

To: Garry Gough
 From: Kirsten Lawrence
 Date: 6 August 2021
 Subject: Ensham Life of Mine Extension Project
 Air Quality Impact Assessment
 Amendment Report

At: Idemitsu Australia Resources
 At: SLR Consulting Australia Pty Ltd
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This memorandum presents a review of the background air quality data used in the Air Quality Impact assessment (AECOM, 2020) prepared for the Ensham Life of Mine Extension Project (the Project). The main focus of this review was to assess whether the background annual average PM₁₀ concentration assumed in the assessment of 23.5 micrograms per cubic metre (µg/m³) is an appropriate estimate of typical background levels. While the air dispersion modelling results presented in the EIS did not predict any exceedances of ambient air quality criteria at the nearest sensitive receptors, the annual average background PM₁₀ value used in the assessment is high compared to the air quality objective for annual average PM₁₀ levels, and has raised questions regarding the assimilative capacity of the airshed to accommodate additional PM₁₀ concentrations associated with the Project.

1 Background

Air quality monitoring data available from the DES monitoring stations at Blackwater and Moranbah at the time of preparing the assessment were reviewed by AECOM to establish the existing air quality environment. These data reviewed included three years of PM₁₀ measurements recorded at Moranbah (2017-2019) and almost one year of PM₁₀ measurements recorded at Blackwater (April 2019 – March 2020).

Based on the review, PM₁₀ and PM_{2.5} data from the Blackwater station recorded from April 2019 to March 2020 were adopted for use in the assessment, as summarised in the table below. Blackwater is located about 41 km to the southeast of Ensham Mine.

Table 1 Background Particulate Levels Used in the Air Quality Assessment

Pollutant	Averaging time	Adopted background concentration (µg/m ³)	Air objective (µg/m ³)	Source
TSP	Annual	58.8	90	Scaled from PM ₁₀ value using a ratio of 0.4
PM ₁₀	24 hours	25.1	50	70 th percentile of 2019-2020 Blackwater data
	Annual	23.5	25	Average of 2019-2020 Blackwater data
PM _{2.5}	24 hours	7.5	25	70 th percentile of 2019-2020 Blackwater data
	Annual	7.0	8	Average of 2019-2020 Blackwater data

2 Ambient Monitoring Data Review and Discussion

A summary of the PM₁₀ and PM_{2.5} data available from the Blackwater air quality monitoring station (AQMS), including data recorded since the 2010 air quality assessment was prepared, is presented in Figure 1. As shown in the plots, both the PM₁₀ and PM_{2.5} concentrations recorded in Blackwater in late 2019 were higher than during the same period in 2020. Both years also show an increase in the PM_{2.5} levels recorded in the second half of the year compared to prior to mid-August.

The DES Air Quality Bulletins for the periods of high PM₁₀ concentrations noted the following:

- September 2019:
 - During September, inland areas of Central Queensland were affected at times by dust carried from further inland by strong southwesterly winds accompanying the passage of cold fronts. These dust events resulted in exceedances of the EPP (Air) 24-hour PM₁₀ objective on three days at Blackwater, four days at Moranbah, and four days at West Mackay between 6 September and 11 September; at Blackwater on 18 September; and at Moranbah on 19 September.
 - The EPP (Air) 24-hour PM_{2.5} objective was also exceeded at Blackwater on 8 September due to the raised dust.
 - Windblown dust from local sources was responsible for further exceedances of the EPP (Air) PM₁₀ objective at Blackwater on 4 and 5 September, and at Moranbah on 3 and 14 September.
 - The Air NEPM annual average PM₁₀ standard was also exceeded at the Moranbah monitoring site over the 12-month period ending September 2019 due to a combination of emission sources, including dust storms, local dust sources, bushfires and planned hazard-reduction burns.
- October 2019:
 - On 9 October, windblown dust was carried over Central Queensland by strong winds associated with the passage of a weather front. The windblown dust levels were sufficient to cause exceedances of the EPP (Air) 24-hour PM₁₀ objective at the Blackwater monitoring site on 9 October and 10 October.
- November 2019
 - Dry conditions combined with strong westerly winds associated with the passage of weather fronts carried dust from central Australia across the Central Queensland region on 6 November and 9 November. These windblown dust events contributed to elevated particle concentrations between 6 November and 14 November. During this period the EPP (Air) 24-hour PM₁₀ objective was exceeded at the West Mackay monitoring site on four days, at the Moranbah monitoring site on seven days, and at the Blackwater monitoring site on five days.
 - The EPP (Air) 24-hour PM_{2.5} objective was also exceeded at the West Mackay monitoring site on two days during this period. On 21 November, both the EPP (Air) 24-hour PM₁₀ and 24-hour PM_{2.5} objectives were exceeded at the Moranbah monitoring site. On this day particle concentrations were elevated during east-northeasterly winds. Based on the wind direction and the PM₁₀ to PM_{2.5} ratio, it is likely that these exceedances were due to a combination of local dust sources and smoke haze from bushfires burning west of Mackay.

