Pacific Environment Limited

Consulting • Technologies • Monitoring • Toxicology

14 December 2015

RESPONSES TO PEER REVIEW REPORT MOUNT OWEN CONTINUED OPERATIONS PROJECT

INTRODUCTION

Pacific Environment (PE) completed an Air Quality Impact Assessment (AQIA) for the Mount Owen Continued Operations Project (the Project) in October 2014. The Project was then placed on exhibition after which a Response to Submissions (RTS) report was prepared to address issues raised by the relevant agencies, community groups and the general public. The RTS report was submitted to the NSW Department of Planning and Environment (DP&E) in June 2015.

The DP&E then commissioned a peer review of the AQIA and RTS report. This peer review was submitted to the DP&E on 30 October 2015 and provided to Pacific Environment for comment on 4 November 2015. A meeting was held at the DP&E on 10 November to discuss and clarify a number of issues raised by DP&E's reviewer. Following this meeting an amended peer review report was issued on 20 November which included revised comments and statements. This document is a response to that amended peer review report issued on 20 November 2015.

The amended peer review report covers a number of issues, some of which require further clarification. Some issues were not considered significant by the reviewer and do not require any further discussion. Where this is the case, a statement has been made to that effect. Each issue is discussed in a separate numbered section in the peer review report and these same numbers have been used in this response document so they can be easily cross-referenced.

The following is the list of documents reviewed and/or referenced in this report:

- Pacific Environment (2014), Air Quality Impact Assessment – Mount Owen Continued Operations. Prepared by Pacific Environment and submitted in October 2014. This document is referred to as the original AQIA or the Project AQIA.
- The Response to Submissions Report (2015), prepared by Umwelt in response to submissions regarding the Project from government agencies, special interest groups and the community. This is referred to as the RTS report and Appendix A of the RTS report includes additional responses regarding specific air quality issues.
- Todoroski Air Sciences (2015a), Peer Review: Air Quality Impact Assessment Mt Owen Continued Operations Project. Prepared by Todoroski Air Sciences for the NSW DP&E and submitted on 30 October 2015.
- Todoroski Air Sciences (2015b), Review: Air Quality Impact Assessment Mt Owen Continued Operations Project. An update to the Peer Review prepared by Todoroski Air Sciences for the NSW DP&E and submitted on 20 November 2015 in response to clarifications sought at a meeting on 10 November 2015 at DP&E.
- Todoroski Air Sciences (2015c), Air Quality and Greenhouse Gas Assessment Rix's Creek Continuation of Mining Project. Prepared by Todoroski Air Sciences and submitted in August 2015. This is referred to as the Rix's Creek AQIA and has been identified as a recent study that has information which is relevant to the areas in the vicinity of the Project.

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Peer Review Section 3.2 NSW EPA Submissions

There were two issues that the NSW EPA raised that they considered were not addressed to their satisfaction in the RTS report. These two issues were:

1. … that the Project AQIA assessment may underestimate diesel particulate emissions by applying a control factor of 85% to the emissions from haul roads; and
2. … that the RTS did not include a complete contemporaneous assessment of 24-hour PM_{10} impacts as it did not consider all days of the year.

Issue 1

On the first issue, the reviewer and PE are in agreement, that diesel emissions have been considered satisfactorily. There is agreement that the USEPA emission factor equations include emissions from diesel exhaust. The NSW EPA was concerned that applying a control factor of 85% to haul road emissions (due to dust suppression mitigation measures employed at the site), also reduces the diesel emission component by 85%. While this is true, a calculation has been completed to check whether there would be any change to the outcomes of the assessment.

Based on PM_{10} emission factors from the EPA 2008 air emissions inventory and haul truck fuel consumption rates there is an estimated 4% difference in PM_{10} emissions when comparing the 85% control of both road dust and exhaust particulates scenario to the 85% control of only road dust scenario. This difference for haulage activities would translate to a 1% difference in PM_{10} emissions across the whole inventory and there would not be any material difference to the outcomes of the assessment.

Issue 2

The second issue raised by the EPA and noted by the reviewer as requiring further work, concerns the 24-hour PM_{10} cumulative assessment. The EPA was concerned that the contemporaneous tables presented in the RTS report had not been extended sufficiently to capture all potential days of exceedance.

Both the EPA and the reviewer have asked for this information which is now presented in the following graphs. Time series were extracted for 24-hour average PM_{10} concentrations at the same six residences as presented in the RTS report. A predicted concentration for each day of the year at each residence was then added to the monitored value on that day, using data from the SX9 monitor.

Figure 1 to **Figure 6** present the total cumulative (modelled plus measured) 24-hour average PM_{10} concentration for the entire year (Year 10 mine plan). As predicted using both the probabilistic (Monte Carlo) and contemporaneous methods, there are anticipated to be exceedances of the cumulative 24-hour average PM_{10} criterion at these properties. However, as noted in the DP&E's Voluntary Land Acquisition and Mitigation Policy, this is not an acquisition criterion for cumulative impact as the reviewer suggests, but relates to the Project only (incremental) increase.

Table 1 below, summarises the number of days predicted to exceed at these six residences in the AQIA using the Monte Carlo method, and the corresponding number of days using the Approved Methods (extended to a full year). R21, R22 and R112 show the same number of estimated days for both methods. R4, R114 and R116 already showed more than 5 potential exceedances per year as presented in the AQIA and so the outcomes of the assessment are unchanged.

Table 1: Estimated number of days of exceedance of 50 µg/m³ in Year 10

Receptor	Approved Methods	Monte Carlo
R4	19	8
R21	3	3
R22	3	3
R112	6	6
R114	31	12
R116	27	10

