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EH/snb
Ref: 221021_Let2_Rev1
14 September 2022

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Re: 57 Station Road, Seven Hills – 19.2MW Two Storey Data Centre – DPE Response

This letter provides a response to DPE's comments regarding the Air Quality Impact Assessment for the proposed development located at 57 Station Road, Seven Hills, also described as Lot B in DP 404669. The proposed development is for a 19.2MW two storey data centre.

The response/approach is informed by the meeting held with DPE on 12/9/2022.

7-The Department notes the submitted air quality impact assessment does not appear to have adequately considered cumulative impacts associated with the Council-approved development to the front of the site. The modelling (particularly Scenario 3 - Emergency operations) should subsequently be updated to address this matter.

With the inclusion of the three additional generators from the already approved data centre the total NOx emissions are expected to increase in Scenario 3 by approximately 20%. As shown in the assessment the Scenario 3 of the assessment, the predicted ground level concentrations of NO_2 of the emergency scenario exceed the criteria for the 100th percentile. It is important to note that Scenario 3 assumes each all generators are operating 100% of the time, therefore a 100th percentile is highly conservative. Based on the system average interruption duration index (SAIDI) and the system average interruption frequency index (SAIFI), a supply loss of ~350 minutes represents 0.069% of the year. Based on this, despite predicted exceedances of the NO_2 impact assessment criteria being likely during operation of all standby generators concurrently, it is not likely that this worst-case scenario would occur in a typical year. A cumulative assessment of 12 generators running at 100% capacity (emergency scenario) would not alter the outcomes of this assessment. Therefore, we believe additional modelling is not considered warranted.

The certain circumstances in which the development would cause additional exceedances are unlikely. There is difficulty in the direct application of the additional exceedance criteria for emergency generators as they are not in operation unless during maintenance or in the event of a power outage representing a very small amount of time over the course of a year. Furthermore, the Approved Methods do not contain methodology for the assessment of infrequent operations with a risk-based consequence and frequency criteria for further assessment. Therefore, additional assessment is not considered warranted.

Note: The 20% increase in emissions has been estimated by calculating the emission rate for the existing generated using a normalised exhaust concentration 4,140 mg/m^3 for the Cummins2250 generator and an exhaust flow rate of 5.6 m^3/s and 1.37 m^3/s for the Cummins2250 and Cummins550 generators respectively then correcting for a dry exhaust flow using a typical factor of 0.35 and calculating the percentage based on the total mass emission rate of these 3 generators compared with the total mass emission rate of the proposed facility.

8-The Department notes the submitted air quality impact assessment has predicted a number of exceedances for both testing scenarios (Scenario 1 and 2). This document should be updated to provide further assessment and/or justification in relation to the predicted exceedances. Consideration should also be made towards the following:
i) undertaking site-specific air quality monitoring to establish more accurate background air quality levels

Accuracy of background measurements are unlikely to alter the outcomes of the assessment based on the predicted incremental impacts from the site. The dispersion modelling assessment requires an hourly background file over a full year period. A year's worth of monitoring is considered too onerous for the proposed development. A shorter period of site-specific monitoring can be undertaken to compare local air quality to the existing data used, however it is unlikely to alter the outcomes of the assessment as the background levels are likely to be similar and not change the total impact.

ii) revising the proposed generator testing hours to reduce the likelihood of any exceedances at nearby sensitive receptors, particularly during periods with elevated background levels

The testing regime is undertaken based on the manufacturer's requirements, reducing the testing regime poses breakdown risks.

Hourly background NO_2 concentration from 2017-2021 have been analysed and it has been established that high background concentrations are most common in the winter, with the highest occurring from evening through to early morning. Background concentrations are lower during the summer, and at their lowest between the hours of 13:00-16:00. Therefore, it is recommended that the annual 65-minute maintenance tests be undertaken during the summer between 13:00-16:00 and regular 35-minute maintenance be undertaken during the daytime between 13:00-16:00.

iii) implementation of pollution reduction controls for the generators

Additional pollution reduction controls for the generators are not considered warranted/reasonable due to the low likelihood the operations would cause exceedances. However, it is recommended that the design, installation, and operation of the back-up generators and/or generator enclosures does not preclude the ability for air pollution emission controls to be retrofitted.

Yours faithfully,
for Benbow Environmental

Kate Barker
Senior Environmental Scientist

Emma Hansma
Senior Engineer

RT Benbow
Principal Consultant

AIR QUALITY IMPACT ASSESSMENT
FOR
LCI CONSULTANTS
57 STATION ROAD, SEVEN HILLS

Prepared for: LCI Consultants

Prepared by: Kate Barker, Senior Environmental Scientist
Emma Hansma, Senior Engineer
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Report No: 221021_AQIA_Rev5
September 2022
(Released: 14 September 2022)

Engineering a Sustainable Future for Our Environment

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DOCUMENT REVISION RECORD

Revision	Date	Description	Checked	Approved
1	2-3-2022	Draft / Rev1	E Hansma	R T Benbow
2	28-3-2022	Rev2	E Hansma	R T Benbow
3	25-5-2022	Rev3	E Hansma	R T Benbow
4	1-6-2022	Rev4	E Hansma	R T Benbow
5	14-9-2022	Rev5	E Hansma	R T Benbow

DOCUMENT DISTRIBUTION

Revision	Issue Date	Issued To	Issued By
1	2-3-2022	LCI Consultants	Benbow Environmental
2	28-3-2022	LCI Consultants	Benbow Environmental
3	25-5-2022	LCI Consultants	Benbow Environmental
4	1-6-2022	LCI Consultants	Benbow Environmental
5	14-9-2022	LCI Consultants	Benbow Environmental

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EXECUTIVE SUMMARY

Benbow Environmental has been engaged by LCI Consultants to undertake an air quality impact assessment for the proposed development located at 57 Station Road, Seven Hills, also described as Lot B in DP 404669. The proposed development is for a 19.2MW two storey data centre.

The assessment determines the likely air quality impacts from the proposed development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016). It determines the proposed development's ability to comply with *Protection of the Environment Operations Act 1997* and *Protection of the Environment Operations (Clean Air) Regulation 2010*. Emissions data from the selected generator type were input into the dispersion modelling software AERMOD to predict the ground level concentrations at the relevant receptors.

The proposed development includes eight (8) 3000kW and one (1) 500kW diesel generators (CAT C175-20 50Hz and CAT C18 50hz) to provide emergency power during transfer to the Uninterruptable Power Source. Each diesel generator operates within an individual housing case with a vertical release point. The primary pollutants of concern from the exhaust emissions are Nitrogen oxides (NO_2), Carbon monoxide (CO), and dust ($PM_{2.5}$). The 3000kW generators have been assessed at a 20m stack height, and the 500kw generator has been assessed at a 6m stack height.

The Protection of the Environment Operations (Clean Air) Regulation (2021outlines the standards of concentration for non-scheduled premises in Schedule of the Regulation, and the relevant standards are as followed:

Air Impurity	*Activity or plant*	*Group*	*Concentration*
Solid Particles	*Any*	*Group C*	*100 mg/m3*

The concentration of particulate matter in each stack of the 3000kw generators (CAT C175-20 50Hz) is 6.5 mg/m^3 and of the 500kw generator (CAT C18 50hz) is 22.1 mg/m^3, which is below the concentration limit of 100 mg/m^3 outline by the Regulation. The POEO Act does not provide concentration limits for carbon monoxide or nitrogen dioxide for unscheduled premises.

The impact assessment criteria for the air pollutants of concern must be applied at the nearest existing and future sensitive receptors in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2016).* The incremental impact must be reported for a defined averaging period and as the 100th percentile prediction.

Under typical operating conditions the generators will not be running and power for the proposal site is fed directly from the grid.

Three scenarios have been assessed. Scenarios 1 and 2 represent realistic operations during routine maintenance and scenario 3 assesses a worst-case scenario where all generators are operating due to the event of a blackout. Scenario 1 assessed the 75% emissions maintenance testing load for NO_2. Scenario 2 assessed the 100% peak emissions maintenance testing load for NO_2, CO, and $PM_{2.5}$ and Scenario 3 assessed emergency operations where all generators are operating at 100% for 100% of the time to assess worst case impacts during a blackout.

NO_2 impacts have been presented utilising method 1, method 2 and method 3 in accordance with the *Approved Methods*. Method 1 assumes all incremental NOx is NO_2 and add this value to the background NO_2. Method 2 utilises background ozone levels for conversion of NOx to NO_2. Method 3 utilises an empirical relationship to determine the conversion, which is a function of wind speed, temperature, background ozone, tabulated seasonal scaling factors and distance from source to receptor.

The 100th percentile hourly averaging period assessment of NO_2 impacts under Scenario 1 shows compliance for all receptors under Method 1 and Method 2, and compliance at all receptors for Method 3 except one (R8). Scenario 1 is a maintenance that will only occur once for 35 mins every quarter for each generator, therefore a 100th percentile operating during all daytime hours is highly conservative.

The 100th percentile hourly averaging period assessment of NO_2 impacts under Scenario 2 shows compliance for all receptors under Method 2, eight of twenty (8/20) receptors under Method 1 and fifteen of twenty (15/20) under Method 3. It is important to note that Scenario 2 is peak testing maintenance which occurs for 65 minutes each year for each generator therefore a 100th percentile operating during all daytime hours is highly conservative.

The 100th percentile hourly averaging period assessment of NO_2 impacts under Scenario 3 shows exceedance at all receptors under Method 1 and Method 3 and compliance for eight of twenty (8/20) receptors under Method 2. It is important to note that Scenario 3 assumes each all generators are operating 100% of the time, therefore a 100th percentile operating during all daytime hours is highly conservative. Based on the system average interruption duration index (SAIDI) and the system average interruption frequency index (SAIFI), a supply loss of ~350 minutes represents 0.069% of the year. Based on this, despite predicted exceedances of the NO2 impact assessment criteria being likely during operation of all standby generators concurrently, it is not likely that this worst-case scenario would occur in a typical year.

Assessment of carbon monoxide shows compliance at all sensitive receptors for the assessed averaging periods.

Assessment of particulate matter under Scenario 2 - maintenance scenario shows exceedances due to elevated background levels of $PM_{2.5}$. Maximum predicted impacts at sensitive receptors were 0.27 $\mu g/m^3$ for the 24-hour averaging periods and 0.04 $\mu g/m^3$ for the annual averaging period. These are considered minimal impacts. Maximum predicted impacts under Scenario 3 – emergency operations at sensitive receptors were 4.8 $\mu g/m^3$ for the 24-hour averaging periods, it is not likely that this worst-case scenario would occur in a typical year.

A Construction Environmental Management Plan (CEMP) is recommended to be prepared that documents the environmental aspects of the construction phase and establishes procedures to manage any potential impacts. It is recommended an Air Quality Control Procedure be presented in the CEMP which sets out the procedure for managing and monitoring air emissions during construction. A summary of the control measures to be provided in the procedure in included in Section 6. Local weather conditions should be taken into account in determining the level and suitability of controls required.

Hourly background NO_2 concentration from 2017-2021 have been analysed and it has been established that high background concentrations are most common in the winter, with the highest occurring from evening through to early morning. Background concentrations are lower during the summer, and at their lowest between the hours of 13:00-16:00. Therefore, it is recommended that the annual 65-minute maintenance tests be undertaken during the summer between 13:00-16:00 and regular 35-minute maintenance be undertaken during the daytime between 13:00-16:00.

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Additional pollution reduction controls for the generators are not considered warranted/reasonable due to the low likelihood the operations would cause exceedances. However, it is recommended that the design, installation, and operation of the back-up generators and/or generator enclosures does not preclude the ability for air pollution emission controls to be retrofitted.

It is recommended that an Emergency Response Plan for the site is provided and includes appropriate procedures for managing air quality emissions and impacts on the surrounding community and environment.

Further assessment is not considered warranted.

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Contents Page

Tables Page

Figures Page

Attachments

1. INTRODUCTION

Benbow Environmental has been engaged by LCI Consultants to undertake an air quality impact assessment for the proposed facility located at 57 Station Road, Seven Hills, also described as Lot B in DP 404669. The proposed development is for a 19.2 MW two storey data centre.

The proposed development includes eight (8) 3000 kW and one (1) 500kW diesel generators to provide emergency power during transfer to the Uninterruptable Power Source. Each diesel generator operates within an individual housing case with a vertical release point. The primary pollutants of concern from the exhaust emissions are NO_x (NO_2), CO, and dust ($PM_{2.5}$).

1.1 SCOPE OF THIS REPORT

The purpose of this assessment is to determine the likely air quality impacts from the proposed development in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016). It determines the proposed development's ability to comply with *Protection of the Environment Operations Act 1997* and *Protection of the Environment Operations (Clean Air) Regulation 2010*.

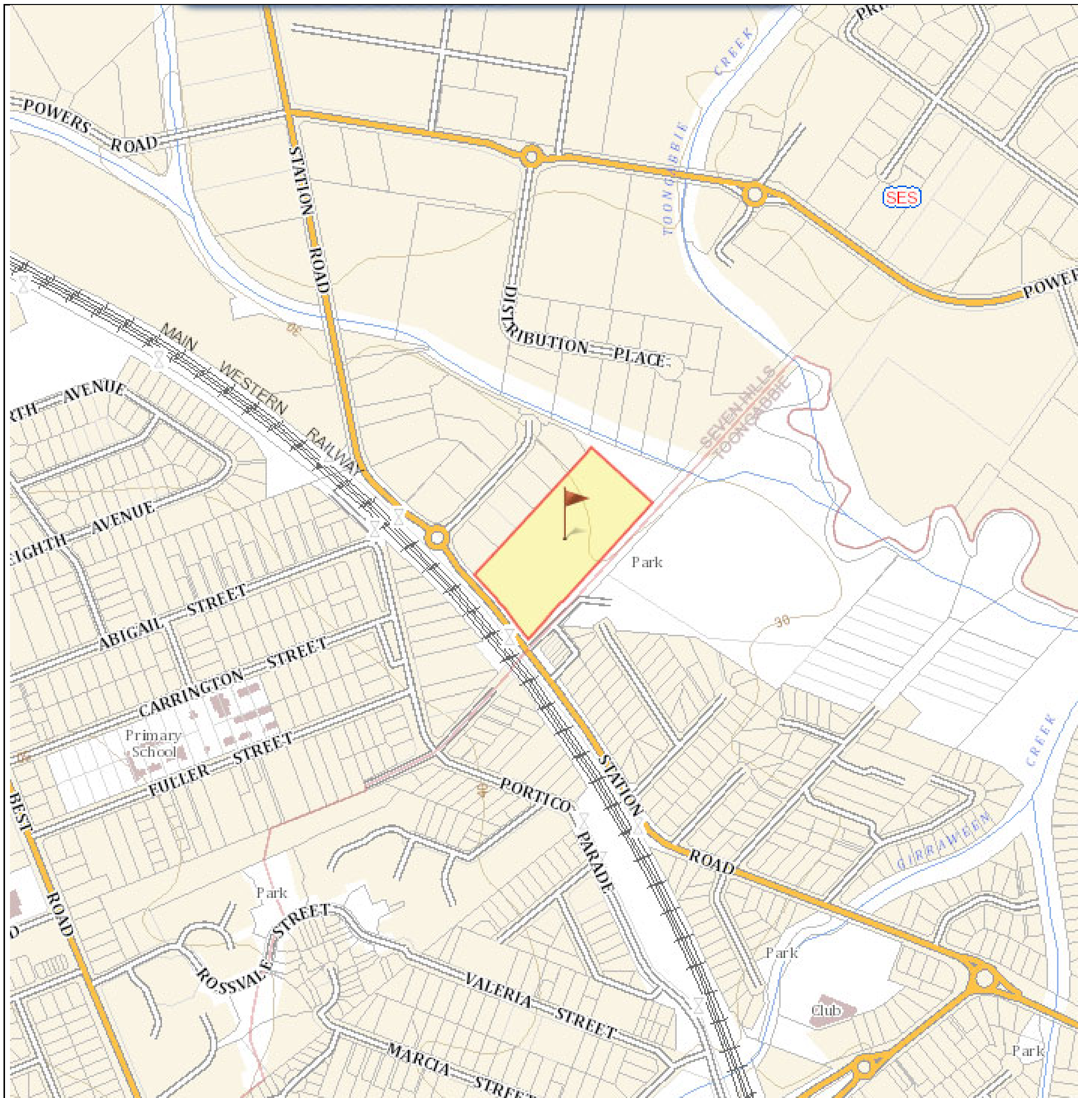
Emissions data from the selected generator types (CAT C175-20 50Hz and CAT C18 50hz) were input into the dispersion modelling software AERMOD to predict the ground level concentrations at the relevant receptors.

2. PROPOSAL OVERVIEW

2.1 SITE LOCATION AND CONTEXT

The subject site is located 57 Station Road, Seven Hills also described as Lot B in DP 404669. Figure 2-1 shows the location of the site and Figure 2-2 shows an aerial photo of the site.

