APPENDIX F - ADDENDUM AIR QUALITY IMPACT ASSESSMENT

EMM
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Luddenham Advanced Resource Recovery Centre

Addendum air quality impact assessment

Prepared for Coombes Property Group & KLF Holdings Pty Ltd
March 2021

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Luddenham Advanced Resource Recovery Centre

Addendum air quality impact assessment

Report Number

J190749 RP29a

Client

Coombes Property Group & KLF Holdings Pty Ltd

Date

2 March 2021

Version

v2 Final

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2 March 2021	2 March 2021

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Table of Contents

Appendices

Tables

Figures

1 Introduction

EMM Consulting Pty Ltd (EMM) prepared an Air Quality Impact Assessment (AQIA) for the Luddenham Advanced Resource Recovery Centre (ARRC) development application (EMM 2020). The AQIA presented a quantitative assessment of potential air quality impacts, with an emphasis on emissions of particulate matter (PM), the key pollutant associated with the ARRC.

The purpose of this Addendum Air Quality Assessment (Addendum AQIA) report is to present updated air quality modelling results for the ARRC. The updated modelling results are required to address changes to the operational assumptions for the site and to response to specific submissions received from the Department of Planning, Industry and Environment (DPIE) and the NSW Environment Protection Authority (EPA).

1.1 Scope of this report

The Addendum AQIA forms part of the overall Submissions Report prepared by EMM (2021) and should be read in conjunction with the Submissions Report for a complete response to all submissions. The specific submissions addressed by this Addendum AQIA are summarised in the following sections.

1.1.1 Revisions to the air quality modelling

The EPA provided a submission on the modelling results and the management of potential exceedances resulting from the operation of the premises, as follows:

> The EPA recommends the AQIA be revised to:
>
> i) Identify additional mitigation measures to manage predicted exceedances, and:
>
> - reduce $PM_{2.5}$ annual average contributions from the premises;
> - reduce 24-hour average $PM_{2.5}$ and PM_{10} contributions from the premises;
>
> ii) Revise the assessment accounting for the additional mitigation measures identified in;
>
> - to reduce incremental ground level concentrations;
>
> iii) Demonstrate that particulate matter emissions have been reduced as far as practicable.

Since the submission of the EIS, there have been refinements to the operational assumptions for the site, primarily in relation to truck movements and proposed equipment operating within the ARRC. The revised operational assumptions are relevant to the management of predicted exceedances and requirement for additional mitigation in the EPA's submission. The revised emission assumptions and modelling results are presented in Section 2 and are discussed in the context of the EPA's submission below.

For detailed responses to EPA's submission, please refer to the Submissions Report.

1.1.2 Western Sydney Airport receptor locations

DPIE provided a submission on the assessment locations for the Western Sydney Airport (WSA) as follows:

> The AQIA further states that the air quality associated with the proposed Western Sydney Airport were considered in the air quality modelling, and included the future terminal areas, runaway area, fuel farm area and airport infrastructure area. Please incorporate the Airport modelling receptor locations in site figures relating to the assessment locations for air quality within the EIS and AQIA

This Addendum AQIA provides a figure showing the WSA modelling locations included in the AQIA and updated modelling for WSA assessment locations (refer Chapter 3).

1.1.3 Assessment of odour impact

DPIE provided a submission on the assessment of odour impacts associated with the ARRC as follows:

> It is understood that general solid waste (putrescible) will not be accepted at the development. The AQIA states that as no putrescible waste will be accepted at the RRF and no sources of odour emissions identified from the RRF operations, odour was not quantitively assessed in the EIS. A quantitative assessment of odour impacts, as per the SEARs requirements should be provided to provide baseline data and conservatively assess and provide mitigation measures for potential odour impacts to future sensitive receptors, including the Western Sydney Airport and approved/future developments in the vicinity.

This Addendum AQIA provides modelling results for odour, presented in Section 4.

2 Updates to the modelling results

2.1 Changes to the ARRC emission inventory

Since the submission of the EIS, changes have been made to the assumptions for truck movements in and out of the site. The majority of waste (approximately 400,000 tonnes (t)) will be brought in by truck and dog, semi-trailer and B-doubles, with an average load of between 30 to 50 t. The emission inventory was therefore updated to account for a revised split for truck movements, as follows:

- 200,000 tonnes per annum (tpa) bulk waste transfer from other KLF facilities with an average incoming load of 35 t;
- 200,000 tpa of bulk general solid waste/excavated materials with an average incoming load of 35 t; and
- 200,000 tpa of waste from construction, industrial and commercial sites with average incoming loads of 5 t (eg skip bins).

The revised assumptions result in a change to the total number of truck movements to site (as the larger incoming loads require less trips) and consequently result in a small decrease to the emission estimates for wheel generated dust from access roads.

More significantly, the allocation of emissions from truck movements across the day has also been updated to reflect the operations of the site more accurately. The previous modelling presented in the EIS assumed an even split of truck movements across the day and night; however, this does not reflect how the site would operate, with the majority of truck movements occurring during the day. The revised modelling presented in this memo therefore assumes that 80% of the truck movements occur between the hours of 6 am and 6 pm with the remaining trucks (20%) entering from 6 pm to 6 am. This is consistent with how other KLF facilities operate.

Finally, the emission estimates for diesel have been revised in response to EPA's submission on reducing emissions from non-road diesel equipment. The proponent has confirmed that most of their existing fleet is US EPA Tier 4 compliant and they have committed to using similar equipment for the ARRC. Emission estimates for diesel are therefore updated using US EPA Tier 4 emission factors (0.02 g/kWh).

The revised emission inventories are presented in Appendix A.

2.2 Emission inventory for quarry infilling

The cumulative scenarios presented in the EIS have been updated to account for quarry infilling (noting this development stage is subject to a separate future approval). An emission inventory has been developed for quarry infilling based on the following assumptions:

- 300,000 tpa of incoming external waste would travel via the site access road and around the northern and eastern perimeter of the site and enter the quarry pit via the existing ramp;
- an addition 60,000 tpa of internal waste from the ARRC would be transported from the ARRC around the eastern perimeter of the site and enter the quarry pit via the existing ramp;
- external waste would be transported in trucks with an average load of 35 t;
- internal waste would be transported in dump trucks with an average load of 38 t;

- trucks would unload in the pit and waste would be rehandled and spread using a front-end loader and compacted using a compactor;
- 3.4 hectares of the pit would be active for wind erosion;
- water carts would operate on the haulage routes and would dampen waste for spreading; and
- diesel consumption would be approximately half that of the operational quarry.

