
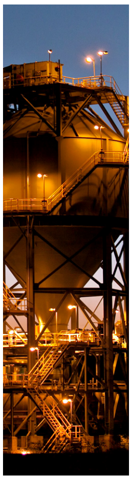
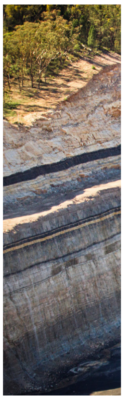
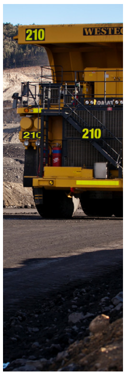

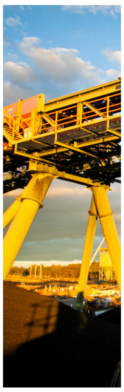

MOOLARBENCOAL

Moolarben Coal Complex
UG4 Ancillary Works Modification

Modification Report

APPENDIX F

AIR QUALITY REVIEW

YANCOAL
兖煤澳大利亚有限公司

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23 September 2019

Michael Moore
Manager – Environmental Standards
Yancoal Australia Ltd

RE: Air Quality Review for Moolarben Coal Complex Stage 1 – UG4 Ancillary Works Modification

Dear Michael,

Todoroski Air Sciences has assessed the potential for air quality impacts associated with a proposed modification to the Moolarben Coal Complex Stage 1 Project Approval (05_0117) – UG4 Ancillary Works Modification (hereafter referred to as the Modification).

This report investigates the potential for dust impacts to arise due to dust emissions associated with the construction and operation of the Modification relative to the approved Moolarben Coal Complex.

The report has been prepared with consideration of the New South Wales (NSW) Environment Protection Authority (EPA) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2017**).

Approved operations at Moolarben Coal Complex

The Moolarben Coal Complex (MCC) is located in the Western Coalfields of New South Wales (NSW), approximately 40 kilometres (km) north of Mudgee. It is bordered by the Goulburn River to the northwest, Goulburn River National Park to the northeast and Munghorn Gap Nature Reserve to the south. The Ulan Coal Mine is located to the northwest and Wilpinjong Coal Mine is located to the east. Ulan settlement and Cooks Gap are located to the west and southwest, respectively.

Mining operations at the MCC are approved until 31 December 2038 and are carried out in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) and Project Approval (08_0135) (Moolarben Coal Project Stage 2).

The MCC operates two stages, Stage 1 and Stage 2 concurrently with a total run-of-mine (ROM) coal extracted (open cut and underground mining) limited to 24 million tonnes in any calendar year. Stage 1 comprises 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 has commenced and at full development will comprise one open cut mine (OC4), two longwall underground mines (UG1 and UG2), and mining related infrastructure.

Project Approval criteria

Project Approval (05_0117) provides air quality performance criteria for Stage 1 of the Moolarben Coal Complex.

Condition 17, Schedule 3 of the Project Approval (05_0117) requires that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the Moolarben Coal Complex do not cause an exceedance of the criteria presented in **Table 1**, **Table 2** and **Table 3**, at any residence on privately owned land.

Table 1: Long term impact assessment criteria for particulate matter

Pollutant	Averaging period	[d] Criterion
TSP	Annual	[a] 90µg/m³
PM_{10}	Annual	[a,d] 25µg/m³
$PM_{2.5}$	Annual	[a,d] 8µg/m³

Source: Table 5 of Project Approval (05_0117)

Table 2: Short term impact assessment criterion for particulate matter

Pollutant	Averaging period	[d] Criterion
PM_{10}	24 hour	[a] 50µg/m³
$PM_{2.5}$	24 hour	[b] 25µg/m³

Source: Table 6 of Project Approval (05_0117)

Table 3: Long term impact assessment criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[c] Deposited dust	Annual	[b] 2 g/m²/month	[a] 4g/m²/month

Source: Table 7 of Project Approval (05_0117)

[a] *Cumulative (i.e. incremental increase in concentrations due to the Moolarben Mine Complex plus background concentrations due to all other sources);*
[b] *Incremental impact (i.e. incremental increase in concentrations due to the Moolarben Mine Complex on its own) with up to 5 allowable exceedances over the life of the project;*
[c] *Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580,10,1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method; and*
[d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents, illegal activities or any other activity agreed by the Secretary.*

