Appendix 10

Air Quality Assessment

AIR QUALITY IMPACT ASSESSMENT

PROPOSED MATERIALS RECYCLING YARD AT MOOREBANK

Moorebank Recyclers Pty Ltd

Job No: 3823

22 March 2010

A PEL Company

PROJECT TITLE:	**PROPOSED MATERIALS RECYCLING YARD AT MOOREBANK**
JOB NUMBER:	**3823**
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1 INTRODUCTION

PAEHolmes (formerly Holmes Air Sciences) have been engaged by Moorebank Recyclers Pty Ltd to assess the air quality impacts of a proposed materials recycling yard at Moorebank in Sydney. This report will accompany the Environmental Assessment (EA), prepared by Nexus Environmental Planning.

The assessment is based on the use of a computer-based dispersion model to predict dust concentrations and deposition levels in the vicinity of the proposed operation. To assess the effect that the dust emissions would have on existing air quality, the dispersion model predictions have been compared to relevant air quality criteria.

A conventional approach has been adopted for the assessment which follows the procedures outlined by the NSW Department of Environment, Climate Change and Water (DECCW, formerly DECC) in their document titled "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW"(hereafter referred to as the *Approved Methods*) (**DEC, 2005**). The guidelines specify how assessments based on the use of air dispersion models should be undertaken. They include guidelines for the preparation of meteorological data, emissions data and relevant air quality criteria. The approach taken in this assessment follows as closely as possible the approaches suggested in the *Approved Methods*.

Emissions of dust from the proposed operations are the focus of this assessment.

2 LOCAL SETTING AND PROJECT DESCRIPTION

Moorebank Recyclers propose to develop a concrete and building waste recycling centre on a site at Moorebank. The plant will recycle construction and demolition waste, concrete, brick and bitumen. Surrounding features of the area include New Brighton Golf Course, the South Western Motorway to the south, the Georges River adjacent to the eastern boundary of the site and Benedict Sand and Gravel to the north. To the immediate west of the site resides moderately dense bushland followed by cleared land currently owned by Boral which has been rezoned by Liverpool Council for residential development. **Figure 1** shows the proposed location for the proposed plant as well as the surrounding features of the area.

The closest existing residential areas are at Milperra to the east and at Moorebank to the west. The land owned by Boral to the northwest and west of the site is currently in the early stages of residential development. Three locations around the site have been selected to represent the nearest sensitive receptors. The receptor locations are also shown in **Figure 1**.

Terrain around the site consists of gentle hills, bounding the Georges River (see **Figure 2**). The terrain information has been included in the dispersion modelling.

Operations at the site will involve the receiving of demolition waste by truck, stockpiling of the waste as feedstock, site reduction of feedstock by crushing, stockpiling of the crushed material as road-base and the out-loading of the crushed material by truck. The assessment has been based on the site layout provided on 19th January 2010 as shown in **Figure 3.**

The plant will process up to 500,000 tonnes of building and construction waste per year, consisting predominantly of bricks, concrete and asphalt. On a busy day it is assumed that a maximum of 1,600 tonnes of material could be delivered to and from the site. Material delivery, load-out, and other site activities will occur between the hours of 6am and 6pm Monday to Saturday. The crusher will be operational between the hours of 7:30am and 5:30pm, Monday to Saturday. For modelling purposes, these hours have been extended to be between 7am and 6pm.

Dust emissions will arise predominantly from the following activities:

- Receiving material;
- Material processing;
- Vehicle traffic movements;
- Wind erosion.

3 AIR QUALITY CRITERIA

When assessing any project with a potential for significant air emissions, it is necessary to compare the impacts of the project with relevant air quality criteria. Air quality criteria are used to assess the potential for ambient air quality to give rise to adverse health or nuisance effects.

Table 3.1 and **Table 3.2** summarise the current air quality assessment criteria noted by the DECCW. Generally, the air quality criteria relate to the total burden of dust in the air and not just the dust from the project being assessed. In other words, some consideration of background levels needs to be made when using these criteria to assess impacts. The estimation of appropriate background levels is discussed further in **Section 4.3**.

Table 3.1: DECCW criteria for particulate matter concentrations

Pollutant	Criterion	Averaging Period	Agency
Total suspended particulate matter (TSP)	90 $\mu g/m^3$	Annual mean	National Health & Medical Research Council
Particulate matter < 10 μm (PM_{10})	50 $\mu g/m^3$	24-hour maximum	DECCW
	30 $\mu g/m^3$	Annual mean	DECCW long-term reporting goal

In addition to health impacts, airborne dust also has the potential to cause nuisance impacts by depositing on surfaces. **Table 3.2** shows the maximum acceptable increase in dust deposition over the existing dust levels. The criteria for dust fallout levels are set to protect against nuisance impacts (**DEC, 2005**).

Table 3.2: DECCW criteria for dust fallout

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

4 EXISTING ENVIRONMENT

This section describes the dispersion meteorology, local climatic conditions and existing air quality environment.

4.1 Dispersion Meteorology

The dispersion model used for this assessment, AUSPLUME v6.0, requires information about the dispersion characteristics of the area. In particular, data are required on wind speed, wind direction, atmospheric stability class[a] and mixing height[b].

The DECCW have listed requirements for meteorological data that are used for air dispersion modelling in their *Approved Methods* (**DEC, 2005**). The requirements are as follows:

- Data must span at least one year;
- Data must be at least 90% complete; and
- Data must be representative of the area in which emissions are modelled.

The Bureau of Meteorology (BoM) operate an automatic weather station at Bankstown Airport which is approximately two kilometres (km) to the northeast of the site. Measured parameters include temperature, wind speed, wind direction and sigma-theta (a measure of the fluctuation of wind direction) at hourly intervals and data for 2005 and 2006 have been acquired. Given the close proximity and absence of significant intervening terrain, the data from Bankstown Airport is considered to be representative of conditions experienced at the project site.

In both 2005 and 2006, there were 8,712 hours of meteorological data recovered which represents 99% of each year. For consistency with the available year of dust monitoring data (see **Section 4.3**) the meteorological data for 2005 have been selected for the dispersion modelling.

Figure 4 and **5** show annual and seasonal windroses from the wind data collected at Bankstown Airport. Annually, it can be seen that winds can occur from most directions with winds from the northwest slightly more frequent. There are few winds from the north-northeast. The predominant winds are generally from the southeast in summer and from the northwest in winter. This pattern of winds was common in both 2005 and 2006, although in 2006 there was in increased frequency of winds from the east-northeast. The percentage of calm conditions in the area (that is, when winds are less than or equal to 0.5 m/s) is around 15%.

To use the wind data to assess dispersion, it is necessary to also have available data on atmospheric stability. Two methods for deriving stability have been investigated; using cloud cover information and using sigma-theta data. The method of Turner (**Turner, 1970**) was used to assign a stability class for each hour of the meteorological data using cloud cover information

[a] In dispersion modelling, stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme, as used in this study, there are six stability classes A through to F. Class A relates to unstable conditions such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

[b] The term mixing height refers to the height of the turbulent layer of air near the earth's surface into which ground-level emissions will be rapidly mixed. A plume emitted above the mixed-layer will remain isolated from the ground until such time as the mixed-layer reaches the height of the plume. The height of the mixed-layer is controlled mainly by convection (resulting from solar heating of the ground) and by mechanically generated turbulence as the wind blows over the rough ground.

from Mascot. The hourly sigma-theta data were also used for stability estimates using the method recommended by the US EPA (**US EPA, 1986**). **Table 4.1** shows the frequency of occurrence of the stability categories expected in the area.

The most common stability class in the area is determined to be D class using either the cloud cover or sigma-theta methods for determining stability class. It is under these conditions that dust emissions will disperse rapidly. For meteorological data files to be used in dispersion modelling, the DECCW have indicated a preference for stability to be determined using cloud cover information. Therefore, the Bankstown Airport data for 2005 and with stability determined from cloud cover records were used for the modelling.

Table 4.1 : Frequency of occurrence of stability classes in the study area

Stability Class	Bankstown Airport 2005		Bankstown Airport 2006	
	Stability by cloud cover	Stability by sigma-theta	Stability by cloud cover	Stability by sigma-theta
A	3.5	12.3	3.0	12.7
B	11.6	4.9	11.5	4.6
C	14.7	8.7	13.8	8.6
D	31.2	42.6	33.2	42.4
E	10.0	11.2	8.8	11.3
F	29.0	20.4	29.7	20.3
Total	100	100	100	100

Joint wind speed, wind direction and stability class frequency tables for the Bankstown Airport 2005 data are provided in **Appendix A**.

Mixing height was determined using a scheme defined by **Powell** (**1976**) for day-time conditions and an approach described by **Venkatram**, (**1980**) for night-time conditions. These two methods provide a good estimate of mixing height in the absence of upper air data.

4.2 Local Climatic Conditions

The BoM also records climatic information at Bankstown Airport. A range of climatic information collected from Bankstown Airport are presented in **Table 4.2** (**Bureau of Meteorology, 2010**).

Temperature and humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean, highest and lowest monthly rainfall and the average number of rain days per month.

Table 4.2: Climate information for Bankstown Airport

Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean 9am temperature (deg C)	22.2	21.6	20.2	17.4	13.8	10.7	9.5	11.5	15.1	18.2	19.3	21.4	16.7
Mean 9am relative humidity (%)	72	78	77	76	79	80	78	70	64	62	67	67	72
Mean 9am wind speed (km/h)	8.2	7.3	6.6	6.7	6.6	6.5	6.5	8.9	10.2	10.6	9.7	9.1	8.1
Mean 3pm temperature (deg C)	26.8	26.4	25.0	22.5	19.5	17.0	16.4	18.0	20.2	22.1	23.5	25.9	21.9
Mean 3pm relative humidity (%)	54	57	56	54	55	55	50	44	45	48	52	51	52
Mean 3pm wind speed (km/h)	20.9	19.0	17.6	15.2	12.9	13.5	14.1	17.6	19.9	20.9	21.6	22.6	18.0
Mean maximum temperature (dec C)	28.1	27.7	26.2	23.6	20.4	17.7	17.2	18.9	21.5	23.7	25.2	27.3	23.1
Highest temperature (Degrees C)	44.8	43.3	41.6	36.9	28.5	25.4	26.7	30.2	35.6	39.7	43.1	43.6	44.8
Mean minimum temperature (deg C)	18.1	18.0	16.1	12.7	9.6	6.6	5.1	6.0	8.6	11.8	14.2	16.6	11.9
Lowest temperature (deg C)	10.4	10.0	7.8	2.4	1.3	-1.9	-4	-0.7	0.0	4.4	6.8	6.3	-4
Mean rainfall (mm)	92.1	108.5	97.6	84.7	70.2	73.5	44.6	49.7	44.6	61.9	76.1	67.0	869.6
Highest rainfall (mm)	233.0	439.8	333.7	416.2	237.4	324.8	150.2	388.0	176.4	195.8	213.0	260.7	1397.8
Lowest rainfall (mm)	3.6	9.8	12.7	2.6	2.8	3.0	0.2	0.2	0.6	1.2	8.6	8.4	493.4
Highest daily rainfall (mm)	154	176.6	121.6	156.2	132.0	171.0	116.8	243.0	103.0	107.8	95.0	83.8	243.0
Mean number of days of rain >= 1 mm	8.1	8.2	8.6	6.6	7.2	6.7	5.1	4.6	5.5	6.8	8.1	7.0	82.5

Climate averages for Station: 066137 Bankstown Airport, Commenced: 1968; Last record: 2010. Latitude (deg S): -33.92; Longitude (deg E): 150.99; State: NSW. Source: ***Bureau of Meteorology (2010)*** *website.*

Temperature data show that January is typically the warmest month with a mean maximum of 28.1°C. July is the coldest month with a mean minimum of 5.1°C.

