AIR QUALITY IMPACT ASSESSMENT

PROPOSED RESOURCE RECOVERY FACILITY AT 25 MARTIN ROAD, BADGERYS CREEK

Precise Planning

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Prepared by

Todoroski Air Sciences Pty Ltd

Suite 2B, 14 Glen Street

Eastwood, NSW 2122

Phone: (02) 9874 2123

Fax: (02) 9874 2125

Email: info@airsciences.com.au

Air Quality Impact Assessment
Proposed Resource Recovery Facility at 25 Martin Road, Badgerys Creek

Author(s):	Aleks Todoroski	Michelle Yu
Position:	Director	Environmental Scientist
Signature:		
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1 INTRODUCTION

This report has been prepared by Todoroski Air Sciences on behalf of Precise Planning. It provides an air quality impact assessment for the proposed development of a Resource Recovery Facility located at 25 Martin Road, Badgerys Creek NSW (hereafter referred to as the Project).

This report is structured to allow a sensible understanding of the proposed development, a review of the existing environmental conditions surrounding the Project site, a description of the emissions estimation and dispersion modelling methodology and the predicted findings of the study.

2 PROJECT SETTING AND DESCRIPTION

2.1 Project Location

The proposed Project is located approximately 2.5km west of Kemps Creek and 2km northeast of Badgerys Creek, in NSW (see **Figure 2-1**). The site is bounded to the east by Martin Road and to the west by Lawson Road. The local land use surrounding the site is comprised of semi-rural land holdings with small-scale agricultural operations and the Kemps Creek Landfill and SAWT facility located approximately 0.9km north of the site.

Residences surrounding the proposed site are identified as the nearest sensitive receptors to the Project, and are shown in **Figure 2-1**.

Figure 2-1: Project location

2.2 Project Description

Activities at the Project would generally consist of the importation (materials sourced from off-site) and processing of various materials for resource recovery. These materials would consist of the following:

- 50,000 tonnes per year of building demolition waste for example, concrete, bricks, tiles, glass, plastic, paper, wood, metal and rubber; and,
- 10,000 tonnes per year of green waste material

The proposed site layout is shown in **Figure 2-2**. Material would be delivered to site via the north-eastern corner along Martin Road before being unloaded and distributed to designated areas and stockpiles within the site. The materials would be sorted and processed before dispatch to customers off-site.

Only fresh green waste material would be received at the Project. This material would be obtained from construction and demolition activities conducted by the Proponent. The material would be processed on site (chipped or shredded) before being dispatched off site within a nominal 24 hour period. As there would be no composting of green waste material at the site, the potential scope for odour impacts to arise from simple processing of fresh green waste material is considered to be small and therefore odour has not been considered further in this assessment.

The site covers an area of approximately 2 hectares and would be prepared with recycled asphalt base except at the western portion of the site which would include a hard stand area.

No putrescible waste would be accepted on-site for processing. The proposed operating hours of the site are Monday to Friday 7am to 5pm and Saturday 8am to 2pm.

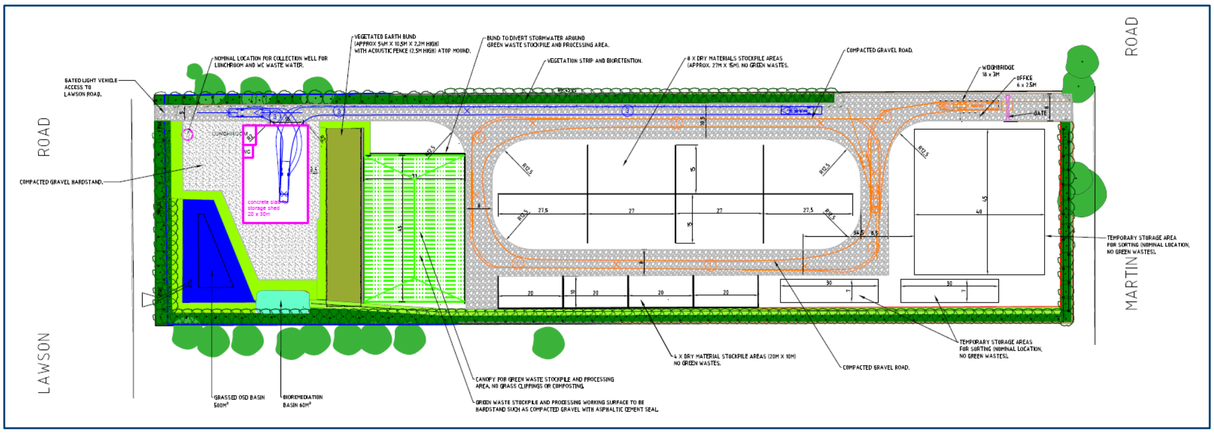

Figure 2-2 Project layout

3 AIR QUALITY CRITERIA

3.1 Preamble

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential air emissions generated by the proposed modification and the applicable air quality criteria.

The air quality goals that are relevant to this study are sourced from the NSW EPA document "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (**NSW DEC, 2005**).

3.2 Particulate matter

Particulate matter refers to particles of varying size and composition. The air quality goals relevant to this assessment refer to three classes of particulate matter based on the sizes of the particles. The first class is referred to as Total Suspended Particulate matter (TSP) which measures the total mass of all particles suspended in air. The upper size range for TSP is nominally taken to be 30 micrometres (µm) as in practice, particles larger than 30 to 50µm settle out of the atmosphere too quickly to be regarded as air pollutants.

The second and third class are sub-classes of TSP, namely PM_{10}, particulate matter with aerodynamic diameters of 10µm or less, and $PM_{2.5}$, particulate matter with aerodynamic diameters of 2.5µm or less.

3.2.1 NSW EPA impact assessment criteria

Table 3-1 summarises the air quality goals that are relevant to this study as outlined in the NSW EPA document "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (**NSW DEC, 2005**). The air quality goals for total impact relate to the total dust burden in the air and not just the dust from the proposal. Consideration of background dust levels needs to be made when using these goals to assess potential impacts.

Table 3-1: NSW EPA air quality impact assessment criteria

Pollutant	Averaging Period	Impact	Criterion
TSP	Annual	Total	90µg/m³
PM_{10}	Annual	Total	30µg/m³
	24 hour	Total	50µg/m³
Deposited dust	Annual	Incremental	2g/m²/month
		Total	4g/m²/month

Source: **NSW DEC, 2005**

The criterion for 24-hour average PM_{10} originates from the National Environment Protection Measure (NEPM) goals (**NEPC, 1988**). These goals apply to the population as a whole, and are not recommended to be applied to "hot spots" such as locations near industry, busy roads or mining. However, in the absence of alternative measures, NSW EPA does apply the criteria to assess the potential for impacts to arise at such locations.

The NEPM permits five days annually above the 24-hour average PM_{10} criterion to allow for bush fires and similar events. Similarly, it is normally the case that days, where ambient dust levels are affected by such events, are excluded from assessment as per the NSW EPA criterion.

3.2.2 $PM_{2.5}$ concentrations

The NSW EPA currently does not have impact assessment criteria for $PM_{2.5}$ concentrations; however the National Environment Protection Council (NEPC) has released a variation to the NEPM (**NEPC, 2003**) to include advisory reporting standards for $PM_{2.5}$ (see **Table 3-2**).

The advisory reporting standards for $PM_{2.5}$ are a maximum 24-hour average of 25µg/m^3 and an annual average of 8µg/m^3, and as with the NEPM goals, apply to the average, or general exposure of a population, rather than to "hot spot" locations.

Table 3-2: Advisory reporting standard for $PM_{2.5}$ concentrations

Pollutant	Averaging Period	Advisory reporting standard
$PM_{2.5}$	24 hours	25µg/m^3
	Annual	8µg/m^3

Source: **NEPC, 2003**

4 EXISTING ENVIRONMENT

This section describes the existing climate and air quality in the area surrounding the Project.

4.1 Local climate

Long-term climatic data from the Bureau of Meteorology weather station at Badgerys Creek Automatic Weather Station (AWS) (Site No. 067108) were analysed to characterise the local climate in the proximity of the Project. The Badgerys Creek AWS is located approximately 4km southwest of the Project.