Figure 1 24-Hour PM₁₀ Concentrations Reported in Blackwater (January 2019 – June 2021)

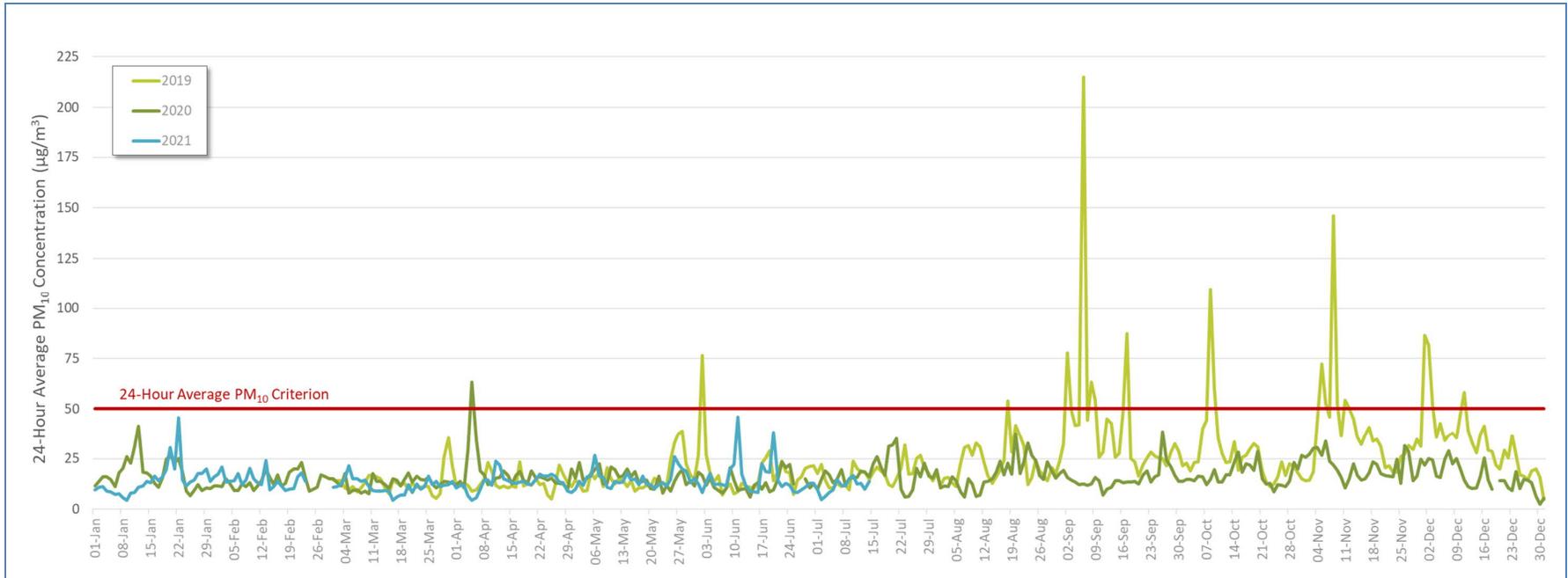
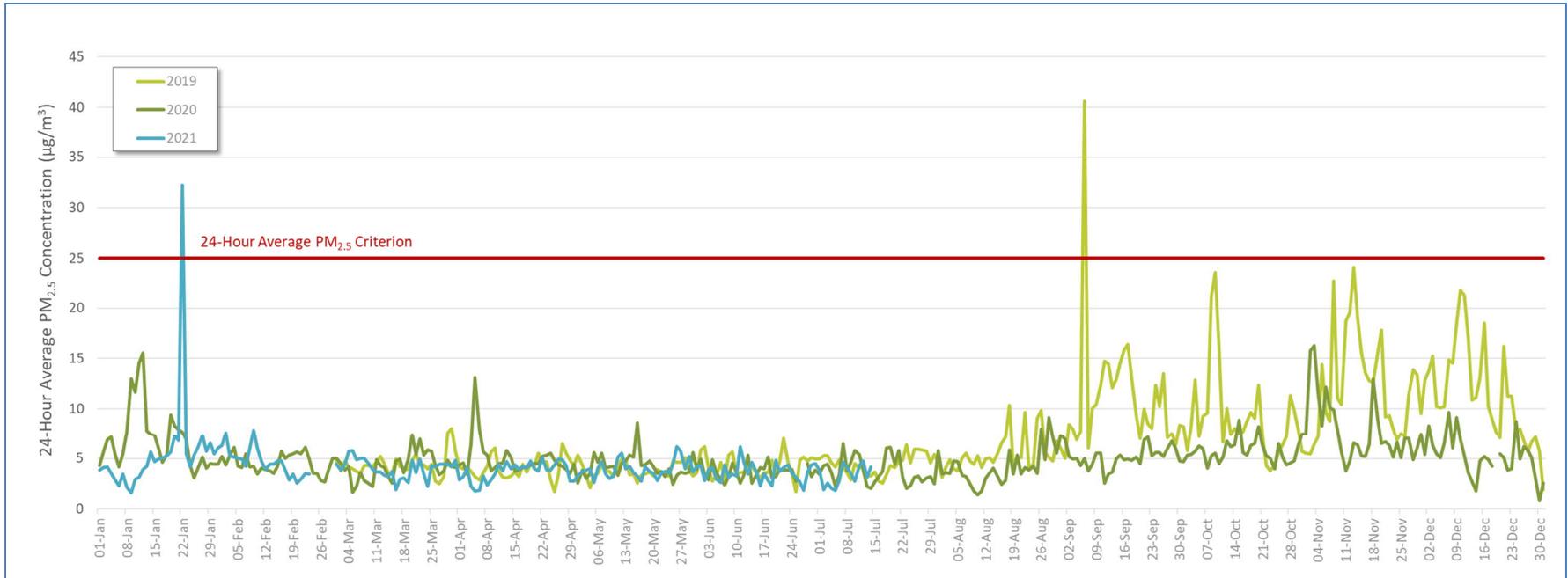


