvals/environmental-management-plans/>

In order to measure compliance with the project approvals, various licences, and site management plans, MCO undertakes a comprehensive environmental monitoring program. The locations of environmental monitoring undertaken during the 2016 reporting period are identified in **Appendix 2**.

This section provides summary details on:

- **Section 6.1** - Meteorological overview
- **Section 6.2** - Noise;
- **Section 6.3** – Blasting;
- **Section 6.4** – Air quality;
- **Section 6.5** – Biodiversity; and,
- **Section 6.6** – Heritage.

Water, rehabilitation and community are reported in **Sections 7.0, 8.0** and **9.0** respectively.

6.1 METEOROLOGICAL OVERVIEW

MCO utilises two permanent meteorological monitoring stations – WS01 – (MCO Administration Office), WS03 (Ulan Road), and one mobile unit, WS04. The localities of the permanent locations are illustrated in **Appendix 2**. WS03 is linked to the real time monitoring system and is the principle weather station for reporting purpose, with WS01 and WS04 are used to supplement weather data as required.

Meteorological parameters recorded by WS03 include:

- wind speed at 10 m, wind direction at 10 m, and standard deviation of wind direction (sigma-theta) at 10 m;
- temperature at 2 m and 10 m;
- relative humidity at 2 m;
- solar radiation at 2 m;
- temperature difference between 2 m and 10 m; and,
- Rainfall

Table 8 summarises rainfall and temperature data obtained from WS03 for 2016. Total rainfall for 2016 was calculated as 850.2mm, with September 2016 being the wettest month (195.2mm) and February being the driest (6.2mm). Rainfall at MCO was similar to the annual rainfall obtained from the Bureau of Meteorology website for the Gulgong Post Office, which recorded 848.4mm for 2016. In 2015, MCO recorded 768.2mm, making 2016 a wetter year and above average. Temperature recorded at WS03 ranged from - 3.6 °C in May 2016, to 36.9°C in January 2016. In comparison to 2015, the 2016 year at MCO was not as cold (in 2015, MCO reached -4.5°C), or as hot (in 2014, MCO reached 37.2°C). From January to April and during December north east winds were predominate with SE winds predominant from May to November.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Meteorological data is presented in **Appendix 3A**.

Table 8: Meteorological Summary – MCO WS03

Month	Rainfall (mm)	Cumulative Rainfall (mm)	Long-term Rainfall (mm)	Cumulative Long-term Rainfall (mm)	Max Temp (°C)	Min Temp (°C)
Jan-16	111.8	111.8	70.8	70.8	36.9	10.7
Feb-16	6.2	118.0	61.1	131.9	36.3	9.8
Mar-16	19.6	137.6	54.6	186.5	34.3	5.9
Apr-16	25.8	163.4	44.1	230.6	31.9	8.1
May-16	65.0	228.4	45.3	275.9	24.5	-3.6
Jun-16	114.6	343.0	51.2	327.1	17.2	-2.8
Jul-16	95.8	438.8	49.4	376.5	20.4	-3.4
Aug-16	62.8	501.6	46.0	422.5	20.8	-2.2
Sep-16	195.2	696.8	47.4	469.9	20.1	0.8
Oct-16	71.2	768.0	55.4	525.3	28.3	1.8
Nov-16	53.0	821.0	59.7	585.0	31.9	4.0
Dec-16	29.2	850.2	67.4	652.4	36.2	7.7
Total	850.2	850.2	652.4	652.4		

6.2 NOISE

MCO manages noise in accordance with the MCO Noise Management Plan (NMP). The NMP was revised in August 2016 and submitted for approval. The plan was developed by MCO with advice from experienced and qualified experts (SLR Consulting Australia Pty Ltd) to satisfy Condition 7, Schedule 3 of PA 05_0117 (as modified) and Condition 8, Schedule 3 of PA 08-0135.

During the reporting period, major noise producing activities included:

- The operation of OC1, OC2 and OC4, the CHPP and rail load-out facilities;
- Construction activities in OC4, Underground 1, CHPP, and Open Cut Admin/Workshop mine infrastructure areas.

Operational processes for MCO to reduce noise emissions included:

- Use of sound attenuated major equipment;
- Separate day and night dumping areas when deemed necessary;
- Use of shielded areas in adverse weather conditions;
- Use of real-time noise monitoring data and Mine Production Environmental Assistants to assist operational personnel in proactive management of noise impacts;
- Use of interactive predictive noise models to assess predicted noise risks associated with meteorological influences;
- Sound power testing equipment; and,
- Regular maintenance of equipment, including sound attenuation components.

6.2.1 REAL-TIME NOISE MONITORING

The NMP identifies response triggers for the real-time noise via four monitoring stations (refer **Appendix 2** for localities). When a trigger has been reached, an SMS alarm is sent to operational personnel and

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

members of the Environment and Community Department. The real-time monitoring network operated throughout the period.

6.2.2 ATTENDED NOISE MONITORING

During the 2016 reporting period, attended environmental noise monitoring was conducted monthly and quarterly. The purpose of attended noise monitoring is to quantify and describe the existing acoustic environment around MCO's operations and compare results with Noise Impact Assessment Criteria for compliance.

Noise Impact Assessment Criteria are specified for day, evening, and night period to protect the amenity of neighbouring residences. Impact Assessment Criteria are expressed as LA1eq (15min) and LA1eq (1min). Table 9 provides a summary of environmental noise monitoring performance relating to attended noise monitoring for 2016, together with the approved criteria at various sites as well as management implications and proposed actions.

Attended environmental noise monitoring was conducted monthly during reporting period. MCO complied with the project specific criteria at all monitoring sites during attended noise monitoring undertaken between January and December 2016. A summary of operational environmental noise surveys conducted around MCO's operations during the period 1 January to 31 December 2016 is provided in **Appendix 3B**.

Predicted noise levels from Year 2016 of the OC4 South West Haul Road Modification (Stage 1 MOD 11 and Stage 2 Modification 1) were compared against actual noise levels during 2016. Results indicated that MCO was generally well under the predicted levels where meteorological conditions were relevant. Two readings were above predictions for LA1,1minute readings, during the inversion with drainage conditions. There are no systemic issues as a result of the operation (**Section 6.2.4**).

6.2.3 ATTENDED VALIDATION NOISE MONITORING

In accordance with the NMP, attended monitoring was undertaken monthly from July 2015 to July 2016 then annually at three locations (i.e. NA2, NA3 & NA12) to verify the results of real-time noise monitoring. As required by the NMP, a fourth location (NA10) will be established during the next reporting period when open cut mining operations in OC2 are within 3.5 km of Receiver 28.

A review of validation monitoring concluded that the three current real-time monitors consistently overestimated the MCO LAeq during the validation periods. The real-time data appeared to be routinely influenced by extraneous low frequency noise sources such as road traffic, aircraft dogs and wind. Due to the ability to distinguish between contributing noise sources, the real-time data is not suitable for compliance purposes and cannot be relied upon to provide accurate estimated of mine generated noise.

It is recommended that further investigation of noise source generating alarms may be warranted prior to implementing noise management response action. Investigation of alternate triggers is also recommended and is currently being progressed. The results from the attended validation of real time noise monitoring are provided in Table 10 below.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 9 : Attended Noise Monitoring Summary

Aspect	Approved Criteria					Performance During the Reporting Period	Key Management implications	Implemented/ proposed management Actions	
	Land No.	Day ¹ LA1eq (15min).	Evening ² LA1eq (15min).	Night ³ LA1eq (15min). LA1eq (1min).					
Attended Noise Monitoring	30,63	39	39	39	45	Monthly attended monitoring was undertaken at three locations (NA1, NA12 & NA6) throughout 2016 as required by the NMP	Noise management controls are effective.	Continue the implementation of the NMP.	
	70	37	37	37	45				
	75	36	36	36	45				
	31	36	35	35	45	Quarterly monitoring was undertaken at three locations (NA11, GRNP & MGNR) throughout 2016 as required by the NMP.		Review real-time noise triggers following real-time validation monitoring.	Review NMP following Annual Review and revise as necessary.
	All other privately owned land residences	35	35	35	45				
	Ulan School	35 (internal) when in use			-	MCO complied with all relevant noise assessment criteria during all attended noise monitoring in 2016.			
	Ulan Anglican Church Ulan Catholic Church	35 (internal) when in use			-				
	Goulburn River National Park Munghorn Gap Nature Reserve	50			-				
									<i>Note approved monitoring locations were selected as representative of residences and are shown in Appendix 2.</i>

1 Day is defined as the period between 7am-6pm Monday to Saturday, and 8am-6pm on Sundays and Public Holidays

2 Evening is defined as the period 6pm-10pm

3 Night is defined as the period from 10pm-7am Monday to Saturday, and 10pm-8am on Sundays and Public Holidays.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 10 : Attended Validation Noise Monitoring

Date	NA2 – Noise Monitoring			NA3 – Noise Monitoring			NA12 – Noise Monitoring		
	Real-time Levels -dB	Attended Levels - dB	Difference - dB	Real-time Levels -dB	Attended Levels - dB	Difference - dB	Real-time Levels -dB	Attended Levels - dB	Difference - dB
	¹ L _{Aeq,LF}	MCO L _{Aeq} ²	MCO L _{Aeq}	¹ L _{Aeq,LF}	MCO L _{Aeq} ²	MCO L _{Aeq}	¹ L _{Aeq,LF}	MCO L _{Aeq} ²	MCO L _{Aeq}
July 2015	35	33	-2	33	<25	>8	35	<25	>10
August 2015	⁻³	IA ⁵	N/A	31	IA ⁵	N/A	33	IA ⁵	N/A
September 2015	33	33	0	30	<25	>5	32	26	-6
October 2015	43	35	-8	27	<25	>2	34	<25	>9
November 2015	27	26	-1	24	IA ⁵	N/A	31	IA ⁵	N/A
December 2015	33	27	-6	34	26	-8	36	<20	>16
January 2016	38	36	-2	30	24	-6	30	23	-7
February 2016	⁻³	36	N/A	27	22	-5	36	IA ⁵	N/A
March 2016	⁻³	38	N/A	36	32	-4	⁻³	29	N/A
April 2016	42	42	0	34	31	-3	33	30	-3
May 2016	⁻³	34	N/A	26	<20	>6	35	<25	>6
June 2016	35	28	-7	17	IA ⁵	N/A	24	<20	>-4
July 2016	31	<25	>6	24	<25	0	33	IA ⁵	N/A

1 LAeq,LF refers to LAeq,15minute in the frequency range 20 to 630 Hz as measured by the real-time noise monitors;

2 MCO LAeq refers to the estimated or measured LAeq,15minute attributed to MCO;

3 Data not available at this location due to temporary loss of communication; and

4 NA indicates real-time monitoring data not available for required time period; and

5 IA denotes MCO inaudible.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.2.4 COMPARISON TO PREDICTED LEVELS

Predicted noise levels from Year 2016 of the OC4 South West Haul Road Modification (Stage 1 MOD 11 and Stage 2 Modification 1) were compared against actual noise levels during 2016.

Measured operational levels are compared to predicted levels in **Table 11**. In this table, a ‘positive’ difference is where the measured level is greater than the predicted level. A ‘negative’ difference is where the measured levels are less than the predicted levels. Notation used in the tables to denote differences is irrespective of the integer value sign. For example, the notation >-17 means the values are more than 17 dB less than the predicted level. Where the meteorological conditions (primarily wind direction and temperature gradient) during the attended monitoring do not correspond with those that are modelled, no further analysis is undertaken. The comparison shows monitoring results are in accordance with predicted results. A summary report for attended noise monitoring and comparison against predicted results is included in **Appendix 3B**.

Table 11: EA Predictions– Attended Noise Monitoring, Various Weather Conditions dB(A)_{Leq (15min)}

Location	NA1 Ulan School	NA6 Lower Ridge Rd	NA12 Winchester Cres
	Day ^{1,2,3}	Night ^{2, 4}	Night ^{2, 4}
January	NR	-8 ⁴	-11 ⁴
February	NR	NR	IA
March	NR	NR	-5 ⁴
April	NR	-5	-4 ⁴
May	NR	NR	>-9 ⁴
June	NR	>-12 ⁴	>-14 ⁴
July	NR	IA	IA ⁴
August	NR	>-17 ⁵	NR
September	NR	-5 ⁴	>-4
October	NR	NR	IA ⁴
November	NR	IA ⁴	NR
December	IA	NR	NR

¹ NR denotes met conditions not relevant, NA denotes not applicable, IA denotes conditions relevant but MCO inaudible during monitoring, NM denotes conditions relevant but MCO not measurable during monitoring.

² Wind conditions assumes winds at speeds between 0.1 and 3 m/s during monitoring;

³ Assumes the following possible predicted wind directions: WSW from 236.25 to 258.75 degrees; W from 258.75 to 281.25 degrees

⁴ Assumes the following possible predicted wind directions for night time monitoring: ENE from 56.25 to 78.75 degrees, E from 78.75 to 101.25 degrees, SSW from 191.25 to 213.75 degrees, SW from 213.75 to 236.25 degrees and WSW from 236.25 to 258.75 degrees; and

⁵ Conditions relevant, however, temperature gradient greater than 0 degrees C per 100 metres during monitoring; and

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.3 BLASTING

MCO manages blasting in accordance with the Blast Management Plan (BMP). The BMP was revised in August 2016 and submitted for approval. The plan was developed by MCO with advice from experienced and qualified experts (SLR Consulting Australia Pty Ltd) to satisfy Condition 15, Schedule 3 of PA 05_0117 (as modified) and Condition 16, Schedule 3 of PA 08-0135 (as modified).

Blasting criteria, blasting hours, blasting frequency, property inspection requirements and operating conditions are provided in Conditions 8 to 14, Schedule 3 and Conditions 9 to 15, Schedule 3 of the NSW Project Approvals (05_0117 and 08_0135, respectively).

The blast monitoring locations are identified in **Appendix 2**. During the reporting period blast monitoring included airblast overpressure and ground vibration at locations representative of privately owned residence, churches and schools, and aboriginal rock shelters where required. BM1 located at Ulan School was relocated to an area with improved solar power potential that will also allow mains power as required to minimise the risk of power outages. In the event power supply is unreliable, mains power connect may be required.

A summary of the blast monitoring parameters is provided in **Table 12**.

Table 12: Blast Monitoring Parameters

Parameter	Units of Measure	Frequency	Sampling Method
Overpressure	dB (Lin Peak)	Every blast	Type 1 noise blast logger
Ground Vibration	mm/s	Every blast	Geophone logger or similar
Fume	AEISG Code of Practice Fume Rating System	Every blast	Observation and video recording

Note - Full meteorological complement of monitoring is undertaken via WS1 (MCO Admin), WS3 (Ulan Road) and WS5 (Mobile Unit), as described in Section 6.1 of this report.

6.3.1 SUMMARY OF BLAST MONITORING RESULTS

Table 13 illustrates monitoring compliance for the reporting period, and a summary of blast monitoring results for the period is provided in **Table 15**. Individual blast results are provided in full at **Appendix 3C**.