Table 4-1 and **Figure 4-1** present a summary of data from the Badgerys Creek AWS collected over an approximate 15-year period.

The data indicate that January is the hottest month with a mean maximum temperature of 29.9ºC and July as the coldest month with a mean minimum temperature of 4.2ºC.

Rainfall peaks during the summer months and declines during winter. The data show February is the wettest month with an average rainfall of 108.0mm over 7.8 days and July is the driest month with an average rainfall of 23.0mm over 3.4 days.

Humidity levels exhibit variability over the day and seasonal fluctuations. Mean 9am humidity levels range from 62% in October to 84% in June. Mean 3pm humidity levels vary from 44% in August and September to 56% in June.

Wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the colder months. The mean 9am wind speeds range from 8.4km/h in March to 11.8km/h in October. The mean 3pm wind speeds vary from 13.7km/h in June to 19.9km/h in October.

Table 4-1: Monthly climate statistics summary – Badgerys Creek AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature												
Mean max. temperature (ºC)	29.9	28.5	26.7	23.9	20.6	17.8	17.3	19.3	22.7	24.7	26.1	28.1
Mean min. temperature (ºC)	16.9	17.1	15.1	11.3	7.6	5.4	4.2	4.6	7.7	10.2	13.4	15.2
Rainfall												
Rainfall (mm)	77.4	108.0	77.3	43.2	40.1	52.1	23.0	35.9	33.9	52.9	76.7	60.2
Mean No. of rain days (≥1mm)	7.1	7.8	7.1	5.3	3.8	5.4	3.9	3.4	4.7	5.7	7.2	6.8
9am conditions												
Mean temperature (ºC)	21.8	21.2	19.0	17.3	13.7	10.5	9.8	11.7	15.5	18.1	19.1	20.9
Mean relative humidity (%)	73	80	83	76	80	84	81	72	66	62	69	69
Mean wind speed (km/h)	9.4	8.7	8.4	9.8	9.6	9.1	9.6	10.6	11.7	11.8	11.0	9.8
3pm conditions												
Mean temperature (ºC)	28.1	26.9	25.3	22.4	19.4	16.7	16.1	17.9	21.0	22.8	24.3	26.5
Mean relative humidity (%)	49	55	55	52	53	56	50	44	44	45	50	48
Mean wind speed (km/h)	17.9	15.9	14.5	14.4	13.9	13.7	15.4	17.8	19.2	19.9	18.9	18.5

Source: **Bureau of Meteorology, 2014**

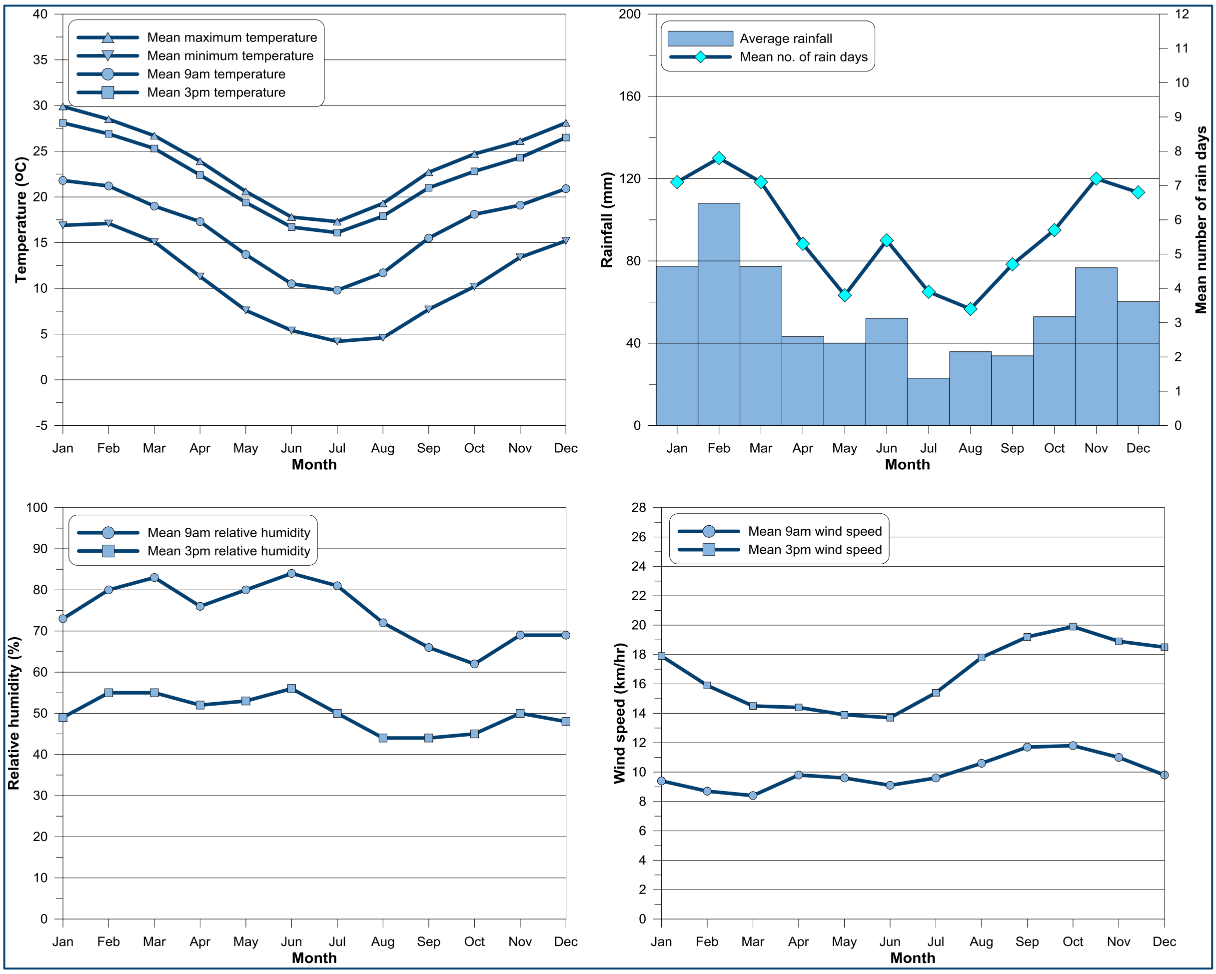

Figure 4-1: Monthly climate statistics summary – Badgerys Creek AWS

4.2 Local meteorology

Site specific meteorological data are not available to characterise the dispersion meteorology of the Project site. To generate representative local meteorological data required for this assessment, the meteorological component of The Air Pollution Model (TAPM) was used in accordance with the applicable NSW EPA guidelines (**NSW DEC, 2005**) for the 2012 calendar period, with data from Badgerys Creek AWS input as observations into the model. The 2012 calendar period was found to be most representative of the area based on a long-term meteorological analysis of data collected from the Badgerys Creek AWS.

Annual and seasonal windroses extracted from TAPM are presented in **Figure 4-2**. On an annual basis winds from the southwest are most frequent. During summer, winds are distributed from the north-northeast to the west-southwest, with the most dominant winds from the southwest. The autumn and winter distributions are similar to the annual patterns, typically dominated by winds from the southwest. In spring the distribution shows a similar pattern with that of summer where the winds are distributed from the north-northeast to the west-southwest with the most dominant winds coming from the southwest. The wind distributions are similar to those observed at the Badgerys Creek AWS.

