Report

Stuart Landfill Bioenergy Facility – Air Quality Assessment

LMS Energy Pty Ltd

Astute Environmental Consulting

Job: 22-187
Date: 19 April 2023

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Project Title	Stuart Landfill Bioenergy Facility – Air Quality Assessment
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1 INTRODUCTION

LMS Energy Pty Ltd (LMS) engaged Astute Environmental Consulting Pty Ltd (Astute) to perform an air quality assessment relating to the Stuart Landfill located 24 Vantassel Street, Stuart Qld on Lot 2 on SP132603 ("the site"). The site currently has a flare that is used to burn gas generated by the landfill.

1.1 Background

It is understood that approval is being sought for the installation of a single CAT 3516LE (1149kW) gas fired engine which will be used to produce electricity. The site is shown below in Figure 1-1 with the existing flare and proposed engine location highlighted with a red arrow.

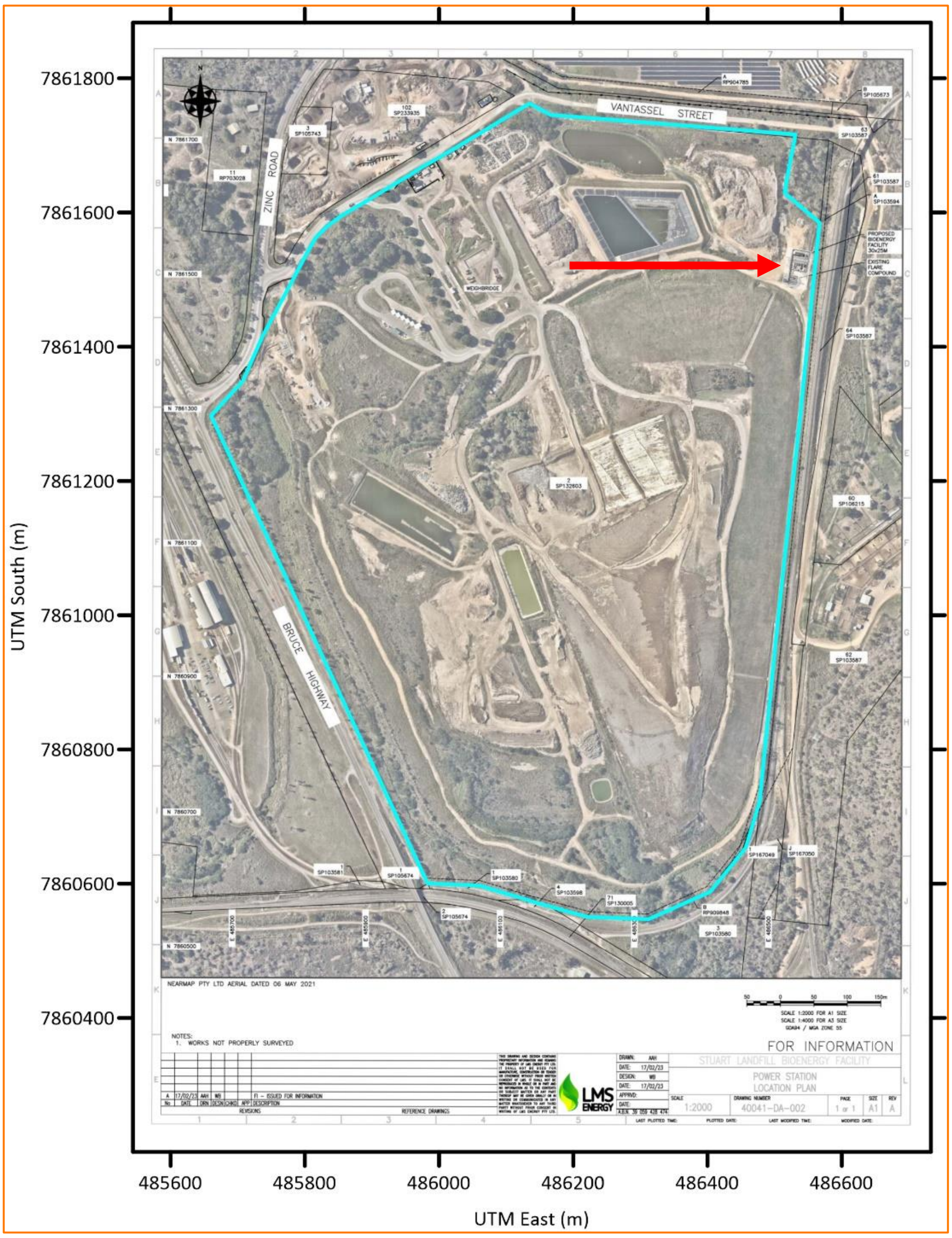


Figure 1-1: Site and Proposed Location (Red Arrow)

1.2 Scope of Work

The scope of work for the assessment included:

- Analysing regional weather data to select a representative year;
- Modelling meteorology for the area using TAPM/CALMET;
- Determine background air quality concentrations with the local airshed;
- Estimating combustion emissions from the proposed power station;
- Predicting local air quality impacts using CALPUFF;
- Comparing the output of the dispersion modelling with the criteria in the Approved Methods; and
- Preparing a report.

