



# MOOLARBEN COAL COMPLEX ANNUAL REVIEW 2018

Document	Version	Issue	Author	Approved
ENV_RPT_ANNUAL REVIEW 2018	1	Mar 2018	MCO	SA

<b>Name of operation</b>	Moolarben Coal Complex
<b>Name of operator</b>	Moolarben Coal Operations Pty Ltd
<b>Development consent / project approval #</b>	05_0117 and 08_0135
<b>Name of holder of development consent / project approval</b>	Moolarben Coal Mines Pty Limited
<b>Mining lease #</b>	ML 1605, 1606, 1628, 1691, 1715
<b>Name of holder of mining leases</b>	Moolarben Coal Mines Pty Ltd, Sojitz Moolarben Resources Pty Ltd and Kores Australia Moolarben Resources Pty Ltd
<b>Water licence #</b>	Refer Table 6
<b>Name of holder of water licence</b>	Moolarben Coal Operations Pty Ltd
<b>MOP/RMP start date</b>	1 January 2017
<b>MOP/RMP end date</b>	31 December 2019
<b>Annual Review start date</b>	01 January 2018
<b>Annual Review end date</b>	31 December 2018
<p><b>I, Steve Archinal, certify that this audit report is a true and accurate record of the compliance status of Moolarben Coal Complex for the period January 1st 2018 to December 31 2018 and that I am authorised to make this statement on behalf of Moolarben Coal Operations.</b></p> <p><i>Note.</i></p> <p>a) <i>The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.</i></p> <p>b) <i>The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).</i></p>	
<b>Name of authorised reporting officer</b>	Steve Archinal
<b>Title of authorised reporting officer</b>	General Manager
<b>Signature of authorised reporting officer</b>	
<b>Date</b>	31 March 2019

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## 1.0 STATEMENT OF COMPLIANCE

A summary of compliance with relevant approval conditions for the reporting period is provided in **Table 1** and **Table 2**. A compliance table key is provided in **Table 3**.

**Table 1: Statement of compliance**

Approval	Compliance Status (Including Administrative Non-compliances)	Approval	Compliance Status (Including Administrative Non-compliances)
PA 05_0117	No	WAL36340	Yes
PA 08_0135	No	WAL37582	Yes
ML 1605	No	WAL37583	Yes
ML 1606	Yes	WAL39799	No
ML 1628	Yes	WAL41888	No
ML 1691	Yes	20BL173935	Yes
ML 1715	Yes	-	-

**Table 2: Non-compliances**

Approval	Condition Number	Condition description (summary)	Compliance status	Comment	Where addressed
PA 08_0135 PA05-0117	Sch. 2 C. 2	The Proponent shall carry out the project generally in accordance with the EA	Non-Compliant	Material stockpiled contrary to EA	12.0
PA 08_0135 PA05-0117	Sch. 3 C. 22	Air Quality Management Plan	Non-Compliant	Non-continuous TEOM monitoring due to being out of service	6.4 and 12.0
PA05-0117 PA 08_0135	Sch. 3 C. 29 Sch. 3 C. 25	Water Supply	Non-Compliant	As at 31 December 2018, MCO had sufficient water source entitlements under both the RPS Model and the OC3 Null Model. Following the August 2018 issue of the OC3 Null Model and then annual review process verification MCO became aware there was an administrative non-compliance because MCO had not held sufficient entitlements for the Upper Goulburn River Water Source between January to July 2018. This was remedied in August 2018 with the purchase of additional entitlements	7.1 and 12.0
WAL41888	MW0603-00001	Take of Water	Non-Compliant		
WAL39799	C. 9	Provide bore details within 2 months of construction.	Non-Compliant	Details of the bore not provided within 2 months of construction	12.0
ML 1605	C. 3	Mining operations to be carried out in accordance with the Mining Operations Plan	Non-Compliant	Material stockpiled contrary to MOP	12.0

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**Table 3: Compliance Table Key**

Risk	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with: <ul style="list-style-type: none"><li>• potential for serious environmental consequences, but is unlikely to occur, or</li><li>• potential for moderate environmental consequences, but is likely to occur</li></ul>
Low	Non-Compliant	Non-compliance with: <ul style="list-style-type: none"><li>• potential for moderate environmental consequences, but is unlikely to occur, or</li><li>• potential for low environmental consequences, but is likely to occur</li></ul>
Administrative	Non-Compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

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## 2.0 INTRODUCTION

The Moolarben Coal Complex (MCC) is located approximately 40 kilometres north of Mudgee in the Western Coalfield of New South Wales (**Figure 1**) within the Mid-Western Regional Local Government Area. Local relevant land ownership within the immediate vicinity of the MCC is provided in **Appendix 1**.

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex (MCC) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Sojitz Moolarben Resources Pty Ltd and a consortium of Korean power companies). MCO and MCM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Current mining operations undertaken across the MCC have approval until 31 December 2038. All mining operations are conducted in accordance with NSW Project Approval (05\_0117) (Moolarben Coal Project Stage 1) as modified, and NSW Project Approval (08\_0135) (Moolarben Coal Project Stage 2) as modified.

The current mining operations are undertaken in accordance with Approval Decisions (EPBC 2007/3297), (EPBC 2013/6926) and (EPBC 2008/4444) under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

Current mining operations at the MCC are conducted in accordance with the requirements of the conditions of Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691, and ML1715 granted under the *Mining Act, 1992*.

### 2.1 SCOPE

This Annual Review has been prepared by MCO (with input from experienced and qualified experts) to satisfy the reporting requirements of NSW Project Approval (05\_0117) (as modified), NSW Project Approval (08\_0135) (as modified), mining leases ML 1605, ML 1606, ML1628, ML1691 and ML1715, and water licences. The report presents a summary of the regulatory compliance, environmental performance, and community engagement activities for MCO.

The following key agencies shall be provided with a copy of this report:

- NSW Department of Planning and Environment (DP&E);
- NSW Department of Planning and Environment – Division of Resources & Geosciences (DRG);
- NSW Department of Industries – Lands and Water (DI-Water);
- NSW Office of Environment and Heritage (OEH);
- NSW Environment Protection Authority (EPA);
- Mid-Western Regional Council (MWRC); and
- Members of the MCC Community Consultative Committee (CCC).

In addition, an electronic copy will be made publicly available on the Moolarben Coal website (<http://www.moolarbencoal.com.au/>) in accordance with Schedule 5, Condition 11 (a) of PA05\_117 and Schedule 6, Condition 11 (a) of PA08\_0135.

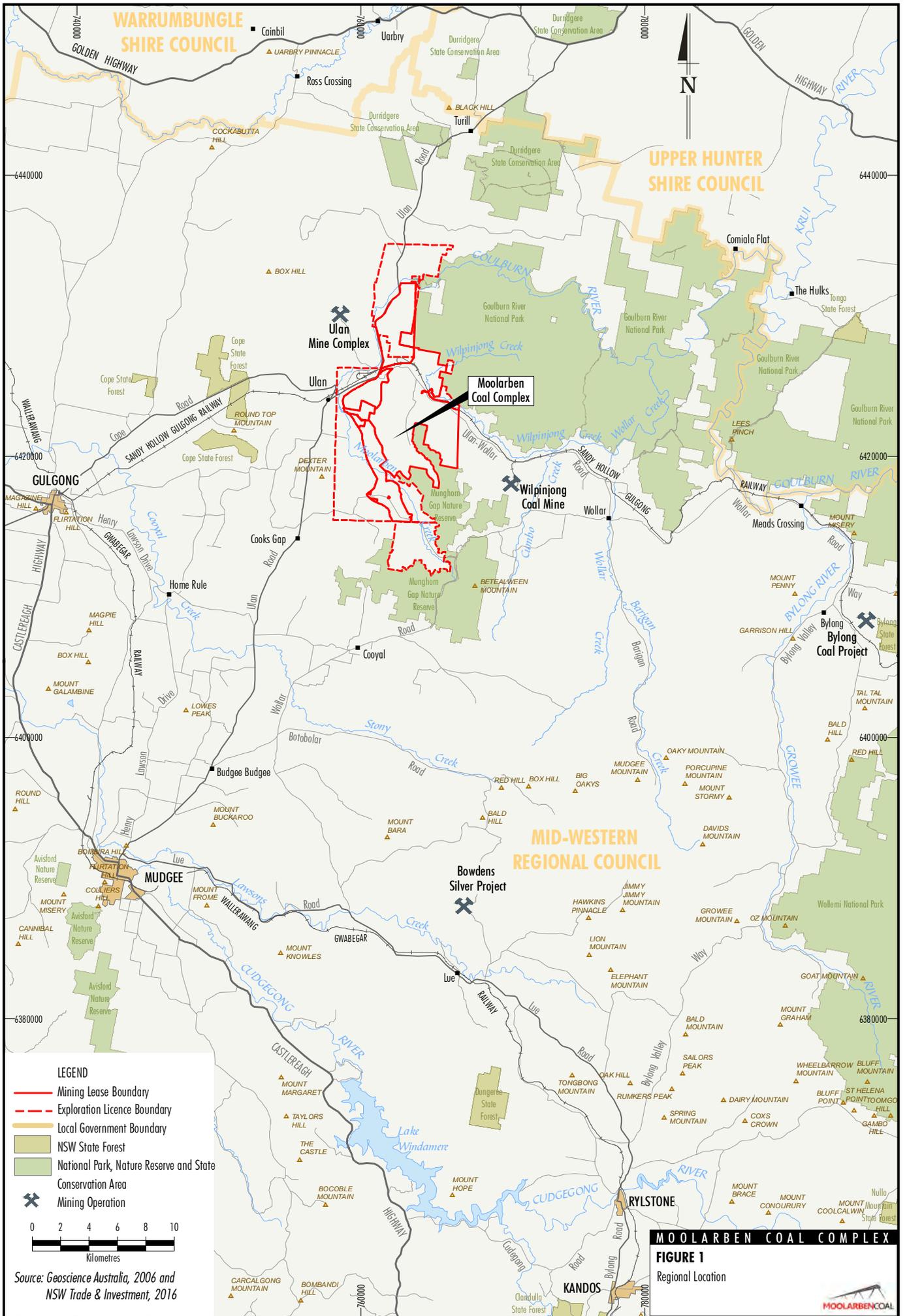
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## 2.2 STRUCTURE OF THIS ANNUAL REVIEW

The remainder of the Annual Review is structured as follows and is based on the *Annual Review Guidelines – Post-approval requirements for State significant mining developments* (NSW Department of Planning and Environment, 2015):

- Section 3: Outlines the relevant statutory approvals.
- Section 4: Outlines the activities undertaken at Moolarben Coal Complex for the period and those proposed for the next period.
- Section 5: Actions required from previous Annual Review.
- Section 6: Outlines environmental performance including meteorological, noise, blasting, air quality, biodiversity, heritage, bushfire and waste.
- Section 7: Outlines the water management performance.
- Section 8: Outlines subsidence performance.
- Section 9: Outlines the rehabilitation management performance
- Section 10: Outlines the community performance.
- Section 11: Describes independent audit requirements.
- Section 12: Provides a summary of incidents and non-compliances.
- Section 13: Outlines activities to be completed in the next reporting period.
- Appendices: Supporting information and monitoring data.

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**MOOLARBEN COAL COMPLEX**  
**FIGURE 1**  
 Regional Location



Source: Geoscience Australia, 2006 and NSW Trade & Investment, 2016

## 2.3 PROJECT DESCRIPTION

The MCC comprises the Moolarben Stage 1 and Stage 2 Projects. An overview of the complex is provided in **Figure 2**. The Stage 1 and Stage 2 operations are summarised in **Table 4** below.

Stage 1 at the Moolarben Coal Complex has been operating for several years and at full development will comprise three open cut mines (OC1, OC2, and OC3), a longwall underground mine (UG4), and mining related infrastructure (including coal processing and transport facilities).

Stage 2 at the Moolarben Coal Complex has commenced and at full development will comprise one open cut mine (OC4), two longwall underground mines (UG1 and UG2), and mining related infrastructure.

**Table 4: Moolarben Coal Complex production overview**

Relevant Approval Component	Moolarben Coal Project	
	Stage 1 Project Approval (05_0117)	Stage 2 Project Approval (08_0135)
Operational Mine Life	Mining operations can be carried out until 31 December 2038.	
Hours of Operation	Mining operations can be carried out 24 hours a day, 7 days a week.	
Coal Extraction Limits	Up to 8 Mtpa of ROM coal can be extracted from the open cut mining operations in any calendar year from Stage 1.	Up to 12 Mtpa of ROM coal can be extracted from the open cut mining operations in any calendar year from Stage 2.
	Up to 8 Mtpa (total) of ROM coal can be extracted from the underground mining operations at the Moolarben Coal Complex in any calendar year.	
Coal Processing and Offsite Transport	Up to 13.5 Mtpa (total) of ROM coal from the Moolarben Coal Complex can be processed in the calendar year 2017, and 13 Mtpa in any calendar year thereafter from Stages 1 and 2.	
	Not more than 7 laden trains on average or 9 laden trains maximum to leave the complex per day.	
	All coal is to be transported from the Moolarben Coal Complex by rail.	All coal extracted from the site is sent to the Moolarben Stage 1 mine surface infrastructure area for processing and/or transport to market.

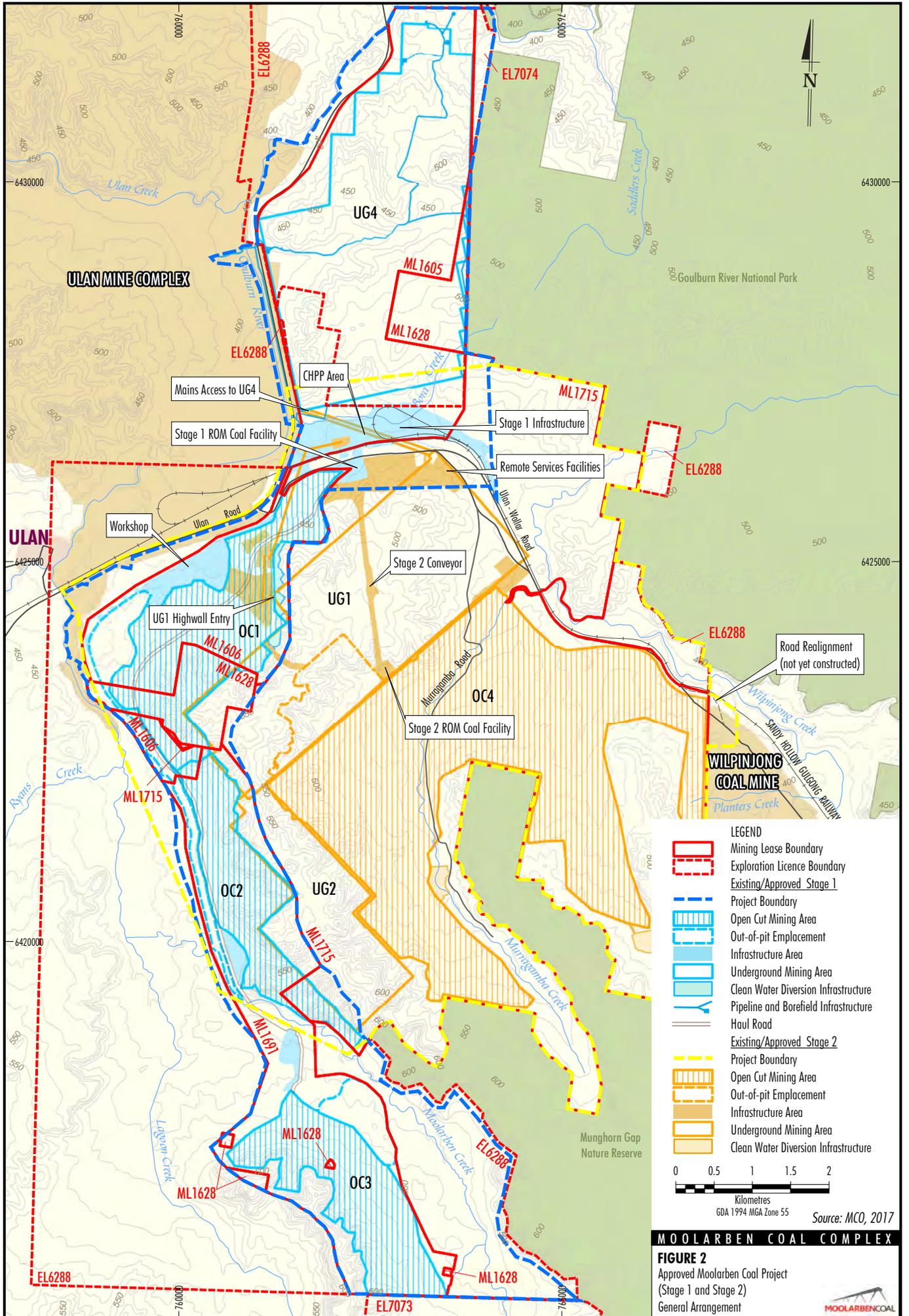
## 2.4 KEY MINE CONTACT PERSONNEL

The following table provides contact details for key personnel responsible for environmental management across the Moolarben Coal Complex.

**Table 5 : Mine Contact Personnel**

Position/Area of Responsibility	Name	Contact Number(s)	Email Address
General Manager	Steve Archinal	02 6376 1500	steve.archinal@yancoal.com.au
Environment and Community Manager	Graham Chase	02 6376 1407	graham.chase@yancoal.com.au
Environment and Community Superintendent	Trent Cini	02 6376 1436	trent.cini@yancoal.com.au
Environment and Community Complaints Line	1800 556 484		
Postal Address	Locked Bag 2003, Mudgee, NSW, 2850		

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### 3.0 APPROVALS

#### 3.1 SUMMARY OF APPROVALS

Project Approvals, Mining Leases, and other Licences relevant to MCO are provided in **Table 6**. Current Project Approvals, EPBC Approvals, Exploration Licences, and Mining Leases are available at [www.moolarbencoal.com.au](http://www.moolarbencoal.com.au).

**Table 6: Relevant Approvals, Leases and Licences**

Approval	Description	Expiry Date
<b>Project Approval – NSW Department to Planning and Environment</b>		
05_0117	Stage 1 as modified	31 December 2038
08_0135	Stage 2 as modified	31 December 2038
<b>Mining Lease – NSW Department of Industry –Resources &amp; Energy</b>		
ML1605	Underground 4, CHPP and infrastructure areas	20 December 2028
ML1606	OC1, OC2, UG1 and associated infrastructure	20 December 2028
ML1628	OC1, OC2, OC3, UG1 and UG4	24 February 2030
ML1691	OC2, OC3, UG1, UG2 and associated infrastructure	23 September 2034
ML1715	OC2, OC4, UG1, UG2 and associated infrastructure	31 August 2036
<b>Mining Operation Plan – NSW Department of Industry –Resources &amp; Energy</b>		
MOP	Stage 1 and Stage 2 operations	31 December 2019
<b>Exploration Licences – NSW Department of Industry –Resources &amp; Energy</b>		
EL6288	Coal Exploration Licence	22 August 2017 (renewal pending)
EL7073	Coal Exploration Licence	12 February 2020
EL7074	Coal Exploration Licence	12 February 2020
<b>Environmental Protection Licence – NSW Environment Protection Agency</b>		
EPL12932	Licence authorising the carrying out of scheduled activities	N/A
<b>Environment Protection and Biodiversity Conservation – Commonwealth Department of the Environment</b>		
2007/3297	Stage 1 coal mines and associated infrastructure	31 December 2027
2008/4444	Stage 2 coal mines	31 December 2065
2013/6926	Modify and extend the Moolarben Coal Project.	31 December 2064
<b>Water Licences – NSW Department of Primary Industries – Water</b>		
WAL 39799	Sydney Basin - North Coast Groundwater Sources – Aquifer Licence	N/A
20BL173935	Monitoring Bore Licence	Perpetuity
WAL36340	Wollar Creek Water Source -Aquifer	N/A
WAL37582	Upper Goulburn River Water Source – Unregulated River	N/A
WAL37583	Wollar Creek Water Source - Unregulated River	N/A
WAL41888	Upper Goulburn River Water Source - Aquifer	N/A

During the reporting period the following approvals were granted:

- Moolarben Coal Complex Mining Operations Plan 2017-2019 amendments C, D & E

An application to modify project Approval (05\_0117) and project Approval (08\_0135) was submitted during the previous reporting period and was being assessed by DPE during the current reporting period. The application also included an EPBC approval application. The application included:

- an increase in the amount of run-of-mine (ROM) coal production from the Stage 1 and Stage 2 open cuts and associated increase in the annual rate of coal processing and product coal production over the life of the mine.
- Minor extensions and reductions of Open Cut 2 and 3 and relocated/additional surface infrastructure.
- Water treatment facilities and increased licensed water releases to manage on-site water surpluses.

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### 3.2 ANNUAL REPORTING

**Table 7** provides a checklist of Annual Reporting requirements and performance conditions along with the relevant sections within this report.