Table 13 : Blast Summary – Compliance Monitoring (BM1 & BM5)

Blast Summary	Number	Compliance (% Of Blasts)
Total Blasts	115	
Days with >2 blasts	0	Compliant
Annual average blasts per week	2.2	Compliant
Blasts outside blasting hours	0	Compliant
Airblast Overpressure >115 dB(Lin Peak)	3 ¹	Compliant (2.6%)
Airblast Overpressure >120 dB(Lin Peak)	0	Compliant
Ground Vibration >5 mm/s)	0	Compliant (0%)
Ground Vibration >10 mm/s)	0	Compliant (0%)
Reportable Fume Events	1	(<1%)

¹Three blasts recorded in exceedance of 115 dBL for the reporting period – two at BM1 (05/04/16 & 07/09/16), and one at BM5 (21/3/16) with environmental effects influencing results on 21/3/16.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.3.2 COMPARISON TO PREVIOUS BLAST MONITORING AND PREDICTED LEVELS

A comparison of the 2016 blast results to 2015 results and predictions in the EA are outlined in **Table 14** below.

Table 14 : Comparison to Blasting Results - BM1 & BM5, 2015 and EA

Site	Vibration Predictions in EA (mm/s)	2015 vibration range (mm/s)	2016 vibration range (mm/s)	Comment on results
BM1 Ulan School	2.3	0.08-3.2	0.08-1.58	Generally consistent with previous results, slightly lower than predicted.
BM5 Ridge Rd	Site not originally modelled	0.01 – 1.76	0.01 – 1.24	Generally consistent with previous results.
Site	Overpressure in EA (dBL)	2015 Overpressure Range (dBL)	2016 Overpressure Range (dBL) ¹	Comment on results
BM1 Ulan School	114.0	88.0-115.9	81.9-116.1	Generally consistent with previous results, slightly higher than predicted.
BM5 Ridge Rd	Site not originally modelled	81.9-115.4	89-110.9	Generally consistent with previous results.

¹ Excludes environmental influenced results.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 15 : Blast Monitoring Summary

Aspect	Approved Criteria				Performance During the Reporting Period	Trend/ Key Management Implications	Implemented/ proposed actions
	Receiver	Air Blast Overpressure Level dB (Linear Peak) dBL ¹	Peak Particle Velocity – Ground Vibration mm/s ²	Allowable Exceedance			
Blast	Receiver				<p>Due to the localities of the blasts, compliance monitoring was undertaken at the following locations for the 2016 reporting period</p> <ul style="list-style-type: none"> • BM1 - Ulan School <ul style="list-style-type: none"> ○ <u>Max. Overpressure</u> =116.1 dBL. On two occasions OP exceeded >115 dBL, which is less than 5% of the total blasts for the year. The.>120 criterion was not exceeded. ○ <u>Max Ground Vibration</u> =1.58 mm/s therefore less than the 5mm/s (and 10mm/s) criterion. Average was calculated as 0.40 mm/s. • BM5 – Ridge Road <ul style="list-style-type: none"> ○ <u>Max. Overpressure</u> =116.3 dBL. –On one occasion, the >115 criterion was exceeded, which is less than 5% of the total blasts for the year. The reading was wind effected. ○ No data was collected for the blast on January the 22nd 2016 due to technical issues with BM5. ○ <u>Max Ground Vibration</u> =1.24 mm/S therefore less than the 5mm/s (and 10mm/s) criterion. Average was calculated as 0.37 mm/s. <p>A full blast summary is contained at Appendix 3C.</p>	<p>The MCO BMP was revised and submitted for approval in the period.</p>	<p>Review Blast Management plan following Annual Review and revise as necessary.</p> <p>Review the blast monitoring network</p>
	Residence Privately Owned	120	10	0%			
		115	5	5% of the total number of blasts over a 12 month period			
All Public Infrastructure ³	-	50	0%				

Notes - ¹- dB (Linear Peak) dBL = decibel linear peak ²- mm/s = millimetres per second ³ - These criteria do not apply if the Proponent has a written agreement with the relevant owner, and has advised the Department in writing of the terms of this agreement. MCO has written agreements with TransGrid and Australian Rail Track Corporation (ARTC) to undertake blasting within 500 metres (m) of the Wollar-Wellington 330 kV transmission line and within 500 m of ARTC infrastructure, respectively.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.4 AIR QUALITY

MCO manages air quality in accordance with Air Quality Management Plan (AQMP). The AQMP was revised in August 2016 and submitted for approval. The plan was developed by MCO with advice from experienced and qualified experts (Todoroski Air Sciences) to satisfy Condition 19, Schedule 3 of PA 05_0117 (as modified) and Condition 20A, Schedule 3 of PA 08-0135.

During the reporting period, MCO undertook air quality monitoring in accordance with the approved AQMP. This included:

- Deposited particulate matter monitoring with Dust Depositional (DD) gauges at eleven locations around the Moolarben Coal Complex;
- PM₁₀ – High Volume Sampling (HVAS) monitoring at two sites – Ulan Village (PM01) and south-west of Open Cut 1 and west of Open Cut 2 (PM02);
- PM₁₀ – Real Time Monitoring via Tampered Element Oscillating Mass Balance's (TEOMs) at four locations around the Moolarben Coal Complex; Total Suspended Particulate (TSP) matter calculated from the results obtained from TEOM PM₁₀ monitoring;
- Preparation for relocation of TEOM05; and
- Meteorological monitoring is undertaken via Automatic Weather Stations (AWSs), with WS3 (located on Ulan Road) the principle station for reporting purposes.

The AQMP monitoring locations are identified in **Appendix 2**. The air quality monitoring program and is outlined in **Appendix 3D**. A summary of air quality monitoring results for the reporting period is provided in **Table 16** and **Table 17** and **Appendix 3D**.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 16: Air Quality Monitoring Summary

Aspect		Approved Criteria	Performance during the Monitoring Period	Trend/ Key Management Implications	Implemented/proposed Management Action
Air Quality	Monitoring Form				
	Dust Deposition	4/g/m ² /month (max total) 2g/m ² /month above background average (Incremental increase)	Annual averages for each dust depositional gauge are reported in Table 18 . All dust depositional results for the 2016 reporting period complied with the 4/g/m ² /month criterion. The 2g/m ² /month criterion was not triggered.	Dust depositional results for the reporting period indicate a declining and/or a stable trend at most locations when compared to the previous year.	Continue the implementation of the AQMP. Review AQMP following Annual Review and revise as necessary.
	PM ₁₀	50µg/m ³ (24hr average)	The maximum PM ₁₀ results for the reporting period are outlined below. <ul style="list-style-type: none"> TEOM 01 – 41.8µg/m³ TEOM 04 – 34.8µg/m³ TEOM 05 – 31.3µg/m³ TEOM 06^a – 71.2µg/m³ (39.1µg/m³ excluding extraordinary events – Prescribed burns) PM01 - 36µg/m³ PM02 - 28µg/m³ 	There were two exceedences of the 24hr PM ₁₀ 24 hour average criteria at TEOM 6 during April. All results exceeding the criteria were associated with and a result of hazard reduction burns in the Goulburn River National Park.	Relocation of TEOM05.
	PM ₁₀	30µg/m ³ (Annual average)	The average PM ₁₀ results for the reporting period are presented in Table 19 . All sites were within compliance of the 30µg/m ³ (Annual limit)	Annual average PM ₁₀ results for the 2016 reporting period indicate a declining and/or stable trend at most locations when compared to 2015.	
	Total Suspended Particulate (TSP)	90µg/m ³ (Annual average)	TSP results are presented in Table 20 TSP is calculated using the approved AQMP methodology based on the accepted relationship that PM ₁₀ constitutes 40% of the total TSP. During the reporting period, all sites were calculated as being below the 90µg/m ³ criterion.	Annual average TSP results for the 2016 reporting period indicate a declining and/or stable trend at most locations when compared to 2015.	

^a Maximum results due to extraordinary event - prescribed burning..

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

An explanation of exceedances of the TEOM 50µg/m³ (Daily limit) criterion is outlined below:

- 28 April 2016 – TEOM06 recorded 71.2µg/m³. An investigation concluded the exceedance was the result of a hazard reduction burn undertaken within the Goulburn River National Park (GRNP) at the time of the exceedance. The prevailing wind was from E to the SE, in the direction of TEOM 06.
- 29 April 2016 – TEOM06 recorded 55.7µg/m³. An investigation concluded the exceedance was the results of a hazard reduction burn undertaken within the Goulburn River National Park (GRNP) at the time of the exceedance. The prevailing wind was from the SE, in the direction of TEOM 06.

As the exceedance on the 28th and 29th of April 2016 was influenced by the hazard reduction burning operations within the GRNP, the air quality impact assessment criteria are not applicable in accordance with Condition 17 and Condition 19, Schedule 3 and Condition 18 and Condition 20, Schedule 3 of PA 05_0117 and PA 08_0135, respectively.

6.4.1 DATA CAPTURE RATE

The following table (**Table 17**) provides details on the data capture rates for the reporting period.

Table 17 Data Capture Rate for PM₁₀ Annual Averages

Location	Criteria (µg/m ³)	2015 Annual Average (µg/m ³)	2016 Annual Average (µg/m ³)	2016 Data Capture Rate
TEOM 01 (Ulan School)	30	13.2	13.0	99.5%
TEOM04 (Ulan Road)	30	9.0	11.6	96.2%
TEOM05 (Ridge Road)	30	8.5	8.5	99.7%
TEOM06 (Ulan-Wollar Road)	30	11.2	11.5	99.2%
PM01 (Ulan Village)	30	13.2	11.5	100%
PM02 (Ridge Road)	30	10.8	9.9	100%

Notes: Power outages, replacement TEOM for TEOM 4, routine maintenance of TEOMs were the main causes of data loss during the 2016 reporting period. The data capture rate was an improvement on the 2015 reporting period. Annual Averages include extraordinary events such as bushfires and prescribed burns.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.4.2 COMPARISON TO PREVIOUS AIR QUALITY MONITORING AND BACKGROUND LEVELS

Dust Deposition

Year 2 of the Stage 1 Optimisation Modification (Mod 9) has been selected for EIS comparison, as it is the most reflective of the current mining operations at MCO. All deposition results are within criteria and generally consistent with predicted with predicted results (Table 18). Data trends are presented in Appendix 3D.

Table 18: Comparison of Depositional Dust results

Dust Gauge	Annual Average (g/m ² /month)							Yr 2 (MOD 9) Predictions
	Back-ground	2011	2012	2013	2014	2015	2016	
DG01	1.2	0.4	0.3	0.5	0.8	0.6	0.5	0.9
DG04	2.0	1.6	1.3	1.3	1.6	1.0	1.2	1.1
DG05	1.8	1.5	0.8	1.0	2.0	0.8	1.3	0.7
DG06	1.2	0.6	0.4	0.7	1.0	0.6	0.6	0.6
DG07	1.7	0.7	0.8	1.0	0.9	0.9	0.9	0.6
DG08	1.4	0.8	0.7	0.7	0.8	0.6	0.7	0.7
DG09		0.5	0.4	0.7	2.0	0.6	0.6	0.6
DG11		-	-	0.6	0.8	0.6	0.7	0.7
DG12		-	-	-	-	1.5	1.0	<1.0
DG13		-	-	-	-	0.7	0.7	0.7
DG14		-	-	-	-	1.1	0.7	1.0

PM₁₀

Year 2 of the Stage 1 Optimisation Modification (Mod 9) has been selected for EIS comparison, as it is the most reflective of the current mining operations at MCO. Results are within criteria and generally consistent with predicted results (Table 19) indicating that current air quality management practices are effective. Data trends are presented in Appendix 3D.

Table 19: Comparison of annual average PM10 Results

Unit	Annual Average (µg/m ³)							Yr 2 (MOD 9) Predictions
	Back-ground	2011	2012	2013	2014	2015	2016	
Ulan School (TEOM01)	15.1	9.3	10.2	12.4	11.4	13.2	13.0	24.7
Ulan Road (TEOM04)	_*	8.9	8.9	10.8	12.7	9.0	11.6	9.5
Ridge Road (TEOM05)	_*	_**	**_	16.6	11.2	8.5	8.5	6.0
Ulan-Wollar Road (TEOM06)	_*	_**	_**	**_	_**	9.0	11.5	12
Ulan Village HVAS (PM01)	17.9	12.4	11.9	12.2	13.8	13.2	11.5	9.5
Ridge Road HVAS (PM02)	_*	10.5	9.7	10.0	11.7	10.8	9.9	13.2

* No background values as site established after 2009. ** No previous data as site not established.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Total Suspended Particulates

TSP results (Table 20) are within criteria and generally consistent with predicted results.

Table 20: Comparison of annual average TSP results

Unit	Annual Average Calculated TSP ($\mu\text{g}/\text{m}^3$)							
	Background	2011	2012	2013	2014	2015	2016	Yr 2 (MOD 9) Predictions
TEOM01(Ulan School)	37.75	23.25	25.5	31	28.5	33	32.6	43.0
TEOM04 (Ulan Road)	0	22.25	22.25	27	31.75	22.5	29.0	19.6
TEOM05 (Ridge Road)	*	**	**	41.5	28	21.25	21.2	14.3
TEOM06 (Ulan-Wollar Road)	*	**	**	**	**	22.5	28.8	25
PM01(Ulan Village HVAS)	44.75	31	29.75	30.5	34.5	33	28.8	43.2
PM02 (Ridge Road HVAS)	*	26.25	24.25	26.25	29.25	27	24.8	18.1

* No background values as site established after 2009. ** No previous data as site not established.

6.4.3 SPONTANEOUS COMBUSTION

No spontaneous combustion events occurred during the period.

6.4.4 GREENHOUSE GAS REPORTING

Yancoal’s Australian operations reported under the National Greenhouse and Energy Reporting Scheme for the 2015-16 financial year. Scope 1 and Scope 2 emissions calculated for the 2015-16 financial year was 168,647t CO₂-e. Scope 1 and Scope 2 emissions calculated for the 2014-15 financial year was 108,222t CO₂-e. The increase in emissions is most likely due to the expansion of the mine and increased operational activity.

Year 4 of the Stage 1 Optimisation Modification (Mod 9), estimated emissions for Scope 1 and Scope 2 at 156,162 t CO₂-e, approximately 12,485 t CO₂-e less than calculated emissions for the 2015-16 financial year. The difference may be a result of different reporting periods i.e. financial year for actual calculated emissions as opposed to calendar year predicted emissions in Mod 9.

The Energy Savings Action Plan was revised in August 2016 and submitted for approval.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

6.5 BIODIVERSITY

MCO manages biodiversity in accordance with the Biodiversity Management Plan (BioMP). The BioMP was revised in August 2016 and submitted for approval. The plan was developed by MCO with advice from experienced and qualified experts (EcoLogical Australia) to satisfy Condition 36, Schedule 3 of PA 05_0117 (as modified) and Condition 39, Schedule 3 of PA 08-0135 (as modified). In accordance with Condition 13(a), Schedule 2 of the Project Approvals (05_0117 and 08_0135), the BioMP is being staged and revisions of the plan will be submitted on a progressive basis.

The objectives of the BioMP are to provide procedures and strategies to be implemented during the life of the Project to minimise biodiversity impacts on site (albeit in consideration of the approved impacts) and enhance biodiversity values on the offset areas. In addition to monitoring, the BioMP describes the necessity of and procedures for:

- Vegetation Clearance Protocol – including Ground Disturbance Permits (GDPs), Pre-clearance surveys, habitat features, identification of suitable release locations;
- Collection and use of locally sourced native seed and supplementary tubetock;
- Strategies to manage vegetation onsite and improve vegetation connectivity;
- Additional biodiversity measures – rehabilitation of the environmental bund, management of salinity, weeds and pests, surface water management and erosion control, management of grazing and agriculture, access restrictions, and bushfire management.