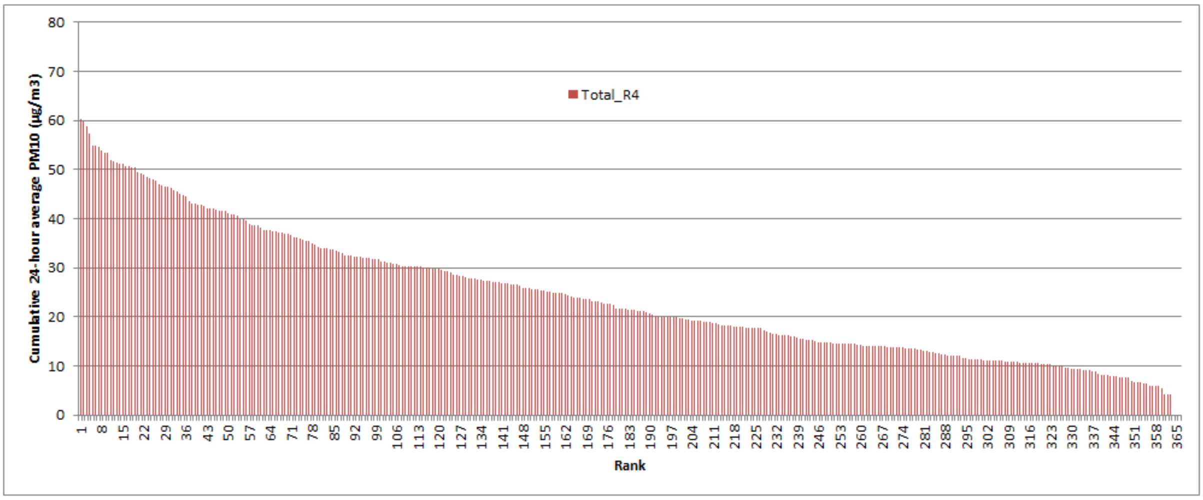

Figure 1: Estimated cumulative 24-hour average PM_{10} at R4

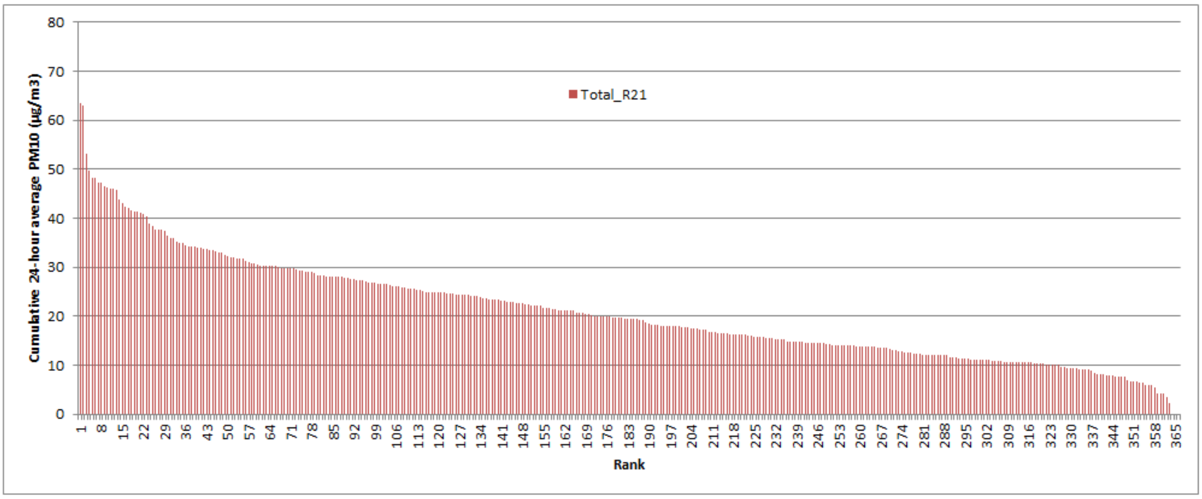

Figure 2: Estimated cumulative 24-hour average PM_{10} at R21

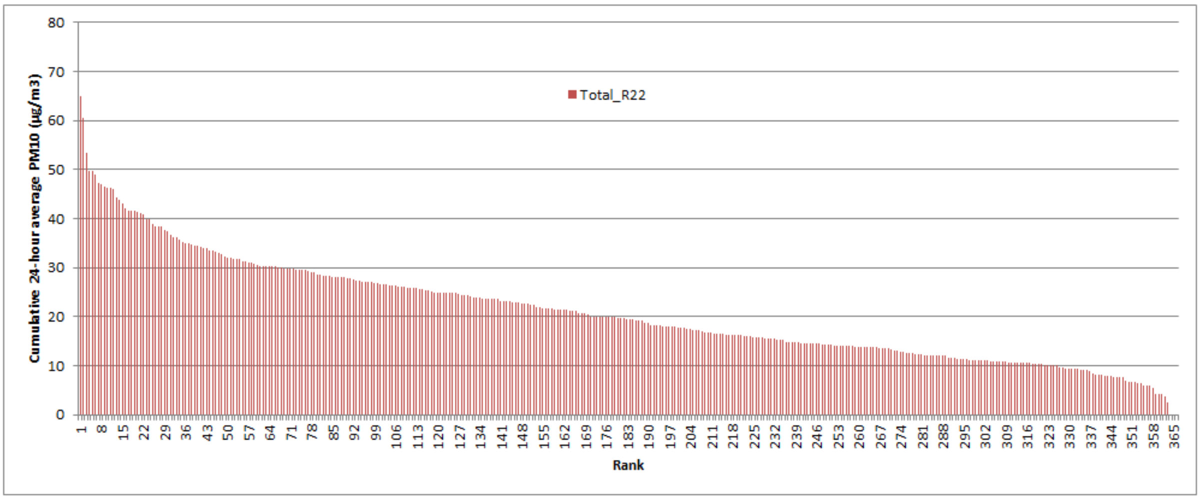

Figure 3: Estimated cumulative 24-hour average PM_{10} at R22

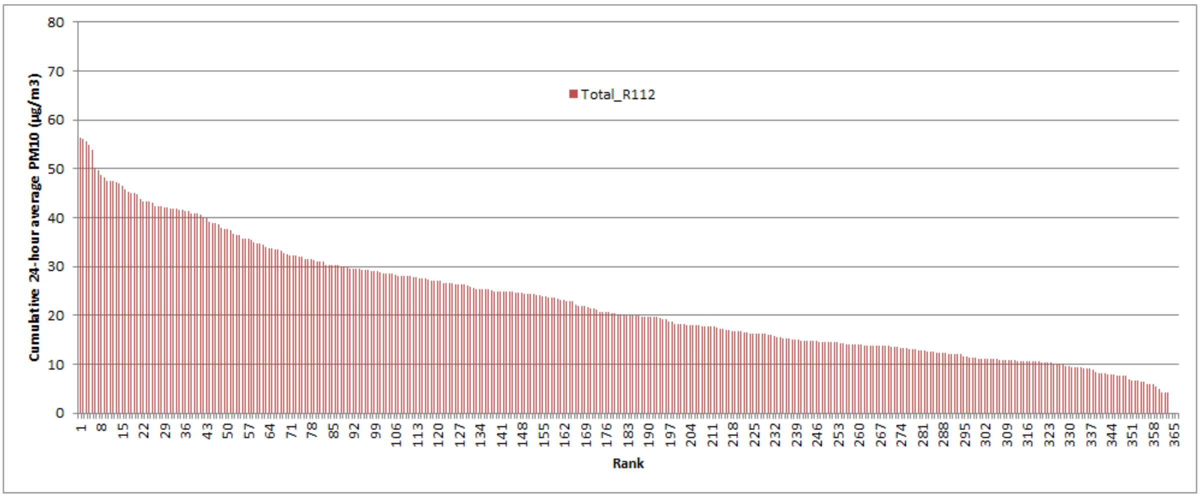

Figure 4: Estimated cumulative 24-hour average PM_{10} at R112

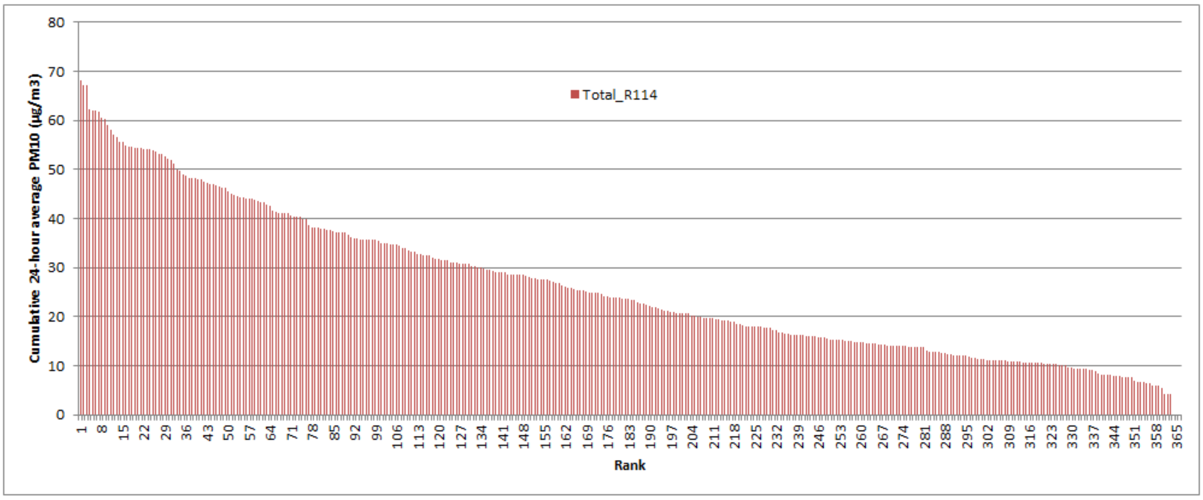

Figure 5: Estimated cumulative 24-hour average PM_{10} at R114

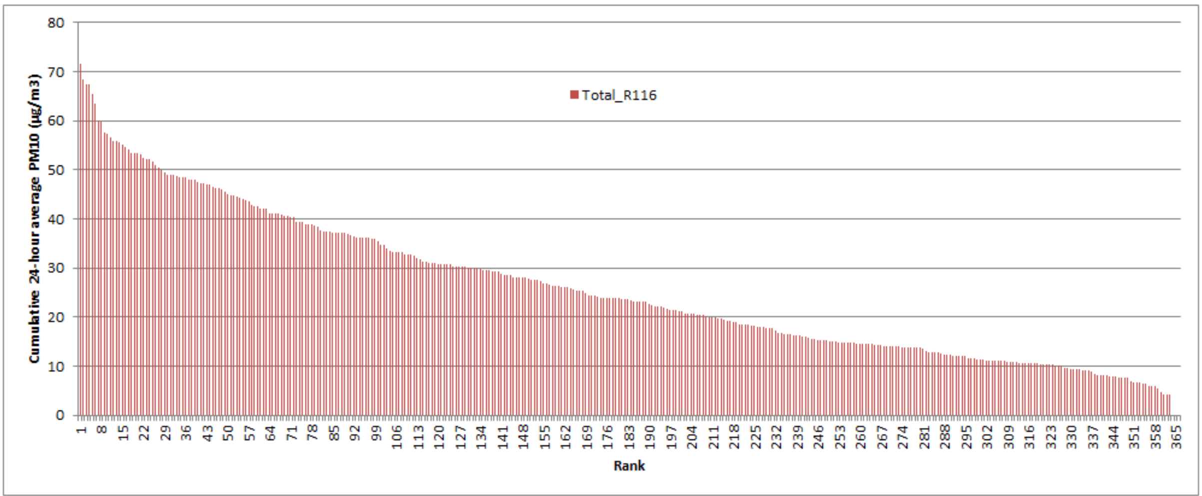

Figure 6: Estimated cumulative 24-hour average PM_{10} at R116

Peer Review Section 3.3 Director-General requirements

The reviewer agrees that the PE assessment of coal train dust is sufficient to meet the DGRs and that no further action is required. It is also noted that the EPA raised no concerns with the assessment of coal train dust impacts in the EIS or AQIA.

Peer Review Section 3.4 Model selection and approach

The reviewer agrees that the PE model selection is appropriate and that no further action is required in this regard. The reviewer did request some additional data here and it assumed that this is referring to the data listed in Section 3.8.1. However, given the reason for the request (as outlined in our response to Section 3.8.1), we do not believe this information is now needed to satisfy the response.

Peer Review Section 3.5 Meteorological (and dust conditions) in selected modelling year

The inputs for every project are determined on a case by case basis and have to use the best data available for the assessment. As noted in the "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA 2005)" a "Level 2" impact assessment is:

- …"conducted using at least one year of site-specific meteorological data. The meteorological data must be 90% complete in order to be acceptable for use in Level 2 assessment."

For Level 2 assessments such as completed for this Project the meteorological data inputs are of primary importance. Neither 2009 nor 2010 had sufficient data capture from both meteorological sites (SX8 and SX13). Capture in 2011 was good (that is, 99% complete) but it was decided to proceed with the more recent 12 month period which had even better data capture (100%). These capture rates are summarised in Table 5.1 of the original AQIA (reproduced below). The selected meteorological data for the assessment satisfy the EPA's requirements, and have also been correlated against longer-term records to confirm that the data are representative of longer term conditions.

Table 5.1: Percentage of calm periods in SX8 and SX13 meteorological data

Period	SX8				SX13			
	2009	2010	2011	2011/2012	2009	2010	2011	2011/2012
All	6.5%	8.2%	7.9%	8.3%	20.1%	3.2%	2.9%	4.0%
Summer	4.0%	5.8%	5.7%	7.7%	2.9%	2.3%	2.1%	3.7%
Autumn	10.1%	11.0%	9.9%	11.1%	59.6%	4.0%	3.6%	3.9%
Winter	7.1%	10.0%	8.2%	7.2%	3.0%	4.1%	2.4%	5.4%
Spring	4.3%	6.7%	8.0%	7.3%	1.8%	2.3%	3.2%	3.2%
Percentage complete	**95%**	**87%**	**99%**	**100%**	**77%**	**98%**	**99%**	**100%**

Note: At the time that meteorological data were compiled for modelling purposes the data for 2013 were not yet available.

Extract of Table 5.1 from the Project AQIA

Once a meteorological database is determined, other input data are considered in that context. Given that the meteorology is the driver for dispersion, the importance of the ambient dust levels during the modelling year was considered secondary and this approach is consistent with the Approved Methods. It should also be noted that ambient dust levels in the air shed around the Project area are influenced by day-to-day operations at a number of different mining operations. The scale, location and nature of these activities can change over the course of a year which can, in turn, influence the measured dust levels at monitoring locations. Some of this variability is almost certainly driving the variability on monitored dust levels observed in Figure 5.5 of the AQIA. Accordingly, while monitored dust levels can be indicative of meteorological conditions, the intensity of mining around the Project area and the annual variability in the scale, location and nature of these activities mean that reliance on these monitored dust levels is likely to be of limited utility in determining a representative meteorological year. In such circumstances, analysis of the chosen meteorological year relative to the meteorological data available from other years and stations is required to ensure the chosen year of data is representative.

To this end, the AQIA includes a detailed assessment and discussion of the representativeness of the meteorological data in the chosen modelling year (September 2011 – August 2012). This information is discussed in detail in Section 5.1.1 of the Project AQIA with windroses for the two on-site weather stations shown in Figure 5.2 (SX8) and Figure 5.2 (SX13).

It is possible, although not clear, that the reviewer is confusing the two sets of windroses presented in the AQIA, by comparing those in Figure 5.3 to those in Figure 5.2. Those two figures should not be compared directly to each other as they represent two different measurement locations. Instead, the modelled year (2011-2012) windroses on the right hand side of each figure, should be compared to the windroses on the left hand side of each figure which represent the entire dataset. Using the example of Figure 5.3, if you compare the windroses for the modelling year (on the right), with those for the whole 4 year dataset (on the left), the comparison is very good.

In the meeting at DP&E on 10 November 2015, the reviewer noted the apparent absence of winds from the northwest during summer at SX8 in the modelling year (Figure 5.2). The reviewer was concerned that the absence of northwesterly winds during summer in the model may result in an underestimate of impacts to residences to the southeast of the Project during the hot summer months.

It was brought to the reviewer's attention that these winds were represented at the SX13 site and the data from both of these stations were used in the CALMET model, as well as other inputs such as local terrain and landuse, to produce a three-dimensional meteorological file with predicted meteorological parameters at all points on the modelling grid. In other words, the fact that these northwesterly winds are not represented in the summer of the modelling year at SX8, does not necessarily mean that they are not represented in the modelled summer conditions near the residences to the southeast. It does also not necessarily mean that northwesterlies did not occur at all in the modelling year as the windroses from both meteorological stations show these winds to be present in other seasons.

The reviewer agreed at the meeting that if a meteorological file could be extracted at a representative point near the residences to the southeast and it showed a northwest contribution during summer, then that would satisfy his concerns and this issue would be considered closed. This has been done and an extract from the meteorological CALMET modelling file was made at the location shown in **Figure 7**. The summer windrose for that site is presented in **Figure 8** and shows winds from the northwest towards the residences in the southeast.

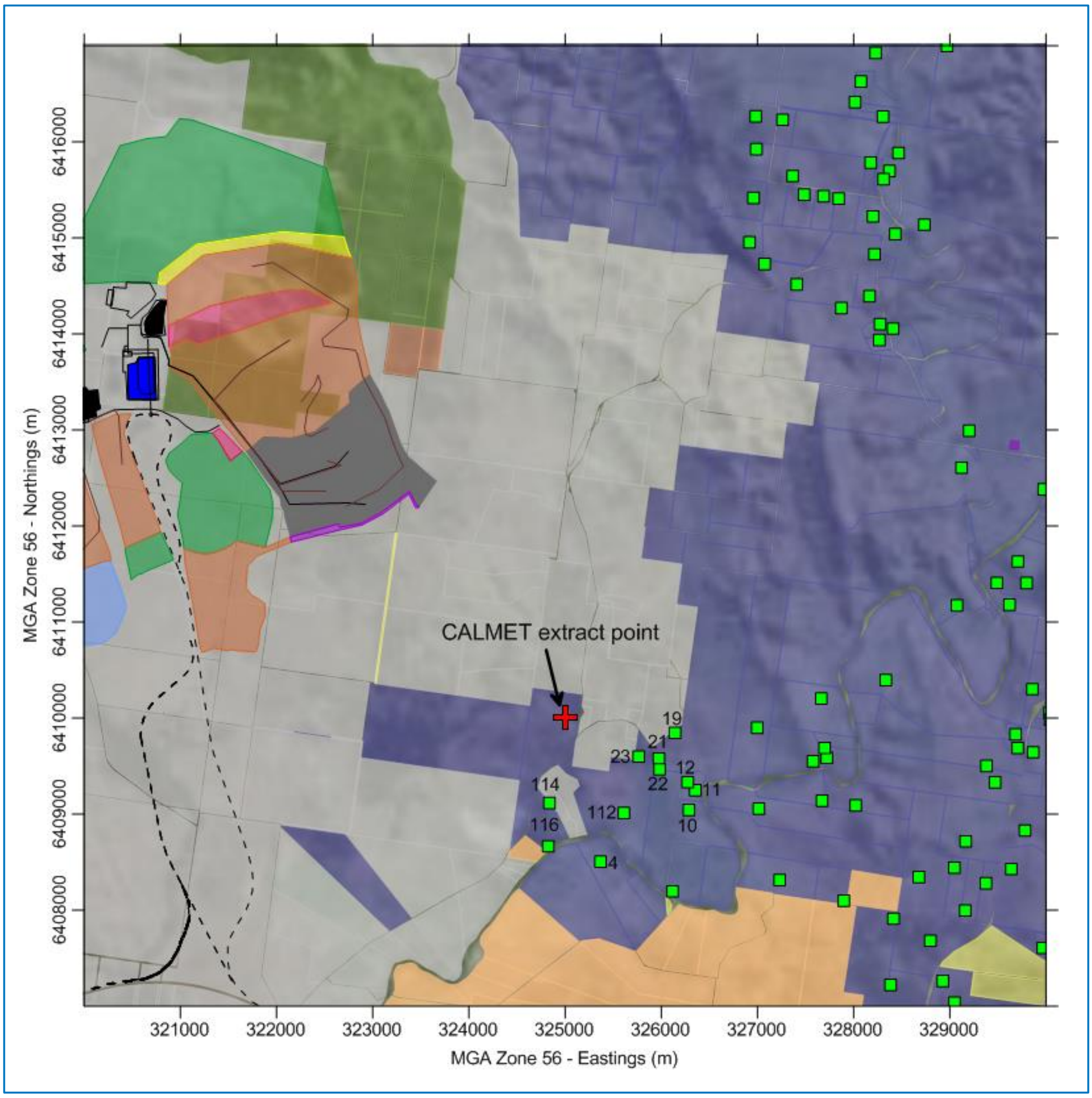

Figure 7: Location of CALMET extract between the Project and residences to the southeast