**Table 7: Annual Review Requirements**

Approval Type & Reference		Annual Review Section
Project Approval 05_0117 Condition 4 Schedule 5	<p><i>By the end of March each year, or other timing as may be agreed by the Secretary, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:</i></p> <ol style="list-style-type: none"> <li><i>a. describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;</i></li> <li><i>b. include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against the</i> <ul style="list-style-type: none"> <li><i>• the relevant statutory requirements, limits or performance measures/criteria;</i></li> <li><i>• the monitoring results of previous years; and</i></li> <li><i>• the relevant predictions in the EA;</i></li> </ul> </li> <li><i>c. identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;</i></li> <li><i>d. identify any trends in the monitoring data over the life of the project;</i></li> <li><i>e. identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and</i></li> <li><i>f. describe what measures will be implemented over the next year to improve the environmental performance of the project.</i></li> </ol>	<p>4.2 &amp; 4.3</p> <p>6 to 9</p> <p>1, 6 to 9 &amp; 12</p> <p>6 to 9</p> <p>6 to 9</p> <p>6 to 10 &amp; 13</p>
Project Approval 08_0135 Condition 4 Schedule 6	<p><i>By the end of March each year, or other timing as may be agreed by the Secretary, the Proponent shall review the environmental performance of the project to the satisfaction of the Secretary. This review must:</i></p> <ol style="list-style-type: none"> <li><i>a. describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;</i></li> <li><i>b. include a comprehensive review of the monitoring results and complaints records of the project over the previous calendar year, which includes a comparison of these results against the</i> <ul style="list-style-type: none"> <li><i>• the relevant statutory requirements, limits or performance measures/criteria;</i></li> <li><i>• the monitoring results of previous years; and</i></li> <li><i>• the relevant predictions in the EA;</i></li> </ul> </li> <li><i>c. identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;</i></li> <li><i>d. identify any trends in the monitoring data over the life of the project;</i></li> <li><i>e. identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and</i></li> <li><i>f. describe what measures will be implemented over the next year to improve the environmental performance of the project.</i></li> </ol>	<p>4.2 &amp; 4.3</p> <p>6 to 9</p> <p>1, 6 to 9 &amp; 12</p> <p>6 to 9</p> <p>6 to 9</p> <p>6 to 10 &amp; 13</p>
Mining Lease 1605, 1606 & 1628 Condition 4 & 5	<p><i>The lease holder must lodge Environmental Management Reports (EMR) with The Director-General annually or at dates otherwise directed by the Director-General.</i></p> <p><i>The EMR must:</i></p> <ul style="list-style-type: none"> <li><i>- report against compliance with the MOP;</i></li> <li><i>- report on progress in respect of rehabilitation completion criteria;</i></li> <li><i>- report on the extent of compliance with regulatory requirements; and</i></li> </ul>	<p>This Report &amp; Section 9</p>

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Approval Type & Reference		Annual Review Section
	- have regard to any relevant guidelines adopted by the Director-General;	
Mining Lease 1691 Condition 4	<p>(a) The lease holder must lodge Environmental Management Reports (EMR) with the Director-General annually or at dates otherwise directed by the Director-General.</p> <p>(b) The EMR must:</p> <p>I. Report against compliance with the MOP;</p> <p>II. Report on progress in respect of rehabilitation completion criteria;</p> <p>III. Report on the extent of compliance with regulatory requirements; and</p> <p>IV. Have regard to any relevant guidelines adopted by the Director-General.</p>	This Report & Section 9
Mining Lease 1715 Condition 3	<p>f) The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must:</p> <p>(i) provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP;</p> <p>(ii) be submitted annually on the grant anniversary (or at such other times as agreed by the Minister; and</p> <p>(iii) be prepared in accordance with any relevant annual reporting guidelines published on the Department's website at <a href="http://www.resources.nsw.gov.au/environment">www.resources.nsw.gov.au/environment</a>.</p>	This Report & Section 9

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## 4.0 OPERATIONS SUMMARY

### 4.1 MINING OPERATIONS

Details of production and associated waste generated by the site for the current and next reporting period are provided in **Table 8**.

**Table 8 : Production Summary**

Material	Approved Limit (PA 05_0117 & 08_0135)	Reporting Period		
		Previous Period (actual)	Current Period (actual)	Next Period (forecast)
Waste Rock/ Overburden (BCM)	N/A	48,507,017	51,640,016	37,398,098
Open Cut ROM Coal (t) (OC1, 2 & 3)	8,000,000	4,975,112	3,933,920	3,218,679
Open Cut ROM Coal (t) (OC4)	12,000,000	8,022,824	9,065,915	8,936,480
Open Cut ROM Coal (t)	13,000,000	12,997,936	12,999,835	12,155,159
Underground ROM Coal (t)	8,000,000	1,717,257	5,588,036	5,858,583
Coal Washing (t)	13,000,000 <sup>1</sup>	13,499,408	12,570,428	11,477,718
Rejects (Co Disposal)	N/A	2,125,682	2,137,235	1,933,782
Product Coal (t)	N/A	12,380,408	16,521,118	16,042,901

<sup>1</sup> 2017 wash limit was 13.5 million tonnes.

### 4.2 REPORTING PERIOD ACTIVITIES

This section provides further detail on the activities completed in the current reporting period. Works were carried out in accordance with the relevant Mining Operations Plan (MOP). **Figure 4** presents the areas of activity.

#### 4.2.1 EXPLORATION

Exploration activities were undertaken in EL6288, EL7073, ML1715, and ML1691, including a total of 49 exploration holes within EL6288, 25 exploration holes within EL7073, and a further 169 exploration holes primarily focusing on UG2 and OC4 within ML1715 and OC3 within ML1691.

#### 4.2.2 LAND DISTURBANCE

During the reporting period the total mine footprint covered 1379ha with the majority of the increased land disturbance associated with the progression of mining. The areas disturbed this reporting period are shown in **Figure 3**.

All land disturbance is undertaken in accordance with the Ground Disturbance Permit (GDP) process. This includes pre-clearance surveys, heritage clearance, erosion and sediment control plans, confirmation of land ownership and disturbance extents reviewed to ensure compliance with relevant management plans (Surface Water, Heritage, Biodiversity and Rehabilitation Management Plans).

Topsoil, mulch and select salvageable hollows were reclaimed for use in rehabilitation areas, or stockpiled for future use.

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### 4.2.3 CONSTRUCTION

Construction works during the reporting period included the mine progression infrastructure and continuation of the Underground 1 project. Mine infrastructure works included water management infrastructure, northern bore fields and ancillary works. Underground 1 Project construction activities undertaken in the period included:

- Construction and commissioning the overland conveyor, sizing station and product stockpile;
- Completion of the CHPP civil earthworks and rehabilitation;
- Nitrogen Plant installation and commissioning at the RSIA;
- Construction of drainage and dewatering infrastructure; and,
- Construction of the rear of panel intake shaft

### 4.2.4 MINING OPERATIONS

Mining activities were undertaken in accordance with relevant project approvals and the approved MOP. During the current reporting period general mining activities included:

- Overburden removal from OC2 and OC4 using excavator and truck fleets;
- Overburden removal from OC4 using cast and dozer push;
- Coal extraction from OC2 and OC4;
- Drilling and blasting select overburden and coal;
- Spoil emplacement in-pit in OC2, OC4 and within the OC4 Out of pit emplacement;
- Bulk spoil reshaping and rehabilitation;
- Construction and operation of water management works;
- Continued underground development; and
- Extraction of LW101 and commencement of LW102.

### 4.2.5 COAL PROCESSING AND TRANSPORT

Open Cut ROM coal was transported from the open cut ROMs via conveyor to the CHPP for processing. ROM coal from the UG1 ROM was transported to the underground product stockpile via conveyor. Washed product coal was transported to the product coal stockpile prior to railing. Coarse rejects were co-mingled with dewatered fine rejects and transported by conveyor to the Rejects Bin and then trucked back to the open pit for selective placement with mine spoil.

All product coal was loaded onto trains via the Train Load-out in the Moolarben rail loop and transported via rail to port. MCO monitors the amount of coal transported from site each year and the date/time of each movement. During the period, the maximum number of train movements per day was 8 with an average of 5.1 per day.

### 4.2.6 REHABILITATION

Rehabilitation works during the reporting period were undertaken within Open Cut 2, Open Cut 4, and progressive rehabilitation of construction areas. More detail of rehabilitation activities during the reporting period is provided in **Section 9.0**.

## 4.3 NEXT REPORTING PERIOD

The proposed mining sequence for 2019 is detailed in the currently approved MOP dated December 2018. The status of proposed activities at the end of 2018 are provided in **Figure 5**.

MCO will continue to operate 24 hours per day, 7 days per week with blasting limited to the hours and frequency detailed in PA 05\_0117 Schedule 3, Condition 9 & 10 and PA 08\_0135 Schedule 3, Condition 10 & 11.

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#### 4.3.1 EXPLORATION

Proposed exploration activities during 2019 will primarily focus on EL7073, the southern areas of EL6288, ML1691 including OC3, and ML1715 including UG1, UG2 and the eastern extents of OC4. All exploration carried out on MCO Exploration Licence areas will be approved through the Division of Resources and Geosciences application to Conduct Exploration Activities, including all required environmental assessments.

#### 4.3.2 LAND DISTURBANCE

During the next reporting period, approximately 128ha will be disturbed for open-cut mining across OC2 and OC4. The areas to be disturbed are shown in **Figure 3**.

#### 4.3.3 CONSTRUCTION

Proposed construction works during the next reporting period includes mine progression infrastructure and of Underground 1 infrastructure. Mine infrastructure works include water management infrastructure, clean water diversions and ancillary works. Underground 1 construction activities include:

- Commissioning of the stone dust silo and drop hole
- Upgrade of the underground waste water treatment plant
- Asphaltting of the MIA

#### 4.3.4 MINING OPERATIONS

Mining operations for the next period are shown in **Figure 5** and include:

- Drilling and blasting select overburden and coal;
- Overburden removal from OC2 and OC4 using dozer, excavator and truck fleets;
- Overburden removal from OC4 using cast and dozer push;
- Spoil emplacement in-pit in OC1, OC2, and OC4;
- Coal extraction from OC2 and OC4;
- Bulk spoil reshaping and rehabilitation;
- Construction and operation of water management works;
- Continued underground development, including commencement of UG4; and
- Continued longwall operations in LW102 and LW103.

#### 4.3.5 COAL PROCESSING AND TRANSPORT

Open Cut ROM coal will be transported from the OC1 and OC4 ROMs via conveyor to the CHPP for processing. Underground coal will be transferred with the dedicated UG1 coal handling system. Product coal will be stored on the product coal stockpile prior to transport. Coarse rejects will be co-mingled with dewatered fine rejects and transported by conveyor to the Rejects Bin from where it will be trucked back to the open pit for selective placement within mine spoil.

All product coal will be loaded onto trains in the Moolarben rail loop and transported via rail. All train movements will be conducted in accordance with the conditions of approval.

#### 4.3.6 REHABILITATION

Rehabilitation works proposed for the next reporting period will be undertaken in OC2, and OC4. Rehabilitation activities will include landform establishment, growth medium development, ecosystem and landuse establishment and rehabilitation maintenance if required.

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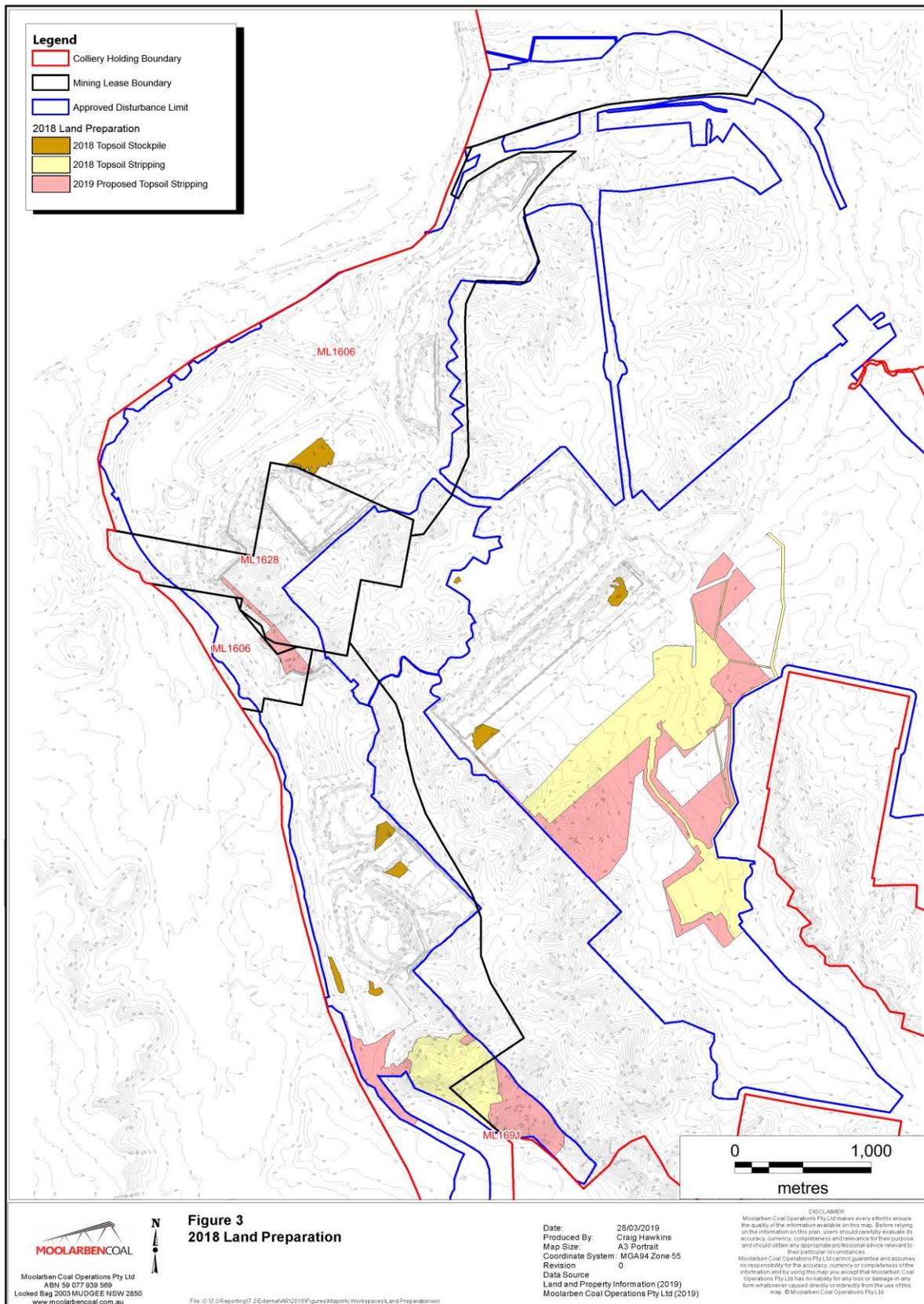


Figure 3: Land preparation areas

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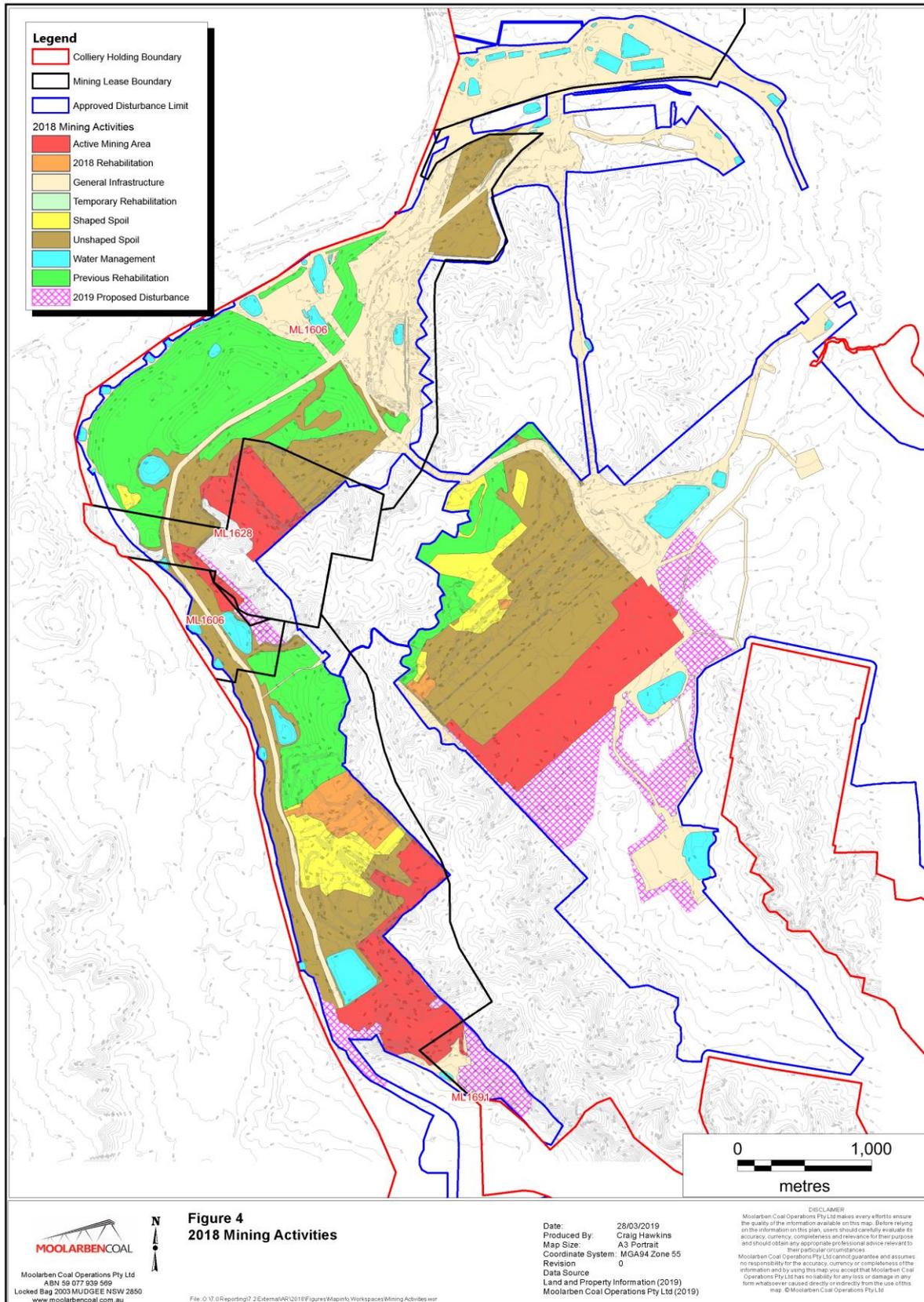


Figure 4: Mining activity areas during the reporting period

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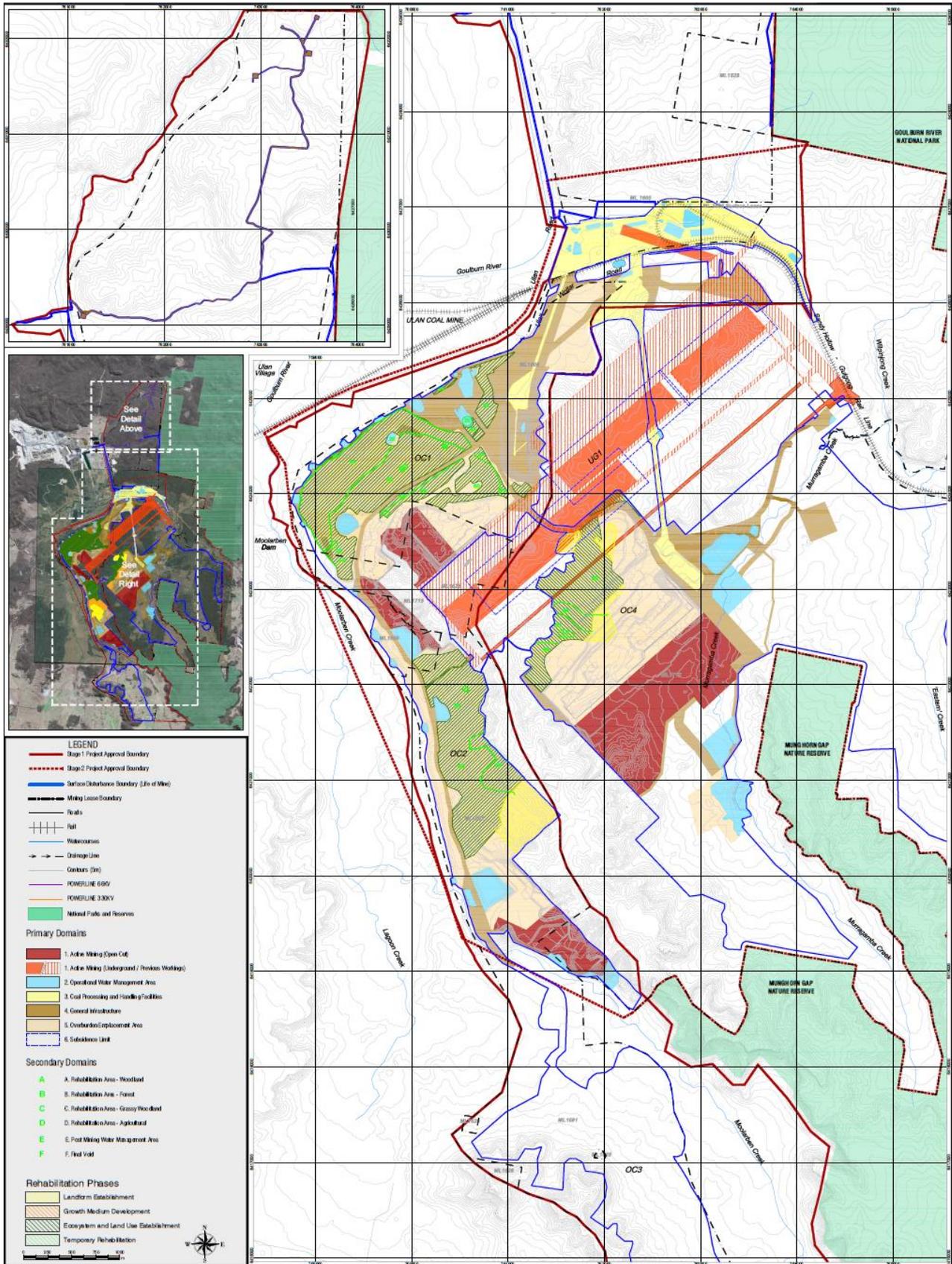


Figure 5: Mining Activities for the next reporting period (MOP Plan 3C)

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## 5.0 ACTIONS REQUIRED FROM PREVIOUS REPORTING PERIOD

Actions in response to the 2017 Annual Review are provided in **Table 9**.