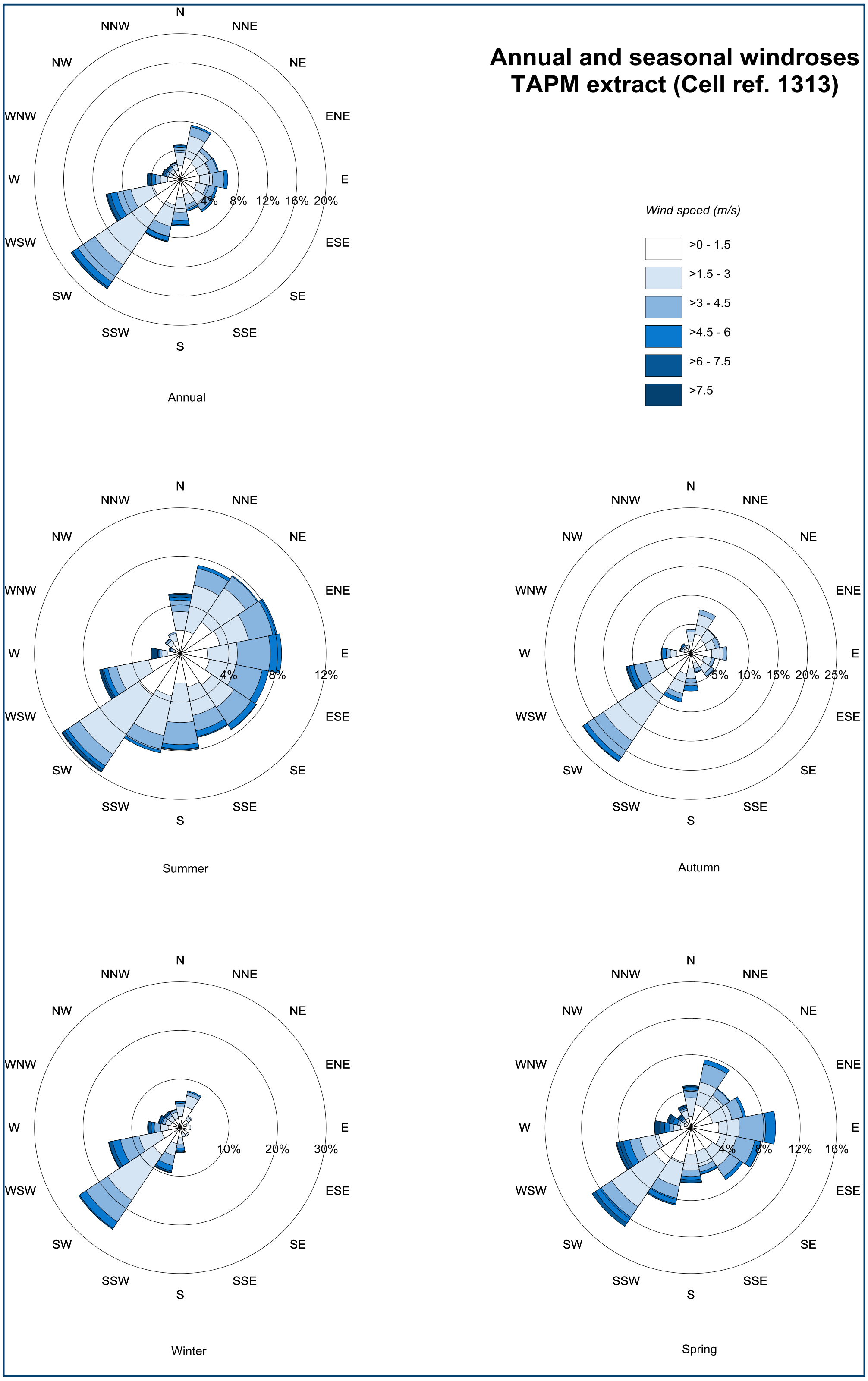

Figure 4-2: Annual and seasonal windroses – TAPM (2012)

4.3 Local air quality

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

There are no available site-specific monitoring data. To estimate the background levels for the site which is a requirement to assess any potential impacts, available data from nearby monitoring stations are used.

The air quality monitors reviewed include four Tapered Element Oscillating Microbalances (TEOMs) operated by the NSW EPA located in the wider area. **Table 4-2** presents a summary of the PM_{10} concentrations for each of the NSW EPA TEOM monitoring stations reviewed from 2010 to 2013. The data indicate that all annual average values are below the relevant criterion of 30µg/m^3, however measured dust levels on a 24-hour average basis are on occasion above the 24-hour average criterion of 50µg/m^3.

Table 4-2: PM_{10} levels from NSW EPA monitoring sites (µg/m³)

Year	Bringelly	Liverpool	St Marys	Prospect
Annual average				
2010	15.5	17.0	15.1	15.4
2011	15.9	18.1	14.7	15.8
2012	15.7	19.8	14.5	17.2
2013	17.0	21.0	16.0	19.2
Maximum level (No. of days above criteria)				
2010	41.1 (0)	41.1 (0)	52.1 (1)	40.1 (0)
2011	86.0 (2)	68.8 (1)	73.9 (1)	41.5 (0)
2012	40.1 (0)	42.5 (0)	34.3 (0)	38.7 (0)
2013	97.2 (3)	98.5 (3)	93.0 (2)	81.8 (4)

Figure 4-3 shows all of the measured 24-hour average PM_{10} levels at the surrounding NSW EPA monitoring stations over the period reviewed. It can be seen that concentrations are nominally highest in the spring and summer months with the warmer weather raising the potential for drier ground elevating the windblown dust, the occurrence of bushfires and pollen levels.

The monitoring station at Bringelly is the closest to the Project area and therefore the dust levels recorded at this station are likely to be the most representative of the ambient air quality in the vicinity of the Project.