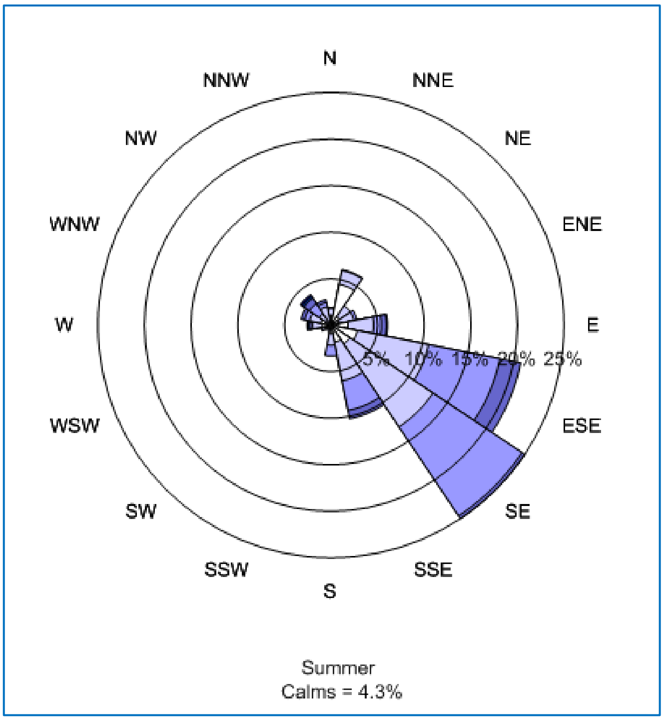

Figure 8: CALMET extract for summer (2011-2012) southeast of the Project

It is also worth noting that recent assessments in the Hunter Valley have used the 2012 data period for modelling. The Rix's Creek Continuation of Mining Project (Todoroski Air Sciences, 2015c), submitted in August 2015, used meteorological data from the calendar year 2012 which is substantially the same period as used in the AQIA. While taken from a different meteorological site, the wind roses shown in the Rix's Creek Continuation of Mining Project assessment show a good correlation to the wind roses for the meteorological year used in the AQIA.

In terms of the reviewer's comment regarding the ambient dust levels during the modelling period not being representative of general conditions in the area, this appears to be inconsistent with the data presented in Table 5.3 of the AQIA (extract shown below).

Table 5.3: Annual average PM_{10} concentrations measured at each HVAS and TEOM site – µg/m³

Year	PM10-1[a]	PM10-2[a]	PM10-3iii[b]	PM10-4	PM10-3ii	TEOM1-SX8[e]	TEOM2-SX10[e]	TEOM3-SX9[e]	TEOM4-SX13[f]	TEOM5-SX14[f]
2002	-	-	-	26	**31**	-	-	-	-	-
2003	-	-	-	25	**38**	-	-	-	-	-
2004	16	18	-	23	**36**	-	-	-	-	-
2005	21	19	-	25	30	-	-	-	-	-
2006	17	19	20	22	27[c]	-	-	-	-	-
2007	21	25	24	25	24	-	-	-	-	-
2008	24	26	25	25	22	-	-	-	-	-
2009	28	29	22	28	27	-	-	-	25	30
2010	22	24	21	22	20	-	-	-	18	23
2011	20	24	20	25	21	18	22	20	18	20
2012	18	25	23	29	**32**	21	24	22	23	13
2013	15	26	21	29	21	19	25	23	23	22

Note: Exceedance of the air quality criterion is shown in bold.
[a] Monitoring commenced May 2004
[b] Monitoring commenced May 2006
[c] No monitoring data for the period of April 2006 to August 2006
[d] No monitoring data prior to July 2010
[e] No monitoring data prior to 2011
[f] No monitoring data prior to 2009

The information presented in Table 5.3 indicates that annual average PM_{10} concentrations in 2011 and 2012 are generally similar in magnitude to those measured in the other years, and in some cases they are higher, with the exception of SX14 (discussed later). The reviewer's comments on this issue are also inconsistent with data presented in the Table 4-3 and Table 4-4 of the recent Rix's Creek assessment, summarising annual average PM_{10} levels in 2012 and surrounding years which show ambient air quality conditions in 2012 to be similar to other calendar years (extracts shown below).

Table 4-3: Summary of PM_{10} levels from NSW EPA TEOM monitoring ($\mu g/m^3$)

	2010	2011	2012	2013	2014(1)
	Annual average				
Singleton(2)	20.0	19.8	22.3	23.3	21.4
Maison Dieu(3)	-	22.1	25.8	25.8	22.7
Camberwell(4)	-	24.4	26.4	27.8	24.8
Singleton NW(4)	-	24.8	25.9	25.9	22.8
Singleton South(5)	-	13.4	19.0	20.2	18.2
	Maximum 24-hour average				
Singleton(2)	32.8	60.5	63.6	62.7	78.9
Maison Dieu(3)	-	78.3	87.7	84.2	63.7
Camberwell(4)	-	85.3	81.6	104.8	79.7
Singleton NW(4)	-	72.2	85.2	91.7	64.7
Singleton South(5)	-	18.1	52.3	60.3	44.8

(1)Data available till December 2014
(2)Data available from December 2010
(3)Data available from April 2011
(4)Data available from July 2011
(5)Data available from December 2011

Extract of Table 4-3 from the recent Rix's Creek AQIA (Todoroski Air Sciences, 2015c)

Table 4-4: Summary of PM_{10} levels from HVAS monitoring ($\mu g/m^3$)

	2010	2011	2012	2013
	Annual average			
Rix's Creek(1)	20.3	24.4	25.2	29.5
Mines Rescue	22.7	19.3	19.6	20.5
Retreat	24.7	23.5	22.8	25.5
HV1(2)	-	-	19.7	21.2
HV3 (2)	-	-	24.0	20.6
HVAS19 (3)	-	-	21.8	-
	Maximum 24-hour average			
Rix's Creek(1)	43.0	107.0	94.0	129.0
Mines Rescue	58.0	51.5	61.0	53.0
Retreat	100.0	122.0	68.0	84.0
HV1(2)	-	-	61.0	73.0
HV3 (2)	-	-	81.0	56.0
HVAS19 (3)	-	-	82.1	-

(1) Data available from March 2010 (2) Data available from January 2012 (3) Data available from January 2012 till December 2012

Extract of Table 4-4 from the recent Rix's Creek AQIA (Todoroski Air Sciences, 2015c)

Based on the information presented above, the air quality conditions for the meteorological modelled year are considered to be generally similar in magnitude to those measured in the other years. It is also noted that the selected meteorological data meet the requirements of the Approved Methods and the EPA was satisfied that the chosen modelling year was appropriate.

Peer Review Section 3.6 Existing air quality and calculation of background levels

Section 3.6 of the peer review raises several main topics for which a response is requested. The following text firstly provides some clarification on the calculation of background levels and model calibration.

Individual monitors will be subject to local activities as well as regional events. Camberwell has been surrounded by various mining activities in recent years and air quality levels in the village are likely to fluctuate accordingly. The OEH monitor at Camberwell located close to SX14, also recorded a low annual average PM_{10} level for the same period (modelling year 2011-2012).

However, a sensitivity analysis has been carried out by removing SX14 from the determination of the calibration grid. **Figure 9** below shows the calibration grid as used in the AQIA and **Figure 10** shows the same grid with the SX14 monitoring data removed from the analysis. This comparison shows that there is very little difference between the two plots except for the area immediately surrounding the SX14 monitor in Camberwell.

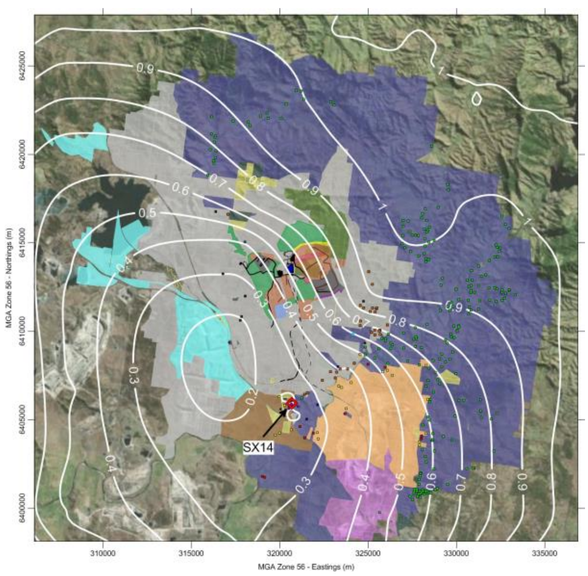

Figure 9: Original calibration grid used in the AQIA

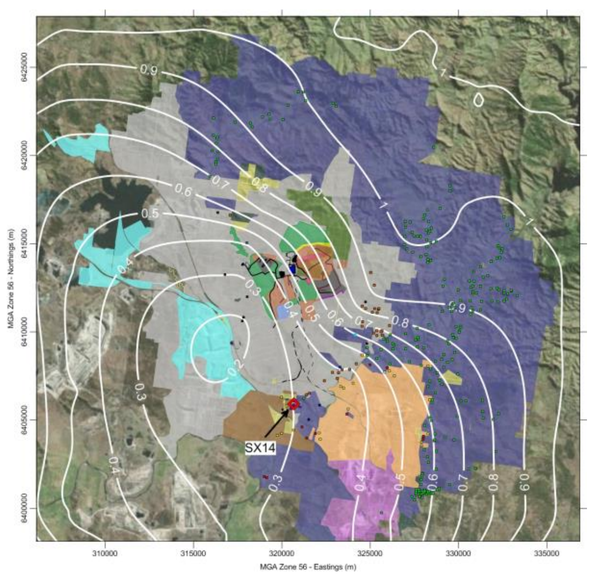

Figure 10: Revised calibration grid with SX14 data removed

It is important to note that removing these data from the analysis does not make any material difference to the calibration values in the main area of significance to the southeast of the Project. **Figure 11** presents a zoomed in plot of this area to the southeast showing calibration contours with and without SX14. It shows that the model is performing reasonably well at all of the privately owned receptors (shown in green), with calibration factors at those residences of between 0.5 – 1.

The monitoring data from SX14 were also excluded from the 24-hour cumulative analysis presented earlier, as suggested by the reviewer.

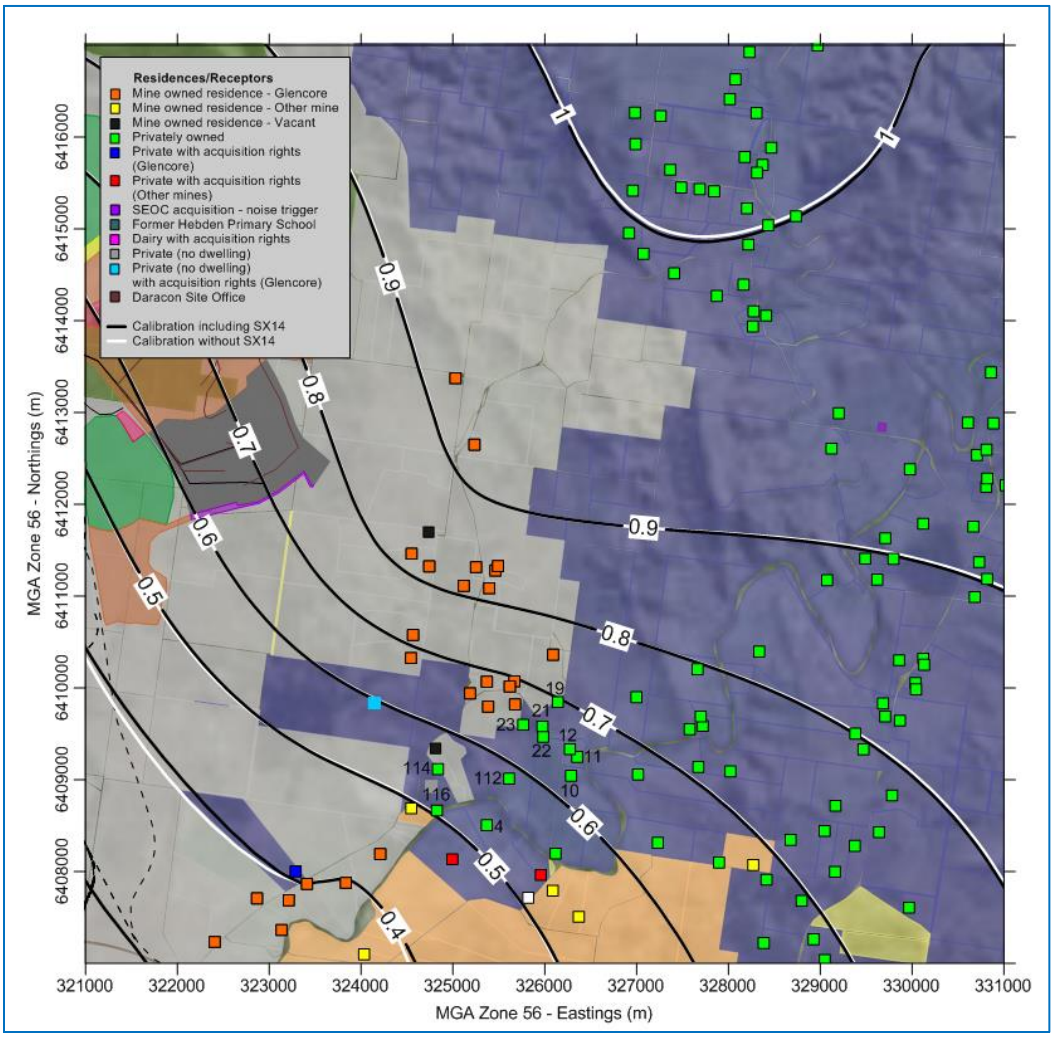

Figure 11: Calibration values in the zoomed in area to the southeast of the Project

It is also important to note that this calibration <u>does not</u> apply to the Project predictions, only the other mine predictions. In other words, the total cumulative annual average can be described as follows:

Total cumulative = [Other mines x calibration] + [non-mining 'background' x <u>100%</u>] + [Project x <u>100%</u>]

The reason the other mines are calibrated is that there is less confidence in the predictions of ground level concentrations from those other operations. The assessment aims to increase this confidence by comparing the results with monitoring data. Dispersion models are only as good as the inputs used, and for other mines, where less detail is known about their operations, relying instead on publicly available annual emissions listed in their relevant assessments.