Rainfall data collected at Bankstown Airport show that February is the wettest month with a mean rainfall of 108.5 mm over 8.2 rain days. Annually the area experiences, on average, 869.6 mm of rain.

4.3 Existing Air Quality

The DECCW operate an air quality monitoring station at Rose Street, Liverpool. The site is approximately 5 km to the west of the project site. A Tapered Element Oscillating Microbalance (TEOM) is used at the Liverpool site to continuously measure particulate matter (PM_{10}) concentrations.

Hourly TEOM data is available for 2005, 2006 and 2007 and have been obtained from the DECCW, summarised in **Table 4.3** below. It should be noted that data for 2005 were chosen over 2006 as the DECCW indicated that the dataset was more complete. Data for 2005 were chosen over 2007 to represent a conservative approach for modelling the impact.

Table 4.3 : Summary of DECCW PM_{10} monitoring data for Liverpool

Month	Measured PM_{10} concentrations by TEOM ($\mu g/m^3$)					
	2005		2006		2007	
	Average	Maximum 24-hour average	Average	Maximum 24-hour average	Average	Maximum 24-hour average
Jan	21	46	20	40	25	40
Feb	22	34	24	35	18	25
Mar	16	30	21	34	19	33
Apr	23	36	21	38	21	39
May	23	51	20	49	23	52
Jun	24	55	18	29	13	23
Jul	22	35	18	36	14	35
Aug	23	42	20	28	16	31
Sep	17	36	21	48	19	38
Oct	20	43	25	38	36	44
Nov	18	29	27	72	16	32
Dec	27	49	23	72	17	24
Annual average	**21**	**-**	**22**	**-**	**19**	**-**
Annual maximum	**-**	**55**	**-**	**72**	**-**	**52**

Monitoring from the Liverpool site show that in 2005, the annual average PM_{10} concentration was 21 $\mu g/m^3$ which is below the DECCW's annual average PM_{10} criteria of 30 $\mu g/m^3$. Maximum 24-hour average PM_{10} concentrations have been above the 50 $\mu g/m^3$ criteria on two occasions; 51 $\mu g/m^3$ on the 3rd May 2005 and 56 $\mu g/m^3$ on the 9th June 2005.

There are no measurements of TSP in the study so it has been assumed that 40% of the TSP is PM_{10}. This relationship was derived from monitoring data from areas in the Hunter Valley where co-located TSP and PM_{10} monitors have been operated for reasonably long periods of time (**NSW Minerals Council, 2000**). On this basis, a value of 53 $\mu g/m^3$ for annual average TSP has been derived from the annual average PM_{10} (21 $\mu g/m^3$).

Dust deposition data are not available for the project site, however there is an approximate relationship between annual average TSP concentrations and annual average dust deposition. The relationship suggests that areas experiencing 90 $\mu g/m^3$ annual average TSP also experience annual average dust deposition of approximately 4 g/m^2/month. The annual average TSP concentration of 53 $\mu g/m^3$ would therefore relate to an annual average dust deposition of 2.4 g/m^2/month.

In summary, the following background levels have been estimated to apply at the nearest sensitive residential receptors:

- Annual average TSP of 53 $\mu g/m^3$
- Annual average PM_{10} of 21 $\mu g/m^3$
- Annual average dust deposition of 2.4 g/m^2/month

In addition, the DECCW guidelines require an assessment against 24-hour PM_{10} concentrations. Existing 24-hour average PM_{10} concentrations will vary from day to day. Monitoring of PM_{10} concentrations at most sites in NSW show that 24-hour average concentrations will be close to, or exceed, the 50 $\mu g/m^3$ criterion on occasions. The exceedances are often due to natural events such as bushfires and dust storms. Clearly this adds some complication to the assessment process as some projects with quite small contributions to existing levels may still demonstrate exceedances when the background levels are high.

For this study, 24-hour average PM_{10} concentrations have been assessed by examining model predictions at the nearest sensitive receptors and highlighting any occasions when the project would cause any additional exceedances of the 50 $\mu g/m^3$ criteria. This is discussed further in **Section 7**.

5 ESTIMATED DUST EMISSIONS

Dust emissions will arise from a range of activities at the site. Total dust emissions have been estimated by analysing the activities taking place at the site for operations at 500,000 tonnes per annum and assuming a maximum daily production of 1,600 tonnes.

The operations which apply in each case have been combined with emission factors developed, both locally and by the US EPA, to estimate the amount of dust produced by each activity. There were significant revisions to the US EPA emission factors for dust generating activities in 2003. The emission factors applied are considered to be the most up to date methods for determining dust generation rates.

The operational description for the project has been used to determine material quantities, equipment locations, stockpile locations and areas, activity operating hours and other details that are necessary to estimate dust emissions.

The most significant dust generating activities from the project have been identified and the dust emission estimates are presented below in **Table 5.1**. Details of the calculations of the dust emissions are provided in **Appendix B**.

Table 5.1: Estimated dust emission due to the project

Activity	TSP emissions (kg/year)	
	Emissions for annual average predictions, based on 500,000 tonnes per year	Emissions for maximum 24-hour average predictions, based on 1,600 tonnes per day
Delivery trucks on paved surfaces entering site	12,257	12,238
Delivery trucks on unpaved surfaces entering site	14,286	14,263
Vehicles unloading to tipping zones	1,446	1,444
Excavators working	1,446	1,444
Primary crushing/pulverising	1,520	1,518
Crushing and screening	15,270	15,246
Loading to product stockpiles	1,446	1,444
Loading product to trucks	1,446	1,444
Pickup trucks on unpaved surfaces exiting site	10,000	9,984
Pickup trucks on paved surfaces exiting site	8,580	8,566
Vehicle exhausts	1,029	1,028
Wind erosion from open areas and stockpiles	5,466	5,466
Wind erosion from tipping stockpiles	653	653
TOTAL	**74,846**	**74,736**

The fraction of fine, inhalable and coarse particles for each activity has been taken into account for the dispersion modelling.

6 APPROACH TO ASSESSMENT

The approach taken for the dust assessment was as follows:

- Estimate annual dust emissions;
- Provide emissions and meteorological information to a computer-based dispersion model to predict dust concentrations in the region and at nearest sensitive receptors; and
- Compare predicted concentrations with relevant air quality criteria.

This section is provided so that technical reviewers can appreciate how the modelling of different particle size categories was carried out.

Dust levels due to the proposed road have been predicted using AUSPLUME. AUSPLUME (Version 6.0) is an advanced Gaussian dispersion model developed on behalf of the Victorian EPA (**VEPA, 1986**) and is based on the United States Environmental Protection Agency's Industrial Source Complex (ISC) model. It is widely used throughout Australia and is regarded as a "state-of-the-art" model. AUSPLUME is the model required for use by the DECCW unless project characteristics dictate otherwise (**DEC, 2005**).

The modelling has been based on the use of three particle-size categories (0 to 2.5 μm - referred to as $PM_{2.5}$, 2.5 to 10 μm - referred to as CM (coarse matter) and 10 to 30 μm - referred to as the Rest).

The distribution of particles in each particle size range is as follows (**SPCC, 1983**):

- $PM_{2.5}$ (FP) is 4.7% of the TSP;
- $PM_{2.5\text{-}10}$ (CM) is 34.4% of TSP; and
- $PM_{10\text{-}30}$ (Rest) is 60.9% of TSP.

Modelling was performed using three AUSPLUME source groups with each group corresponding to a particle size category. Each source in the group was assumed to emit at the full TSP emission rate and to deposit from the plume in accordance with the deposition rate appropriate for particles with an aerodynamic diameter equal to the geometric mean of the limits of the particle size range, except for the $PM_{2.5}$ group, which was assumed to have a particle size of 1 μm. The predicted concentrations in the three plot output files for each group were then combined according to the weightings above (see bullet points preceding this paragraph) to determine the concentration of PM_{10} and TSP.

The AUSPLUME model also has the capacity to take into account dust emissions that vary in time, or with meteorological conditions. This has proved particularly useful for simulating emissions for operations where wind speed is an important factor in determining the rate at which dust is generated.

For the current study, the operations were represented by a series of volume sources located according to the positions of the dust sources. **Figure 6** shows the location of the modelled dust sources.

Dust concentrations and deposition rates have been predicted over the area shown in **Figure 1**. Terrain information has been included in the modelling.

The modelling has been performed using the meteorological data discussed in **Section 4.1** and the dust emission estimates from **Section 5**. Emissions have been modelled between the hours of 6am and 6pm, with the exception of crushing and wind erosion sources which have been modelled between 7am and 6pm and 24 hours per day, respectively. Model predictions have been made at 108 discrete receptors, including nearest residential locations. The location of these receptors has been chosen to provide finer resolution closer to the dust sources and nearby receptors. The AUSPLUME model input files can be provided in electronic form on request.

Dust impacts and model predictions using the AUSPLUME model are presented as contour plots in **Figure 7** and are discussed in **Section 7** below.

7 ASSESSMENT OF IMPACTS

7.1 Operational Impacts

Dust concentrations and deposition levels have been presented as isopleth diagrams in **Figure 7** and **Figure** 8, showing the following:

- Predicted maximum 24-hour average PM_{10} concentration;
- Predicted annual average PM_{10} concentration;
- Predicted annual average TSP concentration; and
- Predicted annual average dust deposition.

In examining the maximum 24-hour average contour plot it should be noted that this does not represent the dispersion pattern for any particular day, but shows the highest predicted 24-hour average concentrations that occurred at each location for the worst day in the year. The maxima are used to show concentrations which can possibly be reached under the modelled conditions. It should also be noted that the contour plots show predicted concentrations due only to modelled dust sources.

Table 7.1 shows the dispersion model predictions for the nearest receptors (see **Figure 1**). Results show the project only contribution, the estimated existing levels and the total concentration or deposition rate.