The assumptions are taken from or consistent with the Concept Design and Filling Strategy (InSitu Advisory 2020) and would be refined further through detailed design as part of a future development application.

A summary of the estimated emissions for quarry infilling compared with the quarry extraction scenario is presented in Table 2.1. The table also presents emission estimates for the ARRC (as presented in the EIS) and the revised estimates based on the changes described in Section 2.1.

The emission inventory for infilling is presented in Appendix A.

Table 2.1 Calculated emissions for development stages

Development stage	TSP (kg/year)	PM_{10} (kg/year)	$PM_{2.5}$(kg/year)
Luddenham Quarry	34,666	10,327	1,437
Quarry infilling	19,845	5,898	801
ARRC (as presented in EIS)	7,786	1,573	578
ARRC (revised estimate)	7,655	1,221	314

2.3 Revised modelling results – residential / commercial

The cumulative scenarios presented in the EIS have been updated to account for quarry infilling.

Cumulative results are presented as follows:

- Cumulative scenario 1: ARRC increment + quarry extraction + background + construction of WSA;
- Cumulative scenario 2: ARRC increment + background + operation of WSA; and
- Cumulative scenario 3: ARRC increment + background + operation of WSA + quarry infilling.

2.4 Annual average PM_{10} and $PM_{2.5}$

The predicted ARRC increment and cumulative annual average PM_{10} and $PM_{2.5}$ concentrations are presented in Table 2.2. The highest predicted ARRC increment for annual average PM_{10} is 2.2 µg/m³ at assessment location R3 (EIS prediction: 3.9 µg/m³). The next highest predicted ARRC increment (0.6 µg/m³) occurs at R6 (EIS prediction: 1.1 µg/m³). There are no exceedances of the impact assessment criterion for annual average PM_{10}.

The highest predicted ARRC increment for annual average $PM_{2.5}$ is 0.8 µg/m³ also at assessment location R3 (EIS prediction: 1.3 µg/m³). The next highest predicted ARRC increment (0.2 µg/m³) occurs at R6 (EIS prediction: 0.4 µg/m³).

For all cumulative assessment scenarios, there is an exceedance of the impact assessment criterion for annual average $PM_{2.5}$ at R3 (8.6 µg/m³ for Scenario 1, 8.3 µg/m³ for Scenario 2 and 8.5 µg/m³ for Scenario 3).

It is noted that R3 is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness under the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (Aerotropolis SEPP).

Table 2.2 Predicted incremental and cumulative annual average PM_{10} and $PM_{2.5}$ concentrations

	PM_{10} (µg/m³)						$PM_{2.5}$ (µg/m³)					
	Increment			Cumulative			Increment			Cumulative		
	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal	**25 µg/m³**						**8 µg/m³**					
R1	0.1	0.1	0.1	19.0	18.7	18.8	<0.1	<0.1	<0.1	7.5	7.4	7.5
R2	0.2	0.2	0.1	19.2	18.8	18.9	0.1	0.1	0.0	7.5	7.5	7.5
R3	2.2	1.8	0.9	22.9	20.8	21.8	0.8	0.4	0.2	**8.6**	**8.3**	**8.5**
R4	0.1	0.3	0.2	19.3	18.8	18.9	<0.1	0.1	<0.1	7.6	7.5	7.6
R5	0.1	0.2	0.1	19.2	18.8	18.9	<0.1	0.1	<0.1	7.6	7.5	7.5
R6	0.6	1.3	0.6	20.8	19.3	19.9	0.2	0.3	0.1	8.0	7.7	7.9
R7	<0.1	0.1	0.1	19.0	18.7	18.8	<0.1	<0.1	<0.1	7.5	7.5	7.5
R8	0.1	0.1	<0.1	18.9	18.7	18.7	<0.1	<0.1	<0.1	7.4	7.4	7.4
C1	0.3	1.4	0.6	20.6	19.0	19.6	0.1	0.3	0.1	7.9	7.6	7.7
AR1	0.2	1.2	0.5	20.3	18.9	19.4	0.1	0.3	0.1	7.8	7.6	7.7

2.5 24-hour average PM_{10} and $PM_{2.5}$

The predicted ARRC increment and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations are presented in Table 2.3. Exceedances of the impact assessment criteria are shown in bold, and the number of additional days above the criteria are shown in brackets.

The highest predicted ARRC increment for 24-hour average PM_{10} is 6.3 µg/m³, at assessment location R3 (EIS prediction: 9.1 µg/m³). The next highest predicted ARRC increment (3.6 µg/m³) occurs at assessment location R6 (EIS prediction: 5.0 µg/m³).

The highest predicted ARRC increment for 24-hour average $PM_{2.5}$ is 1.9 µg/m³, at assessment location R3 (EIS prediction: 3.2 µg/m³). The next highest predicted ARRC increment (1.0 µg/m³) occurs at R6 (EIS prediction: 2.1 µg/m³).

The cumulative daily-varying 24-hour average results at each receptor are derived as follows:

- Cumulative Scenario 1: The 2017 Bringelly daily monitoring data is combined with the maximum predicted 24-hour average concentration from the construction of WSA, added to every day of the background dataset. The project-only predicted increment for each day is then added to this background plus WSA contribution and then combined with the predicted increment for the Luddenham Quarry on the same day;
- Cumulative Scenario 2: The 2017 Bringelly daily monitoring data is combined with the maximum predicted 24-hour average concentration from the operational phase of WSA, added to every day of the background dataset. The project-only predicted increment for each day is then added to this background plus WSA contribution; and
- Cumulative Scenario 3: The 2017 Bringelly daily monitoring data is combined with the maximum predicted 24-hour average concentration from the operational phase of WSA, added to every day of the background dataset. The project-only predicted increment for each day is then added to this background plus WSA contribution and then combined with the predicted increment for the quarry infilling on the same day.