Figure 2-1: Site Location



Source: www.maps.six.nsw.gov.au 2022

↑N	LEGEND: Site Boundary	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

Figure 2-2: Aerial Photograph of the Site and Surrounds

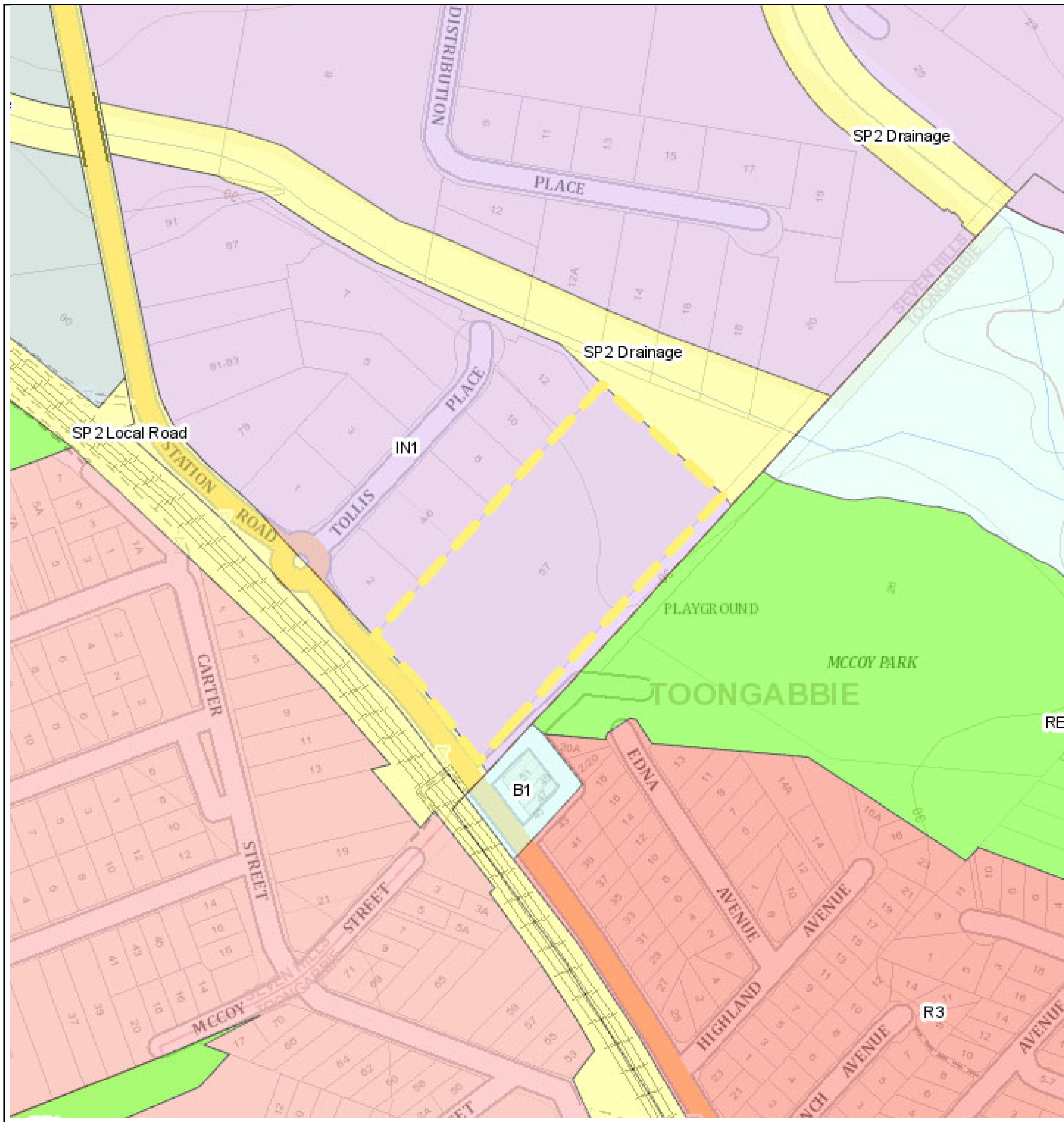
Source: www.maps.six.nsw.gov.au 2022

↑N	LEGEND: Site Boundary	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

2.2 LOCALITY AND SURROUNDING LAND USE

The subject site is zoned as IN1 – General Industrial under the Blacktown Local Environmental Plan (LEP) 2015. There is further General Industrial zoned land to the north and north east, as well as SP2 zoned drainage liens. To the east there is RE1 recreational zoned land. To the south of the site there is a small area of B1 Neighbourhood Centre zone and the R3 Medium Density residential. To the south east the site is bordered immediately by SP2 Local road and then R2 Low Density Residential beyond that. The land zoning map is provided in Figure 2-3.

Figure 2-3: Land Zoning Map



Source: Planning Portal 2018

↑N

LEGEND:

Zone

- B1 Neighbourhood Centre
- B2 Local Centre
- B3 Commercial Core
- B4 Mixed Use
- B5 Business Development
- B6 Enterprise Corridor
- E2 Environmental Conservation
- E3 Environmental Management
- IN1 General Industrial
- IN2 Light Industrial
- R1 General Residential
- R2 Low Density Residential
- R3 Medium Density Residential
- R4 High Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU1 Primary Production
- RU2 Rural Landscape
- RU4 Primary Production Small Lots
- RU5 Village
- SP1 Special Activities
- SP2 Infrastructure
- SP3 Tourist
- W2 Recreational Waterways
- MD SEPP (Major Development) 2005
- WSP SEPP (Western Sydney Parklands) 2009
- WSE SEPP (Western Sydney Employment Area) 2009
- DM Deferred Matter

Site Boundary

Benbow Environmental
25-27 Sherwood Street,
Northmead NSW 2152

2.3 NEAREST IDENTIFIED SENSITIVE RECEPTORS

Table 2-1 provides the list of the nearest identified receptors that have the potential to be affected by the proposed development.

Table 2-1: Nearest Potentially Affected Receivers Considered

Receptor ID	Address	Lot & DP	Direction from Site	Approximate distance to site boundary (m)	Type of Receptor
R1	20A Edna Ave Toongabbie	Lot 1, DP1265160	SE	45	Residential
R2	53 Station Road, Toongabbie	Lot 2, DP215656	SE	25	Residential
R3	1 Mccoy St, Toongabbie	Lot CP, SP90150	S	78	Residential
R4	15 Carter St, Seven Hills	Lot 10, SP90359	SW	68	Residential
R5	7 Carter St, Seven Hills	Lot 3, DP650827	W	80	Residential
R6	2 Tollis Pl, Seven Hills	Lot 11, DP1071476	NW	32	Commercial
R7	8 Tollis Pl, Seven Hills	Lot CP, SP76250	NW	23	Commercial
R8	16 Distribution Pl, Seven Hills	Lot 9, DP1098735	N	128	Commercial
R9	20 Distribution Pl, Seven Hills	Lot 7, DP1098735	N	129	Commercial
R10	4 Tucks Road, Seven Hills	Lot 1, DP1040263	W	330	Residential
R11	McCoy Park, 17 Mimosa Ave, Seven Hills	Lot 17, DP8408	E	94	Recreational
R12	70 Greenmeadows Cres, Toongabbie	Lot 5, DP245140	E	655	Residential
R13	9 Station Road, Toongabbie	Lot 2, DP50I6550	E	465	Residential
R14	12 Station Road, Toongabbie	Lot 501, DP1265209	SE	610	Residential
R15	2C Fuller St, Seven Hills	Lot 501, DP1265209	SW	480	Educational
R16	18 Marcia Street, Toongabbie	SP96495	SW	620	Residential
R17	41 Best Road, Seven Hills	Lot 11, DP843303	SW	675	Educational

Table 2-1: Nearest Potentially Affected Receivers Considered

Receptor ID	Address	Lot & DP	Direction from Site	Approximate distance to site boundary (m)	Type of Receptor
R18	56 Best Road, Seven Hills	Lot 1, DP34778	SW	760	Educational
R19	Best Road Reserve, Best Road, Seven Hills	Lot 121, DP35876	W	650	Recreational
R20	11 Powers Road, Seven Hills	Lot 3, DP227246	NW	485	Industrial

Figure 2-4: Aerial Photograph of the Project Site Location and the Nearest Potentially Affected Receptors

2.4 PROJECT DESCRIPTION

The proposed development is for a 19.2 MW two storey data centre. The proposed development includes the following:

- Construction of a 19.2 MW two storey Ballard;
- Direct evaporative cooling;
- Nine diesel generators;
- No on-site substation;
- Underground stormwater detention vault;
- Admin/facility support; and
- Landscaping.

2.4.1 Pollutants of concerns

Potential pollutants of concern from the standby generators include:

- Greenhouse gases;
- Particulate matter (PM);
- Volatile organic compounds (VOC);
- Nitrous Oxids (NOx);
- Carbon monoxide (CO); and
- Sulfur dioxide (SO2).

3. AIR QUALITY CRITERIA AND GUIDELINES

3.1 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

The Protection of the Environment Operations Act 1997 (POEO Act) applies the following definitions relating to air pollution.

"Air pollution" *means the emission into the air of any air impurity.*

While "air impurity" includes smoke, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, mists, odours and radioactive substances.

The following clauses of this Act have most relevance to the site:

Clause 124 Operation of Plant (other than domestic plant)
The occupier of any premises who operates any plant in or on those premises in such a manner as to cause air pollution from those premises is guilty of an offence if the air pollution so caused, or any part of the air pollution so caused, is caused by the occupier's failure:

a) to maintain the plant in an efficient condition, or
b) to operate the plant in a proper and efficient manner,

Clause 127 Proof of causing pollution
To prove that air pollution was caused from premises within the meaning of Sections 124 – 126, it is sufficient to prove that air pollution was caused on the premises, unless the defendant satisfies the court that the air pollution did not cause air pollution outside the premises.

Clause 128 Standards of air impurities not to be exceeded
(1) The occupier of any premises must not carry on any activity, or operate any plant, in or on the premises in such a manner as to cause or permit the emission at any point specified in or determined in accordance with the regulations of air impurities in excess of:

a) The standard of concentration and the rate, or
b) The standard of concentration or the rate.

Prescribed by the regulations in respect of any such activity or any such plant.

(1A) Subsection (1) applies only to emissions (point source emissions) released from a chimney, stack, pipe, vent or other similar kind of opening or release point.

(2) The occupier of any premises must carry on any activity, or operate any plant, in or on the premises by such practicable means as may be necessary to prevent or minimise air pollution if:
(a) in the case of point source emissions – neither a standard of concentration nor a rate has been prescribed for the emissions for the purposes of subsection (1), or
(b) The emissions are not point source emissions.

(3) A person who contravenes this section is guilty of an offence.

Schedule 1, Clause 17 (1) Electricity Generation

(1) This clause applies to the following activities—

Applies scheduled premises status to electricity generation by means of internal combustion engine in a metropolitan area with capacity to produce more than 30 MW of electrical power and capacity to burn more than 3 MJ of fuel per second.

Schedule 1, Clause 17 (1A)

Notes that clause 17 (1) does not apply if the electricity generation is utilised for emergency stand-by plant operating for less than 200 hours per year.

The site would be required to adhere to the above listed legislative requirements.

3.2 PROTECTION OF THE ENVIRONMENT OPERATIONS (CLEAN AIR) REGULATION 2021

The Protection of the Environment Operations (Clean Air) Regulation (2021), hereby referred to as the Regulation, outlines the standards of concentration for non-scheduled premises in Schedule 6 of the Regulation, and the relevant standards are as followed:

Air Impurity	*Activity or plant*	*Group*	*Concentration*
Solid Particles	*Any*	*Group C*	*100 mg/m3*

The concentration of particulate matter in each stack of the 3000kw generators (CAT C175-20 50Hz) is 6.5 mg/m^3 and of the 500kw generator (CAT C18 50hz) is 22.1 mg/m^3, which is below the concentration limit of 100 mg/m^3 outline by the Regulation.

In addition, while this clause relates to scheduled premises and the proposed development is not scheduled it is noted that:

59 Exemption relating to emergency electricity generation
Emergency standby plant comprising a stationary reciprocating internal combustion engine for generating electricity is exempt from the air impurities standard for nitrogen dioxide and nitric oxide specified in Schedule 4 in relation to that plant if the plant is used for a total of not more than 200 hours per year.

3.3 NSW ENVIRONMENT PROTECTION AUTHORITY GUIDELINES

Impacts from pollutants and particulates are governed by the NSW EPA guideline document, the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2016).*

The impact assessment criteria for the air pollutants of concern must be applied at the nearest existing and future sensitive receptors. The incremental impact must be reported for a defined averaging period and as the 100th percentile prediction.

Concentration Limits for pollutants in this assessment are shown in Table 3-1.

Table 3-1: Air pollutant Concentration Limits

Pollutant	Averaging Period	Concentration (µg/m³)
Nitrogen dioxide	1 hour	246
	Annual	62
$PM_{2.5}$	24 hour	25
	Annual	8
Carbon monoxide	15 minutes	100,000
	1 hour	30,000
	8 hour	10,000
PM_{10}	24 hour	50
	Annual	25
Sulfur dioxide	10 minutes	712
	1 hour	570
	24 hour	228
Polycyclic Aromatic Hydrocarbons (PAH)	1 hour	0.4
Benzene	1 hour	29

3.4 NATIONAL ENVIRONMENT PROTECTION (AMBIENT AIR QUALITY) MEASURE

The National Environment Protection (Ambient Air Quality) Measure (2021) provides the standards and goals for ambient air quality across Australia.

Concentration Limits for pollutants in this assessment are shown in Table 3-1.

Table 3-2: Air pollutant Concentration Limits

Pollutant	Averaging Period	Concentration (µg/m³)
Nitrogen dioxide	1 hour	150
	Annual	28
$PM_{2.5}$	24 hour	25
	Annual	8
PM_{10}	24 hour	50
	Annual	25
Carbon monoxide	1 hour	30,000

3.5 NATIONAL ENVIRONMENT PROTECTION (AIR TOXICS) MEASURE

The National Environment Protection (Air Toxics) Measure (2011) provides a framework for monitoring, assessing, and reporting air toxics levels in ambient air. It aims to allow the facilitation of air toxic management in ambient air that will result in the equivalent protection of human health and wellbeing through the collection of information and development of national standards.

Concentration Limits for pollutants in this assessment are shown in Table 3-1.

Table 3-3: Air pollutant Concentration Limits

Pollutant	Averaging Period	Concentration
Benzene	Annual	0.003 ppm
Benzene(a)pyrene as a marker for Polycyclic Aromatic Hydrocarbons (PAHs)	Annual	0.3ng/m3
Formaldehyde	Annual	0.04 ppm
Toluene	24 hour	1 ppm
	Annual	0.1 ppm
Xylenes (as a total of other, meta and para isomers0	24 hour	0.25 ppm
	Annual	0.2 ppm

Note: the annual average is the arithmetic mean of concentrations from 24-hour monitoring results. A 24 hour period is measured from midnight to midnight.

3.6 Specific Criteria

This assessment focuses on the following primary contaminants of concern. These are considered to have the highest risk to human health and the environment.

Concentration Limits used for this assessment are shown in Table 3-1.

Table 3-4: Air pollutant Concentration Limits

Pollutant	Averaging Period	Concentration (µg/m^3)
Nitrogen dioxide	1 hour	246 µg/m^3
$PM_{2.5}$	24 hour	25 µg/m^3
	Annual	8 µg/m^3
PM_{10}	24 hour	50 µg/m^3
	Annual	25 µg/m^3
Carbon monoxide	15 minutes*	100,000 µg/m^3
	1 hour	30,000 µg/m^3
	8 hour	10,000 µg/m^3
Benzene	Annual	0.003 ppm
Formaldehyde	Annual	0.04 ppm
Toluene	24 hour	1 ppm
	Annual	0.1 ppm
Xylenes (as a total of other, meta and para isomers)	24 hour	0.25 ppm
	Annual	0.2 ppm

*THE AERMOD model is limited by averaging time options. The 1hr averaging period is the lowest available and therefore CO will only be assessed against the 15 min averaging period criteria using post-processing of the 1 hour averaging predictions. The following formula for converting the 1-hour average concentrations to is recommended by the Victorian EPA: $c_{(t)} = c(t_0)\ (t_0/t)^{0.2}$ where (t) is the averaging time (minutes) of interest, and (t_0) is the averaging time consistent with the dispersion rates.

4. EXISTING ENVIRONMENT

4.1 PROJECT SITE REPRESENTATIVE METEOROLOGICAL DATA

Horsley Park Equestrian Centre AWS 067119 was selected as the closest weather station with representative data for the site. The representative year of 2019 was selected as it is the most recent year that is relatively similar to the mean for 2003 to 2021.

Data from Horsley Park weather station is not the same as the prognostic data used for the model, however they are both for the year of 2019. Weather station data does not necessarily adequately represent the meteorological conditions at the site required for accurate predictions using AERMOD, so it is necessary to obtain modelled prognostic data from Lakes Environmental. No-observation prognostic data obtained from Lakes Environmental was used in the model, details are provided in Section 0 and Attachment 2.

4.2 WIND ROSE PLOTS

Wind rose plots show the direction from which the wind is coming from using triangles known as "petals". The petals of the plots in the figure summarise wind direction data into 8 compass directions i.e. north, north-east, east, south-east, etc.

The length of the triangles, or "petals", indicates the frequency with which wind blows from the direction presented. Longer petals for a given direction indicate a higher frequency of wind from that direction. Each petal is divided into segments, with each segment representing one of the six wind speed classes.

The proportion of time for which wind speed is less than speeds in the first class (i.e. 0.5 $m.s^{-1}$) when speed is negligible, is referred to as calm hours or "calms". Calms are not shown on a wind rose as they have no direction, but the proportion of calms for the period under consideration is noted under each wind rose.

The concentric circles in each wind rose are the axes that denote wind frequencies. In comparing the plots it should be noted that the axes vary between wind roses, although all wind roses are the same size. The frequencies shown in the first quadrant (top-left quarter) of each wind rose are stated beneath the diagram.

Wind rose plots for 2019, the most representative year, generated from the Horsley Park data, is shown in

4.3 LOCAL WIND TRENDS

Seasonal wind rose plots for this site using Horsley Park data from 2019 have been included in Figure 4-1.

In 2019 the average wind speed was 2.05 m/s with an average calms frequency of 17.55%. The wind direction predominately arrived to the site from the south-west 18% of the time. South-east winds occurred 11% of the time, north-west and westerly winds occurred at 10% frequency. The remainder were less than 10% frequent.

In summer the average wind speed was 2.22 m/s with an average calms frequency of 16.21%. South-easterly winds were the most prevalent at 20%, easterly winds occurred 16% of the time, southerly winds were 14% frequent and north-easterly winds were 11% frequent. The remainder were less than 9% frequent.

The average wind speed in autumn was 1.67 m/s with a calms frequency of 22.81%. South-westerly winds were the most prevalent at 21%. Northerly winds occurred at 10% frequency and north-westerly winds were 9% frequent. The remainder were 8% frequent or less.

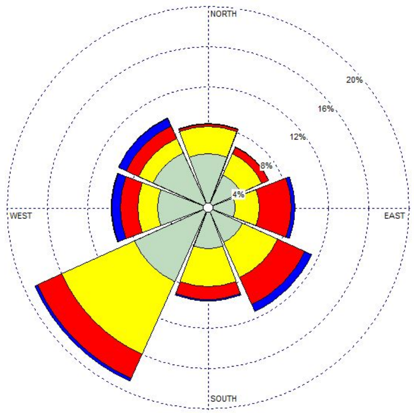
In winter the average wind speed was 2.04 m/s with a calms frequency of 15.21%. South-westerly winds dominated this period at 30%. North-westerly winds and westerly winds both occurred at 15% frequency. The remainder occurred for 8% or less.

The average wind speed in spring was 2.25 m/s with a calms frequency of 15.89%. During this time, the frequency of each direction was quite similar. The most prevalent was south-westerly at 17% frequent, but the remainder had a frequency between 8-11%.

At the Horsey Park Equestrian Centre, the mean daily wind run has been recorded from 2003-2021. The highest was in November at 216 km, slightly above the overall average, and the lowest recoded was in April at 130 km, 40 m below the overall average for that month. The daily wind run for 2019 mostly followed the average trend from all the years of data where it decreased from January heading into winter to increase in June to reach a plateau in the later months of the year from around September-December.