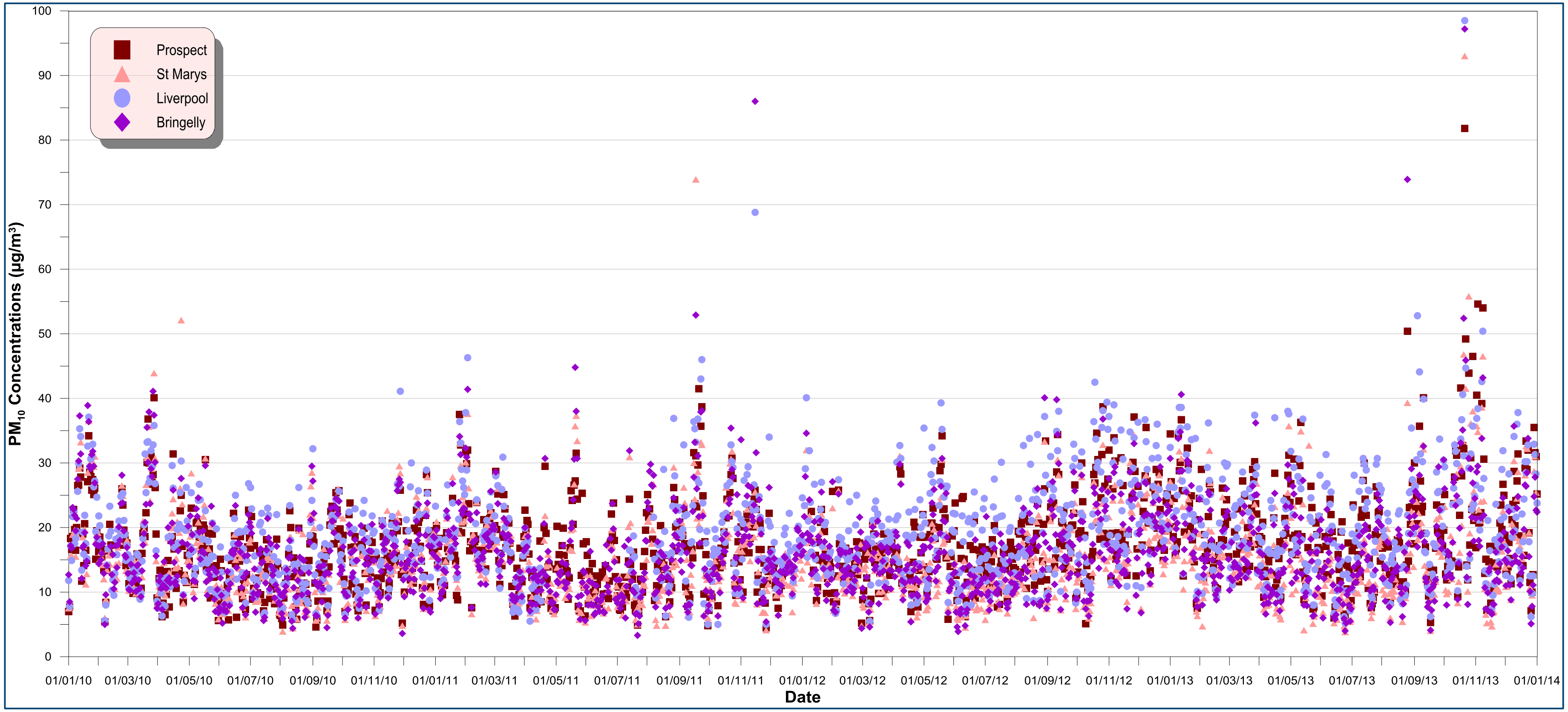

Figure 4-3: Summary of PM_{10} monitoring data – NSW EPA

A review was also conducted for surrounding facilities to identify any additional monitoring data collected by these operations. The review identified that dust deposition monitoring is conducted at the Kemps Creek Landfill and the Brandown Resource Recovery Facility (RRF). These facilities are located approximately 0.9km north and 4km east, respectively, of the Project site. A summary of dust deposition monitoring at the Kemps Creek Landfill and Brandown RRF is shown in **Table 4-3** and **Table 4-4**, respectively. The data indicate levels above 4g/m^2/month at some locations.

Table 4-3: Dust deposition monitoring data – SITA Kemps Creek (g/m^2/month)

Year	D5	D6	D8	D10	D17	D20	D21
2007	2.3	3.9	5.3	5.6	5.3	3.6	2.2
2008	3.8	3.2	8.1	4.7	5.7	4.4	2.8
2009	3.6	4.3	6.4	4.9	5	3.8	2.9
2010	4.7	5.6	10.3	4	4.7	4.8	2.6
2011	2.8	6.7	5.3	3.3	5.5	2.2	2.9

Source: **AECOM, 2013**

Table 4-4: Dust deposition monitoring data – Brandown Pty Ltd (g/m^2/month)

Date	Dust BD-1	Dust BD-2	Dust BD-3
January 2014	2.5	2.0	2.1
February 2014	4.7	5.3	3.3
March 2014	2.7	3.6	3.7

Source: **Brandown, 2014**

Data at some locations indicate levels above 4g/m^2/month. The dust deposition monitors at these locations are generally located too close to the dust sources at the nearby operations to be representative of the deposited dust levels around the Project area. As such, the data from these unrepresentative monitors were not used in this assessment.

4.3.1 Estimated background dust levels

4.3.1.1 PM_{10} Concentrations

As mentioned, there are no readily available site specific monitoring data. Therefore, the background dust levels around the Project were estimated to be similar to those recorded in the NSW EPA Bringelly monitoring station in 2012. As noted in **Sections 4.2** and **4.3**, the 2012 meteorology and the recorded dust levels at the Bringelly station are most likely to be representative of the existing environment of the Project area among the data available. Thus, an annual average PM_{10} background level of 15.7 µg/m^3 was chosen for this assessment (see **Table 4-2**).

4.3.1.2 TSP and Deposited Dust

In the absence of available data, estimates of the annual average background TSP concentrations can be determined from a relationship between measured PM_{10} concentrations. This relationship assumes that a PM_{10} concentration of 30 µg/m^3 corresponds to a TSP concentration of 90 µg/m^3 and dust deposition value of 4 g/m^2/month. This assumption is based on the NSW EPA dust criteria. Applying this relationship with the annual average PM_{10} concentration of 15.7µg/m^3 from the Bringelly monitor, an annual average TSP concentration and deposition value of 47.1µg/m3 and 2.1 g/m^2/month, respectively, is estimated.

4.3.1.3 Summary of background dust levels

The annual average background air quality levels applied in this assessment are as follows:

- PM_{10} concentrations – 15.7µg/m^3;
- TSP concentrations – 47.1µg/m^3; and
- Deposited dust levels – 2.1g/m^2/month.

5 POTENTIAL CONSTRUCTION DUST EMISSIONS

The establishment of the Project site would involve the construction of related infrastructure. This construction activity has the potential to generate dust emissions.

Potential construction dust emissions will be primarily generated due to vehicle movements and windblown dust generated from exposed areas. Exhaust emissions from the operations of construction vehicles and plant will also generate particulate emissions.

The potential dust impacts due to these activities is difficult to accurately quantify on any given day due to the short sporadic periods of dust generating activity that may occur over the construction time frame. The sources of dust are temporary in nature and will only occur during the construction period.

The total amount of dust generated from the construction process is unlikely to be significant due to the nature of the activities, and given that the activities would occur for a limited period, no significant or prolonged effect at any off-site receiver is predicted.

To ensure dust generation during the construction activities is controlled and the potential for off-site impacts is reduced, appropriate (operational and physical) mitigation measures will be implemented.

6 DISPERSION MODELLING APPROACH

6.1 Introduction

The following sections are included to provide the reader with an understanding of the model and modelling approach applied for the assessment.

6.2 Estimated dust emissions

Activities associated with the proposed operations have the potential to generate dust emissions. Potential dust emissions may be generated during the material loading/unloading, transport on-site, crushing material and windblown dust generated from exposed areas and stockpiles.

The estimated dust emissions for activity associated with the operation are presented in **Table 6-1**. The corresponding emission factors from the US EPA AP42 Emission Factors document (**USEPA, 1985 and updates**) and the State Pollution Control Commission document (**SPCC, 1983**) that were applied to estimate the potential dust emissions are outlined below the table. Detailed calculations of the dust emission estimates are provided in **Appendix A**.

Table 6-1: Estimated annual TSP emission rate – Operational activity

Activity	TSP emissions (kg/year)
Hauling to stockpile (concrete, bricks, tiles, etc.)	248
Emplacing at stockpile	43
Loading to crusher	43
Crushing material	18
Unloading crusher to stockpile	43
Loading to truck	43
Hauling material off-site	248
Hauling to stockpile (demolition waste)	248
Emplacing at stockpile	43
Loading to truck	43
Hauling material off-site	248
Wind erosion exposed areas	2,435
Total	**3,702**

The calculations apply conservative variables based on the understanding of the operation and that reasonable dust controls are implemented such as watering of trafficked areas. The total amount of dust generated from the proposed activities is low.

6.3 Modelling methodology

The AUSPLUME dispersion model, in conjunction with a TAPM generated meteorological data file (described in **Section 4.2**), was applied to provide predictions of the ground level concentrations of dust based on the emission estimations provided in **Section 6.2**. Dust sources were modelled as volume sources.

A sample of the AUSPLUME output file is presented in **Appendix B**.

As a conservative measure, the effect of the precipitation rate (rainfall) in reducing dust emissions was not applied.

7 MODELLING RESULTS AND ANALYSIS

This section presents the predicted impacts on air quality that may arise from air pollutants generated by the Project operations, and a brief analysis of the results.

7.1 Dust

Figure 7-1 to **Figure 7-6** present isopleths of the spatial distribution of predicted incremental impacts associated with the operation of the Project over the modelling domain for maximum 24-hour average $PM_{2.5}$ and PM_{10}, annual average PM_{10}, TSP and deposited dust levels.

Figure 7-7 to **Figure 7-9** present isopleths of the spatial distribution of predicted cumulative (total) impacts over the modelling domain for annual average PM_{10}, TSP and deposited dust levels.

The cumulative impact is defined as the modelled impact associated with the operation of the proposed Project combined with the estimated ambient background levels.

Table 7-1 presents the particulate dispersion modelling results at each sensitive receptor shown in **Figure 2-1**.