The methodology for this project follows the requirements in the document *Application requirements for activities with impacts to air* (DES, 2019) and the methodology is summarised graphically in Figure 1-2.

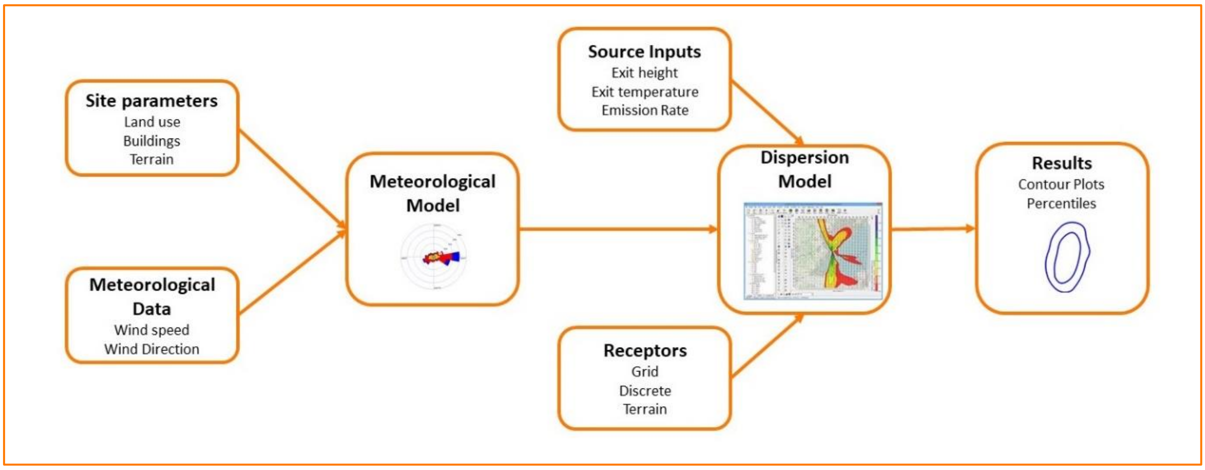


Figure 1-2: Modelling Methodology

2 ASSESSMENT CRITERIA

The *Environmental Protection Act 1994* (State of Queensland, 2020) ("the EP act") is the primary environmental regulation in Queensland. It lists obligations and duties to present environmental nuisance and harm. The EP Act sets out enforcement tools that can be used when offences or acts of non-compliance are identified. Under the EP Act is the Environmental Protection (Air) Policy 2019 (State of Queensland, 2019), which sets limits (criteria) to which the model results can be compared.

The criteria relevant to this project are summarised in Table 2-1 below. For this assessment, the Total Volatile Organic Compounds (TVOCs) are modelled with 100% of the emissions assumed to be Benzene. These are then compared against the air quality objective for Benzene.

Table 2-1: Air Quality Objectives Relevant to the Site

Indicator	Environmental Value	Averaging Period	Air Quality Objective (µg/m³)
Nitrogen dioxide (NO_2)	Health and wellbeing	1 hour	250
		1 year	33
	Health and biodiversity of ecosystems	1 year	62
Carbon monoxide (CO)	Health and wellbeing	8 hours	11,000
Total Volatile Organic Compounds (TVOCs) as Benzene	Health and wellbeing	1 year	5.4

3 METHODOLOGY

3.1 Representative year

The selection of a representative meteorological year for dispersion modelling is critical. Typically, only a single year of data is included in an assessment that predicts impacts over a given period of time. The modelled period should represent long term averages. Critical meteorological factors include wind speed, temperature and relative humidity. These need to be assessed against long term data for the selected area to select the year to be modelled.

We obtained 1 minute wind speed, temperature and humidity data from the Townsville Aerodrome BoM station as this is a local station in an open area (i.e. the airport). The 1 minute data for 2011 to 2020 were then averaged to hourly data using the methodology detailed in USEPA (2000).

The hourly data was further analysed using box and whisker plots. A box and whisker plot is a figure that presents information based on factors such as minimum and maximum values, the 25th and 75th quartile values and averages. They are useful for indicating whether a distribution is skewed and whether there are potential unusual observations (outliers) in the data set. They are particularly useful when large numbers of observations are involved and when two or more data sets are being compared (Statistics Canada, 2013).

Figure 3-1 below shows how a box plot is structured. In the case of the figure, the maximum, minimum, quartile, median and average values are shown. The Inter Quartile Range (IQR) in the figure shows the middle 50% of values (the difference between the 75th and 25th percentiles). The data was also compared by determining a correlation coefficient for each dataset against the long-term average.

The data in box and whisker plots can easily be used to see if the two datasets are different. For example, if the boxes showing the IQR overlap they are not considered different, but if they do not overlap the two datasets can be considered different. The median lines are also critical in that even if the boxes overlap if the median of one dataset is above or below the IQR (box) of another dataset, they are also considered different.

The representative year and dataset modelled here are 2014 as the data for 2014 was similar to the long-term averages.