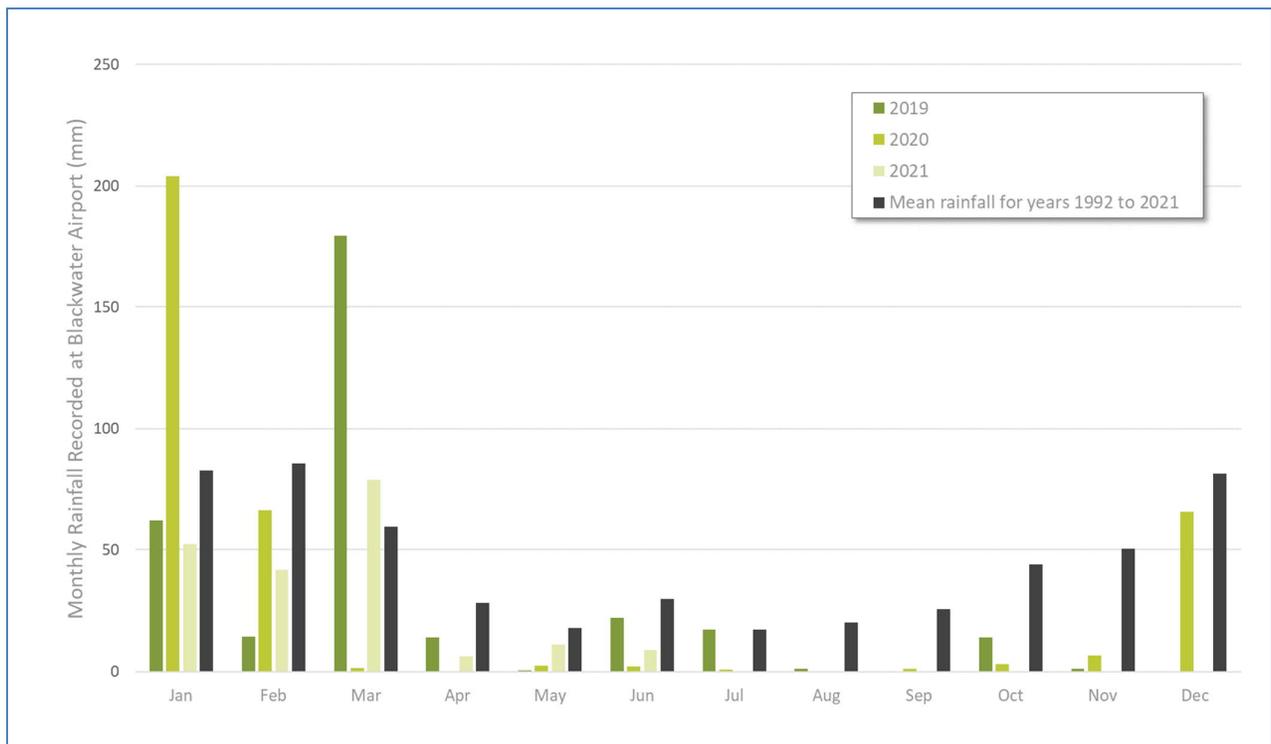
Figure 2 24-Hour PM_{2.5} Concentrations Reported in Blackwater (January 2019 – June 2021)