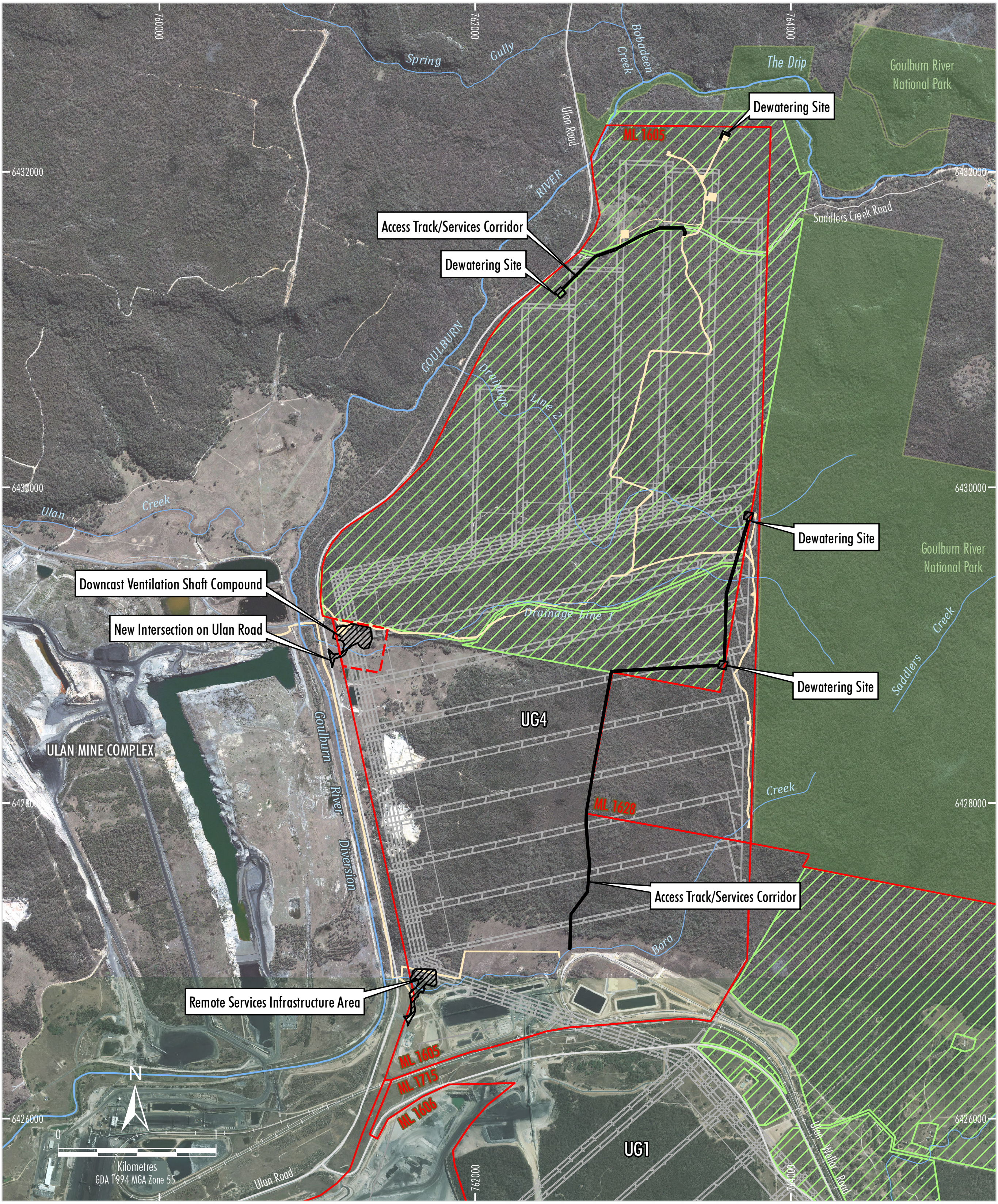
Modification description

The key features associated with the Modification include:

- Development of four additional dewatering bore sites and pads and extension of the associated access and infrastructure corridor for the UG4 underground workings and associated infrastructure;
- Development of a downcast ventilation shaft for UG4 and associated infrastructure; and
- Development of Remote Services Infrastructure Area.

The Modification would not change the longwall panel layout, panel widths, extraction height, panel sequence, production limits or the distance between longwalls and The Drip and Corner Gorge.

Figure 1 presents the indicative surface infrastructure layout for the Modification.



MCM-16-15_MOD15 UG4 AWMod_AQ_201A

LEGEND

Mining Lease Boundary
Mining Lease Application Boundary
Existing Biodiversity Offset Area
Existing/Approved Development
Underground Longwall Layout
Pipeline and Borefield Infrastructure
UG4 Ancillary Works Modification
Indicative Surface Infrastructure Area

Source: MCO (2019); NSW Department of Planning, Industry and Environment (2019)
Orthophoto Mosaic: MCO (April 2016 - May 2012)

MOOLARBENCOAL

MOOLARBEN COAL COMPLEX

Indicative Layout for the Modification

Figure 1

Existing environmental conditions

This section describes the existing environment including the climate and ambient air quality in the general area surrounding the MCC.

Local climate

Long-term climatic data from the Bureau of Meteorology (BoM) weather station at Gulgong Post Office (Site No. 062013) were analysed to characterise the local climate in the proximity of the MCC. The Gulgong Post Office weather station is located approximately 25km southwest of the MCC.

Table 4 and **Figure 2** present a summary of data from the Gulgong Post Office collected over an approximate 23 to 138-year period for the various meteorological parameters.

The data indicates that on average January is the hottest month with a mean maximum temperature of 31.3 degrees Celsius (°C) and July is the coldest month with a mean minimum temperature of 2.6°C.

Rainfall peaks during the summer months and declines during the winter months, with an annual average rainfall of 650.5 millimetres (mm) over 62.9 days. The data show January is the wettest month with an average rainfall of 70.5mm over 5.2 days and April is the driest month with an average rainfall of 43.7mm over 3.9 days.

Relative humidity levels exhibit variability over the day and seasonal fluctuations. Mean 9am relative humidity levels range from 61 percent (%) in October to 84% in June and July. Mean 3pm relative humidity levels vary from 36% in December to 57% in June.

The mean 9am wind speeds range from 4.4 kilometres per hour (km/h) in June to 9.1 km/h in October and November. The mean 3pm wind speeds vary from 7.8 km/h in April to 11.7 km/h in August.

Table 4: Monthly climate statistics summary – Gulgong Post Office

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temp. (°C)	31.3	30.0	27.5	23.5	19.1	15.5	14.8	16.5	19.8	23.7	26.8	29.8	23.2
Mean min. temp. (°C)	16.9	16.4	13.8	9.9	6.3	3.7	2.6	3.4	6.0	9.3	12.3	15.0	9.6
Rainfall													
Rainfall (mm)	70.5	60.9	54.9	43.7	44.9	50.8	48.8	45.8	47.0	55.6	60.0	67.3	650.5
No. of rain days (≥1mm)	5.2	4.8	4.6	3.9	4.7	6.0	6.1	5.7	5.2	5.7	5.5	5.5	62.9
9am conditions													
Mean temp. (°C)	21.7	20.6	18.9	15.8	11.3	7.7	6.7	8.5	12.6	16.5	18.3	20.8	15.0
Mean R.H. (%)	64	71	71	70	79	84	84	76	70	61	63	62	71
Mean W.S. (km/h)	8.2	6.7	6.2	5.9	5.0	4.4	4.9	6.1	7.7	9.1	9.1	8.9	6.9
3pm conditions													
Mean temp. (°C)	29.5	28.4	26.2	22.3	18.0	14.3	13.5	15.3	18.5	22.1	25.1	28.2	21.8
Mean R.H. (%)	37	42	41	42	49	57	54	46	44	40	39	36	44
Mean W.S. (km/h)	9.6	8.5	7.9	7.8	9.0	8.8	9.9	11.7	11.4	11.5	11.4	11.2	9.9