**Table 9 : 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 all environmental management plans as necessary	MCO	Complete.	Sections 6 to 9
WAMP and associated triggers to be reviewed and revised as necessary.	MCO	Complete.	Section 7
Noise Management Plan to be revised with consideration of real-time noise triggers and the Noise Policy for Industry.	MCO	Action Ongoing	Section 6.2
Review and revision of Biodiversity Management Plans.	MCO	Complete	Section 6.5
Progress approvals of stockpile and include in the Mining Operations Plan.	MCO	Action Ongoing	Section 3 and 12
Continue to progress offset security instruments.	MCO	Action Ongoing	Section 6.5
Complete remaining stream flow monitoring system upgrades.	MCO	Complete	Section 7
Continue baseline monitoring of PZ201, 202, 203, 211, 213 and 214 to develop SWL, pH and electrical conductivity triggers.	MCO	Action Ongoing	Section 7.4
Review groundwater model calibration after June 2018	MCO	Complete	Section 7.4
Continued progressive rehabilitation.	MCO	Action Ongoing	Section 9
Establish baseline monitoring sites for LW103 where not already in place.	MCO	Action Ongoing	Section 8
Conduct Independent Environmental Audit	MCO	Complete	Section 11

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## 6.0 ENVIRONMENTAL PERFORMANCE

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

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 2018 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, subsidence, rehabilitation and community aspects are reported in **Sections 7.0, 8.0, 9.0 and 10.0** respectively.

### 6.1 METEOROLOGICAL SUMMARY

MCO utilises two meteorological monitoring station - WS03 (Ulan Road), and WS04 located near OC2. The localities of the stations are illustrated in **Appendix 2**. Both weather stations are linked to the real-time monitoring system, WS03 is the principal weather station for reporting purpose, with WS04 used to supplement weather data as required.

Meteorological parameters recorded by WS03 include:

- wind speed at 10 m;
- wind direction at 10 m;
- sigma theta;
- temperature at 2 m and 10 m;
- relative humidity at 2 m;
- solar radiation at 2 m; and,
- Rainfall

WS03 rainfall and temperature records for 2018 are summarised in **Table 10**. A total of 492mm of rainfall was recorded in 2018, with February the wettest month (77.0 mm) and July the driest (12.2mm). Total rainfall at MCO was 159.6mm lower than the annual average rainfall recorded at the Gulgong Post Office, of 652mm. 2018 rainfall was below average and drier than 2017 which recorded 536.6mm. Temperature recorded at WS03 ranged from – 7.0°C in July 2018 to 41.4°C in January 2018. In comparison to 2017, the 2018 year at MCO was colder (in 2017, MCO reached a low of -6.2°C), but not hotter (in 2017, MCO reached a top of 42.7°C). From January to March and October to December north east and easterly winds were predominant with south westerly and southerly winds predominant from April to September. Monthly wind roses are in **Appendix 3A**.

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

**Table 10: Meteorological Summary – MCO WS03**

Month	Rainfall (mm)	Cumulative Rainfall (mm)	Long-term average Rainfall (mm)	Max Temp (°C)	Min Temp (°C)
Jan-18	28	28.0	70.5	41.4	7.9
Feb-18	77	105.0	61.1	38.2	9.0
Mar-18	26	131.0	55.2	35.7	3.7
Apr-18	27.4	158.4	43.9	31.3	3.9
May-18	15.8	174.2	45.1	25.3	-1.1
Jun-18	31.6	205.8	50.9	19.5	-3.9
Jul-18	12.2	218.0	49.1	22.3	-7.0
Aug-18	46	264.0	45.8	21.5	-3.5
Sep-18	33.6	297.6	47.1	27.9	-1.5
Oct-18	55	352.6	55.5	32.7	2.6
Nov-18	67.2	419.8	60.0	33.5	6.2
Dec-18	72.2	492.0	67.3	38.7	8.5
<b>Total</b>	492.0	492.0	651.5		

## 6.2 NOISE

MCO manages noise in accordance with the MCO Noise Management Plan (NMP). The NMP is currently being revised and will be resubmitted 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, UG1, the CHPP and rail load-out facilities;
- Construction activities in the Underground MIA and Boxcut and CHPP 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 and reactive management of noise impacts;
- Use of interactive predictive noise models to assess predicted noise risks associated with meteorological influences;
- Sound power testing equipment; and
- Routine maintenance of equipment, including sound attenuation components.

### 6.2.1 REAL-TIME NOISE MONITORING

The NMP identifies response triggers for 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

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

### 6.2.2 ATTENDED NOISE MONITORING

During the 2018 reporting period, attended environmental noise monitoring was conducted monthly with additional sites monitored quarterly. The purpose of attended noise monitoring is to quantify and describe the acoustic environment around MCO's operations and compare noise contribution from the MCC to the project Noise Criteria.

Noise Criteria are specified for day, evening, and night period for the amenity of neighbouring residences. Noise Criteria are expressed as LAeq(15min) and LA1(1min). **Table 11** provides a summary of project noise criteria and noise performance based on attended noise monitoring for 2018, together with management implications and proposed actions.

MCO complied with the project specific noise criteria at all monitoring sites during attended noise monitoring in the reporting period. A summary of results from attended noise monitoring undertaken during the period in accordance with the NMP is provided in **Appendix 3B**.

### 6.2.3 ATTENDED VALIDATION NOISE MONITORING

In accordance with the NMP, attended monitoring was undertaken during the reporting period at four locations (i.e. NA2, NA3, NA10 & NA12) to verify the results of real-time noise monitoring.

A review of validation monitoring concluded that the 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 inability to distinguish between contributing noise sources, the real-time data is not suitable for compliance purposes and cannot be relied upon to provide an accurate estimate of mine generated noise.

### 6.2.4 COMPARISON AGAINST PREVIOUS YEARS

Attended noise monitoring results were reviewed against previous years to 2012. This review found a high level of variability in results. Of the results where a noise reading was determined (i.e. not inaudible and criteria applicable, there is some correlation between monitoring results and the distance to the receiver from the operations.

Attended noise monitoring undertaken at NA1 Ulan school between 2012 and 2018 during the day time period shows that MCO was inaudible during 74% of the samples, with no exceedances of criteria. Monitoring at NA6 Lower Ridge Road between 2012 and 2018 during the night period shows that MCO was inaudible during 21% of the samples, with no exceedances. Attended noise monitoring completed at NA12 Winchester Crescent between 2012 and 2018 during the night period shows that MCO was inaudible during 23% of the samples, with no sustained exceedances of criteria.

Quarterly attended noise monitoring results at the Goulburn River National Park and the Munghorn Gap Nature Reserve indicate that MCO was inaudible during 20% and 80% of the samples respectively, with no exceedances recorded during monitoring.

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Table 11 : Attended Noise Monitoring Summary

Aspect	Approved Criteria					Performance During the Reporting Period	Key Management implications	Implemented/ proposed management Actions
	Land No.	Day <sup>1</sup> L <sub>A1eq</sub> (15min).	Evening <sup>2</sup> L <sub>A1eq</sub> (15min).	Night <sup>3</sup>				
				L <sub>A1eq</sub> (15min).	L <sub>A1eq</sub> (1min).			
Attended Noise Monitoring	30,63	39	39	39	45	Monthly attended monitoring was undertaken at three locations (NA1, NA6 & NA12) throughout 2018 as required by the NMP.	Noise management controls effective.	Continue the implementation of the NMP.  MCO will review and if necessary revise, the NMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.
	70	37	37	37	45			
	75	36	36	36	45	Quarterly monitoring was undertaken at three locations (NA11, GRNP & MGNR) throughout 2018 as required by the NMP.		
	31	36	35	35	45			
	All other privately owned land residences	35	35	35	45			
	Ulan School	35 (internal) when in use			-	No exceedance or non-compliances with relevant noise criteria were recorded during monthly attended noise monitoring in 2018.		
	Ulan Anglican Church Ulan Catholic Church	35 (internal) when in use			-			
	Goulburn River National Park Munghorn Gap Nature Reserve	50			-	MCO continued to coordinate noise management with neighbouring mines. <b>Note</b> approved monitoring locations were selected as representative of residences and are shown in <b>Appendix 2</b> .		

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.

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### 6.2.5 COMPARISON TO PREDICTED LEVELS

Predicted noise levels from Year 2018 of the UG1 Optimisation Modification (Stage 1 MOD 12 and Stage 2 Modification 2) were compared against actual noise levels during 2018. Results indicated that MCO was generally well under the predicted levels where meteorological conditions were relevant.

Measured operational levels are compared to predicted levels in **Table 12**. 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. A summary report for attended noise monitoring and comparison against predicted results is included in **Appendix 3B**.

**Table 12: EA Predictions – Attended Noise Monitoring, Various Weather Conditions**

	dB(A) <sub>Leq (15min)</sub>			dB(A) <sub>LA1(1min)</sub>		
	NA1 Ulan School	NA6 Lower Ridge Rd	NA12 Winchester Cres	NA1 Ulan School	NA6 Lower Ridge Rd	NA12 Winchester Cres
	Day <sup>1,2</sup>	Night <sup>2</sup>	Night <sup>2</sup>	Day <sup>1,2</sup>	Night <sup>2</sup>	Night <sup>2</sup>
<b>January</b>	NR	NR	-7 <sup>2</sup>	NA	NR	>-7 <sup>2</sup>
<b>February</b>	NR	-9 <sup>3</sup>	NR	NA	-7 <sup>3</sup>	NR
<b>March</b>	NR	NR	>-9 <sup>2</sup>	NA	NR	>-10 <sup>2</sup>
<b>April</b>	NR	NR	>-9 <sup>2</sup>	NA	NR	>-12 <sup>2</sup>
<b>May</b>	NR	IA <sup>3</sup>	>-14 <sup>3</sup>	NA	IA <sup>2</sup>	>-17 <sup>2</sup>
<b>June</b>	NR	-7 <sup>2</sup>	-7 <sup>2</sup>	NA	>-5 <sup>2</sup>	-6 <sup>2</sup>
<b>July</b>	NR	NR	NR	NA	NR	NR
<b>August</b>	NR	IA <sup>2</sup>	NR	NA	IA <sup>2</sup>	NR
<b>September</b>	NR	NR	NR	NA	NR	NR
<b>October</b>	NR	NR	NR	NA	NR	NR
<b>November</b>	NR	NR	NR	NA	NR	NR
<b>December</b>	NR	IA <sup>2</sup>	NR	NA	IA <sup>2</sup>	NR

<sup>1</sup> 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 directly measurable during monitoring;

<sup>2</sup> Wind conditions assumes winds at speeds between 0.1 and 3 m/s during monitoring and assumes the following possible predicted wind directions: 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;

<sup>3</sup> Strong Inversion of 5.2 degrees Celsius per 100 m or greater.

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## 6.3 BLASTING

MCO manages blasting in accordance with the Blast Management Plan (BMP). 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 residences, churches and schools, and aboriginal rock shelters.

### 6.3.1 SUMMARY OF BLAST MONITORING RESULTS

Blast monitoring compliance for the reporting period is presented in **Table 13**, and a summary of blast monitoring results for the period is provided in **Table 14**. Individual blast results are provided in full at **Appendix 3C**. No exceedances of the blasting criteria occurred during the reporting period.

**Table 13 : Blast Monitoring Summary (BM1 & BM5)**

Blast Summary	Number	Compliance (% Of Blasts)
Total Blasts	143	Compliant
Days with >2 blasts (PA05 Sch 3 C 10)	0 <sup>1</sup>	Compliant
Annual average blasts per week	2.75	Compliant
Blasts outside blasting hours	0	Compliant
Airblast Overpressure >115 dB(Lin Peak) <sup>2</sup>	2 <sup>3</sup>	Compliant (1.4%)
Airblast Overpressure >120 dB(Lin Peak)	0	Compliant
Ground Vibration >5 mm/s	0	Compliant (0%)
Ground Vibration >10 mm/s	0	Compliant
Reportable Fume Events	0	Nil

<sup>1</sup> Misfires excluded as per PA05\_0117 Sch 3 Con. 10 and PA08\_0135, Sch. 3, Con. 11.

<sup>2</sup> Allowable exceedances of 5% of total blasts over a period of 12 months.

<sup>3</sup> Two blast events recorded in exceedance of 115dB for the reporting period –one at BM5 (20/10/18) and one at BM1 (5/12/18)

No blasting was undertaken within 500m of any public road, railway line, 330kV powerline or land outside the site not owned by MCO.

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**Table 14 : 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 <sup>1</sup>	Peak Particle Velocity – Ground Vibration mm/s <sup>2</sup>	Allowable Exceedance			
Blast	Residence Privately Owned	120	10	0%	<p>Compliance monitoring was undertaken at the following representative locations for the 2018 reporting period</p> <ul style="list-style-type: none"> <li>• <b>BM1 – Ulan School</b> <ul style="list-style-type: none"> <li>○ <u>Max. Overpressure</u> =116.6 dBL</li> <li>○ <u>Max Ground Vibration</u> =0.76 mm/s</li> <li>○ <u>Average Ground Vibration</u> = 0.22 mm/s.</li> </ul> </li> <li>• <b>BM5 – Ridge Road</b> <ul style="list-style-type: none"> <li>○ <u>Max. Overpressure</u> =117.3 dBL</li> <li>○ <u>Max Ground Vibration</u> =0.82 mm/s</li> <li>○ <u>Average Ground Vibration</u> = 0.25 mm/s</li> </ul> </li> </ul> <p>A full blast summary is contained at <b>Appendix 3C</b>.</p>	<p>In accordance with condition 13 (c), Schedule 3 of project approval 05_0117 and condition 14 (d), schedule 3 of project approval 08_0135 MCO coordinates the timing of blasting onsite with the timing of blasting at Ulan and Wilpinjong mines to minimise cumulative impacts.</p> <p>Air blast over pressure and peak particle velocity continue to remain stable over the life of the operation at BM1 Ulan School and BM5 Ridge Road.</p>	<p>MCO will review and if necessary revise, BMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.</p> <p>During the reporting period MCO continued to maintain the blast monitoring network.</p>
	All Public Infrastructure	-	50 <sup>3</sup>	0%			
		115	5	5% of the total number of blasts over a 12-month period			

Notes - <sup>1</sup>- dB (Linear Peak) dBL = decibel linear peak <sup>2</sup>- mm/s = millimetres per second <sup>3</sup> - 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.

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### 6.3.2 COMPARISON TO PREVIOUS BLAST MONITORING AND PREDICTED LEVELS

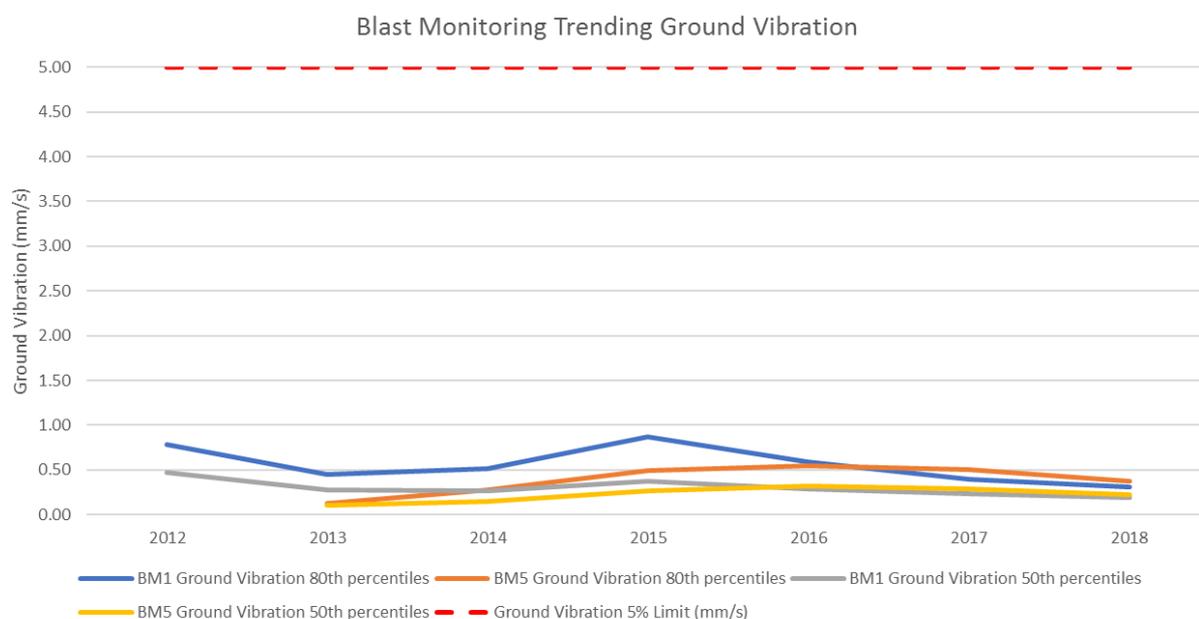
A comparison of the 2018 blast results to the 2017 results and predications in the EA are outlined in **Table 15** below.

**Table 15 : Comparison to Blasting Results - BM1 & BM5, 2017, 2018 and EA**

Site	Vibration Predictions in EA (mm/s)	2017 vibration range (mm/s)	2018 vibration range (mm/s)	Comment on results
BM1 Ulan School	2.3	0.06-1.10	0.03-0.76	Generally lower than previous results and predicted.
BM5 Ridge Rd	Site not originally modelled	0.01 – 1.15	0.01-0.82	Generally lower than previous results.
Site	Overpressure in EA (dBL)	2017 Overpressure Range (dBL) <sup>1</sup>	2018 Overpressure Range (dBL) <sup>1</sup>	Comment on results
BM1 Ulan School	114.0	81.9-115.6	81.1-116.6	Generally consistent with previous results, slightly higher than predicted.
BM5 Ridge Rd	Site not originally modelled	71.2-126.6	78.8-117.3	Generally consistent with previous results.

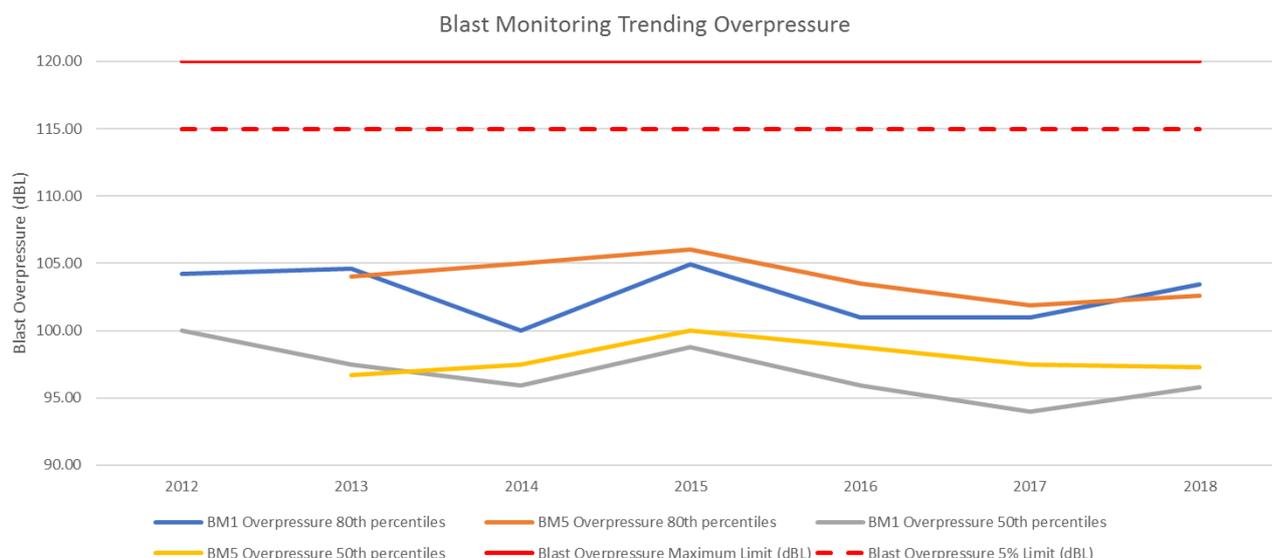
<sup>1</sup> Excludes environmental influenced results.

Blast Monitoring trends since 2012 are depicted below in **Figure 6** and **Figure 7**. The monitoring data indicates a correlation between monitoring results and distance of the receiver from the blast locations. Within the graphs the five percent and maximum limit has been included for the blast overpressure graph and the five percent limit has been included within the ground vibration graph. Results have generally been below these criteria.



**Figure 6 Blast Monitoring Trending Ground Vibration**

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**Figure 7 Blast Monitoring Trending Overpressure**

## 6.4 AIR QUALITY

MCO manages air quality in accordance with Air Quality Management Plan (AQMP). The AQMP was approved in November 2017. 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 and Condition 22, 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;
- PM<sub>10</sub> – 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);
- PM<sub>10</sub> – Real Time Monitoring via Tampered Element Oscillating Mass Balance’s (TEOMs) at three permanent locations around the Moolarben Coal Complex;
- Total Suspended Particulate (TSP) matter calculated from TEOM PM<sub>10</sub> monitoring results;
- Meteorological monitoring is undertaken via Automatic Weather Stations (AWSs), with WS03 (located on Ulan Road) the principal station for reporting purposes.