There are six existing exceedances of the daily PM_{10} criterion in the 2017 background dataset. With the additional contribution from the construction and operation of the WSA, there are another two exceedances of the daily PM_{10} criterion (total of eight existing exceedances across all receptors assumed for background). Therefore, for PM_{10}, the 9th highest cumulative concentrations are presented. For $PM_{2.5}$, there are two existing exceedances of the daily $PM_{2.5}$ criterion in the 2017 background dataset. With the additional contribution from the construction and operational phase of the WSA, no additional exceedances would occur. Therefore, the third highest cumulative concentrations are presented for 24-hour average $PM_{2.5}$ for both scenarios.

As shown in Table 2.3, for 24-hour PM_{10} concentrations, there are additional days over the impact assessment criterion for Scenario 1 at R3 (three additional days) and no additional days over the impact assessment criteria for Scenario 2 or Scenario 3 (with quarry infilling). For 24-hour $PM_{2.5}$ concentrations, there are two additional days over the impact assessment criterion for all scenarios at R3.

It is noted that R3 is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness under the Aerotropolis SEPP.

Table 2.3 Predicted incremental and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations

	PM_{10} (µg/m³) (number of additional days above goal shown in brackets)						$PM_{2.5}$ (µg/m³) (number of additional days above goal shown in brackets)					
	Increment			Cumulative			Increment			Cumulative		
	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal	**50 µg/m³**						**25 µg/m³**					
R1	0.5	1.0	0.7	47.8	44.8	44.9	0.2	0.2	0.1	23.5	23.0	23.0
R2	0.8	2.2	1.1	47.9	44.9	44.9	0.3	0.5	0.2	23.3	22.8	22.9
R3	6.3	10.2	4.2	**50.7 (3)**	48.1	48.5	2.1	1.9	1.0	**25.1 (2)**	**25.1 (2)**	**25.4 (2)**
R4	0.9	3.2	1.3	47.8	45.8	45.9	0.3	0.7	0.3	23.7	23.8	23.9
R5	0.4	2.6	0.9	47.8	45.8	45.9	0.2	0.7	0.3	23.7	23.8	23.8
R6	3.6	5.5	3.0	48.9	46.3	46.6	1.1	1.4	0.7	24.1	24.0	24.1
R7	0.5	1.4	0.5	47.8	45.8	45.8	0.2	0.4	0.2	23.6	23.8	23.8
R8	0.5	1.2	0.6	47.7	44.7	44.8	0.2	0.3	0.1	23.2	22.8	22.8
C1	1.7	8.0	4.7	48.7	46.4	46.6	0.6	1.6	0.7	23.9	23.9	24.0
AR1	1.1	8.6	4.3	48.5	46.3	46.4	0.5	1.6	0.6	23.8	23.9	23.9

2.6 Annual average TSP and dust deposition

The predicted ARRC increment and cumulative annual average TSP and dust deposition are presented in Table 2.4. The highest predicted ARRC increment for annual average TSP is 11.6 $\mu g/m^3$ at assessment location R3 (down from the EIS prediction of 16.7 $\mu g/m^3$). There are no exceedances of the impact assessment criterion for annual average TSP for any scenario.

The highest predicted ARRC increment for annual average dust deposition is 0.7 g/m^2/month also at assessment location R3 (down from the EIS prediction of 0.8 g/m^2/month). There are no exceedances of the impact assessment criterion for annual average dust deposition for any scenario.

Table 2.4 Predicted incremental and cumulative annual average TSP and dust deposition

	TSP (µg/m³)						Dust deposition (g/m²/month)					
	Increment			Cumulative			Increment			Cumulative		
	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry	Quarry infill	Scenario 1 (ARRC + background + WSA construction + Quarry)	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal				90 µg/m³			2 g/m²/month			4 g/m²/month		
R1	0.3	1.0	0.2	51.0	50.0	50.3	<0.1	0.1	<0.1	1.7	1.6	1.6
R2	0.8	2.1	0.4	52.6	50.5	50.9	0.1	0.1	<0.1	1.8	1.7	1.7
R3	11.6	26.1	3.4	87.4	61.3	64.7	0.7	1.5	0.3	3.8	2.3	2.6
R4	0.3	0.9	0.4	51.0	50.0	50.4	<0.1	<0.1	<0.1	1.7	1.6	1.6
R5	0.2	0.7	0.3	50.6	49.9	50.2	<0.1	<0.1	<0.1	1.6	1.6	1.6
R6	2.9	7.7	1.6	60.2	52.6	54.2	0.2	0.4	0.2	2.2	1.8	1.9
R7	0.1	0.4	0.1	50.2	49.8	50.0	<0.1	<0.1	<0.1	1.6	1.6	1.6
R8	0.2	0.6	0.1	50.5	49.9	50.0	<0.1	<0.1	<0.1	1.6	1.6	1.6
C1	1.2	3.5	1.5	54.4	50.9	52.5	0.1	0.2	0.1	1.8	1.7	1.8
AR1	0.8	2.2	1.2	52.8	50.5	51.8	<0.1	0.1	0.1	1.7	1.6	1.8

3 Future airport receptors

Air quality predictions at future receptors associated with the Western Sydney Airport have been modelled. The updated air quality predictions are presented in Table 3.1, Table 3.2 and Table 3.3 at three discrete receptor points for each of the future terminal area, runway area, fuel farm area and airport infrastructure area. The updated air quality predictions reflect the changes to the operational assumptions and the revised cumulative scenario (quarry infilling).

As requested in DPIE's submission, the airport receptor assessment locations are shown in Figure 3.1.

Air quality predictions are presented for Scenario 2 and Scenario 3. Air quality predictions for Scenario 1 are not presented as quarry extraction would be completed in 2024, prior to the start of airport operations in 2026.