Source: **BoM, 2019 (accessed 7 March 2019)**

W.S. = wind speed R.H. = relative humidity

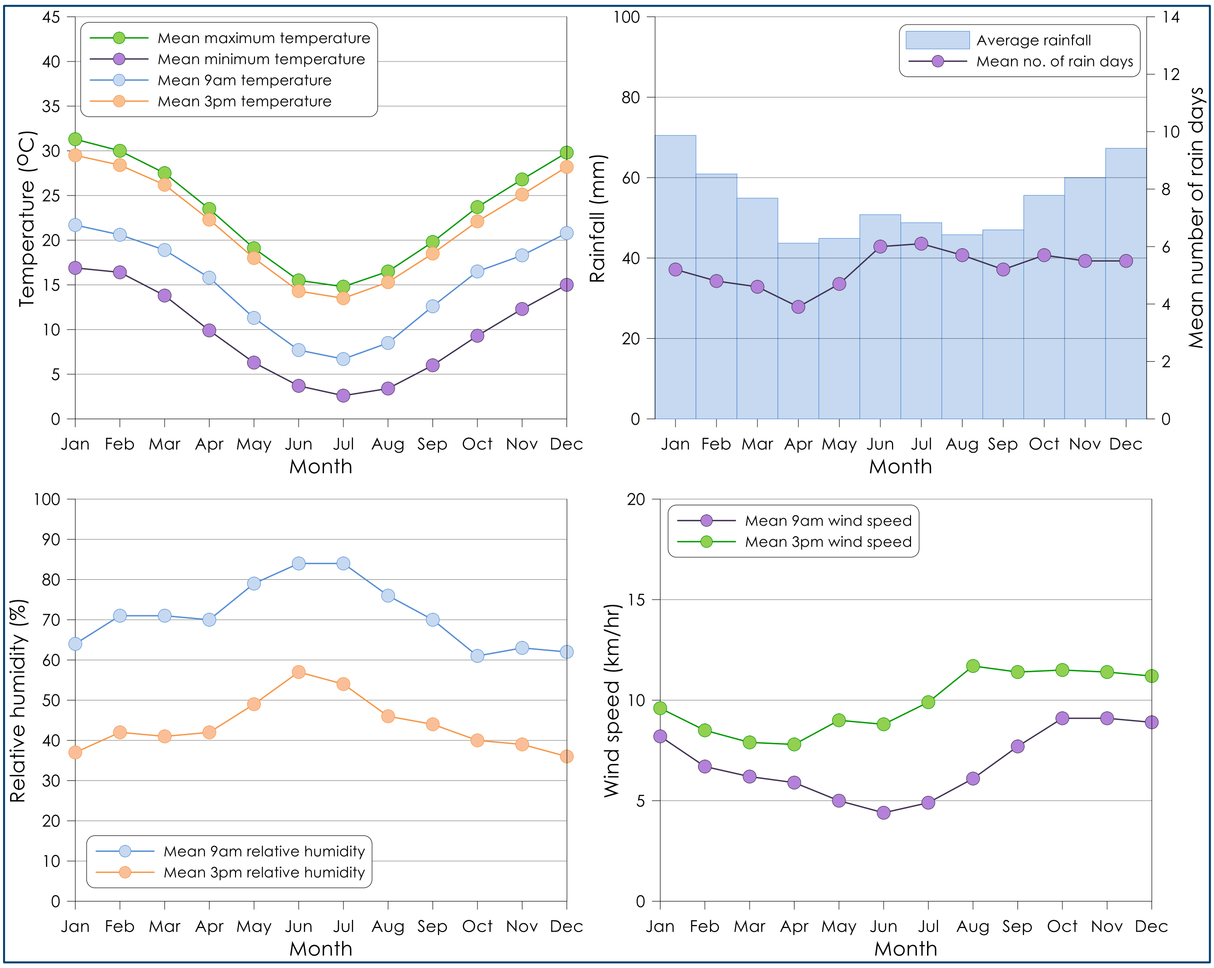


Figure 2: Monthly climate statistics summary – Gulgong Post Office

Local meteorological conditions

MCC operates a 10 metre (m) weather station (WS3) to assist with the environmental management of site operations. Meteorological data from the WS3 weather station collected for the 2017 and 2018 calendar years are reviewed. Annual and seasonal windroses prepared from the data collected are presented in **Figure 3** and **Figure 4**.

Analysis of the 2017 and 2018 annual windroses shows the most common winds are from the east-northeast and the south-southwest, with a lesser portion of winds coming from the south, southwest, west-southwest, northeast and east sectors. Few winds originate from the northwest and southeast quadrants.

During summer, winds are predominantly from the east-northeast sector. The autumn wind distribution is similar to the annual pattern and shows overall fewer winds and lower wind speeds. The winter distribution is dominated by winds from the southwest quadrant. The spring wind distribution is similar to the annual pattern but with a greater portion of winds coming from the southwest sector.