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

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**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 <sup>2</sup> /month (max total)	Annual averages for each dust depositional gauge are reported in <b>Table 18</b> . All dust depositional results for the 2018 reporting period were below the 4/g/m <sup>2</sup> /month criterion. The 2g/m <sup>2</sup> /month criterion was not triggered. Results were impacted by regional dust events.	Annual Average Dust depositional results for the operation indicate a slight increasing trend over the period, yet they remain well below the criteria.	MCO will review and if necessary revise, the AQMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.  During the reporting period MCO continued to maintain the air quality monitoring network.
		2g/m <sup>2</sup> /month above background average (Incremental increase)			
	PM <sub>10</sub>	50µg/m <sup>3</sup> (24hr average)	All PM <sub>10</sub> results were within criteria. Maximum results due to extraordinary events are excluded from the dataset.	24-Hour average PM <sub>10</sub> results for the operation indicate a slight increasing trend over the period, yet they remain well below the criteria.	
	PM <sub>10</sub>	30µg/m <sup>3</sup> (Annual average)	The average PM <sub>10</sub> results for the reporting period are presented in <b>Table 19</b> . All sites were below the Annual average criteria. Results were impacted by regional dust events.	Annual average PM <sub>10</sub> results for the 2018 reporting period indicate a slight increasing trend at all locations when compared to 2017.	
Total Suspended Particulate (TSP)	90µg/m <sup>3</sup> (Annual average)	TSP results are presented in <b>Table 20</b> . TSP is calculated using the approved AQMP methodology based on PM <sub>10</sub> constituting 40% of the total TSP. During the reporting period, all sites were calculated as being below the 90µg/m <sup>3</sup> criterion.	Annual average TSP results for the 2018 reporting period indicate a slight increasing trend at most locations when compared to 2017.		

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### 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 PM<sub>10</sub> Annual Averages**

Location	2018 Data Capture Rate
TEOM 01 (Ulan School)	98%
TEOM04 (Ulan Road)	98%
TEOM06 (Ulan-Wollar Road)	96%
TEOM07 (Ulan Road)	97%
PM01 (Ulan Village)	100%
PM02 (Ridge Road)	100%

### 6.4.2 COMPARISON TO PREVIOUS AIR QUALITY MONITORING AND BACKGROUND LEVELS

#### Dust Deposition

Year 16 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. A number of extraordinary events occurred in 2018 including bushfires and regional dust storms impacting on results. All deposition results are within criteria and generally consistent with predicted results considering the difference in mine progression (Table 18). Data trends are presented in Appendix 3D.

**Table 18: Comparison of Depositional Dust results**

Dust Gauge	Annual Average (g/m <sup>2</sup> /month) (Criteria = 4 g/m <sup>2</sup> /month)								Yr 16 (MOD 9) Predictions
	Back-ground	2012	2013	2014	2015	2016	2017	2018	
DG01	1.2	0.3	0.5	0.8	0.6	0.5	0.6	0.9	0.7
DG04	2.0	1.3	1.3	1.6	1.0	1.2	1.0	1.4	0.9
DG05	1.8	0.8	1.0	2.0	0.8	1.3	1.5	1.8	1.1
DG06	1.2	0.4	0.7	1.0	0.6	0.6	0.7	1.7	0.6
DG07	1.7	0.8	1.0	0.9	0.9	0.9	0.7	1.4	0.6
DG08	1.4	0.7	0.7	0.8	0.6	0.7	0.9	1.7	0.6
DG09	-	0.4	0.7	2.0	0.6	0.6	0.9	1.9	0.7
DG11	-	-	0.6	0.8	0.6	0.7	1.1	1.7	0.8
DG12	-	-	-	-	1.5	1.0	1.2	2.1	*
DG13	-	-	-	-	0.7	0.7	0.7	1.6	0.7
DG14	-	-	-	-	1.1	0.7	1.2	1.9	*

\*No prediction was made for DG12 and DG14 in Year 16 of the Stage 1 Optimisation Modification as they are representative of mine owned land

#### PM<sub>10</sub>

Year 16 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. A number of extraordinary events occurred in 2018 including bushfires and regional dust storms impacting on results. 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.

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**Table 19: Comparison of annual average PM10 Results**

Unit	Annual Average ( $\mu\text{g}/\text{m}^3$ ) <sup>4</sup> (Criteria = 30 $\mu\text{g}/\text{m}^3$ )								
	Back-ground	2012	2013	2014	2015	2016	2017	2018	Yr 16 (MOD 9) Predictions
Ulan School (TEOM01)	15.1	10.2	12.4	11.4	13.2	13.0	12.3	15.1	17.3
Ulan Road (TEOM04)	_ <sup>1</sup>	8.9	10.8	12.7	9.0	11.6	15.1	18.7	15.6
Ulan-Wollar Road (TEOM06)	_ <sup>1</sup>	_ <sup>2</sup>	_ <sup>2</sup>	_ <sup>2</sup>	9.0	11.5	12.5	15.7	*
Ulan Road (TEOM07)	_ <sup>1</sup>	_ <sup>2</sup>	11.2 <sup>3</sup>	16.5	15.5				
Ulan Village HVAS (PM01)	17.9	11.9	12.2	13.8	13.2	11.5	13.0	21.4	17.3
Ridge Road HVAS (PM02)	_ <sup>1</sup>	9.7	10.0	11.7	10.8	9.9	13.5	22.9	12.4

<sup>1</sup> No background values as site established after 2009. <sup>2</sup> No previous data as site not established. <sup>3</sup> Calculated on 5 months of data. <sup>4</sup> Annual Averages exclude extraordinary events such as bushfires and prescribed burns. \*No prediction was made for TEOM06 in Year 16 of the Stage 1 Optimisation Modification as it is representative of conditions 'upwind' of MCO

**Total Suspended Particulates**

TSP results (**Table 20**) are within criteria and generally higher than predicted results due to a number of extraordinary events in 2018 including bushfires and regional dust storms.

**Table 20: Comparison of annual average TSP results**

Unit	Annual Average Calculated TSP ( $\mu\text{g}/\text{m}^3$ ) (Criteria = 90 $\mu\text{g}/\text{m}^3$ )								
	Back-ground	2012	2013	2014	2015	2016	2017	2018	Yr 16 (MOD 9) Predictions
TEOM01(Ulan School)	37.75	25.5	31	28.5	33	32.6	30.7	37.7	32.1
TEOM04 (Ulan Road)	0	22.25	27	31.75	22.5	29.0	37.9	46.8	30.9
TEOM06 (Ulan-Wollar Rd)	*	**	**	**	22.5	28.8	31.4	39.3	***
TEOM07 (Ulan Road)	*	**	**	**	**	**	27.9 <sup>a</sup>	41.3	15.5
PM01(Ulan Village HVAS)	44.75	29.75	30.5	34.5	33	28.8	32.4	53.6	32.1
PM02 (Ridge Road HVAS)	*	24.25	26.25	29.25	27	24.8	33.7	57.4	25.1

\* No background values as site established after 2009.

\*\* No previous data as site not established.

\*\*\* No prediction was made for TEOM06 in Year 16 of the Stage 1 Optimisation Modification as it is representative of conditions 'upwind' of MCO

a - Calculated on 5 months of data

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### 6.4.3 SPONTANEOUS COMBUSTION

One spontaneous combustion event occurred during the period. The area was managed in accordance with MCO Spontaneous Combustion Principal Hazard Management Plan with no off-site impact.

### 6.4.4 GREENHOUSE GAS

Yancoal's Australian operations reported under the National Greenhouse and Energy Reporting Scheme for the 2017-18 financial year. Scope 1 and Scope 2 emissions calculated for the 2017-18 financial year was 232,056t CO<sub>2</sub>-e. Scope 1 and Scope 2 emissions calculated for the 2016-17 financial year was 243,637t CO<sub>2</sub>-e. The decrease in emissions can be attributable to a decrease in construction activities.

Year 16 of the Stage 1 Optimisation Modification (Mod 9), estimated emissions for Scope 1 and Scope 2 at 175,368t CO<sub>2</sub>-e, approximately 56,688t CO<sub>2</sub>-e less than calculated emissions for the 2017-18 financial year. The variance is primarily related to increased diesel consumption, electricity use and material movements above Mod 9 estimations.

The Energy Savings Action Plan was approved within the reporting period.

## 6.5 BIODIVERSITY

MCO manages biodiversity in accordance with the Biodiversity Management Plan (BioMP). A revised version of the BioMP was approved during the reporting period. 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. Offset management is also undertaken in accordance with relevant components of the Landscape Management Plan and Biodiversity Offset Management Plan (2013/6926).

The objectives of the management plans 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 management plans describe 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 tubestock;
- Strategies to manage vegetation onsite and improve vegetation connectivity;
- Additional biodiversity measures – rehabilitation of the environmental bund, 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 zone also includes noxious weed and vertebrate pest monitoring. Monitoring will be used to measure success against the short, medium and long-term targets described in the management plans and identify the need for corrective actions

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

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### 6.5.1 BIODIVERSITY OFFSET WORKS UNDERTAKEN

Weed and feral animal monitoring and control works were undertaken throughout the reporting period. Wild dog and feral pig baiting was undertaken in conjunction with the NSW Local Land Service (LLS) and neighbouring landholders within biodiversity offset properties. Weed control works were undertaken throughout the offset areas focusing on Serrated Tussock, Blackberries, Blue Heliotrope, Tree of Heaven, St Johns Wort, Spiny Rush and Prickly Pear. Native seed collection was continued within MCO owned lands and some offset areas.

During the reporting period over 18 Kilometres of new fencing was installed and over 10 Kilometres of redundant fencing removed from MCO offsets. Track maintenance and upgrades were completed on over 25 kilometres of required access and bushfire management trails. Revegetation works were continued within the offsets.

MCO continued to work with the Department of Planning to progress the security mechanisms for the offset areas associated with the project.

### 6.5.2 BIODIVERSITY OFFSET MONITORING

Flora and fauna monitoring during the reporting period included the Stage 1 and EPBC (2007/3297) Biodiversity Offset Areas (BOAs), Stage 1 Mod 9 and EPBC (2013/6929) offset areas, and the continuation of baseline flora and fauna monitoring of the Stage 2 and EPBC (2008/4444) BOAs. 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
- Rapid assessment
- Fauna surveys targeting diurnal and nocturnal birds, reptiles, amphibians, mammals, microbats and habitat assessment

Stage 2 and EPBC (2008/4444) BOA baseline monitoring included vegetation validation, full floristic survey, fauna surveys and natural regeneration monitoring.

Monitoring is undertaken across two management zones that have been mapped within the BOAs. Each of these zones have defined strategic ecological management objectives, with an overall aim to achieve a sustainable landscape with improved overall ecological quality in the long term. The management zones are:

- Management Zone 1 (MZ1) – Enhancement of remnant vegetation; and
- Management Zone 2 (MZ2) – Regeneration/revegetation of grassland to forest/woodland.

#### 6.5.2.1 Offset Monitoring Results

##### Stage 1 and EPBC (2007/3297) offset areas monitoring

Floristic monitoring undertaken within the Stage 1 BOAs during autumn and spring 2018 recorded:

- 130 species across BOA 1 (including 119 native species, six exotic species and four species unable to be identified as native or exotic)
- 94 species across BOA 2 (including 82 native species, six exotic species and six species unable to be identified as native or exotic)
- 130 species across BOA 3 (including 115 native species, 10 exotic species and five species unable to be identified as native or exotic).

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Monitoring results within MZ1 sites were variable, NSD and NGC performed the best within the MZ1 sites, with 52% of the sites surveyed exceeding their benchmark value for NSD, and 43% of the sites surveyed exceeding their benchmark range for NGC. NMC was the lowest performing attribute within the MZ1 sites, with 39% of sites meeting the benchmark range.

Monitoring results within MZ2 sites were also variable, with NSD generally above the benchmark value or improved from previous year's results, and NGC (grass, shrubs and other) generally above the benchmark range or improving. NTC and NMC continue to be the worst performing structural attributes at each of the MZ2 sites, with no sites meeting the NTC benchmark range and one site meeting the NMC benchmark range.

Fauna monitoring results within the Stage 1 BOAs are similar to previous years. Fauna sites within MZ1 recorded higher numbers of woodland/remnant indicator bird species (70% of sites) and also recorded higher abundance of woodland/remnant indicator bird species at 90% of sites. MZ2 fauna site results were variable, with equal DNG and woodland/remnant indicator bird species at three sites, a higher number of DNG indicator bird species at two sites and a higher number of woodland/remnant indicator bird species at two sites. Abundance of DNG indicator bird species was highest at five sites and equal to woodland/remnant indicator bird species at one site.

Fauna sites within MZ1 recorded higher DNG indicator microbat species numbers, and also recorded higher abundance of DNG indicator microbat species. MZ2 fauna sites were similar, also recording higher DNG indicator microbat species numbers and higher abundance of DNG indicator microbat species.

**Stage 1 Mod 9 and EPBC (2013/6929) offset areas monitoring.**

Species richness ranged during the 2018 monitoring period from 73 at the Clarkes BOA (68 native species, two exotic species, and three that could not be identified as native or exotic) to 177 at the Bobadeen BOA (130 native species, 47 exotic species, and 21 that could not be identified as native or exotic).

Mod 9 MZ1 site monitoring results were variable, NSD and NGC performed the best within the MZ1 sites, with 59% of the sites surveyed meeting or exceeding their benchmark value for NSD, and 77% of the sites surveyed meeting or exceeding their benchmark range for NGC. NMC performed the lowest within the MZ1 sites, with 24% of sites meeting the benchmark range.

MZ2 sites within the MOD 9 BOAs had varying results, with NGC (grass, shrubs and other) generally above the benchmark range or improving (89% of sites). NSD and NTC were the lowest performing structural attributes at each of the MZ2 sites, with only one site meeting the NTC benchmark range and only five sites meeting the NMC benchmark range.

Across the MZ1 fauna monitoring sites, 58% had higher richness and abundance of woodland/remnant indicator birds than DNG indicator birds. Conversely, 80% of MZ2 sites had greater richness of DNG indicator bird species than woodland/remnant indicator bird species, and 60% of sites had a higher abundance of DNG indicator birds. None of the Mod 9 sites recorded all five of either suite of indicator birds, with the most recorded at one site being three indicator bird species (woodland/remnant indicator species at Mod9\_Fa1 (MZ1), and Mod9\_Fa4 and Mod9\_Fa5 (MZ2) at Bobadeen).

Analysis of indicator bat species across the MZ1 sites showed 67% of sites had higher species richness of DNG indicators than woodland/remnant indicators. Four MZ1 sites recorded no woodland/remnant indicator microbats (Mod9\_Fa13 (Clarkes), Mod9\_Fa15, Mod9\_Fa16 (Clifford),

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and Mod9\_Fa19 (Property 24 & 25)). Indicator microbat results varied considerably at MZ2 sites; 30% of sites had greater woodland/remnant indicator microbat species richness than DNG indicator species richness, though abundance of DNG indicator microbats was generally higher (40% of sites).

The presence and activity of birds and microbats at the BOAs is likely to be affected by continuing dry conditions by limiting food resources, and would be expected to respond well to rainfall. It is expected that MZ2 fauna sites will move towards being dominated by woodland/remnant indicator bird and microbat species as the structural attributes within each site diversify and fauna habitat becomes available.

**Stage 2 and EPBC (2008/4444) offset areas monitoring.**

Floristic monitoring undertaken within the Stage 2 BOAs during autumn and spring 2018 recorded:

- 259 species at Dun Dun East (including 182 native species, 60 exotic species and 17 species unable to be identified as native or exotic)
- 89 species across Libertus BOA (including 74 native species, 10 exotic species and five species unable to be identified as native or exotic)
- 181 species across the Nori (Dun Dun West) BOA (including 134 native species, 29 exotic species and 18 species unable to be identified as native or exotic)
- 158 species across the Old Bobadeen BOA (including 91 native species, 47 exotic species and 20 species unable to be identified as native or exotic)
- 191 species across the Onsite Offset BOA (including 137 native species, 37 exotic species and 17 species unable to be identified as native or exotic)
- 118 species across the Ulan 18 BOA (including 83 native species, 25 exotic species and 10 species unable to be identified as native or exotic).

2018 was the second year of monitoring for Stage 2, and therefore benchmark data was still being collected. Generally across the Stage 2 BOAs, the dry conditions that have been experienced during much of 2018 have impacted results, with general trends across the Stage 2 BOAs being down on 2017 monitoring results. These downward trends are particularly evident within the NGC, which is more likely to be impacted by dry conditions than the mid-storey and canopy. Furthermore, the groundcover was impacted by native herbivores and feral animals grazing pressure.

MZ1 sites within the Stage 2 BOAs showed a general decrease across all structural attributes. Overall, NSD and NGC performed the best within the MZ1 sites, with 69% of the sites surveyed exceeding their preliminary benchmark value for both NSD and NGC. NMC performed the worst within the MZ1 sites, with 27% of sites meeting the preliminary benchmark range.

Monitoring results within the Stage 2 BOA MZ2 sites were variable, with NSD generally above the preliminary benchmark value (28% of sites) or showing an increase since 2017 (54% of sites), and NGC generally above the benchmark range (46% of sites) or showing an increase since 2017 (13% of sites). MZ2 sites continued to be below the benchmark range for NTC and NMC with all sites yet to meet the NTC benchmark and one site meeting the NMC preliminary benchmark.

Analysis of floristic data within the Stage 2 BOAs from 2017 to 2018 has shown the results have been variable across the two monitoring periods. As 2018 is only the second year of monitoring for Stage 2, benchmark values are still being determined.

Fauna sites within MZ1 recorded higher numbers of woodland/remnant indicator bird species (53% of sites) and also recorded higher abundance of woodland/remnant indicator bird species at 59% of sites. Fauna sites within MZ2 recorded higher number of DNG indicator bird species (88% of sites) and also recorded higher abundance of DNG indicator bird species at 88% of sites.

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Fauna sites within MZ1 recorded higher numbers of DNG indicator microbat species at 41% of sites and higher abundance of DNG indicator microbat species at 53% of sites. Fauna sites within MZ2 recorded higher numbers of DNG indicator microbat species at 59% of sites and higher abundance of DNG indicator microbat species at 65% of sites.

These results are likely to be reflective of the current bird and microbat habitat available within each site, with sites containing more woodland/remnant indicator bird and microbat species likely to have a higher structural diversity and more fauna habitat resources available. Over time, MZ2 sites would be expected to measure increases in woodland/remnant indicator bird and microbat species as the structural attributes within each site diversify and fauna habitat becomes available.

### 6.5.3 ACTIONS FOR NEXT REPORTING PERIOD

During the next period activities to be undertaken include review of management plans and revision where necessary, continued monitoring, revegetation planning, fencing, track and fire trail works, weed and feral animal control works and maintenance of property security.

## 6.6 HERITAGE

MCO manages Heritage in accordance with the Heritage Management Plan (HMP). The revised HMP was approved in November 2017.

During the reporting period MCO continued the salvage and management of Aboriginal heritage sites associated with the project. The results of all survey and salvage activities during the period have been included in the MCO heritage database.

Annual inspections of heritage conservation areas were completed during 2018, the condition of the areas is unchanged since the last monitoring period.

### 6.6.1 ACTIONS FOR NEXT REPORTING PERIOD

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

## 6.7 BUSHFIRE

During the reporting period the MCO Bushfire Management Plan was reviewed and updated. No major outbreaks of fire occurred at the MCC during the reporting period. MCO continued to implement the Bushfire Management Plan and conducted bushfire trail inspections and maintenance across Moolarben Coal owned lands. In the next reporting period inspection and maintenance works on fire trails will continue.

## 6.8 WASTE MANAGEMENT

During the reporting period MCO continued to maintain a Total Integrated Waste Management Service to manage all waste streams generated on site and to maximise recycling. This includes general waste, cardboard and paper recycling, co-mingled recycling, batteries, waste oil, and steel. The volumes of total waste and recycled material removed from site are shown in **Table 21**. During the reporting period 72% of all waste removed from site was recycled. Waste volumes have been variable

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since 2012, with volumes increasing in association with the expansion of the operations and associated construction works.

**Table 21: Waste Removal Volumes removed during the reporting period**

	2012	2013	2014	2015	2016	2017	2018
<b>Total Waste (t)</b>	990.6	1379.6	1490.5	1276.7	2615.1	2612.9	2559.3
<b>Recycled Waste (t)</b>	778.2	1173.1	1346.5	1058.3	1730.2	1806.0	1851.4
<b>Percentage Recycled</b>	79%	85%	90%	83%	66%	69%	72%

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## 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 March 2018. The plan was developed by MCO with input from DP&E endorsed experienced and qualified experts (WRM Water & Environment, Hydrosimulations 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.

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);
- Mine site water management structures quality and level (monthly/6 monthly), and,
- Licensed discharge points.

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 dewatering and transfer network and installed operational and construction related erosion and sediment controls.

Details of water licensing and associated take are provided in **Section 7.1**. A summary of the site water balance is provided in **Section 7.2**. A summary of surface water monitoring and 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 are provided at **Appendix 3F** and **Appendix 3G** respectively.

### 7.1 WATER LICENCES

A summary of water take and water entitlements under water access licences for the reporting period (1 January to 31 December 2018), as well as a prediction for the next reporting period (1 January to 31 December 2019) is provided in **Table 22**. Water take is provided in six monthly periods to coincide with the water year (i.e. 1 July 2017 to 30 June 2018).