The objective of biodiversity monitoring is to evaluate the vegetation and fauna habitat condition at the Moolarben Coal Complex (including recovery and or enhancement of native vegetation) and to identify appropriate management actions to be applied, where required. Biodiversity monitoring relating to the vegetation management zones includes noxious weed monitoring and vertebrate pest monitoring. This monitoring will be used to measure success against the short, medium and long term targets described in Section 10 (Table 4) of the BioMP and also the need for corrective actions

Monitoring of mine rehabilitation areas is described in the Rehabilitation Management Plan.

6.5.1 LAND PREPARATION

Pre-Clearance Survey

During the reporting period, MCO continued to prepare land for the advancement of Open Cut mining in accordance with approved management plans and GDPs. Pre-clearing surveys were undertaken across approximately 187ha of land during the reporting period.

No threatened flora species listed as vulnerable or endangered under the NSW Threatened Species Conservation Act 1995 (TSC Act) or the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) were observed during the pre-clearing surveys.

Two threatened fauna species listed as vulnerable under the TSC Act were identified during the pre-clearing surveys. These were:

- *Climacteris picumnus victoriae* (Brown Treecreeper (eastern subspecies)) – vulnerable (TSC Act)
- *Melanodryas cucullata cucullata* (Hooded Robin (south-eastern form)) – vulnerable (TSC Act)

Clearing Supervision

During all land disturbance activities for the period, fauna species searches were completed with fauna identified either observed evacuating during clearing or relocated by appropriately qualified ecologists prior to disturbance.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

During the clearing supervision, felling of all identified habitat trees was undertaken under the supervision of a suitably qualified ecologist. The majority of fauna observed during clearing supervision evacuated hollow-bearing trees on their own accord or were relocated [TC1].

6.5.2 BIODIVERSITY OFFSET WORKS UNDERTAKEN

Weed and feral animal baseline monitoring and control works were undertaken throughout the reporting period. Wild dog baiting was undertaken in conjunction with the NSW Local Land Service (LLS) within biodiversity offset properties. Weed control works were undertaken throughout the offset areas focusing on Serrated Tussock, Blackberries, Blue Heliotrope, St Johns Wort, and Prickly Pear. Native seed collection was continued within offset areas.

Fencing maintenance activities were completed on Clarkes and Property Five. On ground and desktop mapping activities were completed on the majority of offsets including weed and feral animal baseline, fire breaks, required fences, waste, and erosion.

A feral animal monitoring program has been set up and undertaken on all offset properties with the exception of Area 2 and Area 3. The program will include Area 2 and 3 during the 2017 reporting period.

A Prescribed Burn was undertaken by the NPWS in the Goulburn River National Park and included a portion on the eastern side of Area 2 offset.

During the period two offset areas were gifted to the National Parks Estate. Offset security mechanisms for 17 of the 19 offset areas were prepared and issued to the DP&E for approval. A revised Biodiversity Offset Management plan for EPBC (2008/4444) was issued to the DotE with amendments to address previous feedback. Additional responses were provided and will be incorporated in future revision of the plan.

6.5.3 BIODIVERSITY OFFSET MONITORING

Flora and fauna monitoring during 2016 included the Stage 1 and EPBC (2007/3297) Biodiversity Offset Areas (BOAs) Area 1, Area 2, Area 3, and continued collection of baseline flora and fauna monitoring of the EPBC (2013/6929) offset areas. Flora monitoring included monitoring of analogue sites located in National Parks or State Conservation Areas. Monitoring locations are provided in **Appendix 2**.

Offset monitoring included:

- Full floristic surveys (72 sites in autumn, 48 sites in spring)
- Rapid assessments (24 sites in spring)
- Fauna surveys (16 sites in spring) targeting diurnal and nocturnal birds, reptiles, amphibians, mammals, microbats and habitat assessment

EPBC (2013/6929) baseline monitoring included vegetation validation, full floristic survey (28 sites), fauna surveys (18 sites) and natural regeneration monitoring.

6.5.3.1 Offset Monitoring Results

Floristic Monitoring– Offset Areas 1, 2 and 3

A total of 459 species (349 native species, 80 exotic species, and 30 species unable to be identified as native or exotic) were recorded across all floristic monitoring sites during the 2016 surveys (spring and autumn). This shows an increase of species in comparison to 2015, however this increase may be attributed to full floristic monitoring sites added to the monitoring program in 2016.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

A total of 276 species (242 native species, 28 exotic species, and six species unable to be identified as native or exotic) were recorded at floristic monitoring sites during autumn 2016, while a total of 407 species (314 native species, 69 exotic species, and 24 species unable to be identified as native or exotic) were recorded during spring 2016. Much like 2015, there was no clear trend in native species diversity observed during 2016. Between spring 2015 and autumn 2016, 24 sites recorded a decrease in native species diversity and 12 recorded an increase. When comparing across spring 2015-2016 survey seasons, the majority of sites (24 out of 39) had a slight increase in native species diversity, three sites had no change (4b, 14a and 17d) and nine survey sites decreased. Of the sites which recorded a decrease in native species diversity, the decreases were minimal ranging from one to eight species.

Natural regeneration within Yellow Box grassy woodland DNG areas was heavily concentrated at the edges of remnant woodland.

Field observations in offsets indicate a relatively high rate of survival for all plantings, with the exception of BOA2 R4. As mature grassy woodland communities tend to have canopy species densities of approximately 30 stems per ha, BOA1 R1, BOA1 R2, BOA1 R3 and BOA3 R5 are considered likely to meet this minimum density and to continue to develop into a woodland or open forest structure. As noted in previous monitoring, there is a high degree of variability in native species diversity both within and between sites, with this trend continuing in 2016. All sites except for site 4f recorded an increase in native species richness between spring 2015 and spring 2016, with seven sites recording the highest or equal highest native species diversity since monitoring commenced.

Floristic Monitoring – EPBC (2013/6929) offset areas.

A total of 323 species (224 native species, 75 exotic species, and 24 species unable to be identified as native or exotic) were recorded across all floristic monitoring sites during the spring 2016 monitoring survey.

Within individual sites, native species richness ranged between four (Mod9_FL27) and 64 (Mod9_FL28). Average native species richness in MZ1 (remnant) sites was 39, contrasting with an average of 15 native species per site across MZ2 (DNG/regeneration). Exotic species, where present, were only found in the ground layer. Exotic ground cover ranged from zero to 18% in MZ1 sites, while MZ2 had a much higher range with one site recording zero and the highest at 96% (average exotic ground cover in MZ2 of 57%). The most common exotic species were perennial herbs and grasses including *Hypochaeris radicata* (Catsear) and *Trifolium* spp. (Clovers).

Biometric monitoring results for each plot, including native species diversity (richness; NSD), native tree cover (NTC), native mid-storey cover (NMC), native ground cover (NGC), exotic cover, number of hollow-bearing trees (HBTs), length of fallen logs, and presence of native canopy species regeneration (regen), are presented in **Appendix 3E**.

Fauna Monitoring – Offset Areas 1, 2, 3 and EPBC (2013/6929)

A total of 173 fauna species were identified during the 2016 spring monitoring. This consisted of 109 birds, 28 mammals, 22 reptiles and 14 amphibians.

A total of 19 threatened fauna species listed under either the NSW Threatened Species Conservation Act 1995 (TSC Act) and/or the Commonwealth EPBC Act were identified within the Stage 1 and Mod 9 BOAs during the 2016 spring survey period. Birds made up 12 of these species, of which 11 are listed as vulnerable under the TSC Act. It should be noted that the increase in threatened bird species richness from 2015 is due to *Artamus cyanopterus* (Dusky Woodswallow) being listed as vulnerable under the TSC Act since the spring 2015 monitoring period.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Additionally, *Merops ornatus* (Rainbow Bee-eater), which in previous reports has been identified as being a listed migratory species has been removed from the EPBC Act. Five threatened microbat species were positively identified and two species possibly identified during monitoring, with each of these species listed as vulnerable under the TSC Act, one listed as endangered under the TSC Act, and one also listed as vulnerable under EPBC Act.

6.5.4 BUSHFIRE

There were no major outbreaks of fire at MCC during the reporting period. In conjunction with NSW National Parks and Wildlife Service (NPWS) a Hazard Reduction Burn (Prescribed burn) was completed on MCO and adjacent lands in 2016.

6.5.5 ACTIONS FOR NEXT REPORTING PERIOD

During the next period activities to be undertaken include;

- Continued monitoring, fencing, and weed and feral animal control works.
- Feral animal monitoring to be expanded to include Area 2 and 3 during the 2017 reporting period.
- Provide assistance to NPWS with proposed prescribed burns.

6.6 HERITAGE

MCO manages Heritage in accordance with the Heritage Management Plan (HMP). The HMP was revised in August 2016 and submitted for approval.

During the reporting period MCO continued the salvage and management of Aboriginal heritage sites associated with the project. An archaeological survey was completed during 2016 of the Powers Conservation Area, in consultation with the RAPs by an appropriately qualified and experienced archaeologist. The results of the survey have been included in the MCO heritage database.

Annual inspections of heritage conservation areas were completed during 2016, the condition of the areas is unchanged since the last monitoring period.

During the reporting period historical heritage site 19 (Glen Moor Homestead) came into the care and control of MCO. The site will be subject to a revised heritage assessment in accordance with the HMP.

6.6.1 ACTIONS FOR NEXT REPORTING PERIOD

Further salvage and management of Aboriginal and European heritage sites associated with the project will be completed during the next reporting period. Registered Aboriginal Party (RAP) groups will continue to be involved in due diligence works associated with disturbance activities in accordance with the Heritage Management Plan.

Revised heritage assessments will be completed on the historical heritage site 19 (Glen Moor Homestead) which will have regard to the site's condition and any changed circumstances.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

7.0 WATER MANAGEMENT

MCO manages water in accordance with the Water Management Plan (WAMP). The Surface Water Management Plan was revised and approved in January 2016. The plan was developed by MCO with input from DP&E endorsed experienced and qualified experts (WRM Water & Environment and Dundon Consulting) in accordance with Condition 33, Schedule 3 of PA 05_0117 (as modified) and Condition 29, Schedule 3 of PA 08-0135. The WAMP was reviewed and revised in the period, incorporating an updated Site Water Balance, Surface Water Management Plan and Groundwater Management Plan. The revised plan was submitted in October for approval. The key updates to the plan include the inclusion of management and mitigation measures for Stage 2 of the project.

During the reporting period, MCO undertook water monitoring and data review in accordance with the WAMP. Surface water and groundwater monitoring sites are provided in **Appendix 2**. Surface water monitoring includes:

- Surface water quality and flow (monthly/6 monthly/event based);
- Stream health (annual);
- Channel stability (annually);
- Licensed discharge points; and,
- Water take from Ulan Coal Mine.

Groundwater related monitoring includes:

- Groundwater levels/pressure (monthly);
- Groundwater quality (6 monthly);
- Groundwater take; and,
- Potential seepage from mine water storages.

The groundwater monitoring includes the following lithological units:

- Quaternary alluvium;
- Tertiary aged unconsolidated sediments;
- Triassic sandstones;
- Permian coal measures;
- Ulan seam coal;
- Marrangaroo formation; and
- Basement units (consisting mostly of granites and metavolcanics).

During the period MCO constructed water storages (mine water and sediment), extended the water transfer network and installed operational and construction related erosion and sediment controls.

A review of monitoring bore locations identified as likely to be lost as a result of mining was completed. It concluded that the loss of resolution would be largely confined to the approved mine area rather than beyond the mining areas and recommended that one additional ground water monitoring bore be installed east of Wilpinjong creek prior to 2023.

Details of water licensing and associated take are provide in **Section 7.1**. A summary of surface water monitoring groundwater monitoring results for the reporting period are provided in **Section 7.3** and **Section 7.4** respectively. Detailed surface water and groundwater monitoring results for the reporting period provided at **Appendix 3F** and **Appendix 3G** respectively.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

7.1 WATER LICENCES

The NSW Department of Primary Industries – Water (DPI Water) requirements are for water take to be reported as part of the annual review with a break-down in six monthly periods to coincide with the water year (i.e. 1 July 2015 to 30 June 2016). Consequently, water take has been reported in a manner consistent with this requirement. MCO measures water take in accordance with the approved Water Management Plan. Water take is either groundwater inflow removed from operation, or water extracted from licenced bores or reduction in stream baseflow.

Water licenses and associated take in the period is summarised in **Table 21**.

Table 21: Water Licences and Take

Licence	Description	Entitlement	2016			2017 (Est)		
			Jan - Jun (ML)	Jul - Dec (ML)	Total (ML)	Jan - Jun (ML)	Jul - Dec (ML)	Total (ML)
Licences under the Water Management Act, 2000								
WAL36340	Wollar Creek Water Source	218 Units ¹	0	2	2	2	3	5
WAL37582	Upper Goulburn River Water Source	9 Units	0	0	0	0	0	0
20BL172002	Porous Rock Aquifer Licence ⁴ –Bores	2950 ML/year ²	4	0	376	50	50	800
20BL173923	Porous Rock Aquifer Licence ⁴ - Mining		102	269		450	250	
20BL173935	Monitoring and Test Bores ⁴	N/A	N/A	N/A	N/A	N/A	N/A	N/A

¹ One unit equivalent to 1.0 ML as per the *Available Water Determination Order for Various NSW Unregulated and Alluvial Water Sources (No. 1) 2014*.

² Under conversion to licences under the Water Management Act, 2000.

³ All porous rock aquifer licenses 20BL1722002 and 20BL173923 share a combined 2950 Units.

⁴ Licences transferring to Water Management Act licences

7.2 WATER BALANCE

MCO monitors the water balance for the operation to assist forecasting and managing site water management. The site water balance (**Table 22**) for the reporting period was prepared with input from suitably qualified and experienced consultants WRM and Peter Dundon. Site water storage increased by 322ML during the reporting period. The main demands were coal processing and dust suppression. The Balance includes a variance of 106ML (3.9%).

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 22: Site Water Balance

Water Sources (Inflows)	Volume (ML)
UCML Water	210
Groundwater Extraction (bores)	4
Rainfall / runoff	2,179
Groundwater inflows	371
Total	2764
Water Loss (Outflows)	
Evaporation	319
Seepage	0
Construction & dust suppression	1098
Licensed Discharge	0
Unlicensed Discharge	0
CHPP Demand	1096
Underground demand	35
Total	2,548
Water Balance	
Inflows minus outflows	216
Change in inventory	322
Balance	106 (3.9%)

7.3 SURFACE WATER

7.3.1 SURFACE WATER QUALITY AND FLOWS

7.3.1.1 Surface Water Flows

In accordance with the SWMP, stream flow gauges have been installed in the ephemeral Wilpinjong, Murrumbidgee, Eastern, Bora and Moolarben Creeks.

The recorded stream gauging is provided in **Appendix 3F**. The flow in the creeks was in response to rain events. Additionally Moolarben Creek flows are influenced by Moolarben Dam located upstream of the gauge. During the period stream gauge record were poor with data loss due to power and/or communications interruptions and equipment failure, with approximately 50% data capture from Murrumbidgee Creek and no usable data from Eastern Creek. Stream flow data has been supplemented with data from Ulan Coal Mines and Wilpinjong Coal Mine where applicable. MCO will review and update as required, the current stream flow monitoring system during the next reporting period with the goal of improving the data capture rates.