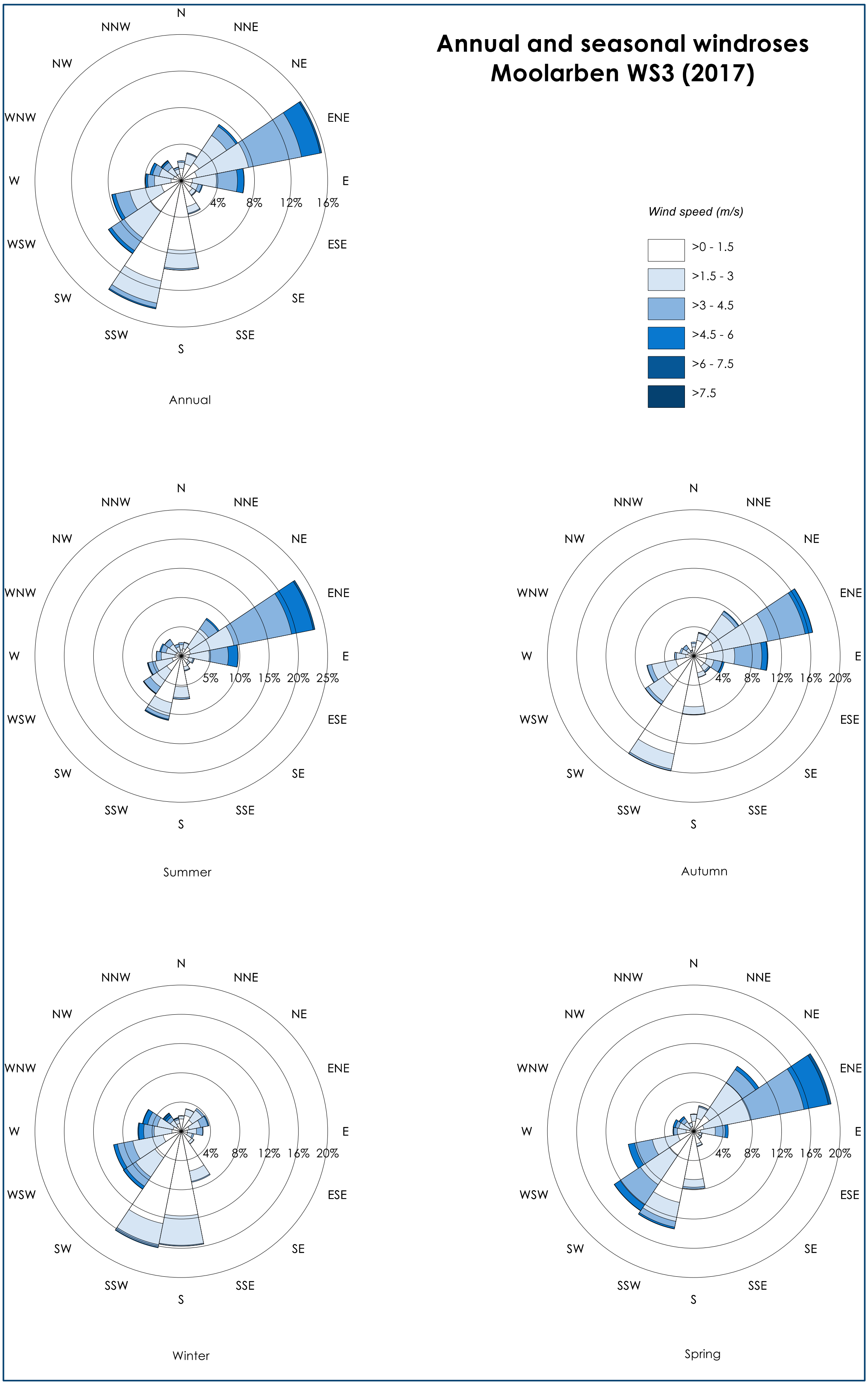


Figure 3: Annual and seasonal windroses – Moolarben WS3 (2017)

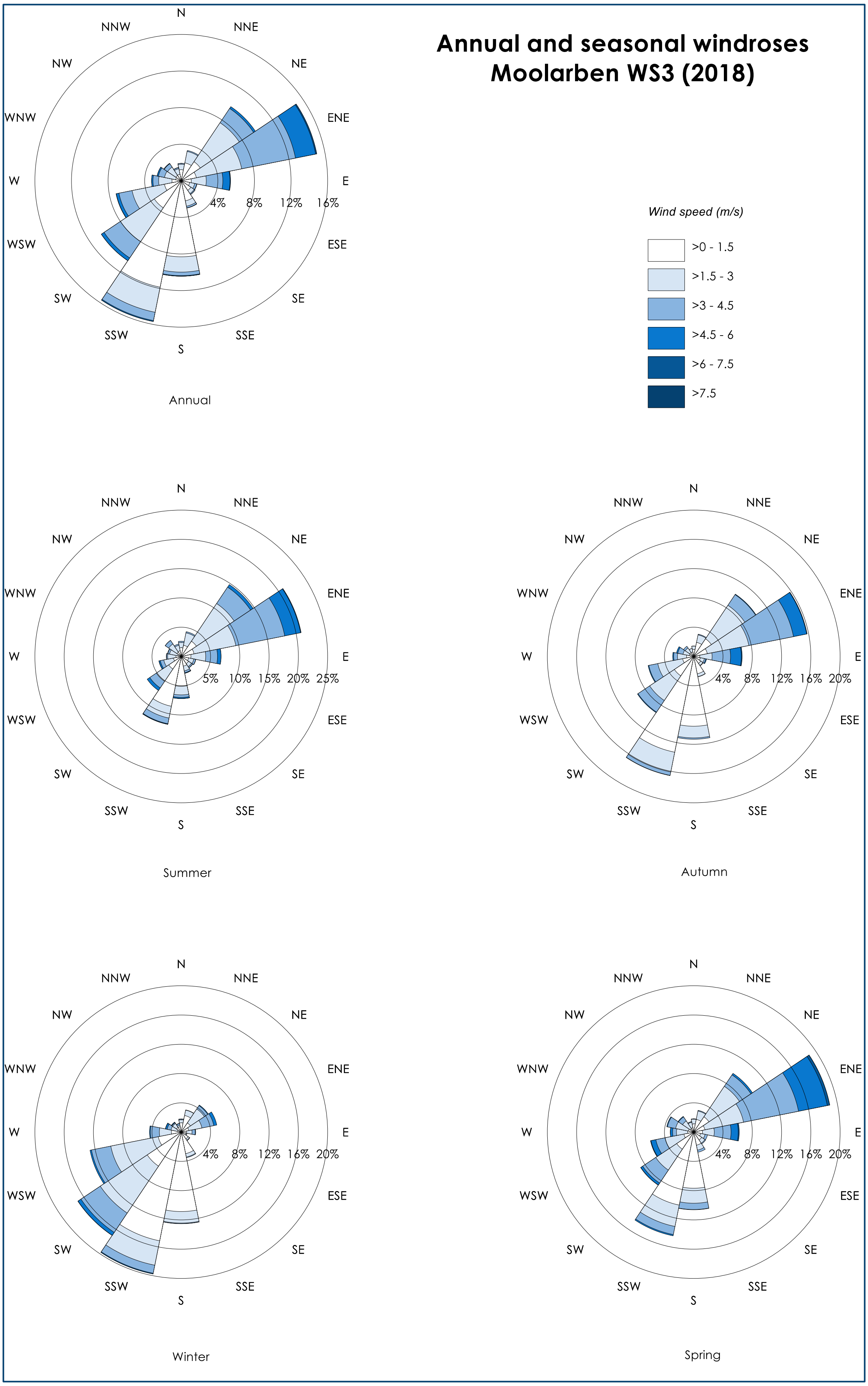


Figure 4: Annual and seasonal windroses – Moolarben WS3 (2018)

Local air quality conditions

The main sources of particulate matter in the wider area include active mining, quarrying, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, and various other commercial, industrial and rural activities.