Table 7.1 : Dust model predictions at nearest sensitive receptors

Receptor ID	Due to project	Existing levels (refer Section 4.3)	Total (project contribution + existing)	Criteria
Maximum 24-hour average PM_{10} ($\mu g/m^3$)				
R1	12.8	-	-	50
R2	6.4	-	-	
R3	13.7	-	-	
Annual average PM_{10} ($\mu g/m^3$)				
R1	1.4	21	22.4	30
R2	0.7	21	21.7	
R3	0.4	21	21.4	
Annual average TSP ($\mu g/m^3$)				
R1	2.2	53	55.2	90
R2	1.0	53	54.0	
R3	0.6	53	53.6	
Annual average dust deposition (g/m^2/month)				
R1	0.6	2.4	3.0	4
R2	0.2	2.4	2.6	
R3	0.1	2.4	2.5	

For annual average PM_{10}, TSP and dust deposition, the model results demonstrate that cumulative impacts of the project would be below relevant air quality criteria at the selected receptor locations.

The predicted 24-hour average PM_{10} concentration from the modelled sources is low (13.7 $\mu g/m^3$ at R3). Dust emissions from the project are unlikely to cause exceedances of the 50 $\mu g/m^3$ criteria however the potential 24-hour average PM_{10} impacts have been investigated further by examining the time series of predicted concentrations at each receptor.

Assessment of cumulative 24-hour average PM_{10} air quality impacts is often complicated as there may be many occasions when background concentrations are already above the 24-hour average air quality criteria. For a more refined analysis, the DECCW recommends (**DEC, 2005**) that there should be no additional exceedances of the 50 $\mu g/m^3$ criteria. Contemporaneous hourly PM_{10} monitoring data are required for this assessment and these data are available for Liverpool, to the west of the project site. These data were collected by the DECCW in 2005.

Figure 9 shows a time series of the background 24-hour average PM_{10} as well as the increment from the modelled sources at the three receptor locations. It can be seen from this figure that the measured background levels at Liverpool were above the 50 $\mu g/m^3$ criteria on two days in 2005. The predicted increment from the project at all three receptor locations represents a small fraction of background levels.

Table 7.2 summarises the dispersion model results for 24-hour average PM_{10} concentrations at the selected sensitive receptor locations. The top 10 background levels and predicted PM_{10} increments are shown.

Table 7.2 : Summary of dispersion model results for PM_{10} at sensitive receptors

Date	Background levels ranked			Model predictions ranked			
	Liverpool PM_{10} – Ranked	Increment from project	TOTAL cumulative impact	Date	Liverpool PM_{10}	Increment from project - Ranked	TOTAL cumulative impact
Receptor R1 (μg/m3)							
9/06/2005	55.5	10.0	65.6	21/05/2005	21.9	12.8	34.7
3/05/2005	50.7	0.9	51.6	5/06/2005	30.7	11.1	41.8
24/12/2005	49.5	0.9	50.3	9/06/2005	55.5	10.0	65.6
8/06/2005	47.9	2.4	50.3	12/06/2005	18.7	8.3	27.0
7/06/2005	44.8	5.1	49.9	29/04/2005	33.7	6.3	40.0
13/01/2005	44.5	1.2	45.7	27/06/2005	13.5	6.0	19.5
6/12/2005	44.2	2.2	46.4	24/06/2005	13.2	5.7	18.9
10/06/2005	42.8	2.8	45.5	28/07/2005	21.0	5.5	26.5
4/06/2005	42.7	1.8	44.5	1/07/2005	2.2	5.2	7.4
4/10/2005	42.6	3.6	46.2	7/06/2005	44.8	5.1	49.9
Receptor R2 (μg/m3)							
9/06/2005	55.5	0.5	56.0	9/06/2005	55.5	0.5	56.0
3/05/2005	50.7	0.7	51.4	3/05/2005	50.7	0.7	51.4
24/12/2005	49.5	0.8	50.3	24/12/2005	49.5	0.8	50.3
8/06/2005	47.9	0.4	48.3	8/06/2005	47.9	0.4	48.3
7/06/2005	44.8	0.5	45.3	7/06/2005	44.8	0.5	45.3
13/01/2005	44.5	0.0	44.5	13/01/2005	44.5	0.0	44.5
6/12/2005	44.2	0.3	44.5	6/12/2005	44.2	0.3	44.5
10/06/2005	42.8	3.4	46.1	10/06/2005	42.8	3.4	46.1
4/06/2005	42.7	0.4	43.1	4/06/2005	42.7	0.4	43.1
4/10/2005	42.6	0.0	42.6	4/10/2005	42.6	0.0	42.6
Receptor R3 (μg/m3)							
9/06/2005	55.5	0.8	56.4	5/06/2005	30.7	13.7	44.4
3/05/2005	50.7	0.7	51.3	31/05/2005	28.4	4.1	32.4
24/12/2005	49.5	0.2	49.6	18/10/2005	14.4	4.0	18.3
8/06/2005	47.9	2.7	50.6	1/06/2005	26.3	3.5	29.9
7/06/2005	44.8	0.9	45.7	28/04/2005	29.7	3.3	32.9
13/01/2005	44.5	0.2	44.7	8/06/2005	47.9	2.7	50.6
6/12/2005	44.2	0.3	44.5	12/09/2005	8.6	2.5	11.1
10/06/2005	42.8	1.2	44.0	10/10/2005	14.6	2.1	16.7
4/06/2005	42.7	1.4	44.0	30/07/2005	31.8	2.0	33.8
4/10/2005	42.6	1.0	43.6	6/06/2005	30.1	1.9	32.0

** 0.0 means less than 0.05*

It can be seen from **Table 7.2** that, by this methodology, there are two instances (days) whereby the predicted increment from the project causes the total cumulative impact to be above 50 $\mu g/m^3$. These instances are considered to be insignificant as the background level for the days in question at R1 are 49.5 $\mu g/m^3$ and 47.5 $\mu g/m^3$, respectively, and the predicted contributions are 0.9 $\mu g/m^3$.and 2.4 $\mu g/m^3$. At receptor R3 the background concentration was recorded as 47.9 2.7 $\mu g/m^3$ and the project is predicted to contribute only 2.7 $\mu g/m^3$.

This assessment shows that it is only when the background levels approach 50 $\mu g/m^3$ that there is the potential for the project to cause an exceedance of 50 $\mu g/m^3$ at the selected receptor locations. The probability of maximum impacts coinciding with maximum background levels would be low and on this basis it would be acceptable to say that the project would not be the cause of exceedances of the 50 $\mu g/m^3$ criteria at nearest sensitive receptors.

7.2 Construction Impacts

Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. In practice, it is not possible to realistically quantify impacts using dispersion modelling. To do so would require knowledge of weather conditions for the few weeks that work will be taking place in each location on the site.

Air quality impacts during construction would largely result from dust generated during earthworks and other engineering activities associated with the plant construction. The total amount of dust generated would depend on the silt and moisture content of the soil, the types of operations being carried out, exposed area, frequency of water spraying and speed of machinery. The detailed approach to construction will depend on decisions that will be made by the successful contractor and changes to the construction methods and sequences are expected to take place during the construction phase.

As construction is likely to continue for approximately six months, it is important that exposed areas be stabilised as quickly as possible and that appropriate dust suppression methods be used to keep dust impacts to a minimum. It is desirable that monitoring be carried out during the construction phase of the project to assess compliance with DECCW criteria. Monitoring may include dust deposition gauges, at the closest residences or other sensitive receptors, to assess compliance.

Proper dust management will require the use of water carts, the defining of trafficked areas, the imposition of site vehicle speed limits and constraints on work under extreme unfavourable weather conditions, such as dry wind conditions.

8 DUST MITIGATION MEASURES

From **Section 5**, dust emissions will arise predominantly from trucks travelling on unsealed surfaces. Moorebank Recyclers will be implementing a number of dust mitigation measures at the site. These measures include:

- watering of unsealed trafficked areas using water carts;
- sweeping of sealed trafficked areas;
- watering of stockpiles.

Allowance for watering and sweeping of trafficked areas has been incorporated into the dust emission estimates which are, in turn, reflected in the model predictions. All additional measures will ensure that dust emissions are subject to a high level of control and that the dispersion model results are conservative.

9 CONCLUSIONS

This report has assessed the air quality impacts of a proposed materials recycling yard at Moorebank. Dispersion modelling has been used to predict off-site dust levels due to the activities on the site. Air quality impacts during construction have been discussed qualitatively.

The dust modelling results showed that annual average PM_{10}, TSP and deposition levels at nearest sensitive receptors would be below the DECCW's assessment criteria, even when considering existing levels. The activities could only have the potential to cause exceedances of the DECCW's 24-hour average PM_{10} criterion when background levels are already high.

It is concluded that there would be no adverse air quality impacts arising from the operation of the proposed materials recycling yard.

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APPENDIX A

JOINT WIND SPEED, WIND DIRECTION AND STABILITY CLASS FREQUENCY TABLES

```
STATISTICS FOR FILE:  C:\Jobs\MBankRec\metdata\Bankstown\Banks2005_CC.aus
MONTHS: All
HOURS : All
OPTION: Frequency

                     PASQUILL STABILITY CLASS 'A'

                        Wind Speed Class (m/s)

            0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND        TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR      1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.000000 0.001837 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001837
    NE   0.000115 0.001377 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001492
   ENE   0.000000 0.000689 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000689
     E   0.000459 0.000689 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001148
   ESE   0.000115 0.000574 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000689
    SE   0.000344 0.000803 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001148
   SSE   0.000230 0.000689 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000918
     S   0.000230 0.001033 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001263
   SSW   0.000115 0.001148 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001263
    SW   0.000459 0.000689 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.001148
   WSW   0.000689 0.001377 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.002066
     W   0.000459 0.001837 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.002296
   WNW   0.000689 0.004017 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.004706
    NW   0.000918 0.005854 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.006772
   NNW   0.000115 0.003329 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.003444
     N   0.000459 0.002296 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.002755

  CALM                                                                          0.001148
-----------------------------------------------------------------------------------------
  TOTAL  0.005395 0.028237 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.034780

   MEAN WIND SPEED (m/s) = 2.04
  NUMBER OF OBSERVATIONS = 303


                     PASQUILL STABILITY CLASS 'B'

                        Wind Speed Class (m/s)

            0.50     1.50     3.00     4.50     6.00     7.50     9.00  GREATER
 WIND        TO       TO       TO       TO       TO       TO       TO     THAN
SECTOR      1.50     3.00     4.50     6.00     7.50     9.00    10.50    10.50    TOTAL
-----------------------------------------------------------------------------------------

   NNE   0.001148 0.001148 0.004706 0.000000 0.000000 0.000000 0.000000 0.000000 0.007002
    NE   0.000115 0.000459 0.002066 0.000000 0.000000 0.000000 0.000000 0.000000 0.002640
   ENE   0.000344 0.001492 0.001377 0.000115 0.000000 0.000000 0.000000 0.000000 0.003329
     E   0.000115 0.001263 0.001263 0.000000 0.000000 0.000000 0.000000 0.000000 0.002640
   ESE   0.000230 0.001148 0.001722 0.000115 0.000000 0.000000 0.000000 0.000000 0.003214
    SE   0.000344 0.000459 0.002296 0.000344 0.000000 0.000000 0.000000 0.000000 0.003444
   SSE   0.001148 0.001033 0.001607 0.000000 0.000000 0.000000 0.000000 0.000000 0.003788
     S   0.000574 0.001263 0.000803 0.000000 0.000000 0.000000 0.000000 0.000000 0.002640
   SSW   0.001607 0.000574 0.000918 0.000230 0.000000 0.000000 0.000000 0.000000 0.003329
    SW   0.001492 0.002066 0.002755 0.000115 0.000000 0.000000 0.000000 0.000000 0.006428
   WSW   0.002525 0.002640 0.002640 0.000115 0.000000 0.000000 0.000000 0.000000 0.007920
     W   0.002410 0.003558 0.003903 0.000115 0.000000 0.000000 0.000000 0.000000 0.009986
   WNW   0.002410 0.008264 0.004017 0.000115 0.000000 0.000000 0.000000 0.000000 0.014807
    NW   0.003444 0.008609 0.005510 0.000459 0.000000 0.000000 0.000000 0.000000 0.018021
   NNW   0.002525 0.002984 0.004362 0.000344 0.000000 0.000000 0.000000 0.000000 0.010216
     N   0.000574 0.002181 0.005510 0.000230 0.000000 0.000000 0.000000 0.000000 0.008494

  CALM                                                                          0.008150
-----------------------------------------------------------------------------------------
  TOTAL  0.021006 0.039141 0.045455 0.002296 0.000000 0.000000 0.000000 0.000000 0.116047

   MEAN WIND SPEED (m/s) = 2.46
  NUMBER OF OBSERVATIONS = 1011
```