These data do not always correspond to the modelling year we are attempting to validate and there is limited detail available on source locations and mine design in order to more accurately spatially represent each site. Modelling is therefore necessarily coarse for those other mines and cannot be modelled in the detail we are able to achieve for the Project being assessed. Many conservative assumptions are also required, including the fact that emission controls on individual source types cannot be incorporated. It is therefore not surprising that model predictions <u>for these other mines</u> are overestimated, particularly at locations where several mines may contribute to elevated particulate matter levels (e.g. the Camberwell area). Model over prediction in the Camberwell area in particular is apparent in most cumulative annual average assessment of mining projects. As an example, the cumulative annual average PM_{10} modelling in the Rix's Creek assessment indicates PM_{10} levels of approximately 40 µg/m³ in this area. These levels are around 12 – 15 µg/m³ higher than is currently being measured (refer to extracted Table 4.3 shown earlier) and are significantly more than the predicted increase in impact from the Rix's Creek project.

We note, however, that southeast of Mount Owen[1] (for which we did have significant detail in 2011-2012), the model is more consistent with monitoring data and therefore less calibration of the raw modelled predictions of 'other mines' is required. In other words, the calibration factor approaches 1, where 1 indicates no calibration and 100% of the predictions for other mines are used.

Some additional data has been drawn out from the modelling results and presented here to provide an indication of the effect of calibrating other mines on the total annual cumulative assessment. Since the reviewer is particularly concerned about potential acquisitions, we have chosen a number of privately owned residences to analyse. These residences represent those closest to the Project in the area of interest to the southeast, where a calibration of between 0.5 – 0.7 was applied in the AQIA. Their locations are shown within the red line in **Figure 12**.

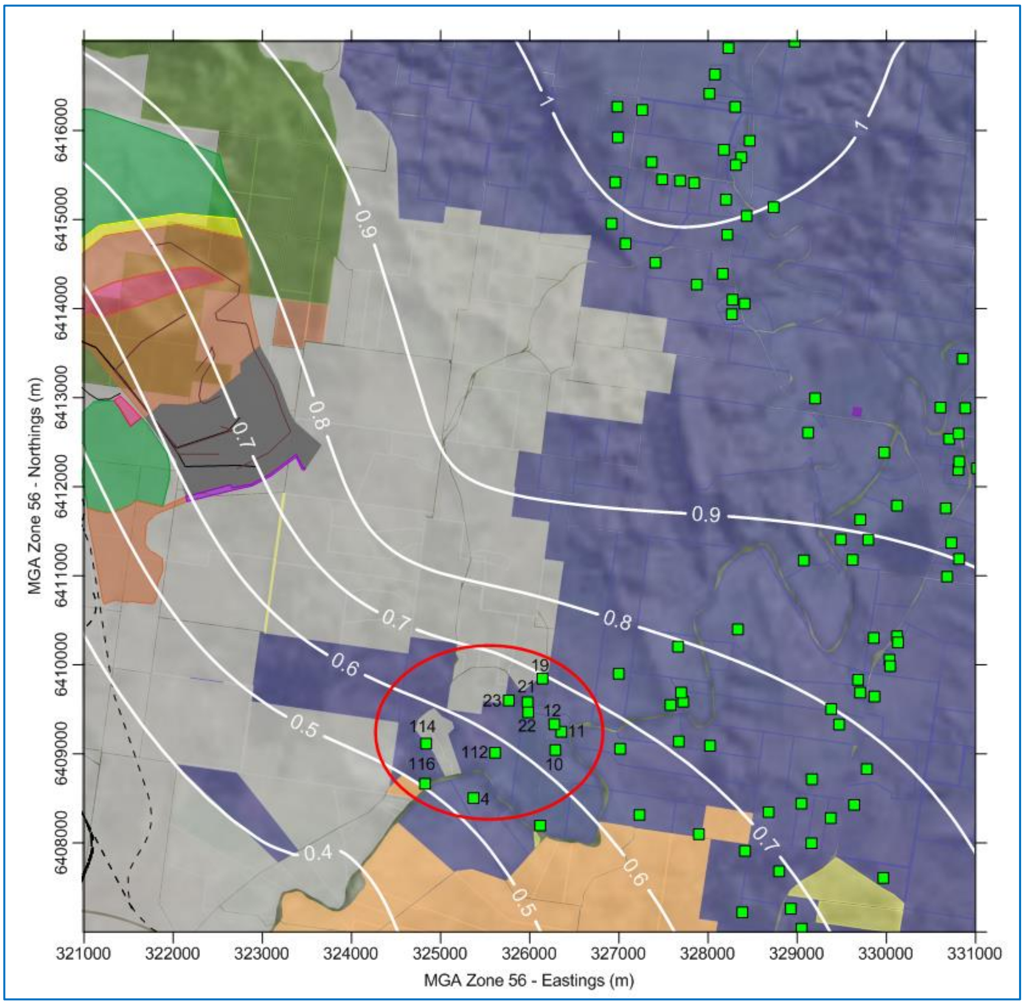

Figure 12: Privately owned residences analysed

[1] In the modelling year (2011-2012), the existing operations at Mount Owen and Ravensworth East are considered in 'other mines' as those emissions will contribute to concentrations at the existing monitoring sites. Going forward, Mount Owen Continued Operations is considered the Project and is not part of the calibrated 'other mines'.

The various contributions from individual mining operations (uncalibrated), the non-mining background and the Project are shown in **Figure 13**, **Figure 14** and **Figure 15**, for Year 1, Year 5 and Year 10 respectively.

Not surprisingly, Integra and Rix's Creek are the largest contributors from other mines, at these particular residences, but these individual contributions are significantly lower than the non-mining background (included in full and uncalibrated) and from the Project (also included in full and uncalibrated). Notably, even using the uncalibrated values for 'other mines' does not result in any exceedances of the cumulative annual average criterion at these residences.

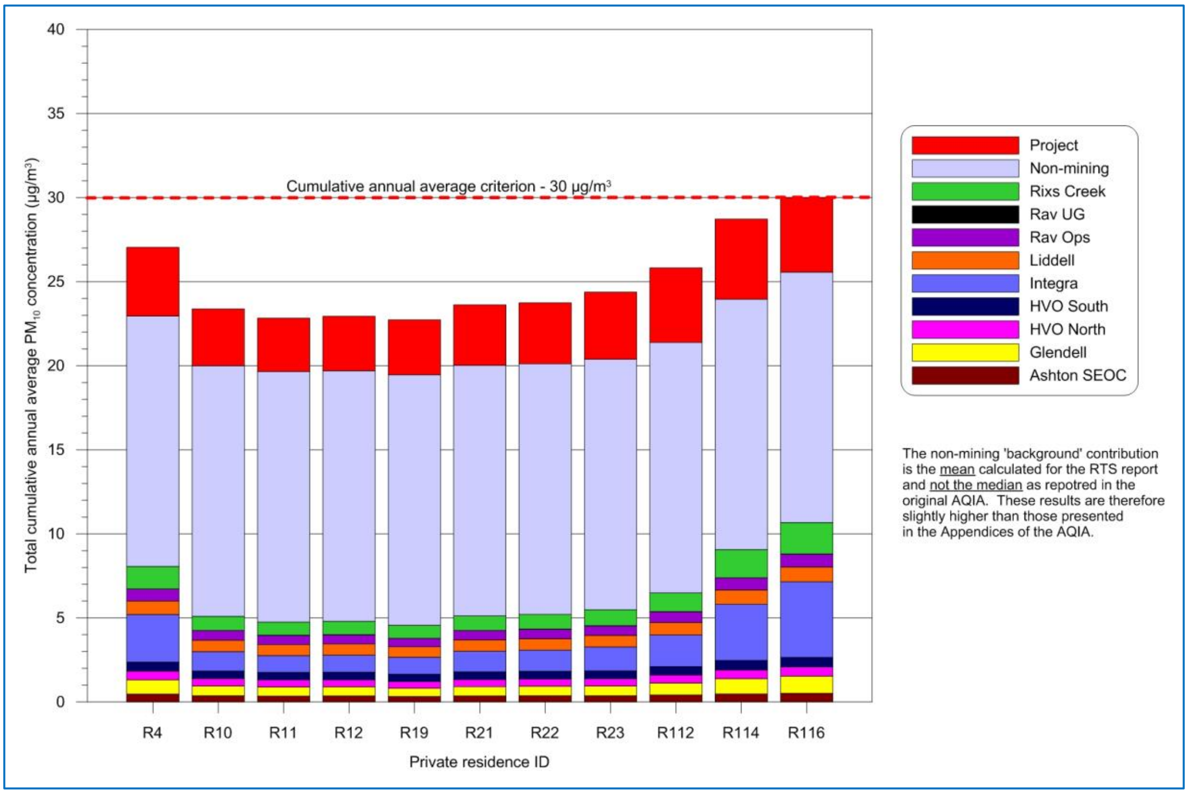

Figure 13: Individual contributions to the total cumulative annual PM_{10} in Year 1

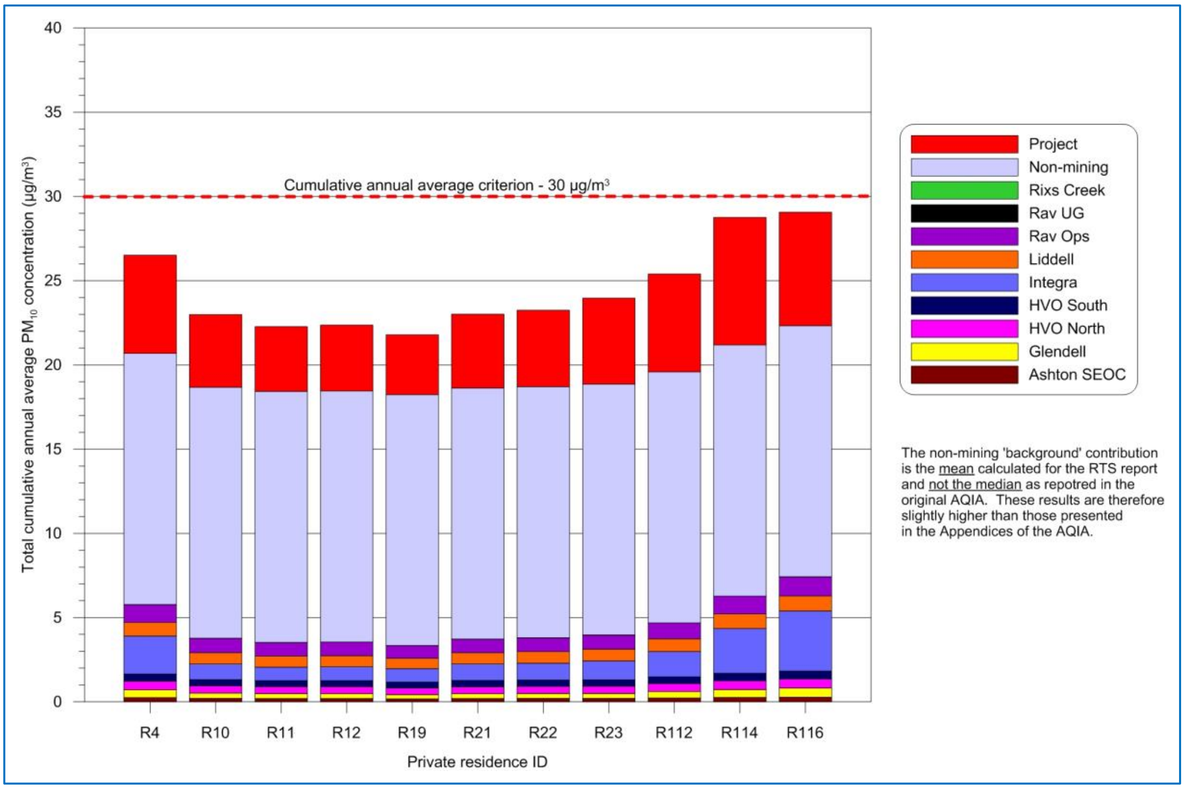

Figure 14: Individual contributions to the total cumulative annual PM_{10} in Year 5