This section reviews the ambient monitoring data collected from a number of ambient monitoring locations in the vicinity of the MCC. The monitoring data reviewed in this assessment include data collected at four Tapered Element Oscillating Microbalances (TEOMs) measuring PM_{10}, two High Volume Air Samplers (HVAS) measuring PM_{10} and 13 dust deposition gauges measuring dust fallout.

Figure 5 shows the approximate location of each of the monitoring stations reviewed in this assessment.

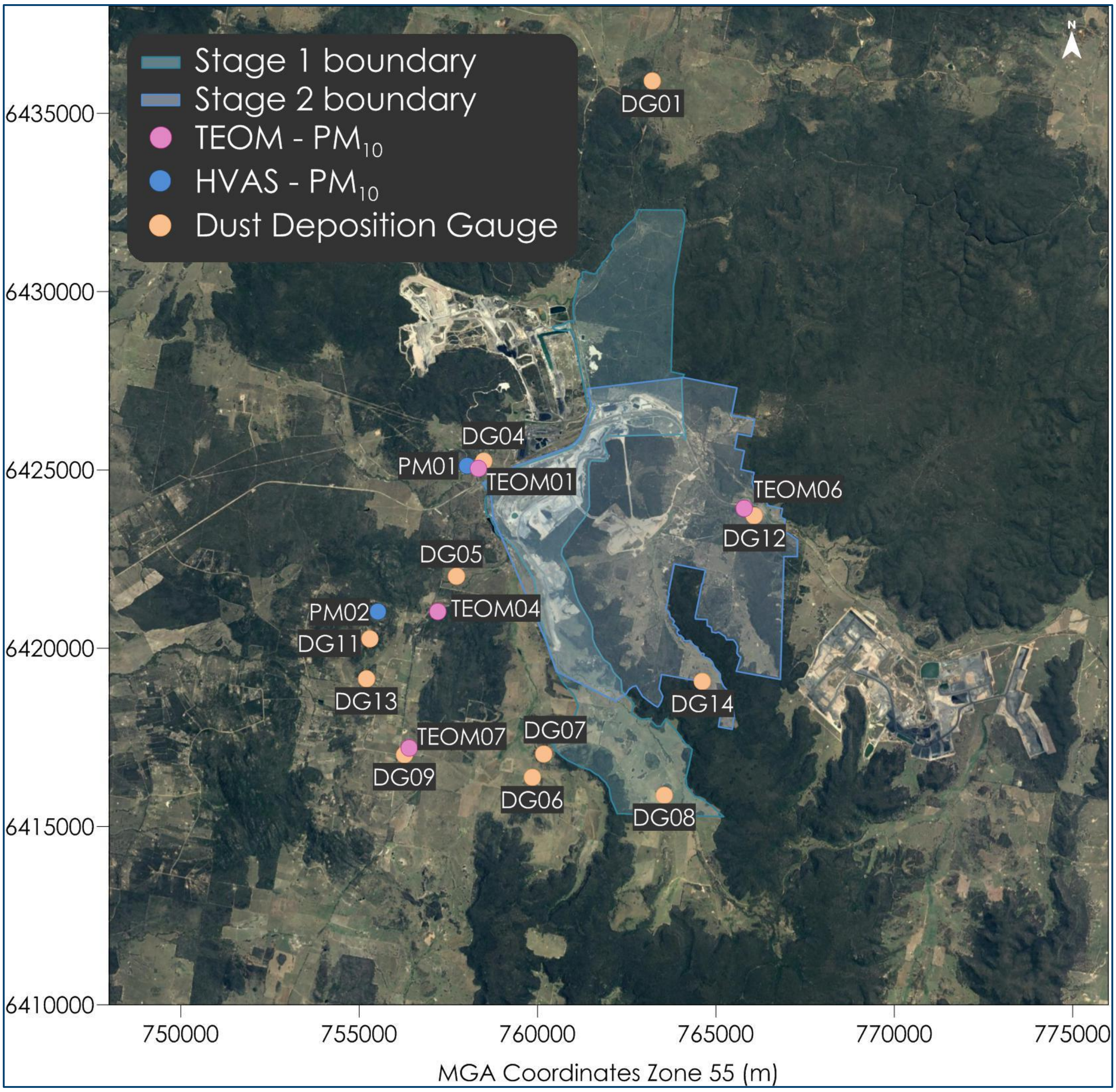


Figure 5: Monitoring locations

TEOM monitoring

A summary of the available ambient TEOM PM_{10} monitoring data is presented in **Table 5**. Recorded 24-hour average PM_{10} concentrations are presented in **Figure 6**.

The monitoring data in **Table 5** include all emission sources in the general vicinity of the MCC. Where TEOM datasets are less than 75% complete for the annual period, they have not been included in the annual average analysis. The annual average PM_{10} concentrations for the monitoring stations were below the criterion of 25µg/m³ for the review period.

Table 5: Summary of TEOM PM_{10} levels MCC monitoring stations (µg/m³)

Station ID	2017	2018	2017	2018	Criterion
	Includes extraordinary events*		Excluding extraordinary events		
	Annual average				
TEOM 01	12.3	17.1	12.3	15.1	**25**
TEOM 04	15.2	20.9	15.2	18.7	**25**
TEOM 06	12.5	18.1	12.5	15.7	**25**
TEOM 07	-	18.9	-	16.5	**25**
	Maximum 24-hour average				
TEOM 01	39.5	234.5	39.5	46.6	**50**
TEOM 04	41.3	253.6	41.3	48.9	**50**
TEOM 06	49.5	200.8	49.5	49.5	**50**
TEOM 07	40.6	268.7	40.6	49.1	**50**
	Number of days >50µg/m³				
TEOM 01	0	9	0	0	-
TEOM 04	0	10	0	0	-
TEOM 06	0	12	0	0	-
TEOM 07	0	11	0	0	-

*Data includes extraordinary events where the criteria does not apply, such as bushfires, prescribed burning, dust storms, fire incidents, illegal activities or any other activity agreed by the Secretary.

The maximum 24-hour average PM_{10} concentrations (see **Figure 6**) recorded at the MCC TEOMs above 50µg/m³ in 2018 were not criteria exceedances, as reported in MCO's 2018 Annual Review, as they were caused by extraordinary events where the 24-hour average criterion does not apply.