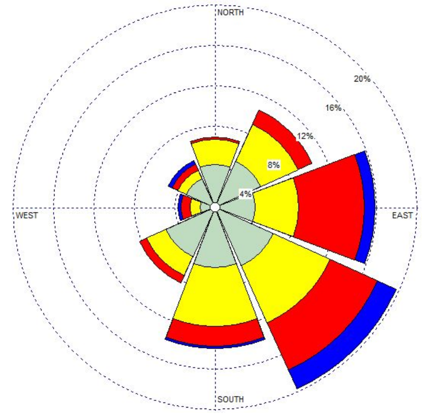
Figure 4-1: Wind rose plots for the referenced meteorological station – Horsley Park, Bureau of Meteorology (2019)

All Seasons



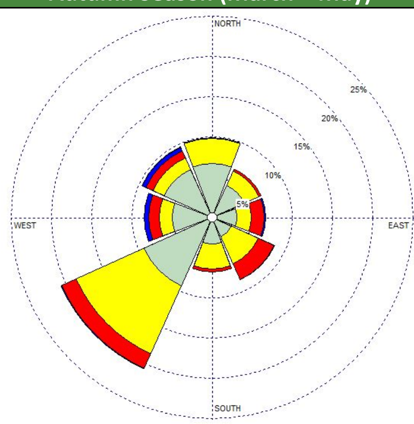
Average Wind Speed: 2.05 m/s
Calms Frequency: 17.55 %
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)



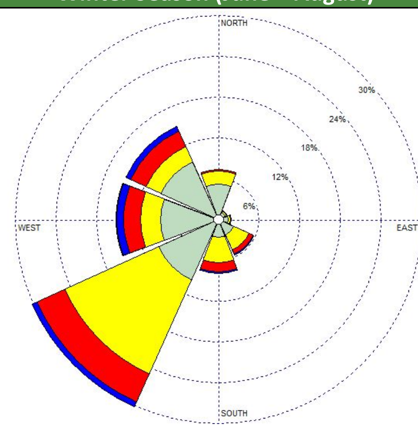
Average Wind Speed: 2.22 m/s
Calms Frequency: 16.21%
Axis Frequencies: 4%, 8%, 12%, 16% and 20%

Autumn Season (March – May)



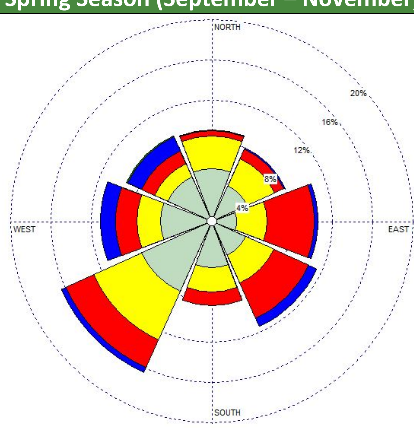
Average Wind Speed: 1.67 m/s
Calms Frequency: 22.81%
Axis Frequencies: 5%, 10%, 15%, 20%, 25%

Winter Season (June – August)



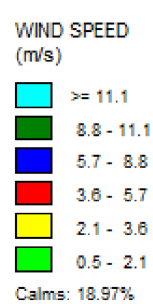
Average Wind Speed: 2.04 m/s
Calms Frequency: 15.21%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Spring Season (September – November)



Average Wind Speed: 2.25 m/s
Calms Frequency: 15.89%
Axis Frequency: 4%, 8%, 12%, 16%, 20%

Legend

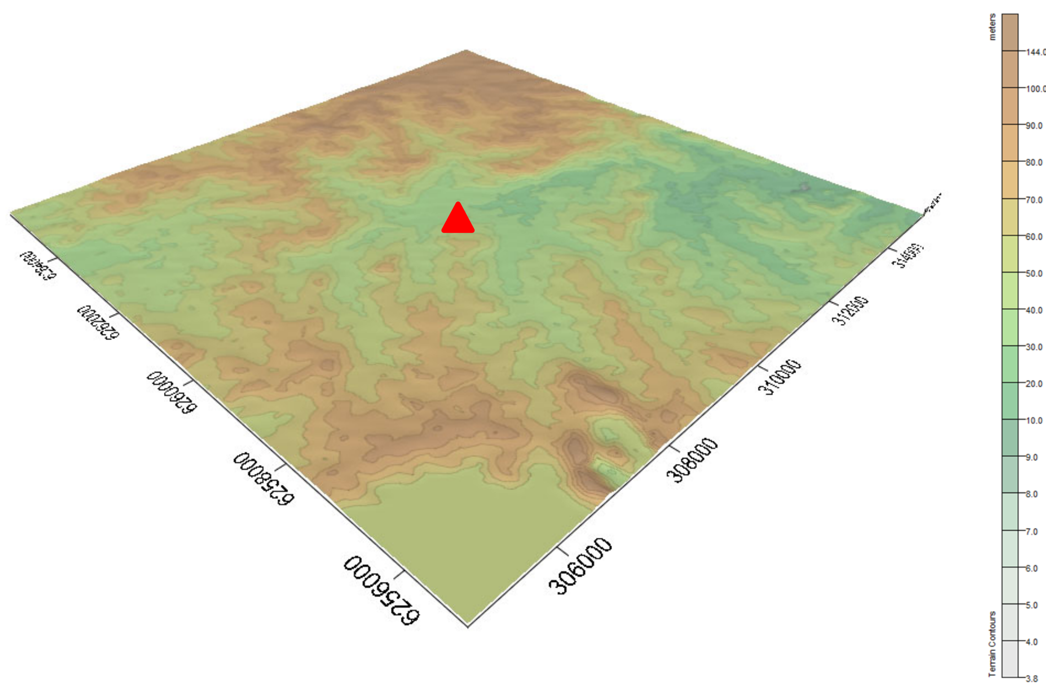


4.4 TERRAIN AND STRUCTURAL EFFECTS ON DISPERSION

The meteorological condition known as katabatic flow (or katabatic drift) is often identified as the condition under which maximum environmental impacts from primarily ground-based sources are likely to occur. Katabatic flow is simply the movement of cold air down a slope, generally under stable atmospheric conditions. Under such circumstances, dispersion of airborne pollutants is generally slow and the associated impacts can reach their peak.

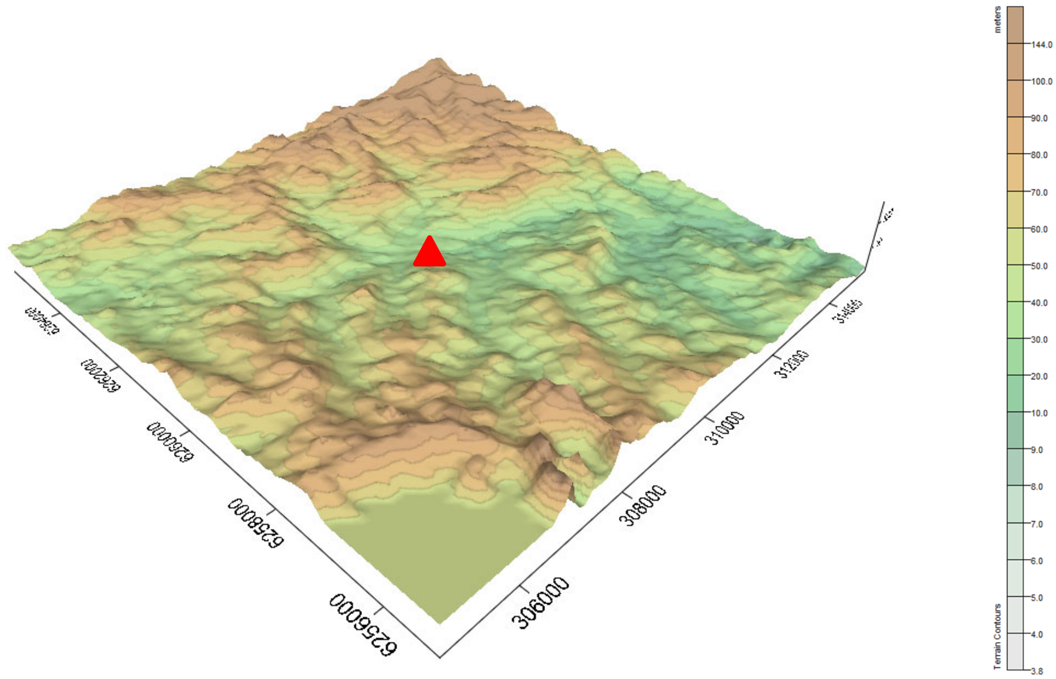
Katabatic flow is unlikely to affect the impacts of emissions from the subject site at the identified near-field receptors as katabatic flow only affects receptors that are located at a lower terrain elevation compared to the site's elevation. As such, no wind direction-specific katabatic flow would be expected to occur. The site terrain is relatively flat and lies within the same contour or lower than the surrounding receptors. Figure 4-2 with all axes equally scaled, shows the terrain as it actually exists when viewed in a conventional three dimensional view. Figure 4-3 shows the terrain with the z-axis (i.e. vertical axis) exaggerated by a factor of 10 (i.e. a given distance on the x-axis or y-axis appears three times as great on the z-axis) in order to provide a clearer description of the topography. A coloured scale bar shows elevations corresponding to the colours used in the figures. It should be noted that these figures are an approximation of the actual terrain, based on terrain information that have been digitised from local contour terrain maps.

Figure 4-2: Local topography of site, no vertical exaggeration



▲ = Site Location

Figure 4-3: Local topography of site, factor of 10 vertical exaggeration



▲ = Site Location

4.5 CLIMATE

Climate data available online at the Australian Bureau of Meteorology website for the Horsley Park Equestrian Centre AWS has monthly statistics from 1997-2022 for minimum and maximum temperature, 1967-2022 for mean rainfall and 1990-2022 for daily solar exposure.

The mean maximum temperatures were highest in January and lowest in June. The mean minimum temperatures were lowest in July and highest in January. The mean rainfall was lowest for December and highest in March. The mean daily solar exposure was highest in November and lowest in June. The monthly and annual average statistics are summarised in the table below.

Table 4-1: Climate Data from the Horsley Park Equestrian Centre AWS

Month	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Mean Rainfall (mm)	Mean Daily Solar Exposure (MJ/m2)
January	32.8	20.5	72.6	21.9
February	29.6	17.3	32.2	20.4
March	27.8	16.9	194.0	14.5
April	24.9	13.1	10.6	13.7

Table 4-1: Climate Data from the Horsley Park Equestrian Centre AWS

Month	Mean Maximum Temperature (°C)	Mean Minimum Temperature (°C)	Mean Rainfall (mm)	Mean Daily Solar Exposure (MJ/m2)
May	21.9	9.2	10.2	11.3
June	17.9	7.7	52.0	8.9
July	18.6	5.8	24.0	10.9
August	19.4	5.9	20.6	13.3
September	22.6	8.7	90.8	16.5
October	26.2	11.6	30.8	21.8
November	29.4	13.8	22.6	24.5
December	31.4	15.8	2.4	24.0
Annual	**25.2**	**12.2**	**563**	**16.8**

4.6 Background Air Quality

No air quality measurements have been undertaken specifically for this project. Instead, the nearest available air quality monitoring data was used to gain an understanding of what current pollutant levels may be around the site and to provide background air quality parameters for the assessment.

A summary of the background air quality levels from Prospect air quality monitoring station relevant to this assessment is provided in Table 4-2: .

Table 4-2: Adopted Particulate Matter Background Levels for Assessment (µg/m3)

Pollutant	Averaging Period	2017	2018	2019	2020	2021
Nitrogen Dioxide	1 Hour Max	114	99	94	82	84
	Annual Average	17.9	15.34	15.8	13.5	13.13
Carbon Monoxide	1 Hour Max	1927	1576	3670	2427	1567
	8 Hour Max	1360	1365	3196	2075	1212
PM2.5	24 Hour Max	30.1	47.5	134 (32.9)*	70.8 (37.1)*	37.3
	Number of 24 Hour Criteria Exceedances	3	4	25 (2)*	13 (3)*	2
	Annual Average	7.7	8.45	11.9 (8.8)*	8.6 (7.8)*	6.9

*Values in parathesis exclude the red summer bushfires from 26 October 2019 – 4 February 2020

Values for 2019 have been used for cumulative assessments for consistency with the 2019 met data file. Data impacted by the 2019 bushfires has been excluded.

5. IDENTIFICATION OF POTENTIAL EMISSIONS

This study assesses the impact of emissions of various pollutants from the proposed diesel generators onsite. The proposed development includes eight (8) 3000kW and one (1) 500kW diesel generators to provide emergency power during transfer to the Uninterruptable Power Source. Each diesel generator operates within an individual housing case with a vertical release point. The primary pollutants of concern from the exhaust emissions are Nitrogen oxides (NO_2), Carbon monoxide (CO), and dust ($PM_{2.5}$). The selected generator types have been specified as a CAT C175-20 (50 Hz) and CAT C18 (50 Hz) diesel generator; the specifications are provided in Attachment 1.

5.1 CONSTRUCTION PHASE

The proposal is expected to result in the following construction work activities shown in Table 5-1.

Table 5-1: Construction Activities

Component	Typical Activities
Site establishment	• Installation of erosion & sediment controls. • Establishment of construction site facilities and temporary security fencing. • Establishment of temporary site entry for construction equipment.
Services	• Relocation/extension of services including electricity, water and telecommunications. • Waste control and management system. • Traffic control staff for pedestrian and vehicle management.
Excavation	• Excavation works for building footings and foundations.
Construction	• Construction of buildings and pavement
Finishing works	• Removal of temporary works. • Decommissioning of any construction facilities. • Site clean-up and disposal of surplus waste materials.

Expected equipment includes excavators, loaders, backhoes, concrete mixer trucks, cranes and common construction hand tools and trucks.

The construction activities have the potential to generate dust (PM10 and PM2.5) and some combustion emissions (NO2).

5.2 OPERATIONAL PHASE

The proposed development includes eight (8) 3000 kW and one (1) 500kW diesel generators to provide emergency power during transfer to the Uninterruptable Power Source. Each diesel generator operates within an individual housing case with a vertical release point. The primary pollutants of concern from the exhaust emissions are NO_x (NO_2), CO, and dust ($PM_{2.5}$).

All eight (8) 3000 kW Colo Generator (CAT C175-20 50Hz) are located on ground level externally on the north-western side of the main building. The 500kW admin generator (CAT C18 50Hz) is also located externally to the south of the main building.

A maintenance regime for the testing of emergency generators will be undertaken. Details of the maintenance operations are provided in Table 7-1 and have been utilised in the assumptions of realistic maintenance scenarios modelled in this assessment.

Potential pollutants of concern from the standby generators include:

- Greenhouse gases;
- Particulate matter (PM);
- Volatile organic compounds (VOC);
- Nitrous Oxide (NOx);
- Carbon monoxide (CO); and
- Sulfur dioxide (SO2).

Providing an uninterrupted power supply to data centres is essential to the operations otherwise various components of the critical IT systems will fail.

6. CONSTRUCTION IMPACT QUALITATIVE ASSESSMENT

This Construction Impact Assessment has been conducted in accordance with *Air Quality Management (IAQM), 2014 Guidance on the assessment of dust from demolition and construction.* The risk associated with dust emissions from construction sites is related to:

- Type of activities being undertaken (number of vehicles and plant etc);
- Duration of activities;
- Size of the site;
- Meteorological conditions;
- Proximity to receptors; and
- Adequacy of the mitigation measures and sensitivity of the receptors.

This construction air quality assessment has been conducted utilising the following steps:

Step 1 – screening assessment
Step 2 – dust risk assessment
Step 3 – Management strategies

Step 1- An assessment will normally be required where there is a human receptor within 350m of the site. As there are residential receptors within 350 m of the property boundary further assessment is considered warranted.

Step 2A – the potential dust emission magnitude is shown in the following table with bolded values being those that represent the proposed development.

Table 6-1: Magnitude of Construction Emissions

Magnitude	Demolition	Earthworks	Construction
Small	**Total building volume <20,000 m^3**	Total site area <2,500 m^2	Total building volume <25,000 m^3
Medium	Total building volume 20,000 m^3 – 50,000 m^3	Total site area 2,500 m^2 – 10,000 m^2	Total building volume 25,000 m^3 – 100,000 m^3
Large	Total building volume >50,000 m^3	**Total site area >10,000 m^2**	**Total building volume >100, 000 m^3**

Step 2B - The sensitivity is defined in the following table.

Table 6-2: Receptor Sensitivity

Receptor ID	Address	Approximate distance to site boundary (m)	Type of Receptor	Receptor Sensitivity	Representative number of receptors	Sensitivity based on proximity
R1	20A Edna Ave Toongabbie	45	Residential	High	1-10	Low
R2	53 Station Road, Toongabbie	25	Residential	High		
R3	1 Mccoy St, Toongabbie	78	Residential	High	10-100	Low
R4	15 Carter St, Seven Hills	68	Residential	High		
R5	7 Carter St, Seven Hills	80	Residential	High		
R6	2 Tollis Pl, Seven Hills	32	Commercial	Medium	10-100	Low
R7	8 Tollis Pl, Seven Hills	23	Commercial	Medium		
R8	16 Distribution Pl, Seven Hills	128	Commercial	Medium	10-100	Low
R9	20 Distribution Pl, Seven Hills	129	Commercial	Medium		
R10	4 Tucks Road, Seven Hills	330	Residential	Medium	1-10	Low
R11	McCoy Park, 17 Mimosa Ave, Seven Hills	94	Recreational	Medium	10-100	Low
R12	70 Greenmeadows Cres, Toongabbie	655	Residential	High	10-100	Low
R13	9 Station Road, Toongabbie	465	Residential	High		
R14	12 Station Road, Toongabbie	610	Residential	High		
R15	2C Fuller St, Seven Hills	480	Educational	High	10-100	Low
R16	18 Marcia Street, Toongabbie	620	Residential	Medium	10-100	Low
R17	41 Best Road, Seven Hills	675	Educational	High	10-100	Low
R18	56 Best Road, Seven Hills	760	Educational	High	10-100	Low

Table 6-2: Receptor Sensitivity

Receptor ID	Address	Approximate distance to site boundary (m)	Type of Receptor	Receptor Sensitivity	Representative number of receptors	Sensitivity based on proximity
R19	Best Road Reserve, Best Road, Seven Hills	650	Recreational	Medium	10-100	Low
R20	11 Powers Road, Seven Hills	485	Industrial	Medium	10-100	Low

Based on the above tables the risk from earthworks and construction is low. Note: All demolition has been complete and covered by SYD09 DA.

Step 3: The following construction mitigation measures are recommended.

A Construction Environmental Management Plan (CEMP) is recommended to be prepared that documents the environmental aspects of the construction phase and establishes procedures to manage any potential impacts. It is recommended an Air Quality Control Procedure be presented in the CEMP which sets out the procedure for managing and monitoring air emissions during construction. The following is a summary of the control measures to be provided in the procedure. Local weather conditions should be taken into account in determining the level and suitability of controls required.

Control Measures

- 24hr air monitoring is to be implemented on site using on-site monitoring units;
- Monitor local weather conditions and cease dust generating operations when conditions result in visible dust emissions, and implement mitigation measures or until weather conditions improve;
- Erection of wind breaks such as fences or vegetative buffers at the site boundary;
- Locate stockpiled materials away from drainage paths, easement, kerb, or road surface, and near existing wind breaks such as trees and fences;
- Dust suppression/wind breaks on stockpiles;
- Limit stockpile height to 5 m (maximum) and size;
- Vehicles leaving the site to be cleaned of dirt and other materials to avoid tracking onto public roads;
- Enforce appropriate speed limits for vehicle on site. Recommended speed limit is <15 km/hr;
- Cover all loads entering and leaving the site; and
- Inspect the site daily using a Site Dust Control Checklist to aid with the implementation of air quality control measures.