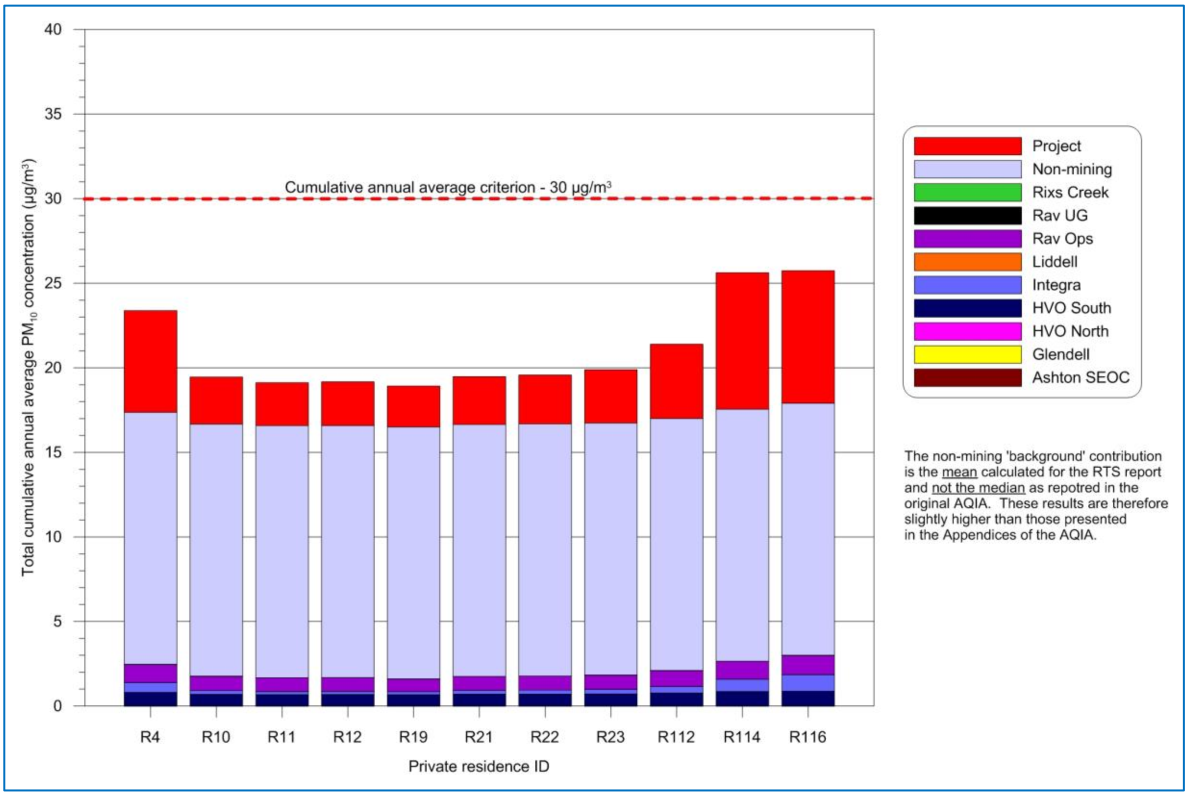

Figure 15: Individual contributions to the total cumulative annual PM_{10} in Year 10

Residences R114 and R116 fall within the acquisition zone for this Project due to predicted PM_{10} 24-hour average concentrations due to the Project alone, the following analysis has therefore focussed on the next most affected private residence (R4) which has been analysed further in order to show the difference the calibration of other mines makes to the total cumulative level.

Figure 16 presents the calibrated and uncalibrated cumulative levels at R4, for all three stages assessed, Year 1, Year 5 and Year 10. The blue area represents the non-mining background estimated using the three OEH monitors that are further removed from the influence of mining activity. This level is 14.9 µg/m³, which is the mean rather than the median used in the original AQIA and is <u>not calibrated</u>. The red area represents the predicted contribution from the Project and is also <u>not calibrated</u>. The green area represents the total contribution from other mines. The solid green represents the raw modelled value and the hatched green shows what this contribution is once it has been calibrated. The calibration factor at R4 is approximately 0.53 (see **Figure 12**).

The non-mining background values are the most significant contributor to the total, representing 55% or more in all years. This figure nicely illustrates that the only value the calibration factor is applied to is the other mines, and that even without this calibration the criterion is not predicted to be exceeded at R4.

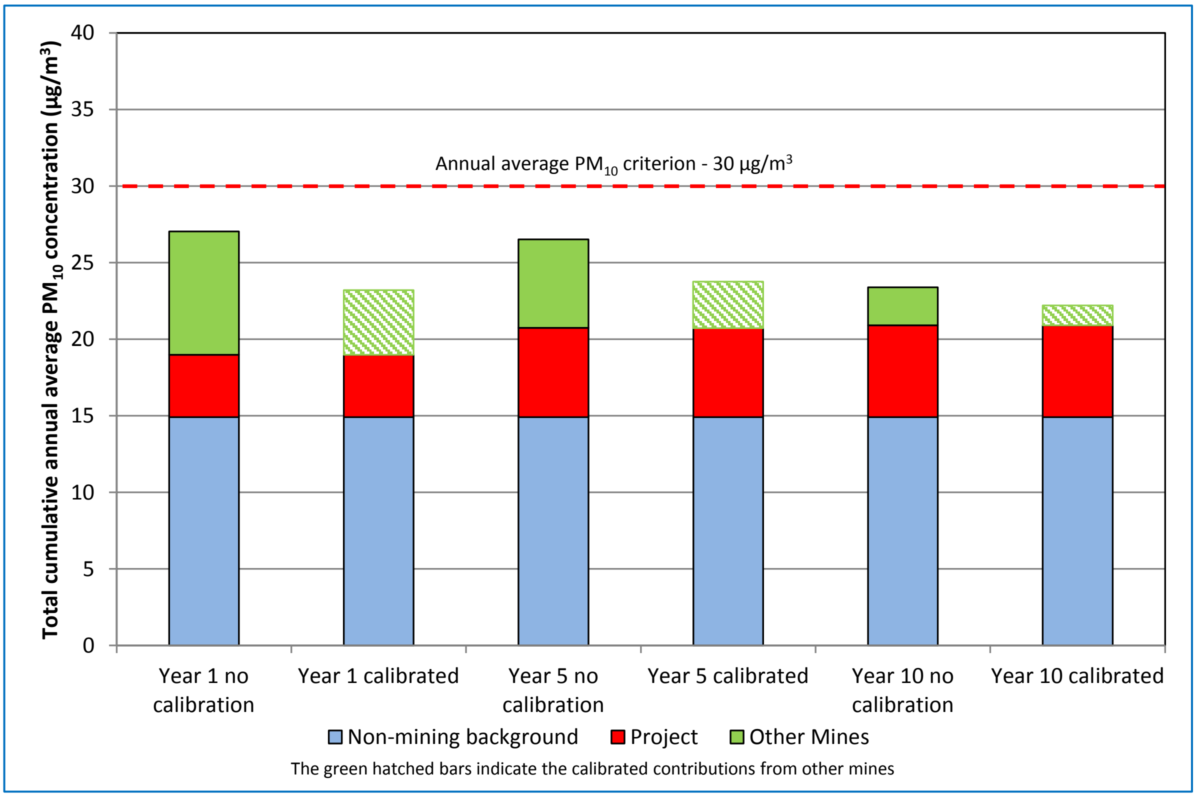

Figure 16: Non-mining background, Project and other mine annual PM_{10} contributions at R4

Peer Review Section 3.6.1 Setting annual average background levels

The issue of median versus average was covered in the response to submissions to the satisfaction of the EPA by carrying out some sensitivity testing. Results showed that the area of impacts would not be materially affected. Further clarification was provided to the reviewer in the meeting on 10 November and he is now satisfied with the approach.

The issue about finer particles and recirculation was only raised to show that even using these more remote sites they may not be completely removed from the influence of mining. This was explained to the reviewer in the meeting on 10 November and it is understood that he has no further issue.

The reviewer still appears to have concerns regarding the use of values from monitoring sites removed from the Project area to represent background levels. We agree that where appropriate, assessments should use available monitoring data close to the site/receptors in order to estimate what ambient background levels would be in the vicinity. However the Hunter Valley is a unique case where there are multiple large mining sources in close proximity to each other and on an annual basis it is not possible to separate out contributions from individual mines at any given receptor using monitoring data.

It is not appropriate to use monitoring data close to the Project to determine background for annual average, where there are other alternative methods of determining non-modelled background levels. The Approved Methods suggests alternative approaches be used for areas where there are already elevated levels of dust. It is noted that the alternative, as set out in the worked example in Section 11.2 of the Approved Methods, deals specifically with the 24-hour average assessment rather than the annual average however this does not mean that alternative approaches are not also suitable for annual average assessments.

To be clear, we are using the term 'background' in this context to define the levels of PM that might be found in this type of area <u>in the absence of mining activity</u> in the Valley. In other words, this is the contribution that all other <u>non-mining</u> sources would make to the air shed, both natural and anthropogenic. In this context, it makes more sense to use monitors that are removed from the influence of mining activity. Mining contributions from both the Project and other surrounding mines are then modelled and added to this non-mining background.

It does not make sense for the annual average assessment, to use data from a monitor, say SX9, and add it to both the Project and other mines. While it is true that this monitor is located near the most affected residences to the southeast of the Project, it will by nature of its location include contributions from all nearby operations. To add these again will result in an overly conservative and unrealistic estimate of levels in that area on an annual basis. Alternatively, to use a background level value derived by subtracting modelled mine and other mine contributions from monitored data from the modelling period runs the risk that the background levels derived by the residual values are artificially low due to the conservative predictions used in the modelling of other mine sources; thus adding these derived background levels to future modelled years potentially underestimates cumulative impacts.

For these reasons, we do not believe it is necessary to reprocess the annual average PM_{10} results using data near the Project. We do not consider that the reprocessing suggested by the reviewer would provide levels which represent a realistic 'background' as we defined above.

The approach used in the AQIA has undergone scrutiny by the NSW EPA and they have concluded that the methodology has been satisfactorily addressed in our RTS report and retains an appropriate degree of conservativeness. The EPA note that the adopted background values and modelled contributions from neighbouring mines have been included in the cumulative annual average assessment.

While there may be some debate on whether one particular method for cumulative annual assessment is "more accurate" than another, there is perhaps more value in comparing the results from these different methods to determine whether similar values are estimated. In the case of residence R4 (described in detail above), we note that the method used in the AQIA and that used in the recent Rix's Creek assessment result in very similar estimates of cumulative annual average PM_{10}.

Figure 17 is an extract from the Rix's Creek AQIA for 2017 which is the closest modelled year to Year 1 of the project. It shows that at R4, the cumulative annual average PM_{10} concentrations are predicted to be between 20 – 30 µg/m³ (probably around 22 – 23 µg/m³). This is almost exactly what is predicted for the same location for the Project, using the calibration factors for other mines (see **Figure 16**).

Similar levels are predicted in the Rix's Creek AQIA at R4 in both 2020 and 2026 (corresponding to Year 5 and Year 10). As shown in **Figure 16** above, these are very similar to the calibrated levels predicted at R4 for the Project annual cumulative PM_{10} assessment of 23 µg/m³ (Year 5) and 21 µg/m³ (Year 10).

In summary then, the methodology used in the AQIA has been tested and is producing results of a similar magnitude to those predicted in recent cumulative assessments in the same area. As noted earlier, the methodology used in the AQIA and RTS has also been accepted by the EPA.