PASQUILL STABILITY CLASS 'C'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000344	0.000803	0.001492	0.000000	0.000000	0.000000	0.000000	0.000000	0.002640
NE	0.000344	0.000459	0.001722	0.001263	0.000000	0.000000	0.000000	0.000000	0.003788
ENE	0.000230	0.000115	0.002755	0.004247	0.000115	0.000000	0.000000	0.000000	0.007461
E	0.000000	0.000344	0.001492	0.002525	0.000000	0.000000	0.000000	0.000000	0.004362
ESE	0.000000	0.000344	0.002870	0.006084	0.000344	0.000000	0.000000	0.000000	0.009642
SE	0.000230	0.000230	0.003214	0.004706	0.001263	0.000344	0.000000	0.000000	0.009986
SSE	0.000459	0.000574	0.000689	0.003214	0.000918	0.000459	0.000000	0.000000	0.006313
S	0.001033	0.001033	0.002181	0.002296	0.000803	0.000115	0.000000	0.000000	0.007461
SSW	0.000918	0.000689	0.001492	0.001377	0.000000	0.000000	0.000000	0.000000	0.004477
SW	0.001492	0.002066	0.002181	0.003099	0.000803	0.000000	0.000000	0.000000	0.009642
WSW	0.001837	0.002410	0.004247	0.002181	0.001148	0.000574	0.000344	0.000000	0.012741
W	0.001492	0.001607	0.001377	0.002525	0.001837	0.001148	0.000689	0.000000	0.010675
WNW	0.001607	0.004017	0.001377	0.002066	0.001377	0.000803	0.000344	0.000000	0.011593
NW	0.002525	0.005051	0.002525	0.002181	0.000344	0.000115	0.000000	0.000000	0.012741
NNW	0.003214	0.002296	0.002410	0.002181	0.001033	0.000115	0.000000	0.000000	0.011249
N	0.000918	0.001033	0.002984	0.001492	0.000574	0.000000	0.000000	0.000000	0.007002
CALM									0.015037
TOTAL	0.016644	0.023072	0.035009	0.041437	0.010560	0.003673	0.001377	0.000000	0.146809

MEAN WIND SPEED (m/s) = 3.72
NUMBER OF OBSERVATIONS = 1279

PASQUILL STABILITY CLASS 'D'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000803	0.001377	0.003673	0.000803	0.000459	0.000115	0.000000	0.000000	0.007231
NE	0.000344	0.001263	0.005854	0.006543	0.003444	0.000115	0.000000	0.000000	0.017562
ENE	0.000000	0.001148	0.004936	0.009986	0.008264	0.000689	0.000000	0.000000	0.025023
E	0.000689	0.000230	0.004017	0.007231	0.004821	0.000115	0.000000	0.000000	0.017103
ESE	0.000000	0.000689	0.006428	0.008150	0.011249	0.001951	0.000000	0.000000	0.028466
SE	0.000000	0.000344	0.005510	0.011823	0.013889	0.005739	0.000803	0.000459	0.038567
SSE	0.000115	0.001033	0.006313	0.008494	0.012397	0.002870	0.000918	0.000230	0.032369
S	0.000459	0.001951	0.005854	0.006313	0.006887	0.001492	0.000803	0.000574	0.024334
SSW	0.001033	0.002755	0.004591	0.001951	0.003099	0.001377	0.000689	0.000115	0.015611
SW	0.000803	0.002640	0.005969	0.001837	0.000689	0.000689	0.000459	0.000115	0.013200
WSW	0.000689	0.002525	0.004247	0.002640	0.002410	0.001722	0.000115	0.000115	0.014463
W	0.000689	0.002181	0.001607	0.001951	0.005854	0.002066	0.001263	0.000344	0.015955
WNW	0.001033	0.002181	0.001607	0.001837	0.003903	0.003558	0.000918	0.000918	0.015955
NW	0.000803	0.002870	0.001377	0.001837	0.003903	0.001148	0.000574	0.000000	0.012511
NNW	0.001492	0.004247	0.002755	0.002640	0.003444	0.000918	0.000230	0.000115	0.015840
N	0.000689	0.002066	0.004477	0.003329	0.002984	0.000230	0.000115	0.000000	0.013889
CALM									0.004247
TOTAL	0.009642	0.029500	0.069215	0.077365	0.087695	0.024793	0.006887	0.002984	0.312328

MEAN WIND SPEED (m/s) = 5.27
NUMBER OF OBSERVATIONS = 2721

PASQUILL STABILITY CLASS 'E'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.000000	0.002181	0.001377	0.000000	0.000000	0.000000	0.000000	0.000000	0.003558
NE	0.000000	0.002066	0.005969	0.001377	0.000000	0.000000	0.000000	0.000000	0.009412
ENE	0.000000	0.002525	0.003099	0.000459	0.000000	0.000000	0.000000	0.000000	0.006084
E	0.000000	0.001033	0.001607	0.000115	0.000000	0.000000	0.000000	0.000000	0.002755
ESE	0.000000	0.001722	0.002640	0.000803	0.000000	0.000000	0.000000	0.000000	0.005165
SE	0.000000	0.001722	0.003214	0.000459	0.000000	0.000000	0.000000	0.000000	0.005395
SSE	0.000000	0.002181	0.002296	0.000689	0.000000	0.000000	0.000000	0.000000	0.005165
S	0.000000	0.003214	0.002984	0.000344	0.000000	0.000000	0.000000	0.000000	0.006543
SSW	0.000000	0.003444	0.001951	0.000000	0.000000	0.000000	0.000000	0.000000	0.005395
SW	0.000000	0.007117	0.002640	0.000115	0.000000	0.000000	0.000000	0.000000	0.009871
WSW	0.000000	0.004706	0.004591	0.000918	0.000000	0.000000	0.000000	0.000000	0.010216
W	0.000000	0.002525	0.002640	0.001722	0.000000	0.000000	0.000000	0.000000	0.006887
WNW	0.000000	0.001722	0.002870	0.000574	0.000000	0.000000	0.000000	0.000000	0.005165
NW	0.000000	0.002066	0.002755	0.001033	0.000000	0.000000	0.000000	0.000000	0.005854
NNW	0.000000	0.002755	0.003099	0.001263	0.000000	0.000000	0.000000	0.000000	0.007117
N	0.000000	0.001722	0.002870	0.000689	0.000000	0.000000	0.000000	0.000000	0.005280
CALM									0.000000
TOTAL	0.000000	0.042700	0.046602	0.010560	0.000000	0.000000	0.000000	0.000000	0.099862

MEAN WIND SPEED (m/s) = 3.22
NUMBER OF OBSERVATIONS = 870

PASQUILL STABILITY CLASS 'F'

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.002984	0.001837	0.001033	0.000000	0.000000	0.000000	0.000000	0.000000	0.005854
NE	0.002296	0.003558	0.002640	0.000000	0.000000	0.000000	0.000000	0.000000	0.008494
ENE	0.002181	0.004362	0.000459	0.000000	0.000000	0.000000	0.000000	0.000000	0.007002
E	0.003099	0.002640	0.000689	0.000000	0.000000	0.000000	0.000000	0.000000	0.006428
ESE	0.002410	0.003444	0.000803	0.000000	0.000000	0.000000	0.000000	0.000000	0.006657
SE	0.002066	0.002410	0.000918	0.000000	0.000000	0.000000	0.000000	0.000000	0.005395
SSE	0.002640	0.002181	0.000574	0.000000	0.000000	0.000000	0.000000	0.000000	0.005395
S	0.004247	0.001837	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.006428
SSW	0.005395	0.001837	0.000230	0.000000	0.000000	0.000000	0.000000	0.000000	0.007461
SW	0.007461	0.004247	0.001148	0.000000	0.000000	0.000000	0.000000	0.000000	0.012856
WSW	0.006887	0.003099	0.001148	0.000000	0.000000	0.000000	0.000000	0.000000	0.011134
W	0.007805	0.004591	0.000344	0.000000	0.000000	0.000000	0.000000	0.000000	0.012741
WNW	0.007576	0.004591	0.001148	0.000000	0.000000	0.000000	0.000000	0.000000	0.013315
NW	0.009068	0.006657	0.002525	0.000000	0.000000	0.000000	0.000000	0.000000	0.018251
NNW	0.012626	0.011478	0.002525	0.000000	0.000000	0.000000	0.000000	0.000000	0.026630
N	0.006084	0.003329	0.000918	0.000000	0.000000	0.000000	0.000000	0.000000	0.010331
CALM									0.125803
TOTAL	0.084826	0.062098	0.017447	0.000000	0.000000	0.000000	0.000000	0.000000	0.290174

MEAN WIND SPEED (m/s) = 1.13
NUMBER OF OBSERVATIONS = 2528

ALL PASQUILL STABILITY CLASSES

Wind Speed Class (m/s)