7.3.1.2 Surface Water Quality

Surface water monitoring was undertaken in the Goulburn River, Bora Creek, Moolarben Creek and Murrumbidgee Creek in accordance with the SWMP. Results varied both spatially and temporarily due to stochastic fluctuations brought about by rainfall events in ephemeral waterways. A number of locations were dry during monitoring rounds. Monitoring identified readings outside the 20th/80th percentile range at both upstream and downstream locations. The findings are described in **Section 7.3.1.5** below. The Monitoring Data is provided in **Appendix 3F**.

7.3.1.3 Rainfall Event Sampling

As per MCO's approved SWMP rainfall sampling is undertaken where rainfall exceeds 30mm in 24 hours. During the reporting period there were eight occasions where rainfall events triggered the

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

requirement to collect additional water samples. Results for the reporting period are provided in **Appendix 3F**.

7.3.1.4 Water Discharges

No water discharges occurred from MCO during the reporting period.

7.3.1.5 Comparison to baseline

Surface water pH in the Goulburn River was neutral to slightly alkaline ranging from 7.1 to 8.6. Readings were generally within the historical range, though above the 80%ile levels. All EC readings were within the 80%ile concentrations whilst the NTU and suspended solids were variable with increased concentrations upstream. Goulburn River water quality is presented in **Figure 6**.



Figure 6: Goulburn River Water Quality

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Bora Creek is an ephemeral creek with flow recorded at SW11 during one event. Sampling at SW10 was predominantly dry with flow during two sampling events. Surface water pH was generally neutral to slightly alkaline ranging from 5.3 to 8.0 with a single pH reading below 6 at SW10 upstream of the operation. Readings were generally within the historical range except the single lower pH reading at SW10. one exception with increased alkalinity. EC, TSS and NTU were generally within the historical range. Higher EC readings were associated with low/no flow conditions. . Bora Creek water quality is presented in **Figure 7**.

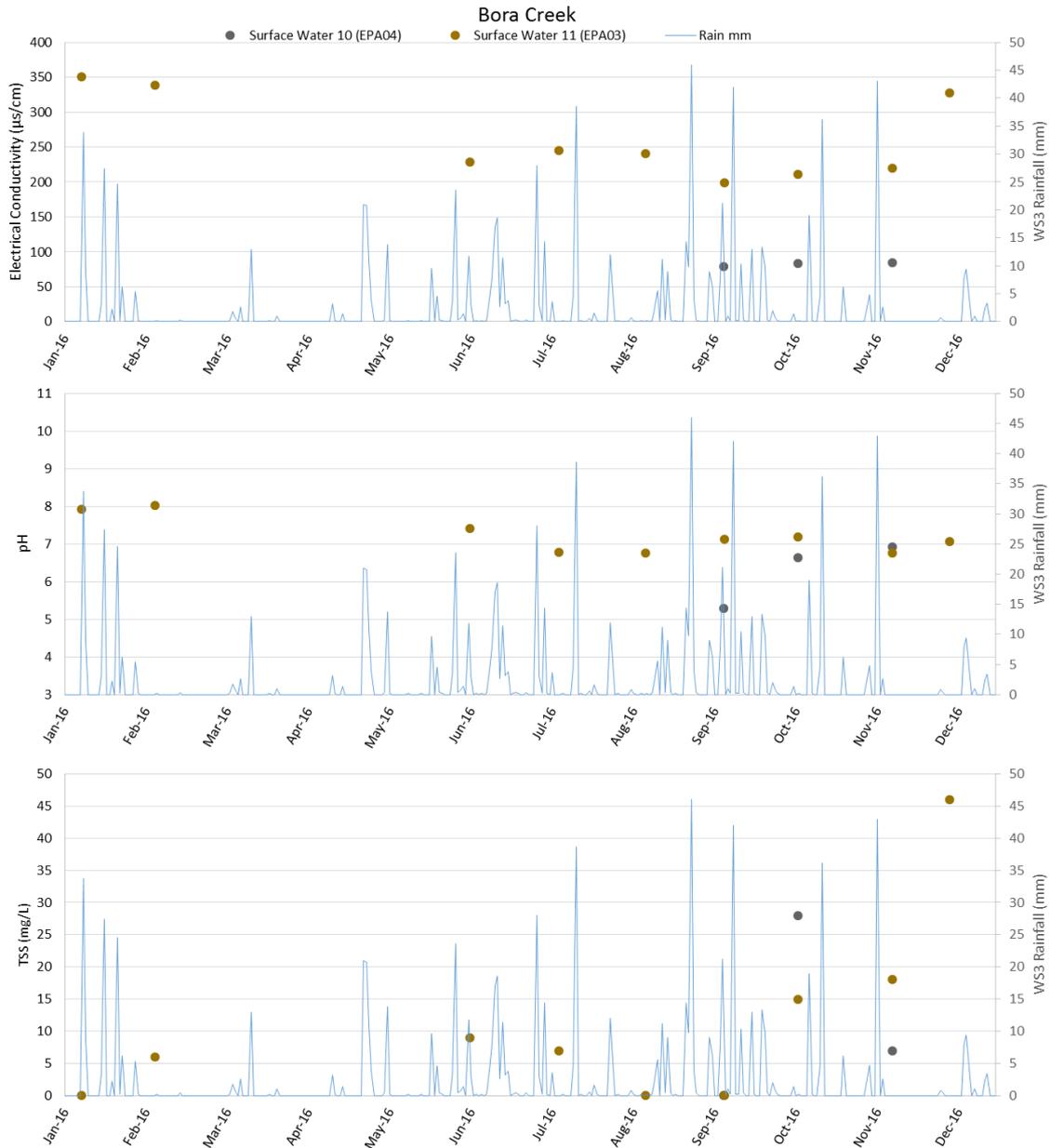


Figure 7: Bora Creek Water Quality

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Moolarben Creek is located to the west of the operation and includes Ulan Coal’s Moolarben Dam. During the period SW 05 and SW09 exhibited more consistent flow, with SW08 often still or dry. Surface water pH was neutral to slightly alkaline ranging from 6.5 to 8.2. Readings were generally within the historical range, though above the 80%ile levels. All EC readings at SW05 were within the 80%ile concentrations while upstream (non-mine impacted) EC readings continued to be elevated, consistent with historical records. NTU and suspended solids were generally consistent with historical data.

Lagoons creek is a tributary of Moolarben Creek, upstream and not impacted by MCO. During the period flow was intermittent. pH, EC and TSS results were within the historical range . Moolarben and Lagoon Creek water quality is presents in **Figure 8**.

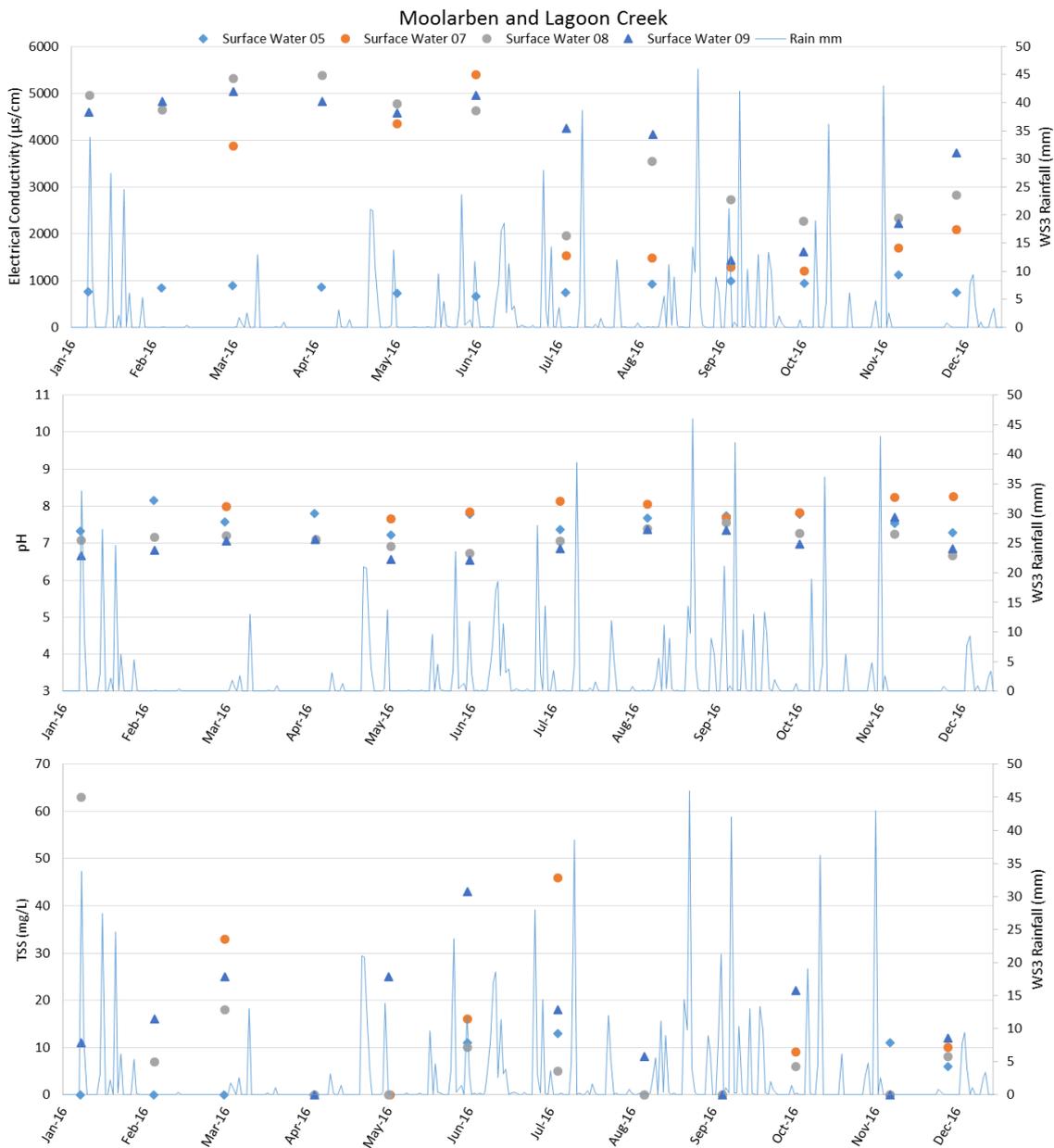


Figure 8: Moolarben and Lagoon Creek Water Quality

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Murragamba Creek is an ephemeral creek with extended dry periods and intermittent flows during 2016. Surface water pH ranged from 6.2 to 8.38. EC ranged from 343 to 1820 $\mu\text{s}/\text{cm}$, with increases associated with extended dry periods. TSS was generally low with elevated readings associated with no flow. Water quality was generally consistent with historical readings.

Eastern Creek is an ephemeral creek not currently impacted by MCO operations. SW20 was only sampled once during the period, being was dry for all other sampling events. Surface water pH ranged from 5.0 to 7.8, EC ranged from 50 to 845 $\mu\text{s}/\text{cm}$ and TSS ranged from 9 to 40.

Wilpinjong Creek is located to the east of the site. The creek had extended dry periods followed by intermittent during 2016. Surface water pH ranged from 5.9 to 8.0 except for SW18 which, when able to be sampled, recorded pH down to 4.4, consistent with previous monitoring. EC results ranged from 191 to 856 $\mu\text{s}/\text{cm}$. TSS results ranged from <5 to 183mg/L with the elevated readings associated with no flow. . Results are indicative of the ephemeral nature and mixed catchment properties. Murragamba, Eastern and Wilpinjong Creek water quality is presents in **Figure 9**.

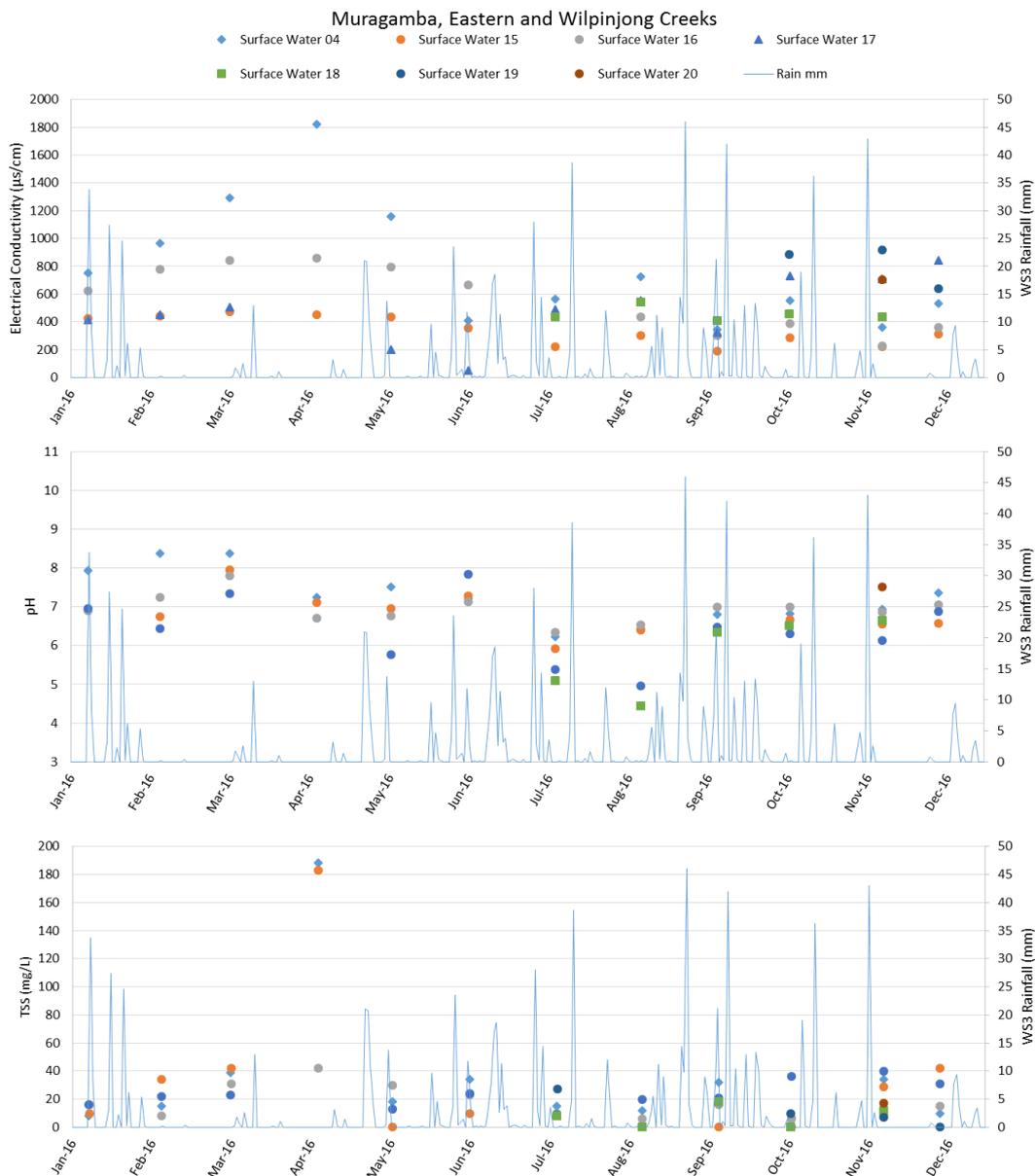


Figure 9: Murragamba, Eastern and Wilpinjong Creek Water Quality

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

7.3.2 STREAM HEALTH MONITORING

Stream Health monitoring was undertaken in April and Spring 2016 including Aquatic Habitat Condition (RCE Index), Aquatic Macroinvertebrate Diversity and Pollution Tolerance SIGNAL2 Scores. Trigger investigation values are have been incorporated into the SWMP, with scores below the trigger level triggering investigation.

