ERM

Level 15 309 Kent Street
Sydney NSW 2000
Locked Bag 3012
Australia Square NSW 1215

Telephone: +61 2 8584 8888
Fax: +61 2 9299 7502

www.erm.com

Belinda Pignone
Environmental Planning and Compliance Coordinator
Hanson
Email: belinda.pignone@hanson.com.au

7 October 2021

Reference: 0418291

Subject: Sancrox Quarry Expansion: EPA Advice on Response to Submissions Report – Air quality

The NSW Environment Protection Authority (EPA) have reviewed the Submissions Report for the proposed Sancrox Quarry Expansion Project (Application SSD-7293). Recommendations for further analysis or explanation were provided to the Department of Planning, Industry and Environment (DPIE) on 22 June 2021, and some of these related to the Air Quality assessment. This letter summarises those comments and EPA recommendations, and provides a response for each.

1 Additional exceedances of the EPA's 24-hour PM_{10} criterion are predicted at receptor R13.

EPA Comment

Given that it is proposed that operations may be undertaken for 24 hours during 20 days a year, a 'Maximum Day (24 hours)' emissions scenario was prepared to show the potential impacts of the 24-hour on-site operations at the maximum daily proposed throughput. Results for this emissions scenario, show that there are 3 predicted additional exceedances of the EPA's 24-hr PM_{10} criterion at receptor R13.

Further, and whilst it is acknowledged that no additional exceedances are predicted for the 'Maximum day (5am – 10pm)' emissions scenario, additional information is required to allow for a robust and transparent review of the assumptions made and input data used to estimate emissions for this emissions scenario.

EPA Recommendation

The EPA recommends that additional information be provided to robustly and transparently demonstrate that no additional exceedances will occur for any of the proposed stages or operating hours at any of the existing and future sensitive receptors located in the vicinity of the premises. Consideration must be given but not necessarily be limited to:

a) Presenting cumulative impacts at receptors located immediately east of the project boundary, where the approved industrial area has been identified.

b) Further information on the proposed control strategies to manage predicted exceedances. Including further information to demonstrate that the proposed monitoring and reactive management measures can manage predicted exceedances.

Additionally, the contour plots should be reviewed and revised where appropriate, given the discrepancies with tabulated results.

ERM Response:

Updated modelling has been carried out for the three scenarios, as follows:

1. Scenario 1 - Annual quarry throughput of 530,000 t/year (normal operating hours)
   - Provides predictions which can be compared against annual average criteria
2. Scenario 2 - Maximum daily quarry throughput (normal operating hours)
   - Maximum daily truck movements of 325 truck movements[1]/day for final product to market
   - Provides predictions which can be compared against 24-hour average criteria
   - Enables a potential maximum daily operation scenario to be modelled against all likely meteorological conditions to provide a maximum impact
   - Does not assume that this will occur every day of the year, but only when these emissions coincide with worst case meteorology
3. Scenario 3 - Maximum daily quarry throughput (extended operating hours for 20 days/year)
   - As per scenario 2 above, but with some activities occurring 24/7 for 20 days of the year, including 37 additional truck movements between 10pm and 7am for final product to market
   - Provides predictions which can be compared against 24-hour average criteria
   - Enables a potential maximum daily operation scenario to be modelled against all likely meteorological conditions to provide a maximum impact
   - Does not assume that this will occur every day of the year, but only when these emissions (20 days of the year) coincide with worst case meteorology

The updated models included an increased area of wind erosion within the pit. It was assumed that 7.5 ha of the pit floor would be generally inactive (no activities) and exposed to wind erosion. This is more than 3 times the area considered in the last modelling iteration. The remaining area will be active and include activities such as excavation, loading to trucks and haulage.

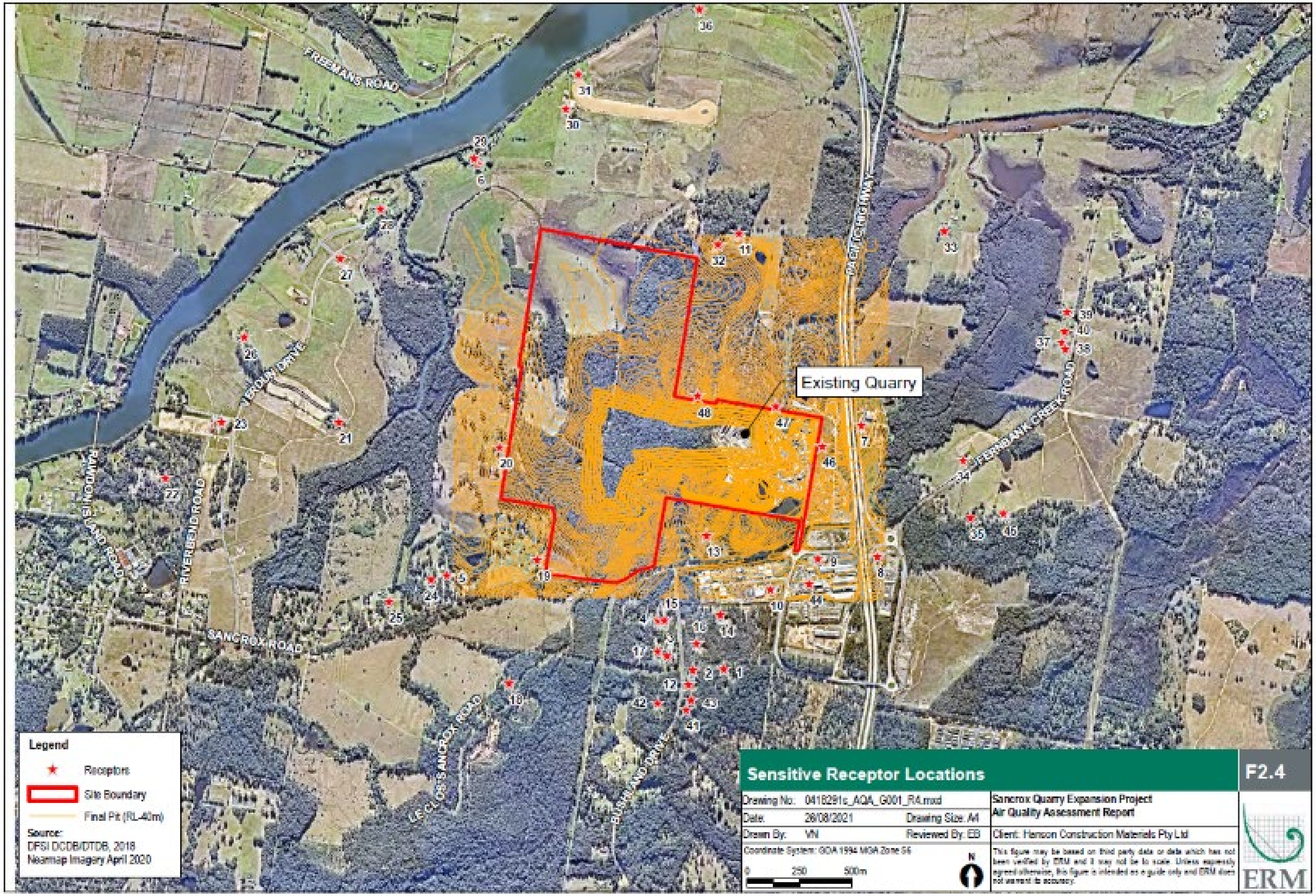
The emissions inventories were updated to account for the times individual activities are anticipated to occur for each scenario. Table 1 shows a summary of these time periods.

In addition to these changes to the emissions inventory, predictions were made at a further three receptors, shown as R46, R47 and R48 in Figure 1. These locations represent industrial areas immediately adjacent to the northern and eastern site boundaries. Transfer of ownership of Receptor 13 (R13) to Hanson will be finalised in September 2021 and so there is no need to consider R13 as a sensitive receptor. However, it is still noted on the figures and greyed out in the tables for completeness.

[1] One truck movement indicates a trip either into or out of the site. So 325 movements in this context, equates to a little over 162 trucks entering the site and 162 trucks leaving the site.

Table 1: Operating hours for different activities

Activity	Hour of operation Scenarios 1 & 2 (normal operation)	Hours of operation Scenario 3 (extended hours for 20 days per year)
Quarry site		
QUARRY - Drilling rock	7am to 5pm	7am to 5pm
QUARRY - Blasting rock	9am to 3pm	9am to 3pm
QUARRY - Excavators on Quarry Floor	5am to 10pm	5am to 10pm
QUARRY - Truck Rear Dumping	5am to 10pm	5am to 10pm
QUARRY - Front End Loaders (FELs)	5am to 10pm	24/7
QUARRY - Primary, secondary and tertiary crushing	5am to 10pm	5am to 10pm
QUARRY - Screening	5am to 10pm	5am to 10pm
QUARRY - Conveyor Transfer Points (2)	5am to 10pm	5am to 10pm
QUARRY - Conveyor Drop Points (8)	5am to 10pm	5am to 10pm
QUARRY - Rock Truck – Loaded / Unloaded, Onsite (unsealed)	5am to 10pm	5am to 10pm
QUARRY - Truck and dog – Loaded / Unloaded, Direct to market (unsealed)	7am to 10pm	24/7
QUARRY - Rock Truck – Loaded / Unloaded, Onsite (sealed)	5am to 10pm	5am to 10pm
QUARRY - Truck and dog – Loaded / Unloaded, Direct to market (sealed)	7am to 10pm	24/7
QUARRY – wind erosion on stockpiles, conveyors and exposed pit area	24/7	24/7
Concrete Recycling Plant (CRP)		
CRP - Truck Rear Dumping	7am to 5pm	7am to 5pm
CRP - Crushing	7am to 5pm	7am to 5pm
CRP - Truck and dog - Delivery of Dry Products (loaded / unloaded)	7am to 5pm	7am to 5pm
Concrete Batching Plant (CBP)		
CBP - Coarse Aggregate - Truck Rear Dumping	5am to 7pm	5am to 7pm
CBP - Sand - Truck Rear Dumping	5am to 7pm	5am to 7pm
CBP - Transfer of Aggregate	5am to 7pm	24/7
CBP - Transfer of Sand	5am to 7pm	24/7
CBP - Bag filter	5am to 7pm	24/7
CBP – Loaded / Unloaded truck and dog - coarse aggregate	5am to 7pm	5am to 7pm
CBP - Loaded / Unloaded truck and dog - Sand	5am to 7pm	5am to 7pm
CBP - Loaded / Unloaded Tanker - cement and cement supplement brought onsite	5am to 7pm	24/7
CBP - Loaded / Unloaded Agitator truck - product taken offsite	5am to 8pm	24/7
Asphalt Plant (AP)		
AP - Bitumen Delivery and Storage	5am to 10pm	24/7
AP - High quality aggregate delivery and storage	5am to 10pm	24/7
AP - Dryer emissions with bag filter	5am to 10pm	24/7
AP - Truck Load Out	5am to 10pm	24/7
AP - Loaded / Unloaded Tanker - bitumen delivery	7am to 5pm	7am to 5pm
AP - Loaded / Unloaded truck and dog - asphalt to market	5am to 10pm	24/7


FREEMANS ROAD
PACIFIC HIGHWAY
Existing Quarry
FERNBANK CREEK ROAD
VERDUN DRIVE
RAWDON ISLAND ROAD
RIVERBEND ROAD
SANCROX ROAD
LE CLOS SANCROX ROAD
SUNNYMEADE DRIVE
Legend
Receptors
Site Boundary
Final Pit (RL-40m)
Source:
DFSI DCDB/DTDB, 2018
Nearmap Imagery April 2020
Sensitive Receptor Locations
F2.4
Drawing No: 0418291s_AQA_G001_R4.mxd
Date: 26/08/2021
Drawing Size: A4
Drawn By: VN
Reviewed By: EB
Coordinate System: GDA 1994 MGA Zone 56
0 250 500m
N
Sancrox Quarry Expansion Project
Air Quality Assessment Report
Client: Hanson Construction Materials Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Results

Scenario 1 - annual throughput of 530,000 t/y, normal operating hours

Updated contour plots for annual average predicted TSP, PM_{10} and $PM_{2.5}$ concentrations are provided in Figure 2, Figure 3 and Figure 4, respectively. These plots represent the predicted cumulative impact, including both the Project increment and background. It can be seen that there are no predicted exceedances of the EPA assessment criteria at any of receptors assessed.