Table 7-1: Particulate dispersion modelling results for sensitive receptors

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD (g/m²/mth)	PM_{10} (µg/m³)	TSP (µg/m³)	DD (g/m²/mth)
	Incremental impact						Cumulative impact		
	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average	Annual average	Annual average	Annual average
	-	-	-	-	-	2	30	90	4
1	0.2	0.03	1.7	0.2	0.4	0.02	15.9	47.5	2.1
2	0.2	0.03	1.9	0.2	0.4	0.03	15.9	47.5	2.1
3	0.2	0.03	1.7	0.2	0.4	0.03	15.9	47.5	2.1
4	0.5	0.07	3.9	0.6	1.1	0.08	16.3	48.2	2.2
5	0.5	0.07	3.6	0.5	1.1	0.08	16.2	48.2	2.2
6	0.4	0.06	3.0	0.5	0.9	0.07	16.2	48.0	2.2
7	0.2	0.02	1.3	0.2	0.4	0.02	15.9	47.5	2.1
8	0.1	0.02	1.2	0.2	0.3	0.02	15.9	47.4	2.1
9	0.4	0.02	2.4	0.2	0.3	0.02	15.9	47.4	2.1
10	0.7	0.05	4.1	0.4	0.8	0.06	16.1	47.9	2.1
11	0.8	0.07	5.1	0.5	1.1	0.09	16.2	48.2	2.2
12	0.2	0.01	1.3	0.1	0.2	0.01	15.8	47.3	2.1
13	0.3	0.01	1.9	<0.1	0.2	0.02	15.8	47.3	2.1
14	0.4	0.01	2.3	<0.1	0.2	0.02	15.8	47.3	2.1
15	0.5	0.03	3.5	0.2	0.4	0.04	15.9	47.5	2.1
16	0.9	0.03	5.2	0.2	0.4	0.05	15.9	47.5	2.1
17	0.9	0.04	5.6	0.3	0.5	0.07	16.0	47.6	2.2
18	1.4	0.11	8.2	0.8	1.6	0.19	16.5	48.7	2.3
19	0.9	0.10	5.2	0.8	1.4	0.11	16.5	48.5	2.2
20	0.6	0.07	3.8	0.5	1.0	0.08	16.2	48.1	2.2

The dust dispersion modelling results show that the Project would have a minimal impact at nearby assessed sensitive receptors. It is unlikely that the Project would result in any discernible change to existing background air quality levels.

The predicted cumulative PM_{10}, TSP and dust deposition levels based on applying the estimated background levels in **Section 5.3** indicate they would be below the relevant criteria at the assessed sensitive receptor locations.

Figure 7-1: Predicted incremental maximum 24-hour average $PM_{2.5}$ concentrations (µg/m³)

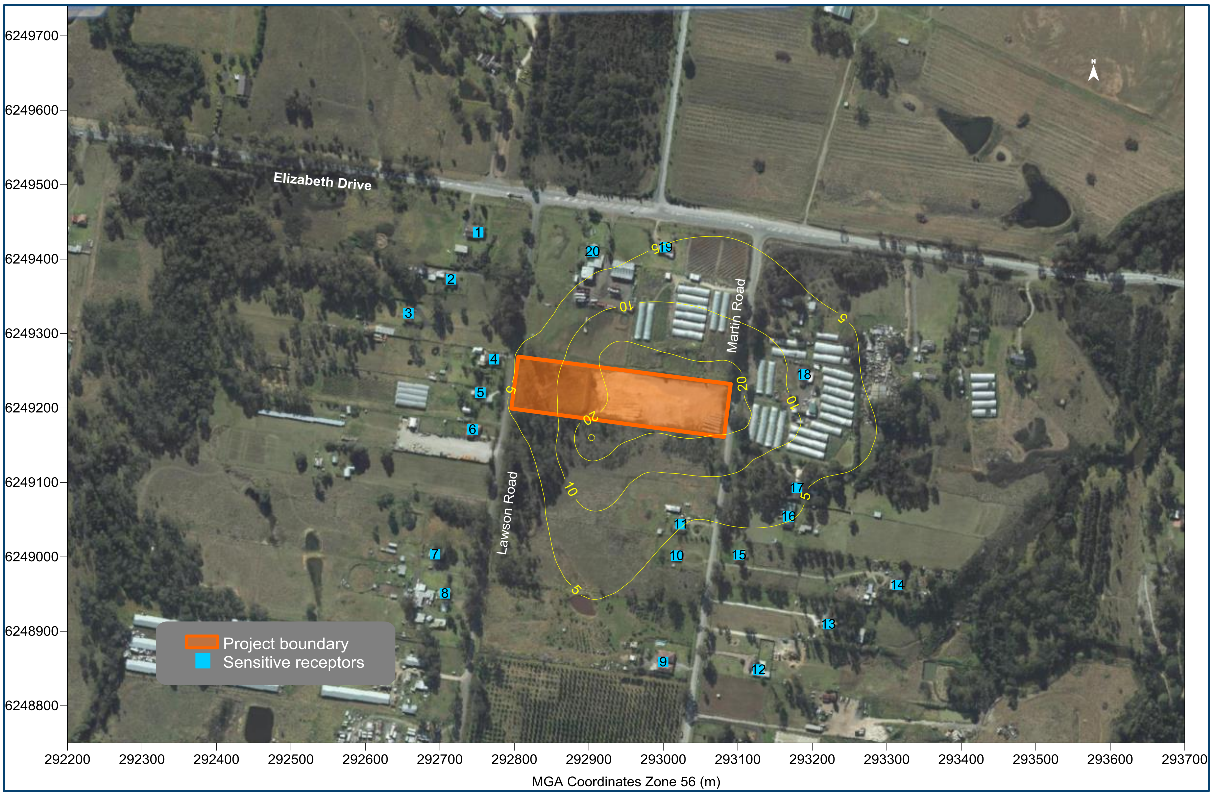

Figure 7-2: Predicted incremental maximum 24-hour average PM_{10} concentrations (µg/m³)

Figure 7-3: Predicted incremental annual average $PM_{2.5}$ concentrations (µg/m³)

Figure 7-4: Predicted incremental annual average PM_{10} concentrations (µg/m³)

Figure 7-5: Predicted incremental annual average TSP concentrations (µg/m³)

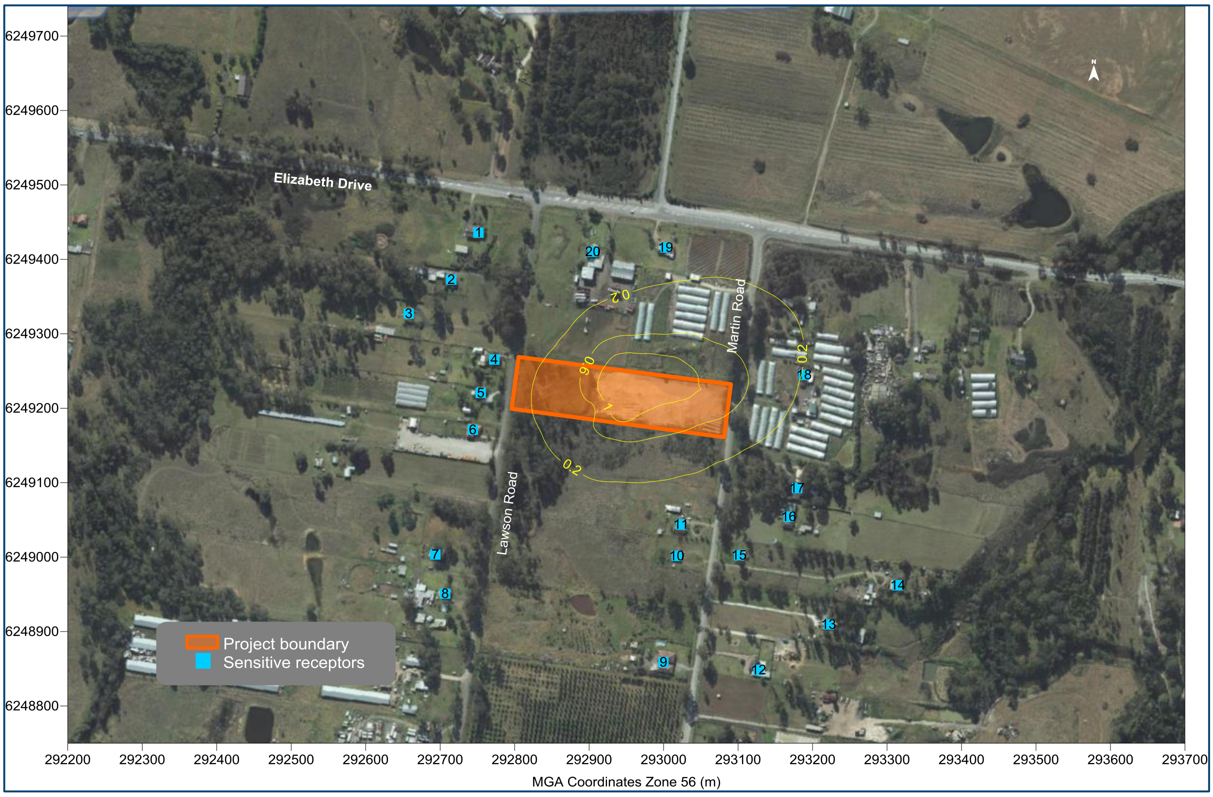

Figure 7-6: Predicted incremental annual average dust deposition levels (g/m²/month)