- December 2019
 - Dry conditions combined with strong winds associated with the passage of a weather front carried dust from central Australia across the Central Queensland region on 3 December. This windblown dust event was responsible for exceedances of the EPP (Air) 24-hour PM₁₀ objective measured at the West Mackay and Blackwater monitoring sites on 3 December and at the Moranbah and Blackwater monitoring sites on 4 December.
 - A further PM₁₀ exceedance was measured at the Blackwater monitoring site on 12 December. On this day the elevated PM₁₀ levels occurred during easterly winds, indicating that mining activities were unlikely to have been responsible. While a specific source could not be identified, a dust-generating activity in the immediate vicinity of the monitoring station was most likely the cause.

A review of the rainfall records recorded by the Bureau of Meteorology at Blackwater Airport (see Figure 3). This plot shows that during both 2019 and 2020, the monthly rainfall during September to December were well below average. This indicates that the lower PM₁₀ concentrations recorded in Blackwater during these months in 2020 compared to 2019 is less likely to be related to the local dry conditions in 2019, but is instead more strongly associated with long-distance transport of dust due to dry and windy conditions further inland in Central Australia, as identified in the DES Air Quality Bulletins.

Figure 3 Monthly Rainfall Records – Blackwater Airport

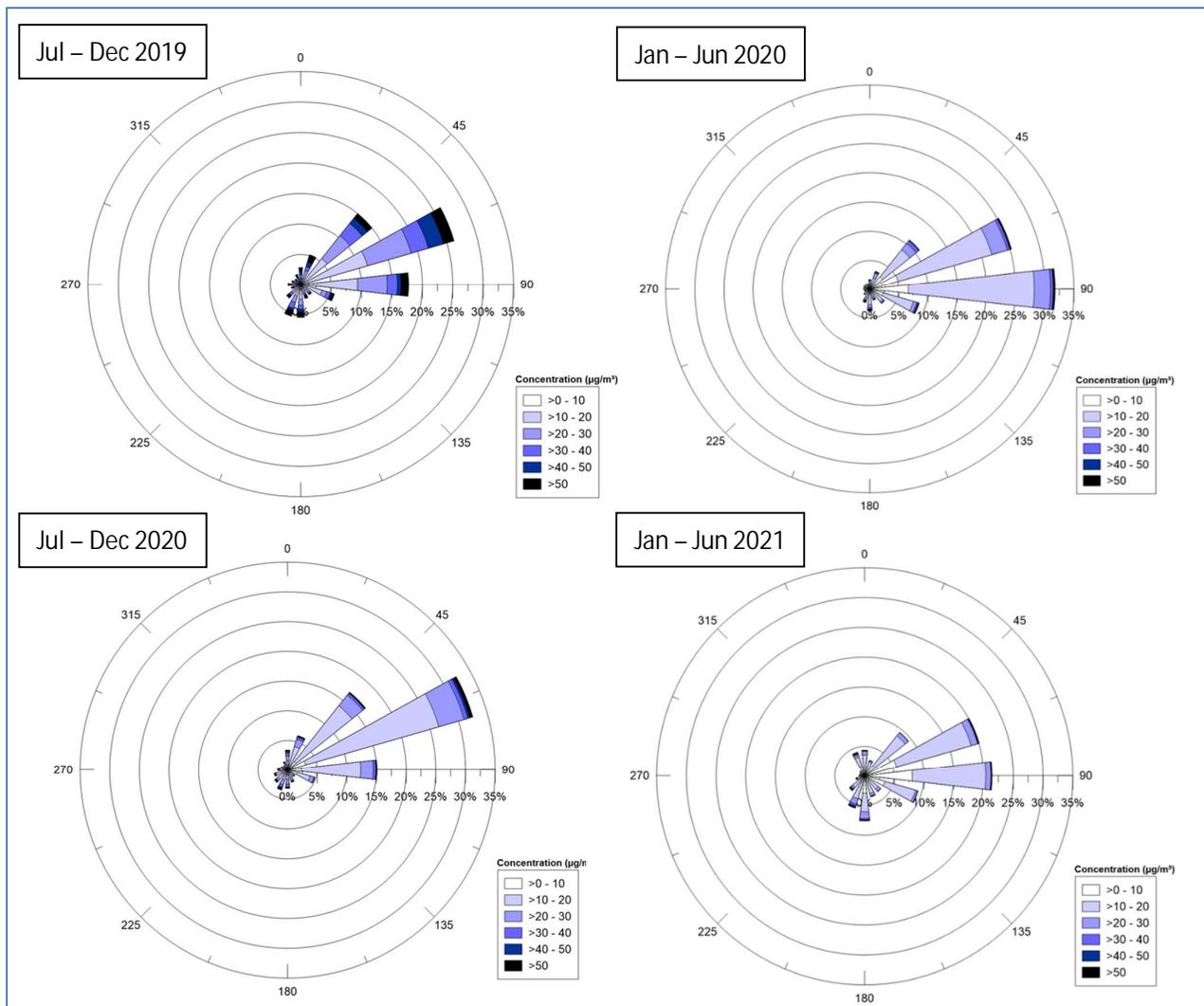


In late 2019 and early 2020, there was also the severe ‘Black Summer’ bushfire event that affected large areas of eastern Australia, from Queensland down to Victoria. On 6 September, strong west to north-westerly winds produced extreme to catastrophic bushfire conditions in much of southeast Queensland. By the following day, significant bushfires were burning in southeast Queensland and by the afternoon of 8 September, there were more than 60 fires burning across the state. The bushfire season officially ended on 31 January 2020, with the fires having burned an estimated 6.6 million hectares.

This event had significant impacts on ambient particulate concentrations recorded by AQMSs in Southeast Queensland, and potentially also may have contributed to elevated PM₁₀ and PM_{2.5} concentrations being recorded further inland.