Table 2 presents the predicted annual average cumulative concentrations at all receptors with the Project increment in brackets. It can be seen that the project increments are relatively low.

Table 2: Predicted annual average cumulative concentrations

Receptor ID	TSP (µg/m^3) Cumulative (Project increment)	PM_{10} (µg/m^3) Cumulative (Project increment)	$PM_{2.5}$ (µg/m^3) Cumulative (Project increment)
Criteria	90 µg/m^3	25 µg/m^3	8 µg/m^3
1	30.8 (0.6)	15.8 (0.7)	5.6 (0.1)
2	30.9 (0.7)	15.8 (0.7)	5.6 (0.1)
3	31.3 (1.1)	16.1 (1)	5.7 (0.2)
4	32.1 (1.9)	16.5 (1.4)	5.7 (0.2)
5	30.6 (0.4)	15.4 (0.3)	5.6 (0.1)
6	30.3 (0.1)	15.2 (0.1)	5.5 (0)
7	32.8 (2.6)	16.4 (1.3)	5.7 (0.2)
8	31.2 (1.0)	15.8 (0.7)	5.6 (0.1)
9	32 (1.8)	16.2 (1.1)	5.6 (0.1)
10	31.9 (1.7)	16.3 (1.2)	5.7 (0.2)
11	30.8 (0.6)	15.5 (0.4)	5.6 (0.1)
12	30.8 (0.6)	15.7 (0.6)	5.6 (0.1)
13	37.1 (6.9)	18.7 (3.6)	6 (0.5)
14	31.5 (1.3)	16.3 (1.2)	5.7 (0.2)
15	32 (1.8)	16.5 (1.4)	5.7 (0.2)
16	31.1 (0.9)	16.1 (1)	5.7 (0.2)
17	31.4 (1.2)	16.1 (1)	5.7 (0.2)
18	30.7 (0.5)	15.5 (0.4)	5.6 (0.1)
19	31.6 (1.4)	16.1 (1)	5.7 (0.2)
20	30.6 (0.4)	15.5 (0.4)	5.6 (0.1)
21	30.3 (0.1)	15.2 (0.1)	5.5 (< 0.1)
22	30.2 (< 0.1)	15.1 (< 0.1)	5.5 (< 0.1)
23	30.2 (< 0.1)	15.1 (< 0.1)	5.5 (< 0.1)
24	30.5 (0.3)	15.4 (0.3)	5.5 (< 0.1)
25	30.4 (0.2)	15.3 (0.2)	5.5 (< 0.1)
26	30.2 (< 0.1)	15.1 (< 0.1)	5.5 (< 0.1)
27	30.3 (0.1)	15.1 (< 0.1)	5.5 (< 0.1)
28	30.3 (0.1)	15.2 (0.1)	5.5 (< 0.1)
29	30.3 (0.1)	15.2 (0.1)	5.5 (< 0.1)

Receptor ID	TSP (μg/m^3) Cumulative (Project increment)	PM_{10} (μg/m^3) Cumulative (Project increment)	$PM_{2.5}$ (μg/m^3) Cumulative (Project increment)
Criteria	90 μg/m^3	25 μg/m^3	8 μg/m^3
30	30.3 (0.1)	15.2 (0.1)	5.5 (< 0.1)
31	30.3 (0.1)	15.2 (0.1)	5.5 (< 0.1)
32	30.8 (0.6)	15.5 (0.4)	5.6 (0.1)
33	30.5 (0.3)	15.3 (0.2)	5.5 (< 0.1)
34	31.2 (1)	15.7 (0.6)	5.6 (0.1)
35	30.9 (0.7)	15.7 (0.6)	5.6 (0.1)
36	30.3 (0.1)	15.2 (0.1)	5.5 (< 0.1)
37	30.5 (0.3)	15.3 (0.2)	5.5 (< 0.1)
38	30.5 (0.3)	15.3 (0.2)	5.5 (< 0.1)
39	30.5 (0.3)	15.3 (0.2)	5.5 (< 0.1)
40	30.5 (0.3)	15.3 (0.2)	5.5 (< 0.1)
41	30.6 (0.4)	15.6 (0.5)	5.6 (0.1)
42	30.8 (0.6)	15.7 (0.6)	5.6 (0.1)
43	30.7 (0.5)	15.6 (0.5)	5.6 (0.1)
44	31.6 (1.4)	16 (0.9)	5.6 (0.1)
45	30.8 (0.6)	15.6 (0.5)	5.6 (0.1)
46	39.1 (9.1)	19 (3.9)	6 (0.5)
47	44.4 (14.2)	20.3 (5.2)	6.1 (0.6)
48	38.3 (7.9)	18 (2.9)	5.8 (0.3)

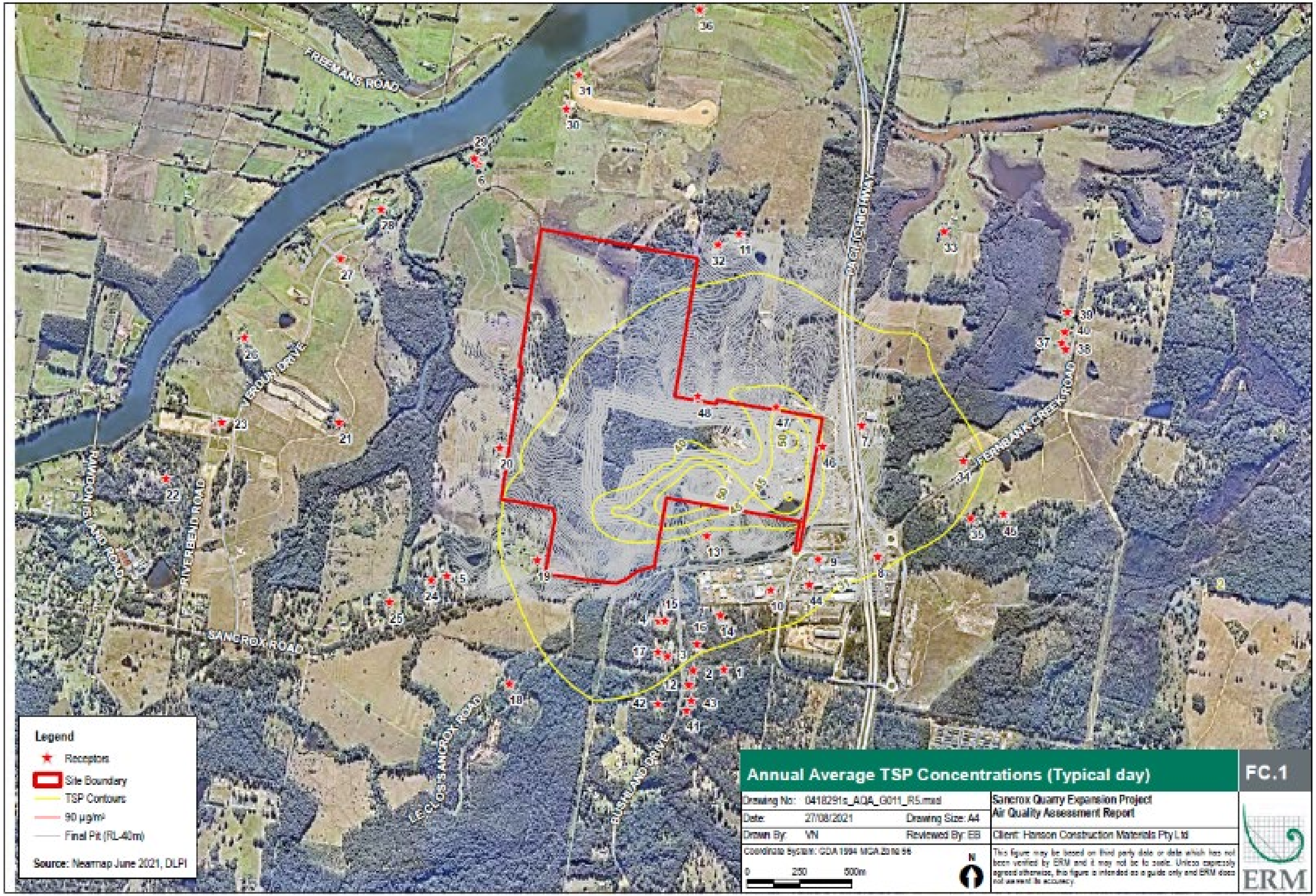


Figure 2: Cumulative annual average TSP concentrations for throughput of 530,000 t/y