7. OPERATIONAL IMPACT QUANTITATIVE ASSESSMENT

The air dispersion model AERMOD was used for the prediction of off-site impacts associated with the air emissions from the site's operations. AERMOD uses air dispersion based on planetary boundary layer turbulence structure and scaling concepts. The AERMOD model replaced AUSPLUME as the air dispersion model accepted by the Victorian EPA in January 2014 and is a suitable model to use for this air assessment.

The model was used to estimate the concentration impacts on receptors for each hour of input meteorology. Air emissions from the site's operations can be considered to have been adequately represented using the modelling program.

During normal operation the mains switch board provide power to the data storage cells are through a dedicated primary transformer. The diesel generators require operation during maintenance and emergencies only.

Maintenance testing will only occur during the hours of 7am -6pm Mon – Fri. This has been assumed in the model.

7.1 MODEL SELECTION

It is in the general experience of Benbow Environmental that AERMOD is an accepted air dispersion model by the NSW EPA. We have had a significant number of AERMOD air quality assessments reviewed by the NSW EPA and accepted. AUSPLUME v. 6.0 is the approved dispersion model for use in most applications in NSW in the NSW EPA Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales. AUSPLUME was last updated in 2004. AERMOD is considered a more acceptable model in the industry as it is routinely updated by the USE EPA and uses advanced algorithms to take into account impacts that cause the plume to behave in a non-gaussian manner. AERMOD is considered to be more conservative than dispersion model CALPUFF (also recommended in the approved methods) as demonstrated in Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia' .

7.2 MODELLING SCENARIOS

Three scenarios have been assessed. Scenarios 1 and 2 represent realistic operations during routine maintenance (maintenance schedule is provided in Table 7-1) and Scenario 3 assesses a worst-case scenario based where all generators are operating due to the event of a blackout. The likelihood of this event is discussed in section 7.2.1.

- Scenario 1: Testing – 1 generator operating at 75% for 35 mins
  - Nitrogen dioxide (1 hour)

    Scenario 1 reflects the 70% load quarterly test plan. 70% load emission data is not available, 75% mass emission rate was based on operations for 35 mins within 1hour.

- Scenario 2: Peak testing – 1 generator operating at 100% for 65 mins
  - Nitrogen dioxide (1 hour)
  - $PM_{2.5}$ (24 hour)

- $PM_{2.5}$ (annual)
- CO (24 hour)
- CO (8 hour)

- Scenario 3: Emergency operations (worst case) – All generator operating at 100% for 100% of the time
  - Nitrogen dioxide (1 hour)
  - $PM_{2.5}$ (24 hour)
  - CO (24 hour)
  - CO (8 hour)

Note: The annual averaging period is not included for this scenario, as the results are not considered to be representative, see section 7.2.1.

Table 7-1: Maintenance testing schedule

MSFT Global PM Standards		Alternate Test Plan		SYD01 19.2MW Colo			
Month	*% load*	Test	Run duration (min)	Colo Generator	Admin Generator	Mechanical Generator	Total Min
1	*no-load*	Monthly	10	8	1	0	90
2	*no-load*	Monthly	10	8	1	0	90
3	*70*	Quarterly	35	8	1	0	315
4	*no-load*	Monthly	10	8	1	0	90
5	*no-load*	Monthly	10	8	1	0	90
6	*70*	Quarterly	35	8	1	0	315
7	*no-load*	Monthly	10	8	1	0	90
8	*no-load*	Monthly	10	8	1	0	90
9	*70*	Quarterly	35	8	1	0	315
10	*no-load*	Monthly	10	8	1	0	90
11	*no-load*	Monthly	10	8	1	0	90
12	*100*	Annual	65	8	1	0	585
Power Interruption Test							

Total (min)	2250
Total (Hrs)	37.5

7.2.1 Likelihood of worst case scenario

Under standard operating conditions the site will receive power from the mains grid. A worst case scenario where all generators would be in operation concurrently would be during a power outage. Scenario 3 assesses this emergency operations where all generators are operating at 100% for 100% of the time. The modelling of the generators operating 100% of the time has been undertaken as a worst case.

The 'State of the energy market 2021' report published by Australian Energy Regulator (AER) - system average interruption duration index (SAIDI) and the system average interruption frequency index (SAIFI) reported that the average electricity customer experienced 1.66 total interruptions to supply (0.7% fewer than the previous year) and 350.1 total minutes off supply (27% more than the previous year, and includes both planned and unplanned minutes). The figures from this report regarding interruptions and minutes off supply are reproduced below as figures. This higher amount off supply was largely driven by the impact of bushfires and planned work by Ausgrid pausing all live work.

There are 525,600 minutes in an average year. A supply loss of ~350 minutes (less than 6 hours) represents 0.069% of the year. Based on this, despite predicted exceedances of the NO_2 impact assessment criteria being likely during operation of all standby generators concurrently, it is not likely that this worst-case scenario would occur in a typical year.

Figure 7-1: Reproduced Figure 3.32 from 'State of the energy market 2021' report published by Australian Energy Regulator (AER) - system average interruption frequency index (SAIFI).

Figure 3.32 Interruptions to supply (SAIFI) – electricity distribution networks

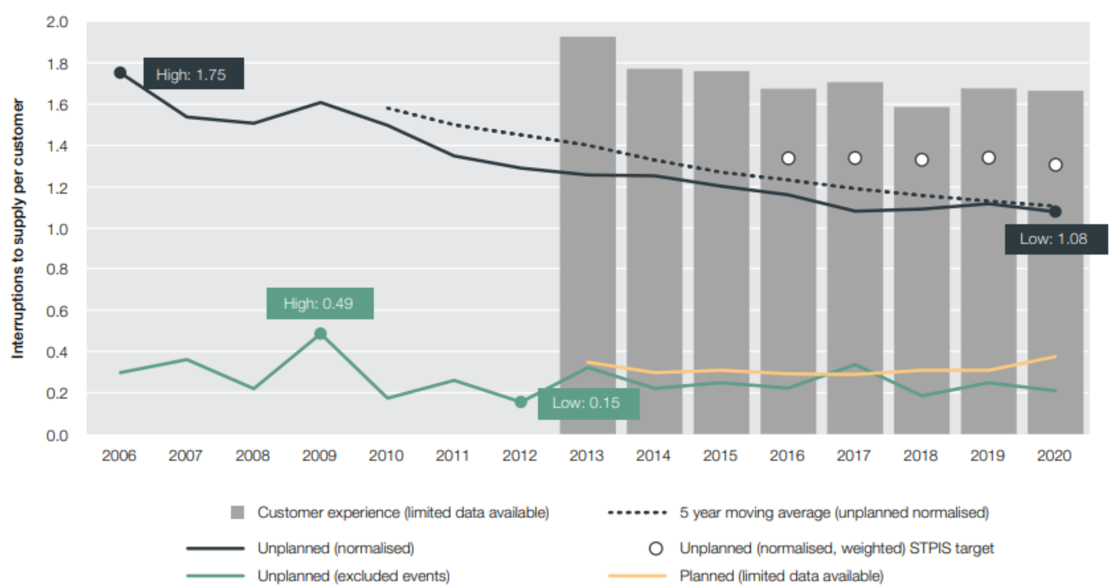
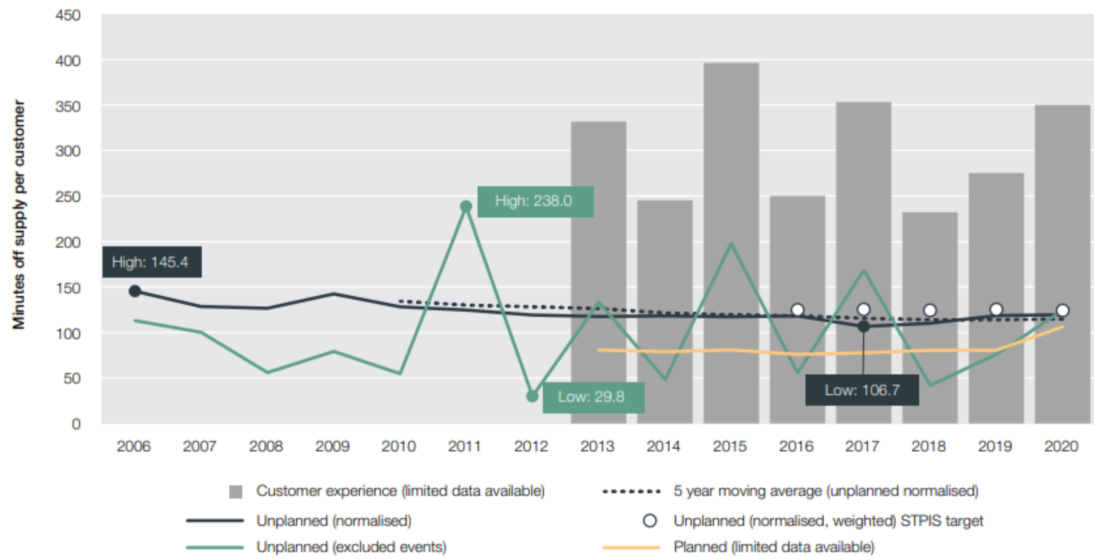


Figure 7-2: Reproduced Figure 3.33 from 'State of the energy market 2021' report published by Australian Energy Regulator (AER) - system average interruption duration index (SAIDI).

Figure 3.33 Minutes off supply (SAIDI) – electricity distribution networks



7.3 MODEL INPUTS

7.3.1 Emission Sources

7.3.1.1 Emission characteristics

The following table summarises the exhaust stack emissions data provided by the technical data sheet for the selected generator type which provides the emission data used in AERMOD to predict ground level concentrations. For the purposes of this assessment, conversion of NO_x to NO_2 has been assumed at 100% and PM has been assumed to be 100% $PM_{2.5}$.

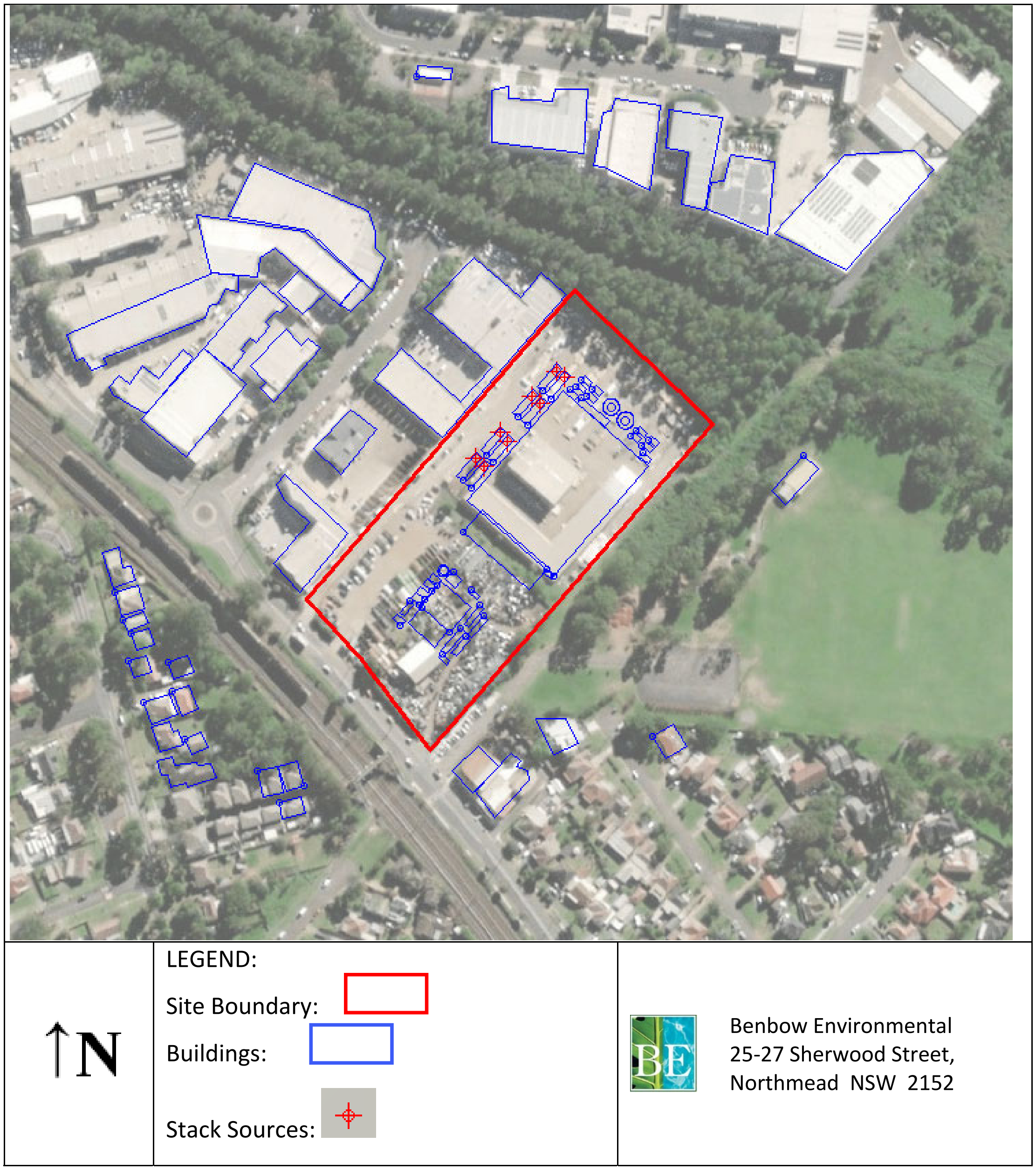
Table 7-2: Summary of emission characteristics

Characteristic	Colo Generator (CAT C175-20 50Hz)		Admin generator (CAT C18 50Hz)	
Load	100%	75%	100%	75%
Stack Height; m	20	20	6	6
Exhaust Stack Diameter; m	0.5	0.5	0.152	0.152
Exhaust Velocity; m/s	59.78	52.28	101.86	82.39
Wet exhaust Gas flow rate; Am^3/min	704.5	604.1	110.9	89.7
Dry exhaust Gas flow rate; Nm^3/min	240.3	215.8	33.5	28.9
Exhaust Temperature, (°C)	460.7	433.4	548.7	503.4
NO_x, mg/Nm^3	2816	1952.9	2112	1840.3
NO_x, g/s	11.3	4.10	1.18	0.517
CO, mg/Nm^3	459.1	788.1	385.9	189.8
CO, g/s	1.84	1.65	0.22	0.053
PM, mg/Nm^3	57.2	18.9	22.1	13.9
PM, g/s	0.026	0.040	0.012	0.0039

Note: 75% emission mass emission rate is based on operating 35 mins in an hour in accordance with the maintenance schedule

The generator stacks are modelled as a point sources that are wake-affected. The nearby buildings have been included in the model to predict for their interferences with the trajectory of emissions. Figure 7-3 shows the arrangement of the modelled source and nearby buildings.

Figure 7-3: Arrangement of Modelled Sources



7.3.1.2 NOx to NO2 conversion

The assessment of NO_2 impacts is complex as the NOx released from the stack undergoes oxidation with atmospheric ozone. The oxidation of NO to NO_2 is assessable by three methods outlined by the Approved Methods. Method 1, method 2, and Method 3 range from simplistic to more detailed. All three will be used for comparison in this assessment.

7.3.1.3 VOCs

Site specific VOC data is not available. Using table 43 of Australian Government National Pollutant Inventory Emission estimate technique manual for Combustions engines Version 3.0 June 2008 for stationary engines greater than 450 kW the following VOC emission factors have been used to calculate emission rates and compared against site specific NOx data provided for the generators assessed and compared as a ratio to the approved methods criteria.

Table 7-3: Emission Factors for VOCs and NOx

Substance	Emission factor scientific notation (kg/m³)	Emission Rate (g/s)	Approved Methods Criteria (1hr) (mg/m3)	Ratio of emission rate to criteria
Acetaldehyde	0.00041	9.31E-05*	0.042	2.22E-03
Benzene	0.013	2.95E-03*	0.029	1.02E-01
Formaldehyde	0.0013	2.95E-04*	0.02	1.48E-02
Toluene	0.0046	1.04E-03*	0.36	2.90E-03
Xylenes	0.0032	7.27E-04*	0.19	3.83E-03
NOx	(Based on site data)	11.3	0.246	4.59E+01

*based on data fuel consumption rate of 817.7L/hr presented in the data sheet for 100% consumption

As can be seen in the above table NOx has the highest ratio of emission rate to criteria therefore will be the most critical pollutant regarding compliance. No further assessment of VOCs is considered warranted.

7.3.2 Meteorological Input Data

Prognostic meteorological data for the year 2019 were obtained from Lakes Environmental Services and pre-processed using AERMET, details are provided in Attachment 2. The resultant upper air and surface data files were input to AERMOD.

7.3.2.1 WRF

The Weather Research and Forecasting (WRF) Model is a next-generation mesoscale numerical weather prediction system designed as a collaborative effort between the American National Centre for Atmospheric Research (NCAR) and other meteorological specialist organisations. It was created for both atmospheric research and operational forecasting applications and serves a wide range of meteorological applications across scales from tens of meters to thousands of kilometres.

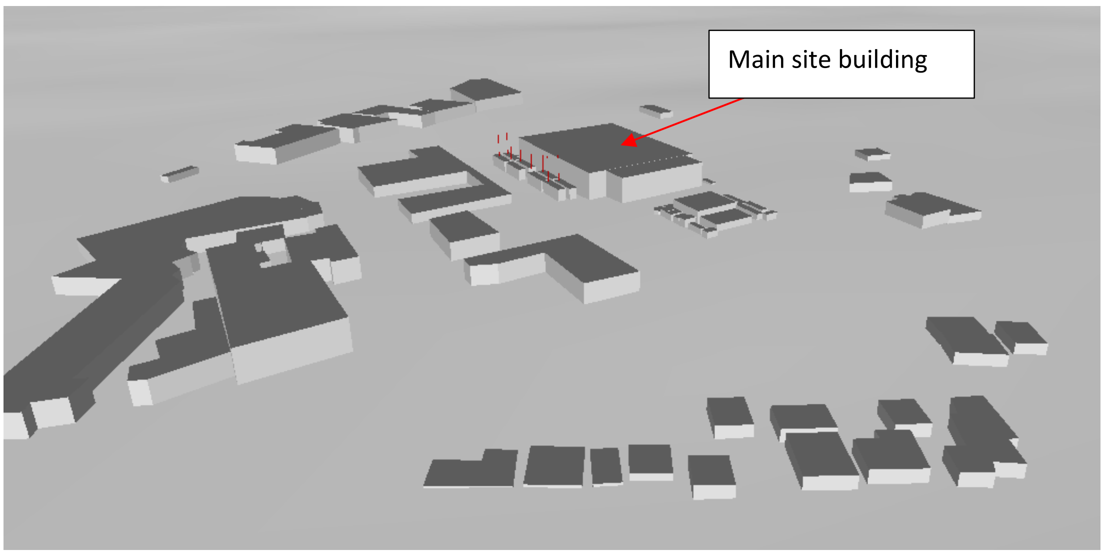
A prognostic meteorological data file was created by Lakes Environmental using the WRF model.