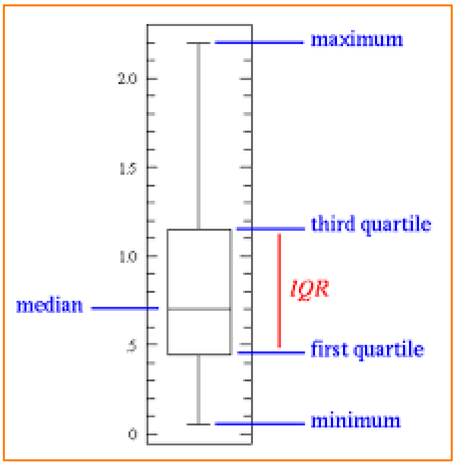


Figure 3-1: Boxplot Structure

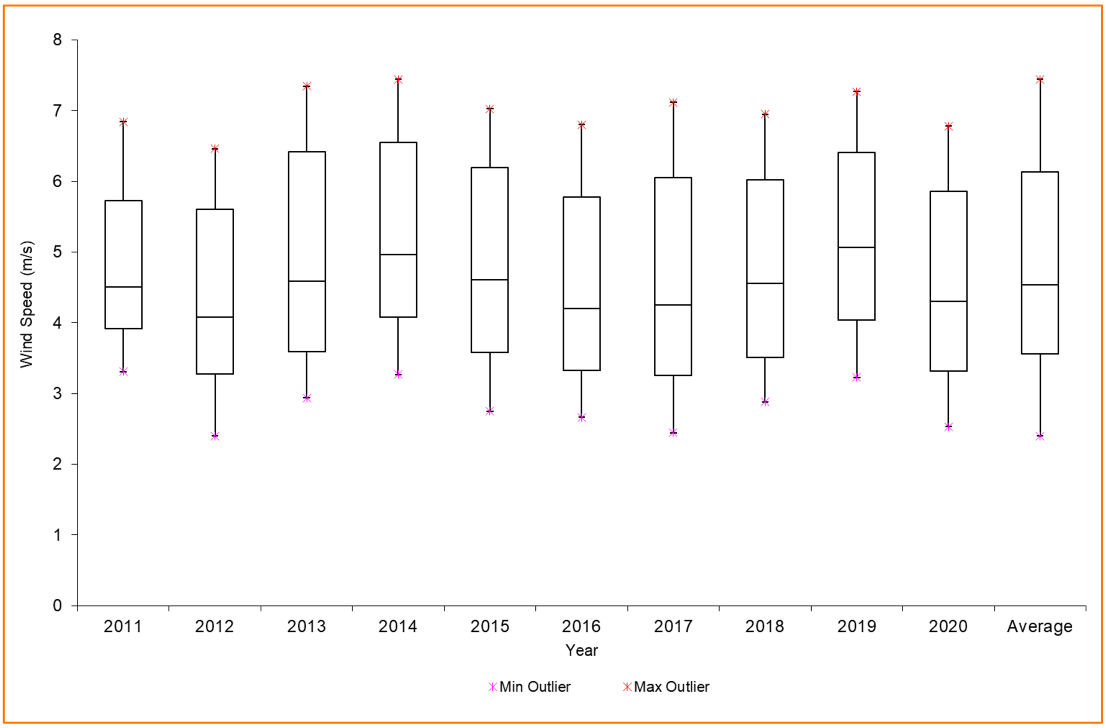


Figure 3-2: Wind Speed (2011-2020)