The modelling results presented in in Table 3.1, Table 3.2 and Table 3.3 show:

- there would be no exceedances of the annual average impact assessment criteria for PM_{10} and $PM_{2.5}$ at the airport terminal, runway or infrastructure areas;
- there would be no exceedances of the annual average impact assessment criteria for PM_{10} at the airport terminal, runway, infrastructure or fuel farm areas.
- exceedances of the annual average impact assessment criteria for $PM_{2.5}$ are limited to the fuel farm area for Scenario 3;
- exceedances of the 24-hour average impact assessment criteria for PM_{10} and $PM_{2.5}$ are limited to the fuel farm area (2–4 additional days over the impact assessment criteria) for Scenario 3; and

It is noted that the health-based air quality criteria for particulate matter are designed to offer protection for periods of exposure ranging from 24-hours to annual averages. It is expected that exposure risk at the Fuel Farm area would be minimal as employees would not spend significant periods of time within this area.

Furthermore, modelling predictions are based on a conservatively high rate of quarry infill. The quarry infill scenario will be refined and mitigated if needed in a future development application.

Table 3.1 Predicted incremental and cumulative annual average PM_{10} and $PM_{2.5}$ concentrations for airport receptors

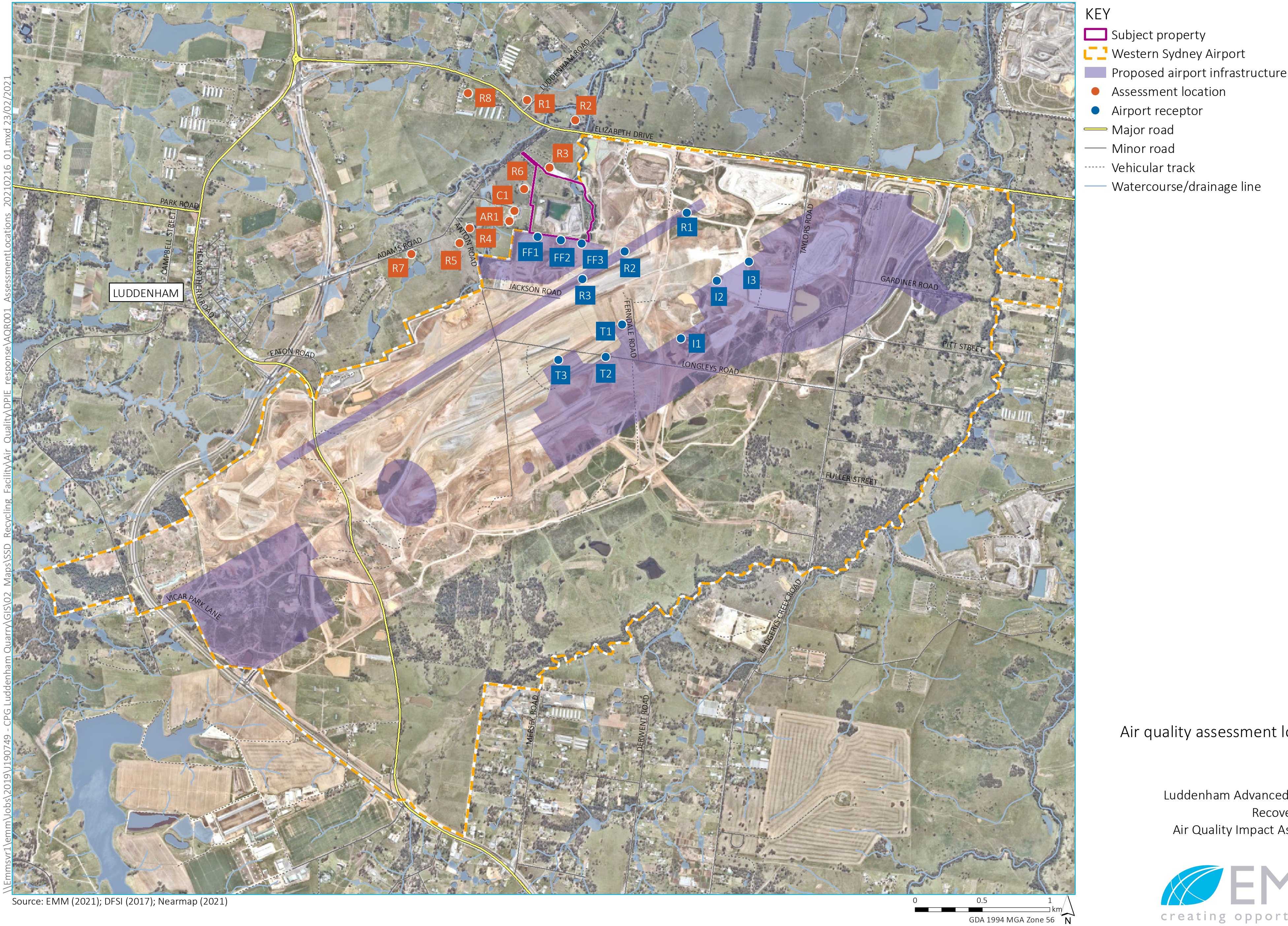
	PM_{10} (µg/m³)				$PM_{2.5}$ (µg/m³)			
	Increment		Cumulative		Increment		Cumulative	
	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal	**25 µg/m³**				**8 µg/m³**			
Terminal R1	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Terminal R2	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Terminal R3	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Runway R1	<0.1	0.1	18.7	18.9	<0.1	<0.1	7.5	7.5
Runway R2	0.1	0.3	18.8	19.1	<0.1	0.1	7.5	7.6
Runway R3	0.1	0.3	18.8	19.1	<0.1	0.1	7.5	7.6
Fuel farm R1	0.2	2.2	18.9	21.2	0.1	0.3	7.6	7.9
Fuel farm R2	0.3	3.1	19.0	22.1	0.1	0.5	7.6	**8.1**
Fuel farm R3	0.2	3.5	18.9	22.4	0.1	0.5	7.6	**8.1**
Infrastructure R1	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Infrastructure R2	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5
Infrastructure R3	<0.1	0.1	18.7	18.8	<0.1	<0.1	7.5	7.5

Table 3.2 Predicted incremental and cumulative 24-hour average PM_{10} and $PM_{2.5}$ concentrations for airport receptors