Six-monthly PM₁₀ ‘pollution roses’ compiled from the Blackwater station data during 2019 and 2020 are presented in Figure 4. The roses show no significant differences in the predominant wind directions in the second half of 2019 compared to the same period in 2020 that could have contributed to the higher concentrations recorded in 2019.

Figure 4 1-Hour PM₁₀ and PM_{2.5} Data Plotted by Wind Direction – Blackwater Monitoring Station



If the more recent 2020 PM₁₀ and PM_{2.5} datasets were used to estimate background levels for the purposes of the cumulative impact assessment, the values would be as shown in Table 2. It is noted that the 70th percentile 24-hour average values used in the air quality assessment (i.e. as shown in Table 1) are approximately equivalent to 90th percentile values calculated from the 2020 dataset.

Table 2 Background Particulate Levels Based on 2020 Monitoring Data

Pollutant	Averaging time	Adopted background concentration (µg/m ³)	Air objective (µg/m ³)	Source
TSP	Annual	40.5	90	Scaled from PM ₁₀ value using a ratio of 0.4
PM ₁₀	24 hours	17.6	50	70 th percentile of 2020 Blackwater data
	Annual	16.2	25	Average of 2020 Blackwater data
PM _{2.5}	24 hours	5.5	25	70 th percentile of 2020 Blackwater data
	Annual	5.0	8	Average of 2020 Blackwater data

3 Conclusions

The high particulate concentrations recorded in 2019 demonstrate that PM₁₀ and PM_{2.5} levels in the study area can be elevated at times due to events such as dust storms, controlled burns and uncontrolled bushfires. However, based on the review of more recent data collected at Blackwater (as shown by Figure 1) the levels recorded during 2019 may represent a very conservative overestimate of typical levels, particularly in relation to PM₁₀.

Given that the use of the more conservative background levels shown in Table 1 does not result in the prediction of cumulative TSP, PM₁₀ or PM_{2.5} concentrations above the relevant criteria at any of the sensitive receptors identified for investigation in the assessment, revising the analysis to use the levels presented in Table 2 is not considered to be warranted. However, in terms of the potential assimilative capacity of the environment, the data review indicates that the annual average PM₁₀ value of 23.5 µg/m³ used in the assessment is likely to overestimate the typical levels in Blackwater, and hence the levels that may typically occur in the vicinity of Ensham Mine. Based on 2020 data, the annual average background PM₁₀ value is only 65% of the relevant criterion leaving 35% assimilative capacity, as opposed to the 6% implied by the Air Quality Impact Assessment.

Checked/
 Authorised by: GS