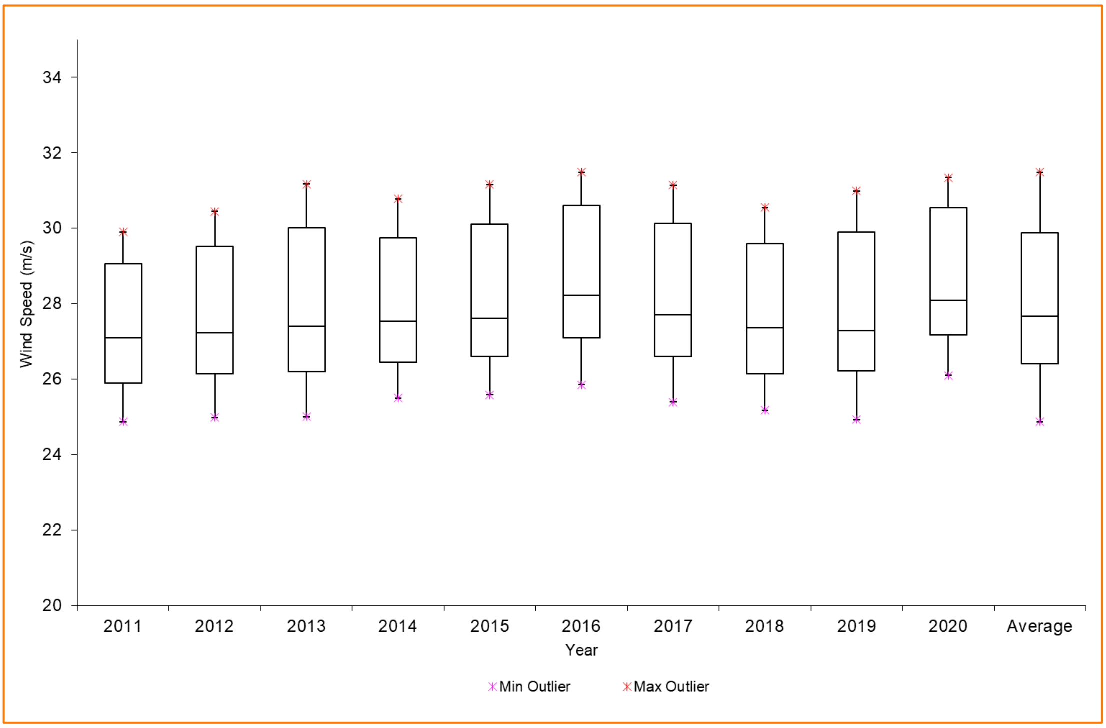


Figure 3-3: Temperature - 2011-2020

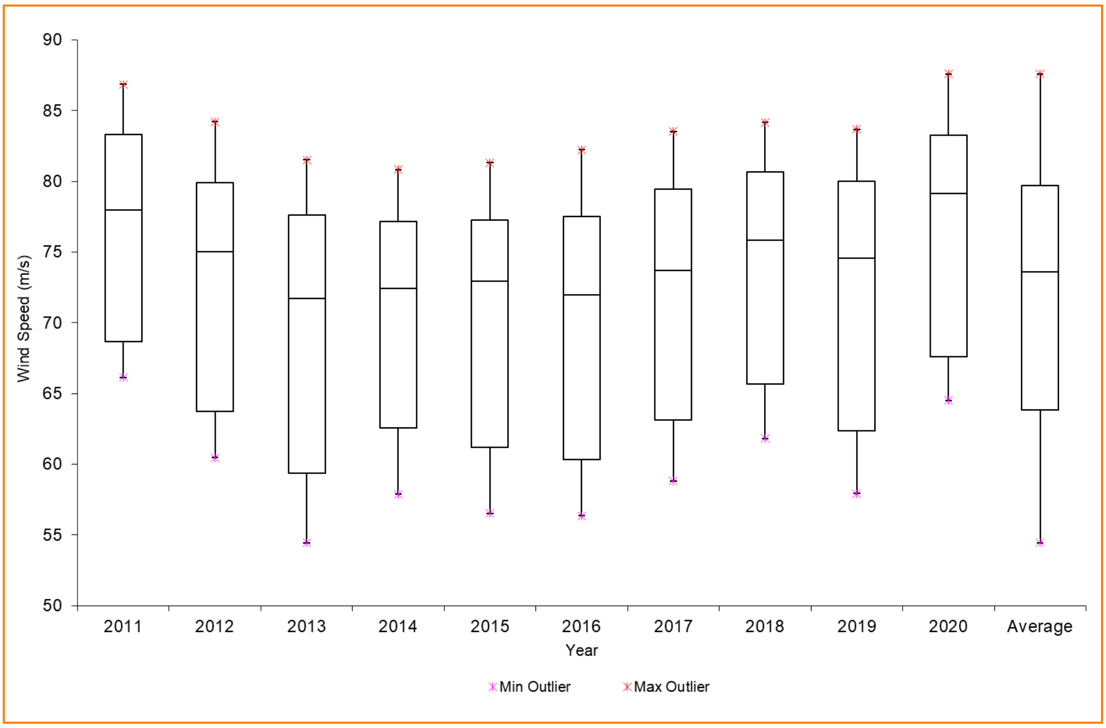


Figure 3-4: Relative Humidity – 2011-2020

3.2 Modelling Methodology

The modelling methodology is described below. The methodology is consistent with the requirements outlined in *Application requirements for activities with impacts to air* (DES, 2019).

3.2.1 TAPM

TAPM v4 is a three-dimensional meteorological and air pollution model developed by CSIRO. TAPM is a prognostic model which uses synoptic-scale data to predict hourly meteorology in a modelled area. Details about TAPM can be found in the TAPM user manual (Hurley, 2008a) and details of the model development and underlying equations can be found in Hurley (2008b). Verification studies have been published and are also available (Hurley, et al., 2008c).

TAPM v4 predicts meteorology using a series of fluid dynamics and scalar transport equations (Hurley, 2008b) and it has both prognostic meteorological and air pollution components. Key meteorological factors including terrain and seabreeze related flows are predicted at both local and regional scales.

The TAPM default land use database was further refined as it poorly represented the land use within the 300m modelling domain. The default and adjusted land use files are presented in Figure 3-5. The TAPM setup is summarised in and is consistent with good practice and the requirements in NSW EPA (2022)

The output from TAPM was used as the initial guess field for CALMET (see Figure 1-2).