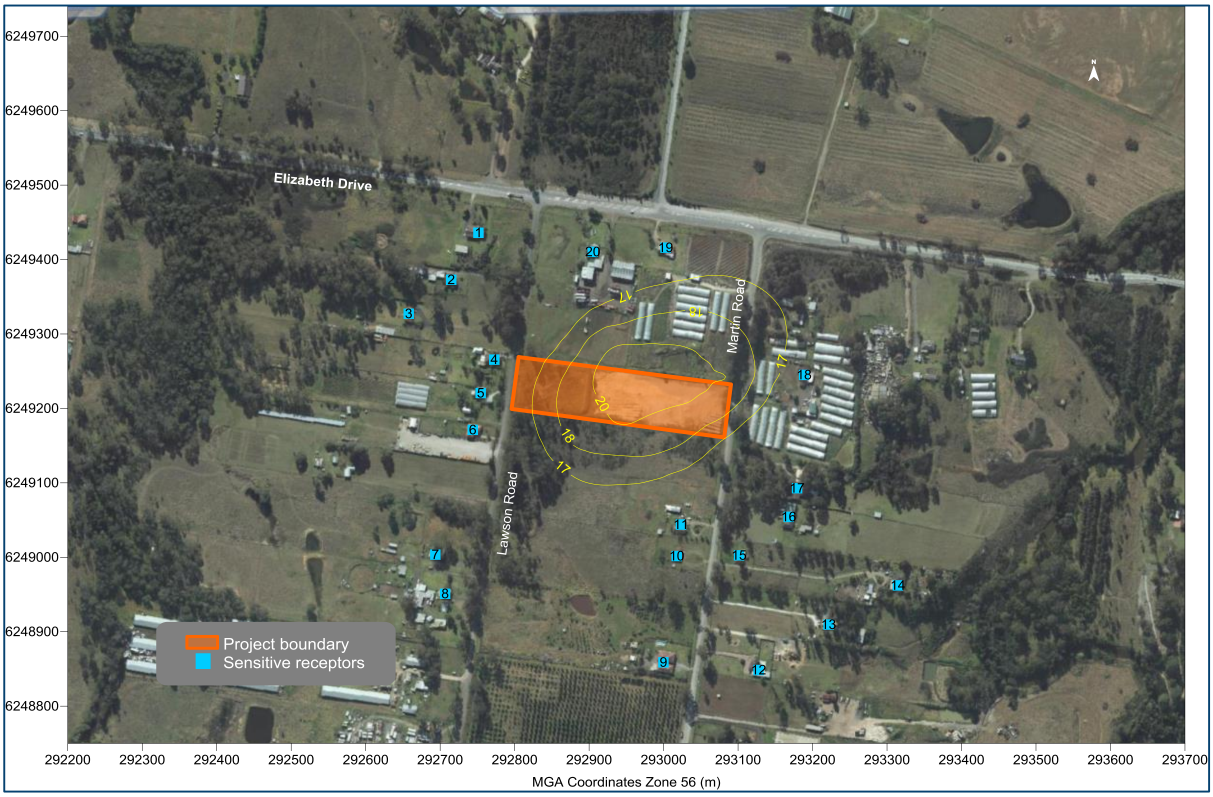

Figure 7-7: Predicted cumulative annual average PM_{10} concentrations (µg/m³)

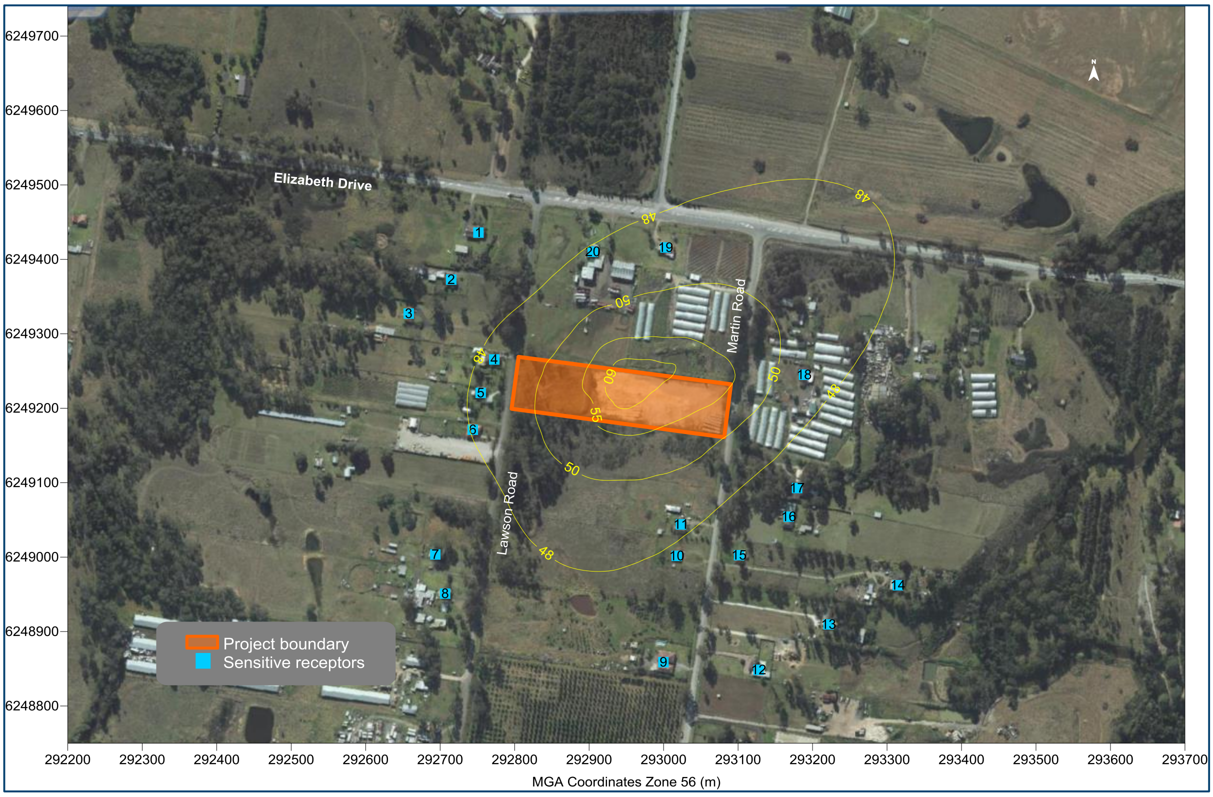

Figure 7-8: Predicted cumulative annual average TSP concentrations (µg/m³)