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**Table 22: Water Licences and Take**

Water Access Licence	Description	Entitlement <sup>1</sup> (Units)	2018 Estimated Water take (ML) (GWMP RPS model <sup>3</sup> / OC3 Null Model <sup>4</sup> )			2019 Forecast Water Take (ML)
			Jan - Jun	Jul - Dec	Total	
36340	Wollar Creek Water Source	218	3.5 / 9	3.5 / 10	7 / 19	20
37582 & 41888	Upper Goulburn River Water Source	99 <sup>2</sup>	<1 / 46	<1 / 48	<1 / 94	94
39799	Sydney Basin - North Coast Groundwater Sources	2950	820 <sup>5</sup> / 772 <sup>5</sup>	748 / 693	1568 / 1462	1456

<sup>1</sup> One unit equivalent to 1.0 ML as per the *Available Water Determination Order for Various NSW Unregulated and Alluvial Water Sources (No. 1) 2017* and *Available Water Determination Order for the North Coast Coastal Sands and the North Coast Fractured and Porous Rock Groundwater Sources 2017*

<sup>2</sup> 90ML exchanged in June and registered in August 2018.

<sup>3</sup> Derived from "Moolarben Stage 2 - Groundwater Accounting and Water Sharing Plan Summary" (RPS Aquaterra ,2012) and from monitoring.

<sup>4</sup> OC3 Null Model (Aug 2018) and water balance used to estimate water take by water source.

<sup>5</sup> 6ML was extracted from dewatering bore M1. No other water was directly extracted from WAL 39799 tagged groundwater extraction bores

Water take is estimated as part of the Annual Review after the end of the calendar year. MCO determines water take in accordance with the approved Water Management Plan. Water take is either groundwater inflow removed from operation, water extracted from licenced bores, or modelled reduction in stream baseflow. The review estimate incorporates site water balance reconciliations, recirculation to underground and water take for the period. Indirect or passive take is based on modelling predictions for the relevant period.

Water take by water source has been determined in consideration of the Groundwater Model (RPS Model) documented in the approved Groundwater Management Plan (GWMP). MCO has had a revised groundwater model prepared by HydroSimulations as part of the Open Cut Optimisation Modification application (Stage 1 (MOD 14) and Stage 2 (MOD 3)) lodged in October 2017 and currently under assessment. The mine schedule and sequence in the reporting period varies from that in the HydroSimulations model. Further model revision and analysis was undertaken by HydroSimulations in 2018 to better reflect actual mine sequence, including exclusion of OC3 resulting in the development of the OC3 Null Model (OC3 Null Model) in August 2018. This OC3 Null Model has also been used in the estimation of water take for the 2018 calendar year despite the fact that it was only released in August 2018. The estimated water take during the 2018 calendar year has been summarised in Table 23 below based on both methods (ie RPS Model and OC3 Null Models).

The review found that all water source entitlements for the 2018 calendar year were greater than estimated water take determined against the RPS Model as per the GWMP. The water source entitlements for the 2018 calendar year were also greater than estimated water take determined against the OC3 Null Model with the exception of the Upper Goulburn River Water Source in the first half of the 2018 calendar year. While MCO has estimated water take using the OC3 Null Model across the entire 2018 calendar year, it obviously did not become aware of that modelled water take for the period from January to July 2018 until it was released in August 2018 and verified through the annual review process.

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In early 2018, MCO commenced the process to acquire additional entitlements in the Upper Goulburn River Water Source. The purchase of 90ML was agreed in June 2018 and registered in August 2018. MCO has therefore taken all necessary action to ensure that it held sufficient water entitlements for the Upper Goulburn River Water Source in the 2018 calendar year and will continue to review and take necessary actions to secure required water entitlements (where required). MCO has reported an administrative non-compliance with the water take from the Upper Goulburn River Water Source between January to July 2018 because it was not aware of the water take assessed under the OC3 Null Model until the model was released in August 2018 and verified through the Annual Review process. The shortfall was remedied in August 2018.

## 7.2 WATER BALANCE

MCO monitors the water balance for the operation to assist forecasting and management of site water. The site water balance (**Table 23**) for the reporting period was prepared with input from suitably qualified and experienced consultants WRM and Peter Dundon. Site water storage increased by 159ML during the reporting period. The main demands were coal processing and dust suppression. The Balance includes a variance of 49ML (1.2%).

During the Period, 6ML was extracted from Production Bore M1 under licence.

**Table 23: Site Water Balance**

<b>Water Sources (Inflows)</b>	<b>Volume (ML)</b>
UCML Water	423
Groundwater Extraction (bores)	6
Rainfall / runoff	747
Groundwater inflows	1,569
Total	2,745
<b>Water Loss (Outflows)</b>	
Evaporation	451
Seepage	0
Construction & dust suppression	1,122
Licensed Discharge	0
Unlicensed Discharge	0
CHPP Demand	880
Underground demand	182
Total	2,635
<b>Water Balance</b>	
Inflows minus outflows	110
Change in inventory	159
Balance	-49 (1.8%)

## 7.3 SURFACE WATER

### 7.3.1 SURFACE WATER QUALITY AND FLOWS

#### 7.3.1.1 Surface Water Flows

The Moolarben Coal Complex is within the Upper Goulburn River and Wollar Creek catchments. Moolarben Creek and Sportsmans Hollow creek are the primary tributaries of the upper Goulburn River catchment with Bora creek a minor tributary. Wilpinjong Creek and its tributaries (Eastern and Murrumbidgee creeks) drain to the Wollar creek. Most the watercourses are ephemeral in nature.

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In accordance with the SWMP, stream flow gauges have been installed in the ephemeral Wilpinjong, Murragamba, Eastern and Bora Creeks. Creek flow is heavily influenced by rain events. Data has been supplemented with data from Ulan Coal Mines. The recorded stream gauging is provided in **Appendix 3F**.

### 7.3.1.2 Surface Water Quality

Surface water monitoring was undertaken in the Goulburn River, Bora Creek, Moolarben Creek, Wilpinjong Creek, Murragamba Creek, and Eastern Creek in accordance with the SWMP. Results varied both spatially and temporarily consistent with fluctuations associate with rainfall events in ephemeral watercourses. Several locations were dry during monitoring rounds reflecting the ephemeral nature of the creeks and below average rainfall. Monitoring identified readings outside the 20<sup>th</sup>/80<sup>th</sup> percentile range at both upstream and downstream locations. The findings are described in **Section 7.3.2.1** below. Water quality data for the period is presented in **Figure 8**, **Figure 9** and **Figure 10**. 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 two occasions where rainfall events triggered the requirement to collect additional water samples. All samples were collected within the prescribe timeframes.

## 7.3.2 Water Discharges

MCO is licensed to discharge water in accordance with its Environmental Protection Licence (EPL 12932) subject to various water quality and rainfall criteria.

No water discharges occurred from MCO during the reporting period.

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### 7.3.2.1 Comparison to baseline and trends

Location	Trigger Values (20 <sup>th</sup> / 80 <sup>th</sup> %ile)		Performance during the Monitoring Period (01/01/2018 - 31/12/2018)	Trend/ Key Management Implications (Monitoring Period 01/01/2014 - 31/12/2018)	Implemented / proposed Management Action
<b>Surface Water Quality</b>					
Goulburn River  Sites; SW01 SW02 SW12*	PH	6.5 - 8.5	Surface water pH in the Goulburn River was neutral to slightly alkaline ranging from 7.4 to 8.0 (20%ile and 80%ile). Readings were generally within the historical range, though above the 80%ile levels. All results were within the current trigger levels during the period.	pH readings range between 7.4 and 8.2 (20%ile and 80%ile) for SW01 and SW02 and between 7.1 and 7.6 (20th and 80th percentiles) for SW12. There is no discernible trend in pH at these locations over the last five years.	Continue the implementation of the SWMP.  MCO will review and if necessary revise, the SWMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.
	EC	900	The EC readings were generally consistent with the samples over the last five years. EC ranged from 401 to 842 (20%ile and 80%ile) during the reporting period. All SW12 results were below the current trigger levels. Some results in the first half of the year were higher than the trigger level at SW01 and SW02.	EC readings range between 595 and 842 µS/cm (20%ile and 80%ile) for SW01 and SW02 and between 401 and 573 µS/cm (20th and 80th percentiles) for SW12. The recorded EC values for Goulburn River are generally below the trigger level (900 µS/cm) over the last five years. Slight increases in EC found during 2018 will likely be a result of two consecutive years of below average rainfall and releases.	
	Turbidity	25	All the turbidity results were below the current trigger level.	Turbidity readings range between 1 and 8 NTU (20%ile and 80%ile) for SW01 and SW02 and between 5 and 30 NTU (20%ile and 80%ile) for SW12. The turbidity readings for all three monitoring locations are generally below the trigger level (25 NTU). There is no discernible trend in turbidity at these locations over the last five years.	
Bora Creek	PH	6.5 - 7.5 (6.5-8.5)**	Bora Creek is an ephemeral creek with flow not recorded during monthly sampling events at both SW10 and SW11 during 2018.	pH ranged from 6.6 to 7.5 (20%ile and 80%ile) for SW10 and from 6.6 to 7.5 (20%ile and 80%ile) for SW11. The majority of the pH samples are within	

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Location	Trigger Values (20 <sup>th</sup> / 80 <sup>th</sup> %ile)		Performance during the Monitoring Period (01/01/2018 - 31/12/2018)	Trend/ Key Management Implications (Monitoring Period 01/01/2014 - 31/12/2018)	Implemented / proposed Management Action
Sites; SW10* SW11				the trigger levels. There is no discernible trend in pH at these locations over the last five years.	
	EC	318 (900)**	Bora Creek is an ephemeral creek with flow not recorded during monthly sampling events at both SW10 and SW11 during 2018.	EC readings range between 80 and 116 µS/cm (20%ile and 80%ile) for SW10 and between 162 and 338 µS/cm (20%ile and 80%ile) for SW11. All EC readings were below the trigger level. There is no discernible trend in EC at these locations over the last five years.	
	Turbidity	331	Bora Creek is an ephemeral creek with flow not recorded during monthly sampling events at both SW10 and SW11 during 2018.	Turbidity readings at SW10 range between 3 and 6 NTU (20%ile and 80%ile) and between 33 and 103 NTU (20%ile and 80%ile) for SW11. There is no discernible trend in turbidity at these locations over the last five years.	
<b>Moolarben and Lagoons Creek</b>  Sites; SW05 SW07* SW08* SW09*	PH	6.5 – 7.7	pH in Moolarben and Lagoon creeks was generally consistent with the historical data. Trigger investigation levels were exceeded on 4 occasions within Moolarben Creek, in accordance with the SWMP the surface water response and contingency plan was followed and the exceedances were determined not to be attributable to MCO.	pH was neutral to slightly alkaline ranging from 6.7 to 8.0 (20%ile and 80%ile). Some of the samples were above the trigger levels for Moolarben Creek. The pH at SW08 and SW09, upstream of the confluence of Lagoon Creek, is generally lower than at SW05 and SW07. There is no discernible tend in the results.	
	EC	1,000	All EC readings at SW05 were within the trigger level while upstream (non-mine impacted) EC readings continued to be elevated, consistent with historical records.	EC readings at SW05 range between 479 and 853 µS/cm (20%ile and 80%ile) and are lower than the trigger level. Upstream (non-mine impacted) Lagoon Creek (SW07) and Moolarben Creek (SW08 and SW09), the EC readings are elevated ranging between 1,567 and 5,086 µS/cm (20%ile and 80%ile). There appears the be a small increase	

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Location	Trigger Values (20 <sup>th</sup> / 80 <sup>th</sup> %ile)		Performance during the Monitoring Period (01/01/2018 - 31/12/2018)	Trend/ Key Management Implications (Monitoring Period 01/01/2014 - 31/12/2018)	Implemented / proposed Management Action
				in EC at all locations since early-2018, likely due to reduced flows in the early part of 2018.	
	Turbidity	34	Turbidity readings were all consistent with the historical data and generally below the trigger level.	The 20th percentile turbidity readings for all four monitoring locations ranges between 1 and 4 NTU, while the 80th percentile ranges between 16 and 27 NTU. The majority of the turbidity readings are less than the trigger level for Moolarben Creek. There is no discernible trend in at these locations over the last five years.	
<b>Murragamba, Eastern and Wilpinjong Creek</b>  Sites; SW04 SW15 SW16 SW17* SW19* SW20*	PH	a. 6.1 – 7.7 b. 6.4-7.3 c. 6.5-7.4	pH was generally consistent with historical data. The majority of samples were outside of the current trigger levels during the period, in accordance with the SWMP the surface water response and contingency plan was followed and the exceedances were determined not to be attributable to MCO.	pH readings range between 6.2 and 6.8 (20th and 80th percentiles) for upstream Murragamba Creek (SW19) and between 6.9 and 8.3 (20%ile and 80%ile) for downstream Murragamba Creek (SW04). The 20th and 80th percentiles for SW04 are above the trigger levels for Murragamba Creek.  Wilpinjong Creek has a pH ranging between 6.1 and 7.3 (20%ile and 80%ile) for SW15, SW16 and SW17, while the 20th percentile for SW18 is 4.7. There is no discernible trend in pH at these locations over the last five years.	
	EC	a. 1,622 b. 437 c. 714	The EC readings at all sites were generally lower than the historical data.	The EC in Murragamba Creek ranges between 38 and 584 µS/cm (20%ile and 80%ile) for SW19 and 254 and 1,013 µS/cm (20%ile and 80%ile) for SW04. SW04 recorded high EC readings between January 2014 and April 2014 and also between July 2015 and July 2016. These high EC recording are associated with extended dry periods.	

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Location	Trigger Values (20 <sup>th</sup> / 80 <sup>th</sup> %ile)		Performance during the Monitoring Period (01/01/2018 - 31/12/2018)	Trend/ Key Management Implications (Monitoring Period 01/01/2014 - 31/12/2018)	Implemented / proposed Management Action
				Wilpinjong Creek has EC ranging between 88 and 630 µS/cm (20%ile and 80%ile). There is no discernible trend in EC at these locations over the last five years.	
	Turbidity	a. 156 b. ND c. ND	SW04 and SW16 recorded turbidity readings consistent with historical records, while SW15 and SW17 recorded 20th and 80th percentiles which were higher than the historical 20th and 80th percentiles. All turbidity readings at SW04 were significantly below the trigger level for Murrumbidgee Creek.	Murrumbidgee Creek has turbidity readings between 12 and 86 NTU (20%ile and 80%ile) with the majority of the samples recording a turbidity value below the trigger level. Wilpinjong Creek has a turbidity ranging between 20 and 156 NTU (20%ile and 80%ile). There is no other discernible trend in turbidity at these locations over the last five years.	

- \* Monitoring site does not have associated trigger investigation levels
- \*\* Limit equivalent to approved EPL discharge limits during releases
- a. Trigger investigation levels are for SW04
- b. Trigger investigation levels are for SW15
- c. Trigger investigation levels are for SW16
- ND. No data (i.e. less than 24 monitoring points)

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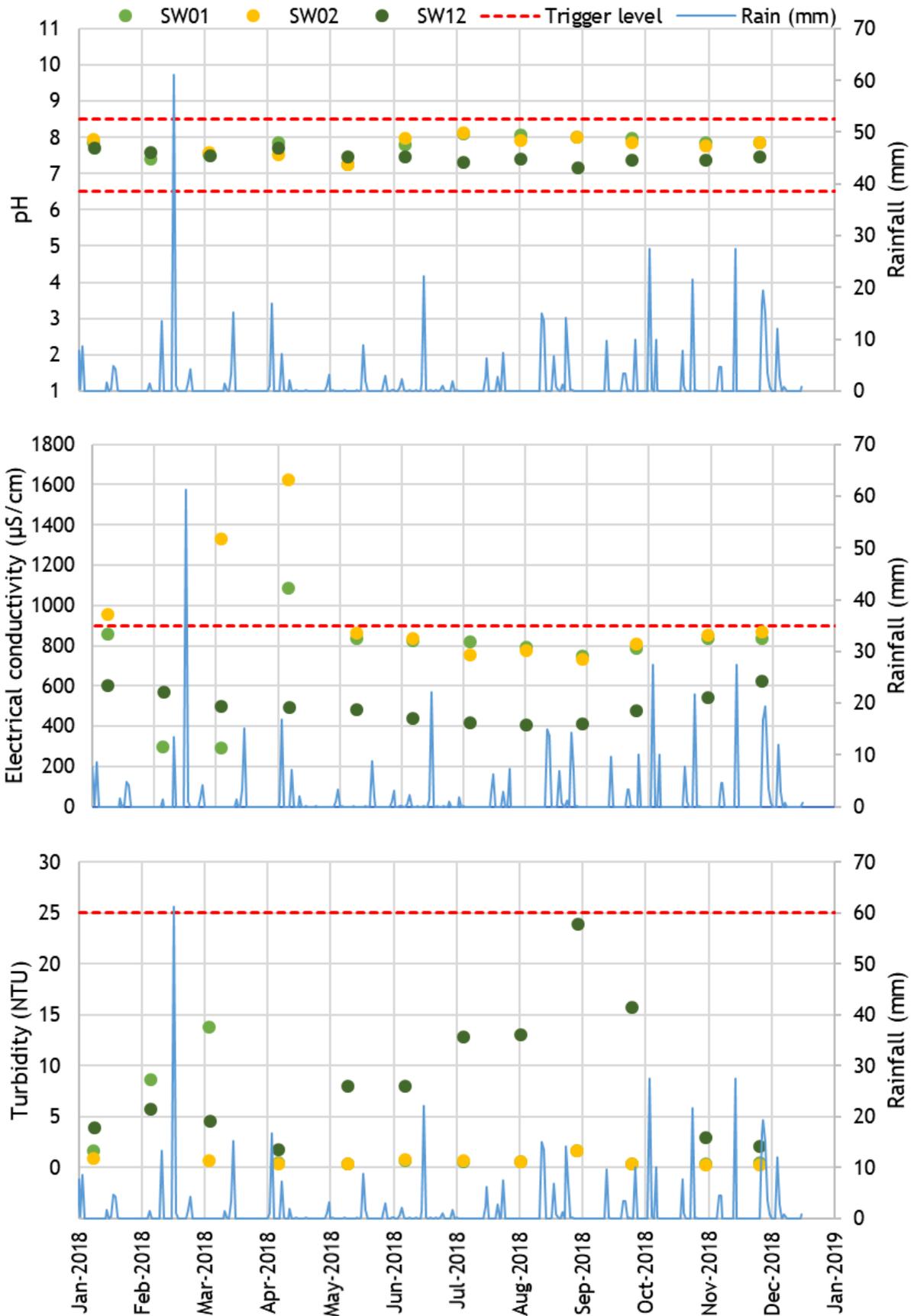


Figure 8: Goulburn River Water Quality

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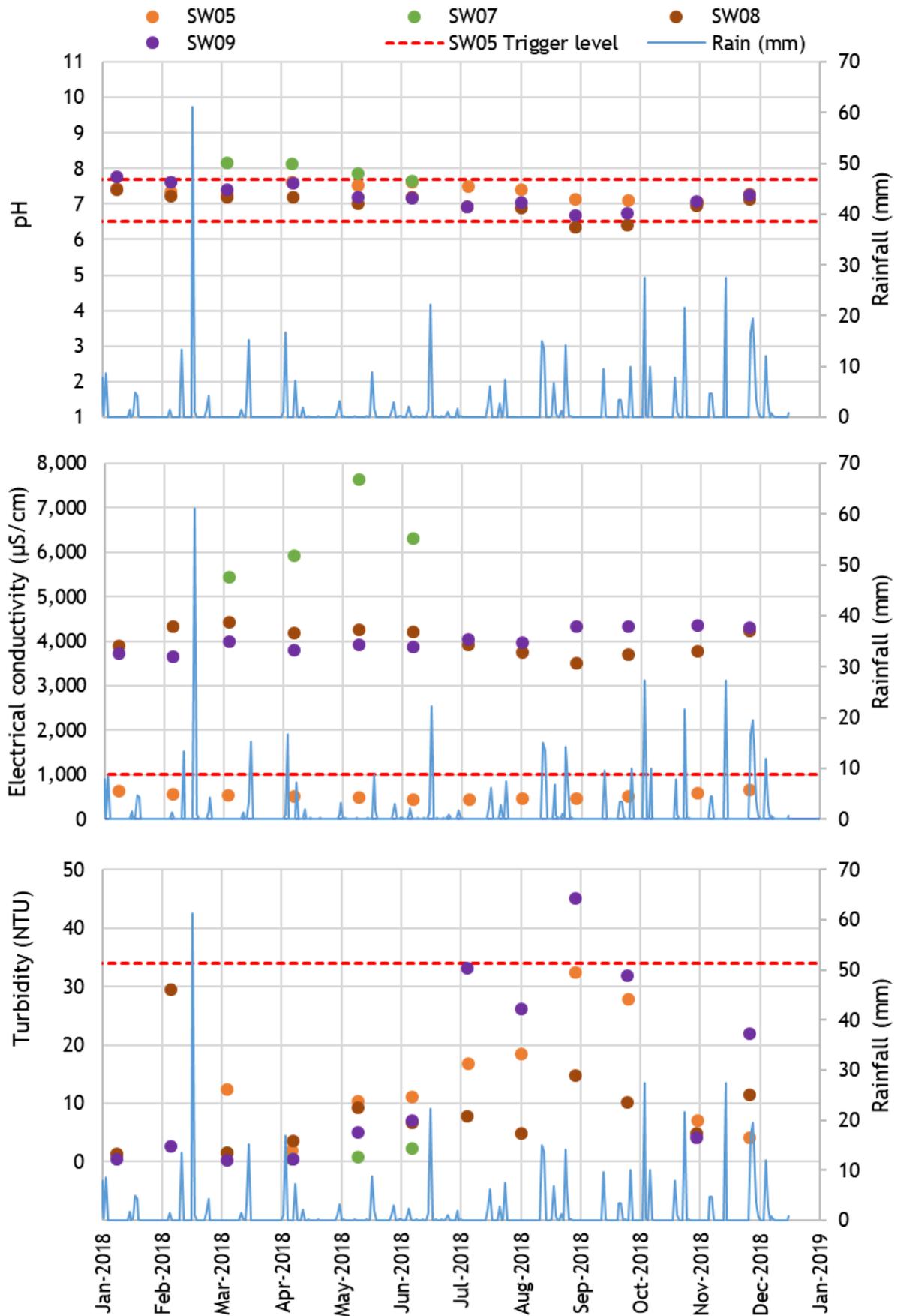