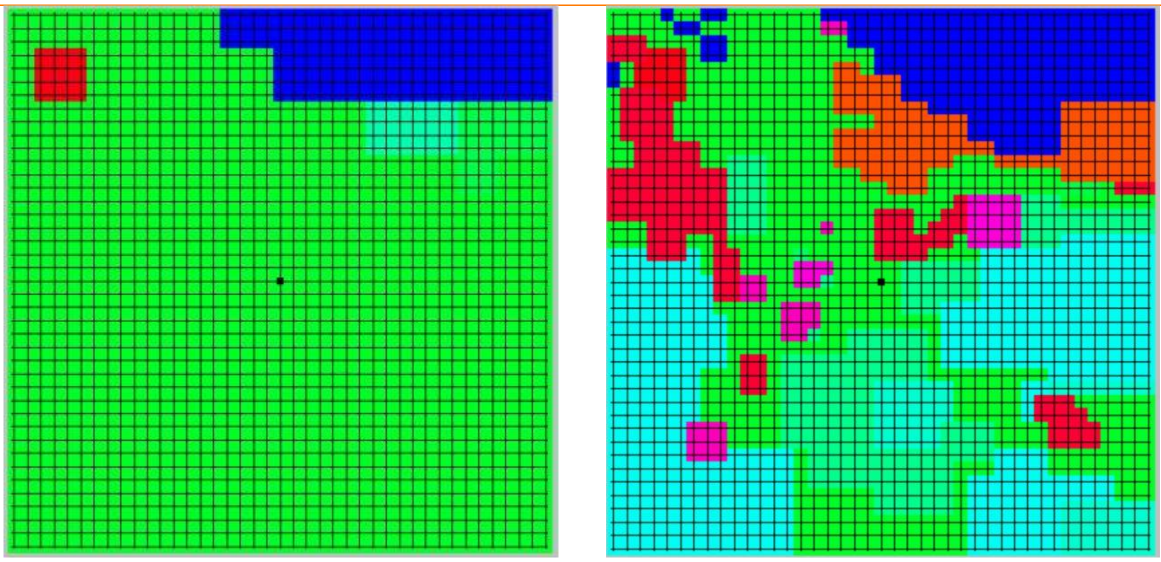


Figure 3-5: Default TAPM (left) and Adjusted Landuse 300m (right) for the Site

3.2.2 CALMET

CALMET is the meteorological pre-processor to CALPUFF and generates wind fields that include slope flows, terrain effects, and can incorporate factors including terrain blocking. CALMET uses meteorological inputs in combination with land use and terrain information for the modelling domain to predict a three-dimensional meteorological grid (which includes wind speed, direction, air temperature, relative humidity, mixing height, and other variables) for the area (domain) to be modelled in CALPUFF.

A 10 km x 10 km domain with a terrain resolution of 100 m was modelled with the centre of the domain to the northeast of the site. A terrain resolution of 30 m was used throughout the domain and was initially taken from the SRTM dataset using CALPUFF view. This was then converted to a 100 m resolution for the model runs.

Land use was initially based on the Australia Pacific Global Land Cover Characterisation (GLCC) dataset at 1km resolution. The land use was then manually edited at 100 m resolution based on a recent aerial photograph of the area using Google Earth Pro and CALPUFF View.

3.2.3 CALPUFF

CALPUFF (Exponent, 2011) is a US EPA regulatory dispersion model and is a non-steady state puff dispersion model that simulates the effects of varying meteorological conditions on the emission of pollutants. The model contains algorithms for near source effects including building downwash, partial plume penetration as well as long range effects such as chemical transformation and pollutant removal. CALPUFF is widely recognised as being the best model for odour studies as it handles light wind conditions and terrain effects better than simpler steady state models such as AUSPLUME and AERMOD. As such it is accepted as a regulatory model in all states of Australia.

CALPUFF simulates complex effects including vertical wind shear, coastal winds including recirculation and katabatic drift. The model employs dispersion equations based on a Gaussian distribution of puffs released within the model run, and it includes variable effects between emission sources.

The modelling methodology is summarised in Table 3-1

Table 3-1: TAPM, CALMET and CALPUFF Setup

Model	Parameter	Value
TAPM (v 4.0.5)	Number of grids (spacing)	30km, 10km, 3km, 1km, 0.3km
	Number of grid points	41 x 41 x 25 (vertical)
	Year of analysis	2014
	Centre of analysis	19° 20.5' South (latitude), 146° 52' East (longitude)
	Meteorological data assimilation	Yes– DES Stuart (Townsville) r_site = 2,000m k_site = 2 q_site = 1.0
CALMET (v 6.5.0)	Meteorological grid domain	10 km x 10 km
	Meteorological grid resolution	0.1 km
	South-west corner of domain	X = 481.000 km, Y = 7856.500 km
	Surface meteorological stations	NA
	Upper air meteorological data	Model generated.
	3D Windfield	m3D from TAPM (0.3 km) input as in initial guess in CALMET
	Year of analysis	2014
	Terrad	1.5 km
CALPUFF (v 6.42)	Method used to compute dispersion coefficients	2 - dispersion coefficients using micrometeorological variables
	Building downwash included	Yes; Prime method
	Method used to compute plume rise for point sources not subject to building downwash? (MRISE)	Gas engines = 1 (Briggs plume rise) Flare = 2 (Numerical plume rise)
	Default settings	All other CALPUFF defaults have been used in line with OEH (2011).