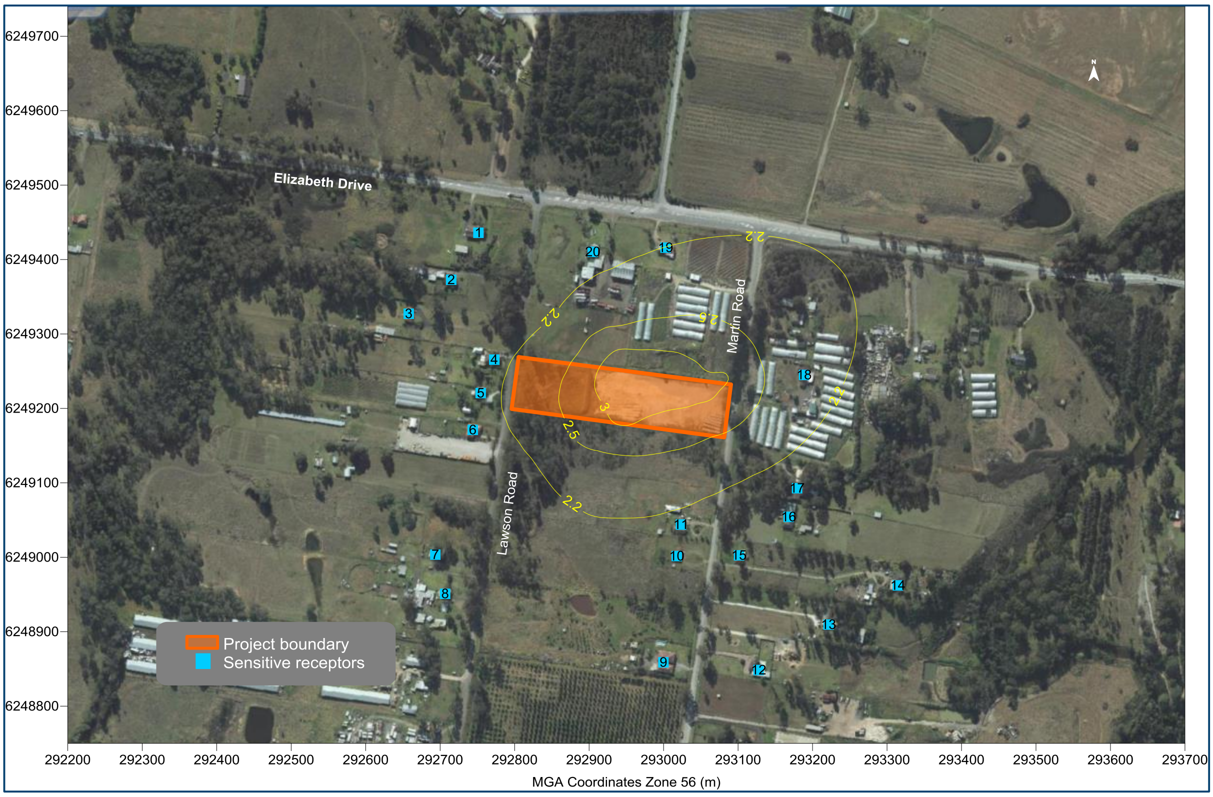

Figure 7-9: Predicted cumulative annual average dust deposition level (g/m²/month)

7.1.1 Assessment of total (cumulative) 24-hour average PM_{10} concentrations

To assessment the potential cumulative 24-hour average PM_{10} impacts for the Project, the NSW EPA assessment method as outlined in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW DEC**, **2005**) was applied to examine the potential maximum total (cumulative) 24-hour average PM_{10} impacts for the proposed Project.

A Level 1 assessment was conducted and involved adding the maximum predicted incremental impact of the Project at the sensitive receptors with the maximum background concentration recorded (40.1 µg/m^3) at the NSW EPA Bringelly monitoring site for the corresponding modelling period. The results of the Level 1 assessment is presented in **Table 7-2** for each of the sensitive receptors. Results indicate that the predicted maximum impact at all sensitive receptors is not likely to exceed the relevant criteria.

Table 7-2: Cumulative 24-hour PM_{10} assessment - Maximum impact

Receptor ID	Predicted concentrations - incremental impact (µg/m^3)	Maximum background concentration (µg/m^3)	Predicted concentrations - maximum impact (µg/m^3)	Impact assessment criteria (µg/m^3)
1	1.7	40.1	41.8	50
2	1.9	40.1	42.0	50
3	1.7	40.1	41.8	50
4	3.9	40.1	44.0	50
5	3.6	40.1	43.7	50
6	3.0	40.1	43.1	50
7	1.3	40.1	41.4	50
8	1.2	40.1	41.3	50
9	2.4	40.1	42.5	50
10	4.1	40.1	44.2	50
11	5.1	40.1	45.2	50
12	1.3	40.1	41.4	50
13	1.9	40.1	42.0	50
14	2.3	40.1	42.4	50
15	3.5	40.1	43.6	50
16	5.2	40.1	45.3	50
17	5.6	40.1	45.7	50
18	8.2	40.1	48.3	50
19	5.2	40.1	45.3	50
20	3.8	40.1	43.9	50

8 MITIGATION MEASURES

The proposed activities at the site will generate dust emissions, therefore it is prudent to take reasonable and practicable measures to prevent and minimise excessive generation of dust emissions to the surrounding environment.

8.1 Dust from operational activities

To ensure that dust generation during operational activities is managed and the potential for off-site impacts is reduced, appropriate operational and physical mitigation measures would be utilised. **Table 8-1** summarises the potential mitigation strategies which may be employed.

Table 8-1: Potential dust mitigation options

Source	Mitigation Measure
General	Activities to be assessed during adverse weather conditions and modified as required (e.g. cease activity where reasonable levels of dust cannot be maintained using the available means)
	Engines of on-site vehicles and plant switched off when not in use
	Vehicles and plant fitted with pollution reduction devices
	Maintain and service vehicles according to manufacturer's specifications
	Haul roads and plant to be sited away from sensitive receivers where possible
Exposed areas and Stockpiles	Minimise area of exposed surfaces
	Water suppression on exposed areas and stockpiles
	Minimise amount of stockpiled material
	Locate stockpiles away from sensitive receivers
	Apply barriers, covering or temporary rehabilitation
	Progressive staging of construction activities
	Rehabilitation of completed sections as soon as practicable
	Keep ancillary vehicles off exposed areas
Material handling	Reduce drop heights from loading and handling equipment
Crushing material	Water suppression
Hauling activities	Watering of haul roads (fixed or mobile)
	Sealing of long term / heavy use roads
	Sealed haul roads to be cleaned regularly
	Restrict vehicle traffic to designated routes, that can be managed by regular watering
	Impose speed limits
	Wheel wash or grids near exit points to minimise mud/ dirt track out
	Street cleaning to remove dirt tracked onto sealed roads
	Covering vehicle loads when transporting material off- site

9 SUMMARY AND CONCLUSIONS

This report has assessed the potential dust impacts associated with the proposed Resource Recovery Facility located at 25 Martin Rd, Badgerys Creek in NSW.

Dispersion modelling with the AUSPLUME model was used to predict the potential for off-site dust impacts in the surrounding area due to the operation of the Project.

It is predicted that emissions of $PM_{2.5}$, PM_{10}, TSP and dust deposition will comply with the applicable assessment criteria at all sensitive receptors and would therefore not lead to any unacceptable level of environmental harm or impact in the surrounding area.

Nevertheless, the site will apply appropriate dust management measures to minimise the potential occurrence of excessive dust emissions from the site.

Overall, the assessment shows that the Project can operate without causing any discernible air quality impact at the sensitive receptors in the surrounding environment.

10 REFERENCES

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Appendix A

Emission Inventory

PROPOSED RESOURCE RECOVERY FACILITY

The dust emissions from the proposed Resource Recovery Facility have been estimated from the operational description of the proposed activities provided by the Proponent and have been combined with emissions factor equations that relate to the quantity of dust emitted from particular activities based on intensity, the prevailing meteorological conditions and composition of the material being handled.

Emission factors and associated controls have been sourced from the US EPA AP42 Emission Factors (**US EPA, 1985 and Updates**) and the State Pollution Control Commission document "*Air Pollution from Coal Mining and Related Developments*" (**SPCC, 1983**).