	PM_{10} (µg/m^3) (number of additional days above goal shown in brackets)				$PM_{2.5}$ (µg/m^3) (number of additional days above goal shown in brackets)			
	Increment		Cumulative		Increment		Cumulative	
	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal			**50 µg/m^3**				**25 µg/m^3**	
Terminal R1	0.8	1.6	45.8	45.9	0.4	0.4	23.8	23.8
Terminal R2	0.7	1.5	45.8	45.9	0.3	0.3	23.8	23.8
Terminal R3	0.5	1.1	45.8	45.9	0.2	0.2	23.8	23.8
Runway R1	0.9	2.0	45.8	45.9	0.4	0.4	23.8	23.8
Runway R2	0.8	5.3	45.8	46.2	0.4	0.8	23.8	23.8
Runway R3	1.1	4.6	45.9	46.0	0.5	0.7	24.0	23.8
Fuel farm R1	1.3	10.0	45.9	49.0	0.5	1.2	24.0	24.4
Fuel farm R2	1.7	16.0	45.9	**55.2 (2)**	0.6	2.6	23.9	25.0
Fuel farm R3	2.0	23.7	45.8	**55.4 (4)**	0.9	3.0	23.8	**25.5 (2)**
Infrastructure R1	0.4	1.3	45.8	45.9	0.2	0.2	23.8	23.8
Infrastructure R2	0.5	1.0	45.8	45.9	0.3	0.2	22.1	22.1
Infrastructure R3	0.2	1.8	45.8	45.9	0.1	0.3	22.1	22.1

Table 3.3 Predicted incremental and cumulative annual average TSP and dust deposition for airport receptors

	TSP (µg/m³)				Dust deposition (g/m²/month)			
	Increment		Cumulative		Increment		Cumulative	
	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)	ARRC	Quarry infill	Scenario 2 (ARRC + background + WSA operation)	Scenario 3 (ARRC + background + WSA operation + quarry infill)
Goal	90 µg/m³				2 g/m²/month		4 g/m²/month	
Terminal R1	0.1	0.2	49.8	50.0	<0.1	<0.1	1.6	1.6
Terminal R2	0.1	0.1	49.8	49.9	<0.1	<0.1	1.6	1.6
Terminal R3	0.1	0.2	49.8	50.1	<0.1	<0.1	1.6	1.6
Runway R1	0.2	0.3	49.9	50.2	<0.1	<0.1	1.6	1.6
Runway R2	0.3	0.7	50.0	50.7	<0.1	0.1	1.6	1.7
Runway R3	0.3	0.8	50.0	50.8	<0.1	0.0	1.6	1.7
Fuel farm R1	1.0	6.4	50.7	57.1	<0.1	0.6	1.6	2.2
Fuel farm R2	1.2	8.7	50.9	59.7	0.1	0.7	1.7	2.4
Fuel farm R3	0.9	10.1	50.6	60.7	<0.1	0.8	1.6	2.4
Infrastructure R1	0.1	0.1	49.8	49.9	<0.1	<0.1	1.6	1.6
Infrastructure R2	0.1	0.2	49.8	50.0	<0.1	<0.1	1.6	1.6
Infrastructure R3	0.1	0.1	49.8	49.9	<0.1	<0.1	1.6	1.6



\\Emmsvr1\emm\Jobs\2019\J190749 - CPG Luddenham Quarry\GIS\02_Maps\SSD_Recycling_Facility\Air_Quality\DPIE_response\AQR001_AssessmentLocations_20210216_01.mxd 23/02/2021

Source: EMM (2021); DFSI (2017); Nearmap (2021)

Air quality assessment locations

Luddenham Advanced Resource
Recovery Centre
Air Quality Impact Assessment
Figure 3.1

EMM
creating opportunities

4 Odour assessment

4.1 DPIE submission

A conservative worse case odour assessment is presented to address DPIE's submission (below) to account for potential odour emissions from the ARRC and future activity of quarry infilling.

> It is understood that general solid waste (putrescible) will not be accepted at the development. The AQIA states that as no putrescible waste will be accepted at the RRF and no sources of odour emissions identified from the RRF operations, odour was not quantitively assessed in the EIS. A quantitative assessment of odour impacts, as per the SEARs requirements should be provided to provide baseline data and conservatively assess and provide mitigation measures for potential odour impacts to future sensitive receptors, including the Western Sydney Airport and approved/future developments in the vicinity.

4.2 Assessment of odour impacts

The criteria used to assess odour impacts are "odour units" (ou) which are effectively the number of dilutions required for a sample of odorous air to reach the odour detection threshold (below which odour would not be perceptible). The odour nuisance level can be as low as 2 ou and as high as 10 ou (for less offensive odours), whereas an odour assessment criterion of 7 ou is likely to represent the level below which 'offensive' odours should not occur.

The Technical Framework for Assessment and Management of Odour from Stationary Sources in NSW (NSW DECC 2006) recommends that, as a design criterion, no individual should be exposed to ambient odour levels of greater than 7 ou. NSW EPA (2016) prescribes odour goals which take into account the population density for a particular area. The most stringent odour goal of 2 ou is acceptable for the whole population and therefore appropriate for densely populated areas. A summary of the NSW EPA's population-based odour assessment criteria is presented in Table 4.1. Odour goals are compared against the 99th percentile of dispersion modelling predictions and for averaging periods known as a 'nose response average'[1].

Table 4.1 Impact assessment criteria for complex mixtures of odorous air pollutants

Population of affected community	Odour units (ou), nose response time average, 99th percentile
2	7
10	6
30	5
125	4
500	3
Urban (2000) and / or schools and hospitals	2

The population of the community in the vicinity of the ARRC is likely to be less than 30, which would correspond to an odour goal of 5 ou. The transient population for the future operation at the WSA may be higher, therefore the more stringent odour goal of 2 ou may be more appropriate for some areas of the WSA (ie terminal building), although it is noted that exposure would be unlikely as limited time would be spent outside the terminal building.

1 nose response average refers to the instantaneous perception of odours by the human nose and is derived using peak-to-mean ratios, described in Section 3

It is expected that the odour environment in the vicinity of the fuel farm and runways would be dominated by odour from aviation fuel.