7.3.2.1 Autumn 2016

Autumn stream health monitoring was undertaken during April 2016 following an extended dry period. SH03, SH04, SH08, SH16, SH18 and SH19 were dry during monitoring so no water quality or macroinvertebrate data was collected. Water levels were low at the remaining sites. The monitoring locations are illustrated in **Appendix 2**. *Note monitoring sites SH14 to SH19 were established for the collection of baseline data prior to impact by mining in OC4.*

- Aquatic Habitat Condition (RCE Index) - RCE scores remained stable at all sites. All sites were at or above established trigger values. High RCE scores were recorded at five sites and were all characterised by complete riparian zones and banks stabilised by trees and shrubs.
- Aquatic Macroinvertebrate Diversity - Taxa diversity in autumn fell below the established trigger values at five sites (SH01, SH05, SH06, SH10 and SH13). Taxa diversity at these sites has remained low due to a prolonged period of low rainfall and concomitant low flow in the Goulburn River. Isolated pools along Wilpinjong Creek (SH15 and SH17) showed signs of entering an anaerobic state, with sediment odours indicating a low oxygen environment.
- Pollution Tolerance SIGNAL2 Scores - SIGNAL2 scores were above established trigger values for all sites, except SH10 upstream of the site. The indicative condition improved at two sites, with SH12 changing from severely to moderately disturbed, and at SH13 showing a change from moderate disturbance to mild disturbance.

7.3.2.2 Spring 2016

Spring stream health monitoring was completed during September 2016. SH03, SH08, SH18 and SH19 were dry during this round of monitoring, so no water quality or macroinvertebrate data were collected. Water levels were low at the remaining sites. The monitoring locations are illustrated in **Appendix 2**.

- Aquatic Habitat Condition (RCE Index) - All site scores were at or above established trigger values with the exception of site SH08 and SH13. Whilst sites established in 2014 with no established trigger values conditions have been stable at all four sites.
- Aquatic Macroinvertebrate Diversity - Taxonomic diversity has continued to experience a downward trend in taxa richness since 2012, however all sites except site SH03 were above established trigger values.
- Pollution Tolerance SIGNAL2 Scores - The average SIGNAL2 score increased between spring 2015 surveys and spring 2016 surveys at all sites except SH14, SH15, SH02, SH06 and SH13. The indicative condition of all the sites has remained the same since autumn 2016. Sites established in spring 2014 (SH14, SH15, SH16 and SH17) no established trigger values, have shown only a small degree of variability in SIGNAL2 score since their instigation and are therefore considered stable. Taxa richness is also higher than previous surveys at these sites.

7.3.2.3 Trends

Climatic factors and flow regimes are a dominant influence on aquatic ecological communities. There were fewer flow events in the Goulburn River in the past three years than previously (NSW Office of

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Water gauging station 210006), which has potentially resulted in a greater groundwater influence on base flows and more frequent periods of no flow or pool isolation.

Sampling at MCO in spring 2016 occurred following a period of high flow, which influenced the physico-chemistry at each site, although most of the parameters measured were similar to values recorded previously. Taxa richness declined steadily at all sites between 2012 and autumn 2016, but increased in spring 2016. RCE and Signal2 scores have remained relatively consistent. Data trends are presented in **Appendix 3F**.

7.3.3 CHANNEL STABILITY MONITORING

Channel stability monitoring was undertaken during April 2016 at locations in **Appendix 2**. Monitoring involved visual and written observational surveys of erosive and depositional features, cross sections at strategic locations and photographic records of each stream reach which included:

- Monitoring the reach of Bora Creek and a tributary from the western culvert of the MCO rail loop and its confluence with Goulburn River;
- Monitoring the reach of Moolarben Creek upstream of Moolarben Dam;
- Monitoring the reach of Murragamba Creek;
- Monitoring the reach of Eastern Creek; and,
- Monitoring the reach of Wilpinjong Creek.

7.3.3.1 Monitoring results

Bora Creek continues to show signs of increasing stability downstream in 2016 with areas of active erosion in the upper reaches. This condition is unchanged since the last monitoring period. Bora Creek Tributary continues to exhibit a potentially stable channel, unchanged from the previous monitoring period.

Moolarben Creek remains generally stable with sections experiencing erosion. Areas of active and potentially stabilising channels are located just upstream of the dam wall (MC-pt4 to MC-pt9). This is unchanged from 2015. Results indicate that Moolarben Creek is spatially variable, moving from areas of active erosion through to areas of high stability. The most frequent classification for the creek is stable there has been no change since 2015.

Murragamba Creek has limited active erosion, with mainly stable or potentially stabilising channels represented. The two sites located within Eastern Creek are very active and stable, monitoring during 2016 showed no change to stability within Murragamba and Eastern Creeks.

Wilpinjong Creek continues to remain spatially variable, with sections experiencing active erosion to stabilisation. There has been a general improvement in Activity Scores, with the section between WC-pt3 and WC-pt13 receiving a higher score at each site then in 2015. The dominate classification of each site is shared between potentially stabilising and active. These sections continue to exhibit low percentage vegetation cover in the channel or on the channel banks.

7.3.3.2 Trends

Channel stability within each creek was variable during the period. Locations vulnerable to erosion were characterised by steep banks, little vegetative cover and exposed dispersive subsoil. More stable locations were characterised by vegetated banks with low gradient slopes. Where active erosion was recorded at sites along each creek, this was predominantly the result of natural influences exacerbated by past land use and agricultural practices that exposed dispersive subsoils. The impact

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

of creek stability within these creeks due to mining operations is considered negligible over the past 12 months.

7.3.4 WATER DISCHARGES

No water discharges occurred from MCO during the reporting period.

7.3.5 EFFLUENT

During the period MCO continued to operate three sewerage treatment plants. A fourth sewerage treatment plant was constructed and commissioned in quarter 2 of 2016. Discharge quantity was within design limits during the period. Discharge quality is presented in **Appendix 3F**.

7.4 GROUNDWATER

7.4.1 GROUNDWATER LEVELS

MCO monitors a network of piezometers in accordance with the Groundwater Management Plan (GWMP). The monitoring program includes trigger values were established to determine the need for investigation and possible response actions for potential impacts to groundwater levels in the alluvial and Triassic aquifers. The Permian strata does not include triggers as it is already extensively affected by past mining, and is predicted to undergo further impact from ongoing mining and contains groundwater of generally poor quality.

Response triggers for groundwater levels within Quaternary alluvium and Triassic sandstone aquifers are based on the minimal impact considerations in the Aquifer Interference Policy (DPI, 2012). Monitoring frequency and response triggers have been implemented to identify trends that could potentially lead to a private bore being impacted above the Aquifer Interference Policy considerations (i.e. greater than 2 m drawdown). Response triggers, along with monitored groundwater levels in the current reporting period are presented in **Table 23** and **Table 24**.

MCO had negligible impact on private groundwater users during the reporting period. Groundwater level response triggers were not activated within any of the Triassic strata monitoring bores. PZ105C recorded a reduced level of about 0.4m below its baseline range though is not impacted by current MCC operations. The obstruction observed in PZ101C was not able to be rectified during the reporting period.

During the reporting period the response triggers for groundwater levels within Quaternary alluvium and paleochannel (unconsolidated Tertiary sediments) monitoring bores were not triggered with the exception of PZ58, on further investigation an obstruction was located in PZ58. Rectification of the obstructions will be completed during the next reporting period.

Table 23: Trigger Levels – Triassic Bores

Triassic Piezometer Number	Base of Triassic (mAHD)	Interval/Level Monitored (mbgl)	Minimum Observed Groundwater Level/Pressure (mAHD)		Trigger Level (mAHD)
			Baseline	2015	
PZ101C	371.5	24-30	380.7	-**	378.7
PZ105C	360.6	22-28	376.9	376.50	374.9
PZ129 (35m)*	387.0	35	388.4	391.00	387.0 (dry)

* PZ129 is a vibrating wire piezometer drilled in Triassic strata to a depth of 74 m. Pressure transducers have been installed at 35 m, 53 m and 74 m (refer Table 7 of GWMP). ** Bore obstructed.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 24: Trigger Levels – Alluvium and Palaeochannel Bores

Alluvium Piezometer Number	Interval/Level Monitored (mbgl)	Minimum Observed Groundwater Level/Pressure (mAHD)		Trigger Level (mAHD)
		Baseline	2016	
PZ55	11-14	421.8	423.18	419.8
PZ58	8-11	467.5	..**	465.8 (dry)
PZ184	6-9	412.0	411.44	410.4 (dry)
PZ187	15-21	415.7	416.15	413.7
PZ188	12-18	415.2	415.73	413.2
PZ201*	7-10	409.5	409.5	TBC
PZ202*	7-10	411.6	408.33	TBC
PZ203*	14-20	403.4	400.41	TBC

* PZ201, 202 and 203 baseline to be developed. ** Bore obstructed.

A comparison of groundwater levels to the previous reporting period and baseline levels is presented in **Table 25**. Continued monitoring of locations not impacted by mining is considered to contribute to the baseline. Standing water level/pressures for all piezometers for the period (including vibrating wire piezometers) are presented in **Appendix 3G**.

A regional reduction in standing water levels was continued to be observed in Permian overburden and the Ulan seam, consistent with the mining of the Ulan seam at MCO and adjacent operations.

Table 25: Comparison of Groundwater Levels to Baseline Levels

Bore	Lithology screened	Baseline Standing Water range (mbtoc)	Minimum Level (mbtoc)		Comments
			Previous Period	2016	
PZ003	Ulan seam	3.13-4.72	4.27	4.30	Consistent with previous monitoring.
PZ39	Siltstones above Ulan seam	8.64-11.16	10.7	10.65	Consistent with previous monitoring.
PZ40B	Permian OB	6.06-9.17	8.85	8.92	Consistent with previous monitoring.
PZ44	Ulan Granite	7.84-12.60	11.28	11.53	Consistent with previous monitoring.
PZ55	Quaternary Alluvium	3.33-7.63	6.41	6.28	Consistent with previous monitoring.
PZ58	Tertiary Aged Sediment	9.04-10.59	9.99	9.78	Consistent with previous monitoring.
PZ101C	Lower Triassic	21.34-22.25	21.46	21.47	Consistent with previous monitoring. Borehole partially obstructed.
PZ101B	Permian OB	27.29-39.8	32.19	33.09	Consistent with previous monitoring. Lowering trend indicative of regional depressurisation.
PZ102B	Ulan seam	32.96-53.46	40.96	42.79	Consistent with previous monitoring.
PZ102A	Marrangaroo Conglomerate	33.27-52.91	41.23	42.91	Consistent with previous monitoring.
PZ103C	Lower Triassic	22.70-27.78	26.76	26.77	Consistent with previous monitoring. Natural Variation evident.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Bore	Lithology screened	Baseline Standing Water range (mbtoc)	Minimum Level (mbtoc)		Comments
			Previous Period	2016	
PZ103B	Permian OB	24.55-58.03	49.69	52.94	Consistent with previous monitoring. Lowering trend indicative of regional depressurisation.
PZ103A	Ulan seam	50.66-69.22	58.33	59.74	Consistent with previous monitoring.
PZ104	Ulan seam	50.22-58.76	57.65	57.82	Consistent with previous monitoring.
PZ105C	Lower Triassic	10.86-12.09	12.25	12.5	Generally consistent with previous monitoring. Natural Variation evident.
PZ105B	Permian OB	11.17-14.00	12.74	13.02	Consistent with previous monitoring.
PZ105A	Permian OB	16.36-29.72	19.68	19.90	Consistent with previous monitoring.
TB105	Permian OB and Ulan Seam	16.31-29.59	19.55	19.79	Consistent with previous monitoring.
PZ106B	Permian OB	7.90-11.01	12.57	13.98	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam and natural variation.
PZ106A	Permian OB	58.89-87.07	83.01	83.42	Consistent with previous monitoring.
PZ107	Ulan seam	65.28-66.35	65.49	65.43	Consistent with previous monitoring.
PZ109	Permian OB	52.68-54.78	54.62	57.7	Consistent with previous monitoring.
PZ111	Ulan seam	23.67-28.01	29.5	30.73	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ112B	Permian OB	3.71-6.51	6.01	6.20	Consistent with previous monitoring
PZ127	Triassic	Dry	Dry	Dry	Consistent with previous monitoring
	Permian OB	47.2-52.1	52.27	52.63	Generally consistent with previous monitoring.
	Permian OB	84.7-101.3	89.12	90.50	Consistent with previous monitoring.
	Ulan seam	103.4-126.1	104.6	106.72	Consistent with previous monitoring.
PZ128	Triassic	Dry	Dry	Dry	Consistent with previous monitoring.
	Permian OB	28.6-29.8	29.91	30.08	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
	Permian OB	28.6-33.6	34.04	34.39	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation.
PZ129	Triassic	25.2-29.6	26.68	26.95	Consistent with previous monitoring.
	Permian OB	27.1-41.2	29.63	30.44	Consistent with previous monitoring.
	Permian OB	36.0-38.8	38.48	38.86	Consistent with previous monitoring.
PZ130	Permian OB	37.7-40.4	37.76	37.47	Consistent with previous monitoring.
	Permian OB	51.6-58.9	59.19	60.32	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation.
	Ulan seam	79.3-88.2	88.41	85.78	Consistent with previous monitoring.
PZ133	Permian OB	18.5-20.2	18.93	18.95	Consistent with previous monitoring.
	Permian OB	19.0-20.3	20.25	20.76	Consistent with previous monitoring.
	Ulan seam	58.3-62.4	61.36	61.28	Consistent with previous monitoring.
PZ137	Permian OB	16.38-18.93	18.45	18.37	Consistent with previous monitoring.
PZ149	Permian OB	8.09-11.47	Dry	Dry	Generally consistent with previous monitoring. Natural variation evident.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Bore	Lithology screened	Baseline Standing Water range (mbtoc)	Minimum Level (mbtoc)		Comments
			Previous Period	2016	
PZ151	Ulan seam	60.30-70.49	66.11	66.58	Consistent with previous monitoring.
PZ152	Permian OB	9.40-10.86	11.01	10.94	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ156	Ulan seam	73.02-83.95	81.71	88.68	Generally consistent with previous monitoring. Lowering trend indicative of local depressurisation of Ulan Seam.
PZ157	Ulan seam	63.52-73.40	70.37	76.00	Generally consistent with previous monitoring. Lowering trend indicative of local depressurisation of Ulan Seam.
PZ170	Permian OB	14.68-16.56	16.6	16.82	Generally consistent with previous monitoring.
PZ174	Permian OB	6.10-7.92	7.77	7.71	Consistent with previous monitoring.
PZ175	Permian OB	3.27-7.03	6.95	7.20	Consistent with previous monitoring. Natural Variation evident.
PZ176	Permian OB	2.24-3.74	3.48	3.61	Consistent with previous monitoring.
PZ177	Permian OB	2.00-4.00	4.02	4.16	Generally consistent with previous monitoring. Natural Variation evident.
PZ179	Triassic	24.6-28.0	25.98	27.47	Consistent with previous monitoring.
	Permian OB	25.8-32.7	27.57	28.75	Consistent with previous monitoring.
	Ulan seam	64.5 – 71.4	71.12	74.58	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ184	Tertiary paleochannel	6.19-7.43	7.65	7.96	Generally consistent with previous monitoring. Natural variation evident.
PZ186	Permian OB	8.47-17.21	11.57	12.27	Consistent with previous monitoring. Lowering trend indicative of regional depressurisation
PZ187	Wilpinjong Creek Alluvium	0.78-2.88	2.22	2.39	Consistent with previous monitoring.
PZ188	Wilpinjong Creek Alluvium	7.29-8.40	7.82	7.89	Consistent with previous monitoring.
PZ189	Permian OB	10.41-14.90	12.87	13.30	Consistent with previous monitoring. Lowering trend indicative of regional depressurisation
PZ191	Ulan seam	30.96-42.16	44.79	46.24	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ192	Triassic	47.5-48.6		46.06	Consistent with previous monitoring.
	Ulan seam roof	72.9-80.4		86.24	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
	Ulan seam base	80.9-93.4		91.3	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ193	Permian OB	42.1-42.4		42.39	Consistent with previous monitoring.
	Ulan seam roof	90.84-93.32		93.29	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
	Ulan seam base	96.2-99.1		99.03	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ194	Triassic	64.9-65.1		65.10	Consistent with previous monitoring.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Bore	Lithology screened	Baseline Standing Water range (mbtoc)	Minimum Level (mbtoc)		Comments
			Previous Period	2016	
	Ulan seam roof	110.7-112.7		112.6	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
	Ulan seam base	125.3-128.6		128.5	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ195	Top Permian	50.4-50.5		50.5	Consistent with previous monitoring.
	Ulan seam roof	101.7-103.3		103.3	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
	Ulan seam base	138.9-140.7		140.7	Generally consistent with previous monitoring. Lowering trend indicative of regional depressurisation of Ulan Seam.
PZ201	Palaeochannel	6.4-7.1		7.1	Baseline Monitoring
PZ202	Palaeochannel	9.2-9.8		9.8	Baseline Monitoring
PZ203	Palaeochannel	8.6-9.0		9.0	Baseline Monitoring