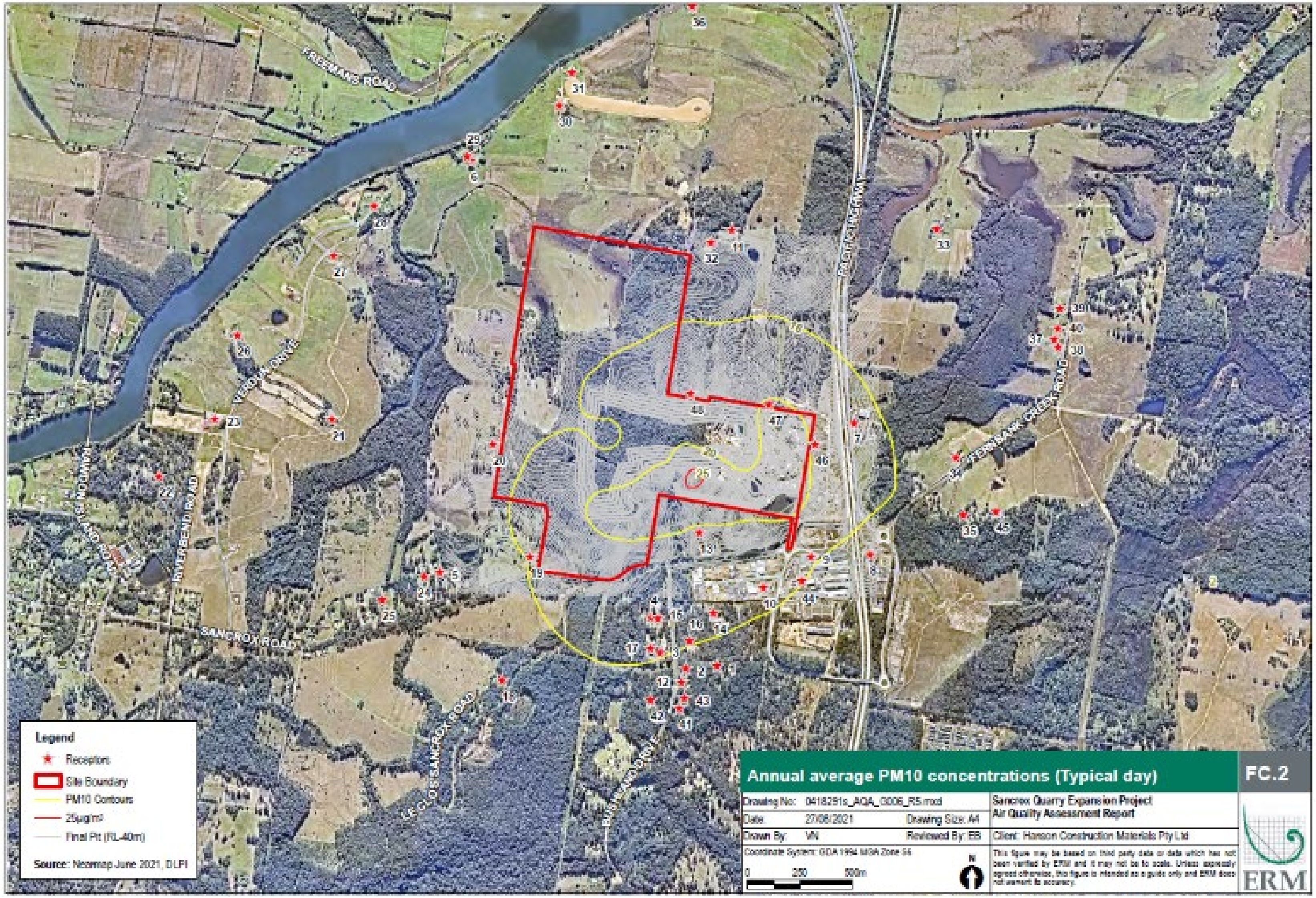


Figure 3: Cumulative annual average PM_{10} concentrations for throughput of 530,000 t/y

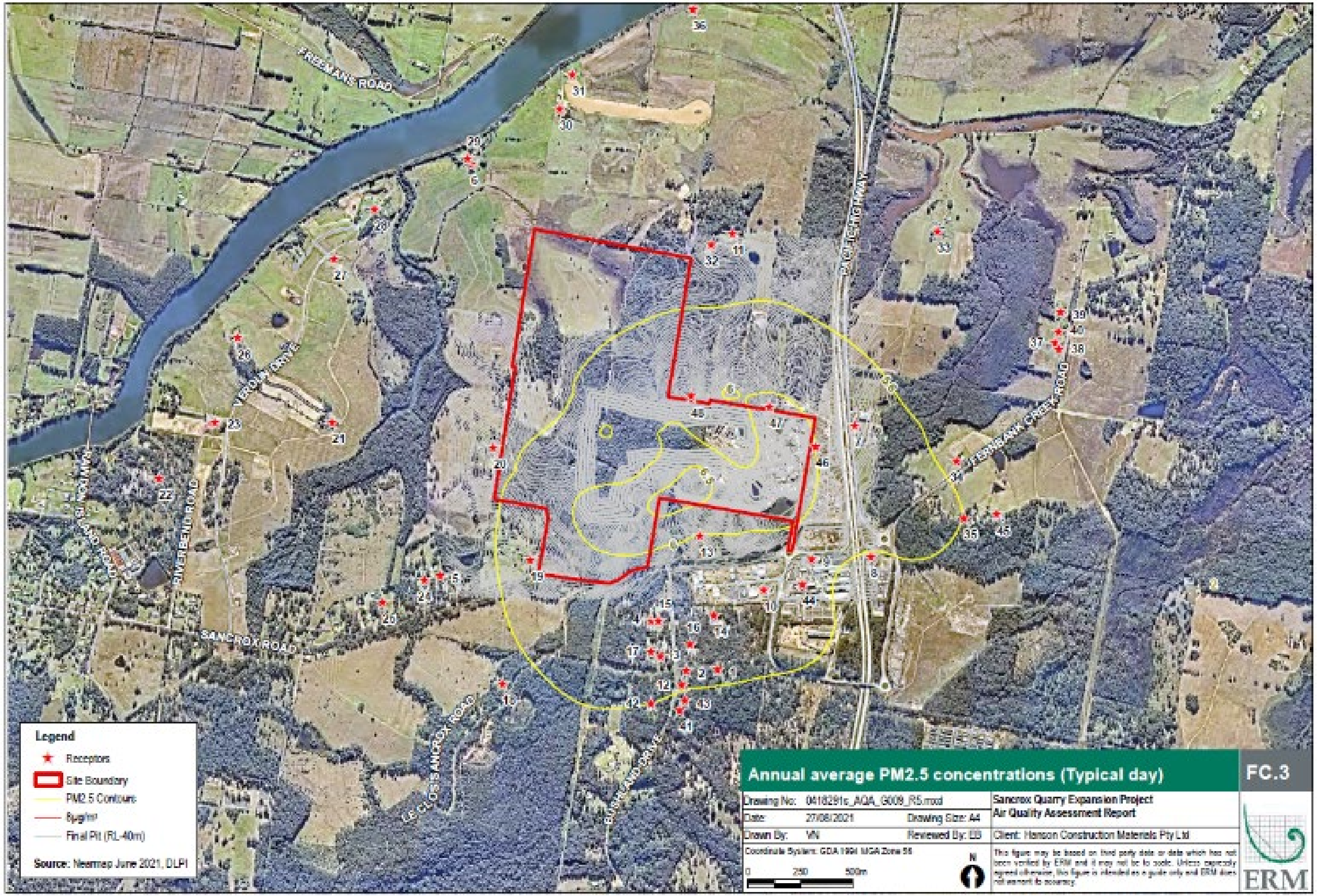


Figure 4: Cumulative annual average $PM_{2.5}$ concentrations for throughput of 530,000 t/y

Additional analysis of the typical throughputs on a daily basis throughout the year, shows that the maximum 24-hour average PM_{10} criterion is not expected to be exceeded at the nearest sensitive receptors. Figure 5 shows the combined background (blue) and project contributions (orange) to the total cumulative PM_{10} concentrations for each day at R47. This plot also shows that the higher background concentrations generally do not occur at the same time as higher project contributions.

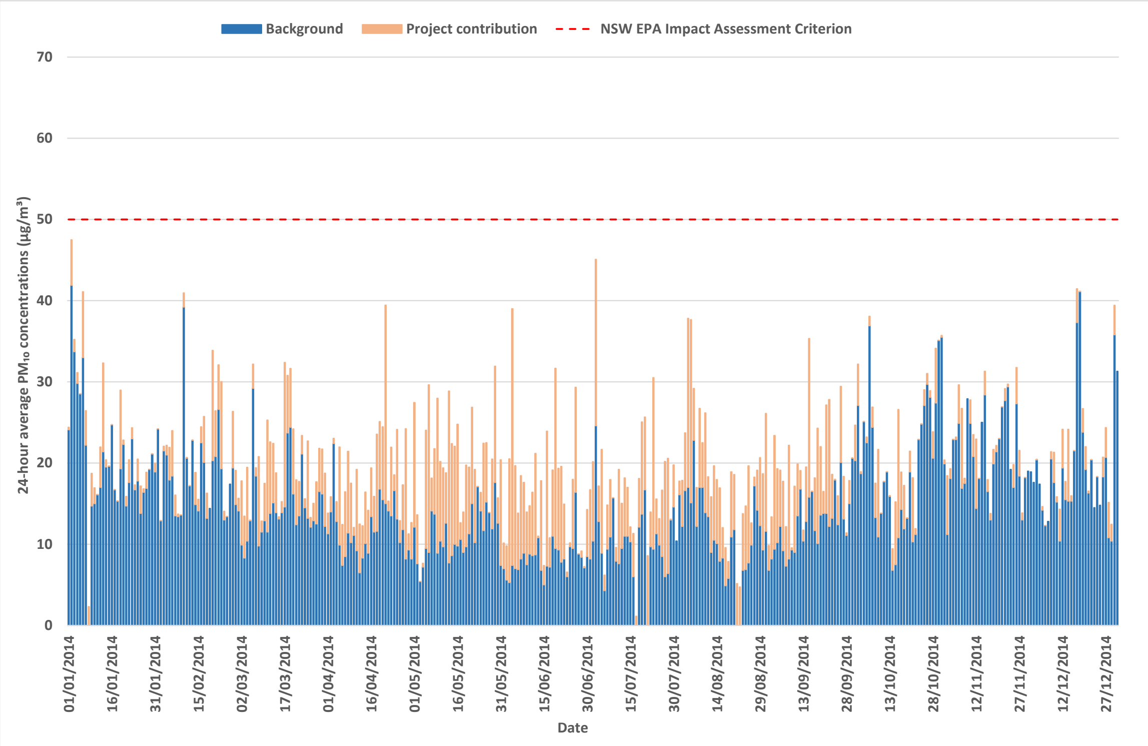


Figure 5: Cumulative 24-hour average PM_{10} concentrations at R47 for throughput of 530,000 t/y

Scenario 2 - maximum daily throughput, normal operating hours

From time to time, the site will require a higher daily throughput, to meet demand and a maximum 325 truck movements/day for final product to market. To understand what may occur at the nearest receptors if this increase in throughput coincides with worst-case meteorological conditions, this additional scenario has been modelled.

The values for the individual sensitive receptors are presented in Table 3, showing the cumulative PM_{10} concentrations, together with the Project increment on that day. The results show the predicted exceedances at receptors R46, R47 and R48. The final column shows the largest Project contribution (no background concentration), and shows that for all receptors except R46, R47 and R48, the Project contributions are moderate to low. Updated contour plots for maximum 24-hour average PM_{10} and $PM_{2.5}$[2] are provided in Figure 6 and Figure 7. These plots show the project contribution only, noting high contributions at R46, R47 and R48.