4.3 Odour emissions

The incoming waste would not generally be odorous therefore odour impacts during operation of the ARRC are not expected. Notwithstanding, a proportion of the incoming waste would be organic (wood waste, garden waste, paper and cardboard) and therefore has the potential to generate odour for the quarry infilling scenario (from the decomposition of residual organic waste that was not able to be recycled). The ARRC would aim to recover as much of this organic waste as possible, and therefore only a small volume of degradable waste is expected to be returned to the quarry void. Notwithstanding, a conservative worse case odour assessment is presented which accounts for potential odour emissions from the ARRC facility and from the quarry infilling.

Odour emissions from the ARRC are estimated using an emission factor of 25.1 ou.m^3/tonne/second (The Odour Unit 2018). This emission factor is applied to derive an odour emission rate (OER, expressed as ou.m^3/s) for the ARRC warehouse based on an hourly processing rate of 71.4 tonnes per hour. This results in a total warehouse OER of 1793 ou.m^3/s which is assumed to emit evenly across the four entry/exit doors.

To derive odour emission rates for quarry infilling, odour emission data for putrescible waste landfills were reviewed for sites where relatively recent odour monitoring was conducted. A summary of these data is provided in Table A.5. As limited putrescible waste would be directed for quarry filling, the approach taken for this assessment is to use lowest specific odour emission rate (SOER, expressed as ou.m^3/m^2/s) reported in Table A.5, which were all putrescible waste landfills.

There are limited odour data available for non- putrescible waste landfills, however odour measurements were taken at the active tip face of the Bingo Eastern Creek Recycling Park, which accepts similar waste to that proposed for the ARRC. The odour measurement at the active tip face for this site is comparable to the lowest SOER for the active tip face at the putrescible waste landfills reported in Table A.5 , thereby validating the approach for this assessment.

The quarry pit is split into three operational areas for modelling, as follows:

- active tip face, with an area of ~1,350 m^2 and an odour emission rates of 0.4 ou.m^3/m^2/s;
- daily cover, with an area of ~5,350 m^2 and an odour emission rates of 0.03 ou.m^3/m^2/s; and
- intermediate cover, with an area of ~55,330 m^2 and an odour emission rates of 0.019 ou.m^3/m^2/s.

4.4 Odour modelling results

4.4.1 Peak-to-mean ratios

The instantaneous perception of odours by the human nose occurs over very short timescales (~ 1 second), but dispersion model predictions are typically made for a one hour averaging period. To estimate the effects of plume meandering and concentration fluctuations perceived by the human nose, it is possible to multiply dispersion model predictions by a correction factor called a “peak-to-mean ratio”. The peak-to-mean ratio (P/M60) is defined as the ratio of peak 1-second concentrations to mean 1-hour average concentrations. To estimate peak 1-second concentrations from hourly averaged odour concentrations, a peak-to-mean ratio (P/M60) of 2.3 has been applied in accordance with Table 6.1 of NSW EPA 2016.

4.4.2 Results

The results of the odour modelling are presented in Table 4.2. All receptors are below the odour goal of 5 ou, with most receptor locations at or below 1 ou (the theoretical level at which no odour would occur). The exception is the fuel farm area, which is adjacent to the quarry boundary, however the predicted odour concentration at these locations is less than the design criterion of 7 ou, therefore nuisance odour impacts are unlikely. Furthermore, it is expected that the odour environment in the vicinity of the fuel farm would be dominated by odour from aviation fuel. The predicted odour at fuel farm area is predominantly from quarry infilling, which will be considered further in a future development application.

Table 4.2 Predicted odour impacts for all receptors

Receptor	Odour concentration (ou) 99th percentile, nose response average
R1	<1
R2	1
R3	3
R4	1
R5	1
R6	2
R7	<1
R8	<1
C1	2
AR1	2
Terminal R1	<1
Terminal R2	<1
Terminal R3	<1
Runway R1	<1
Runway R2	1
Runway R3	1
Fuel farm R1	4
Fuel farm R2	6
Fuel farm R3	3
Infrastructure R1	<1
Infrastructure R2	<1
Infrastructure R3	<1

5 Conclusion

Changes to the operational assumptions for the site has required updates to the air quality modelling predictions presented in the EIS. Furthermore, the cumulative scenarios presented in the EIS have been revised to account for quarry infilling.

Revised modelling results predict that air quality and odour impacts from the proposed operation of the ARRC would not adversely impact local air quality. Exceedances of the impact assessment criteria are limited to receptor R3, which is currently vacant and the property owner intends to develop the property for commercial purposes in line with the recent rezoning to Agribusiness.

Modelling predictions for a number of future airport receptors indicate that there would be no air quality impact for the operation of the WSA, with exceedances of the impact assessment criteria limited to the fuel farm area where exposure risk would be minimal.

6 References

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Appendix A

Revised dust emissions inventory and odour emission estimates

A.1 Revised emission inventories for ARRC (changes to truck movements and diesel emissions)

Table A.1 Revised TSP emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Haulage																	
Waste trucks in - waste transfer	795.6	2,457		1.08	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks in - construction waste	684.2	17,200		0.13	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	6.4		7.4		70	
Waste trucks in - bulk waste	795.6	2,457		1.08	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks out - waste transfer	233.0	2,457	VKT/y	0.32	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	15.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	70	Water flushing/street sweeping
Waste trucks out - construction waste	145.2	17,200		0.03	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	1.4		7.4		70	
Waste trucks out - bulk waste	270.9	2,857		0.32	kg/VKT	200,000	t/y	35.0	t/load	0.500	km/trip	15.0		7.4		70	
Product trucks in	699.0	7,371		0.32	kg/VKT	600,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Product trucks out	1,831.8	5,657		1.08	kg/VKT	600,000	t/y	35.0	t/load	0.330	km/trip	50.0		7.4		70	
Material handling and processing in shed																	
Internal haul - waste trucks	755.6	10,320	VKT/y	0.4881	kg/VKT	600,000	t/y	25.0	t/load	0.430	km/trip	23.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Internal haul - product trucks	894.3	8,571	VKT/y	0.6955	kg/VKT	600,000	t/y	35.0	t/load	0.500	km/trip	32.5		7.4	road surface silt loading (g/m2)	85	
Trucks unloading waste in warehouse	36.7	600,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^1.3							85	
Excavator sorting / picking	36.7	600,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^1.3							85	
Non-recyclable material - rehandle	3.7	60,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^1.3							85	Enclosure and water sprays
Recyclable material - conveyor/transfer	165.2	540,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^1.3	5	transfer points					85	
Recyclable material - screening	89.1	540,000	t/y	0.0043	kg/t											85	
Recyclable material - rehandle	33.0	540,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^1.3							85	
Crushing concrete/masonry	12.2	135,000	t/y	0.0125	kg/t											85	