3.2.4 Emissions Estimation

The site has been modelled and analysed based on technical data provided by LMS for the Caterpillar 3516LE and recent emissions monitoring reports on a similar flare taken from the LMS site at Swanbank. The modelling has been based on one Caterpillar 3516LE gas generator and the existing flare.

The technical data for all modelled emissions sources are presented in Table 3-2 and Table 3-3.

Table 3-2: Technical Data for Caterpillar 3516LE

Parameter		Value	Source
Equipment Specifications	Type	Caterpillar 3516LE	Client
	Fuel type	Landfil gas (biogas)	
	Number	1	
	100% Load power (kW)	1,149	Caterpillar G3516 LE Gas Engine Technical Data
Stack details	Release height (m)	7.6	Current EA value
	Exhaust Diameter (m)	0.3	Typical diameter
	Temperature (°C)	502	Caterpillar G3516 LE Gas Engine Technical Data
	Exhaust flow (wet; $Nm^3/bkW\text{-}hr$)	4.37	
	Flow rate (Nm^3/s)	1.31	6% moisture content
	Exit velocity (m/s)	56.35	Calculated
In-stack conc. (mg/Nm^3)	NO_x (Oxides of nitrogen)	500	Licence limit based on LMS Swanbank
	Carbon Monoxide	1,400	
	TVOCs as Benzene	1,100	
Emission Rate (g/s)	NOx	0.66	Calculated
	Carbon Monoxide	1.84	Calculated
	TVOCs as Benzene	1.44	Calculated

Table 3-3: Technical Data for Flares

Parameter		Value	Source
Equipment Specifications	Type	Flare	Client
	Fuel type	Landfil gas (biogas)	
	Number	1	
Stack details	Release height (m)	8	Based on EA limit at Swanbank Site
	Exhaust Diameter (m)	1.7	
	Temperature (°C)	988	Test data from LMS9 at Swanbank – 03/04/2019
	Flow rate (Nm^3/s)	3.83	
	Exit velocity (m/s)	8.21	
In-stack conc. (mg/Nm^3)	NO_x (Oxides of nitrogen)	150	Based on EA limit at Swanbank Site
	Carbon Monoxide	700	
	TVOCs as Benzene	10	
Emission Rate (g/s)	NOx	0.57	Calculated
	Carbon Monoxide	2.68	
	TVOCs as Benzene	0.04	

3.3 Modelling of NOx Chemistry

Oxides of nitrogen (NO_x) emitted from combustion sources are primarily composed of nitric oxide (NO) and nitrogen dioxide (NO_2).

Eventually, all NO emitted is oxidized to NO_2 in the atmosphere in the presence of ozone and sunlight. This formation of NO_2 from NO is a complex photochemical process depending on factors that include the total amount of available NO_x and ozone. The reaction takes place over several hours and can result in increased ground-level NO_2 concentrations further down-plume (far-field) and decreased closer to the source (near field).

As recommended by the NSW Approved Methods (NSW EPA, 2022) a Level 1 Assessment assuming a 100% conversion of NO to NO_2 with the maximum prediction and maximum background concentrations has been adopted here.