It is important to note that the maximum daily throughput will not occur every day. This scenario is modelled to calculate the 24-hour concentrations for the different daily meteorological conditions that could occur through the year and ensure a worst-case combination of emissions and meteorology is captured. When the worst-case meteorological conditions occur this will result in the maximum 24-hour average prediction at each receptor. These conditions will obviously be different for each receptor, depending on the direction and distance from the site. For example, worst case conditions for receptor R20 will likely occur when winds are from the east, and from the south for R32. These conditions will not occur at the same time and this is discussed further in relation to R46, R47 and R48.

Table 3: Predicted maximum 24-average PM_{10} cumulative concentrations for maximum daily throughput (normal operating hours)

Receptor ID	PM_{10} (µg/m^3) Cumulative	PM_{10} (µg/m^3) Project increment (on the same day as cumulative maximum)	PM_{10} (µg/m^3) Maximum Project increment for the year
Criteria	50 µg/m^3	N/A	N/A
1	43.2	1.3	18.9
2	43.4	4.2	18.8
3	45.2	6.0	21.4
4	46.9	7.7	24.0
5	42.3	0.4	6.5
6	41.9	<0.1	1.8
7	44.9	3.0	17.2
8	42.4	0.5	8.9
9	44.5	2.6	12.0
10	45.2	3.3	14.8
11	42.4	0.5	6.9
12	43.1	1.2	16.2
13	52.9	13.7	35.6
14	45.7	6.5	23.5
15	47.1	7.9	24.0
16	45.0	5.8	24.9

[2] There are no predicted exceedances of the maximum 24-hour average $PM_{2.5}$ cumulative concentrations as background levels are generally low. No further discussion is required for $PM_{2.5}$.

Receptor ID	PM_{10} (µg/m^3) Cumulative	PM_{10} (µg/m^3) Project increment (on the same day as cumulative maximum)	PM_{10} (µg/m^3) Maximum Project increment for the year
Criteria	50 µg/m^3	N/A	N/A
17	45.6	6.4	21.9
18	42.3	0.4	7.0
19	43.5	4.3	13.3
20	42.5	0.6	20.2
21	42.0	0.1	2.8
22	42.0	0.1	1.6
23	42.0	0.1	1.9
24	42.2	0.3	6.0
25	42.1	0.2	3.7
26	41.9	<0.1	1.9
27	42.0	0.1	1.7
28	42.0	0.1	2.2
29	41.9	<0.1	1.7
30	41.9	<0.1	1.7
31	41.9	<0.1	1.5
32	42.4	0.5	6.2
33	43.3	1.4	2.9
34	42.6	0.7	7.4
35	42.7	0.8	9.6
36	42.0	0.1	1.4
37	42.2	0.3	2.8
38	42.2	0.3	2.9
39	42.3	0.4	2.8
40	42.3	0.4	2.8
41	42.9	1.0	12.6
42	43.4	1.5	13.2
43	42.9	1.0	13.9
44	44.3	2.4	10.4
45	42.4	0.5	7.2
46	**63.5**	**54.8**	**54.8**
47	**70.1**	**62.7**	**62.7**
48	**64.0**	39.4	47.2

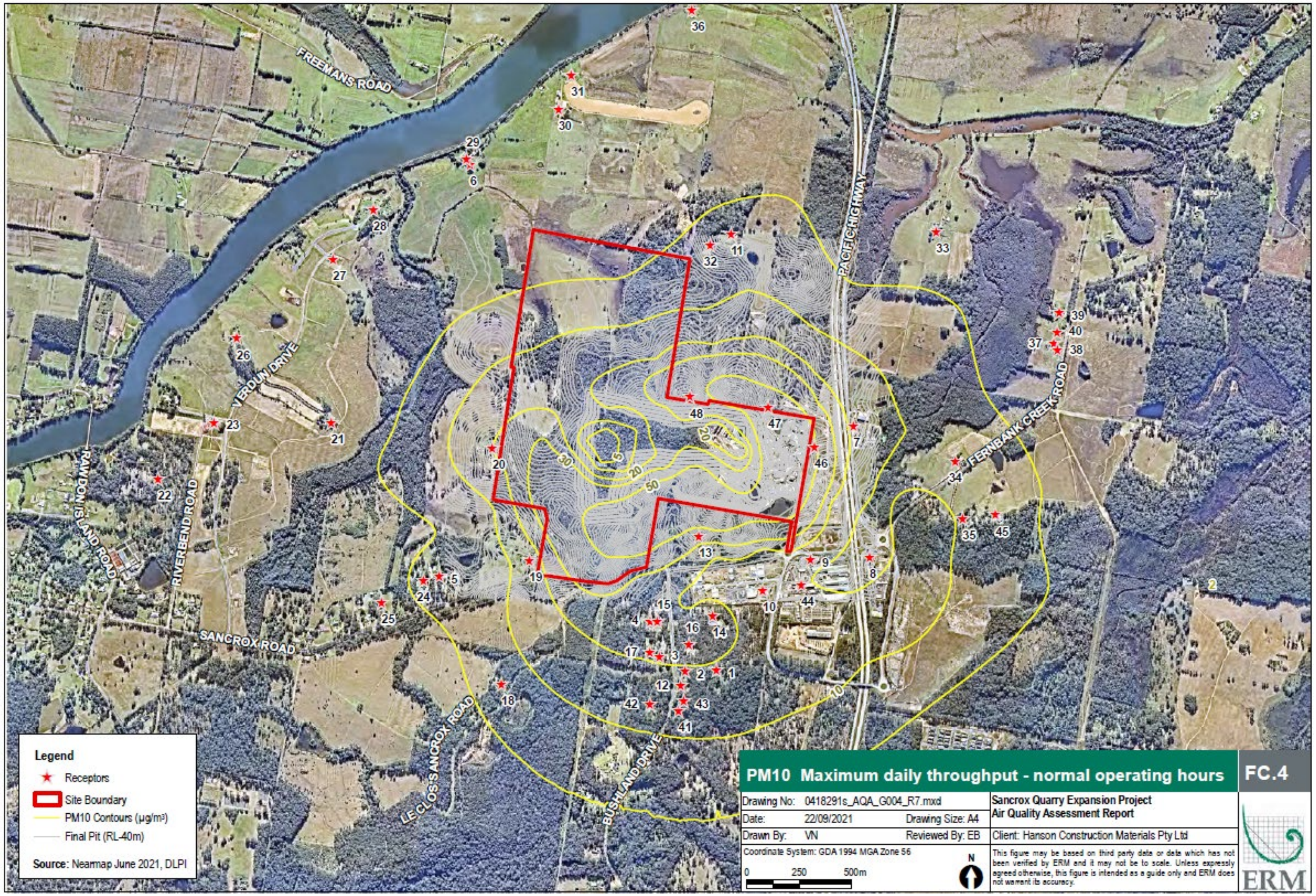


Figure 6: Project increment maximum 24-hour average PM_{10} concentrations for maximum daily throughput (normal operating hours)

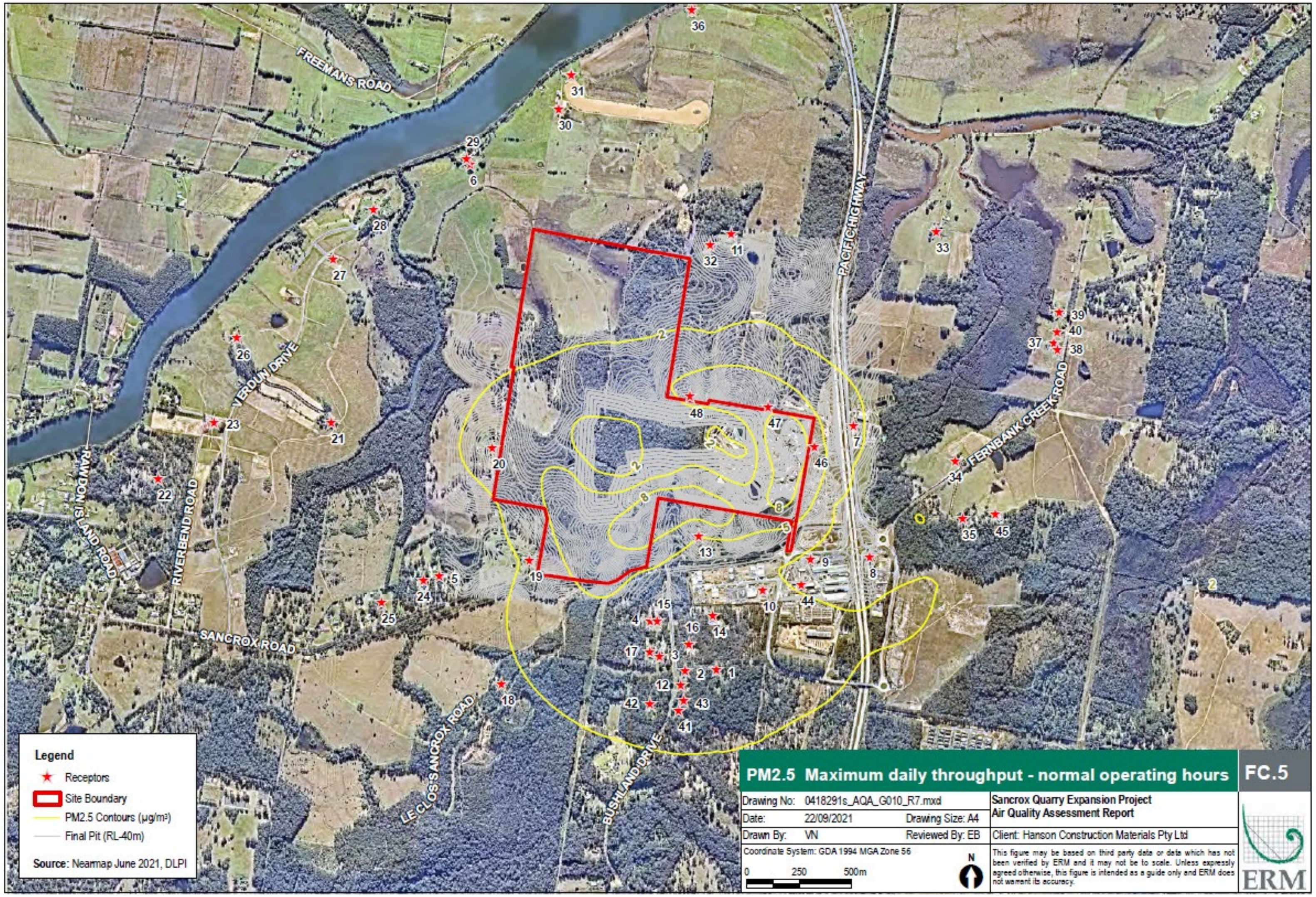


Figure 7: Project increment maximum 24-hour average $PM_{2.5}$ concentrations for maximum daily throughput (normal operating hours)

Given the close proximity of receptors R46, R47 and R48 to the site boundary, it is not unexpected that from time to time there may be higher PM_{10} Project contributions at these locations. Figure 8 to Figure 10 show time series plots for R46, R47 and R48, of the daily 24-hour averages throughout the year for both background (blue) and Project contribution (orange). It can be seen from these that while there are anticipated to be exceedances due to the Project, these are relatively infrequent given the extremely close proximity of these receptors to the site boundary.