Table A.1 Revised TSP emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Shredding timber	24.3	270,000	t/y	0.0125	kg/t											85	
Future processing - shredding tyres	1.8	20,000	t/y	0.0125	kg/t											85	
Future processing - sand screening at wash plant	16.5	100,000	t/y	0.0043	kg/t											85	
Future processing - rehandle	14.7	120,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	2	times rehandle					85	
Rehandle processed material to stockpile bins	24.8	405,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
FEL wheel generated dust	22	7,500	VKT/y	0.0200	kg/VKT	600,000	t/y	4.0	t/load (wt ave)	0.050	km/trip	1.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Product - rehandle to truck	36.7	600,000	t/y	0.0004	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Wind erosion (shed)																	
Shed area	11.9	1.4	ha	850	kg/ha/yr											99	Enclosure
Miscellaneous																	
Onsite diesel consumption	20.5	311	kL/annum	0.07	kg/kL												
Total (kg/yr)	**7,655**																

Table A.2 Revised PM_{10} emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Haulage																	
Waste trucks in - waste transfer	140.8	2,457		0.1910	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks in - construction waste	121.1	17,200		0.0235	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	6.4		7.4		70	
Waste trucks in - bulk waste	140.8	2,457		0.1910	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks out - waste transfer	48.0	2,457	VKT/y	0.0559	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	15.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	70	Water flushing/street sweeping
Waste trucks out - construction waste	29.9	17,200		0.0050	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	1.4		7.4		70	
Waste trucks out - bulk waste	48.0	2,857		0.0559	kg/VKT	200,000	t/y	35.0	t/load	0.500	km/trip	15.0		7.4		70	
Product trucks in	123.7	7,371		0.0559	kg/VKT	600,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Product trucks out	324.2	5,657		0.1910	kg/VKT	600,000	t/y	35.0	t/load	0.330	km/trip	50.0		7.4		70	
Material handling and processing in shed																	
Internal haul - waste trucks	33.7	10,320	VKT/y	0.0937	kg/VKT	600,000	t/y	25.0	t/load	0.430	km/trip	23.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Internal haul - product trucks	27.5	8,571	VKT/y	0.1335	kg/VKT	600,000	t/y	35.0	t/load	0.500	km/trip	32.5		7.4	road surface silt loading (g/m2)	85	
Trucks unloading waste in warehouse	17.4	600,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Excavator sorting / picking	17.4	600,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Non-recyclable material - rehandle	1.7	60,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	Enclosure and water sprays
Recyclable material - conveyor/transfer	15.6	540,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	5	transfer points					85	
Recyclable material - screening	30.0	540,000	t/y	0.0004	kg/t											85	
Recyclable material - rehandle	15.6	540,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Crushing concrete/masonry	5.5	135,000	t/y	0.0003	kg/t											85	
Shredding timber	10.9	270,000	t/y	0.0003	kg/t											85	
Future processing - shredding tyres	0.8	20,000	t/y	0.0003	kg/t											85	

Table A.2 Revised PM_{10} emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Future processing - sand screening at wash plant	5.6	100,000	t/y	0.0004	kg/t											85	
Future processing - rehandle	3.5	120,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	2	times rehandl e					85	
Rehandle processed material to stockpile bins	11.7	405,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
FEL wheel generated dust	4.3	7,500	VKT/y	0.0038	kg/VKT	600,000	t/y	4.0	t/load (wt ave)	0.050	km/trip	1.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Product - rehandle to truck	17.4	600,000	t/y	0.0002	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Wind erosion (shed)																	
Shed area	6.0	1.4	ha	425	kg/ha/yr											99	Enclosure
Miscellaneous																	
Onsite diesel consumption	20.5	311	kL/ann um	0.07	kg/kL												
Total (kg/yr)	**1,221**																

Table A.3 Revised $PM_{2.5}$ emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Haulage																	
Waste trucks in - waste transfer	36.9	2,457		0.0501	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks in - construction waste	31.8	17,200		0.0062	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	6.4		7.4		70	
Waste trucks in - bulk waste	43.0	2,457		0.0501	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	50.0		7.4		70	
Waste trucks out - waste transfer	10.8	2,457	VKT/y	0.0147	kg/VKT	200,000	t/y	35.0	t/load	0.430	km/trip	15.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	70	Water flushing/street sweeping
Waste trucks out - construction waste	6.7	17,200		0.0013	kg/VKT	200,000	t/y	5.0	t/load	0.430	km/trip	1.4		7.4		70	
Waste trucks out - bulk waste	10.8	2,857		0.0147	kg/VKT	200,000	t/y	35.0	t/load	0.500	km/trip	15.0		7.4		70	
Product trucks in	32.5	7,371		0.0147	kg/VKT	600,000	t/y	35.0	t/load	0.430	km/trip	15.0		7.4		70	
Product trucks out	85.1	5,657		0.0501	kg/VKT	600,000	t/y	35.0	t/load	0.330	km/trip	50.0		7.4		70	
Material handling and processing in shed																	
Internal haul - waste trucks	8.2	10,320	VKT/y	0.0227	kg/VKT	600,000	t/y	25.0	t/load	0.430	km/trip	23.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Internal haul - product trucks	6.6	8,571	VKT/y	0.0323	kg/VKT	600,000	t/y	35.0	t/load	0.500	km/trip	32.5		7.4	road surface silt loading (g/m2)	85	
Trucks unloading waste in warehouse	2.6	600,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Excavator sorting / picking	2.6	600,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Non-recyclable material - rehandle	0.3	60,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	Enclosure and water sprays
Recyclable material - conveyor/transfer	2.4	540,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3	5	transfe r points					85	
Recyclable material - screening	2.0	540,000	t/y	0.00003	kg/t											85	
Recyclable material - rehandle	2.4	540,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^ 1.3							85	
Crushing concrete/masonry	1.0	135,000	t/y	0.00005	kg/t											85	
Shredding timber	2.0	270,000	t/y	0.00005	kg/t											85	
Future processing - shredding tyres	0.2	20,000	t/y	0.00005	kg/t											85	