7.3.3 Building Wake Effects

Building-wake effects occur when emissions from a source are hindered as they move from winds "washing" the emissions down to the nearest building structure. This phenomenon can enhance off-site impacts (depending on the location of the building structure, wind direction and the source).

Building-wake effects are considered in the air dispersion modelling phase of the assessment by representing all buildings and structures on and around the site as structures in the model using the BPIP/PRIME algorithm. Buildings input into the model are shown in the following figure.

Figure 7-4: Buildings input in model



7.3.4 Prognostic Wind Data

Seasonal wind rose plots for this site using 2019 Lakes Environmental Services prognostic surface data files were input to AERMOD which have been included in Figure 4-1.

In 2019 the average wind speed was 3.06 m/s with an average calms frequency of 1.43%. The wind direction predominately arrived to the site from the north 18% of the time. North-west and south-west winds occurred 18% of the time, south-east winds 12% of the time and north-east winds 11% of the time. The remainder were 10% or less frequent.

In summer the average wind speed was 3.23 m/s with an average calms frequency of 1.25%. Northerly winds were the most prevalent at 19%, north-easterly and south-easterly winds occurred 18% of the time, easterly winds were 14% frequent and southerly winds were 13% frequent. The remainder were less than 8% frequent.

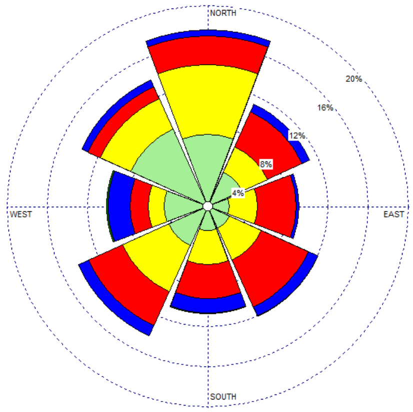
The average wind speed in autumn was 2.80 m/s with a calms frequency of 1.45%. North-easterly winds were the most prevalent at 18%. Northerly and south-westerly winds occurred at 17% frequency and north-easterly winds occurred at 11% frequency. The remainder were 10% frequent or less.

In winter the average wind speed was 2.97 m/s with a calms frequency of 1.72%. South-westerly winds dominated this period at 23%. North-westerly, westerly and northerly winds occurred at frequencies of 17%, 16% and 15% respectively. Southerly winds occurred at 13%. The remainder were less than 8% frequent.

The average wind speed in spring was 3.25 m/s with a calms frequency of 1.28%. During this time, the frequency of each direction was quite similar. The most prevalent was northerly at 19% frequent, but the remainder had a frequency between 9-14%.

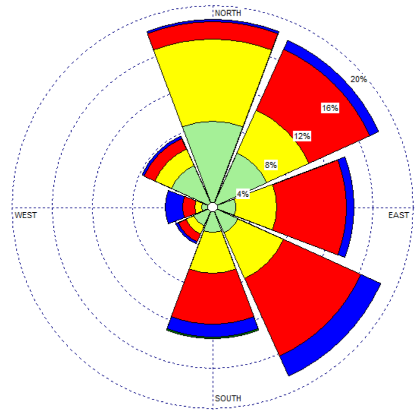
Figure 7-5: Wind rose plots for the Prognostic Surface Data File Bureau of Meteorology (2019)

All Seasons



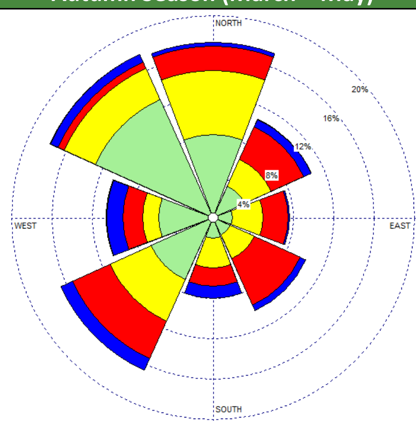
Average Wind Speed: 3.06 m/s
Calms Frequency: 1.43 %
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)



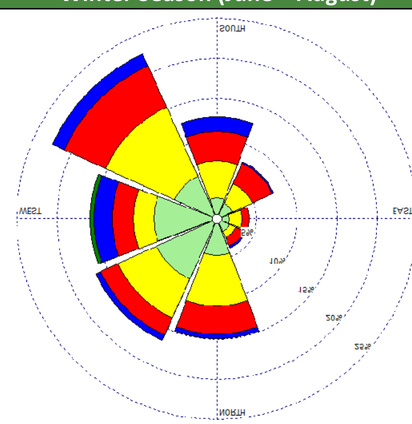
Average Wind Speed: 3.23 m/s
Calms Frequency: 1.25%
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Autumn Season (March – May)



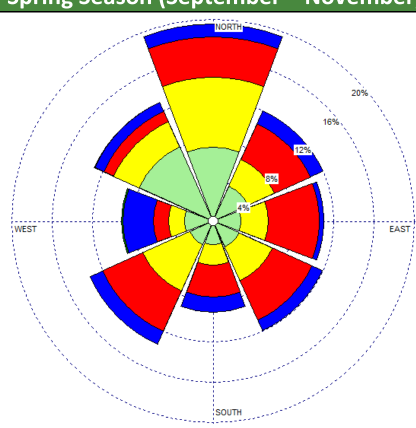
Average Wind Speed: 2.80 m/s
Calms Frequency: 1.45%
Axis Frequencies: 4%, 8%, 12%, 16% and 20%

Winter Season (June – August)



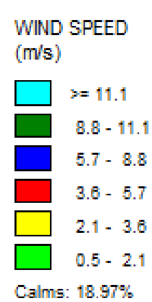
Average Wind Speed: 2.97 m/s
Calms Frequency: 1.72%
Axis Frequencies: 6%, 12%, 18%, 24%, 30%

Spring Season (September – November)



Average Wind Speed: 3.25 m/s
Calms Frequency: 1.28%
Axis Frequency: 4%, 8%, 12%, 16%, 20%

Legend



7.3.5 Terrain Effects on Air Impacts through Katabatic Air Drainage

As previously mentioned, given the generally flat nature of the terrain elevation surrounding the site, minimal local katabatic air drainage effects are anticipated and would not be expected to significantly affect the air impact results at the surrounding residences, industrial premises or public recreation areas. Terrain was input into the model utilising STRM1 (Global ~30 m) Version 3 map data.

7.3.6 Grid

The site domain used in the model was 8 km x 8 km centred on the site. Two uniform cartesian grid receptor networks input details are as follows:

Table 7-4: Uniform Cartesian Grid Receptor Network Inputs

	UCART1		UCART2	
	X-Axis	Y-Axis	X-Axis	Y-Axis
Centre Coordinates	310035.81	6260320.89	310030.00	6260436.55
No of Points	23	21	12	12
Spacing	113.85	103.86	30	32
# Receptors	483		144	

7.4 MODEL RESULTS

Background levels were selected from 2019 local air quality data for consistency with the met data file. Background levels are combined with predicted incremental impacts from modelling to assess the cumulative impact for compliance with the criteria.

All generators were assessed individually for impacts on receptors for both Scenario 1 and Scenario 2. Generator 6 (as identified in the image below) is reflective of worst-case impacts and the results for this generator are provided in this section. Results for each other generator are available on request. Scenario 3 assesses all generators operating simultaneously.

7.4.1 Scenario 1 – Maintenance testing

7.4.1.1 NOx (NO_2) 1 hour averaging period

7.4.1.1.1 100th Percentile Assessment

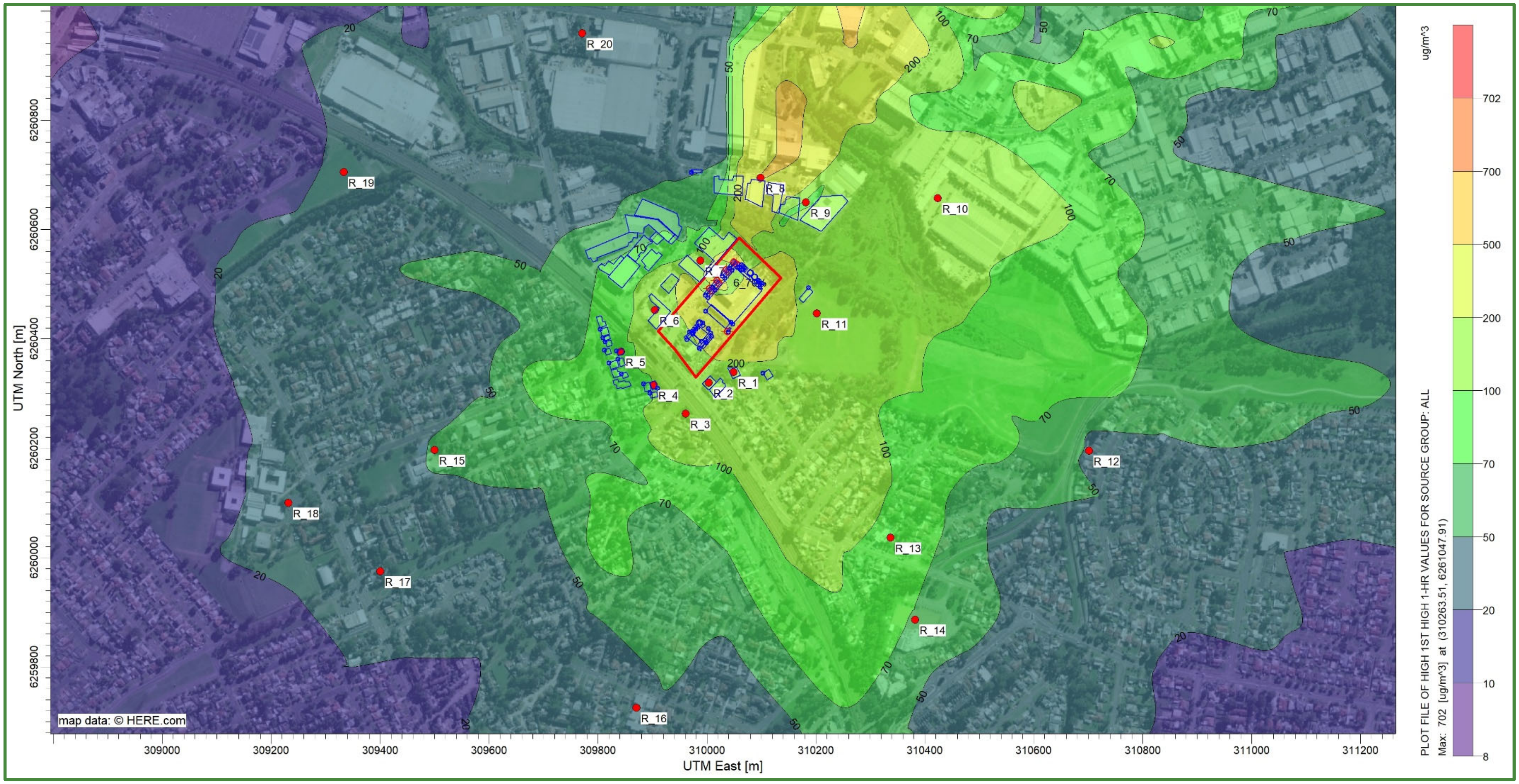
Table 7-5: Scenario 1: NO_2 Impacts at Sensitive Receptors for 100th Percentile

Receptor	Method 1				Method 2				Method 3			
	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2
R1	12/06/2019 18:00	56.1	160.2	216.3	21/11/2019 8:00	67.7	115.4	169.6	21/11/2019 8:00	67.7	115.4	165.8
R2	2/05/2019 7:00	29.1	152.8	181.8	21/11/2019 8:00	67.7	66.6	134.4	2/05/2019 7:00	29.1	152.8	126.1
R3	2/05/2019 7:00	29.1	96.5	125.6	5/03/2019 18:00	22.3	88.1	101.5	19/11/2019 8:00	92.9	7	98.8
R4	21/05/2019 18:00	57	94.8	151.8	24/10/2019 18:00	54.4	91.8	103	24/10/2019 1 8:00	54.4	91.8	122.4
R5	24/05/2019 18:00	61.4	97.5	158.9	19/11/2019 8:00	92.9	2.2	95.1	24/05/2019 18:00	61.4	97.5	123.3
R6	19/07/2019 18:00	48.7	104.6	153.3	4/02/2019 17:00	25.8	101.3	127.1	4/02/2019 17:00	25.8	101.3	114.9
R7	26/09/2019 9:00	38.7	110.8	149.6	7/12/2019 10:00	3.8	110.8	114.6	28/08/2019 12:00	13.5	127.4	114.4
R8	16/07/2019 7:00	38.2	522.1	560.2	16/07/2019 7:00	38.2	522.1	98.4	19/11/2019 8:00	92.9	3.9	96.3
R9	11/06/2019 7:00	41.6	83.2	124.8	19/11/2019 8:00	92.9	3.7	96.6	19/11/2019 8:00	92.9	3.7	96
R10	15/08/2019 7:00	34.5	119.7	154.2	19/11/2019 7:00	94.1	0.3	94.4	5/09/2019 7:00	51.2	85.8	105.6
R11	12/09/2019 18:00	55.2	156.5	211.7	19/11/2019 8:00	92.9	6.8	99.7	12/09/2019 18:00	55.2	156.5	154.6

Table 7-5: Scenario 1: NO_2 Impacts at Sensitive Receptors for 100th Percentile

Receptor	Method 1				Method 2				Method 3			
	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2
R12	12/09/2019 18:00	55.2	41.8	97	19/11/2019 7:00	94.1	0.4	94.5	19/11/2019 7:00	94.1	0.4	94.4
R13	2/09/2019 7:00	51.8	79	130.7	19/11/2019 7:00	94.1	10.6	104.7	19/11/2019 7:00	94.1	10.6	102.6
R14	19/11/2019 7:00	94.1	11.9	106	19/11/2019 7:00	94.1	11.9	106	19/11/2019 7:00	94.1	11.9	103.6
R15	24/05/2019 18:00	61.4	53.8	115.2	19/11/2019 7:00	94.1	0.3	94.4	24/05/2019 18:00	61.4	53.8	95.6
R16	19/11/2019 7:00	94.1	0.9	95	19/11/2019 7:00	94.1	0.9	95	19/11/2019 7:00	94.1	0.9	94.9
R17	19/11/2019 7:00	94.1	0.3	94.4	19/11/2019 7:00	94.1	0.3	94.4	19/11/2019 7:00	94.1	0.3	94.3
R18	19/11/2019 7:00	94.1	0.3	94.4	19/11/2019 7:00	94.1	0.3	94.4	19/11/2019 7:00	94.1	0.3	94.3
R19	19/11/2019 7:00	94.1	0.4	94.5	19/11/2019 7:00	94.1	0.4	94.5	19/11/2019 7:00	94.1	0.4	94.4
R20	19/11/2019 7:00	94.1	0.4	94.5	19/11/2019 7:00	94.1	0.4	94.5	19/11/2019 7:00	94.1	0.4	94.5

Figure 7-6: Isopleth for NOx – 100th Percentile (without background)



7.4.2 Scenario 2 - Peak Emissions

7.4.2.1 NOx (NO_2) 1 hour

7.4.2.1.1 100th Percentile Assessment

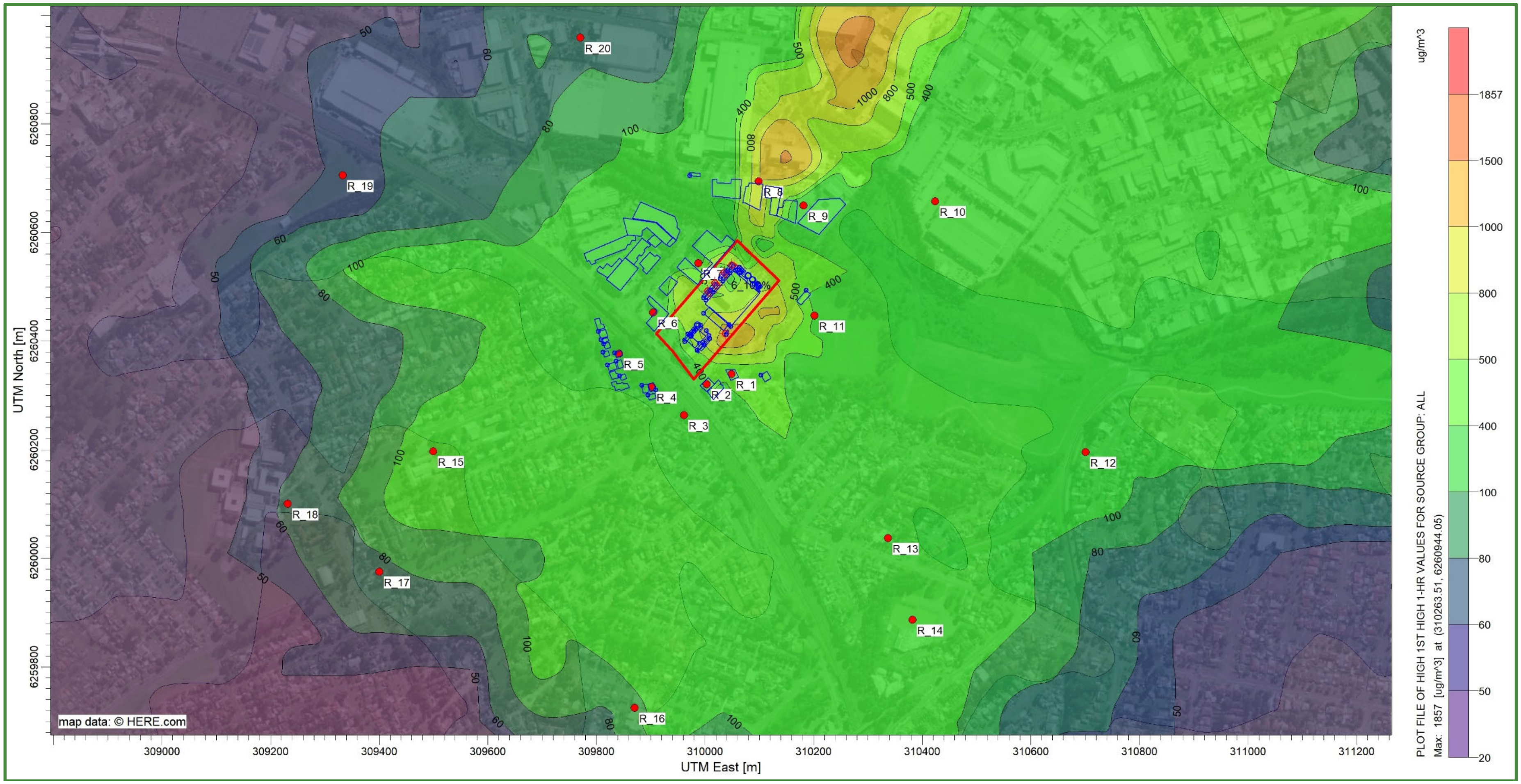
Table 7-6: Scenario 2: NO_2 Impacts at Sensitive Receptors for 100th Percentile