It is also important to understand that while these data are represented in the form of a time series plot, this assumes that the maximum daily throughput scenario occurs every day of the year. Clearly this is not the case in reality and so these results need to be reviewed in their context. The purpose here is simply to demonstrate what the predicted Project contribution may be for each of the daily meteorological conditions that could occur at the site.

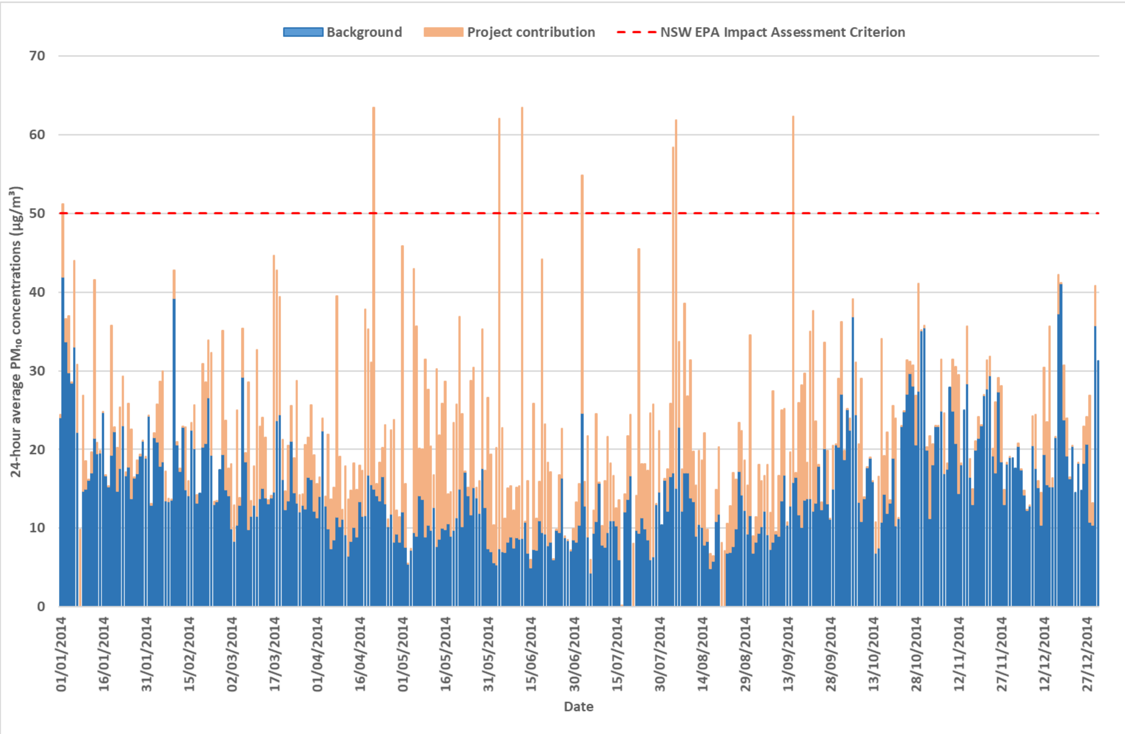


Figure 8: Cumulative 24-hour average PM_{10} concentrations at R46 for maximum daily throughput (normal operating hours)

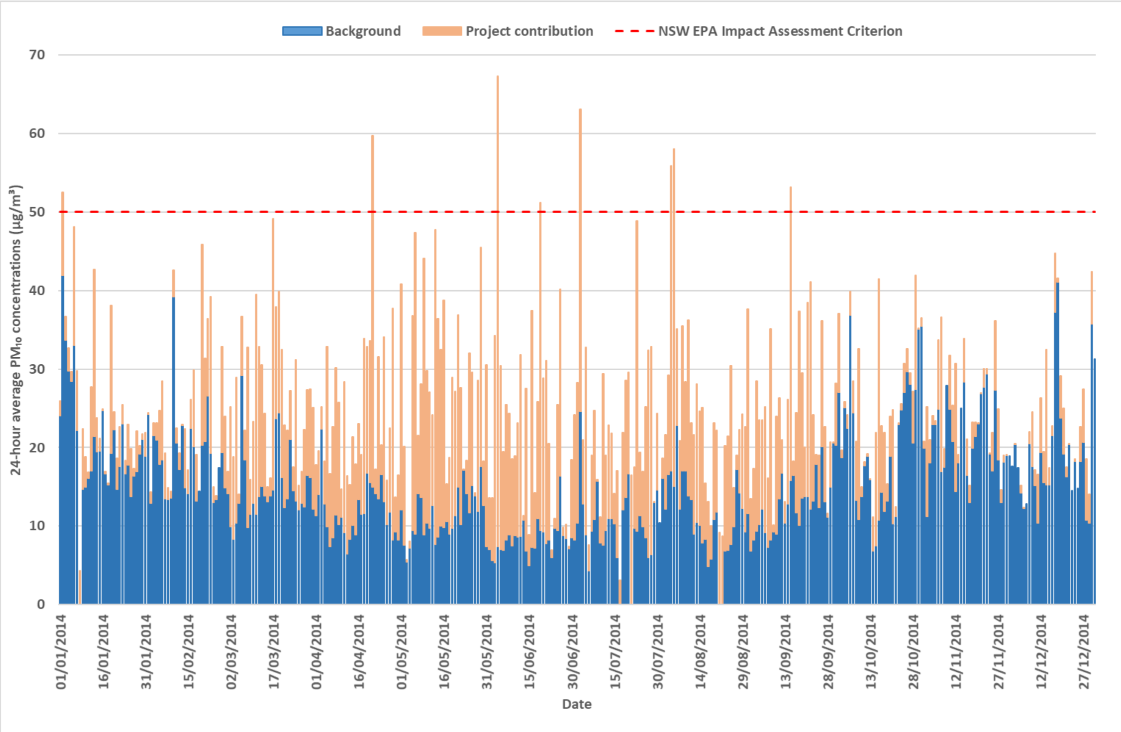


Figure 9: Cumulative 24-hour average PM_{10} concentrations at R47 for maximum daily throughput (normal operating hours)

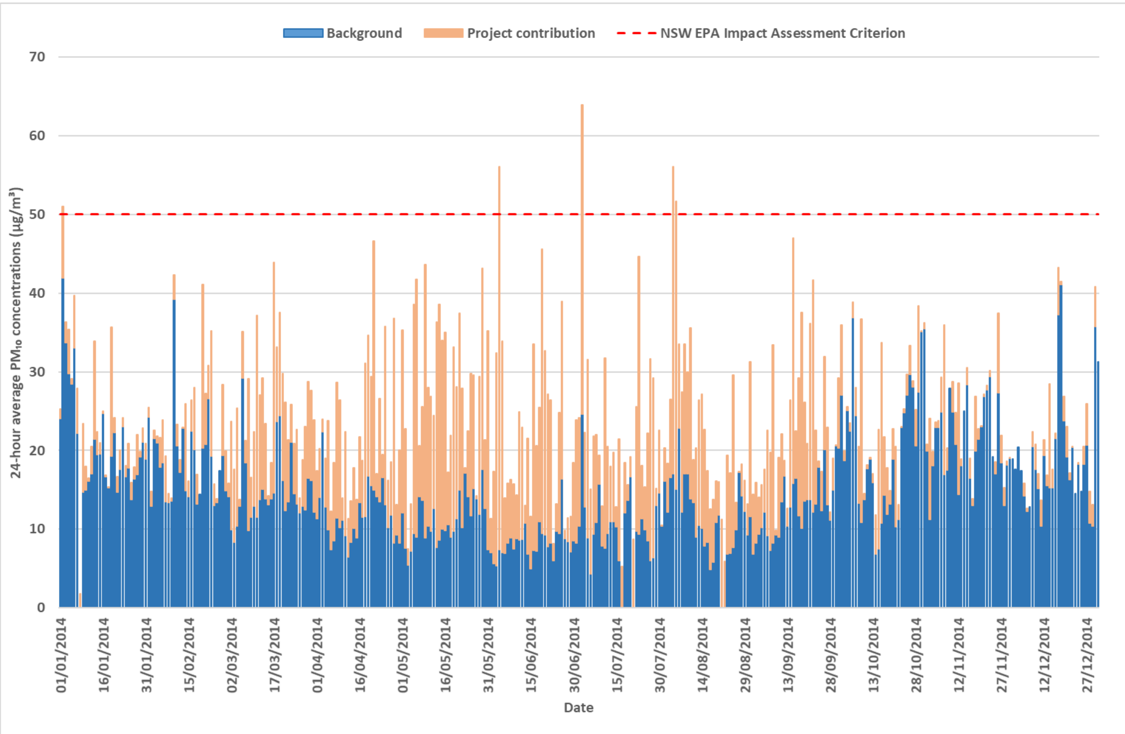


Figure 10: Cumulative 24-hour average PM_{10} concentrations at R48 for maximum daily throughput (normal operating hours)

Additional analysis was therefore carried out to better understand the conditions under which these high concentrations are predicted to occur.

Even in the absence of a project such as this, there will be exceedances of short-term PM_{10} criteria on occasion, due to natural / regional events such as bushfires, dust storms or hazard reduction burns. Without historical local monitoring data it is not possible to confirm the frequency of these events. However, it has been demonstrated that the Project contributes very little on an annual average basis and complies with these criteria, even at these nearest receptors.

It has also been demonstrated that while the Project may contribute more significantly to short-term (24-hour) elevated levels, these are unlikely to occur very often, with only seven predicted exceedances of the 24-hour average PM_{10} criterion at R47 and R46. For management purposes, it is therefore important to understand the conditions which lead to these elevated levels occur so they can be managed accordingly.

Figure 11 shows a polar plot of predicted PM_{10} concentrations at R47. These results are based on 1-hour predictions to align with the 1-hour meteorology. The polar plot shows that the highest (dark red) concentrations at R47 occur when wind speeds are low (less than 2 m/s), and predominantly from the southwestern quadrant. There are also periods of higher wind speeds (in excess of 10 m/s) when winds are from the southwest that contribute to some mid to higher concentrations (yellow to orange).