4 EXISTING ENVIRONMENT

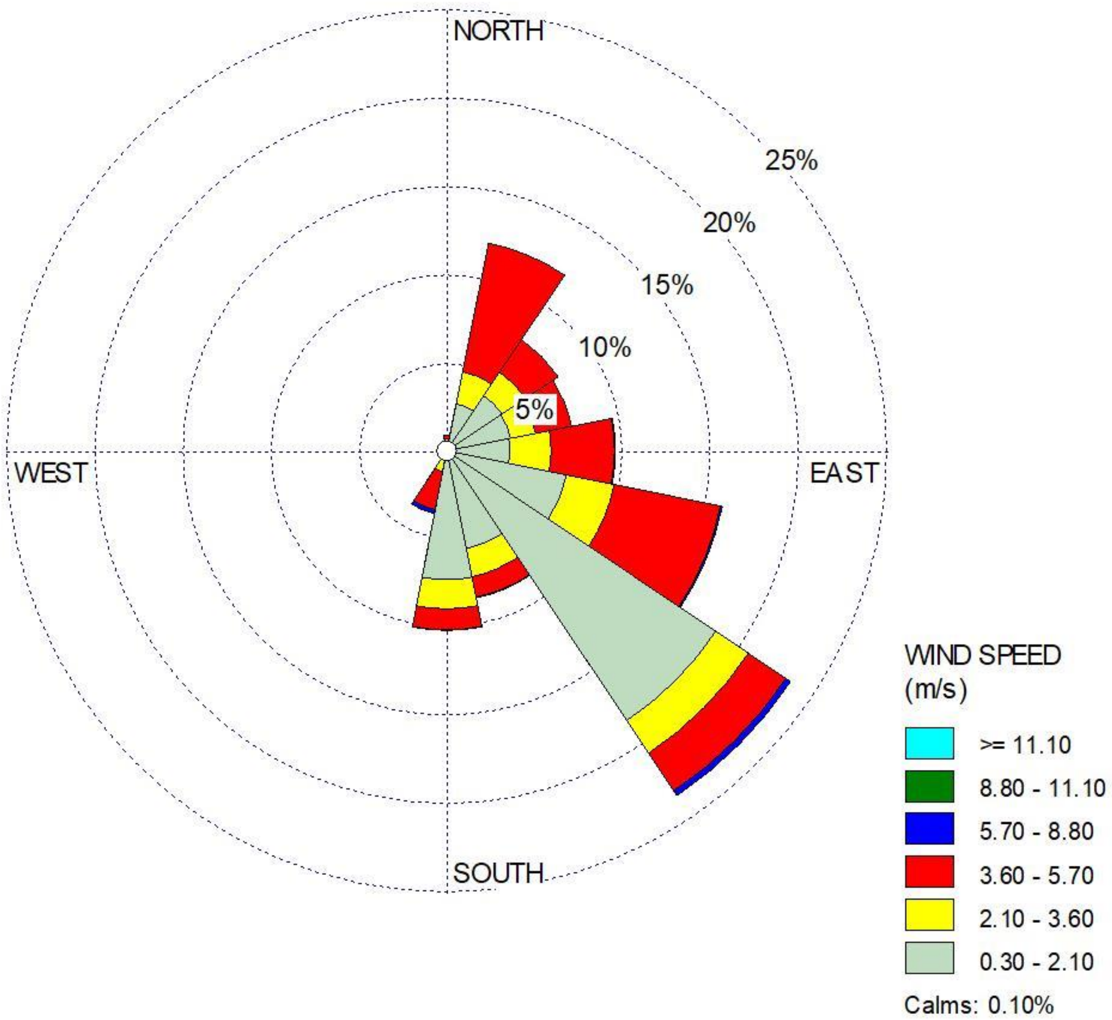
4.1 Metrological Data

4.1.1 Wind Speed and Direction

Wind roses have been generated from data extracted from CALMET at the site and are presented in Figure 4-1 and Figure 4-2.

Wind roses are used to show the frequency of winds by direction and strength. The bars show the compass points (north, north-north-east, north-east etc) from which wind could blow. The length of each bar shows the frequency of winds from that direction and the different coloured sections within each bar show the wind speed categories and frequency of winds in those categories. In summary, wind roses are used to visually show winds over a defined period.

The annual wind rose (Figure 4-1) shows that the site is dominated by south easterly through easterly winds. The time of day wind roses show a low proportion of calm winds (~0.2%) with light winds over the year (up to 3.3 m/s) occurring ~64% of the time. The wind speed frequencies are summarised graphically in Figure 4-3.

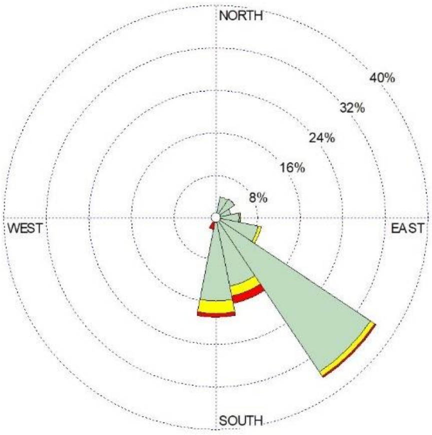


Location: X=486,000m East=7,861,500m South	*Year:* 2014	*Data Source:* CALMET extract
Calm winds: 0.1 %	*Average wind speed:* 2.55 m/s	*Creator:* W. Shillito

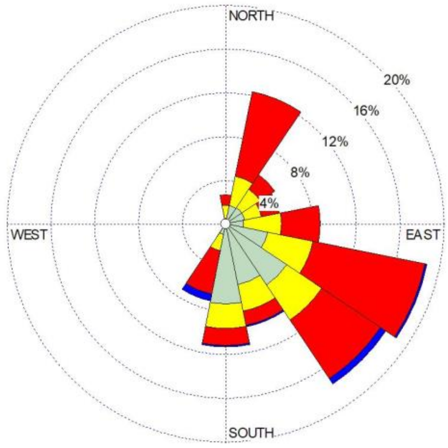
Figure 4-1: Annual Wind Rose for Centre of Domain[1]