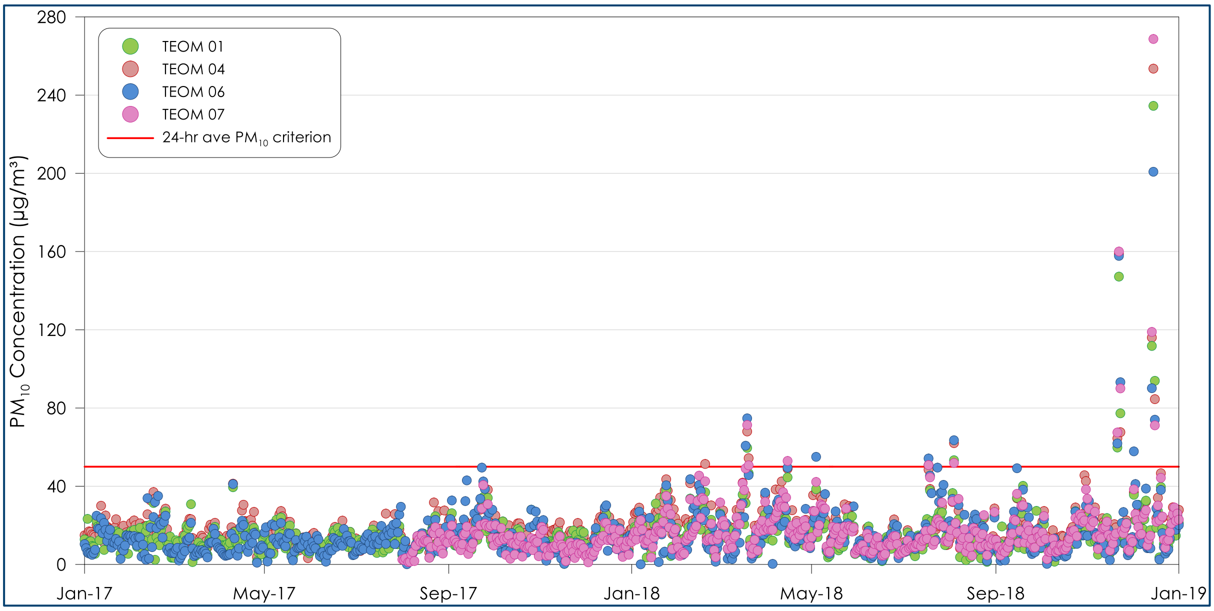


Figure 6: TEOM 24-hour average PM_{10} concentrations at MCC TEOM monitors

HVAS monitoring

A summary of the available HVAS PM_{10} monitoring data collected between January 2017 and December 2018 is shown in **Table 6**. Recorded 24-hour average PM_{10} concentrations are presented in **Figure 7**.

The monitoring data presented in **Table 6** indicate that the annual average PM_{10} concentrations for the monitoring stations are well below the criterion of 25µg/m³. **Figure 7** shows that the recorded 24-hour average PM_{10} concentrations follow a seasonal trend with concentrations nominally highest in the spring and summer months with the warmer weather raising the potential for drier ground elevating windblown dust, pollen levels and the occurrence of bushfires.

Table 6: Summary of annul average HVAS PM_{10} levels (µg/m³)

HVAS Monitor	Annual average		Criterion (1)
	2017	2018	
PM 01	13.9	17.2	**25**
PM 02	14.4	18.4	**25**

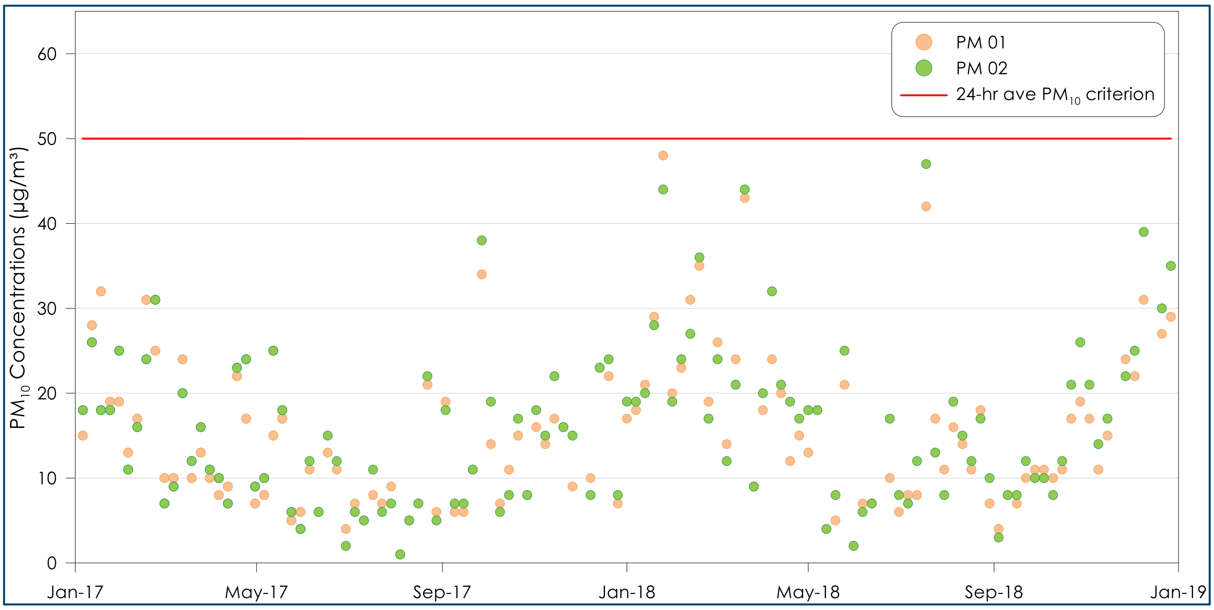


Figure 7: HVAS 24-hour average PM_{10} concentrations

Dust deposition monitoring

Table 7 summarises the annual average dust deposition levels at each gauge during 2017 to 2018.

All gauges recorded an annual average insoluble deposition level below the relevant criterion of 4g/m²/month.