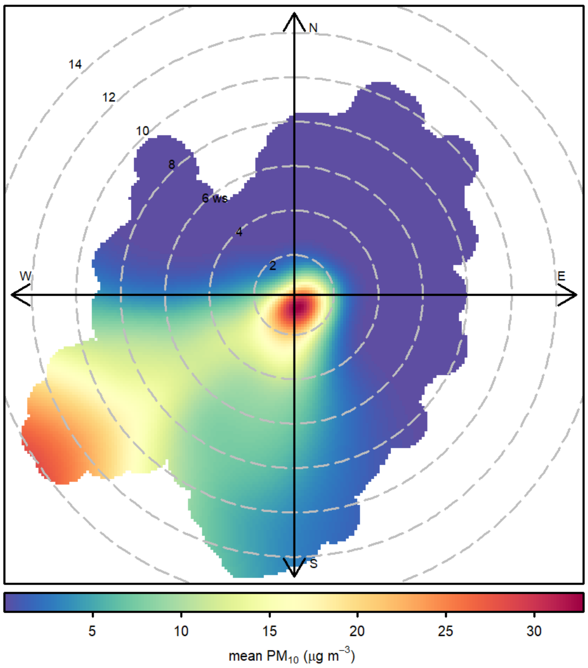


Figure 11: Predicted 1-hour average PM_{10} Project contributions at R47, for each wind speed and direction

This indicates there are likely to be two main conditions that lead to higher short-term concentrations at R47. Firstly, higher wind speeds can increase emissions from sources such as wind erosion. These higher emissions do not always necessarily result in higher ground level concentrations as dispersion is generally better at these times (hence the yellow/orange shading rather than red). However, if these situations are then followed by overnight inversion conditions where winds are calm and dispersion is poor, this can lead to higher concentrations until the emissions are dispersed the following day. It is likely that this is what is occurring here to produce the elevated concentrations at R47. These inversion conditions are generally more prevalent in the cooler months, which is when these maximum Project contributions are predicted to occur, as shown in the time-series plots.

It is noted that these closest receptors are industrial and are therefore not occupied at all times, and so the 24-hour averages any occupants would experience could therefore be lower in reality. However, this does not negate the need for good site management, particularly when winds are stronger and from the west and southwest.

It should also be remembered that these results relate to a maximum daily throughput scenario and that this will not occur every day of the year. Management measures can easily be put in place to ensure on the occasions when this maximum throughput is required, the meteorological conditions are understood and mitigation is in place. This is discussed in detail in Section 2.

Scenario 3 - maximum daily throughput, extended operating hours

A second maximum daily throughput scenario was also modelled, which includes some activities operating for extended hours, as listed previously in Table 1 including 37 additional truck movements overnight between 10pm and 7am for final product to market. The results are presented here for completeness, but are very similar to those discussed above for scenario 2.

The values for the individual sensitive receptors are presented in Table 4, showing the cumulative PM_{10} concentrations, together with the Project increment on that day. The results show the predicted exceedances at receptors R46, R47 and R48. The final column shows the largest Project contribution (regardless of background), and shows that for all receptors except R46, R47 and R48, the Project contributions are moderate to low. Updated contour plots for maximum 24-hour average PM_{10} and $PM_{2.5}$[3] are provided in Figure 12 and Figure 13. These plots show the project contribution only, noting high contributions at R46, R47 and R48.

Having demonstrated that the Project is predicted to comply with the annual average criteria with increased wind erosion areas, further analysis was done on the maximum daily throughput scenarios (normal operating hours and extended operating hours).

It was shown that there were no predicted additional exceedances of PM_{10} at the majority of receptors, including all residential receptors. There were however some estimated exceedances at three of the closest industrial receptors, R46, R47 and R48. Figures 14 to 16 present the same information for scenario 3 as was presented earlier for scenario 2.

The conditions under which these are likely to occur are when winds are from the west and southwest, and predominantly under low wind speed conditions. The model estimates that exceedances of the 24-hour PM_{10} criterion would only be likely to occur if these conditions coincide with the maximum daily throughput. Under a typical daily throughput there are no anticipated exceedances.

There is also no significant difference in predictions between scenarios 2 and 3, that is, for the maximum daily throughput under either normal or extended operating hours. This maximum throughput does not occur every day and could be easily managed to avoid exceedances using a Trigger Action Response Plan (TARP), as described further in Section 2.

It is also important to note that scenarios 2 and 3 are based on all processes including blasting, concrete batching and asphalt plants and quarry operating simultaneously, which is an unlikely scenario. Blasting is an intermittent activity and product demand for concrete, and particularly

[3] There are no predicted exceedances of the maximum 24-hour average $PM_{2.5}$ cumulative concentrations as background levels are generally low. No further discussion is required for $PM_{2.5}$.

asphalt, is campaign based rather than routine. Maximum 24-hour average predicted concentrations for these scenarios are therefore very conservative.

Table 4: Predicted maximum 24-average PM_{10} cumulative concentrations for maximum daily throughput (extended operating hours)

Receptor ID	PM_{10} ($\mu g/m^3$) Cumulative	PM_{10} ($\mu g/m^3$) Project increment (on the same day as cumulative maximum)	PM_{10} ($\mu g/m^3$) Maximum Project increment for the year
Criteria	90 $\mu g/m^3$	N/A	N/A
1	43.2	1.3	19.1
2	43.6	4.4	18.9
3	45.4	6.2	21.6
4	47.0	7.8	24.1
5	42.3	0.4	6.5
6	41.9	<0.1	1.8
7	45.1	3.2	17.6
8	42.5	1.4	9.3
9	44.6	2.7	12.4
10	45.5	6.3	14.9
11	42.4	0.5	6.9
12	43.1	1.2	16.4
13	53.5	14.3	35.8
14	46.0	6.8	23.7
15	47.3	8.1	24.1
16	45.1	5.9	25.1
17	45.8	6.6	22.0
18	42.3	0.4	7.0
19	43.6	4.4	13.3
20	42.5	0.6	20.2
21	42.0	0.1	2.8
22	42.0	0.1	1.6
23	42.0	0.1	1.9
24	42.2	0.3	6.0
25	42.1	0.2	3.7
26	41.9	<0.1	1.9
27	42.0	0.1	1.7
28	42.0	0.1	2.2
29	41.9	<0.1	1.7
30	41.9	<0.1	1.7
31	41.9	<0.1	1.5
32	42.4	0.5	6.2
33	43.3	1.4	2.9
34	42.6	0.7	7.7
35	42.7	0.8	10.0
36	42.0	0.1	1.4

Receptor ID	PM_{10} (µg/m^3) Cumulative	PM_{10} (µg/m^3) Project increment (on the same day as cumulative maximum)	PM_{10} (µg/m^3) Maximum Project increment for the year
Criteria	90 µg/m^3	N/A	N/A
37	42.2	0.3	2.8
38	42.2	0.3	2.9
39	42.3	0.4	2.8
40	42.3	0.4	2.8
41	42.9	1.0	12.7
42	43.4	1.5	13.3
43	42.9	1.0	14.0
44	44.5	2.6	10.7
45	42.4	0.5	7.5
46	**63.5**	48.5	**54.8**
47	**70.2**	**62.8**	**62.8**
48	**63.9**	39.3	48.7

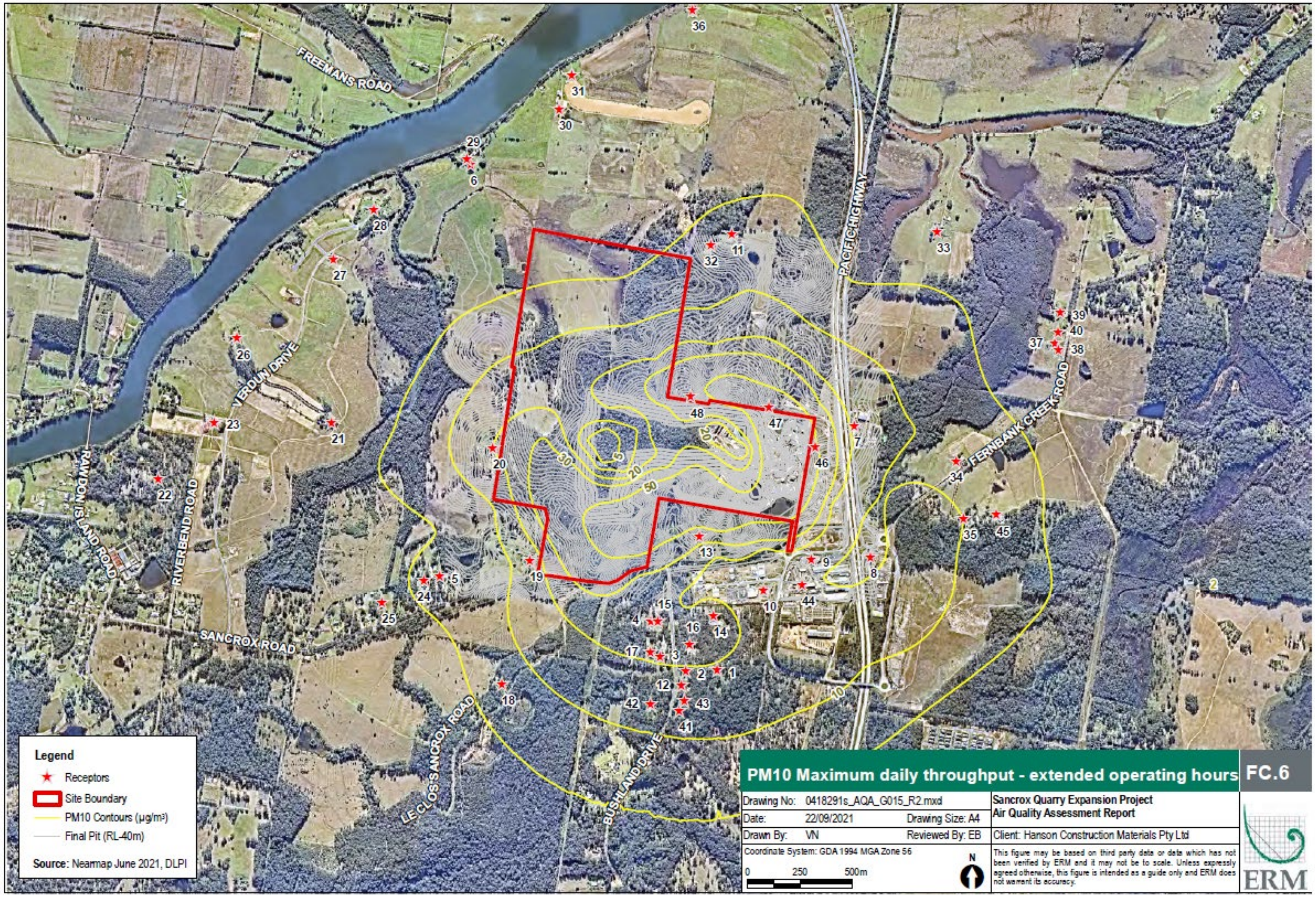


Figure 12: Project increment maximum 24-hour average PM_{10} concentrations for maximum daily throughput (extended operating hours)