Table A-1: Emission factor equations

Activity	Emission factor equation	Variable	Control	Source
Loading / emplacing material	EF = k x 0.0016 x [$(U/2.2)^{1.3}$ / $(M/2)^{1.4}$] kg/tonne	K_{TSP} = 0.74 U = wind speed (m/s) M = moisture content (%)	-	US EPA, 1985
Hauling on unsealed surfaces	EF = k x $(s/12)^a$ x $(W/2.72)^b$ lb/VMT	k = 1.38 (kg/VKT) s = surface material silt content (%) W = average weight of vehicle (tonnes) a = 0.7 b = 0.45	75% - watering trafficked areas	US EPA, 1985
Wind erosion	EF = 0.4 kg/ha/hour	-	50% - watering of exposed areas	SPCC, 1983
Crushing	EF = 0.0006 kg/tonne	-	Wet suppression	US EPA, 1985

Table A-2: Emissions Inventory

ACTIVITY	TSP emission (kg/y)	Intensity	Units	Emission Factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units	Variable 4	Units	Variable 5	Units	Variable 6	Units
Hauling to stockpile (concrete, bricks, tiles, etc)	248	30,000	tonnes/year	0.033	kg/t	20	tonnes/load	0.3	km/return trip	2.2	kg/VKT	5.0	% silt c	30	Ave GMV (ton	75	% Control
Emplacing at stockpile	43	30,000	tonnes/year	0.001	kg/t	1.206	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
Loading to crusher	43	30,000	tonnes/year	0.001	kg/t	1.206	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
Crushing material	18	30,000	tonnes/year	0.001	kg/t												Controlled
Unloading crusher to stockpile	43	30,000	tonnes/year	0.001	kg/t	1.206	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
Loading to truck	43	30,000	tonnes/year	0.001	kg/t	1.206	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
Hauling material off-site	248	30,000	tonnes/year	0.033	kg/t	20	tonnes/load	0.3	km/return trip	2.2	kg/VKT	5.0	% silt c	30	Ave GMV (ton	75	% Control
Hauling to stockpile (Demo waste)	248	30,000	tonnes/year	0.033	kg/t	20	tonnes/load	0.3	km/return trip	2.2	kg/VKT	5.0	% silt c	30	Ave GMV (ton	75	% Control
Emplacing at stockpile	43	30,000	tonnes/year	0.001	kg/t	1.206	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
Loading to truck	43	30,000	tonnes/year	0.001	kg/t	1.206	average of (wind speed/2.2)^1.3 in m/s	2	moisture content in %								
Hauling material off-site	248	30,000	tonnes/year	0.033	kg/t	20	tonnes/load	0.3	km/return trip	2.2	kg/VKT	5.0	% silt c	30	Ave GMV (ton	75	% Control
Wind erosion exposed areas	2,435	1.4	ha	0.40	kg/ha/hour	8,760	hours									50	% Control
Total TSP emissions (kg/yr)	**3,702**																

Appendix B

Sample of AUSPLUME output file

```
1                 _____________________________________________

                   AUSPLUME Input File : Dust concentration

                  _____________________________________________

 Concentration or deposition                         Concentration
 Emission rate units                                 grams/second
 Concentration units                                 microgram/m3
 Units conversion factor                             1.00E+06
 Constant background concentration                            0.00E+00
 Terrain effects                                     Egan method
 Plume depletion due to dry removal mechanisms included.
 Smooth stability class changes?                     No
 Other stability class adjustments ("urban modes")   None
 Ignore building wake effects?                       Yes
 Decay coefficient (unless overridden by met. file)  0.000
 Anemometer height                                   10 m
 Roughness height at the wind vane site              0.500 m

                   DISPERSION CURVES
 Horizontal dispersion curves for sources <100m high  Pasquill-Gifford
 Vertical  dispersion  curves for sources <100m high  Pasquill-Gifford
 Horizontal dispersion curves for sources >100m high  Briggs Rural
 Vertical  dispersion  curves for sources >100m high  Briggs Rural
 Enhance horizontal plume spreads for buoyancy?      Yes
 Enhance  vertical  plume spreads for buoyancy?      Yes
 Adjust horizontal P-G formulae for roughness height? Yes
 Adjust  vertical  P-G formulae for roughness height? Yes
 Roughness height                                    0.100m
 Adjustment for wind directional shear               None

                    PLUME RISE OPTIONS
 Gradual plume rise?                                 Yes
 Stack-tip downwash included?                        Yes
 Building downwash algorithm:                       Schulman-Scire method.
 Entrainment coeff. for neutral & stable lapse rates 0.60,0.60
 Partial penetration of elevated inversions?         No
 Disregard temp. gradients in the hourly met. file?  No

 and in the absence of boundary-layer potential temperature gradients
 given by the hourly met. file, a value from the following table
 (in K/m) is used:
```

Wind Speed Category	Stability Class A	B	C	D	E	F
1	0.000	0.000	0.000	0.000	0.020	0.035
2	0.000	0.000	0.000	0.000	0.020	0.035
3	0.000	0.000	0.000	0.000	0.020	0.035
4	0.000	0.000	0.000	0.000	0.020	0.035
5	0.000	0.000	0.000	0.000	0.020	0.035
6	0.000	0.000	0.000	0.000	0.020	0.035

```
 WIND SPEED CATEGORIES
 Boundaries between categories (in m/s) are:  1.54,  3.09,  5.14,  8.23, 10.80

 WIND PROFILE EXPONENTS: "Irwin Rural" values (unless overridden by met. file)

 AVERAGING TIMES
 24 hours
  average over all hours

 _____________________________________________________________________________

                  _____________________________________________

                   AUSPLUME Input File : Dust concentration

                                SOURCE GROUPS

                  _____________________________________________

              Group No.    Members
```

```
 ________________________________________________________________
       1       1       2       3       4       5       6       7
               8       9      10      11      12      13      14

              15      16      17      18      19      20
       2      21      22      23      24      25      26      27
              28      29      30      31      32      33      34

              35      36      37      38      39      40
       3      41      42      43      44      45      46      47
              48      49      50      51      52      53      54

              55      56      57      58      59      60

 _____________________________________________________________________________

1                  ____________________________________________

                     AUSPLUME Input File : Dust concentration

                              SOURCE CHARACTERISTICS

                   ____________________________________________


                     VOLUME SOURCE: 1

   X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
  292900  6249246          62m              2m        10m             2m

                (Constant) emission rate = 1.00E+00 grams/second

          Hourly multiplicative factors will be used with
          this emission factor.

                     Particle  Particle  Particle
                       Mass      Size    Density
                     fraction  (micron)  (g/cm3)
                    _____________________________
                       1.0000      1.0      2.50


                     VOLUME SOURCE: 2

   X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
  292922  6249243          62m              2m        10m             2m

                (Constant) emission rate = 1.00E+00 grams/second

          Hourly multiplicative factors will be used with
          this emission factor.

                     Particle  Particle  Particle
                       Mass      Size    Density
                     fraction  (micron)  (g/cm3)
                    _____________________________
                       1.0000      1.0      2.50


                     VOLUME SOURCE: 3

   X(m)     Y(m)     Ground Elevation    Height   Hor. spread   Vert. spread
  292951  6249239          63m              2m        10m             2m

                (Constant) emission rate = 1.00E+00 grams/second

          Hourly multiplicative factors will be used with
          this emission factor.

                     Particle  Particle  Particle
                       Mass      Size    Density
                     fraction  (micron)  (g/cm3)
                    _____________________________
                       1.0000      1.0      2.50
```

```
                    VOLUME SOURCE: 4

   X(m)      Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 292985   6249234            64m               2m         10m             2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0      2.50


                    VOLUME SOURCE: 5

   X(m)      Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 293024   6249229            64m               2m         10m             2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0      2.50


                    VOLUME SOURCE: 6

   X(m)      Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 293057   6249232            64m               2m         10m             2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0      2.50


                    VOLUME SOURCE: 7

   X(m)      Y(m)      Ground Elevation     Height    Hor. spread    Vert. spread
 292896   6249229            62m               2m         10m             2m

               (Constant) emission rate = 1.00E+00 grams/second

         Hourly multiplicative factors will be used with
         this emission factor.

                    Particle  Particle  Particle
                      Mass      Size    Density
                    fraction  (micron)  (g/cm3)
                   _____________________________
                      1.0000      1.0      2.50

~~~~~
```