WIND SECTOR	0.50 TO 1.50	1.50 TO 3.00	3.00 TO 4.50	4.50 TO 6.00	6.00 TO 7.50	7.50 TO 9.00	9.00 TO 10.50	GREATER THAN 10.50	TOTAL
NNE	0.005280	0.009183	0.012282	0.000803	0.000459	0.000115	0.000000	0.000000	0.028122
NE	0.003214	0.009183	0.018251	0.009183	0.003444	0.000115	0.000000	0.000000	0.043388
ENE	0.002755	0.010331	0.012626	0.014807	0.008379	0.000689	0.000000	0.000000	0.049587
E	0.004362	0.006198	0.009068	0.009871	0.004821	0.000115	0.000000	0.000000	0.034435
ESE	0.002755	0.007920	0.014463	0.015152	0.011593	0.001951	0.000000	0.000000	0.053834
SE	0.002984	0.005969	0.015152	0.017332	0.015152	0.006084	0.000803	0.000459	0.063935
SSE	0.004591	0.007691	0.011478	0.012397	0.013315	0.003329	0.000918	0.000230	0.053949
S	0.006543	0.010331	0.012167	0.008953	0.007691	0.001607	0.000803	0.000574	0.048669
SSW	0.009068	0.010445	0.009183	0.003558	0.003099	0.001377	0.000689	0.000115	0.037534
SW	0.011708	0.018825	0.014692	0.005165	0.001492	0.000689	0.000459	0.000115	0.053145
WSW	0.012626	0.016758	0.016873	0.005854	0.003558	0.002296	0.000459	0.000115	0.058540
W	0.012856	0.016299	0.009871	0.006313	0.007691	0.003214	0.001951	0.000344	0.058540
WNW	0.013315	0.024793	0.011019	0.004591	0.005280	0.004362	0.001263	0.000918	0.065542
NW	0.016758	0.031107	0.014692	0.005510	0.004247	0.001263	0.000574	0.000000	0.074151
NNW	0.019972	0.027089	0.015152	0.006428	0.004477	0.001033	0.000230	0.000115	0.074495
N	0.008724	0.012626	0.016758	0.005739	0.003558	0.000230	0.000115	0.000000	0.047750
CALM									0.154385
TOTAL	0.137511	0.224747	0.213728	0.131657	0.098255	0.028466	0.008264	0.002984	1.000000

MEAN WIND SPEED (m/s) = 3.20
NUMBER OF OBSERVATIONS = 8712

FREQUENCY OF OCCURENCE OF STABILITY CLASSES

A : 3.5%
B : 11.6%
C : 14.7%
D : 31.2%
E : 10.0%
F : 29.0%

STABILITY CLASS BY HOUR OF DAY

Hour	A	B	C	D	E	F
01	0000	0000	0000	0058	0063	0242
02	0000	0000	0000	0058	0061	0244
03	0000	0000	0000	0065	0052	0246
04	0000	0000	0000	0056	0058	0249
05	0000	0000	0032	0069	0039	0223
06	0000	0015	0101	0088	0028	0131
07	0000	0055	0151	0111	0007	0039
08	0005	0134	0129	0095	0000	0000
09	0017	0129	0139	0078	0000	0000
10	0048	0145	0102	0068	0000	0000
11	0067	0132	0100	0064	0000	0000
12	0062	0124	0102	0075	0000	0000
13	0050	0103	0116	0094	0000	0000
14	0042	0071	0103	0147	0000	0000
15	0012	0058	0085	0208	0000	0000
16	0000	0038	0072	0253	0000	0000
17	0000	0007	0038	0285	0019	0014
18	0000	0000	0001	0243	0064	0055
19	0000	0000	0008	0177	0081	0097

```
  20 0000 0000 0000 0119 0102 0142
  21 0000 0000 0000 0093 0082 0188
  22 0000 0000 0000 0076 0082 0205
  23 0000 0000 0000 0072 0071 0220
  24 0000 0000 0000 0069 0061 0233


--------------------------------
STABILITY CLASS BY MIXING HEIGHT
--------------------------------
Mixing height     A    B    C    D    E    F
    <=500 m     0007 0228 0465 0400 0870 2528
   <=1000 m     0222 0497 0445 0398 0000 0000
   <=1500 m     0074 0286 0369 1485 0000 0000
   <=2000 m     0000 0000 0000 0251 0000 0000
   <=3000 m     0000 0000 0000 0180 0000 0000
    >3000 m     0000 0000 0000 0007 0000 0000

----------------------------
MIXING HEIGHT BY HOUR OF DAY
----------------------------
       0000  0100  0200  0400  0800  1600  Greater
        to    to    to    to    to    to   than
Hour   0100  0200  0400  0800  1600  3200  3200
  01   0216  0060  0036  0005  0029  0017  0000
  02   0213  0069  0031  0004  0029  0017  0000
  03   0219  0065  0020  0007  0033  0018  0001
  04   0226  0057  0031  0004  0023  0021  0001
  05   0258  0043  0021  0005  0020  0016  0000
  06   0167  0112  0070  0001  0005  0008  0000
  07   0112  0065  0112  0070  0001  0003  0000
  08   0000  0081  0116  0166  0000  0000  0000
  09   0000  0000  0108  0177  0078  0000  0000
  10   0000  0000  0000  0237  0126  0000  0000
  11   0000  0000  0000  0141  0222  0000  0000
  12   0000  0000  0000  0092  0271  0000  0000
  13   0000  0000  0000  0029  0334  0000  0000
  14   0000  0000  0000  0000  0363  0000  0000
  15   0000  0000  0000  0000  0363  0000  0000
  16   0000  0000  0000  0000  0363  0000  0000
  17   0009  0011  0015  0000  0316  0012  0000
  18   0021  0047  0053  0002  0204  0036  0000
  19   0061  0056  0065  0001  0120  0060  0000
  20   0098  0073  0077  0004  0056  0055  0000
  21   0132  0092  0048  0006  0047  0038  0000
  22   0175  0069  0047  0004  0040  0028  0000
  23   0191  0070  0035  0008  0034  0025  0000
  24   0202  0066  0034  0004  0031  0026  0000
```

Statistics for Bankstown Airport meteorological 2005 data file with stability determined by the method of **Turner (1970)**.

APPENDIX B

DUST EMISSION CALCULATIONS

ESTIMATED DUST EMISSIONS : MOOREBANK RECYCLERS, MOOREBANK

The dust emission inventory has been formulated from the operational description provided by Moorebank Recyclers. Estimated emissions are presented for all significant dust generating activities associated with the operations. The relevant emission factors used for the study are described below.

Hauling material / product on unsealed surfaces
After the application of water to the internal haul roads the emission factor used for trucks hauling material on unsealed surfaces was taken to be 1.0 kg per vehicle kilometre travelled (kg/VKT).

Hauling material / product on sealed surfaces
After the use of street sweepers and implementation of a wheel wash at the exit the emission factor used for trucks hauling material on sealed surfaces was taken to be 0.2 kg per vehicle kilometre travelled (kg/VKT).

Vehicle exhausts
Emissions from heavy diesel vehicle exhausts can be estimated using the **US EPA (1985)** emission factor of 0.7 g/brake-horsepower hour (g/hp-h). Assume that the average power level of each truck on site 100 hp. This includes slowly manoeuvring on site and idling. Also assume that each truck spends 15 minutes on site.

Loading/unloading material. Also used for excavators loading.
Each tonne of material loaded will generate a quantity of TSP that will depend on the wind speed and the moisture content. Equation 1 shows the relationship between these variables.

Equation 1

$$E_{TSP} = k \times 0.0016 \times \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right) \qquad kg/t$$

where,
$E_{TSP} = TSP\ emissions$
$k = 0.74$
$U = wind\ speed (m/s)$
$M = moisture\ content (\%)$
$[where\ 0.25 \le M \le 4.8]$

Primary crushing of material – that is, pulverising
The emission factor used for primary crushing of material has been taken to be 0.0152 kg/t (**US EPA, 1985 and updates**).

Crushing and screening of material

The emission factor used for crushing of material (secondary) has been taken to be 0.1527 kg/t (**US EPA, 1985 and updates**). It has been assumed that there would be a reduction to TSP emissions from the use of enclosures. The reduction uses the same relationship between the controlled and uncontrolled US EPA emission factors (that is, 90%).

Wind erosion

The emission factor for wind erosion was assumed to be 0.4 kg/ha/h as per **SPCC (1983)**.

Emissions inventory: Moorebank Recyclers, Moorebank

ACTIVITY (for annual predictions)	TSP (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units
Delivery trucks on paved surfaces entering site	**12,257**	500,000	t/y	0.02451	kg/t	14	t/truck load	1.716	0.2	kg/VKT	0.2
Delivery trucks on unpaved surfaces entering site	**14,286**	500,000	t/y	0.02857	kg/t	14	t/truck load	0.4	1.0	kg/VKT	1.0
Vehicles unloading to tipping zones	**1,446**	500,000	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2			
Excavators working	**1,446**	500,000	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2			
Primary crushing/pulverising	**1,520**	50,000	t/y	0.01520	kg/t	0	%reduction	2			
Crushing and screening	**15,270**	500,000	t/y	0.15270	kg/t	90	%reduction	2			
Loading to product stockpiles	**1,446**	500,000	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2			
Loading product to trucks	**1,446**	500,000	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2			
Pickup trucks on unpaved surfaces exiting site	**10,000**	500,000	t/y	0.02000	kg/t	20	t/truck load	0.4	1.0	kg/VKT	1.0
Pickup trucks on paved surfaces exiting site	**8,580**	500,000	t/y	0.01716	kg/t	20	t/truck load	1.716	0.2	kg/VKT	0.2
Vehicle exhausts	**1,029**	58,824	trucks/y	0.0007	kg/hp-h	0.25	h/truck	100			
Wind erosion from open areas and stockpiles	**5,466**	3.12	ha	0.4	kg/ha/h	8760	h/d	50			
Wind erosion from tipping stockpiles	**653**	0.37	ha	0.4	kg/ha/h	8760	h/d	50			
TOTAL	**74,846**										

ACTIVITY (for max daily predictions)	TSP (kg/y)	Intensity	Units	Emission factor	Units	Variable 1	Units	Variable 2	Units	Variable 3	Units
Delivery trucks on paved surfaces entering site	**12,238**	499,200	t/y	0.02451	kg/t	14	t/truck load	1.716	km/return trip	0.2	kg/VKT
Delivery trucks on unpaved surfaces entering site	**14,263**	499,200	t/y	0.02857	kg/t	14	t/truck load	0.4	km/return trip	1.0	kg/VKT
Vehicles unloading to tipping zones	**1,444**	499,200	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2	moisture content (%)		
Excavators working	**1,444**	499,200	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2	moisture content (%)		
Primary crushing/pulverising	**1,518**	49,920	t/y	0.01520	kg/t	0	%reduction	2	Number of stages		
Crushing and screening	**15,246**	499,200	t/y	0.15270	kg/t	90	%reduction	2	Number of stages		
Loading to product stockpiles	**1,444**	499,200	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2	moisture content (%)		
Loading product to trucks	**1,444**	499,200	t/y	0.00289	kg/t	2.44	average of (wind speed/2.2)^1.3 in m/s	2	moisture content (%)		
Pickup trucks on unpaved surfaces exiting site	**9,984**	499,200	t/y	0.02000	kg/t	20	t/truck load	0.4	km/return trip	1.0	kg/VKT
Pickup trucks on paved surfaces exiting site	**8,566**	499,200	t/y	0.01716	kg/t	20	t/truck load	1.716	km/return trip	0.2	kg/VKT
Vehicle exhausts	**1,028**	58,729	trucks/y	0.0007	kg/hp-h	0.25	h/truck	100	hp		
Wind erosion from open areas and stockpiles	**5,466**	3.12	ha	0.4	kg/ha/h	8760	h/y	50	% control using water spray		
Wind erosion from tipping stockpiles	**653**	0.37	ha	0.4	kg/ha/h	8760	h/y	50	% control using water spray		
TOTAL	**74,736**										