Figure 9: Moolarben and Lagoon Creek Water Quality

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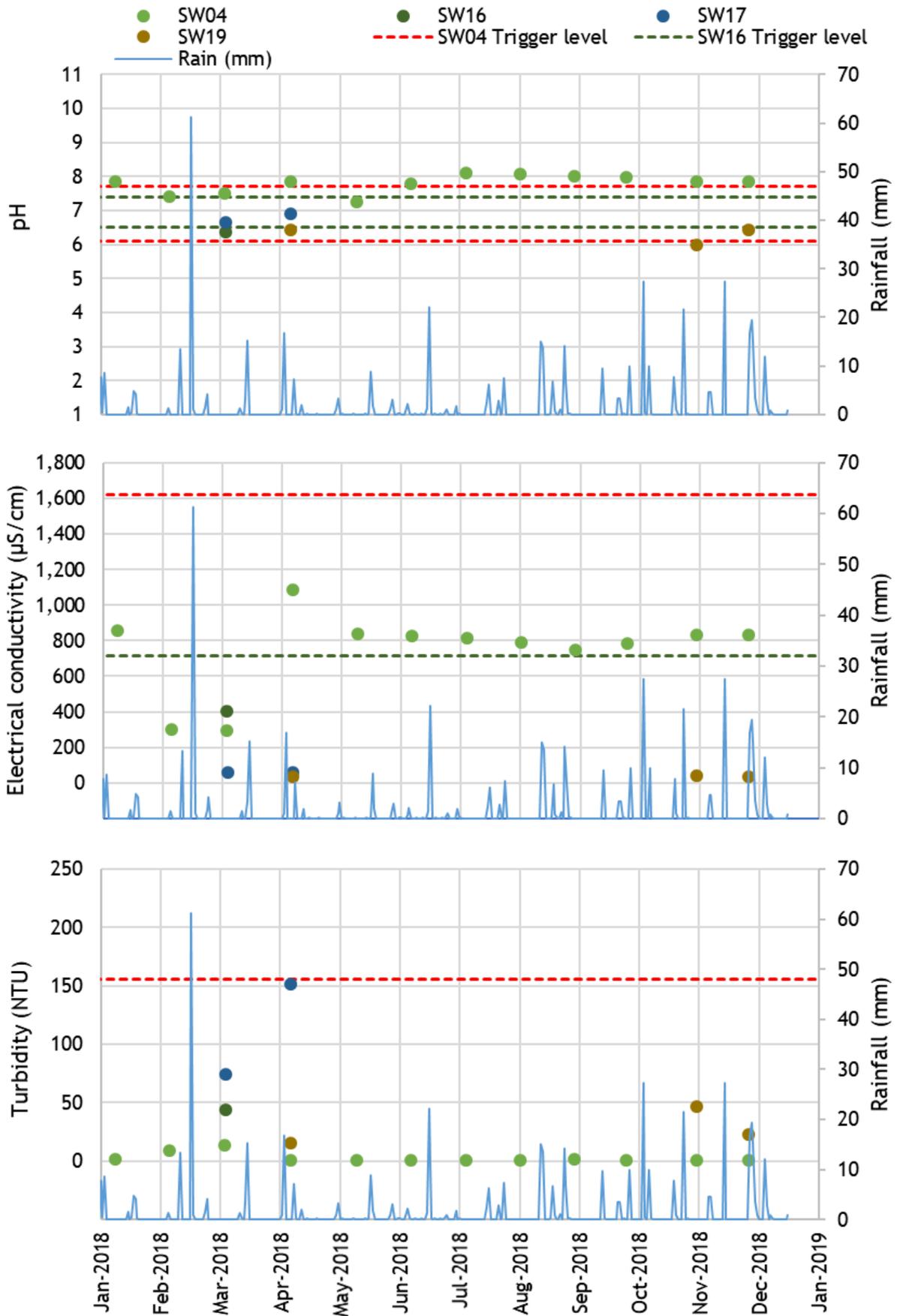


Figure 10: Murragamba, Eastern and Wilpinjong Creek Water Quality

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### 7.3.3 STREAM HEALTH MONITORING

Stream Health monitoring was undertaken in Autumn and Spring 2018 including Aquatic Habitat Condition (RCE Index), Aquatic Macroinvertebrate Diversity and Pollution Tolerance SIGNAL2 Scores. Trigger investigation values have been incorporated into the SWMP, with scores below the trigger level triggering investigation.

#### 7.3.3.1 Autumn 2018

Autumn stream health monitoring was undertaken between 1st May and 4<sup>th</sup> May 2018. Sites SH03, SH04, SH15 and SH19 were dry and were not sampled. The Autumn 2018 stream health sampling was during a low flow event following a prolonged dry period with flows decreasing from the previous Spring sampling event.

There were no indications of MCO mine-related impact on stream health or aquatic habitat condition in Autumn 2018, with differences between sites in Autumn 2018 generally relating to differences in site natural environmental habitat and climatic factors.

- Aquatic Habitat Condition (RCE Index) - All site results were above established trigger values (Figure 3), and RCE scores were consistent with those recorded during the autumn and spring 2017 stream health surveys.
- Aquatic Macroinvertebrate Diversity - The macroinvertebrate taxa diversity results were above trigger value levels at all sites (Figure 4). The site diversity values across the larger catchment groups (Moolarben Creek and Goulburn River) were generally lower than the pre-mining mean values. Wilpinjong Creek site diversity values were more varied compared to recent surveys; sites SH14 and SH18 recorded their highest values to date, whereas SH16 was similar to recent surveys and SH17 was lower than spring 2017.
- Pollution Tolerance SIGNAL-2 Scores – SIGNAL-2 scores were above established trigger values at all sites (Figure 5). All Moolarben Creek site SIGNAL-2 values were higher than pre-mining average values. For the Goulburn River catchment sites, two of the downstream river sites were lower than pre-mining average values (SH02 and SH13), Bobadeen Creek site SH01B and upstream river site SH05 were above average. Wilpinjong Creek site SIGNAL-2 scores were consistent with the previous two seasons' results.

#### 7.3.3.2 Spring 2018

Spring stream health monitoring was undertaken between 2<sup>nd</sup> and 4<sup>th</sup> October 2018. Sites SH03, SH04, SH15 and SH19 were dry and were not sampled in spring 2018. The spring 2018 stream health sampling was conducted after a small rainfall event following a generally dry period. The monitoring locations are illustrated in **Appendix 2**.

- Aquatic Habitat Condition (RCE Index) - RCE scores were above established trigger values at all sites (Figure 8). There were no changes over consecutive surveys to RCE scores at half of the sites, with only minor changes in spring 2018 due to variations in the levels of filamentous green algae between surveys.
- Aquatic Macroinvertebrate Diversity - The site Taxa Diversity results were above established trigger values for spring 2018 (Figure 9). Except for SH13, all Goulburn River and Moolarben Creek sites recorded higher diversities than the autumn 2018 survey, however SH05 was the only one of these sites that supported more taxa than the pre-mining average number of taxa. The Wilpinjong Creek spring 2018 site diversity scores were slightly better than autumn 2018 at site SH16, with the remainder of the sites recording reduced diversities.

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- **Pollution Tolerance SIGNAL-2 Scores** - The spring 2018 SIGNAL-2 scores were all above established trigger values (Figure 10). Compared to pre-mining SIGNAL-2 mean values, the Moolarben Creek and Goulburn River spring 2018 scores were generally similar or higher indicating a higher proportion of pollution sensitive taxa. In contrast, all the Wilpinjong Creek sites had reduced SIGNAL-2 values compared to autumn 2018.

### 7.3.3.3 Trends

Review of the aquatic habitat condition (RCE Index) trends indicate that overall there has been little change in site aquatic habitat conditions with variations generally related to stream bed conditions and stream vegetation ratios. Variability is more pronounced for sites located in smaller sub-catchments due mainly to variations in creek bed characteristics responding to wet and dry conditions.

Given that overall aquatic habitat conditions of MCO Stream Health sites have remained stable, climatic factors and flow regimes are the dominant influence on aquatic ecological community and macroinvertebrate assemblage change over time. Flow regimes are related to the physical locations of monitoring sites within their respective catchments in regard to local rainfall runoff or in regard to licensed discharges. Accordingly, sites located in the smaller upper catchments above mining discharge, including Wilpinjong and Moolarben Creeks, can be expected to be influenced more readily by low flow and drought or high scouring storm flow conditions (boom and bust). Sites in the Goulburn River would experience an overall lower frequency of drought and low flow events than the upper creeks with flow regimes for sites below the Ulan Creek discharge mediated by licensed discharge flows from the Ulan Mine Complex (UMC) and some additional contribution from Bobadeen Creek.

### 7.3.4 CHANNEL STABILITY MONITORING

The channel stability monitoring program occurred on the 25th and 26th September and on 8th and 11th October 2018 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.

#### 7.3.4.1 Monitoring results

Bora Creek channel stability monitoring results indicate a similar declining trend moving downstream, as assessed previously. The upper reaches of Bora Creek including sites BC-pt01 to BC-pt04 were ranked 'Very Stable' to 'Potentially Stabilising'. The lower reaches of Bora Creek were ranked 'Potentially Stabilising' to 'Very Active'. The 2018 scores are considered comparable to the results recorded in 2017 except at BC-pt10 where stabilisation works have increased this sites score to 'Stable'. There was a slight improvement to the overall channel stability trend in 2018.

Moolarben Creek channel stability monitoring identified continuation of morphological processes identified in previous monitoring, however the overall trend for 2018 indicates a slight declining trend. The main reasons were the slightly lower scores attributed to less vegetation noted on either the floor of the channel and/or the bank walls at a portion of sites where stock was noted. The average classification for Moolarben Creek in 2018 was 'Potentially Stabilising'.

Murragamba Creek channel stability monitoring results indicate slightly declining scores when compared to 2017 results. The main observation in 2018 was the decline in vegetation noted along the creek banks and creek bed in contrast to 2017. The decline in observed vegetation on the floor and walls of the flow channel was reflected in slightly lower channel stability scores at nearly all sites when compared to 2017.

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Wilpinjong Creek channel stability monitoring results indicate no significant variances in stability when compared to previous results. The 2018 channel stability monitoring also noted similar morphological processes, as assessed and identified previously and continues to remain spatially variable. The average CSIRO classification for Wilpinjong Creek in 2018 was 'Potentially Stabilising'.

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

#### 7.3.5 EFFLUENT

During the period MCO continued to operate four sewerage treatment plants. Discharge quantity was within design limits during the period. Discharge quality is presented in **Appendix 3F**.

### 7.4 GROUNDWATER

#### 7.4.1 GROUNDWATER LEVELS

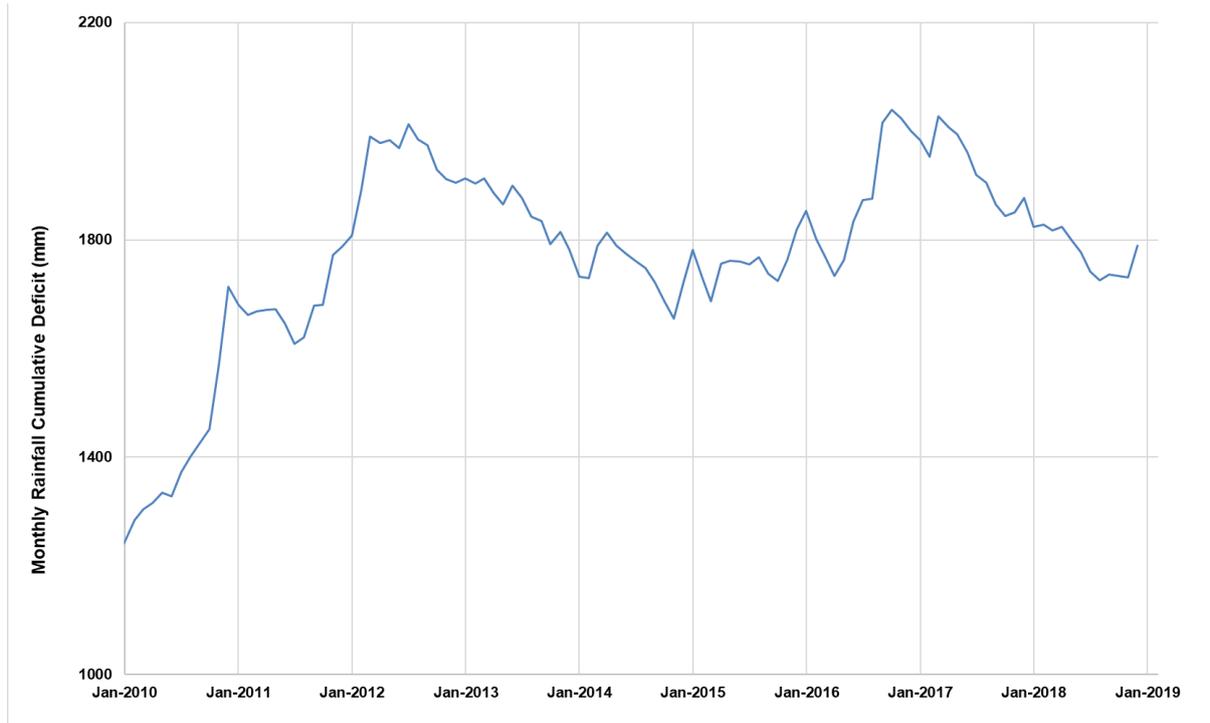
MCO monitors a network of piezometers in accordance with the Groundwater Management Plan (GWMP). The monitoring program includes trigger values established to determine the need for investigation and possible response actions for potential impacts to groundwater levels in the alluvial and Triassic aquifers. 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).

Groundwater level trends in the period were variously influenced by rainfall (as indicated by the Rainfall Cumulative Deviation (RCD)), UG1 mining, open cut operations and regional depressurisation due to neighbouring operations. Rainfall in the reporting period was significantly below average with a resultant reduction in the RCD (**Figure 11**). The RCD reduction correlated with a reduction in water levels throughout the monitoring network.

Two groundwater level investigation sites were triggered during the period, PZ184 and PZ105C. PZ105C appears to be a localised effect with Triassic bores between PZ105C and MCO's operations not exhibiting the same level of response. PZ105A and B were decommissioned with PZ105A converted to a VWP to eliminate any potential interconnectivity. PZ184 is located within the approved OC4 pit and between current OC4 operations and neighbouring operations. It has exhibited a general conformance with the RCD with potential regional mining influence. Investigation triggers, along with monitored groundwater levels are presented in **Table 24**. Standing water level/pressures for all piezometers for the period (including vibrating wire piezometers) are presented in **Appendix 3G**.

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**Figure 11: Rainfall Residual Mass - Wollar**

Drawdown in the Ulan coal seam and the Permian coal measures is influenced by open cut mining, UG 1 underground mining and neighbouring operations. The influence of UG1 continued over the period, with the rate of decline slowing.

PZ211, 213 and 214 located north east of UG1 to assess impacts of UG1 on the Wilpinjong Creek palaeochannel exhibited no discernible influence from mining in the 2018 period.

Groundwater levels in Triassic bores exhibited variable responses over the period. PZ101C and PZ105C locate 5 km north of the current MCO mining operations, show potential additional influences with PZ105C recording a reduced level below its baseline range. Triassic bores between these bores and MCOs operations do not exhibit the same level of response. PZ179 VWP exhibited a decline during the period with an increase in level towards the end of the year aligned with the RCD indicating a rainfall effect.

During the period PZ157 was grouted up to mitigate safety risks and removed from the program. PZ105B and TB105 were decommissioned and PZ105A was converted from a standpipe monitoring bore to a Vibrating Wire Piezometer. PZ201, PZ202, PZ203, PZ211, PZ213 and PZ214 continued to be monitored to establish a baseline.

Over the longer-term many monitoring network bores exhibit a long-term rise in water levels from 2006 to December 2012 followed by a prolonged period of water level decline to December 2018.

The Groundwater Model was revised in the reporting period using contemporary data and modelling software. The groundwater level observations were generally consistent with model predictions to support the Open-cut Optimisation modification including drawdown associated with mining at UG1. Variance in drawdown is likely to reflect slight variances in mining sequences and the below average rainfall and associated reduction in the rainfall cumulative deviation in the period where the model assumes average rainfall. Further model revision and analysis was undertaken by 2018 to better reflect

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actual mine sequence, including exclusion of OC3 resulting in the development of the OC3 Null Model (OC3 Null Model) in August 2018.

#### 7.4.2 GROUNDWATER QUALITY

Site specific trigger levels for acidity (pH) and electrical conductivity (EC) have been developed for the Moolarben Coal Complex. A review of the groundwater quality performance is provided in **Table 25**. Water quality results from all piezometers are provided in **Appendix 3G**.

Water quality for the period is generally consistent with baseline data and previous monitoring results. Three water quality investigation sites for EC were triggered in the period at PZ058A, PZ102B and PZ103A. PZ058A was installed to replace PZ058 and EC is considered to reflect the bore replacement rather than impacts from mining. PZ102B and 103A are consistent with the historical range of quality with trends indicating a possible connection to neighbouring operations. PZ055 EC remained elevated above trigger levels though appears to have stabilised. Monitoring at PZ055 is to be conducted monthly and an interception drain will be installed upslope of the bore.

#### 7.4.3 PRIVATE GROUNDWATER USERS

MCO had negligible impact on private groundwater users during the reporting period. No compensatory water supply was required or supplied during the period.

#### 7.4.4 ACTIONS FOR NEXT REPORTING PERIOD

During the next reporting period the following actions are proposed:

- Continued baseline monitoring of 211, 213, 214, 215, 216, 217, 218, 219, 220, and 221 to develop SWL, pH and electrical conductivity triggers.
- Review groundwater triggers as part of next Groundwater Management Plan Review.
- WAMP to be reviewed and revised as necessary

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**Table 24: Water Levels – Triassic, Alluvium and Palaeochannel Bore Performance**

Location	Investigation Trigger Level (mAHD)	Minimum Groundwater Level/Pressure (mAHD)		Trend/ Key Management Implications	Implemented/proposed Management Action
		Baseline	2018		
<b>Alluvium and Palaeochannel Bores</b>					
PZ55	419.8	421.8	423.1	Investigation triggers exceeded at PZ184 in October and November 2018 due to climatic and regional effects.  Below average rainfall with continued reduction in rainfall cumulative deviation.  Bores generally exhibited a declining trend during 2018 consistent with the RCD.	Continue monitoring program.  Continue monitoring to develop triggers for bores without triggers.  MCO will review and if necessary revise, the GWMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.
PZ58a	465.8 (dry)	467.5	467.0		
PZ184	410.4 (dry)	412.0	410.3		
PZ187	413.7	415.7	415.5		
PZ188	413.2	415.2	413.7		
PZ203	401.1	403.1	402.7		
PZ211*	TBC	433.5	432.4		
PZ213*	TBC	408.6	413.8		
PZ214*	TBC	414.9	413.9		
<b>Triassic Bores</b>					
PZ101C	378.7	380.7	380.5	Declining water level/pressures generally consistent with the RCD and rainfall recharge and natural discharge.  PZ105C declined below trigger appears to be a localised effect with Triassic bores closer to MCOs operations not exhibiting the same level of response. Monitoring to continue.	Bores adjacent to 105C decommissioned or converted to VWP.  Continue monitoring program.
PZ105C	374.9	376.9	373.9		
PZ129 (VWP-35m)	387.0 (dry)	388.4	390.2		

\* Trigger to be developed.

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**Table 25: Water Quality Performance**

Location	Investigation Trigger Criteria	Trend/ Key Management Implications	Implemented/proposed Management Action
<b>Water Quality</b>			
All	pH and Electrical Conductivity	Water quality for the period is generally consistent with baseline data and previous monitoring results. Three water quality investigation for electrical conductivity (EC) were triggered in the period at PZ058A, PZ102B and PZ103A. PZ058A was installed to replace PZ55 and EC is considered to reflect the bore replacement rather than impacts from mining. PZ102B and 103A are consistent with the historical range of quality. PZ55 EC remained elevated though appears to have stabilised. Monitoring is to be conducted monthly and an interception drain will be installed upslope of the bore. The bore continues to be monitored.	Continue monitoring program. MCO will review and if necessary revise, the GWMP in accordance with Schedule 5 condition 5 and Schedule 6 condition 5 of PA05_0117 and PA08_0135 respectively.

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## 8.0 MINE SUBSIDENCE

MCO undertakes secondary extraction in accordance with the UG1 Longwalls 101 to 103 Extraction Plan (2017) (the Extraction Plan). The Extraction Plan and associated sub-plans were prepared with input from experienced and qualified experts to satisfy Condition 5, Schedule 4 of PA 08\_0135 and was approved in September 2017.

During the reporting period, secondary extraction was undertaken in Longwall 101 and LW102A. Mining of longwall panel 101 was completed on 20 June 2018. A longwall move was carried out in July 2018 with LW102A commencing on 08 August 2018. As of the 31 December 2018 Longwall LW102A had retreated 1,658m.