7.4.2 GROUNDWATER QUALITY

Site specific trigger levels for pH and electrical conductivity have been developed for the Moolarben Coal Complex. A comparison of the monitoring results for the period, and a comparison to the previous period and baseline is provided in **Table 26**. Water quality for the period is generally consistent with baseline data and previous monitoring results. Some isolated, not repeated variances were observed and will continue to be monitored. Water quality results from all piezometers are provided in **Appendix 3G**.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Table 26: Comparison of Groundwater pH and EC to Background pH and EC

Bore	Lithology screened	Results Data Range (pH)			Data Range (µS/cm)			Comments
		Baseline	Previous Period	2016	Baseline	Previous Period	2016	
PZ003	Ulan seam	5.7 - 7.2	6.6 – 7.1	6.3-6.5	680-3290	915 – 1343	695-728	Consistent with previous monitoring.
PZ39	Siltstones above Ulan seam	5.5 - 7.3	5.7 – 5.8	5.8-5.9	480-2190	479 – 732	626-650	Consistent with previous monitoring.
PZ40B	Permian OB	5.5 - 7.1	4.73 – 5.4	6.3-6.9	590-1470	1,013 – 1,165	1126-1233	Consistent with previous monitoring.
PZ44	Ulan Granite	5.6 - 7.5	6.7 – 7.2	6.7-6.8	2430-3660	1,957 – 2,820	2640-2910	Consistent with previous monitoring.
PZ55	Quaternary Alluvium	5.2 - 7.1	5.2-6.9	5.5-5.8	240-2291	1,992-2,109	2,530-2,680	Increasing trend currently under investigation
PZ58	Tertiary Aged Sediment	2.5 - 4.9	Insufficient water to sample	Obstruction	8120-16580	Insufficient water to sample	No sample	Obstruction
PZ101C	Lower Triassic	5.9 7.52	No sample	No sample	530-1010	No sample	No sample	Obstruction
PZ101B	Permian OB	6.0 - 8.0	7.4-7.8	7.6-7.7	620-1140	663-799	786-809	Consistent with previous monitoring.
PZ102B	Ulan seam	5.9 - 7.9	6.6-7.4	6.7-6.8	1170-3040	2,073-2,156	2,450-2,490	Consistent with previous monitoring.
PZ102A	Marrangaroo Conglomerate	6.1 - 8.3	6.8-7.2	7.0	620-3160	1,770-2,340	1,935-2,102	Consistent with previous monitoring.
PZ103C	Lower Triassic	5.1 - 6.8	5.1-6.6	5.3	304-570	278-324	318-320	Consistent with previous monitoring.
PZ103B	Permian OB	5.1 - 7.3	6.0-6.9	6.2	300-710	449-461	528-530	Consistent with previous monitoring.
PZ103A	Ulan seam	5.4 - 8.1	6.5-7.4	6.5-6.6	380-1070	571-657	582-615	Consistent with previous monitoring.
PZ104	Ulan seam	11.4 - 13.1	12.4-12.7	12.7-13.2	1060-8340	6,680-7,740	8,140-8,670	Generally consistent with previous monitoring.
PZ105C	Lower Triassic	5.1 - 6.8	5.8-7.6	6.4-6.6	193-693	183-266	193-204	Generally consistent with previous monitoring.
PZ105B	Permian OB	5.3 - 7.9	4.8-6.2	5.2-5.3	191-660	167-292	190-202	Generally consistent with previous monitoring.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Bore	Lithology screened	Results Data Range (pH)			Data Range (µS/cm)			Comments
		Baseline	Previous Period	2016	Baseline	Previous Period	2016	
PZ105A	Permian OB	5.3 - 7.8	5.3-6.6	5.8	246-810	212-290	295-299	Consistent with previous monitoring.
TB105	Permian OB and Ulan Seam	6.8 - 7.8	7.2-7.9	7.1-7.3	540-1310	620-719	659-681	Consistent with previous monitoring.
PZ106B	Permian OB	4.9 - 8.2	5.0-5.9	5.4	660-6020	1,899-2,180	2,015-2,193	Consistent with previous monitoring.
PZ106A	Permian OB	5.8 - 12.3	8.6-10.5	9.7-9.9	630-3530	627-688	720-734	Consistent with previous monitoring.
PZ107	Ulan seam	4.7 - 7.1	6.0-7.2	6.4-6.5	600-950	600-690	685-939	Generally consistent with previous monitoring.
PZ109	Permian OB	6.1 - 7.63	7.1-7.6	7.2-7.3	690-1680	884-1,078	974-1,016	Consistent with previous monitoring.
PZ111	Ulan seam	5.8 - 7.0	6.1-6.7	5.8-6.0	640-1730	698-752	842-865	Consistent with previous monitoring.
PZ112B	Permian OB	4.3 - 6.7	5.1-5.8	5.2-5.4	1800-8240	1,804-1,806	1,026-2,530	Generally consistent with previous monitoring.
PZ137	Permian OB	5.1 - 6.7	5.5-6.4	5.9	780-2285	1,100-1,359	1,239-1,288	Consistent with previous monitoring.
PZ149	Permian OB	5.1 - 6.7	Insufficient water to sample	5.6	N/A	Insufficient water to sample	5,150	Consistent with previous monitoring.
PZ151	Ulan seam	5.7 - 7.0	6.5-7.0	6.5-6.8	480-1,550	1,314-1,340	1,633-1,674	Consistent with previous monitoring.
PZ152	Permian OB	5.1 - 6.4	Insufficient water to sample	No sample	4840-7,020	Insufficient water to sample	No sample	Obstruction
PZ156	Ulan seam	4.3 - 7.1	5.9-6.8	5.5-6.2	440-1,020	617-811	556-614	Consistent with previous monitoring.
PZ157	Ulan seam	5.9 - 7.6	6.4-7.2	6.4-6.9	470-855	720-891	848-851	Consistent with previous monitoring.
PZ170	Permian OB	5.4 - 6.7	6.2-6.3	6.3-6.5	2,200-6,920	4,390-5,290	4,250-4,310	Consistent with previous monitoring.
PZ174	Permian OB	5.4 - 6.5	5.8-6.3	6.3	7,110-13,440	8,270-10,950	10,280-11,770	Generally consistent with previous monitoring.
PZ175	Permian OB	5.3 - 7.0	6.5-7.1	6.5-6.7	1,120-17,380	6,050-17,570	681-7,910	Generally consistent with previous monitoring. Isolated lower EC reading in 2016.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

Bore	Lithology screened	Results Data Range (pH)			Data Range (µS/cm)			Comments
		Baseline	Previous Period	2016	Baseline	Previous Period	2016	
PZ176	Permian OB	5.0 - 7.8	6.4-6.4	6.5	650-1,260	289-520	587-647	Consistent with previous monitoring
PZ177	Permian OB	5.8 - 6.7	6.6-7.3	6.5-6.8	1,620-8,130	2,710-7,800	1,059-6,530	Generally consistent with previous monitoring.
PZ184	Tertiary paleochannel	3.9 - 5.6	3.0-3.6	3.3-3.5	3,700-6,950	4,770-7,600	4,850-7,810	Generally consistent with previous monitoring. pH has fallen below range. Not impacted by MCO operations.
PZ186	Permian OB	5.8 - 8.2	6.3-7.1	6.6	345-520	293-483	368-372	Consistent with previous monitoring
PZ187	Wilpinjong Creek Alluvium	5.3 - 8.2	5.5-6.4	5.8-8.0	150-430	168-189	171-342	Consistent with previous monitoring
PZ188	Wilpinjong Creek Alluvium	4.6 - 8.4	6.0-6.7	5.8-6.3	149-1020	182-265	200-212	Consistent with previous monitoring
PZ189	Permian OB	5.6 - 7.2	6.2-6.9	6.2-6.6	340-530	305-340	321-372	Consistent with previous monitoring
PZ191	Ulan seam	3.9 - 6.9	5.9-6.2	5.9-6.2	210-620	442-535	384-429	Consistent with previous monitoring
PZ201	Palaeochannel	-	-	5.9-6.2	-	-	297-303	Baseline Monitoring
PZ202	Palaeochannel	-	-	5.4-5.6	-	-	57-105	Baseline Monitoring
PZ203	Palaeochannel	-	-	5.4-5.6	-	-	342-394	Baseline Monitoring

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	Mar 2017	MCO	G Chase

7.4.3 SPRING AND SEEP CENSUS

During the reporting period, a consultant was engaged to establish a spring and seep census that includes the upper reaches of Eastern Creek and Goulburn River around the northern and north-western boundary of UG4. The census will be completed during the 2017 reporting period with results presented in the 2017 Annual Review.

7.4.4 ACTIONS FOR NEXT REPORTING PERIOD

During the next reporting period the following actions are proposed:

- Obstructed piezometers to be rectified where practicable;
- A spring and seep census survey will be completed, including the upper reaches of Eastern Creek and Goulburn River around the northern and north-western boundary of UG4; and,
- Baseline monitoring of PZ201, 202 and 203 will continue to develop SWL, pH and electrical conductivity triggers.
- WAMP to be reviewed and revised as necessary.

8.0 REHABILITATION

This section of the AR aims to satisfy the various annual rehabilitation reporting requirements for Project Approvals PA05_0117 and PA08_0135, the MOP and Moolarben Coal Complex MLs.

At the end of December 2016 MCO had undertaken cumulative, rehabilitation activities over more than 170ha of the completed portions of the environmental bunds and overburden emplacement areas. In addition, interim/temporary rehabilitation in the form of landscaping and planting has been completed around the main offices, rail loop, environmental bunds and entry to the operational areas. External batters on dam walls and rail loop embankments have also been temporarily rehabilitated.

The MCO Rehabilitation Management Plan (RMP) describes the management of rehabilitation at the Moolarben Coal Complex for Stage 1 and Stage 2. The RMP was updated following the approval of the UG1 Modification and was approved in September 2016.

The MCO Mining Operations Plan (MOP) was revised following the approval of the UG1 Optimisation modification and as part of exploration activities with approvals received in May and October respectively. A MOP replacement was prepared for the 2017 to 2018 period and was approved in December 2016. The 2017-2018 MOP describes the proposed Stage 1 and Stage 2 mining and rehabilitation activities for the period 1 January 2017 to 1 January 2019 (the MOP term). A description of the proposed rehabilitation activities during the MOP term is provided in Section 7.2 of the MOP. Mining and rehabilitation progression are shown on MOP Plans 3A and 3B. The MOP and RMP is available on the Moolarben Coal website (www.moolarbencoal.com.au).

The following review of the rehabilitation performance for 2016, applies to the proposed rehabilitation activities outlined in the 2015 to 2016 MOP.

8.1 MINING AND REHABILITATION STATUS

The mining and rehabilitation status is presented in **Table 27**. The land preparation activities undertaken in the period and proposed areas in the next period are presented in **Figure 3**. The status of mining and rehabilitation is presented in **Figure 4**. The status of mining and rehabilitation, and the agreed post rehabilitation land-use is presented in **Figure 5**.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

Table 27: Mining and Rehabilitation Status

Mine Area Type	Previous Reporting Period (2015)	This Reporting Period (2016)	Next Reporting Period (2017)
Total Mine Footprint	921	1,214	1,396
Total Active Disturbance	714	945	1,127
Temporary Rehabilitation	56	52	52
Land being Prepared for Rehabilitation	0	10	60
Land under active Rehabilitation	151	177	243
Completed Rehabilitation	0	0	0

8.2 VEGETATION CLEARANCE AND TOPSOIL STRIPPING

Vegetation clearance was undertaken in accordance with the Vegetation Clearance Protocol, Landscape Management Plan and GDPs within the OC2, OC4 and infrastructure areas (**Figure 3**) as described in **Section 6.5.1**. Stripped topsoil was either placed in temporary stockpiles for later use, or placed directly on areas prepared for rehabilitation. Vegetation was either mulched or retained for use as habitat features within rehabilitation areas.

8.3 SEED COLLECTION

Native seed collection continued throughout the period with seed harvested from MCO owned lands. All activities were undertaken in accordance with the requirements of the Florabank Guidelines (2000). At December 2016 MCO's seed bank contained 496,716 grams of native seed for use in rehabilitation activities across the MCC.

8.4 REHABILITATION MONITORING

MCO undertakes a monitoring program of rehabilitation areas in accordance with the RMP. The monitoring program includes landscape function analysis, vegetation dynamics, floristic monitoring, vegetation structure and growth, fauna monitoring and visual monitoring.

8.4.1 ECOSYSTEM FUNCTION ANALYSIS

Landscape Function Analysis

Landscape organisation (LO), a measure of the proportion of the landscape occupied by resource accumulating patches, ranged from 0.5 (site R4, R11 & R13) to 1.0 (site R9 & R14). The average LO across all rehabilitation sites was 0.8. This contrasts to an LO range of 0.834 to 0.996 for analogue sites (A1a, A1b, A5a, and A5b) (average LO 0.931) (**Figure 10**). Litter and bare soil were the dominant interpatch/patch types across the rehabilitation sites (with litter dominant at 12 sites, and bare soil dominant at four sites).