A summary of dust emission estimates for each activity, activity type, location of emission sources and activity hours are provided below. The location of the sources can be obtained from **Figure 6**.

```
-------------------------------    10-Mar-2010 10:01
 DUST EMISSION CALCULATIONS V2
 -------------------------------

 Output emissions file  : C:\Jobs\3823_Conc_Moorebank\Met\Mbank_1d.src
 Meteorological file    : C:\Jobs\3823_Conc_Moorebank\Met\Banks2005_CC.aus
 Number of dust sources : 26
 Number of activities   : 13
 No-blast conditions    : None
 Wind sensitive factor  : 1.788 (2.443 adjusted for activity hours)
 Wind erosion factor    : 91.172

  -----ACTIVITY SUMMARY-----
 ACTIVITY NAME : Delivery trucks on paved surfaces entering site
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 12238 kg/y
 FROM SOURCES  : 7
1 2 3 4 5 6 7
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Delivery trucks on unpaved surfaces entering site
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 14263 kg/y
 FROM SOURCES  : 9
8 12 13 16 18 19 24 25 26
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Vehicles unloading to tipping zones
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1444 kg/y
 FROM SOURCES  : 2
16 18
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Excavators working
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1444 kg/y
 FROM SOURCES  : 4
15 16 17 18
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Primary crushing/pulverising
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 1518 kg/y
 FROM SOURCES  : 2
20 21
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Crushing and screening
 ACTIVITY TYPE : Wind insensitive
 DUST EMISSION : 15246 kg/y
 FROM SOURCES  : 2
22 23
 HOURS OF DAY  :
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Loading to product stockpiles
 ACTIVITY TYPE : Wind sensitive
 DUST EMISSION : 1444 kg/y
 FROM SOURCES  : 3
24 25 26
 HOURS OF DAY  :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

 ACTIVITY NAME : Loading product to trucks
```

ACTIVITY TYPE : Wind sensitive
DUST EMISSION : 1444 kg/y
FROM SOURCES : 3
24 25 26
HOURS OF DAY :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

ACTIVITY NAME : Pickup trucks on unpaved surfaces exiting site
ACTIVITY TYPE : Wind insensitive
DUST EMISSION : 9984 kg/y
FROM SOURCES : 9
8 12 13 16 18 19 24 25 26
HOURS OF DAY :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

ACTIVITY NAME : Pickup trucks on paved surfaces exiting site
ACTIVITY TYPE : Wind insensitive
DUST EMISSION : 8566 kg/y
FROM SOURCES : 7
1 2 3 4 5 6 7
HOURS OF DAY :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

ACTIVITY NAME : Vehicle exhausts
ACTIVITY TYPE : Wind insensitive
DUST EMISSION : 1028 kg/y
FROM SOURCES : 16
1 2 3 4 5 6 7 8 12 13 16 18 19 24 25 26
HOURS OF DAY :
0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0

ACTIVITY NAME : Wind erosion from open areas and stockpiles
ACTIVITY TYPE : Wind erosion
DUST EMISSION : 5466 kg/y
FROM SOURCES : 17
8 9 10 11 12 13 14 16 18 19 20 21 22 23 24 25 26
HOURS OF DAY :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

ACTIVITY NAME : Wind erosion from tipping stockpiles
ACTIVITY TYPE : Wind erosion
DUST EMISSION : 653 kg/y
FROM SOURCES : 2
15 17
HOURS OF DAY :
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