Table 7: Annual average dust deposition (g/m²/month)

Dust gauge	2017	2018	Criterion
DG01	0.6	0.9	**4**
DG04	1.0	1.4	**4**
DG05	1.5	1.8	**4**
DG06	0.7	1.7	**4**
DG07	0.7	1.4	**4**
DG08	0.9	1.7	**4**
DG09	0.9	1.9	**4**

Dust gauge	2017	2018	Criterion
DG11	1.1	1.7	**4**
DG12	1.2	2.1	**4**
DG13	0.7	1.6	**4**
DG14	1.2	1.9	**4**

Assessment of potential air quality impacts

To investigate the potential effect that the Modification may have on dust levels in the surrounding environment, a qualitative analysis was undertaken for the proposed change in dust levels associated with the Modification relative to the dust levels associated with the approved MCC assessed in the *Air Quality Assessment Moolarben Coal Project OC Optimisation Modification* (**Todoroski Air Sciences, 2017**).

Aspects of the Modification that would generate dust emissions include the construction activities for the various infrastructure associated with the underground mining operations. The operational activities are expected to generate minimal dust as they are not inherently dusty sources. Each of these activities are assessed in the following sections.

<u>Potential construction dust emissions</u>

The construction activities associated with the Modification have the potential to generate dust which can affect the quantum of dust emissions generated at the MCC. The construction activities which are required to support the Modification would occur progressively, in parallel with ongoing mining operations and include:

- Construction of dewatering bores, pads and associated infrastructure;
- Construction of ventilation shaft, compound area and associated infrastructure;
- Construction of a Remote Services Infrastructure area; and
- Construction of access tracks and infrastructure corridors.

Additional mobile equipment would be required for short periods during the construction activities. Construction activities would generally be undertaken during daylight hours, 7 days per week, with the exception of the ventilation shaft compound undergoing construction 24 hours per day. The indicative timing for construction activities for each aspect of the Modification is outlined in **Table 8** below.

Table 8: Indicative construction timing

Component	Construction Timing	Overlap
Northern Dewatering Bores	• 7am to 6pm Mon to Sat and 8am to 6pm Sundays and public holidays. • Earthworks construction Monday to Friday. • Drilling 7 days per week. • Earth works and access would take approximately 8 weeks. • Bore construction would take approximately 8 to 12 weeks.	• Construction of northern dewatering bore sites would occur over approximately 3 years after the southern sites.

Component	Construction Timing	Overlap
Southern Dewatering Bores	• 7am to 6pm Mon to Sat and 8am to 6pm Sundays and public holidays. • Earth works and access would take approximately 8 weeks. • Bore construction would take approximately 8 to 12 weeks.	• Construction of southern dewatering bore sites may overlap with the construction of the remote services infrastructure area (during 2021).
Ventilation Shaft Compound	• 24 hours per day. • 7 days per week. • Earth works and access would take approximately 12 weeks. • Construction would take approximately 6 months.	• Construction of the southern dewatering bore sites may overlap with the construction of the downcast ventilation shaft (during 2022-23).
Remote Services Infrastructure Area	• 7am to 6pm Mon to Sat and 8am to 6pm Sundays and public holidays. • Earth works and access would take approximately 12 weeks. • Total construction would take approximately 3 to 4 months.	• Construction of the southern dewatering bore site may overlap with the construction of the remote services infrastructure area (during 2021).

To consider the potential effect of dust emissions associated with the construction activities, the estimated dust emissions are compared with the approved levels of dust for the MCC. The rate of dust emission has been calculated by analysing the primary dust generating activities associated with the Modification which include drilling, the handling of excavated material, vehicle movements and windblown dust generated from exposed areas.

A summary of the total dust emissions from the construction activities of the Modification are presented in **Table 9**. Detailed dust emissions inventories for the construction components are presented in **Appendix A**.

Table 9: Summary of estimated dust emission rate for construction activity associated with the Modification (kg)

Component	Construction Activity	TSP	PM_{10}	$PM_{2.5}$
Dewatering infrastructure	Drilling bores	7	4	0.2
	Loading excavated material to haul truck	-	-	-
	Hauling excavated material to emplacement area - southern sites	186	46	5
	Hauling excavated material to emplacement area - northern sites	139	35	3
	Unloading excavated material at emplacement area	-	-	-
	Wind erosion of exposed areas - bores	1,547	774	116
	Excavating trench for HV cable	22	11	2
	Filling trench for HV cable	22	11	2
	Wind erosion of exposed areas – HV cable	2,644	1,322	198
	Sub-Total emissions	**4,568**	**2,201**	**326**
Ventilation shaft compound	Drilling vent shaft and drop hole	2	1	0.1
	Loading excavated material to haul truck	-	-	-
	Hauling excavated material to emplacement area	2,124	527	53
	Unloading excavated material at emplacement area	-	-	-
	Wind erosion of exposed areas	2,788	1,394	209
	Sub-Total emissions	**4,914**	**1,922**	**262**

Remote Services Infrastructure Area	Drilling service hole	4	2	0.1
	Loading excavated material to haul truck	-	-	-
	Hauling excavated material to emplacement area	52	13	1
	Unloading excavated material at emplacement area	-	-	-
	Wind erosion of exposed areas	1,981	990	149
	Sub-Total emissions	**2,037**	**1,005**	**150**
Total emissions for all construction activities		**11,518**	**5,128**	**738**

kg = kilogram

Note, the unloading of excavated material would result in negligible emissions given the material would be sufficiently moist.

Table 10 presents a comparison of the estimated construction activity dust emissions for the closest mine plan year assessed for the approved MCC (Year 2021) (**Todoroski Air Sciences, 2017**). As the construction activity would occur over a 6-month period, the estimated dust emissions have been prorated to allow for a direct comparison with the estimated dust emissions for the approved MCC.

Table 10: Comparison of estimated TSP emission rate for the construction activity associated with the Modification and approved operations

Scenario	TSP emissions (kg for 6 months)	TSP emissions (kg/yr)	Percent of approved total dust emissions (%)
Modification	11,518	23,037	-
Approved - Year 2021	-	5,236,797	0.42

Table 10 indicates that the total dust generated from the construction activities associated with the Modification would see a potential increase in dust emissions of approximately 0.42% of the approved MCC dust emissions.

This increase in dust emissions is considered minor and would be unlikely to be discernible beyond the existing approved levels of dust in the area surrounding the MCC. Furthermore, the nearest private off-site receptor is located approximately 1.2km from any of the Modification components. Given that the activities would occur for a limited period and the distance of the Modification to the nearest private off-site receptor, no discernible effect at any off-site receptor is predicted to arise as a result of construction activities.