Receptor	Method 1				Method 2				Method 3			
	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2
R1	26/01/2019 7:00	35.6	443.2	478.8	21/11/2019 8:00	67.7	303.9	188.5	30/10/2019 18:00	20.6	386.8	349.4
R2	2/05/2019 7:00	29.1	394.3	423.4	21/11/2019 8:00	67.7	176.9	175.8	30/06/2019 7:00	0	369.6	306.7
R3	11/07/2019 8:00	9.8	288.6	298.3	21/11/2019 9:00	16.4	112.2	128.6	11/07/2019 8:00	9.8	288.6	249.3
R4	13/05/2019 18:00	40.3	264.7	305	30/10/2019 17:00	14.8	217.6	157.2	24/10/2019 18:00	54.4	236.2	229.3
R5	24/05/2019 18:00	61.4	236.1	297.5	30/12/2019 17:00	14.6	174.4	189	24/05/2019 18:00	61.4	236.1	211.3
R6	31/10/2019 18:00	5.6	327.6	333.2	15/01/2019 15:00	18.1	246.5	221.6	31/10/2019 18:00	5.6	327.6	284.1
R7	28/08/2019 12:00	13.5	339.2	352.7	7/12/2019 12:00	9.3	208.3	185.2	28/08/2019 12:00	13.5	339.2	282.1
R8	16/07/2019 7:00	38.2	975	1013.2	16/07/2019 7:00	38.2	975	143.7	4/06/2019 9:00	29.9	123.8	121.5
R9	11/06/2019 7:00	41.6	207.7	249.3	4/12/2019 17:00	37.4	93.8	131.2	14/06/2019 10:00	19.7	169.3	144.9
R10	15/08/2019 7:00	34.5	310.9	345.4	6/12/2019 18:00	44.2	63.3	107.5	5/09/2019 7:00	51.2	264.6	219.2
R11	12/09/2019 18:00	55.2	398	453.3	21/12/2019 16:00	34.1	167.9	178.4	12/09/2019 18:00	55.2	398	308

Table 7-6: Scenario 2: NO_2 Impacts at Sensitive Receptors for 100th Percentile

Receptor	Method 1				Method 2				Method 3			
	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2
R12	19/07/2019 7:00	36.5	131.9	168.4	19/11/2019 7:00	94.1	1	95.1	12/09/2019 18:00	55.2	103.6	121
R13	21/05/2019 7:00	33.5	192.9	226.4	19/11/2019 7:00	94.1	26.6	120.7	19/11/2019 7:00	94.1	26.6	115.4
R14	21/05/2019 7:00	33.5	139.1	172.6	19/11/2019 7:00	94.1	30.1	124.2	23/07/2019 18:00	15.3	140.4	131.9
R15	24/05/2019 18:00	61.4	136.8	198.2	19/11/2019 7:00	94.1	0.7	94.8	24/05/2019 18:00	61.4	136.8	148.3
R16	2/05/2019 7:00	29.1	87.6	116.6	19/11/2019 7:00	94.1	2.3	96.4	19/11/2019 7:00	94.1	2.3	95.9
R17	24/05/2019 18:00	61.4	58.5	119.9	19/11/2019 7:00	94.1	0.6	94.8	24/05/2019 18:00	61.4	58.5	98.6
R18	19/07/2019 18:00	48.7	62.6	111.3	19/11/2019 7:00	94.1	0.6	94.7	19/11/2019 7:00	94.1	0.6	94.6
R19	19/11/2019 7:00	94.1	0.9	95	19/11/2019 7:00	94.1	0.9	95	19/11/2019 7:00	94.1	0.9	94.9
R20	5/07/2019 9:00	50.9	68.9	119.8	19/11/2019 7:00	94.1	1	95.1	19/11/2019 7:00	94.1	1	94.9

Figure 7-7: Isopleth for NOx – 100th Percentile (without background)



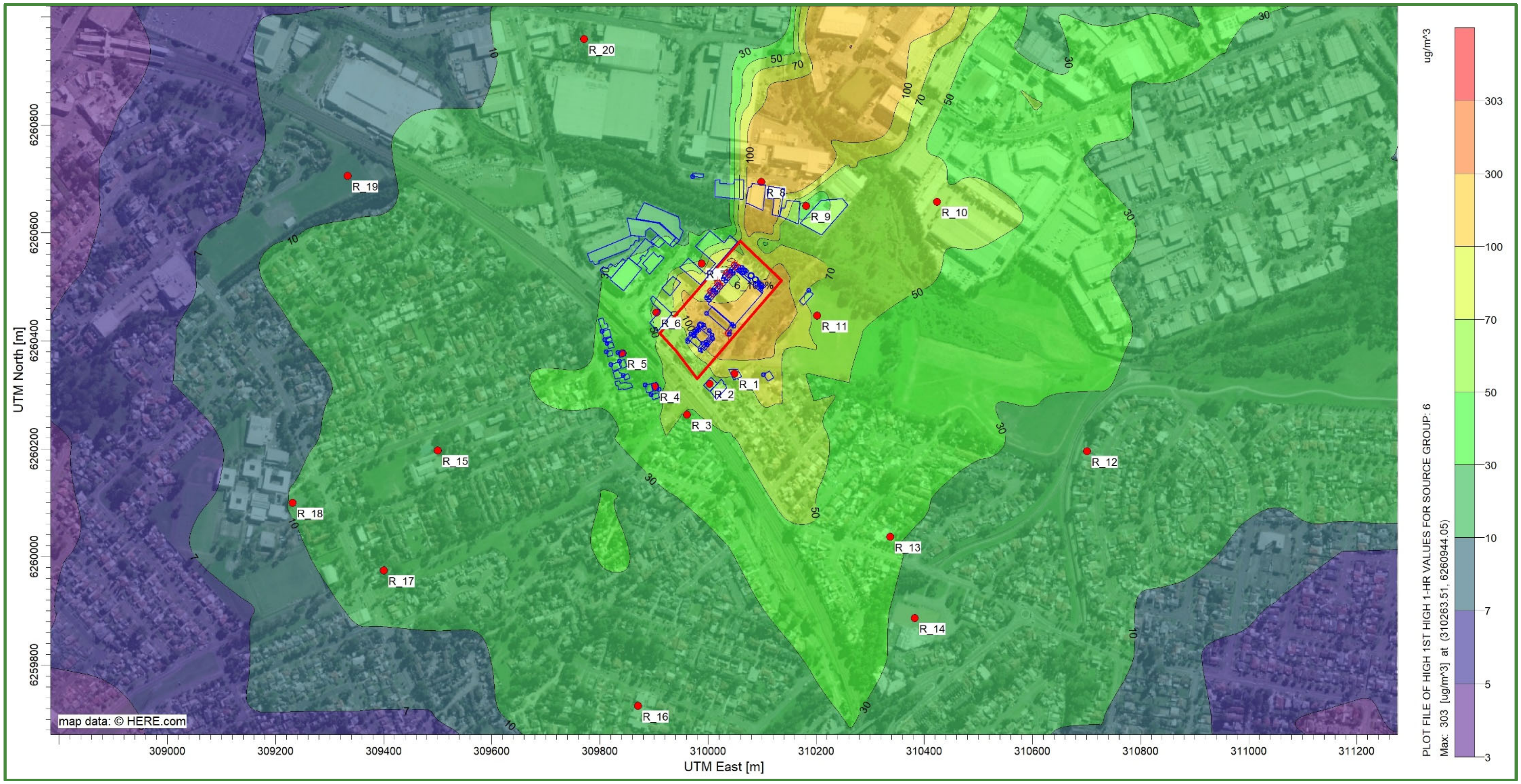
7.4.2.2 Carbon monoxide (CO) 1 hour and 15 minute conversion

Table 7-7: CO Impacts at Sensitive Receptors for 100th Percentile (1 hour)

Receptor ID	Incremental Impact (µg/m³)	Background (µg/m³)	Cumulative Impact (µg/m³)	Criteria (µg/m³)	Complies? (Yes/no)
R1	72.29	3670	3742.29	30000	Yes
R2	64.31	3670	3734.31	30000	Yes
R3	47.07	3670	3717.07	30000	Yes
R4	43.17	3670	3713.17	30000	Yes
R5	38.50	3670	3708.5	30000	Yes
R6	53.43	3670	3723.43	30000	Yes
R7	55.33	3670	3725.33	30000	Yes
R8	159.02	3670	3829.02	30000	Yes
R9	33.87	3670	3703.87	30000	Yes
R10	50.70	3670	3720.7	30000	Yes
R11	64.92	3670	3734.92	30000	Yes
R12	21.52	3670	3691.52	30000	Yes
R13	31.46	3670	3701.46	30000	Yes
R14	22.90	3670	3692.9	30000	Yes
R15	22.31	3670	3692.31	30000	Yes
R16	14.28	3670	3684.28	30000	Yes
R17	12.14	3670	3682.14	30000	Yes
R18	10.21	3670	3680.21	30000	Yes
R19	8.45	3670	3678.45	30000	Yes
R20	11.23	3670	3681.23	30000	Yes

The highest 1 hour predicted impact impact of CO occurs at R8. This is converted to a 15 minute prediction usuing the formula outlined in Section 3.3. The 15 minute predicted incremental impact would be 209.8 µg/m³ and complies with the NSW EPA criteria of 100,000 µg/m³.

Figure 7-8: Isopleth for CO 1 hour – 100th Percentile (without background)

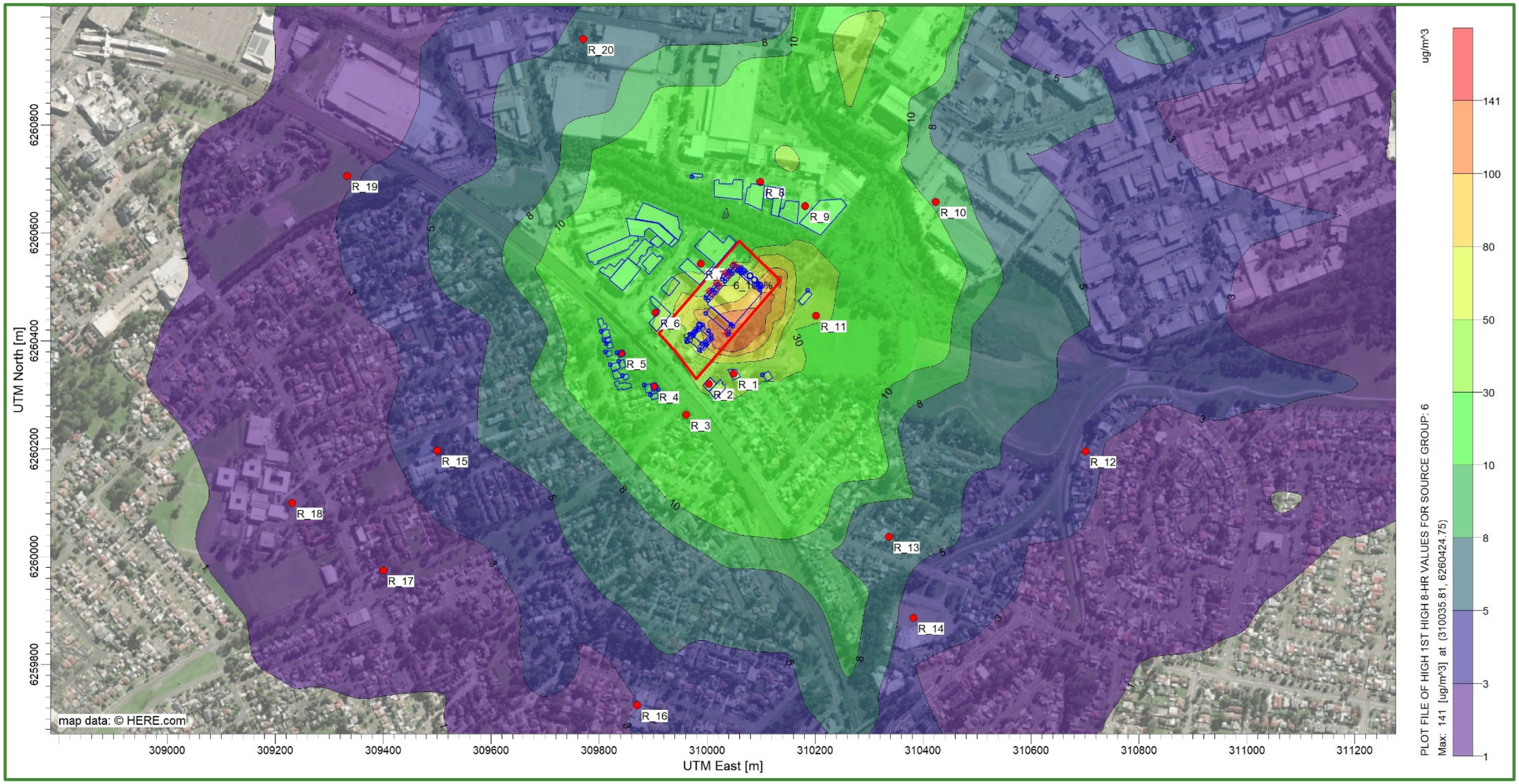


7.4.2.3 Carbon monoxide (CO) 8 hour

Table 7-8: CO Impacts at Sensitive Receptors for 8 hour 100th Percentile

Receptor ID	Incremental Impact (µg/m³)	Background (µg/m³)	Cumulative Impact (µg/m³)	Criteria (µg/m³)	Complies? (Yes/no)
R1	40.49	3196	3236.49	10000	Yes
R2	34.67	3196	3230.67	10000	Yes
R3	20.76	3196	3216.76	10000	Yes
R4	19.81	3196	3215.81	10000	Yes
R5	19.52	3196	3215.52	10000	Yes
R6	29.62	3196	3225.62	10000	Yes
R7	22.90	3196	3218.9	10000	Yes
R8	20.05	3196	3216.05	10000	Yes
R9	20.01	3196	3216.01	10000	Yes
R10	9.59	3196	3205.59	10000	Yes
R11	34.73	3196	3230.73	10000	Yes
R12	3.22	3196	3199.22	10000	Yes
R13	5.95	3196	3201.95	10000	Yes
R14	3.65	3196	3199.65	10000	Yes
R15	3.89	3196	3199.89	10000	Yes
R16	2.90	3196	3198.9	10000	Yes
R17	2.34	3196	3198.34	10000	Yes
R18	1.99	3196	3197.99	10000	Yes
R19	2.85	3196	3198.85	10000	Yes
R20	5.66	3196	3201.66	10000	Yes

Figure 7-9: Isopleth for CO 8 hour – 100th Percentile (without background)



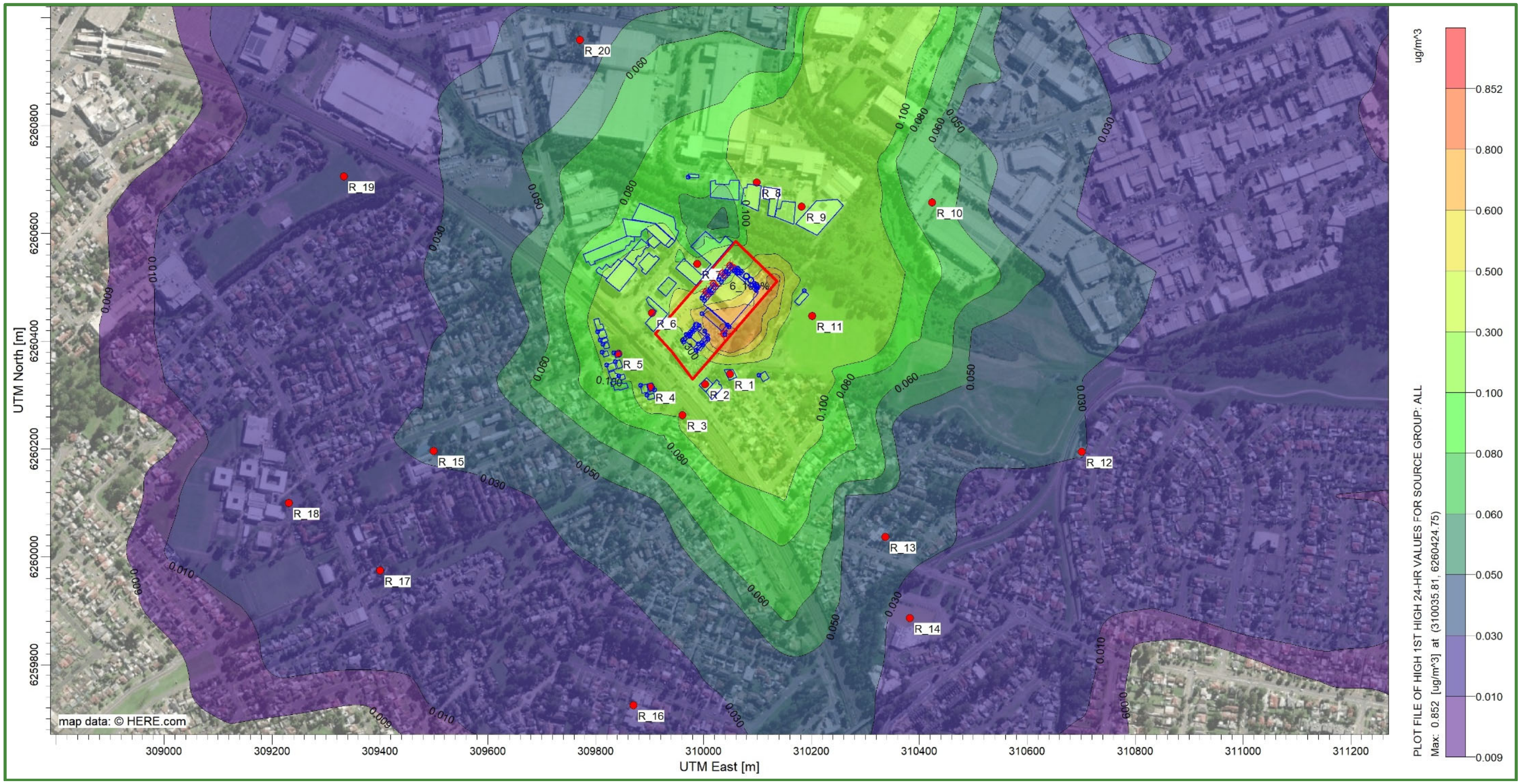
7.4.2.4 $PM_{2.5}$ (24 hours)