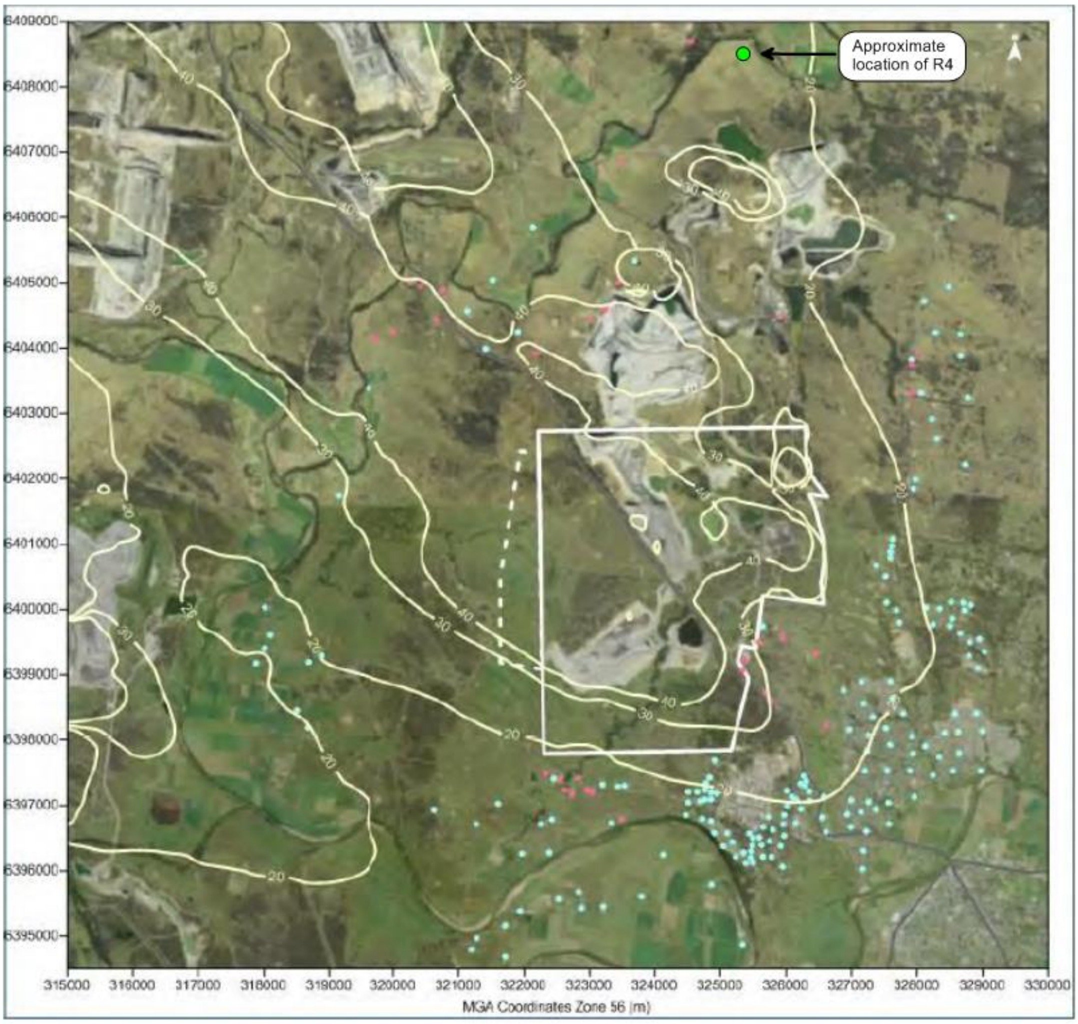

Figure 17: Predicted annual average PM_{10} concentration due to emissions from the Rix's Creek Project and other sources in 2017 – µg/m3 (Figure E-6 from Todoroski Air Sciences, 2015)

Peer Review Section 3.6.1.1 TSP levels

Co-located TSP and PM_{10} data are limited and is likely to be a conservative approach as the TSP:PM_{10} ratio may be lower away from mining. Regardless of this, there was no requirement in the DGRs to assess TSP for this Project.

The reviewer requires no further action.

Peer Review Section 3.6.1.2 PM_{10} levels

The reviewer's comments regarding the use of mean versus median to estimate annual average background values have been addressed in the sensitivity testing presented in the RTS report (described earlier in the response to Section 3.6.1).

The reviewer is satisfied as to this point and no further action is required.

Peer Review Section 3.6.1.3 $PM_{2.5}$ levels

The reviewer is satisfied that the approach in the AQIA regarding background $PM_{2.5}$ is likely to be conservative and no further action is required.

Peer Review Section 3.6.2 Summary of annual average background level selection

The issues regarding the use of the median has been addressed in the sensitivity testing presented in the RTS report (described earlier in the response to Section 3.6.1). No further action is required.

Issues regarding the use of monitors further removed from the site have also been discussed above. These monitors were deliberately used to be more representative of 'background' levels (as defined above) that are less dominated by mining. Other mines and the Project are added to this.

This methodology has been accepted by the EPA and is supported by similar cumulative impact results in other assessments.

Peer Review Section 3.7 Emissions

The reviewer's concern with the emission calculations used in the assessment is the use of on-site silt and moisture content measurements and whether this skews the inventory. At the meeting on 10 November the reviewer was mainly concerned about the difference in moisture content between the in pit and out of pit overburden moisture content. In particular, it was thought that the use of the measured 'inactive overburden' moisture and silt data would lead to a much smaller proportion of emissions from dozers. The 'inactive overburden' data is only used in the modelled emissions from dozers working on overburden out-of-pit. The modelled emissions from handling overburden in-pit and the unloading of overburden trucks use the lower moisture overburden data which were obtained from the testing of samples of in-pit overburden.

The emissions for Year 1 were recalculated applying the lower moisture content of the in-pit overburden to the out-of-pit activities. This increased the overall TSP levels in the modelled Years 1, 5 and 10 by 0.3%, 0.3% and 0.4%, respectively and would make no material difference to the outcomes of the assessment. The distributions of TSP by activity for the original inventory and the reduced moisture inventory are shown below in **Figure 18** and **Figure 19** respectively. The updated calculations do not show any significant change to the distribution for TSP emissions and would not result in any material difference to the outcomes of the assessment.

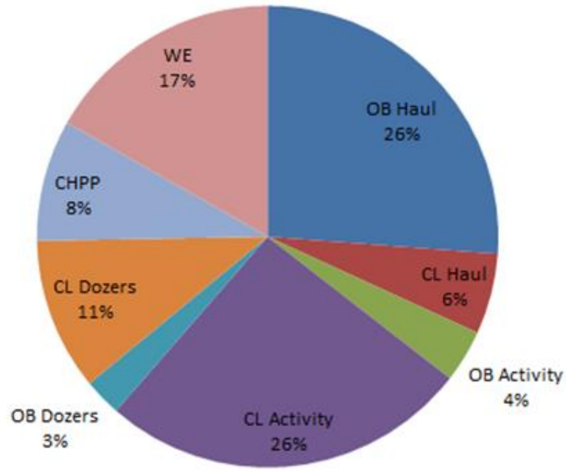

Figure 18: Original TSP emission distribution using onsite in pit moisture measurements

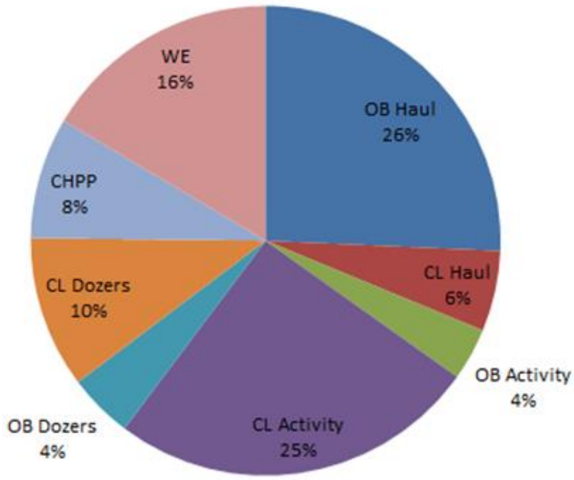

Figure 19: Revised emissions distribution using reduced moisture out of pit

It is noted that the relative distribution of emissions by source is unique for each mining project. It is not only dependent on silt and moisture contents, but by other things such as haul distances, dozer hours, coal handling procedures and emission control measures, among other things. For this Project, there are significant amounts of coal haulage, transfer and processing from Glendell which are included in the coal activities. There is also haulage and transfer of coal to other ROM pads and conveyers and not just to the CHPP. The depth of the North Pit and the predominance of in-pit emplacement also means that more overburden can be dumped without the need for shaping than is possible for many shallower operations. It is also noted that a significant amount of planning went into the design of this Project in order to reduce haul distances and overburden transfers which also leads to lower contributions from these activities.

The emissions inventory calculations for each modelled stage of the Project underwent significant review prior to modelling, both internally and by an external peer reviewer.

The silt and moisture data applied in the inventories were collected on site and therefore meet the US EPA's preferred approach of collecting site specific data.

Peer Review Section 3.7.1 Train dust emissions

The reviewer does not note any issues of significance with regard to emissions from train dust and does not require any further response.

As noted earlier, the EPA did not raise any concerns with the assessment of coal train dust emissions in the AQIA or EIS.

Peer Review Section 3.7.2 Blasting

The peer reviewer has incorrectly referred to NO_2 emissions, however the emissions reported in the AQIA are total NO_x not NO_2 and would therefore be higher. NO_x emissions are used and predictions are then converted to NO_2 using the conservative Ozone Limiting Method (OLM).

This was explained at the meeting on 10 November and the reviewer was satisfied that emission levels were appropriate and that the OLM conversion was conservative.

The reviewer notes that no further action is required.

Peer Review Section 3.7.3 Emissions from other mines

The issue of which other mines were included in the cumulative assessment and which were not was clarified in the meeting on 10 November and the reviewer is satisfied with the approach adopted in the assessment and requires no further action.

The area southeast of the Project is removed from the northwest-southeast wind direction axis, in relation to Rix's Creek. Additional emissions from potential Rix's Creek operations in the future are unlikely to have a significant effect on those receptors. The recent Rix's Creek AQIA shows that the contributions from those operations are very minor at those residences.

Peer Review Section 3.8.1 Approach to predictions and analysis of impacts – Dust Assessment

The reviewer is concerned about the use of monitoring data from SX14 and the impact this may have on the calibration factors. As described previously (see response to Peer Review Section 3.6), removing these data from the analysis makes little difference to the calibration grid across the domain, and almost no difference at all in the main area of interest south east of the Project. The only difference from the original AQIA, is a potential exceedance at R127c in Year 1. **Figure 20** presents the individual contributions at this location both with and without SX14 used in the calculations. Using SX14 in the calibration the cumulative annual average PM_{10} at R127c is estimated to be 28 µg/m^3, and 31 µg/m^3 when it is removed from the calibration grid.

It is also clear from **Figure 20** that the contributions from both the Project and non-mining background remain the same as they are not calibrated. It is also clear that the Project is not a significant contributor to levels at R127c, and contributes approximately 2 µg/m^3 to the total cumulative annual average PM_{10} predictions.

It is also noted that annual average PM_{10} concentrations due to operations at Mt Owen are predicted to decrease at R127c with the Project relative to those from existing operations. **Figure 21** shows the predicted levels at R127c due to existing operations are approximately 5 µg/m^3, and are estimated to decrease to approximately 2 µg/m^3 in future years.

Given that monitoring shows levels near R127c are currently below the assessment criterion[2] and that levels due to the Project at that location are predicted to decrease from existing levels, it can be concluded that the Project is not likely to be the cause of the modelled exceedances of this criterion at R127c.

[2] The annual average PM_{10} measurement at the OEH Camberwell site in 2012 was 26.4 µg/m^3, 27.8 µg/m^3 in 2013 and 24.8 µg/m^3 in 2014.

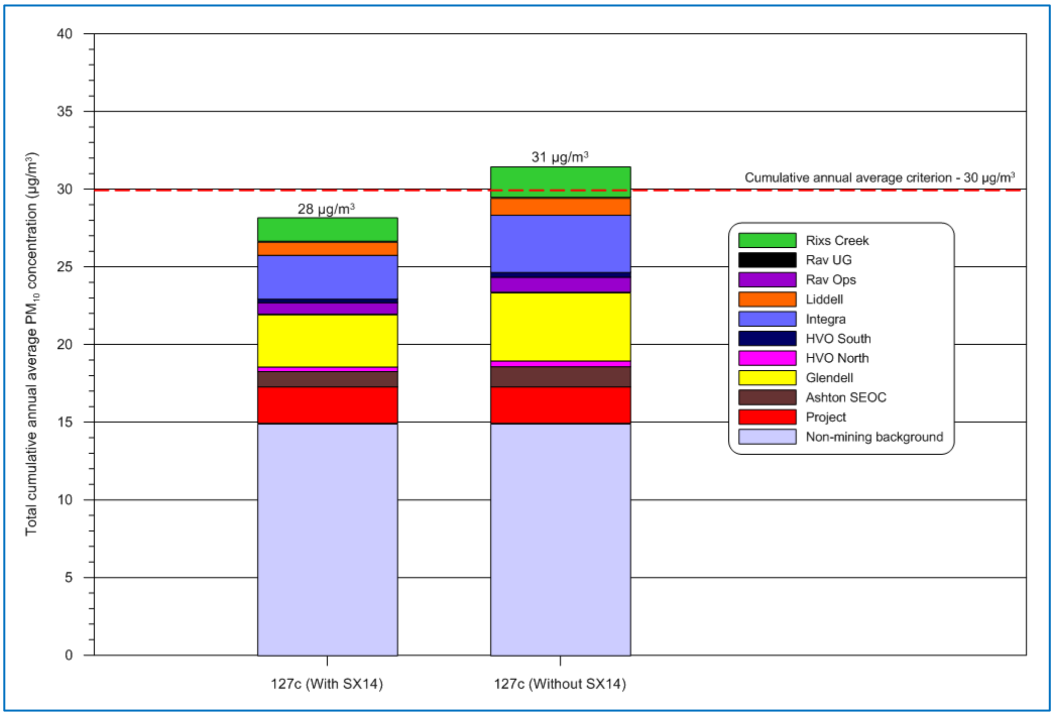

Figure 20: Individual contributions to the cumulative annual average PM10 concentrations at R127c, with and without using SX14