In contrast to results from previous years, there is a relatively high litter cover, primarily consisting of Acacia pods and flowering debris within rehabilitation sites. Due to the above average rainfall that occurred in late winter/spring, Acacia species were able to flower and set more seed than normal. This event has contributed to the generally higher litter results. Monitoring sites are presented in **Appendix 2**.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

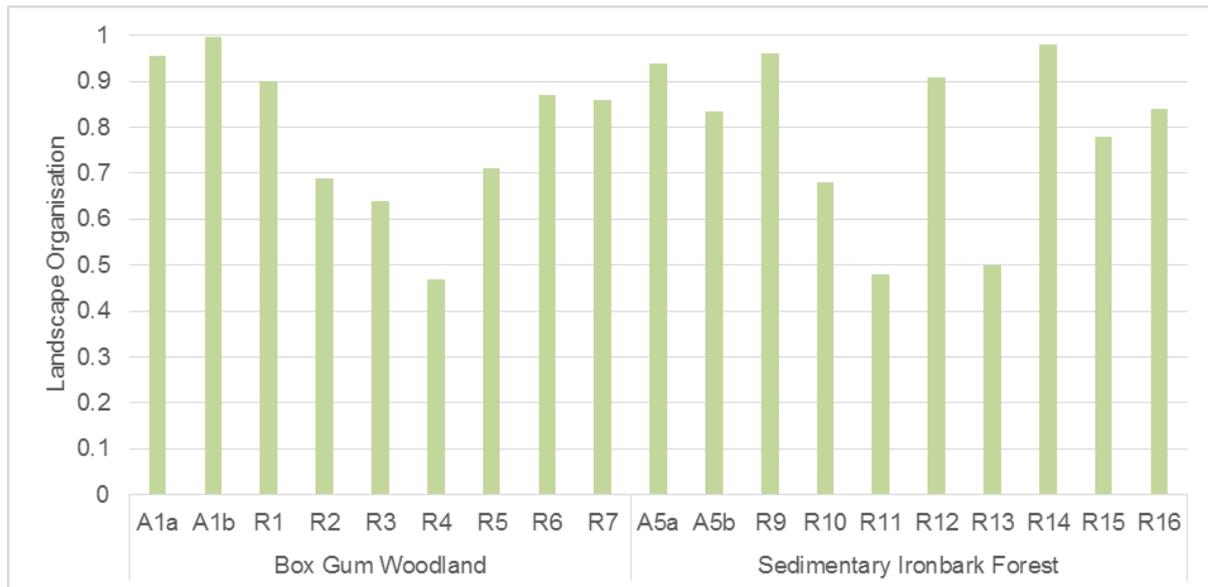


Figure 10: Landscape Organisation for each LFA transect, spring 2016 (analogues: spring 2014)

Vegetation Dynamics

The tree densities recorded at the Box Gum Woodland rehabilitation sites R1, R2 and R7 (which ranged from 80 to 113 trees per hectare) were lower than the tree densities recorded at the Box Gum Woodland analogue plots (which ranged from 125 to 325 trees per hectare). The tree density recorded at a number of sites has increased compared to spring 2015 while tree densities recorded at R3, R5 and R6 continued to be above the analogue sites range. However these sites demonstrated a decrease in tree density compared to the 2015 monitoring.

Low tree densities were recorded at a number of Sedimentary Ironbark Forest rehabilitation sites (ranging from 40 to 170 trees per hectare) compared to the analogue sites (which ranged from 225 to 275 trees per hectare). Tree density compared to analogue sites was variable across the Sedimentary Ironbark Forest rehabilitation sites. Trends in tree density between monitoring events were also variable.

However, based on assessments of vegetation structure and canopy species composition, the majority of sites appear to be continuing to develop towards shrubby Box – Gum, Box – Ironbark, or Grey Gum dominated woodland/forest.

Floristic Monitoring

During autumn and spring 2016, all Box Gum Woodland rehabilitation floristic plots exhibited a higher number of native species than exotic. Native species richness during autumn ranged from 11 to 34 species, with exotic species richness ranging from one to five species. During spring, native species richness ranged from 18 to 43 species, with exotic species richness ranging from five to 14 species (**Figure 11**).

Comparison of data between autumn 2015 and autumn 2016 indicates that native species richness recorded at the majority of Box Gum Woodland rehabilitation sites has generally increased. Exotic species richness over the same period has reduced at each Box Gum Woodland floristic plot. Spring native and exotic species richness has either decreased or remained consistent between spring 2015 and spring 2016 within the Sedimentary Ironbark Forest rehabilitation sites.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

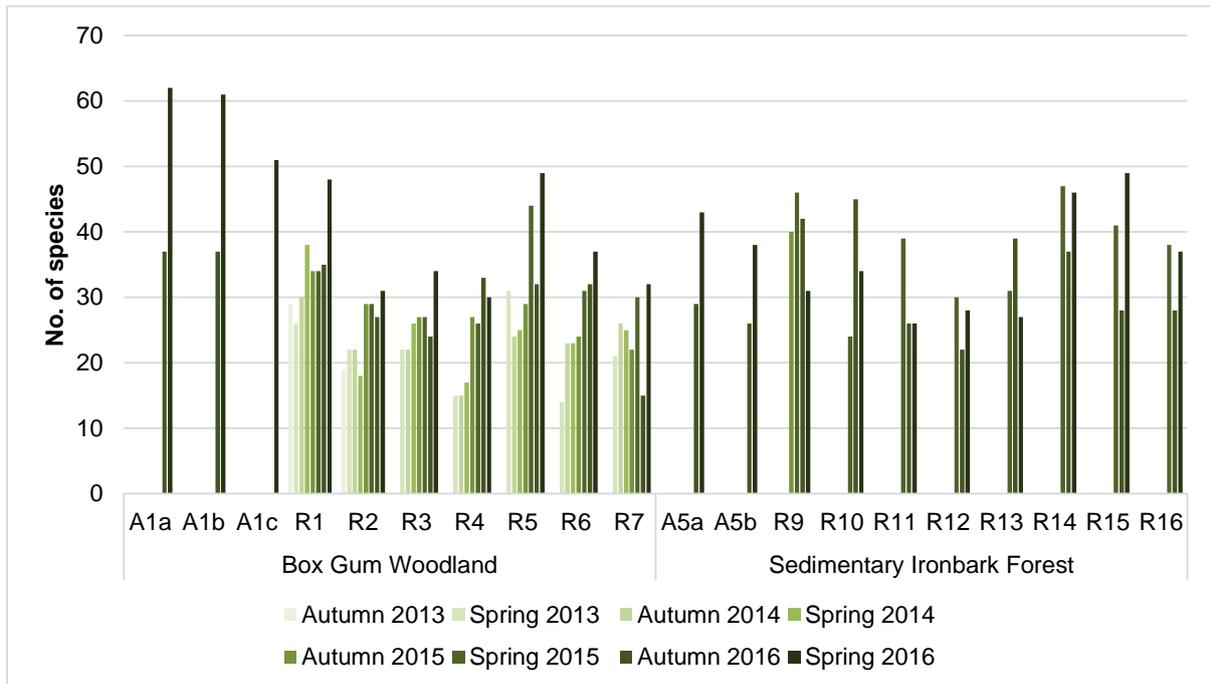


Figure 11: Species Richness (autumn 2013 – spring 2016)

Vegetation Structure and Growth

At both the Box Gum Woodland and Sedimentary Ironbark Forest sites, the lowest height of the upper strata continues to be less than that seen at their respective analogue sites. This trend is consistent with the age of the rehabilitation. The minimum heights of the upper strata has generally shown an increase demonstrating that these species are continuing to establish within the rehabilitation area.

Spring 2016 monitoring indicated that the upper and mid layers of the rehabilitation was dominated by *Acacia* species, including *Acacia linearifolia* (Narrow-leaved Wattle), *Acacia spectabilis* (Mudgee Wattle), *Acacia polybotrya* and *Acacia verniciflua* (Varnish Wattle). However, the majority of the remaining Box Gum and Ironbark rehabilitation sites lacked eucalypts (the target canopy species) in the upper storey. However, eucalypts (*E. punctata* and *Eucalyptus* spp.) were recorded in the mid-storey of three sites within the Box Gum Woodland rehabilitation area (R3, R5 and R7) and two plots within the Sedimentary Ironbark Rehabilitation area (R13 and R14), up to a height of 3.5 m.

Fauna Monitoring

A total of 69 fauna species were recorded during spring 2016, including two threatened species (*Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat) and *Saccolaimus flaviventris* (Yellow-bellied Sheath-tail Bat)). A comparison of species richness over the last four years of monitoring is shown in **Figure 12**. A record number of bird, reptile and amphibian species were recorded during spring 2016.

Forty-eight bird species were observed utilising habitat within the rehabilitation areas during spring 2016. This is a substantial increase in sightings within the rehabilitation area compared to previous years. *Anthus novaeseelandiae* (Australasian Pipit) was identified during the fauna surveys. This species is considered to be an indicator species for grassland or low shrubland environments, including derived or cleared landscapes consistent with the landscape present at OC1.

The presence of obligate woodland bird species such as honeyeaters, and a higher species richness, indicates that sections of the rehabilitation are maturing and are more advanced in their transition toward functioning woodland ecosystems. The presence of both grassland and woodland species

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

across multiple sites may be reflective of the highly heterogeneous, mosaic nature of vegetation structure and development throughout the rehabilitation area.

The listed species *Gallinago hardwickii* (Latham’s Snipe), *Chthonicola sagittata* (Speckled Warbler) and *Epthianura albifrons* (White-fronted Chat), which were recorded during previous years’ monitoring in the rehabilitation area, were not sighted during the spring 2016 survey.

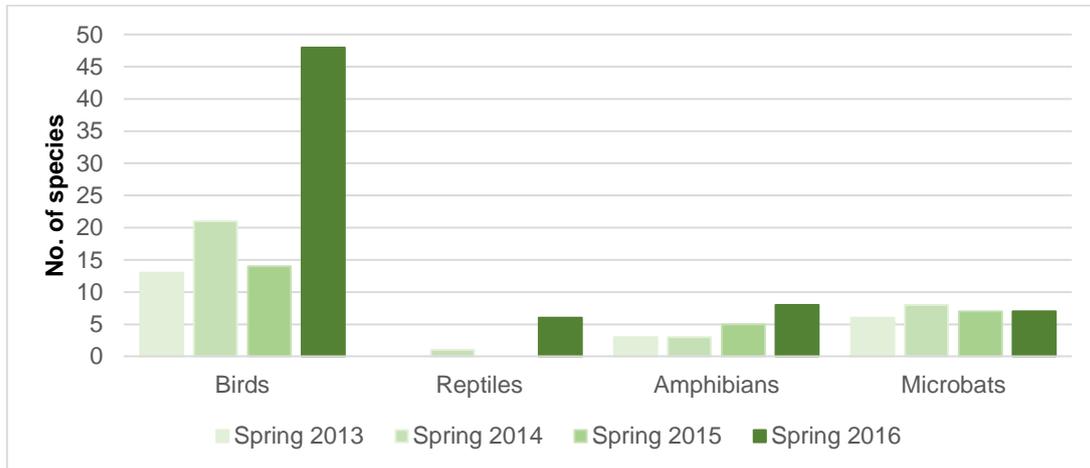


Figure 12: Comparison of target fauna species

Visual Monitoring

Visual monitoring found that weeds density had reduced in spring 2016, being generally observed as occurrences of individual plants or small patches rather than strong infestations. The noxious weed *Hypericum perforatum* (St John’s Wort) was scattered throughout OC1 along with larger patches in an open grassed area opposite the western end of Transect 2. *Carthamus lanatus* (Saffron Thistle) was present in large numbers in open locations where canopy species have not established enough to provide a closed canopy.

Visual monitoring undertaken during spring 2016 observed that the OC1 rehabilitation area was generally stable, with only isolated areas of moderate erosion on steeper areas.

Rehabilitation performance and changes since 2015 are presented in **Figure 13** below.

Assessment of RMP Performance Indicators

Analysis of the Box Gum Woodland and Sedimentary Ironbark Forest rehabilitation against the RMP Performance Indicators (and vegetation structure indicators) is presented in **Table 28** and **Table 29**.

Table 28: Box Gum Shrubby Woodland rehabilitation assessment

Objective: Establish native vegetation comparable to Box Gum Shrubby Woodland communities including stands of <i>Allocasuarina</i> spp.	Completion Criteria (by years 5-7)			
	Species composition targets			Vegetation structure targets
	Presence of one to three overstorey species from Box Gum Shrubby Woodland	Presence of stands of <i>Allocasuarina</i> spp.	Presence of at least four native ground cover species that are present at analogue sites	Indicator species plant densities trending towards plant densities of analogue sites
R1	Yes	No	Yes	

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

R2	Yes	No	Yes	Currently the structure lacks a <i>Eucalyptus</i> canopy, upper layer is <i>Acacia</i> sp., dominated, and the ground cover is <i>C. dactylon</i> dominated with some native ground cover species.
R3	Yes	No	Yes	
R4	Yes	No	Yes	
R5	Yes	No	Yes	
R6	Yes	No	Yes	
R7	Yes	No	Yes	

Table 29: Sedimentary Ironbark Forest rehabilitation assessment

Objective: Establish native vegetation comparable to Sedimentary Ironbark Forest communities including stands of <i>Allocasuarina</i> spp.	Completion Criteria (by years 5-7)			
	Species composition targets			Vegetation structure targets
	Presence of two to three overstorey species from Sedimentary Ironbark Forest	Presence of stands of <i>Allocasuarina</i> spp.	Presence of at least four native ground cover species that are present at analogue sites	Indicator species plant densities trending towards plant densities of analogue sites
R9	Yes	No	Yes	Currently the structure lacks a <i>Eucalyptus</i> canopy, upper layer is <i>Acacia</i> sp., dominated, and the ground cover is <i>C. dactylon</i> dominated with some native ground cover species.
R10	No	No	Yes	
R11	No	No	No	
R12	No	No	Yes	
R13	Yes	No	No	
R14	Yes	No	Yes	
R15	No	No	Yes	
R16	Yes	No	Yes	

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase



Rehabilitation Success

- 2016 Good
- 2016 Average
- 2016 Poor
- 2015 Good
- 2015 Average
- 2015 Poor

Ulan Road

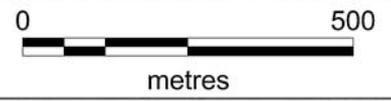


Figure 16
Rehabilitation Progress 2015 to 2016

Date: 30/03/2017
 Produced By: Craig Hawkins
 Map Size: A3 Portrait
 Coordinate System: MGA94 Zone 55
 Revision: 0
 Data Source
 Land and Property Information (2014)
 Moolarben Coal Operations Pty Ltd (2017)

DISCLAIMER
 Moolarben Coal Operations Pty Ltd makes every effort to ensure the quality of the information available on this map. Before relying on the information on this plan, users should carefully evaluate its accuracy, currency, completeness and relevance for their purpose and should obtain any appropriate professional advice relevant to their particular circumstances.
 Moolarben Coal Operations Pty Ltd cannot guarantee and assumes no responsibility for the accuracy, currency or completeness of the information and by using this map you accept that Moolarben Coal Operations Pty Ltd has no liability for any loss or damage in any form whatsoever caused directly or indirectly from the use of this map. ©Moolarben Coal Operations Pty Ltd



Moolarben Coal Operations Pty Ltd
 ABN 59 077 939 569
 Locked Bag 2003 MUDGEE NSW 2850
 www.moolarbencoal.com.au

8.5 REHABILITATION WORKS

Rehabilitation of disturbed lands are undertaken sequentially (or in phases) to achieve the final land use. A description of these phases of rehabilitation relevant to the Moolarben Coal Complex are provided in the MOP. A summary of rehabilitation phases completed during the reporting period within Domain 5 included:

Decommissioning

There were no decommissioning activities undertaken at MCO.