APPENDIX C

FIGURES

Figure 1: Location of study area and proposed site

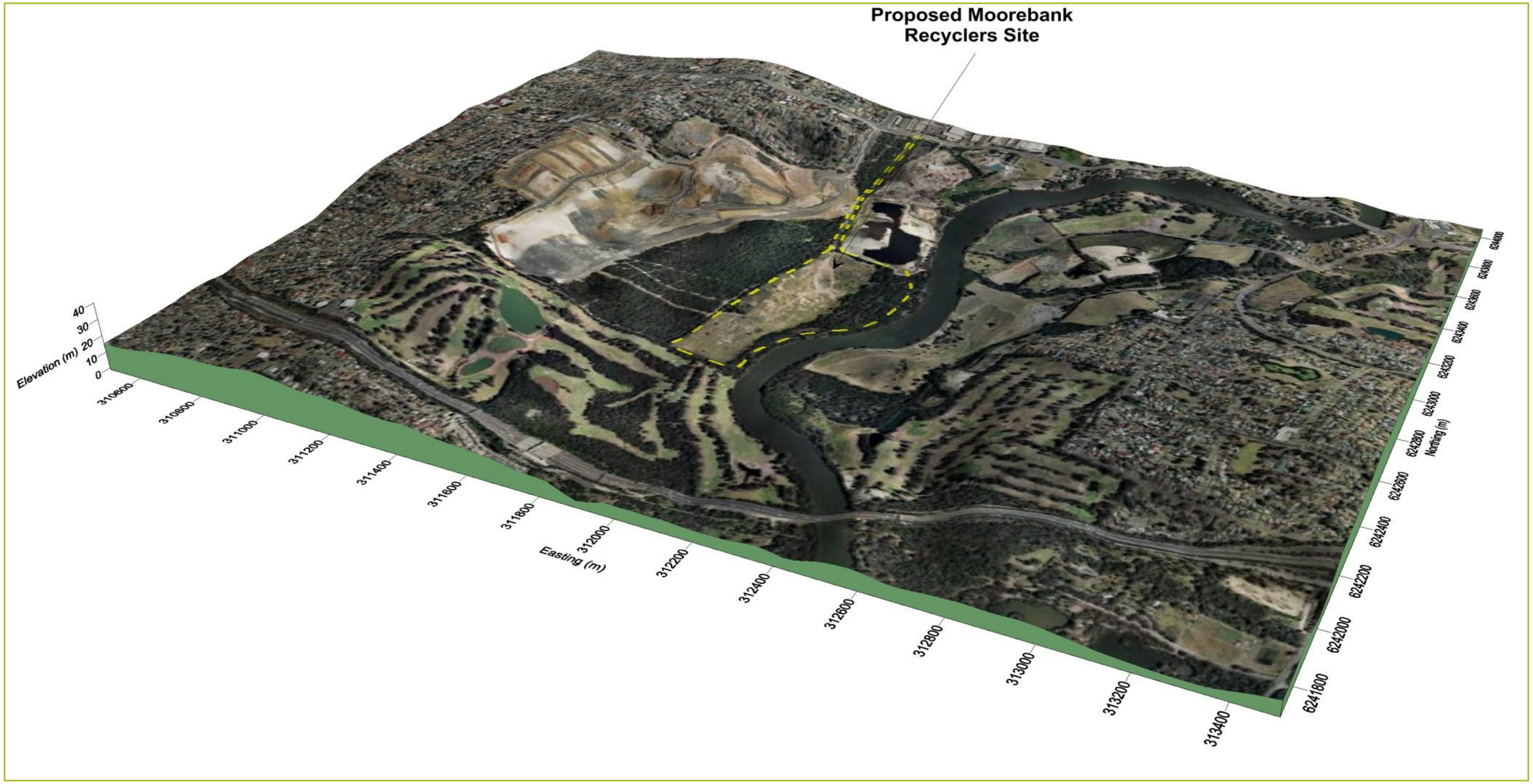


Figure 2: Pseudo three-dimensional representation of the local terrain

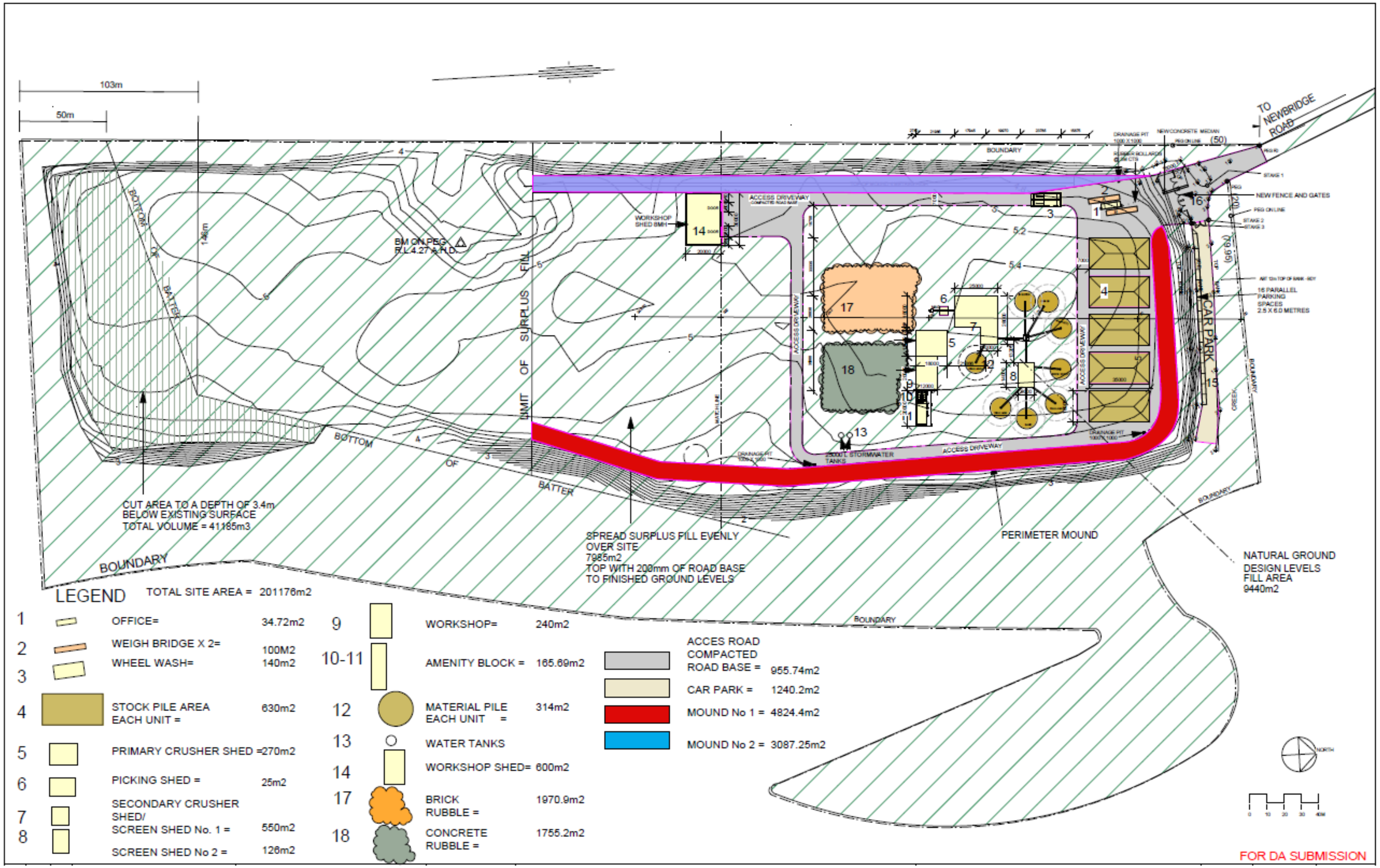


Figure 3: Site layout

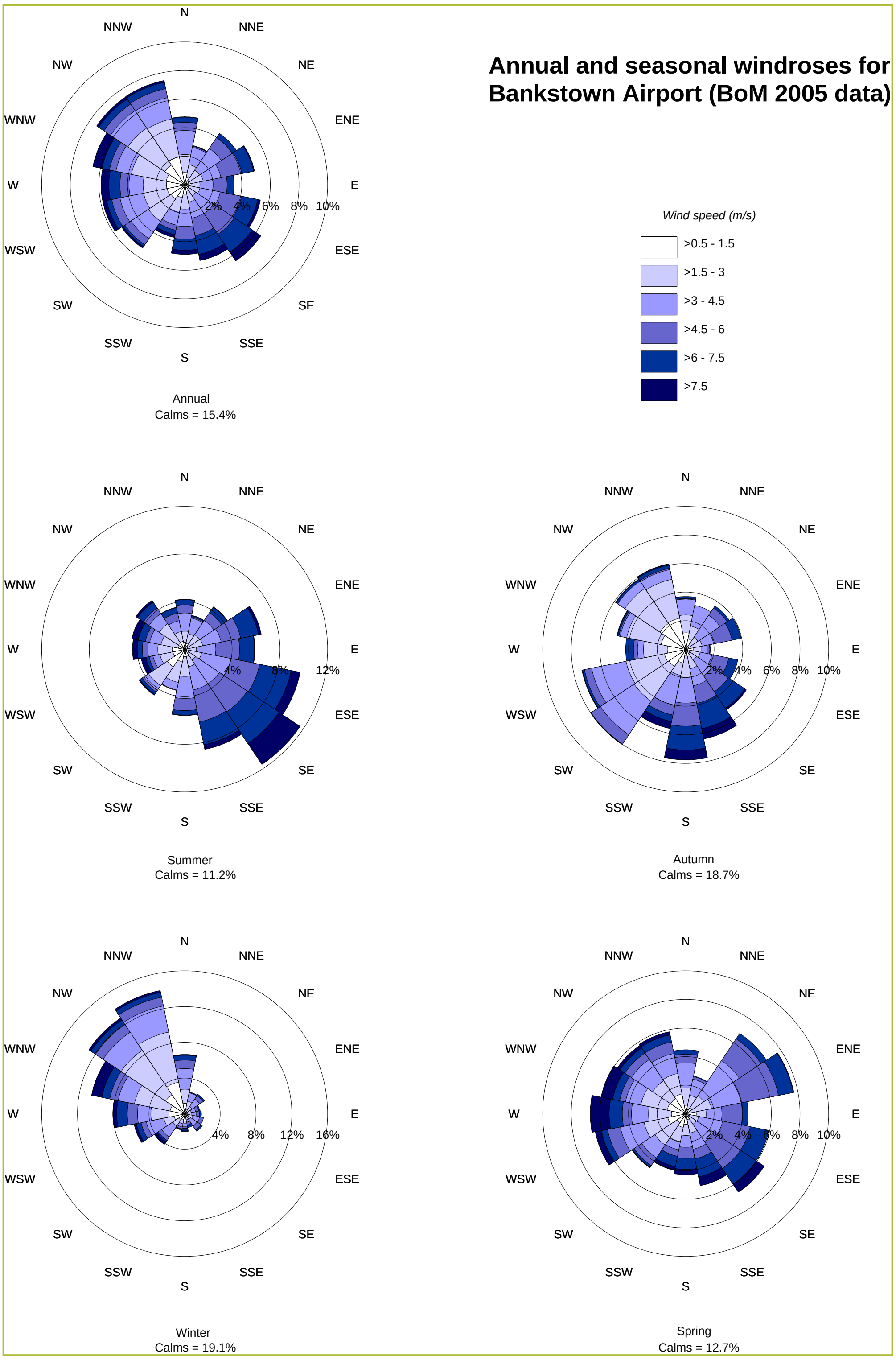


Figure 4: Annual and Seasonal windroses for Bankstown Airport (2005)

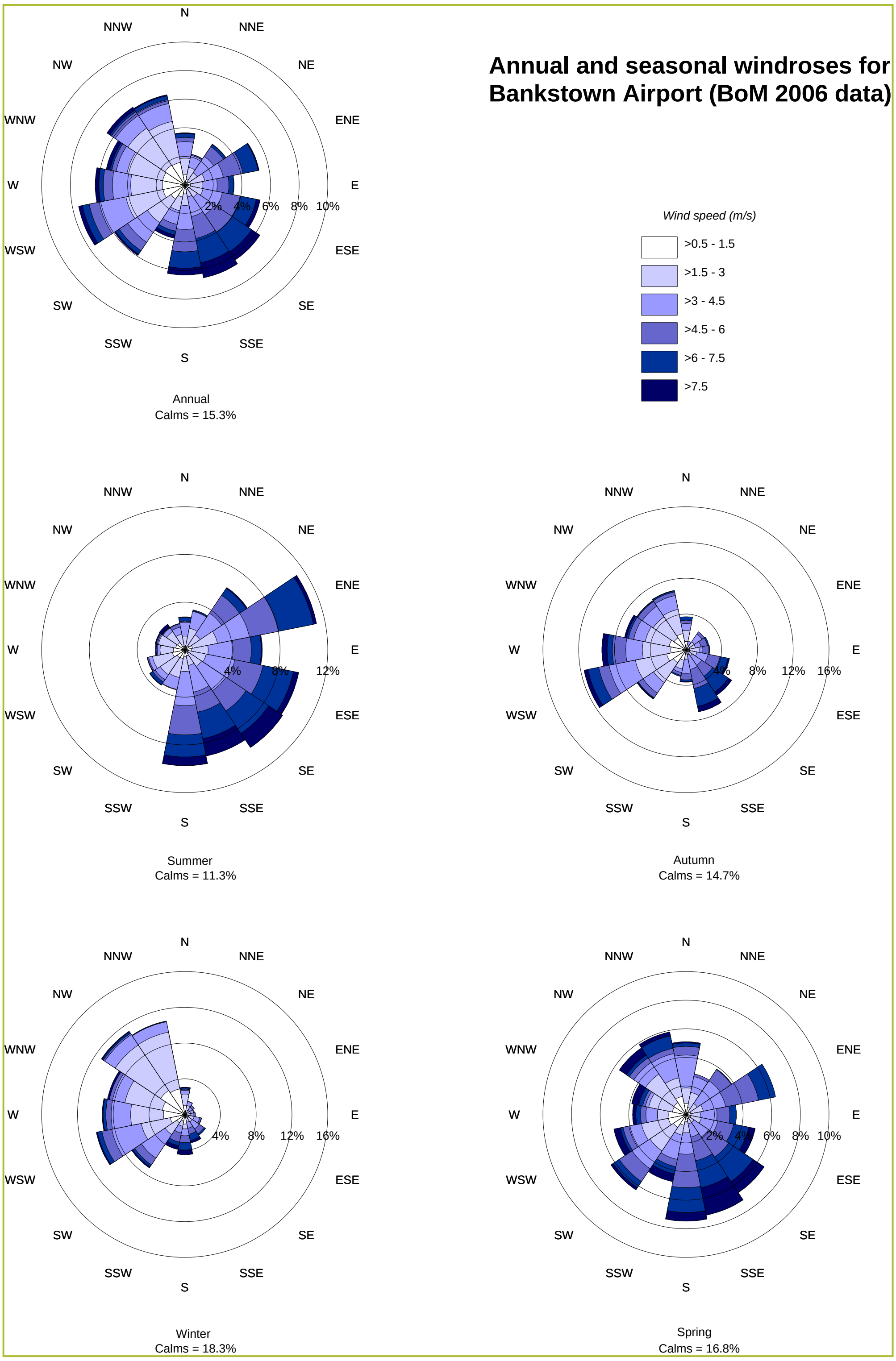


Figure 5: Annual and Seasonal windroses for Bankstown Airport (2006)

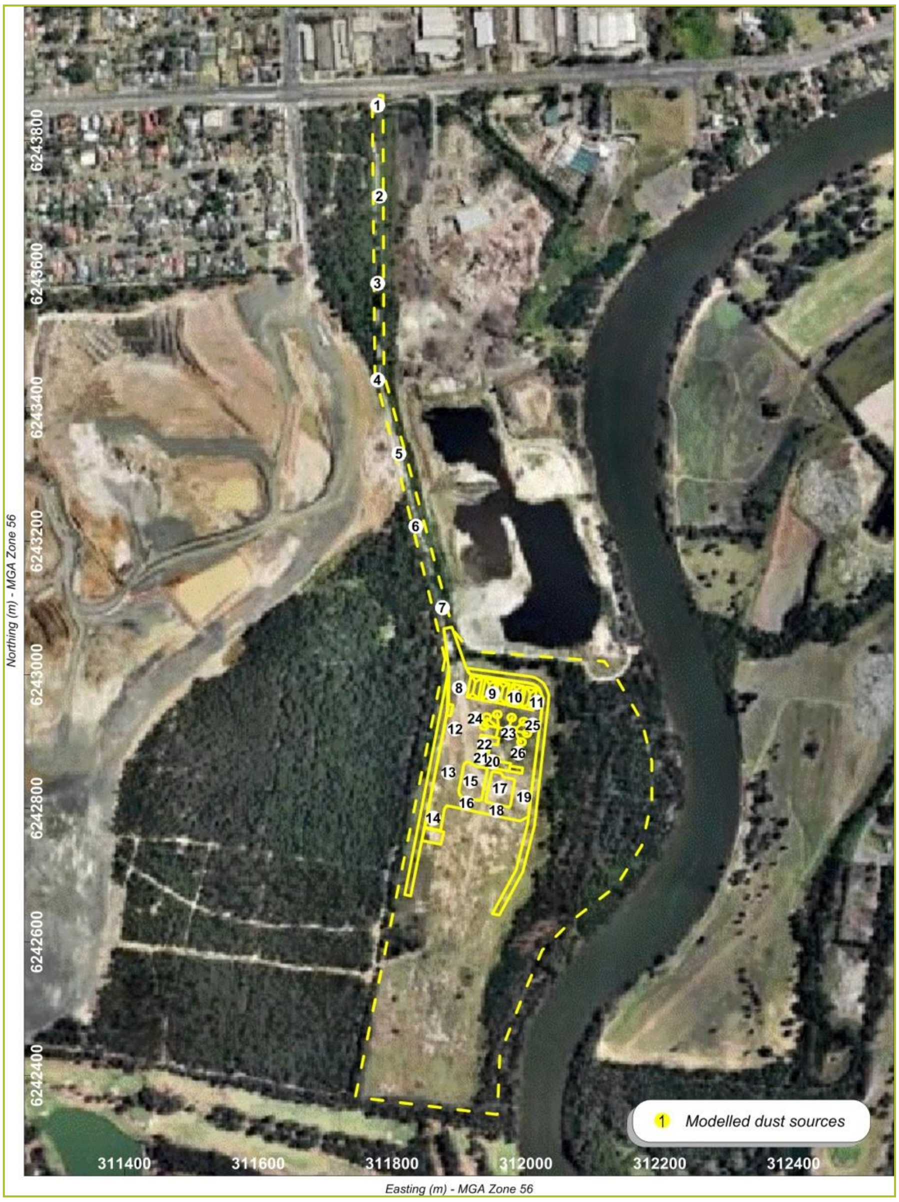
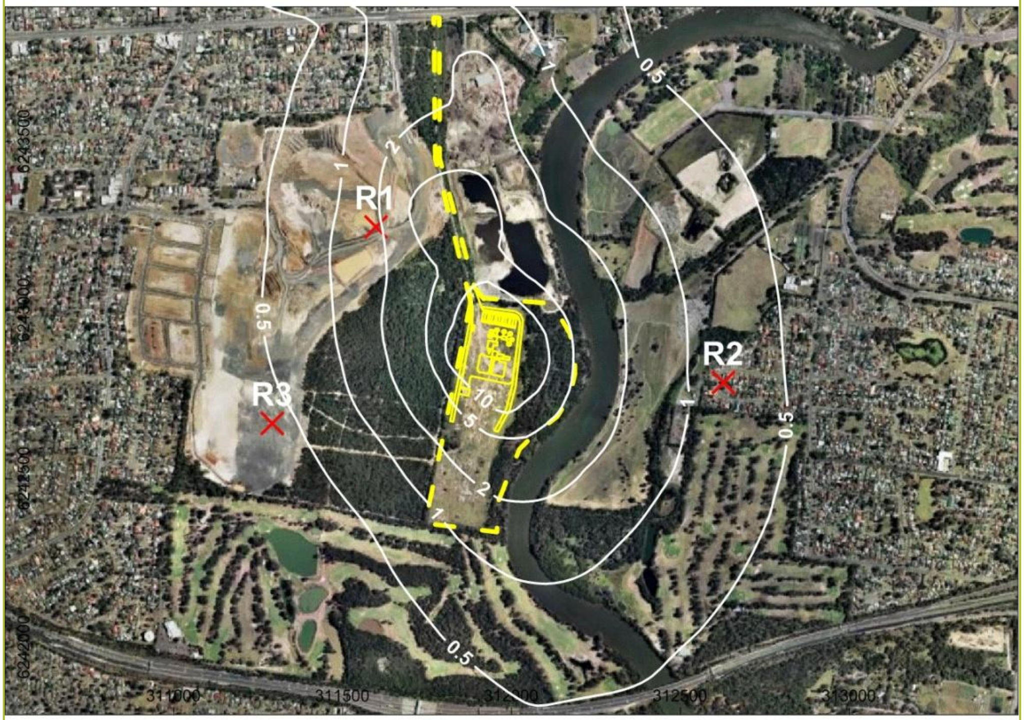