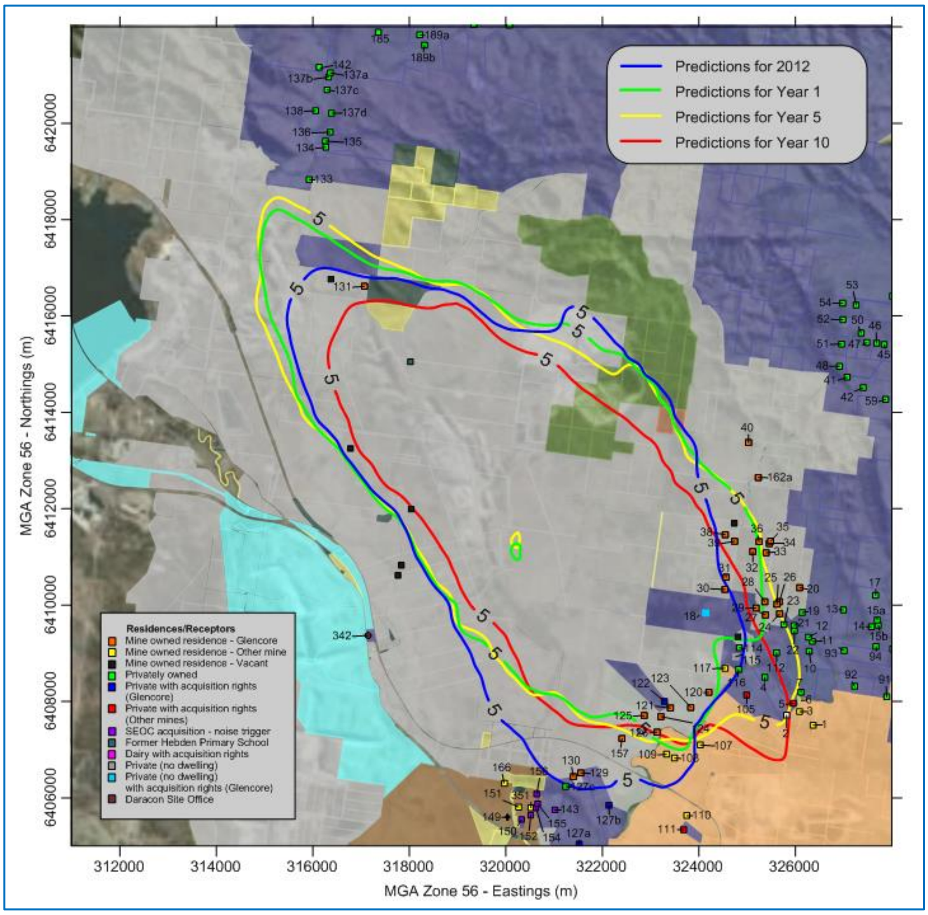

Figure 21: Predicted annual average PM10 concentrations for current and proposed operations

The reviewer has also noted that there may be an error in some of the results presented in Appendix E of the AQIA. The spreadsheets used to make the contour plots and on which the conclusions are drawn, are correct. However, there was an error in transcribing those data from those spreadsheets to the tables for Year 10 (Table E3). The updated information for Table E3 is presented below in **Table 2**. This transcription error does not alter the assessment findings. All other tables in Appendix E of the AQIA have been checked and are consistent with the model outputs.

On this basis, and in consideration of the modelling issues raised by the reviewer and addressed in this document and the RTS, the provision of the additional modelling data requested by the reviewer is not considered to be necessary, particularly given the close correlation of predicted cumulative annual average PM_{10} predictions in the AQIA with predictions in other studies.

Table 2: Updated Table E3 from the original AQIA – Cumulative predictions – Year 10

Receptor ID	Annual Average			
	$PM_{2.5}$	PM_{10}	TSP	Dust Deposition
	Assessment criteria			
	8 µg/m³	30 µg/m³	90 µg/m³	4 g/m²/month
Private Receptors				
2	8	20	55	2.4
4	8	21	58	2.6
5	8	19	54	2.4
6	8	19	52	2.4
7	8	19	52	2.4
10	8	17	47	2.3
11	8	17	46	2.3
12	8	17	46	2.3
13	8	16	43	2.2
14	8	16	43	2.1
15b	8	16	42	2.1
15a	8	15	42	2.1
17	7	15	42	2.1
19	8	17	46	2.3
21	8	17	47	2.3
22	8	17	47	2.3
23	8	18	48	2.4
41	7	14	39	2.0
42	7	14	39	2.0
43	7	14	39	2.0
44a	7	14	39	2.0
45	7	14	39	2.0
46	7	14	39	2.0
47	7	14	39	2.0
48	7	14	39	2.0
49	7	14	39	2.0
50	7	14	39	2.0
51	7	14	39	2.0
52	7	14	39	2.0
53	7	14	39	2.0
54	7	14	39	2.0
55	7	14	39	2.0
56b	7	14	39	2.0
57	7	14	39	2.0
58	7	14	39	2.0
59	7	14	39	2.0
60	7	14	39	2.0
61	7	14	39	2.0
62	7	14	39	2.0
63a	7	14	39	2.1
162b	7	14	39	2.1
350	7	14	39	2.1
66	7	14	39	2.1
67	7	14	39	2.0
68	7	14	40	2.1
69b	7	14	40	2.1
69a	7	14	40	2.1

71	7	14	40	2.1
72	7	14	40	2.1
73	7	15	40	2.1
74	7	15	41	2.1
75	7	15	40	2.1
76	7	15	40	2.1
77	7	15	40	2.1
78	7	14	40	2.1
79	7	14	40	2.1
80	7	14	40	2.1
81	7	14	40	2.1
82	7	15	41	2.1
83	7	15	41	2.1
84a	7	15	41	2.1
85	7	15	41	2.1
86	7	15	42	2.1
87	7	15	41	2.1
88	7	15	42	2.1
89	8	16	43	2.2
91	8	16	44	2.2
92	8	16	45	2.2
93	8	16	45	2.2
94	8	16	43	2.1
95	8	16	42	2.1
96	8	16	43	2.2
97	8	16	43	2.2
98	8	15	42	2.2
99	8	16	44	2.2
100	8	16	44	2.2
101	8	16	44	2.2
102a	8	16	45	2.2
102b	8	17	45	2.2
105	8	22	61	2.6
111	8	20	54	2.3
112	8	19	53	2.5
114	9	23	65	2.8
116	9	23	64	2.7
122	8	21	59	2.4
127b	8	18	47	2.2
127a	8	17	45	2.2
133	8	17	45	2.1
134	8	16	44	2.1
135	8	16	43	2.1
136	8	16	43	2.1
137d	8	15	42	2.1
138	8	16	43	2.1
137c	8	15	42	2.1
137b	8	15	42	2.1
137a	8	15	42	2.1
142	8	15	42	2.1
143	8	17	45	2.2
144a	8	19	48	2.4
145	8	18	46	2.3
146	8	17	44	2.2
147	8	16	43	2.2
148	8	16	44	2.2
149	8	17	44	2.2
150	8	17	45	2.2
152	8	17	45	2.2
154	8	17	45	2.1
155	8	17	44	2.1
156	8	16	45	2.1
163	8	16	42	2.1
185	7	15	40	2.1
189a	7	14	40	2.0
189b	7	14	40	2.0
191	7	14	39	2.0
192	7	14	39	2.0
181	7	14	39	2.0
196	7	14	39	2.0
194a	7	14	39	2.0

195b	7	14	38	2.0
195a	7	14	38	2.0
194b	7	14	38	2.0
197a	7	14	38	2.0
197b	7	14	38	2.0
208	7	14	38	2.0
337	7	14	38	2.0
209	7	14	38	2.0
215	7	14	38	2.0
216	7	14	38	2.0
217	7	14	38	2.0
210	7	14	38	2.0
211	7	14	39	2.0
178	7	14	38	2.0
212	7	14	39	2.0
213	7	14	39	2.0
56a	7	14	39	2.0
44b	8	16	43	2.2
218	7	14	38	2.0
220	7	14	38	2.0
224	7	14	38	2.0
223c	7	14	38	2.0
223a	7	14	38	2.0
223b	7	14	38	2.0
214	7	14	39	2.0
226	7	14	39	2.0
228	7	14	39	2.0
227	7	14	39	2.0
229	7	14	39	2.0
230	7	14	39	2.0
221	7	14	39	2.0
248	7	14	39	2.0
232	7	14	39	2.0
249	7	14	39	2.0
233	7	14	39	2.0
234	7	14	39	2.0
235	7	14	39	2.0
236	7	14	39	2.0
245	7	14	39	2.0
241	7	14	39	2.0
237b	7	14	38	2.0
237a	7	14	38	2.0
240	7	14	38	2.0
242	7	14	39	2.0
244	7	14	39	2.0
243	7	14	39	2.0
246	7	14	39	2.0
347	7	14	39	2.0
247	7	14	39	2.0
250	7	14	39	2.0
251	7	14	39	2.0
252	7	14	39	2.0
253	7	14	39	2.1
348	7	14	39	2.0
254	7	14	39	2.1
255	7	14	39	2.1
277	7	15	40	2.1
287	7	15	42	2.2
285	7	15	41	2.1
283	7	15	41	2.1
274	7	15	41	2.1
272	7	15	42	2.1
270	7	15	42	2.1
279	8	16	43	2.2
281	8	16	44	2.2
280	7	14	39	2.0
282	8	18	48	2.3
290	8	17	46	2.3
164	8	18	48	2.3
292a	8	17	47	2.3
292b	8	17	47	2.3

289	8	17	45	2.2
288	8	17	45	2.2
294	8	17	47	2.3
293	8	18	48	2.3
295	8	18	47	2.3
296	8	17	47	2.3
297d	8	17	46	2.3
297a	8	17	46	2.3
297b	8	17	46	2.3
297c	8	17	46	2.3
299	8	17	45	2.3
300	8	17	45	2.2
302	8	17	45	2.2
303	8	17	45	2.2
349b	8	17	44	2.2
349a	8	17	44	2.2
305	8	17	44	2.2
298	8	16	44	2.3
304b	8	16	43	2.2
304a	8	16	43	2.3
306	8	17	44	2.2
307	8	17	44	2.2
308	8	17	44	2.2
309	8	17	44	2.2
310	8	17	44	2.2
311	8	17	44	2.2
312	8	17	44	2.2
319	8	18	48	2.3
320	8	17	44	2.2
321	8	17	44	2.2
318	8	17	44	2.2
322	8	17	44	2.2
317	8	17	44	2.2
316	8	17	44	2.2
323	8	17	44	2.2
324	8	17	44	2.2
315	8	16	43	2.2
314	8	16	43	2.2
330	8	16	43	2.2
329	7	14	39	2.0
328	8	16	43	2.2
327	8	16	43	2.2
326	8	17	44	2.2
325	8	17	44	2.2
144c	8	19	48	2.3
144b	8	19	48	2.3
278	7	15	41	2.1
84b	7	15	41	2.1
137e	7	15	41	2.1
259	7	15	40	2.1
260	7	15	41	2.1
127c	8	17	46	2.2
115	9	23	66	2.8
Mine Owned Receptors				
1	8	19	51	2.4
3	8	19	53	2.4
20	8	16	45	2.2
24	8	18	48	2.4
25	8	18	48	2.4
26	8	17	48	2.3
27	8	18	51	2.4
28	8	18	50	2.4
29	8	19	52	2.5
30	9	22	63	2.8
31	8	21	60	2.7
32	8	18	48	2.3
33	8	17	46	2.3
34	8	17	46	2.2
35	8	17	45	2.2
36	8	17	47	2.3
38	8	19	51	2.5

39	8	18	50	2.4
40	7	15	41	2.1
90	8	16	43	2.2
104	8	17	45	2.2
107	8	21	58	2.4
108	8	20	56	2.4
109	8	20	56	2.4
110	8	21	56	2.4
117	9	24	68	2.8
120	8	22	61	2.5
121	8	21	59	2.4
123	8	21	58	2.4
124	8	21	58	2.4
125	8	21	57	2.4
126	8	20	56	2.4
129	8	18	49	2.2
130	8	17	48	2.2
131	8	18	52	2.3
151	8	17	44	2.1
351	8	17	44	2.1
157	8	20	55	2.3
158	8	17	45	2.2
159	8	17	44	2.2
160	8	17	44	2.2
162a	7	15	41	2.1
344	8	18	49	2.3
165	8	18	49	2.3
291	7	14	39	2.0
342	8	17	45	2.2
166	8	17	45	2.1
352	8	16	44	2.2
353	8	16	43	2.2

Peer Review Section 3.8.2.1 Nitrogen dioxide assessment – Operational activities

It is acknowledged that the background data available are a significant distance from the Project, but these are the only data available which contain both NOx/NO_2 and Ozone (required for the OLM).