All emitted particulates are conservatively assumed to be $PM_{2.5}$

Table 7-9: PM2.5 24 hour Averaging Period Modelling Results – 100th Percentile

Receptor ID	Incremental Impact (µg/m³)	Background (µg/m³)	Cumulative Impact (µg/m³)	Criteria (µg/m³)	Complies? (Yes/no)
R1	0.27	32.9	33.17	25	No
R2	0.19	32.9	33.09	25	No
R3	0.10	32.9	33.00	25	No
R4	0.13	32.9	33.03	25	No
R5	0.13	32.9	33.03	25	No
R6	0.20	32.9	33.10	25	No
R7	0.12	32.9	33.02	25	No
R8	0.12	32.9	33.02	25	No
R9	0.14	32.9	33.04	25	No
R10	0.07	32.9	32.97	25	No
R11	0.22	32.9	33.12	25	No
R12	0.03	32.9	32.93	25	No
R13	0.04	32.9	32.94	25	No
R14	0.02	32.9	32.92	25	No
R15	0.03	32.9	32.93	25	No
R16	0.02	32.9	32.92	25	No
R17	0.02	32.9	32.92	25	No
R18	0.02	32.9	32.92	25	No
R19	0.02	32.9	32.92	25	No
R20	0.04	32.9	32.94	25	No

Figure 7-10: PM2.5 24 Hour Averaging Period Modelling Results – 100th Percentile (without background)

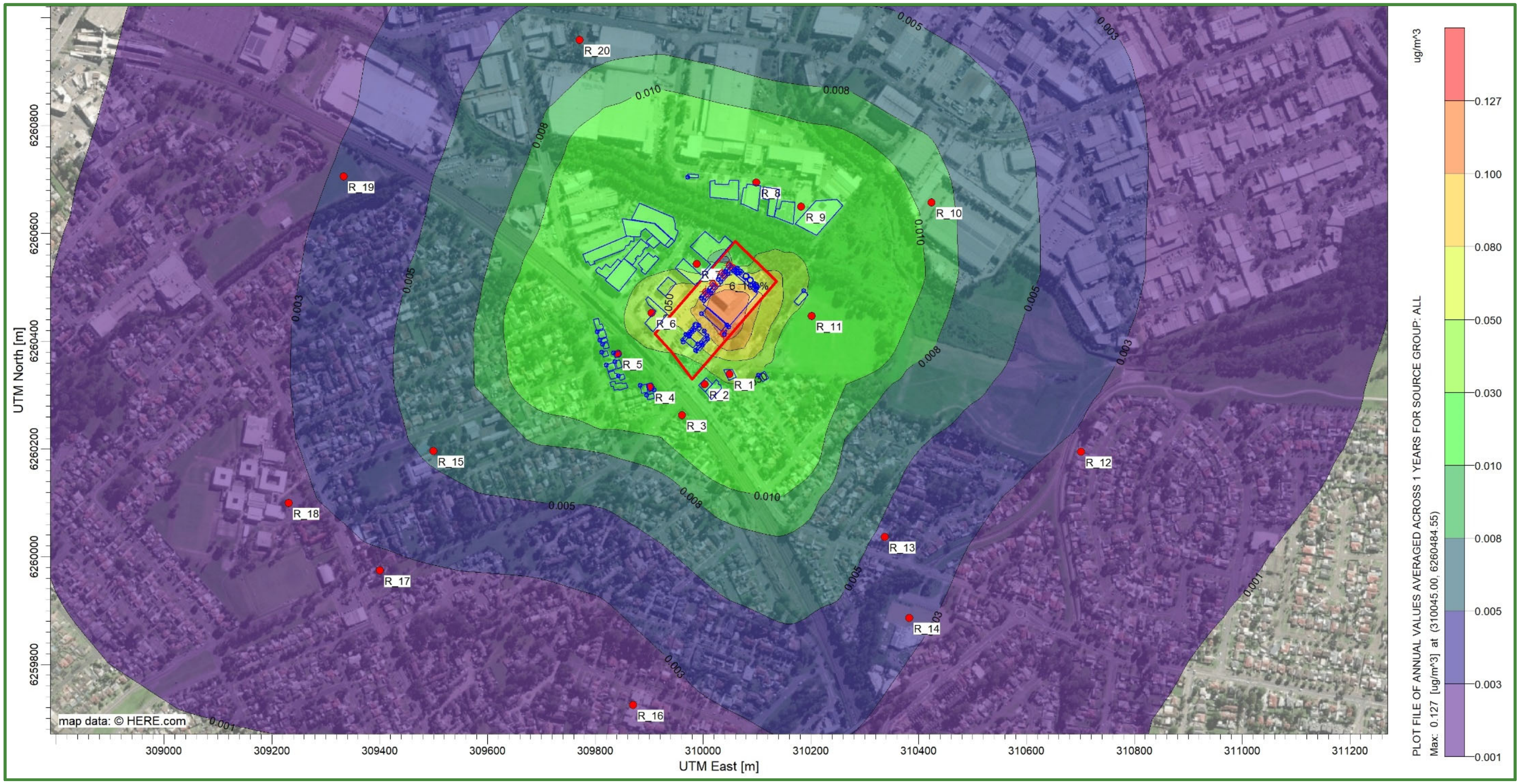


7.4.2.5 $PM_{2.5}$ (Annual)

Table 7-10: PM2.5 Annual Averaging Period Modelling Results – 100th Percentile

Receptor ID	Incremental Impact (µg/m^3)	Background (µg/m^3)	Cumulative Impact (µg/m^3)	Criteria (µg/m^3)	Complies? (Yes/no)
R1	0.03	8.8	8.83	8	No
R2	0.02	8.8	8.82	8	No
R3	0.01	8.8	8.81	8	No
R4	0.02	8.8	8.82	8	No
R5	0.02	8.8	8.82	8	No
R6	0.04	8.8	8.84	8	No
R7	0.02	8.8	8.82	8	No
R8	0.02	8.8	8.82	8	No
R9	0.02	8.8	8.82	8	No
R10	0.01	8.8	8.81	8	No
R11	0.02	8.8	8.82	8	No
R12	0.00	8.8	8.80	8	No
R13	0.00	8.8	8.80	8	No
R14	0.00	8.8	8.80	8	No
R15	0.01	8.8	8.81	8	No
R16	0.00	8.8	8.80	8	No
R17	0.00	8.8	8.80	8	No
R18	0.00	8.8	8.80	8	No
R19	0.00	8.8	8.80	8	No
R20	0.01	8.8	8.81	8	No

Figure 7-11: PM2.5 Annual Averaging Period Modelling Results – 100th Percentile (without background)



7.4.3 Scenario 3 – Emergency operations

7.4.3.1 NOx (NO_2) 1 hour

7.4.3.1.1 100th Percentile Assessment

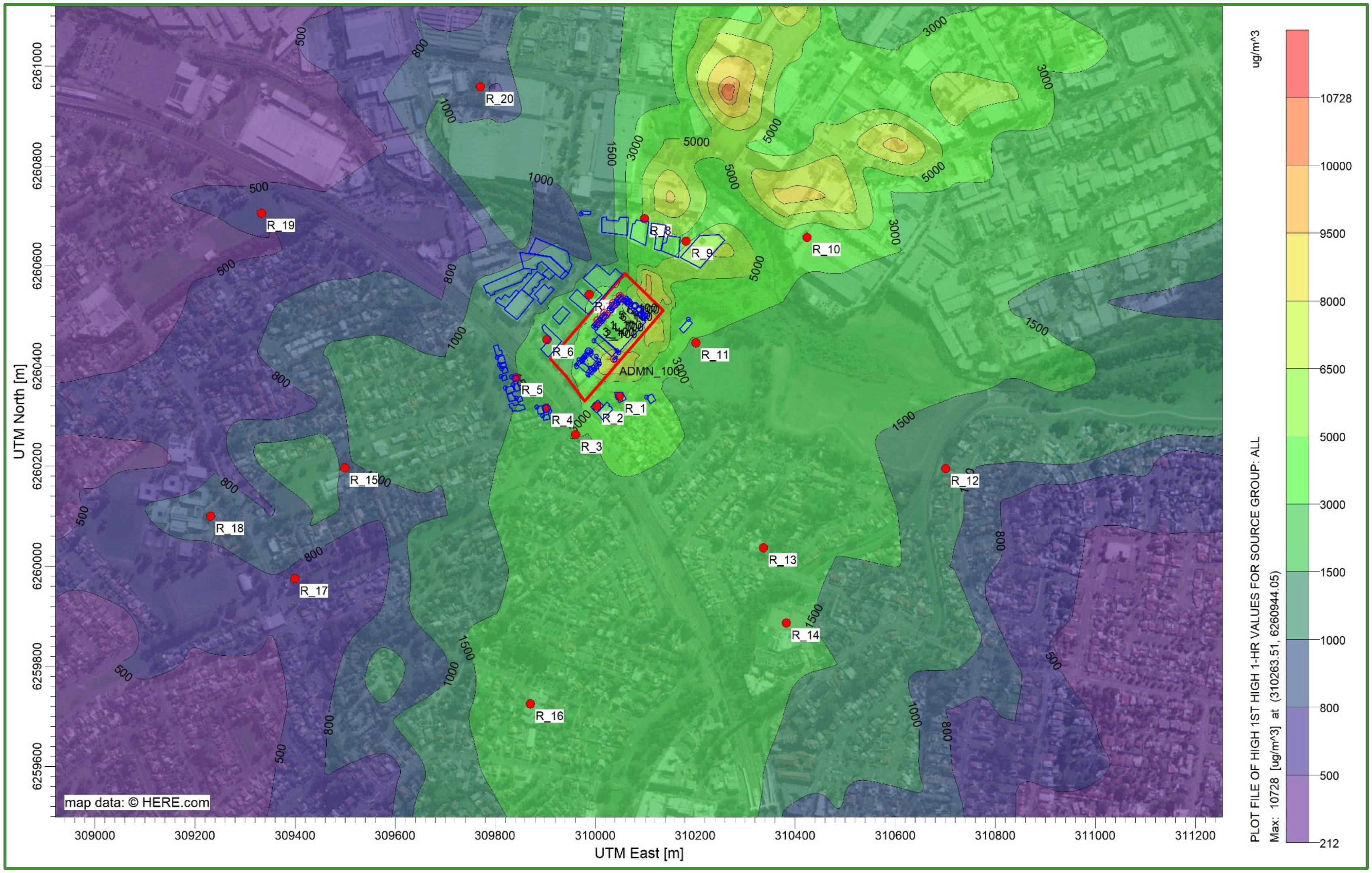
Table 7-11: Scenario 3: NO_2 Impacts at Sensitive Receptors for 100th Percentile

Receptor	Method 1				Method 2				Method 3			
	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2
R1	24/03/2019 23:00	9.5	3571.7	3581.2	10/12/2019 12:00	32.7	1836.3	456.0	31/08/2019 05:00	0.0	3335.8	2650.1
R2	31/10/2019 21:00	21.0	3357.7	3378.8	10/12/2019 12:00	32.7	1668.4	439.3	31/10/2019 21:00	21.0	3357.7	2301.8
R3	17/11/2019 20:00	1.9	3088.7	3090.6	17/11/2019 20:00	1.9	3088.7	355.2	17/11/2019 20:00	1.9	3088.7	2286.6
R4	14/04/2019 20:00	30.9	2204.2	2235.1	12/01/2019 19:00	5.5	2048.4	328.6	12/01/2019 19:00	5.5	2048.4	1808.2
R5	28/01/2019 18:00	0	1459.6	1459.6	01/11/2019 16:00	11.2	1319.9	305.0	04/12/2019 18:00	32.1	1381.2	1247.5
R6	28/05/2019 18:00	11.7	1927.9	1939.7	01/11/2019 15:00	13.0	1563.7	330.5	04/12/2019 17:00	37.4	1644.4	1482.1
R7	20/12/2019 12:00	9.3	2697.9	2707.2	19/11/2019 13:00	0.0	2644.1	339.1	19/11/2019 13:00	0.0	2644.1	2022.1
R8	17/05/2019 07:00	31.8	5151.5	5183.3	17/05/2019 07:00	31.8	5151.5	547.0	17/05/2019 07:00	31.8	5151.5	3303.0
R9	16/10/2019 01:00	38.8	4848.0	4886.8	16/10/2019 01:00	38.8	4848.0	523.6	16/10/2019 01:00	38.8	4848.0	3117.3
R10	17/05/2019 04:00	35.7	3187.1	3222.8	19/11/2019 07:00	94.1	2717.3	384.0	18/01/2019 04:00	35.7	2885.9	2059.5
R11	22/03/2019 18:00	17.3	2885.9	2903.2	17/01/2019 17:00	10.9	1823.5	353.1	17/10/2019 17:00	1.9	2761.6	2211.0

Table 7-11: Scenario 3: NO_2 Impacts at Sensitive Receptors for 100th Percentile

Receptor	Method 1				Method 2				Method 3			
	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2	Date/Time	Background NO_2	Increment NOx	Total NO_2
R12	17/08/2019 04:00	43.7	1058.5	1102.1	17/01/2019 17:00	10.9	229.6	193.7	17/08/2019 07:00	17.7	917.8	696.9
R13	13/01/2019 06:00	0.0	2144.6	2144.6	13/01/2019 06:00	0.0	2144.6	280.9	13/01/2019 06:00	0.0	2144.6	1587.0
R14	17/10/2019 04:00	30.9	1614.2	1645.1	13/01/2019 05:00	0.0	1455.1	219.5	17/10/2019 19:00	3.8	1485.3	1102.9
R15	15/10/2019 20:00	11.5	940.3	951.8	01/11/2019 16:00	11.2	268.2	199.9	15/10/2019 20:00	11.5	940.3	707.3
R16	17/11/2019 20:00	1.9	1602.5	1604.4	17/11/2019 20:00	1.9	1602.5	206.6	17/11/2019 20:00	1.9	1602.5	1187.8
R17	15/10/2019 21:00	21.1	715.0	736.0	04/12/2019 19:00	19.0	387.3	179.2	15/10/2019 21:00	21.1	715.0	475.1
R18	15/10/2019 20:00	11.5	949.6	961.0	18/02/2019 17:00	14.6	293.6	168.0	15/10/2019 20:00	11.5	949.6	714.1
R19	15/09/2019 23:00	30.8	582.2	613.0	30/12/2019 19:00	11.0	225.5	180.5	15/09/2019 23:00	30.8	582.2	400.5
R20	01/04/2019 24:00	19.4	817.7	837.1	26/01/2019 13:00	9.1	193.1	193.7	26/04/2019 04:00	19.4	817.7	538.6

Figure 7-12: Isopleth for NOx – 100th Percentile (without background)



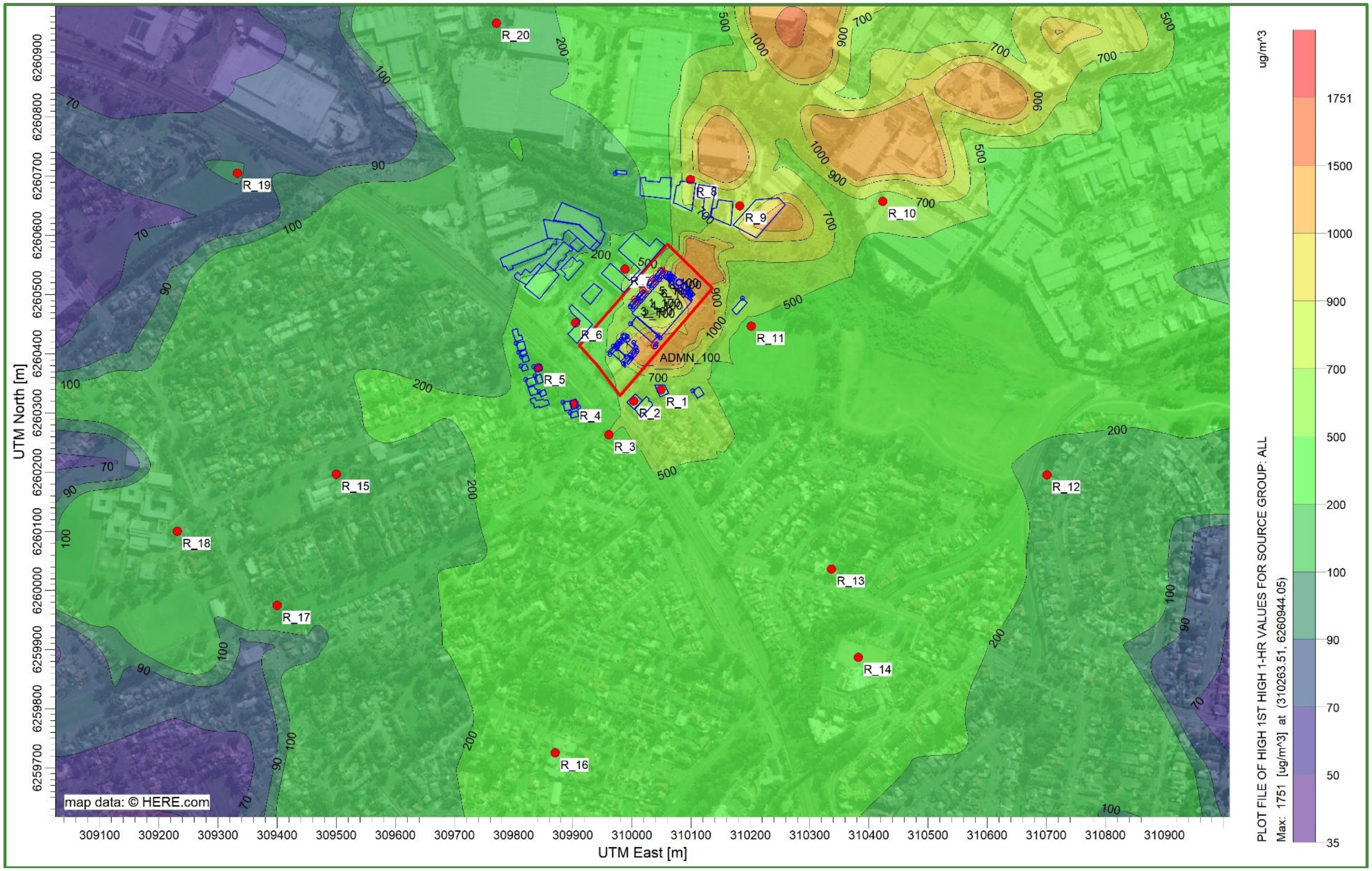
7.4.3.2 Carbon monoxide (CO) 1 hour and 15 minute conversion

Table 7-12: CO Impacts at Sensitive Receptors for 100th Percentile (1 hour)

Receptor ID	Incremental Impact (µg/m³)	Background (µg/m³)	Cumulative Impact (µg/m³)	Criteria (µg/m³)	Complies? (Yes/no)
R1	583.56	3670	4253.6	30000	Yes
R2	548.05	3670	4218.1	30000	Yes
R3	504.46	3670	4174.5	30000	Yes
R4	359.99	3670	4030.0	30000	Yes
R5	238.72	3670	3908.7	30000	Yes
R6	314.65	3670	3984.7	30000	Yes
R7	440.53	3670	4110.5	30000	Yes
R8	840.76	3670	4510.8	30000	Yes
R9	791.23	3670	4461.2	30000	Yes
R10	520.17	3670	4190.2	30000	Yes
R11	471.18	3670	4141.2	30000	Yes
R12	172.76	3670	3842.8	30000	Yes
R13	351.27	3670	4021.3	30000	Yes
R14	264.68	3670	3934.7	30000	Yes
R15	154.83	3670	3824.8	30000	Yes
R16	262.75	3670	3932.8	30000	Yes
R17	117.86	3670	3787.9	30000	Yes
R18	155.81	3670	3825.8	30000	Yes
R19	95.33	3670	3765.3	30000	Yes
R20	133.46	3670	3803.5	30000	Yes

The highest 1 hour predicted impact impact of CO occurs at R8. This is converted to a 15 minute prediction usuing the formula outlined in Section 3.3. The 15 minute predicted incremental impact would be 1109.4 µg/m³ and complies with the NSW EPA criteria of 100,000 µg/m³.