Figure 6: Location of modelled dust sources

Maximum 24-hour average PM_{10} - $\mu g/m^3$



Annual average PM_{10} - $\mu g/m^3$

Figure 7: Maximum 24-hour average and annual average PM_{10} dispersion model predictions for the proposed operations

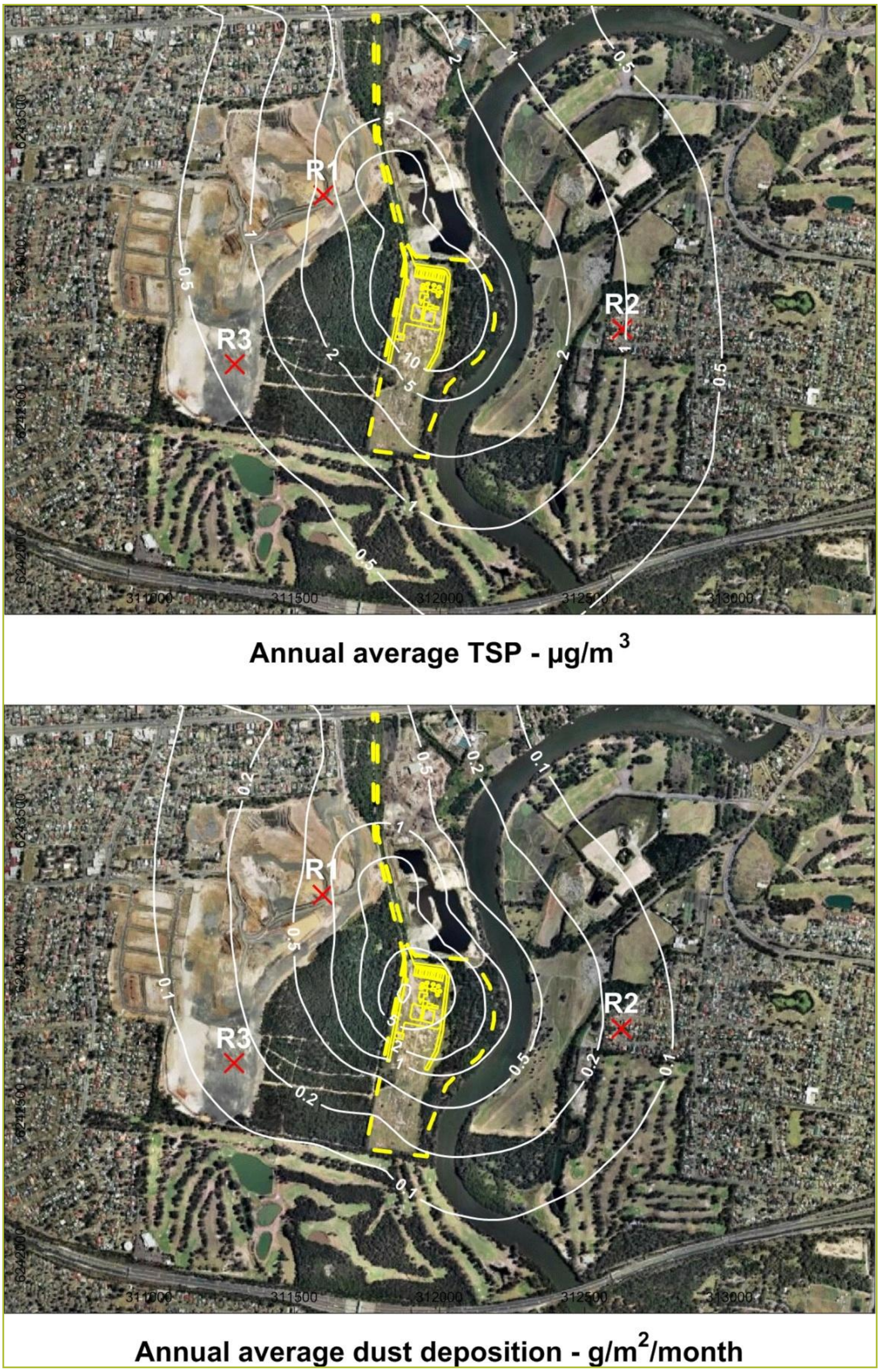


Figure 8: Annual average TSP and dust deposition dispersion model predictions for the proposed operations

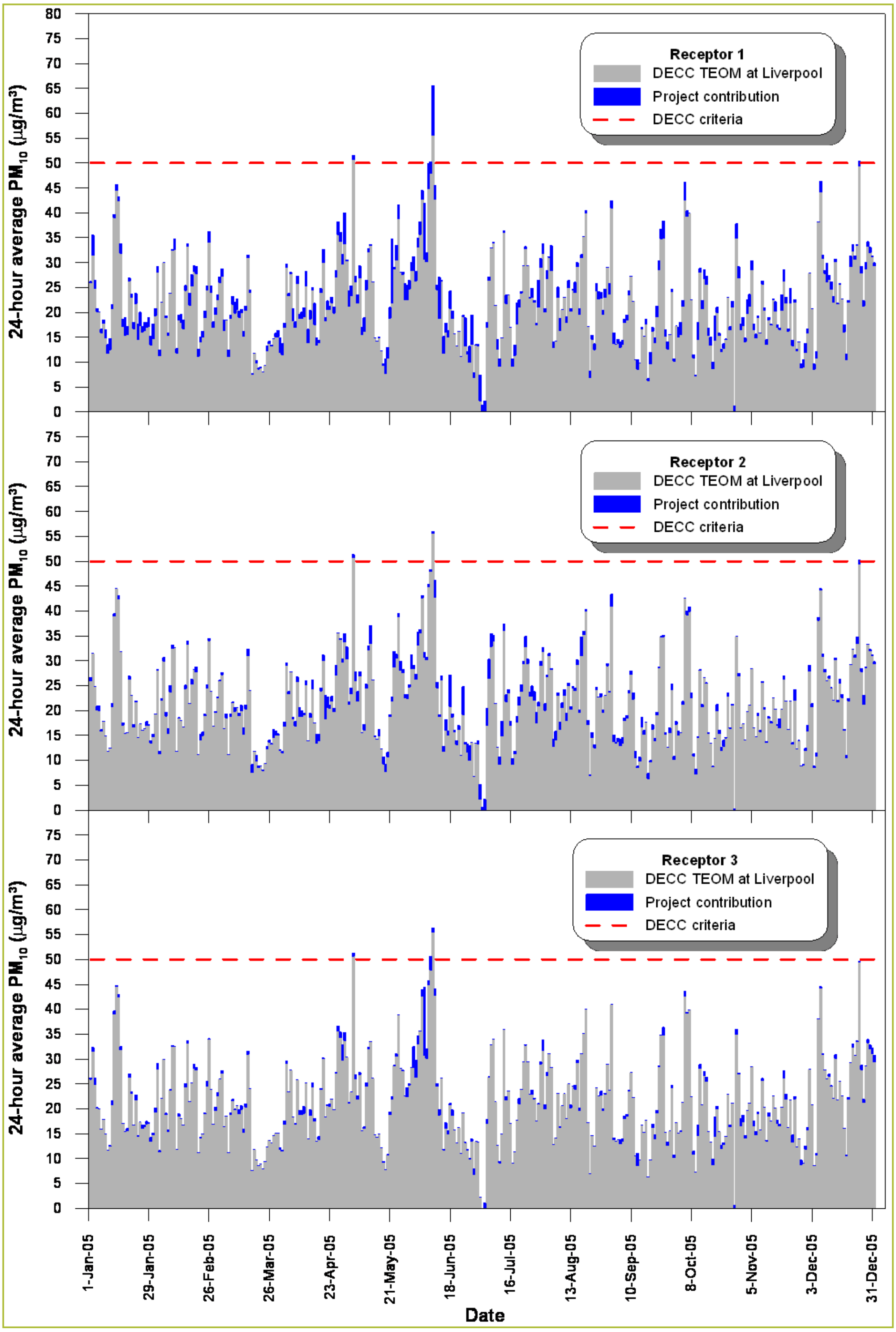


Figure 9: Time series of predicted 24-hour average PM_{10} concentrations at nearest receptors