Table A.3 Revised $PM_{2.5}$ emissions inventory for ARRC

Activity	Emission estimate (kg/year)	Intensity	Units	Emission Factor	Units	Variable 1		Variable 2		Variable 3		Variable 4		Variable 5		Control %	Control
Future processing - sand screening at wash plant	0.4	100,000	t/y	0.00003	kg/t											85	
Future processing - rehandle	0.5	120,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^1.3	2	times rehandle					85	
Rehandle processed material to stockpile bins	1.8	405,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^1.3							85	
FEL wheel generated dust	0.0	7,500	VKT/y	0.00000	kg/VKT	600,000	t/y	4.0	t/load (wt ave)	0.050	km/trip	1.0	Wt ave vehicle gross mass (t) loaded	7.4	road surface silt loading (g/m2)	85	
Product - rehandle to truck	2.6	600,000	t/y	0.00003	kg/t	5	mc %	1.2	(ws/2.2)^1.3							85	
Wind erosion (shed)																	
Shed area	0.9	1.4	ha	64	kg/ha/yr											99	Enclosure
Miscellaneous																	
Onsite diesel consumption	19.9	311	kL/annum	0.06	kg/kL												
Total (kg/yr)	**314**																

A.2 Quarry infill scenario

Table A.4 TSP, PM_{10} and $PM_{2.5}$ emissions inventory for Quarry infill scenario

Activity	TSP Emission estimate (kg/year)			Intensity	Unit	Emission Factor			Unit	Variable										Control %	Control
	TSP	PM_{10}	$PM_{2.5}$			TSP	PM_{10}	$PM_{2.5}$													
Hauling - external trucks entering via access road - sealed	1,520.2	291.8	70.6	3,857	VKT/y	1.31	0.25	0.06	kg/VKT	7.4	Road silt loading (g/m²)	0.5	km/trip	8,571	Loads/y	55	loaded weight (t)	35	tonnes per load	0.7	Water flushing/street sweeping
Hauling - external trucks entering via access road - unsealed	4,342.4	1,115.8	111.6	6,000	VKT/y	2.89	0.74	0.07	kg/VKT	5.0	% silt content	0.7	km/trip	8,571	Loads/y	55	loaded weight (t)	35	tonnes per load	0.75	Watering
Hauling - internal trucks from ARRC	891.6	229.1	22.9	1,105	VKT/y	3.23	0.83	0.08	kg/VKT	5.0	% silt content	0.7	km/trip	1,579	Loads/y	70	loaded weight (t)	38	tonnes per load	0.75	
Unloading waste	102.8	48.6	7.4	360,000	t/y	0.0004	0.0002	0.00003	kg/t	2.6	Average wind speed (m/s)	5	Moisture content (%)							0.3	
Rehandle	102.8	48.6	7.4	360,000	t/y	0.0004	0.0002	0.00003	kg/t	2.6	Average wind speed (m/s)	5	Moisture content (%)							0.3	
FEL/compactor movements	3,472.2	892.2	89.2	14,560	VKT/y	0.48	0.12	0.01	kg/VKT	5.0	% silt content	1	Average weight (t)			8	speed in km/h	1,820	FEL hours	0.5	Watering
Hauling - external trucks exiting via access road - unsealed	2,951.2	758.3	75.8	6,429	VKT/y	1.84	0.47	0.05	kg/VKT	5.0	% silt content	0.8	km/trip	8,571	Loads/y	20	empty weight (t)	35	Truck capacity (t)	0.75	Watering
Hauling - external trucks exiting via access road - sealed	481.5	92.4	22.4	3,429	VKT/y	0.47	0.09	0.02	kg/VKT	7.4	Road silt loading (g/m²)	0.4	km/trip	8,571	Loads/y	20	empty weight (t)	35	Truck capacity (t)	0.7	Water flushing/street sweeping
Hauling - internal trucks back to ARRC	626.9	161.1	16.1	1,105	VKT/y	2.27	0.58	0.06	kg/VKT	5.0	% silt content	0.7	km/trip	1,579	Loads/y	32	empty weight (t)	38	Truck capacity (t)	0.75	Watering
Active pit	2,023.0	1,011.5	151.7	3.4	ha	850	425	64	kg/ha/y											0.3	Sheltering
Grader (road maintenance)	3,200.4	1,118.2	99.2	10,400	VKT/y	0.62	0.22	0.02	kg/km	8	speed of graders in km/h	1,300	grader hours							0.5	Watering
Onsite diesel consumption	130.4	130.4	126.4	198	kl/yr	0.66	0.66	0.64	kg/kL												
Total (kg/yr)	**19,845**	**5,898**	**801**			1.31	0.25	0.06	kg/VKT												

A.3 Review of odour emissions and rates for modelling

Table A.5 Review of odour emissions data and odour emission rates for modelling

Source	Whytes Gully[1]	Spring Farm[4]	Woodlawn[2]	Lucas Heights[3]	SOER used for modelling
Active tip face	1.115	0.424	0.7	*26-40	0.424
Daily cover	1.023	0.069		0.03	0.03
Intermediate cover	0.035	0.019	0.3		0.019

Note: * measured using upwind/downwind transect method and therefore not comparable to other sources and sites which were measured using an isolation flux hood

1 PAEHolmes, 2012

2 Heggies, 2010

3 GHD, 2015

4 Pacific Environment, 2013