Due to the minor, indiscernible increase in dust emissions and the distance between components of the Modification and the nearest private off-site receptors, a quantitative assessment of the specific changes in air quality at individual receptors due to the Modification was considered unnecessary.

To ensure dust emissions from the construction activities associated with the Modification and the potential for off-site impacts are minimised where possible, MCO would continue to implement the monitoring and management measures in its existing Air Quality Management Plan (**MCO, 2017**). Appropriate operational and physical dust mitigation measures such as maintaining sufficient levels of moisture on the surface of trafficked surfaces, visual inspection of dust plumes and limiting vehicle speeds would continue to be implemented.

Potential operational dust emissions

The potential dust emissions for the operational activities associated with the Modification are considered to be insignificant. The operation of the dewatering bores, the downcast ventilation shaft and Remote Services

Infrastructure are not inherently dusty activities and any dust arising from these sources will be negligible in comparison to the approved operations of the MCC.

It is noted that the Modification does not seek to change the longwall panel layout, panel widths or extraction height, panel sequence, production limits or the distance between longwalls and The Drip and Corner Gorge, and hence the Modification would not affect the approved mining operations of the MCC.

Summary and conclusions

This assessment has examined the likely air quality effects resulting from the Modification.

The assessment estimates that potential dust generated from the construction activities associated with the Modification is of the order of approximately 0.42% of the approved MCC activity. This increase is considered minor and indiscernible with the nearest private off-site receptor located approximately 1.2km from any of the Modification components. Provided that reasonable construction dust controls are implemented and managed, there would be no adverse impacts expected to arise.

The operational activities associated with the Modification would not generate any significant dust emissions and overall, it is reasonable to conclude that the Modification is unlikely to cause any negative discernible impact at any surrounding sensitive receptor locations relative to the approved MCC.

Please feel free to contact us if you would like to clarify any aspect of this report.

Yours faithfully,
Todoroski Air Sciences

Philip Henschke

References

Bureau of Meteorology (2019)

Climate Averages Australia, Bureau of Meteorology website, accessed February 2019. <http://www.bom.gov.au/climate/averages>

NSW Environment Protection Authority (2017)

"Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales", January 2017.

Moolarben Coal Operations Pty Ltd (2017)

"Air Quality Management Plan", prepared by Moolarben Coal Operations Pty Ltd, November 2017.

Todoroski Air Sciences (2017)

"Air Quality Assessment Moolarben Coal Project OC Optimisation Modification", prepared for Moolarben Coal Operations Pty Ltd by Todoroski Air Sciences, October 2017.

Appendix A

Emissions Inventory

Table A-1: Emissions inventory [1]

Activity	TSP emission	PM10 emission	PM25 emission	Intensity	Units	Emission Factor - TSP	Emission Factor - PM10	Emission Factor - PM25	Units	Var. 1	Units	Var. 2	Units	Var. 3 - TSP/PM10 /PM25	Units	Var. 4	Units	Var. 5	Units	Var. 6	Units
Dewatering infrastructure																					
Drilling bores	7	4	0.2	12	holes/yr	0.59	0.31	0.02	kg/hole												
Loading excavated material to haul truck	wet material - no emissions			1,302	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	20	M.C. (%)								
Hauling excavated material to emplacement area - southern sites	186	46	5	651	t/yr	1.713	0.425	0.043	kg/t	10	t/load	8.0	km (returr	1.4/0.4/0.04	kg/VKT	4.2	S.C. (%	15	Ave GMV	75	% contro
Hauling excavated material to emplacement area - northern sites	139	35	3	651	t/yr	1.713	0.425	0.043	kg/t	10	t/load	6.0	km (returr	1.4/0.4/0.04	kg/VKT	4.2	S.C. (%	15	Ave GMV	75	% contro
Unloading excavated material at emplacement area	wet material - no emissions			651	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	20	M.C. (%)								
Wind erosion of exposed areas - bores	1,547	774	116	2	ha	0.10	0.05	0.007	kg/ha/hr	8,760	hrs										
Excavating trench for HV cable	22	11	2	21,148	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	2	M.C. (%)								
Filling trench for HV cable	22	11	2	21,148	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	2	M.C. (%)								
Wind erosion of exposed areas - HV cable	2,644	1,322	198	3	ha	0.10	0.05	0.007	kg/ha/hr	8,760	hrs										
Sub-Total emissions	**4,568**	**2,201**	**326**																		
Ventilation shaft compound																					
Drilling vent shaft and drop hole	2	1	0.1	3	holes/yr	0.59	0.31	0.02	kg/hole												
Loading excavated material to haul truck	wet material - no emissions			4,250	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	20	M.C. (%)								
Hauling excavated material to emplacement area	2,124	527	53	4,250	t/yr	0.277	0.069	0.007	kg/t	10	t/load	14.0	km (returr	1.4/0.4/0.04	kg/VKT	4.2	S.C. (%	15	Ave GMV	75	% contro
Unloading excavated material at emplacement area	wet material - no emissions			4,250	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	20	M.C. (%)								
Wind erosion of exposed areas	2,788	1,394	209	3	ha	0.10	0.05	0.007	kg/ha/hr	8,760	hrs										
Sub-Total emissions	**4,914**	**1,922**	**262**																		
Remote Services Infrastructure Area																					
Drilling service hole	4	2	0.1	7	holes/yr	0.59	0.31	0.02	kg/hole												
Loading excavated material to haul truck	wet material - no emissions			294	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	20	M.C. (%)								
Hauling excavated material to emplacement area	52	13	1	294	t/yr	0.308	0.077	0.008	kg/t	10	t/load	5.0	km (returr	1.4/0.4/0.04	kg/VKT	4.2	S.C. (%	15	Ave GMV	75	% contro
Unloading excavated material at emplacement area	wet material - no emissions			294	t/yr	0.001	0.00050	0.00008	kg/t	0.893	Ave. (WS/	20	M.C. (%)								
Wind erosion of exposed areas	1,981	990	149	2	ha	0.10	0.05	0.007	kg/ha/hr	8,760	hrs										
Sub-Total emissions	**2,037**	**1,005**	**150**																		
Total emissions for all construction activities	**11,518**	**5,128**	**738**																		

[1] The activities associated with the Modification would also include initial site preparation / land clearing, however, this would occur prior to the above activities and are therefore not included in the emissions inventory. The air quality emissions associated with initial site preparation would be smaller than the emissions associated with drilling and the movement of excavated material.