Landform Establishment

26ha in OC2 had reshaping completed to final landform. Final landforms in OC2 were established to the relevant completion criteria including:

- Constructed landforms consist with surrounding topography;
- Slopes were generally less than 10° to 18°;
- Constructed landforms were free draining; and
- No hostile overburden material in the final surface layers.

Growth Medium Development

26ha in OC2 had topsoil applied, the application of topsoil in OC2 was spread using MCO existing mine fleet. Growth medium in OC2 was managed and applied to the relevant completion criteria including:

- Topsoil depths achieved a minimum of 100mm; and
- Appropriate soil ameliorants have been applied in accordance with specification and recommendations from subsoil and topsoil material characterisation testing
- Topsoil areas were lightly ripped along the contour

Ecosystem and Landuse Establishment

151ha of rehabilitation in the ecosystem and landuse establishment phase located in OC1 and OC2 were maintained and further enhanced.

8.6 ACTIONS DURING NEXT PERIOD

Rehabilitation actions to be progressed in the next period include:

- Continued progressive rehabilitation;
- Continued weed and feral animal control; and,
- Continued monitoring of rehabilitation areas with poor cover or density with consideration of follow-up seeding and/or wood debris placement.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

9.0 COMMUNITY

9.1 COMMUNITY ENGAGEMENT

During 2016, MCO continued to foster positive relationships with the local community through engagement and ongoing financial support provided to a range of community groups and events – including, but not limited to – Mudgee High School and Ulan Public School, Mudgee Triathlon Club, Lake Windamere Under Canvas, Watershed Landcare Group, Mudgee Parkrun, Mudgee Rotary, Mudgee Show Rodeo, Rylstone Pony Club, Kanandah Retirement, and Sculptures in the Garden. MCO also supported the Westpac Rescue Helicopter service, the Benevolent Society, Lifeskills and continued its sponsorship of the Moolarben Celebrity Golf Classic with all proceeds going to the local community (over \$100,000 since it commenced). In total, MCO provided **\$109, 900** in community donations during 2016 to 40 community groups and events through its Community Support Program (**Appendix 6**).

Community/stakeholder related activities undertaken during the reporting period include:

- Moolarben Spirit Awards Program;
- Mine tour/career talks with each of the local High Schools and University students;
- Mine visit/tour with a local aged care facility;
- Mine visit/Tour with U3A;
- Mudgee District High Schools ‘Try-A-Trade’
- Vocational student placement from Wollongong University;
- Provide use of MCO training facilities to RFS and other local mines;
- Careers information evening for 2017 apprentices; and,
- Direct engagement with nearby landholders.

Moolarben continued to provide the community with information on its website (www.moolarbencoal.com.au). Information available included project approvals, CCC meeting minutes, community complaint records, environmental monitoring information, environmental audits, environmental management plans and annual environmental management reports.

MCO continued to operate a free-call 24-hour Environment and Community Complaints Hotline (1800 657 639) during the reporting period to allow the community to contact the operation directly to ask questions or raise concerns about mining activities.

9.2 COMMUNITY COMPLAINTS

In accordance with Condition M6.2 of EPL 12932, MCO maintains a 24 hour Environment and Community Complaints Hotline (1800 556 484). This Hotline is to respond to any complaint from neighbouring residents or interested stakeholders. The Hotline is advertised in the local media and is also available on the MCO website and in the community newsletters.

MCO has developed a Community Complaints Procedure which details how to receive, respond to, record, and action any community complaint received to site. This procedure also outlines the reporting requirements relating to community complaints, including:

- Monthly reporting of community complaints on the MCO website;
- Discussion of community complaints as part of the operational performance provided during CCC meetings; and,
- A summary of complaints is provided in the Annual Review and Annual Return (as part of EPL reporting).

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

During 2016, a total of 167 complaints were received in relation to MCO Operations by 30 complainants. All complaints are investigated and reported on the Moolarben Coal website (www.moolarbencoal.com.au). 55% of complaints were received by four complainants. Noise remained the primary issue of concern (94% of complaints) (**Figure 14**).

A comparison of complaints to previous years is presented in **Table 30**. There has been a decrease in noise complaints during the period. This decrease may be attributed to an increase in operations located within the OC4 area of the MCC. A register of complaints is provided in **Appendix 5**.

The ongoing use of Mining and Production Environmental Assistance continues to provide real-time feedback to the mining operation, and mine planning to allow for protected work areas to be developed. Ongoing community liaison and consultation has continued.

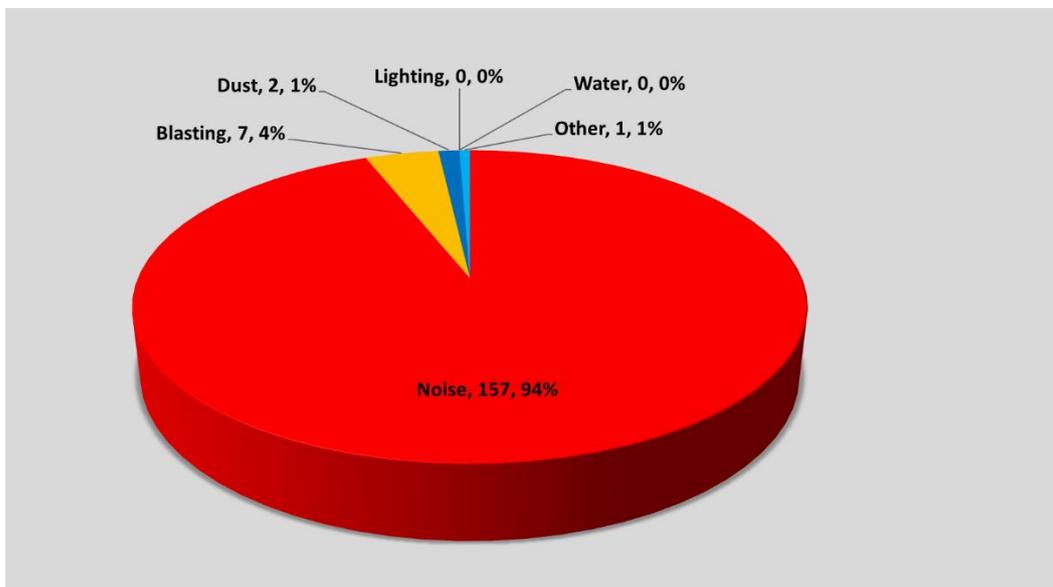


Figure 14 : Community Complaints 2016 – Breakdown by Type

Table 30: Comparison of Community Complaints

Reporting Period	Noise	Blasting	Dust	Lighting	Water	Other	Total
2010-2011	110	3	0	0	0	0	113
2011-2012	334	17	2	0	3	3	359
2012-2013	117	0	1	0	0	2	120
2013-2014	239	12	2	0	0	3	256
2015	274	6	2	1	0	3	286
2016	157	7	2	0	0	1	167

9.3 COMMUNITY CONSULTATIVE COMMITTEE (CCC)

In accordance with Condition 6, Schedule 5 of project approval (05_0117) and Condition 6, Schedule 6 of project approval (08_0135) the Community Consultative Committee (CCC) continued to meet during the 2016 reporting period. The purpose of a Community Consultative Committee is to provide a forum for open discussion between MCO, the community, the local council and other key

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

stakeholders on issues directly relating to the project, including performance against any conditions, and to keep the community informed on these matters.

Members of the MCO CCC for 2016 are presented in **Table 31**. MCO conducted four CCC meetings during the reporting period with summaries provided in **Table 32**. Meetings were chaired by an independent chairperson with the minutes being available on the MCO website.

Table 31: CCC Members 2016

Name	Representing	Name	Representing
Aleshia Lonsdale	Mudgee Local Aboriginal Land Council	Annette Riley	Ulan Public School (Principal)
Andrew Palmer	Mudgee Chamber of Commerce	David Stokes	Local Landholder
Julia Imrie	Local Landholder and Business Owner	Max Walker	Councillor, Mid-Western Regional Council
Bev Smiles	Mudgee District Environment Group	Mr John Turner	Previous Independent Chair Endorsed by DP&E in March 2014 as CCC Chairperson
		Ms Lisa Andrews	Current Independent Chair Endorsed by DP&E in May 2016 as CCC Chairperson

Table 32: CCC Meeting Summary

Date	Meeting Summary
22 March	General update on community interaction, operations and exploration, and environmental monitoring. Update on the Independent Environmental Audit Summary of the Underground 1 Optimisation Modification
14 June	General update on community interaction, operations and exploration, and environmental monitoring. Presentation of 2015 Annual Review
6 September	General update on community interaction, operations and exploration, and environmental monitoring.
6 December	Site tour of current operations General update on community interaction, operations and exploration, approvals and environmental monitoring. Christmas dinner was provided by MCO

9.4 ULAN ROAD STRATEGY

A detailed plan of implementation has been developed and agreed between MCO, the Mid Western Regional Council and the Ulan and Wilpinjong Coal mines and is documented in the *Funding and Delivery of Ulan Road Upgrade and Maintenance*. The Mid Western Regional Council continues with the capital and maintenance works on the road. Moolarben continues to make financial contributions to the capital and maintenance costs of the Ulan Road works detailed in the agreement. In addition Moolarben has investigating the Council sourcing material from the site.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

18 properties along Ulan road have also been identified for noise attenuation works. Works required at each of the properties was determined generally in accordance with the RMS guidelines. Works are progressing on the relevant properties with 5 properties remaining to be completed.

10.0 INDEPENDENT AUDIT

In December 2015, an Independent Environmental Audit (IEA) was undertaken in accordance with Condition 9, Schedule 5 of PA 05_0117 (as modified) and Condition 9, Schedule 6 of PA 08_0135. The IEA was undertaken by Trevor Brown and Associates, a summary of the report and response to the audit action list were provided in the 2015 Annual Review and is located on the MCO website (www.moolarbencoal.com.au). **Table 33** provides a summary of MCO's response to the Audit Action list.

The next Independent Audit will be required by December 2018.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	April 2017	MCO	G Chase

Table 33: Independent Audit Action List and status as at 31 December 2016

IEA Reference	Recommendation	Status
Recommendations		
PA05_0117 Sch 5 cond 4 PA08_0135 Sch 6 cond 4,	It is recommended that future Annual Reviews be prepared with consideration of the format and content of the recently released Annual Review Guidelines (October 2015).	Complete
Blast Management Plan	It is recommended that management of blasts to reduce potential of fume generation should be reviewed in relation to the Blast Fume Management Strategy by ensuring the quality of product used for the blasts is checked before the blast is initiated and meets the gassing specifications provided by the supplier.	Complete - Blast Management Plan revised.
Project Approval 05_0117 Schedule 3 condition 70 Energy Savings Action Plan	It is recommended that the Energy Saving s Action Plan be reviewed to identify any energy saving measures which may be implemented on site to reduce the energy use in relation to the mining operations. The ESAP is also to include a program to monitor the effectiveness of the measures to reduce energy use.	Complete - ESAP revised.
Biodiversity Offset	It is recommended that the staged development of the Biodiversity Management Plan and offset management to meet the long term security requirements of the Project Approval and the EPBC Approvals conditions, be progressed in general accordance with the correspondence submitted to DP&E on 8 December 2015 to secure the biodiversity offset areas.	In Progress. Pending DPE response on draft security instruments provided by MCO in November 2015
Improvement Opportunities		
Opportunity 1	As development of rehabilitation performance indicators and completion criteria is an iterative process, the completion criteria should be reviewed and revised where necessary using monitoring results to refine the completion criteria in future revisions of the Rehabilitation Management Plan and the Mining Operations Plan in accordance with clause (i) Explanatory Note 2 – Rehabilitation and Mine Closure in ESG3: Mining Operations Plan (MOP) Guidelines September 2013 NSW Trade and Investment	Complete - RMP and MOP revised and approved by DRE.
Opportunity 2	The testing of subsoil and spoils should be refined to identify reactive soils and guide amelioration requirements to reduce the risk of tunnel and gully erosion in rehabilitated areas and creek line restoration.	Complete - RMP and MOP revised and approved by DRE
Opportunity 3	As the final design of the Murragamba and Eastern Creek diversions are being developed, consideration should be given to removing the channel banks from rehabilitated areas once adequate grass cover has been established ($\geq 70\%$), to re-establish sheet flow conditions to minimise the potential for tunnel and subsequent gully erosion. Landform stability using this approach can be verified via spoil characterisation, the use of an erosion prediction model and landform evolution models (such as WEPP and SIBERIA) can be useful relatively low cost tools for assisting landform design planning.	Noted - To be included with detailed design.
Opportunity 4	In future revisions of the Rehabilitation Management Plan, Biodiversity Management Plan and Mining Operations Plan the management and mitigation measures to be undertaken on site should be refined to provide clear direction as to what management and mitigation measures will be implemented to the various areas of the site as the nature of the rehabilitation and restoration of the final landform and land uses are determined.	Complete - RMP and MOP and Biodiversity Management Plan revised.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	March 2017	MCO	G Chase

11.0 INCIDENTS & NON COMPLIANCES

There were two reportable incidents during the period.

- On the 20th of January a contract dozer operator cleared a fence line outside of the approved GDP, located within the approved disturbance limits of the OC4 pit. The Incident was reported to DP&E and EPA. No adverse impacts occurred.
- On the 18th of July a blast at MCO resulted in a fume event level 4B occurring. The Incident was reported to EPA & DP&E. Blast fume did not leave site. No adverse impacts occurred.

Minor administrative non-compliances during the reporting period were:

- Non-continuous monitoring of TEOMs due to power supply interruption and routine maintenance. No adverse impacts occurred.
- Blast Monitor (BM05) did not record vibration or overpressure results for a blast event on 22.03.16 due to monitor in incorrect monitoring mode. No adverse impacts occurred.

A penalty notice was received for production of coal in excess of the open-cut ROM coal limit. PA05_0117 Sch2 Cond 6 in 2014.

No official cautions or warning letters were received or prosecution proceedings undertaken by any regulatory agency during the period.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	March 2017	MCO	G Chase

12.0 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

The following is a summary of measures to be implemented in the next reporting period.

- Review and revise environmental management plans as necessary;
- Review noise triggers during the period and revise where required;
- Review the blast monitoring network by June 2017;
- Continued monitoring, fencing, and weed and feral animal control works;
- Feral animal monitoring to be expanded to include Area 2 and 3 during the 2017 reporting period;
- Revised heritage assessments to be completed on the historical heritage site 19 (Glen Moor Homestead) which will have regard to the site's condition and any changed circumstances by December 2017.
- Finalise relocation of TEOM05 (subject to access agreements).
- Review and update as required, the current stream flow monitoring system during the next reporting period;
- Obstructed piezometers to be rectified where practicable;
- Complete spring and seep census survey will be completed, including the upper reaches of Eastern Creek and Goulburn River around the northern and north-western boundary of UG4 by December 2017; and,
- Continue baseline monitoring of PZ201, 202 and 203 will continue to develop SWL, pH and electrical conductivity triggers throughout the period.
- WAMP to be reviewed and revised as necessary.
- Continued progressive rehabilitation; and,
- Continued monitoring of rehabilitation areas with poor cover or density with consideration of follow-up seeding and/or wood debris placement.

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2016	1	March 2017	MCO	G Chase