During the reporting period MCO continued to conduct monitoring of subsidence lines, flora and fauna habitats, cliffs, landscape features, and built features for LW101 and LW102. Routine monitoring of subsidence lines, surface water, groundwater, UG1 inflows and outflows continued. Routine built feature monitoring triggers were not exceeded in the period. Post mining inspections were carried out for flora and fauna above LW101. Two years of post-mining monitoring is required to determine whether the Biodiversity Subsidence Performance Measure has been met, (i.e. negligible subsidence impacts or environmental consequences) and will be reported on in the 2019 Annual Review.

Subsidence monitoring included the 2D ground monitoring A, B and C lines. Monitoring line A is orientated transverse to the Longwalls and crosses LW101 near the commencing end. At the end of 2018, LW102A had not yet mined beneath the A Line, with the extracted face located approximately 630 m from the monitoring line. Line B is a longitudinal monitoring line located above the centreline of LW101 at the commencing end. At the end of 2018, LW102A had not yet mined adjacent to the B Line, with the extracted face located approximately 200 m from the south-west end of the monitoring line. Line C is a monitoring line located along the centreline of LW101, at the longwall finishing end. At the end of 2018, the extraction face of LW102A was located more than 2.5km from the south-west end of monitoring Line C. Subsidence impacts during the period were consistent with predictions as shown in **Table 26**.

**Table 26 Comparison of maximum observed and predicted vertical subsidence, tilt and strain for the A, B and C Line.**

Survey Line	Type	Maximum vertical subsidence (mm)	Maximum tilt (mm/m)	Maximum tensile strain (mm/m)	Maximum compressive strain (mm/m)
A	Measured	1791	53	8	5
	Predicted	2250	45	15 <sup>1</sup>	15 <sup>1</sup>
B	Measured	1755	50	64	19
	Predicted	2250	100	> 30 <sup>1</sup>	> 30 <sup>1</sup>
C	Measured	1770	31	6	16
	Predicted	2250	65	25 <sup>1</sup>	25 <sup>1</sup>

<sup>1</sup> denotes that the values represent the conventional strains based on the predicted curvatures multiplied by a factor of 10.

A summary of performance against the relevant subsidence performance indicators and subsidence performance measures (i.e. the subsidence performance assessment), detailed in the Extraction Plan and Condition 1 and Condition 3, Schedule 4 of Project Approval (08\_0135) is provided in **Table 27** and **Table 28**.

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**Table 27: Assessment of Subsidence Performance Indicators Measures for UG1 – Natural and Heritage Features**

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
<b>Water Resources:</b>					
<i>Drainage Lines (DL1 – DL7)</i>	<i>No greater subsidence impacts or environmental consequences than predicted in the EA</i>	<ul style="list-style-type: none"> <li>• Change in visible erosion.</li> <li>• Development of, or change in, head-cut erosion along DL7.</li> <li>• Change in character, such as increased erosion or change in vegetation along drainage line.</li> <li>• Extensive duration of water ponding.</li> <li>• Downstream water quality (consistent with approved complex-wide SWMP).</li> <li>• Appearance of unsealed surface cracking across the bed of DL7.</li> </ul>	<b>No</b>	<p>DL1 – DL7 were located outside the mined extents of LW101 and LW102A at the end of 2018. It is unlikely that these drainage lines experienced measurable ground movements due to the mining.</p> <p>No impacts greater than predicted recorded.</p> <p>Pre-mining inspections of monitoring point establishment along D7 completed.</p>	<b>No</b>
<b>Land:</b>					
<i>Cliffs C7, C9 and C10</i>	<i>Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs or fracturing, that in total do not impact more than 0.5% of the total face of such cliffs within any longwall mining domain)</i>	<ul style="list-style-type: none"> <li>• Not applicable (NA). C7, C9 and C10 are located outside the Study Area of Longwalls LW101 to LW103.</li> </ul>	<b>NA</b>	<p>Cliffs C7, C9 and C10 were located outside the mined extents of LW101 and LW102A at the end of 2018, at distances ranging between 1.8 km to 2.2 km. It is unlikely that these cliffs experienced measurable ground movements due to the mining.</p> <p>No impacts greater than predicted recorded.</p>	<b>No</b>
<i>Other cliffs</i>	<i>No greater subsidence impacts or environmental consequences than predicted in the EA</i>	<ul style="list-style-type: none"> <li>• The total length of cliffs within the Longwalls 101-103 Study Area that experiences cliff instabilities (i.e. the exposure of a fresh face of rock and debris scattered around the base of the cliff) is to be less than 6 m.</li> </ul>	<b>No</b>	<p>Cliffs C5 and C6 are located 110 m and 130 m south of the as-extracted extent of LW102A. All other relevant cliffs are outside LW101 to 103 area.</p> <p>Pre-mining inspections and establishment of monitoring points at cliff line C5 and C6 above LW103 were completed.</p> <p>It is unlikely that these cliffs experienced measurable ground movements due to mining. No adverse impacts have been reported for Cliffs during 2018.</p>	<b>No</b>

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Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
<p><i>Minor cliffs</i> <i>Rock face features</i> <i>Steep slopes</i></p>	<p><i>Minor environmental consequences (that is, occasional rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of each such type of features within any longwall mining domain)</i></p>	<ul style="list-style-type: none"> <li>In each instance of an identified impact (occasional rockfalls, displacement of boulders or slabs, or fracturing) the affected percentage of the total face area of the feature affected will be determined. It is expected that occasional rockfalls or fracturing would not impact more than 5% of the total face area of rock ledges and overhangs in the Longwall mining domain.</li> </ul>	<b>No</b>	<p>Pre-mining surveys completed and monitoring sites established above LW101 and LW102A.</p> <p>Ground movements measured during 2018 were similar to or less than those predicted</p> <p>Some minor rockfalls and cracking.</p> <p>Post-mining surveys to be undertaken at the completion of longwall mining.</p>	<b>No</b>
<b>Biodiversity:</b>					
<p><i>Threatened species, threatened populations, or endangered ecological communities</i></p>	<p><i>Negligible subsidence impacts or environmental consequences</i></p>	<p>Subsidence related impacts to threatened flora, fauna or EECs, including:</p> <ul style="list-style-type: none"> <li>Areas of cracking or ponding that exceed predictions in the subsidence predictions and assessments of the impacts relating to the predicted subsidence above Longwalls 101-103;</li> <li>Declining trend in canopy health or vegetation structure inconsistent with seasonal trends at analogue sites;</li> <li>Deterioration in tree health outside natural variations (analogue sites to be used as a guide);</li> <li>Areas of weed incursion and/or infestation; or</li> <li>Mortality of more than a small number of threatened flora or fauna species attributed to subsidence impacts.</li> <li>Evidence of impacts (attributable to subsidence) to more than 5% of features that provide potential bat roosting sites in the Longwalls 101 to 103 Study Area (i.e. cliffs and minor cliffs).</li> </ul>	<b>No</b>	<p>Pre-mining baseline floristic monitoring along transects above LW101 and LW102A completed.</p> <p>Six baseline floristic sites were established above LW101 and LW102 in five Plant Community Types (PCTs). Two of these, PCT 266 and PCT 1606, are listed as an Endangered Ecological Community (EEC).</p> <p>Pre-mining targeted cliff line monitoring for potential microbat roosting sites completed. Low levels of activity of the three target predominantly cave-roosting microbat species across all sites sampled, indicating that significant roosts of these species were unlikely to be present within the study area.</p> <p>Post-mining surveys were undertaken at the completion of LW101 and no performance measures had been exceeded.</p>	<b>No</b>
<b>Heritage Sites:</b>					
<p><i>Aboriginal heritage sites</i> <i>S2MC 236 (AHIMS No.s 36 3 0016 and 36 3 0134)</i></p>	<p><i>Negligible subsidence impacts or environmental consequences</i></p>	<ul style="list-style-type: none"> <li>Not applicable (NA) S2MC236 [AHIMS No.s 36-3-0016 and 36-3-0134] are located outside the Study Area of Longwalls LW101 to LW103.</li> </ul>	<b>No</b>	<p>S2MC236 [AHIMS Nos. 36-3-0016 and 36-3-0134] are located outside the Study Area of Longwalls LW101 to LW103.</p>	<b>No</b>

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Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
<i>Historic Heritage Sites</i>	<i>No greater subsidence impacts or environmental consequences than predicted in the EA</i>	<ul style="list-style-type: none"> <li>Not applicable (NA) all historic heritage sites are located outside the Study Area of Longwalls LW101 to LW103.</li> </ul>	<b>No</b>	All Historic heritage sites are located outside LW101 to LW103.	<b>No</b>
<b>Mine Workings:</b>					
<i>First workings</i>	<i>First working under an approved Extraction Plan beneath any feature where performance measures require negligible subsidence impacts or negligible environmental consequences to remain long-term stable and non-subsiding</i>	<ul style="list-style-type: none"> <li>First workings remain long-term stable and non-subsiding</li> </ul>	<b>No</b>	<p>First workings have been designed to meet the requirements of Condition 7, Schedule 4 of Project Approval (08_0135).</p> <p>First workings approval was granted on the 24 March 2016, 4 May 2016 and 31 August 2018 by the Deputy Secretary of the NSW Department of Industry – Resources and Energy, in accordance with the requirements under Condition 7, Schedule 4 of PA08_0135.</p>	<b>No</b>
<i>Second workings</i>	<i>To be carried out only in accordance with an approved Extraction Plan</i>	<ul style="list-style-type: none"> <li>Second working are carried out in accordance with an approved Extraction Plan.</li> </ul>	<b>No</b>	Second workings have been carried out in LW101 and LW102 in accordance with the approved <i>Longwalls 101-103 Extraction Plan</i> during the assessment period.	<b>No</b>

**Table 28: Assessment of Subsidence Performance Indicators Measures for UG1 – Built Features**

Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator Indicators Exceeded?	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
<b>Key Public Infrastructure:</b>					
<i>Gulgong-Sandy Hollow Railway Line</i>	<i>Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired</i>	<ul style="list-style-type: none"> <li>No defects or deformation of the rail track and associated infrastructure due to mining.</li> <li>No visual displacement at joints or cracks in culverts.</li> </ul>	<b>No</b>	<p>The Sandy Hollow Gulgong Railway Line is located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements</p> <p>No triggers of FF'Line indicating no defects, deformation of displacement of joints in culverts due to mining.</p>	<b>No</b>

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Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator Indicators Exceeded?	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
<i>Ulan-Wollar Road</i>		<ul style="list-style-type: none"> <li>No additional visible pavement cracking or other defects of the road pavement (when compared against baseline conditions and sections of road outside the Study Area) resulting in deterioration of road quality.</li> <li>No ponding of water on the road surface as a result of changes in grade from subsidence associated with Longwalls 101-103.</li> <li>No joint displacement or cracking or other defects of the drainage structure (e.g. pipes/culverts) in excess of 5 mm.</li> <li>Serviceability of guard rails, marker posts and signage is maintained.</li> </ul>	<b>No</b>	<p>The Ulan-Wollar Road is located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements.</p> <p>No triggers of FF Line indicating no additional cracking, defects, additional ponding, deformation or displacement of joints in culverts due to mining.</p>	<b>No</b>
<b>Other Infrastructure:</b>					
<i>Murragamba Road</i>	<p><i>Always safe.</i></p> <p><i>Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.</i></p>	<ul style="list-style-type: none"> <li>Not applicable (NA) as Murragamba Road is not publicly accessible.</li> </ul>	<b>NA</b>	<p>Murragamba Road is not publicly accessible.</p> <p>No observed impacts to Murragamba Road occurred during the assessment period as a result of Longwall LW101 and LW102A.</p>	<b>No</b>
<i>Low voltage electricity power line</i>	<p><i>Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</i></p>	<ul style="list-style-type: none"> <li>The structural integrity of the 66 kV/22 kV dual circuit powerline (power poles and transmission lines) is maintained.</li> <li>The electrical clearance from land, vegetation and roads is maintained.</li> <li>The serviceability of the access roads/tracks is maintained.</li> </ul>	<b>No</b>	<p>No loss of service or observed impacts to the 66kV/22kV powerline and three associated power poles occurred during the assessment period, as a result of Longwall LW101 and LW102A.</p>	<b>No</b>
<i>Telecommunication cable</i>  <i>Fibre-optic cable</i>	<p><i>Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.</i></p> <p><i>Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</i></p>	<ul style="list-style-type: none"> <li>Negligible transmission loss from mine subsidence impacts.</li> <li>Negligible impacts on structural integrity of the cable lines from mine subsidence.</li> </ul>	<b>No</b>	<p>The telecommunication cable and optical fibre cable are located outside the Longwalls 101-103 Study Area, but may be subject to far-field horizontal movements and non-conventional ground movements.</p> <p>No observed impacts on either the telecommunications line and/or the fibre optic cable occurred during the assessment period, as a result of Longwall LW101 and LW102A.</p>	<b>No</b>
<i>Murragamba Trig Station</i>		<ul style="list-style-type: none"> <li>Not applicable (NA) as the Murragamba Trig Station is located outside the Longwalls 101-103 study Area.</li> </ul>	<b>NA</b>	<p>The Murragamba Trig Station is located outside the Longwalls 101-103 Study Area.</p>	<b>No</b>

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Subsidence Impact Performance Measure		Subsidence Impact Performance Indicator Indicators Exceeded?	Indicators Exceeded?	Assessment of Subsidence Impact Performance Measures	Performance Measures Exceeded?
<i>Other built features and improvements, including fences</i>	<i>Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.  Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</i>	<ul style="list-style-type: none"> <li>Not applicable (NA) as no other non-mine owned built features and improvements are located within the Longwalls 101-103 Study Area.</li> </ul>	<b>NA</b>	No other non-mine owned built features and improvements are located within the Longwalls 101-103 Study Area.	<b>No</b>
<b>Public Safety:</b>					
<i>Public safety</i>	<i>Negligible additional risk</i>	<ul style="list-style-type: none"> <li>No more than negligible additional risk to public safety.</li> </ul>	<b>No</b>	No more than negligible additional risk to public safety has occurred during the assessment period, as a result of Longwall LW101 or LW102A, due to the remote location and restricted access of UG1 within MCO's mining operation.  There were no incidents regarding public safety as a result of Longwall LW101 and LW102A during the assessment period.	<b>No</b>

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### 8.1.1 ACTIONS FOR NEXT REPORTING PERIOD

Activities in the 2019 reporting period include:

- Routine environmental and subsidence line monitoring.
- Establishment and baseline monitoring of additional monitoring locations associated with LW103 where not completed.
- Remediation works, (Eg. Tracks) as required.

### 8.1.2 SUBSIDENCE REMEDIATION

No subsidence management actions were required to be undertaken as a result of LW101 or LW102 extraction during the reporting period.

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## 9.0 REHABILITATION

MCO manages rehabilitation in accordance with Rehabilitation Management Plan (RMP) and Mining Operations Plan (MOP). The RMP was developed by MCO with advice from experienced and qualified experts to satisfy Condition 68, Schedule 3 of PA 05\_0117 and Condition 56, Schedule 3 of PA 08-0135. 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 November 2016.

The MOP was developed to meet the requirements of Mining Lease Conditions. The MCO Mining Operations Plan (MOP) was revised during the reporting period to extend mining operations into 2019. The currently approved MOP describes the proposed Stage 1 and Stage 2 mining and rehabilitation activities for the period 1 December 2016 to 31 December 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, 3B and 3C. The MOP and RMP are available on the Moolarben Coal website ([www.moolarbencoal.com.au](http://www.moolarbencoal.com.au)).

This section addressed the annual rehabilitation reporting requirements for Project Approvals PA05\_0117 and PA08\_0135, the MOP and Moolarben Coal Complex MLs. The rehabilitation performance review for 2018, applies to the proposed rehabilitation activities outlined in the 2016 to 2019 MOP.

### 9.1 MINING AND REHABILITATION STATUS

At the end of December 2018 MCO had undertaken cumulative, rehabilitation activities over more than 200ha of the completed areas of overburden emplacement. In addition, interim/temporary rehabilitation in the form of landscaping and planting has been completed around the main offices, environmental bunds and entry to the operational areas. External batters on dam walls and rail loop embankments have also been temporarily rehabilitated.

During the reporting period MCO continued to undertake monitoring and maintenance activities within the existing rehabilitated areas. This included the reseeding of areas with limited cover, placement of mulch, and weed and feral animal control activities.

The mining and rehabilitation status is presented in **Table 29**. The land preparation activities undertaken in the period and proposed areas in the next period are discussed in **Section 9.5** and **Section 9.6** and 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**.

**Table 29: Mining and Rehabilitation Status**

Mine Area Type	Previous Reporting Period (2017)	This Reporting Period (2018)	Next Reporting Period (2019)
Total Mine Footprint	1,351	1,379	1,507
Total Active Disturbance	1,018	1,036	1,113
Land being Prepared for Rehabilitation	57	88	45
Land under active Rehabilitation	226	255	349
Completed Rehabilitation	0	0	0

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## 9.2 VEGETATION CLEARANCE AND TOPSOIL STRIPPING

Vegetation clearance was undertaken in accordance with the Vegetation Clearance Protocol 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 salvaged was either mulched or retained for use as habitat features within rehabilitation areas.

## 9.3 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 2018 MCO's seed bank contained 216,088 grams of native seed for use in rehabilitation activities across the MCC.

## 9.4 REHABILITATION MONITORING

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

### 9.4.1 ECOSYSTEM FUNCTION ANALYSIS

#### Landscape Function Analysis

LFA assessment allows for the calculation of a Landscape Organisation Index (LO), reflecting the proportion of a transect occupied by patches. Patches are defined by soil surface elements, such as perennial ground cover, litter, logs or rocks that help retain soil and other resources at a site. A higher LO index implies a more stable transect that is less prone to erosion and resource loss.

LO ranged from 0.5 (site R4) to 1.0 (site R10 & R17), with the average LO across all rehabilitation sites being 0.8. This contrasts to an LO range of 0.834 and 0.996 for analogue sites (average LO 0.931) (**Figure 12**) Litter (62.9%) and bare soil (22.1%) were the dominant inter-patch/patch types across the rehabilitation sites.

Analogue sites were dominated by litter (41.3%) and ground cover (40.7%). Box Gum Shrubby Woodland analogue sites (A1a, A1b and A1c) had less than 5% bare soil, with the LO dominated by ground cover (65.4%). The Sedimentary Ironbark Forest analogue sites (A5a and A5b) were dominated by litter (58.2%), with bare soil ranging from 5.1% to 16.6%. While there is a trend of decreasing bare soil at the majority of monitoring sites, at this stage bare soil is much higher at the rehabilitation sites compared to target Box Gum Shrubby Woodland analogues.

Trees/shrubs, and microhabitat features such as logs and rocks, continue to contribute to a limited proportion of the rehabilitation landscape. The average contribution of each of these patch types was consistently less than 1%. Cryptogams were only present within one rehabilitation site (R10 – 27.4%) while they constituted between 3.8% and 22.8% of the total landscape in sites A5a and A5b respectively. This result is to be expected considering the long period of time that is required for these features to establish. Monitoring sites are presented in **Appendix 2**.

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Figure 12: Landscape Organisation for each LFA transect, spring 2018 (analogues: spring 2014)

**Floristic Monitoring**

During autumn 2018, all Box Gum Woodland rehabilitation floristic plots exhibited a higher number of native species than exotic. Native species richness ranged from 13 to 30 species, with exotic species richness ranging from 0 to 9 species. During spring 2018, native species richness ranged from 23 to 31 species, with exotic species richness ranging from two to six species (Figure 13). Species richness decreased in some monitoring and analogue sites. Species richness has generally increased over the recent years with some variations relating to seasonal conditions.