Figure 7-13: Isopleth for CO 1 hour – 100th Percentile (without background)

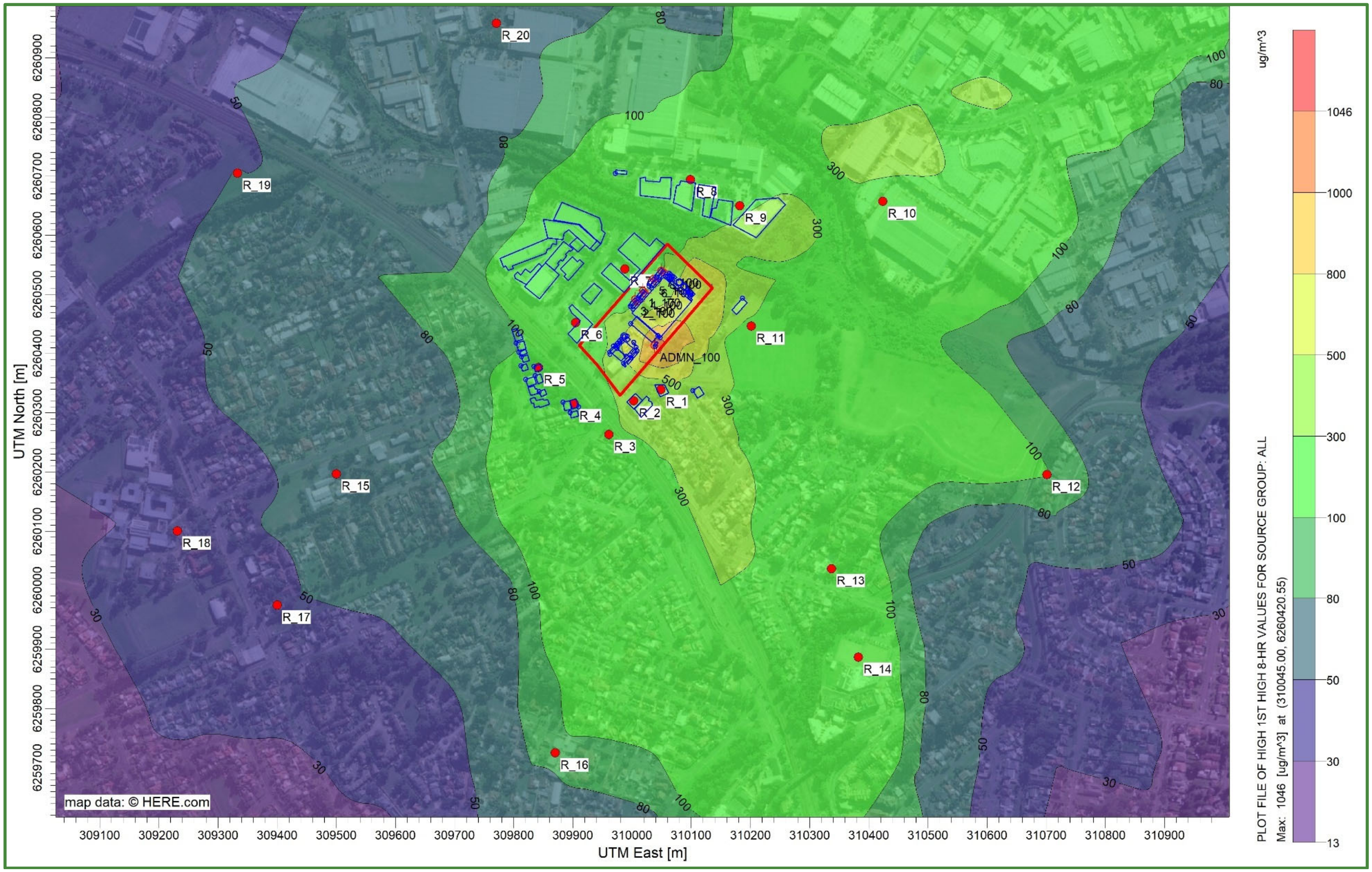


7.4.3.3 Carbon monoxide (CO) 8 hour

Table 7-13: CO Impacts at Sensitive Receptors for 8 hour 100th Percentile

Receptor ID	Incremental Impact (µg/m^3)	Background (µg/m^3)	Cumulative Impact (µg/m^3)	Criteria (µg/m^3)	Complies? (Yes/no)
R1	466.60	3196	3662.6	10000	Yes
R2	390.40	3196	3586.4	10000	Yes
R3	250.72	3196	3446.7	10000	Yes
R4	210.44	3196	3406.4	10000	Yes
R5	136.92	3196	3332.9	10000	Yes
R6	174.32	3196	3370.3	10000	Yes
R7	178.02	3196	3374.0	10000	Yes
R8	134.89	3196	3330.9	10000	Yes
R9	258.85	3196	3454.9	10000	Yes
R10	202.86	3196	3398.9	10000	Yes
R11	279.18	3196	3475.2	10000	Yes
R12	101.43	3196	3297.4	10000	Yes
R13	170.98	3196	3367.0	10000	Yes
R14	135.84	3196	3331.8	10000	Yes
R15	64.65	3196	3260.6	10000	Yes
R16	93.91	3196	3289.9	10000	Yes
R17	46.16	3196	3242.2	10000	Yes
R18	39.44	3196	3235.4	10000	Yes
R19	50.55	3196	3246.5	10000	Yes
R20	68.03	3196	3264.0	10000	Yes

Figure 7-14: Isopleth for CO 8 hour – 100th Percentile (without background)



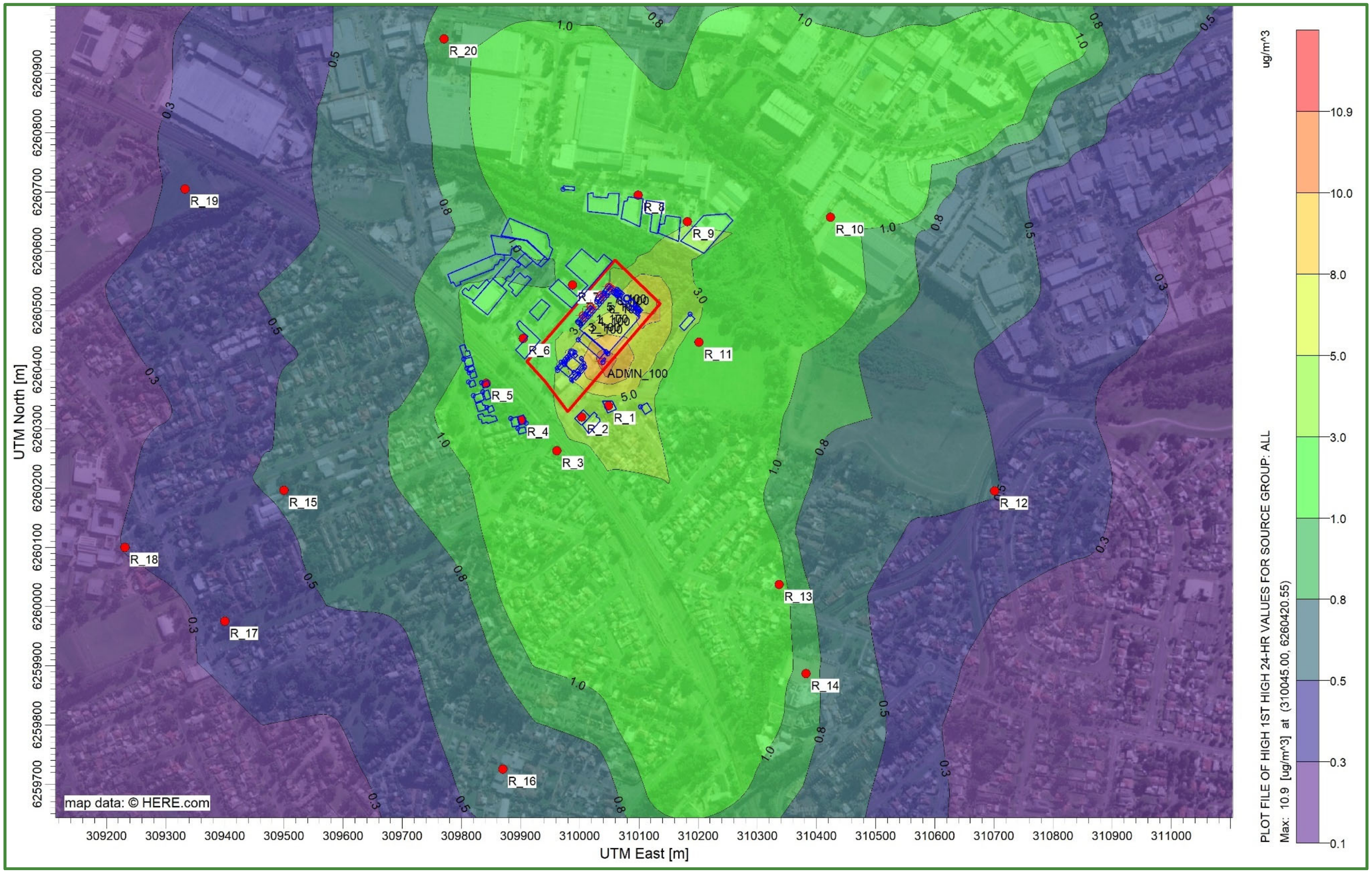
7.4.3.4 $PM_{2.5}$ (24 hours)

All emitted particulates are conservatively assumed to be $PM_{2.5}$.

Table 7-14: PM2.5 24 hour Averaging Period Modelling Results – 100th Percentile

Receptor ID	Incremental Impact (µg/m^3)	Background (µg/m^3)	Cumulative Impact (µg/m^3)	Criteria (µg/m^3)	Complies? (Yes/no)
R1	4.84	32.9	37.74	25	No
R2	3.77	32.9	36.67	25	No
R3	2.51	32.9	35.41	25	No
R4	1.65	32.9	34.55	25	No
R5	1.36	32.9	34.26	25	No
R6	1.56	32.9	34.46	25	No
R7	1.61	32.9	34.51	25	No
R8	1.44	32.9	34.34	25	No
R9	2.91	32.9	35.81	25	No
R10	1.27	32.9	34.17	25	No
R11	2.41	32.9	35.31	25	No
R12	0.52	32.9	33.42	25	No
R13	1.08	32.9	33.98	25	No
R14	0.87	32.9	33.77	25	No
R15	0.53	32.9	33.43	25	No
R16	0.65	32.9	33.55	25	No
R17	0.34	32.9	33.24	25	No
R18	0.30	32.9	33.20	25	No
R19	0.32	32.9	33.22	25	No
R20	0.87	32.9	33.77	25	No

Figure 7-15: PM2.5 24 Hour Averaging Period Modelling Results – 100th Percentile (without background)



7.4.4 Contemporaneous assessment

Due to the high background levels of NO_2, CO, $PM_{2.5}$ at the site, the *Approved Methods* requires a demonstration that no additional exceedances of the impact assessment criteria will occur because of the proposed site activities.

However, it is not necessary to conduct this additional assessment at this stage as it is evident that the background likely that the shown predicted levels of emissions from the selected generator type combined with the high levels of background in the ambient air that the development will cause additional exceedances.

7.5 MITIGATION MEASURES

Additional pollution reduction controls for the generators are not considered warranted/reasonable due to the low likelihood the operations would cause exceedances. However, it is recommended that the design, installation and operation of the back-up generators and/or generator enclosures does not preclude the ability for air pollution emission controls to be retrofitted.

7.5.1 Maintenance

Maintenance is to be undertaken as per the maintenance schedule presented in Table 7-1. Operation of standby generators during testing and maintenance should be minimised as far as practicable.

Hourly background NO_2 concentration from 2017-2021 have been analysed and it has been established that high background concentrations are most common in the winter, with the highest 58occurring from evening through to early morning. Background concentrations are lower during the summer, and at their lowest between the hours of 13:00-16:00. Therefore, it is recommended that the annual 65-minute maintenance tests be undertaken during the summer between 13:00-16:00 and regular 35-minute maintenance be undertaken during the daytime between 13:00-16:00.

7.5.2 Emergency Operation

It is recommended that power outage NO_2 monitoring procedure be included in the site's Emergency Response Plan. This procedure is to:

- Provide all practical measure to reduce the duration of the outage.
- Direct a suitably qualified consultant or suitably qualified/trained onsite personnel to monitor NO_2 levels utilising a gas detector at nearest sensitive receptors downwind of the site in the event of all power outages.
- Include measures such as informing emergency services, issuing a local air quality warning and instructing affected residence/sensitive premises to undertake measures proportional to the impacts to avoid harm such as closing windows or evacuation.

This concludes the report.

Kate Barker
<u>Senior Environmental Scientist</u>

Emma Hansma
<u>Senior Engineer</u>

Linda Zanotto
<u>Senior Environmental Engineer</u>

RT Benbow
<u>Principal Consultant</u>

8. LIMITATIONS

Our services for this project are carried out in accordance with our current professional standards for site assessment investigations. No guarantees are either expressed or implied.

This report has been prepared solely for the use of LCI Consultants, as per our agreement for providing environmental services. Only LCI Consultants is entitled to rely upon the findings in the report within the scope of work described in this report. Otherwise, no responsibility is accepted for the use of any part of the report by another in any other context or for any other purpose.

Although all due care has been taken in the preparation of this study, no warranty is given, nor liability accepted (except that otherwise required by law) in relation to any of the information contained within this document. We accept no responsibility for the accuracy of any data or information provided to us by LCI Consultants for the purposes of preparing this report.

Any opinions and judgements expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal advice.

ATTACHMENTS

Attachment 1: Generator Details

Package Performance

Low Emissions

Performance	Standby		Mission Critical	
Frequency	50 Hz		50 Hz	
Gen set power rating without fan	3200 ekW		3200 ekW	
Gen set power rating without fan @ 0.8 power factor	4000 kVA		4000 kVA	
Emissions	Low Emissions		Low Emissions	
Performance number	EM1358-03		EM1361-03	
Fuel Consumption				
100% load without fan – L/hr (gal/hr)	828.6	(218.9)	828.6	(218.9)
75% load without fan – L/hr (gal/hr)	653.7	(172.7)	653.7	(172.7)
50% load without fan – L/hr (gal/hr)	439.2	(116.0)	439.2	(116.0)
25% load without fan – L/hr (gal/hr)	244.6	(64.6)	244.6	(64.6)
Cooling System				
Engine coolant capacity – L (gal)	440.0	(116.2)	440.0	(116.2)
Inlet Air				
Combustion air inlet flow rate – m^3/min (cfm)	305.5	(10786.9)	305.5	(10786.9)
Exhaust System				
Exhaust stack gas temperature – °C (°F)	460.7	(861.2)	460.7	(861.2)
Exhaust gas flow rate – m^3/min (cfm)	704.5	(24877.4)	704.5	(24877.4)
Exhaust system backpressure (maximum allowable) – kPa (in. water)	6.7	(27.0)	6.7	(27.0)
Heat Rejection				
Heat rejection to jacket water – kW (Btu/min)	1732	(98480)	1732	(98480)
Heat rejection to exhaust (total) – kW (Btu/min)	3034	(172533)	3034	(172533)
Heat rejection to aftercooler – kW (Btu/min)	374	(21288)	374	(21288)
Heat rejection to atmosphere from engine – kW (Btu/min)	196	(11145)	196	(11145)
Heat rejection from alternator – kW (Btu/min)	140	(7969)	140	(7969)
Emissions* (Nominal)				
NOx mg/Nm^3 (g/hp-h)	2346.6	(4.99)	2346.6	(4.99)
CO mg/Nm^3 (g/hp-h)	254.9	(0.54)	254.9	(0.54)
HC mg/Nm^3 (g/hp-h)	43.0	(0.11)	43.0	(0.11)
PM mg/Nm^3 (g/hp-h)	4.6	(0.01)	4.6	(0.01)
Emissions* (Potential Site Variation)				
NOx mg/Nm^3 (g/hp-h)	2816.0	(5.99)	2816.0	(5.99)
CO mg/Nm^3 (g/hp-h)	458.9	(0.98)	458.9	(0.98)
HC mg/Nm^3 (g/hp-h)	57.2	(0.14)	57.2	(0.14)
PM mg/Nm^3 (g/hp-h)	6.5	(0.02)	6.5	(0.02)

**mg/Nm^3 levels are corrected to 5% O_2. Contact your local Cat dealer for further information.*

Attachment 2: Metdata Details

AERMET-Ready & AERMOD-Ready Met Data Generated by WRF and MMIF

Feb 14, 2022

Met Data Order Information:

Order #	MET2220360
Ordered by	Bethany Carlyon
Company	Benbow Environmental
Met Data Type	AERMET-Ready WRF-MMIF (Onsite & Upper Air Met Data) AERMOD-Ready WRF-MMIF (SFC & PFL Met Data)
Start-End Date	Jan 01, 2019 hour 00 - Dec 31, 2019 hour 23
Center Point	Lat.: 33.77895 S – Long.: 150.9483 E
Datum	WGS 84
UTM Zone	-56
Base Elevation	59.12 m
WRF Grid Cell	4 km x 4 km
Site Time Zone	UTC+1000
Closest City & Country	Seven Hills - Australia

Lakes Environmental Software
E-mail : sales@webLakes.com
Web Site: www.webLakes.com

Meteorological Data Files

This order includes two sets of meteorological data files as output by the US EPA's **Mesoscale Model Interface Program (MMIF)**:

- AERMET-Ready Onsite (*.DAT) & Upper Air (*.FSL), and
- AERMOD-Ready Surface (*.SFC) & Profile (*.PFL)

Execution of MMIF was done according to the recommendations found in the EPA's ***Guidance on the Use of the Mesoscale Modeling Interface Program (MMIF) for AERMOD Applications*** **document**.[1]

The AERMOD-Ready files were generated by processing the AERMET-Ready data files output by MMIF through the most recent version of the US EPA's AERMET meteorological pre-processor executable (Version **21112**). This includes use of the MMIF-generated AERSURFACE output file for Stage 3 surface characteristics.[1]

If you want to input the AERMOD-Ready files directly to your AERMOD project, proceed to the **AERMOD View Instructions** on page 7.

Customers who want to process the data through AERMET can proceed to the **AERMET View Instructions** on page 3.

[1] EPA-454/B-18-005, https://www3.epa.gov/ttn/scram/models/relat/mmif/MMIF_Guidance.pdf.

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