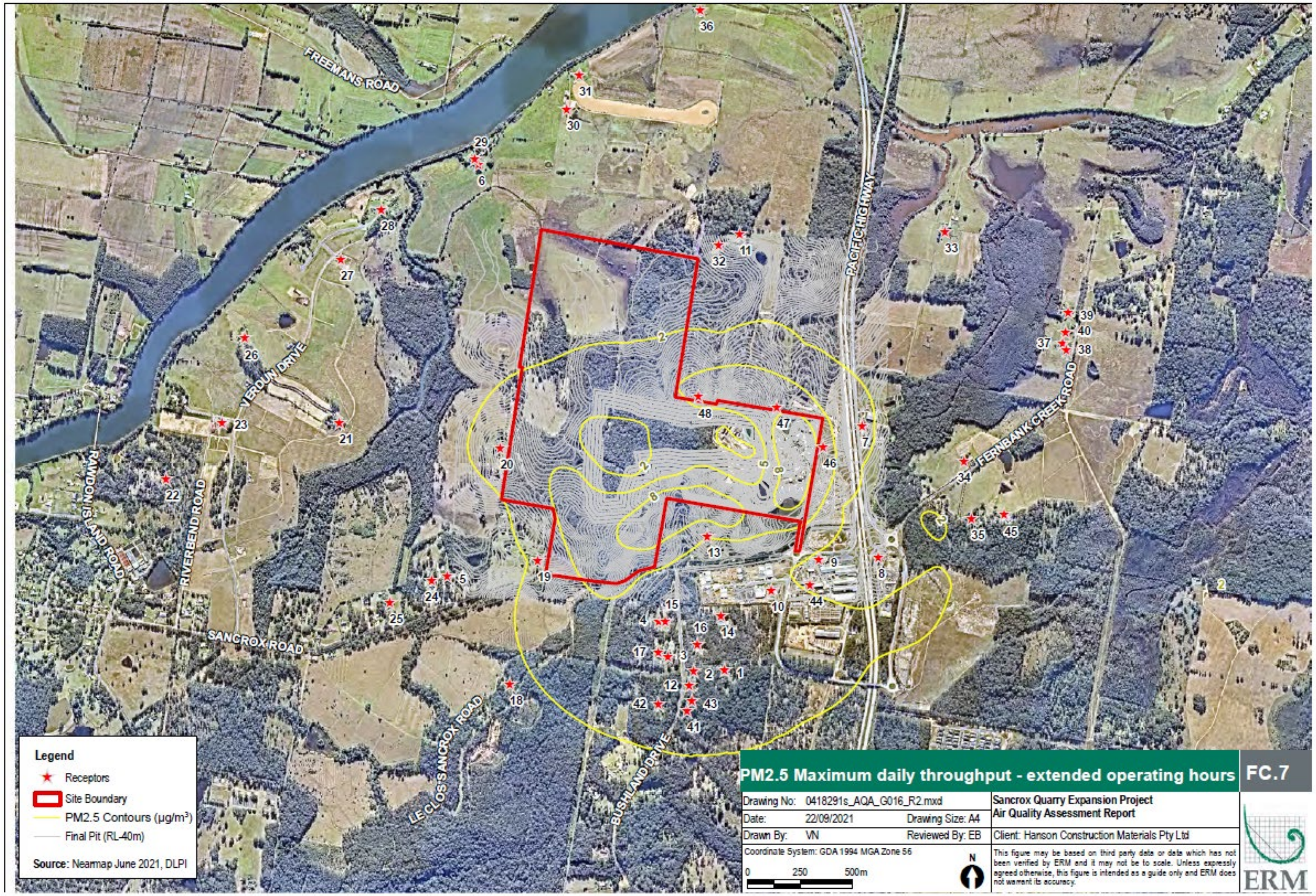


Figure 13: Project increment maximum 24-hour average $PM_{2.5}$ concentrations for maximum daily throughput (extended operating hours)

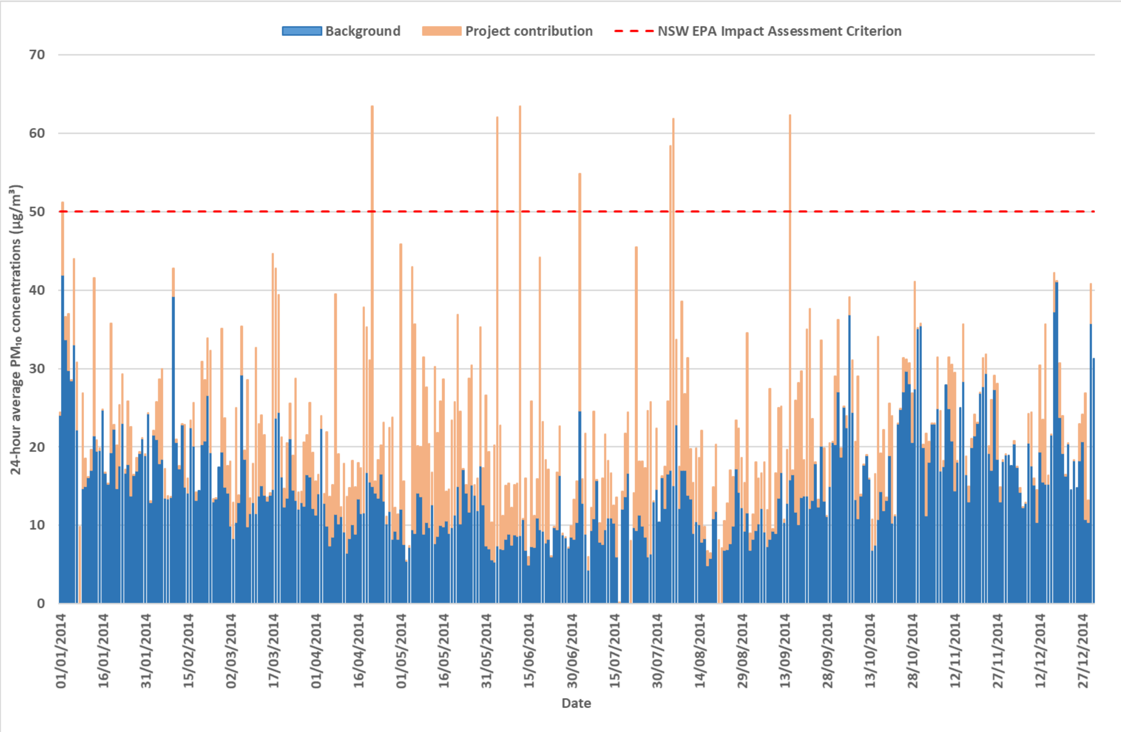


Figure 14: Cumulative 24-hour average PM_{10} concentrations at R46 for maximum daily throughput (extended operating hours)

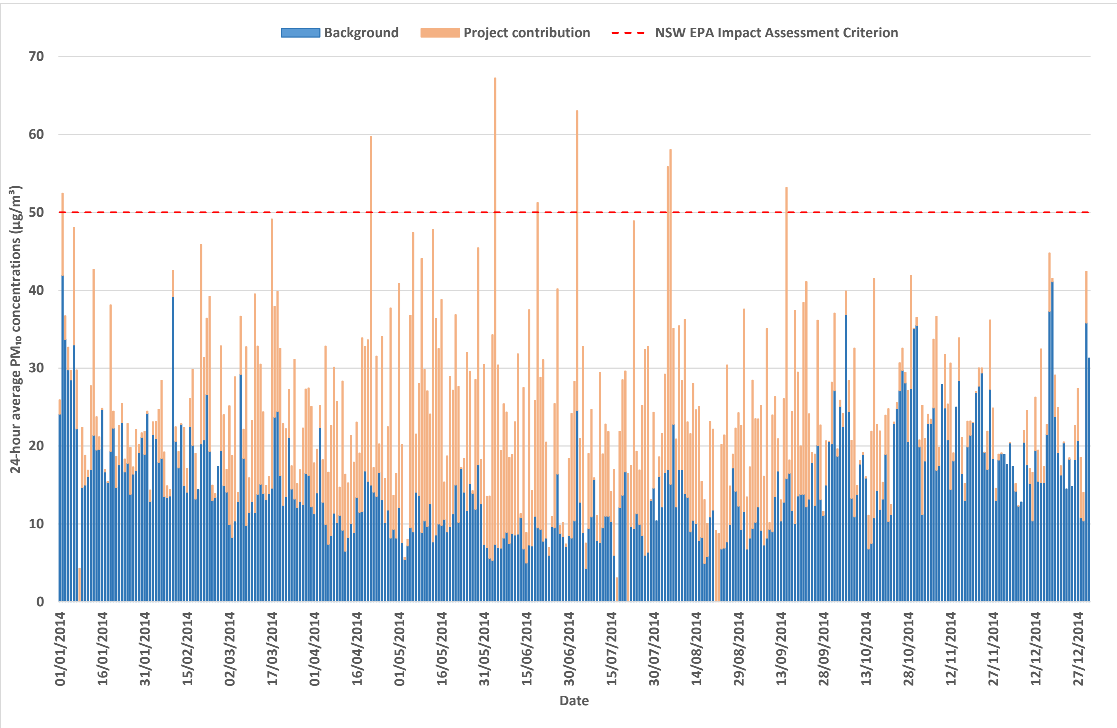


Figure 15: Cumulative 24-hour average PM_{10} concentrations at R47 for maximum daily throughput (extended operating hours)

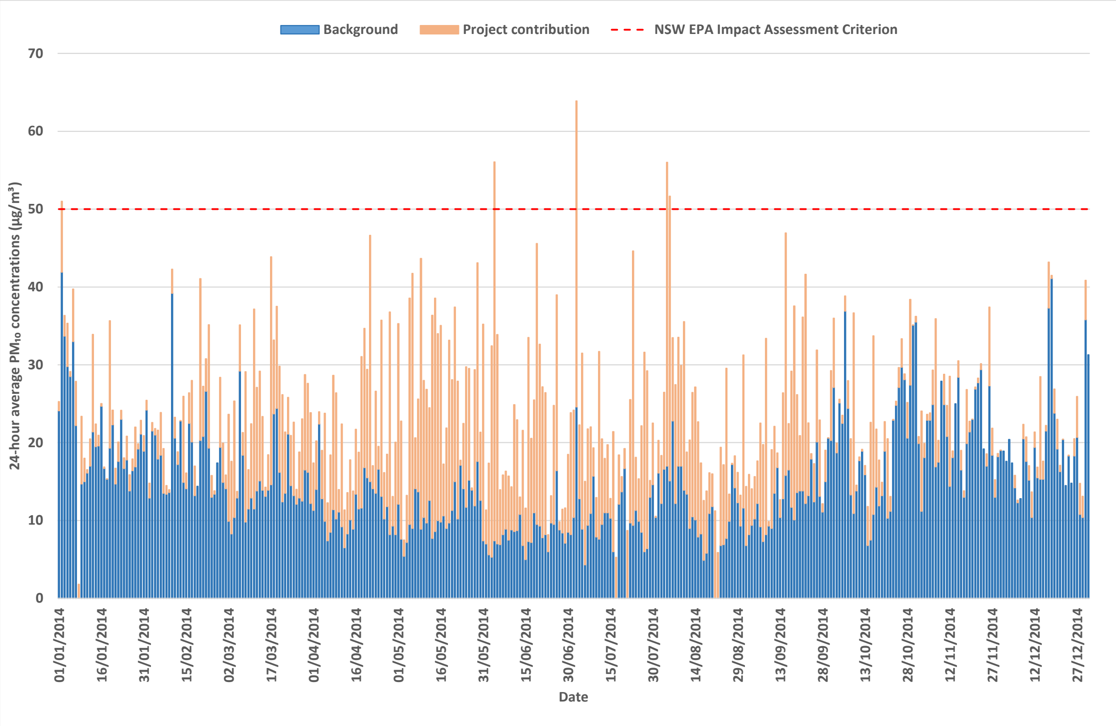


Figure 16: Cumulative 24-hour average PM_{10} concentrations at R48 for maximum daily throughput (extended operating hours)

2 Despite the elevated emission reduction factors used to estimate the emissions inventories, modelling results predict large project-only concentrations.