The reviewer considers this issue is not significant and no further action is required.

Peer Review Section 3.8.2.2 Nitrogen dioxide assessment – Blasting

With respect to the times for which blasts have been assessed, the reviewer is incorrect. As shown in Table 11.1 of the AQIA, NO_2 concentrations were assessed for all hours of the year (8784 in total) and were not limited to the 9am to 5pm period. Accordingly, blasting between 7am and 9am was accounted for and assessed. The blast assessment showed that the exceedances that are predicted to occur at this time are almost exclusively in the winter months. There are no predicted exceedances between 7am and 9am at these nearest locations during the warmer months. This information will be used to inform the Blast Fume Management Plan.

Also noted in the AQIA there are some meteorological conditions under which exceedances were predicted to occur at properties R114 and R116 should a Rating 3 Fume Category event occur at the closest blasting point to these residences. As discussed in the RTS and AQIA, the assessment has identified that the meteorological conditions under which these exceedances may occur are very specific and potential impacts can be effectively managed by excluding blasting during these periods.

As discussed in the RTS report, Mount Owen is committed to updating the Blast Fume Management Plans to restrict blasting to periods when meteorological conditions are not conducive to fume dispersal towards any residential receivers around the Project area. By identifying the conditions where a worst case blast scenario in specific areas may result in exceedances of criteria at the nearest residences and including management controls which prevent blasting in these areas during these conditions, the potential for an exceedance at these residences or any residences further away is reduced to as low as reasonably practicable. These controls would be implemented in relation to all blasts, including those carried out between 7am and 9am.

Additionally, blast design and management measures play an important role in minimising the likelihood of the occurrence of higher category blast fume events. Controls of this nature are already incorporated into the relevant Blast Fume Management Plans and will continue to be used for the Project. Additional reasonable and feasible measures may also be implemented as further knowledge and technology regarding blast fume generation becomes available. Mount Owen will also continue to operate the notification system to advise residents of all proposed blasts.

Peer Review Section 3.9 Overall model accuracy

The reviewer states that:

"… for annual average values the modelling results would typically lie within approx. 100% to 150% of the actual levels, a ratio of 1.0 to 0.66."

A reference to the "100% to 150% of the actual levels" suggestion should be provided by the reviewer, although it is not apparent how this has been derived. However, in the light of the coarseness and conservatism in the model inputs for the other mines (as described in response to Peer Review Section 3.6), this component is performing reasonably well at the receptors of interest to the southeast of the Project. **Figure 11** shows that the model calibration is between 0.5 – 0.6 at the most affected receptors. As discussed previously, it is again noted that this calibration is <u>only applied to other mines</u> where the inputs are more conservative, and not to either the Project or the estimated non-mining background. The conservativeness of modelling predictions for the Project are retained in full in the AQIA annual average cumulative predictions and, as detailed in the RTS, the modelled predictions are considered to be conservative. Furthermore, the AQIA predicted cumulative impacts at R4 are consistent with the cumulative annual average predictions in the Rix's Creek cumulative annual average assessment indicating that the different modelling approaches produce similar results.

It must also be noted that Residences R114 and R116 are in this area and are already subject to acquisition regardless of cumulative annual average predictions. The majority of the remaining receptors in that area have calibration factors (for other mines only) of greater than 0.6 and the predicted results (calibrated or uncalibrated) are all within the cumulative annual average criteria of 30µg/m^3 (PM_{10}) and are consistent with predictions in other contemporary cumulative impact assessments.

Peer Review Section 4 Discussion and conclusions

The reviewer concludes that

"… the Project is generally sound and is unlikely to be a significant risk to the environment."

The reviewer also notes that there is no relative comparison between the current and future line of impact. **Figure 22** and **Figure 23** below shows the predicted maximum 24-hour average $PM_{2.5}$ and PM_{10} concentration (Project only), for Year 1, 5 and 10 relative to the current operations. The same comparison for predicted annual average Project only concentrations are shown in **Figure 24** and **Figure 25** for $PM_{2.5}$ and PM_{10}, respectively.

As expected, these contours track to the southeast as the Project progresses.

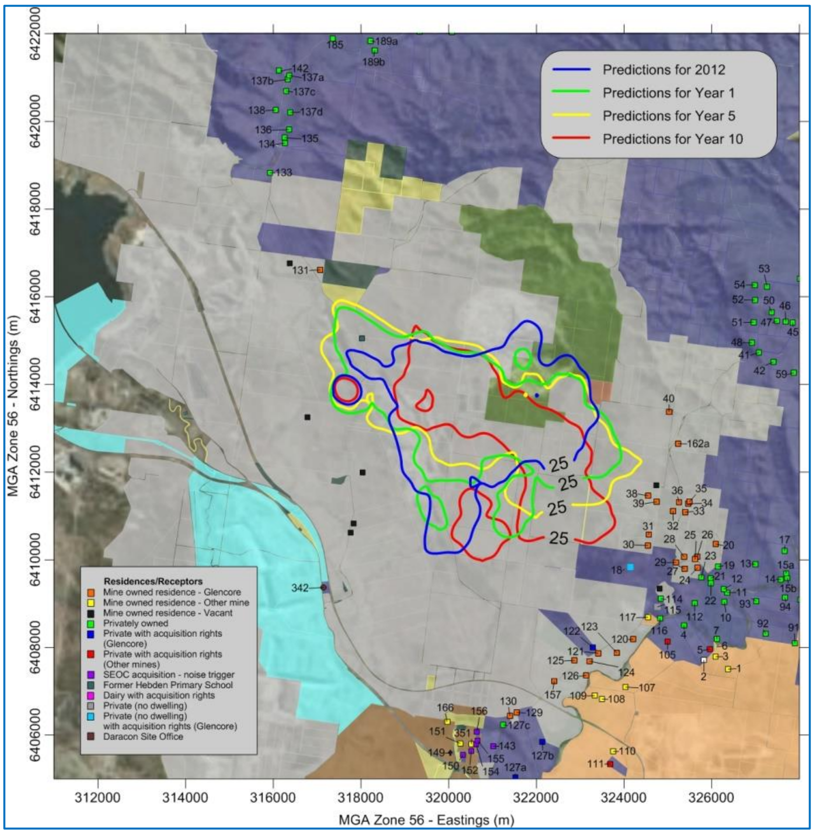

Figure 22: Predicted maximum 24-hour average $PM_{2.5}$ concentration (Project only)

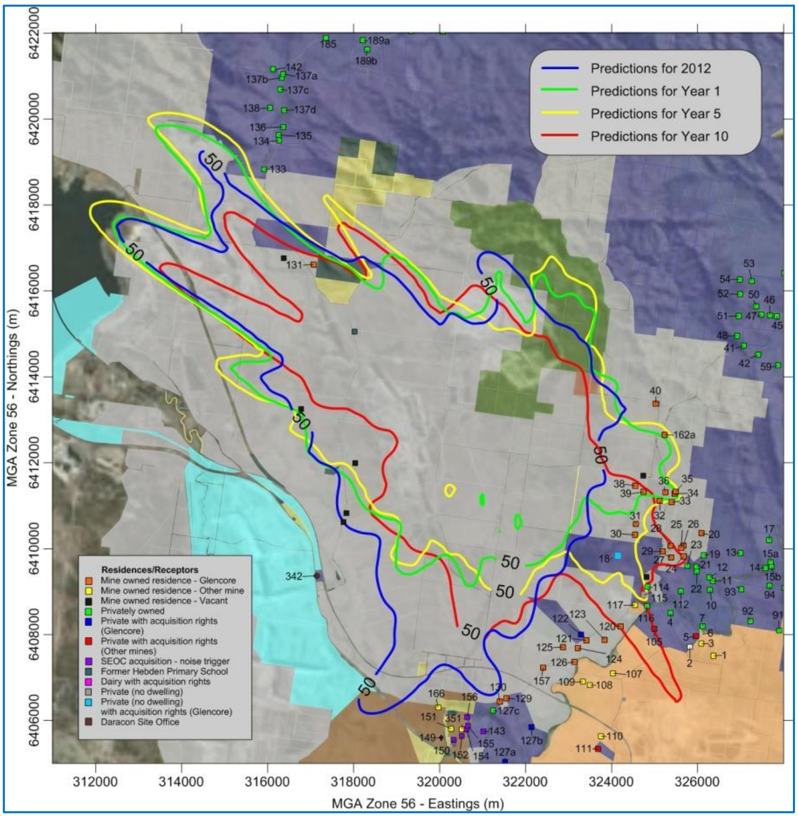

Figure 23: Predicted maximum 24-hour average PM_{10} concentration (Project only)

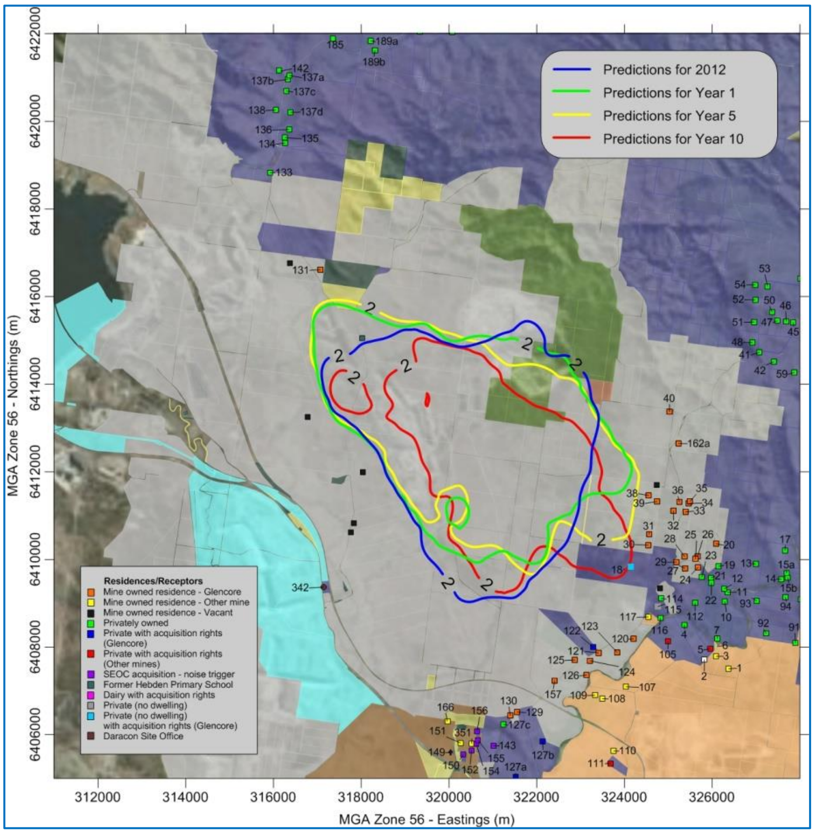

Figure 24: Predicted annual average $PM_{2.5}$ concentration (Project only)

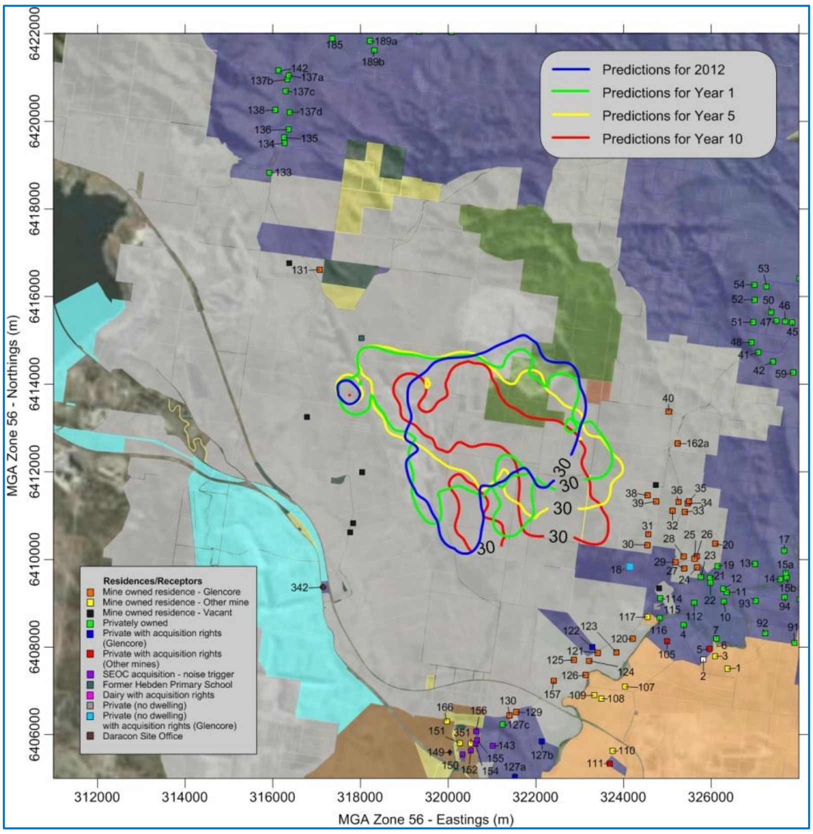

Figure 25: Predicted annual average PM_{10} concentration (Project only)

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