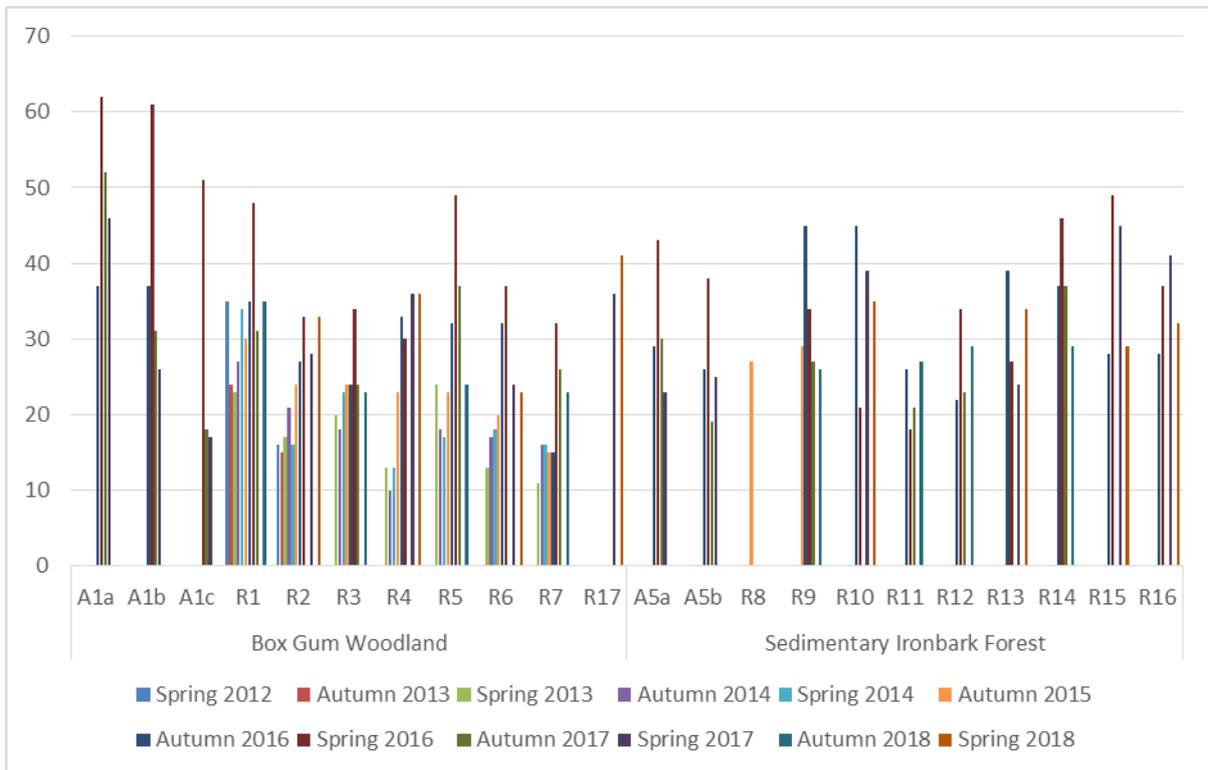


Figure 13: Species Richness (autumn 2013 – spring 2018)

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### Vegetation Structure and Growth

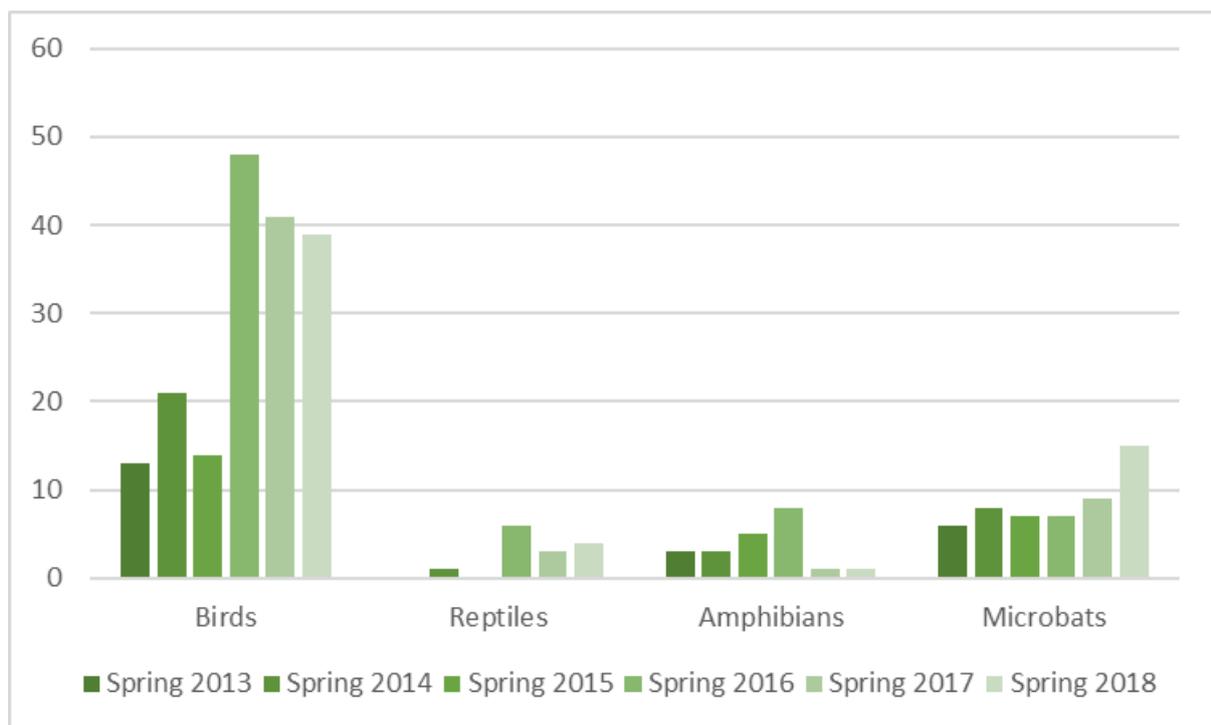
At both the Box Gum Woodland and Sedimentary Ironbark Forest sites, the lowest height of the upper strata continues to be less than that seen at their respective analogue sites. This trend is consistent with the age of the rehabilitation. The minimum heights of the upper strata has generally shown an increase demonstrating that these species are continuing to establish within the rehabilitation area. As with spring 2017, spring 2018 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). Eucalypts (*E. punctata* and *Eucalyptus spp.*) were recorded in the upper and mid-storey of seven of the eight Box Gum Shrubby Woodland rehabilitation sites and five of the eight sites within the Sedimentary Ironbark Rehabilitation area.

### Fauna Monitoring

A total of 58 native and one exotic fauna species were recorded during spring 2018, including four threatened species Spotted Harrier (*Circus assimilis*), *Nyctophilus corbeni* (Corben’s Long-eared Bat), *Chalinolobus dwyeri* (Large-eared Pied Bat) and *Miniopterus orianae oceanensis* (Eastern Bentwing-bat). The increasing species richness trend over the last five years of monitoring is shown in **Figure 14**. A record number of microbat species were recorded at Anabat sites, and bird species richness was well above the historical average for the third year in a row.

Birds were the most abundant class of fauna identified during spring 2018, with 38 native species recorded during the survey. This included 10 species that were not recorded within OC1 during the 2017 monitoring.

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



**Figure 14: Comparison of target fauna species**

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### Visual Monitoring

Weeds (exotic plants excluding cover crop species) during spring 2018 were generally observed as occurrences of individual plants or small patches rather than strong infestations. The Priority Weeds *Eragrostis curvula* (African Lovegrass), *Hypericum perforatum* (St John’s wort) and *Senecio madagascariensis* (Fireweed) were scattered throughout open areas of OC1 where canopy species have not yet established well.

Visual monitoring undertaken during spring 2018 observed isolated areas of moderate erosion particularly on steeper areas.

Noticeable growth of eucalypts was observed throughout areas of the February 2012 rehabilitation area. The association between higher eucalypt densities and microhabitat features such as LWD, or along sheltered gentle gully areas, was similarly observed in a number of other areas throughout the OC1 rehabilitation.

### Assessment of Rehabilitation 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 30** and **Table 31**.

**Table 30: Box Gum Shrubby Woodland rehabilitation assessment**

Objective: Establish native vegetation comparable to Box Gum Shrubby Woodland communities including stands of <i>Allocasuarina</i> spp. Monitoring Sites and Year established	Completion Criteria (by years 5-7)			
	Species composition targets			Vegetation structure targets
	Presence of <b>one to three overstorey</b> species from Box Gum Shrubby Woodland	Presence of at least <b>four native ground cover species</b> that are present at analogue sites	*Presence of <b>stands</b> of <i>Allocasuarina</i> spp.	Indicator species plant densities trending towards plant densities of analogue sites
November 2010 R1	Yes	Yes	Yes	Whilst overstorey species from the Box Gum Woodland communities are present, the current structure lacks a <i>Eucalyptus</i> canopy, upper layer is <i>Acacia</i> spp. dominated, and native groundcover is in very low densities.
November 2010 R2	Yes	Yes		
February 2012 R3	Yes	Yes		
February 2012 R4	Yes	Yes		
February 2012 R5	Yes	Yes		
February 2012 R6	Yes	No		
February 2012 R7	Yes	No		
December 2014 R17	Yes	Yes		

\*Stands of *Allocasuarina* spp. are only required to be present with in the rehab area not within each monitoring site

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**Table 31: 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 <b>two to three overstorey</b> species from Sedimentary Ironbark Forest	Presence of at least <b>four native ground cover species</b> that are present at analogue sites	*Presence of <b>stands</b> of <i>Allocasuarina</i> spp.	Indicator species plant densities trending towards plant densities of analogue sites
Monitoring Sites and Year established				
February 2013 R9	Yes	Yes	Yes	Whilst overstorey species from the Sedimentary ironbark communities are present, the current structure lacks a <i>Eucalyptus</i> canopy, upper layer is <i>Acacia</i> spp. dominated, and native groundcover is in very low densities.
March 2012 R10	Yes	Yes		
March 2012 R11	No	Yes		
March 2012 R12	No	Yes		
November 2012 R13	Yes	Yes		
November 2012 R14	Yes	Yes		
March 2012 R15	No	Yes		
November 2012 R16	Yes	Yes		

\*Stands of *Allocasuarina* spp. are only required to be present with in the rehab area not within each monitoring site

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## 9.5 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 included:

### Decommissioning

There were no decommissioning activities undertaken at MCO.

### Landform Establishment

62ha in OC2 and OC4 had reshaping completed to final landform. Final landforms 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

27ha in OC2 and OC4 had topsoil applied. Growth medium was managed and applied to the relevant completion criteria including:

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

### Ecosystem and Landuse Establishment

255ha of rehabilitation in the ecosystem and landuse establishment phase located in OC1, OC2 and OC4 were maintained and further enhanced.

## 9.6 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 supplementary seeding.

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## 10.0 COMMUNITY

### 10.1 COMMUNITY ENGAGEMENT

During 2018, 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 – Gulgong, Ulan and Lue Public Schools, Mudgee Playgroup, Gulgong Little Athletics, Watershed Landcare, Mudgee and Gulgong Chamber of Commerce, Mudgee Rotary, Mudgee Lions Club, Rylstone Street Feast and Sculptures in the Garden. MCO also supported the Queensland University of Technology’s Cancer and Ageing Research Program (CARP), Kanandah Retirement Mudgee, Lifeskills Plus, and continued its sponsorship of the Moolarben Celebrity Golf Classic with all proceeds going to the local community. In total, MCO provided **\$309,500** in community donations during 2018 to 40 community groups and events through its Community Support Program and other programs (**Appendix 6**).

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

- Mine tour/career talks with each of the local High Schools and TAFE students (Skills4Trade)
- Mudgee District High Schools ‘Try-A-Trade’;
- Vocational student placement from Wollongong University;
- Work experience for 2 students in Mining Engineering and Maintenance;
- Careers Expo at Gulgong High School;
- Careers information evening for 2018 apprentices;
- Spirit Awards ceremony for 2017 overall winner (held in March);
- Active participation in Wild Dog Groups and the LLS; and
- Direct engagement with nearby landholders.

Moolarben continued to provide the community with information on its website ([www.moolarbencoal.com.au](http://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 reviews.

MCO continued to operate a free-call 24-hour Environment and Community Complaints Hotline (1800 556 484) during the reporting period to allow the community to contact the operation directly to ask questions or raise concerns about mining activities.

### 10.2 COMMUNITY COMPLAINTS

MCO maintains a 24-hour Environment and Community Complaints Hotline (1800 556 484). This Hotline is available in order to receive any complaints from neighbouring residents or interested stakeholders. Details for the Hotline are available on the MCO website and in 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).

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During 2018, a total of 65 complaints were received in relation to MCO Operations by 16 complainants. All complaints are investigated and included in the complaints register on the Moolarben Coal website ([www.moolarbencoal.com.au](http://www.moolarbencoal.com.au)). 45% of complaints were received by two complainants. Noise remained the primary issue of concern (83% of complaints), followed by blasting; vibration and overpressure (15%) (Figure 15).

A comparison of complaints to previous years is presented in Table 32. There has been a decrease in noise complaints during the period and continues the trend since 2015. A register of complaints is provided in Appendix 5.

The ongoing use of Mining and Production Environmental Assistants continues to provide real-time feedback to the mining operation and to inform proactive and reactive responses. Ongoing community and stakeholder liaison and consultation has continued.

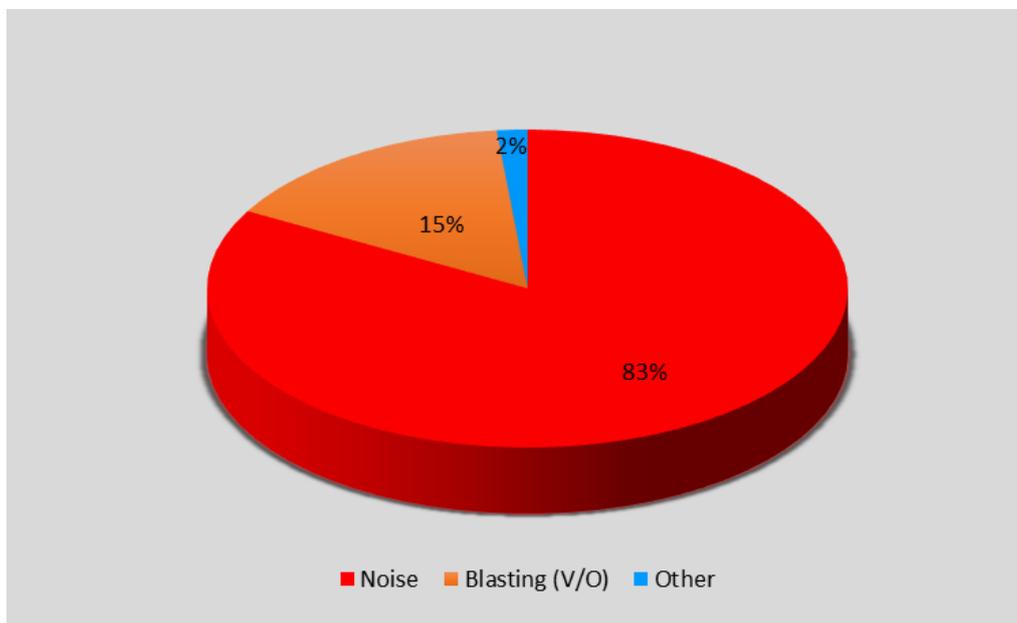


Figure 15 : Community Complaints 2018 – Breakdown by Type

Table 32: Comparison of Community Complaints

Reporting Period	Noise	Blast	Air	Water	Other	Total
2013 - 2014	239	12	2	0	3	256
2015	274	6	2	0	4	286
2016	157	7	2	0	1	167
2017	108	3	1	2	1	115
2018	54	10	0	0	1	65

### 10.3 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 2018 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

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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 2018 are presented in **Table 33**. MCO conducted four CCC meetings during the reporting period with summaries provided in **Table 34**. Meetings were chaired by an independent chairperson with the minutes being available on the MCO website.

**Table 33: CCC Members 2018**

Name	Representing	Name	Representing
Aleshia Lonsdale	Mudgee Local Aboriginal Land Council	Helen Ungaro	Ulan Public School and Local Landholder.
Andrew Palmer	Mudgee Chamber of Commerce	David Stokes	Local resident
Julia Imrie	Local Landholder and Business Owner	John O'Neil	Councillor, Mid-Western Regional Council
Bev Smiles	Mudgee District Environment Group	Ms Lisa Andrews	DP&E endorsed Independent Chair.

**Table 34: CCC Meeting Summary**

Date	Meeting Summary
13 March	General update on community interaction, operations and exploration, environmental monitoring, community complaints, rehabilitation, biodiversity offset management, and employment. Update on the Open Cut Optimisation Modification.
12 June	General update on community interaction, operations and exploration, environmental monitoring, community complaints, rehabilitation, biodiversity offset management and employment. Update on the Open Cut Optimisation Modification. Presentation of 2017 Annual Review.
11 September	General update on community interaction, operations and exploration, environmental monitoring, community complaints, biodiversity offset management, and employment. Update on the Open Cut Optimisation Modification.
27 November	General update on community interaction, operations, exploration, environmental monitoring, community complaints, rehabilitation, biodiversity offset management and employment update. Update on the Open Cut Optimisation Modification.

#### 10.4 ULAN ROAD STRATEGY

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.

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. The current status is:

- 10 properties with works completed;
- 3 properties have agreements in place for works to be completed;
- 1 properties with agreement in principle;
- 1 property where owners have declined mitigation works;

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- 2 properties on review are outside the mitigation zone; and
- 1 property recently requested mitigation works - property to be assessed.

## 11.0 INDEPENDENT AUDIT

During the reporting period 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 pitt&sherry during October 2018. In general, operational environmental management activities observed during the site inspection were being carried out in a competent manner, with the non-compliances identified by the Auditors being the exception.

Non-compliances identified included:

- Overpressure exceedance.
- CHPP Stockpile.
- Non-continuous environmental monitoring (power and communications).
- Regent Honey Eater Credits calculations issued Feb 2016. No response from OEHL.
- Bore notifications not issued within 2 months timeframe.
- Waste reporting included in 2017 Annual Review but not 2016 Annual Review.
- Offset covenants not finalised. Covenants being reviewed by DPE since September.
- Stage 2 Biodiversity Offset Management Plan not approved.

**Table 35: IEA Recommendations and Observations**

IEA Reference	Recommendation	Status
<b>Non-Compliances</b>		
PA 05_0117 Sch. 2 Con 2 and PA 08_0135 Sch. 2 Con 2	There is no further recommendation: MCO investigated the causes of the overpressure exceedances and implemented remedial measures as required.  The CHPP stockpile has been included in the Stage 1 Modification 14 and Stage 2 Modification 3 application.	Overpressure action complete.  Stockpile pending Stage 1 Mod 14 approval.
PA 05_0117 Sch. 3 Con 64 (c) and PA 08_0135 Sch. 3 Con 52 (c)	Whilst the requirement for PA05_0117 Schedule 3 Condition 64 (c) and PA08_0135 Schedule 3 Condition 52 (c) was not met in the 2016 report MCO have since included this waste minimisation and management reporting in their Annual Reviews. As such there are no recommendations.	Complete
PA 08_0135 Sch. 3 Con 9	There is no further recommendation: MCO investigated the causes of the overpressure exceedances and implemented remedial measures as required.	Complete
PA 08_0135 Sch. 3 Con 32	There are no recommendations	Complete. Monitors Upgraded.
PA 08_0135 Sch. 3 Con 35	Contact OEHL to confirm that they are satisfied with the calculation of species credits for the Regent Honeyeater.	Complete.
EPL No. 12932 Con L6.3	There is no further recommendation: MCO investigated the causes of the overpressure exceedances and implemented remedial measures as required.	Complete

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IEA Reference	Recommendation	Status
EPL No. 12932 Con M2.1	An observation is noted due to recurring non-compliance. It is recommended that the power issues are permanently resolved so that the temporary sampler is not relied upon.	Complete. Monitors on mains power.
EPL No. 12932 Con M2.2	An observation is noted due to recurring non-compliance. It is recommended that the power issues are permanently resolved so that the temporary sampler is not relied upon.	Complete. Monitors on mains power.
EPBC Approval (2008/4444) Con 03	MCO to continue to consult with DotEE to resolve this issue and document these efforts.	A complex wide Biodiversity Offset Management Plan was submitted by MCO to the DotEE for consultation in November 2018.  MCO will continue to consult with DotEE to finalise the Biodiversity Offset Management Plan.
EPBC Approval (2008/4444) Con 04	MCO to continue to consult with DotEE to resolve this issue and document these efforts.	MCO continue to liaise with the DPE to finalise offsets securities and update DotEE.
ML1605 Con 3	Update the MOP following approval of the stockpile location.	Pending approval of Stage 1 Mod 14.
Water Licence (WAL39799- (20BL172002)) Con 09	Ensure that bore notifications are sent to DPI within the prescribed period.	Complete.
<b>Observations</b>		
PA 05_0117 Sch. 3 Con 36 (d) and (f)	Ensure that the updated plan covers all requirements of this Condition and seek approval of DP&E of the updated plan.  As part of the approved BioMP staged preparation ensure that the next revision of the plan either addresses the risks directly or references the relevant section(s) of the Land Management Plan.	To be submitted within 3 months of finalising of long-term security of offsets.
PA 05_0117 Sch. 5 Con 5 and PA 08_0135 Sch. 6 Con 5	There are no recommendations (as the recent revision of the EMS as closed out this issue)	Complete
ML1691 Condition 5	There are no recommendations	Complete
NRAR	Ensure that a comparison is made against modelled results in all future Annual Reviews.	Complete in 2017 Annual Review.

A copy of the IEA including the Audi findings can be found on MCO's Website ([www.moolarbecoal.com.au](http://www.moolarbecoal.com.au))

The next Independent Audit will be required by December 2021.

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## 12.0 INCIDENTS & NON-COMPLIANCES

Minor administrative non-compliances during the reporting period included

- Non-continuous monitoring of TEOMs due to power supply interruption and routine maintenance.
- As at 31 December 2018, MCO had sufficient water source entitlements under both the RPS Model and the OC3 Null Model. Following the August 2018 issue of the OC3 Null Model and then annual review process verification MCO became aware there was an administrative non-compliance because MCO had not held sufficient entitlements for the Upper Goulburn River Water Source between January to July 2018. This was remedied in August 2018 with the purchase of additional entitlements. During the reporting period MCO failed to log details of production water bores drilled under licence WAL39799 within the prescribed time frame. The details of the bore were provided to the Department, MCO will provide notifications to the DPI within 2 months of construction of new production bores.

A stockpile of surplus material from construction was created within an approved disturbance area during the 2017 reporting period. The stockpile material was assessed to have been stockpiled in a location contrary to the Environmental Assessment and Project Approvals (Condition 2 of schedule 2 of PA 05\_0117 and Condition 2 Schedule 2 of PA 08\_0135). DPE issued a Penalty Notice and Order to remedy the breach and DRG issued a Caution and Direction in the 2017 Reporting period. MCO has included the stockpile as part of Stage 1 Mod 14, which is currently being assessed by the DPE and Independent Planning Commission.

No prosecution proceedings were undertaken by any regulatory agency during the period.

A hydrocarbon incident occurred on 19 July 2018 with approximately 2,400l of oil leaking from an oil tank due to a failed gasket at the OC1 Fuel farm. The spill was contained and disposed of by a licenced waste contractor.

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### 13.0 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 and revision of Biodiversity Management Plans.
- Progress approvals of CHPP stockpile and include in the Mining Operations Plan.
- Continue to progress offset security instruments.
- Continue baseline monitoring of PZ201, 202, 203, 211, 213 and 214 to develop SWL, pH and electrical conductivity triggers.
- Continued progressive rehabilitation.
- Establish baseline monitoring sites for LW103 where not already in place.

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