EPA Comment

Modelling results exhibited in the revised AQIA predict large increments at various sensitive receptors. The largest predicted 24-hr PM_{10} concentration for the 'Maximum Day (24 hours)' emissions scenario is 28.5 µg/m^3.

It should be noted that failing to achieve in practice the high proposed emission reduction levels that are incorporated in the emissions inventory calculation will increase the risk of adverse air quality impacts due to the proposed operations.

EPA Recommendation

The EPA considers that this issue has been partially addressed. As discussed in Item 1 above, further information on the implementation of the proposed control strategies measures must be provided.

ERM Response:

The proposed mitigation measures are relatively standard and considered best practice for extractive industries such as this proposal. These include dust collection on drill rigs, water sprays on stockpiles and at conveyor transfer points. While these controls are certainly effective on those individual sources, the bulk of emissions are from wheel generated dust. These sources represent over 85% of the total emissions and so applying best practice controls to haul routes is a much more effective way of controlling emissions from the site. Obviously sealing roads is the most effective way to do this, and the 90% control factor applied to these sealed sections is likely to be conservative. That is, in reality there could be more than 90% achieved through this measure. Where roads are not sealed, watering and chemical dust suppressants are proposed which are highly effective in controlling wheel generated dust.

Therefore, controls on other sources will be beneficial and should be applied, but in terms of total reductions from the site, ensuring dust control on unsealed haul routes will have the most impact. With an active management plan in place involving monitoring (both visual inspection and monitoring equipment), this should be easily achievable.

With the above mitigation measures in place, dispersion modelling predicts it is unlikely that prolonged impacts will be experienced at any of the nearby sensitive receptors. On some days there may be short-term impacts at receptors R46, R47 and R48, and so additional management may be required to avoid these.

To enable the site management to estimate when these impacts may occur and mitigate in advance to enable reductions or avoidance of these impacts, Hanson will include a Trigger Action Response Plan (TARP). Hanson currently utilises TARPs at other quarry sites which work effectively as part of their suite of air quality management measures.

- A 1-hour average will be used to identify sustained elevated dust concentrations that could potentially result in an exceedance of the PM_{10} criterion. The time-step will provide sufficient time for additional mitigation measures to be implemented at the quarry to reduce dust emissions before an exceedance occurred.
- The trigger levels within the TARP will be consistent with levels used at a number of major construction and extractive industry site in NSW to successfully manage dust impacts in a proactive manner.
- Nominated 1-hour average trigger levels will be reviewed as monitoring data is collected at the site. This will ensure that the trigger levels remain appropriate for the ongoing monitoring and management of PM_{10} emissions from the quarry.

Table 5 provides an example of how this procedure would work in practice.

Table 5: Example of a TARP procedure

Action level	Trigger level	Response
Alert	$X \leq PM_{10} \leq Y$	■ Quarry management to review wind direction and environmental conditions to determine if elevated emissions are originating from the quarry or sourced from another local or regional source/event. ■ Quarry management to confirm all standard mitigation practices are being followed and remain alert as to any further increase in PM_{10} concentrations that may require further action.
Action I	$Y \leq PM_{10} \leq Z$	■ Exceedance of interim trigger level will alert quarry management of increase in short term PM_{10} concentrations. ■ Will prompt review of the need to increase / relocate water where required based on visible dust etc. ■ Even if elevated PM_{10} concentration is concluded to be due to elevated background concentrations rather than emissions from the Quarry, steps will be taken to minimise the additional incremental impacts from the Quarry where possible.
Action II	$Z \leq PM_{10}$	■ Direct action by Quarry management to reduce emission levels. For example. assessing whether dust-generating activities (including processing, load and haul, unloading activities) are to be temporarily stopped or relocated until conditions improve.
The trigger levels X, Y and Z are not yet defined as these levels will be dependent on the location of the air quality monitor and its proximity to the boundary. These will be defined in the AQMP.		

To enable these mitigation actions to be undertaken when required, the site should include PM_{10} monitoring on the northern and eastern boundaries, as well as an onsite weather station. Data from this network will provide real-time information to site managers regarding both PM_{10} concentrations and meteorological conditions to enable the appropriate management of emissions and therefore impacts offsite before they occur. This may include the ability to manage the timing of blasts based on weather conditions and site activities. Monitoring data can also be used to validate the modelling at these receptors given the conservative nature of the assessment.

3 The revised AQIA does not present cumulative impacts at future receptors located adjacent to the project boundary.

EPA comment

The area located to the east and adjacent to the project boundary is an approved industrial area. According to the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (The Approved Methods), potential impacts due to the proposal must be assessed at the nearest existing or likely future sensitive receptors.

EPA Recommendation

The EPA considers that this issue has not been sufficiently addressed and recommends that the proponent:

a) Confirm the proposed operating hours for the concrete batching plant, the concrete recycling plant, the asphalt plant and the quarry operation are consistent with the hours modelled for each activity.

b) Clarify if the 'Maximum day (5 am - 10 pm)' is a separate modelling scenario from the 'Maximum day (24 hours)'.

c) Demonstrate that the emissions rates (g/s) for each modelling scenario account for the proposed operating hours for each plant/process of the proposal and reflective of the operating capacity for the revised project.

d) Demonstrate that the modelled emissions from unsealed haul roads represent a reasonable worst-case scenario with consideration of the maximum proposed daily truck movements. Where the proposed maximum daily number of truck movements differ from the numbers used in the preparation of the emissions inventory, detailed discussion and analysis must be provided to determine the effect on results and conclusions presented in the revised AQIA.

e) Provides detailed information to justify the assumptions made and input data used to estimate emissions due to wind erosion from the pit.

ERM Response:

a) The operating hours for each of the facilities and for each modelling scenarios are listed in Table 1.

b) There are three separate modelling scenarios, as described above in Section 1. One represents the total annual throughput and two represent a maximum daily throughput for different hours of operation. These are summarised again below.

Scenario 1: Annual average quarry throughput of 530,000 t/y for normal operating hours, which is 5am to 10pm for most activities (as per Table 1). This will occur for the majority of the year.

Scenario 2: Maximum daily quarry throughput /day for normal operating hours, which is 5am to 10pm for most activities (as per Table 1) and maximum daily truck movements of 325 truck movements/day for final product to market. This will occur only as required to meet demand.

Scenario 3: Maximum daily quarry throughput of /day for extended operating hours which is 24 hours per day for transport of product offsite and includes maximum daily truck movements of 325 truck movements/day and 37 additional truck movements overnight, both for final product to market. The extended hours will occur on a maximum of 20 days/year when additional product is required to be transported offsite. This does not include any additional production above what would be required for scenario 2.

c) There are no differences between the emission factors used to calculate total emissions for each scenario. Various AP-42 emission factors published by the US EPA are used for both. The differences lie in the hours over which these total emissions are released, which by definition alters the rate of emission.

For example, the total emissions for haulage are calculated using the size of the truck, the distance travelled and the number of movements undertaken. The total emission can then be calculated and this is the same for all scenarios for this number of truck movements. If this activity is limited to certain hours then that total emission is spread over those hours. If those hours are extended (as per scenario 3), the same total emission for that activity but is able to be spread over a longer time period, resulting in a lower emission rate per second.

In summary:

- the emission factors for each activity are the same for each scenario
- times over which these emissions are spread can vary
- emission rates in g/s can therefore vary depending on the time over which these emissions are released

Emission calculations for some activities are also dependent on the wind speed (e.g. material transfer and wind erosion), while others are not (e.g. wheel generated dust). Once total emissions are calculated, the hours over which those emission occur is considered in the model, using a time varying emissions file. This becomes important during dispersion, because even though high wind speed conditions may lead to elevated emissions, these conditions are very effective in dispersing pollutants (reducing concentrations). In other words, the relationship between emissions and impact is not linear, and so high emissions do not always result in high ground level concentrations at receptors.

d) The emissions from wheel generated dust represent a reasonable worst-case scenario as the location of the haul road is adjacent to the nearest receptors. The maximum haul lengths from the bottom of the pit to processing areas is also representative. In addition, for scenarios 2 and 3 which represent the maximum daily throughput, this results in the maximum movement of trucks in a day both for extracted material hauled out of the pit, as well as hauling product offsite.

Maximum truck movements and proximity to the nearest receptors is representative of a worst-case scenario for 24-hour average concentrations.

Annual averages are characterised in scenario 1, but also represent a worst-case due to assumptions around the maximum annual throughput and the proximity of haul routes to the nearest sensitive receptors.

In addition to truck payload, the weight of the truck is also considered in the emissions calculation. This will either be fully loaded or empty, depending on whether the truck is leaving or entering the site. ‘Truck and dog’ vehicles are also slightly different in mass to ‘Rock Trucks’. All these factors are considered in the calculation of total emissions from wheel generated dust.

e) The area within the quarry exposed to wind erosion was increased significantly from the previous assessment. The previous assessment used approximately 2.2 ha, which assumed that only 25% of the pit was subject to wind erosion. This was increased to 7.5 ha in the modelling presented here, which accounts for the western section of the pit. This assumes that almost two thirds of the pit floor will not include any activity and be left exposed to wind erosion. The remaining eastern section of the pit incorporates extraction, loading and hauling activities. This ensures a reasonable representation of the pit. All stockpiles have also been included as wind erosion sources.

Please do not hesitate to contact ERM if you have any inquiries regarding the content of this report.

For Environmental Resources Management Australia Pty Ltd

Jane Barnett
Air Quality Partner

Murray Curtis
Partner