[1] Approximately 2 km east of weather station location

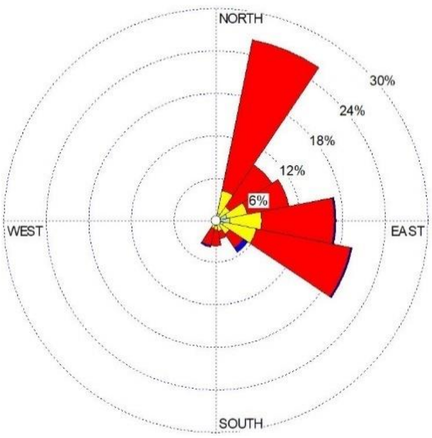
1 AM to 6 AM



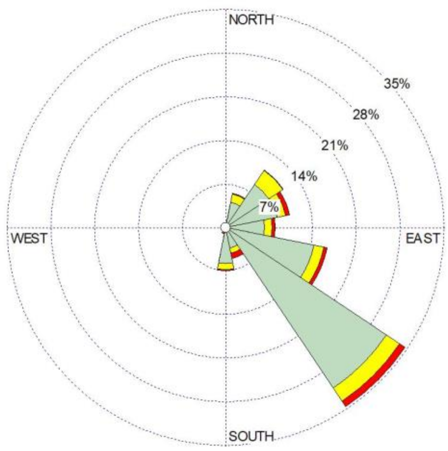
7 AM to 12 PM



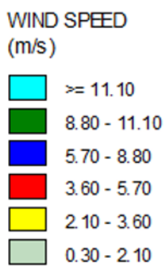
1 PM to 6 PM



7 PM to 12 AM



Period	*Average wind speed (m/s)*	*Calm winds %*
1 AM to 6 AM	1.6	0.2
7 AM to 12 PM	3.0	0.2
1 PM to 6 PM	3.8	0.0
7 PM to 12 AM	1.8	0.0



Location:	*Year:*	*Data Source:*	*Creator:*
X=486,000m East=7,861,500m South	2014	CALMET extract	W. Shillito

Figure 4-2: Time of Day Wind Rose for the site

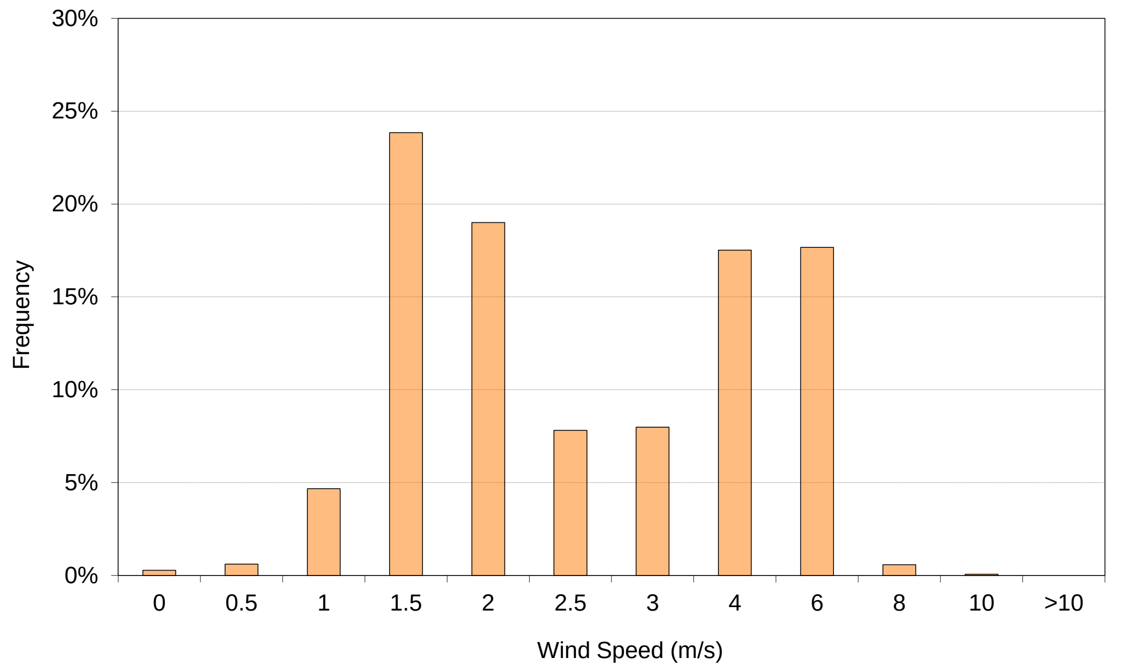


Figure 4-3: Wind Speed Frequency

4.1.2 Atmospheric Stability

Atmospheric stability is a key factor in dispersion modelling and is used to describe turbulence in the atmosphere. Turbulence is an important factor in plume dispersion. Turbulence increases the width of a plume due to random motion within the plume. This changes the plume cross-sectional area (width and height of the plume), thus diluting or spreading the plume. As turbulence increases, the rate at which this occurs also increases. Limited or weak turbulence, therefore, does not dilute or diffuse the plume as much as strong turbulence and leads to high downwind concentrations. This is often associated with low wind speeds (<0.3 m/s).

The Pasquill-Gifford stability scheme has been in use for many years to define turbulence in the atmosphere. The scheme uses stability classes from A to F[2]. Class A is highly unstable and at the other end of the scheme are class F conditions, which are very stable conditions that commonly occur at night and in the early morning. As noted above, under stable conditions, plumes do not disperse as well as during the day (unstable conditions) and these conditions can lead to impacts, especially for ground level sources.

Between Class A and Class F are stability classes that range from moderately unstable (B), through neutral (D) to slightly stable (E). Whilst classes A and F are most often associated with clear skies, class D is linked to sunset and sunrise, or cloudy and/or windy daytime conditions. Unstable conditions most often occur during the daytime and stable conditions are most common at night.

The stability classes predicted by CALMET for the Development Site are summarised in Figure 4-4. The data shows that E and F class stability occurs 45% of the time. The frequency of D class stability

[2] Note that CALPUFF uses a more accurate micrometeorological scheme for turbulence.

(32%) is commonly seen in areas with winds above 2.5 m/s at night or site with a high frequency of cloudy days.

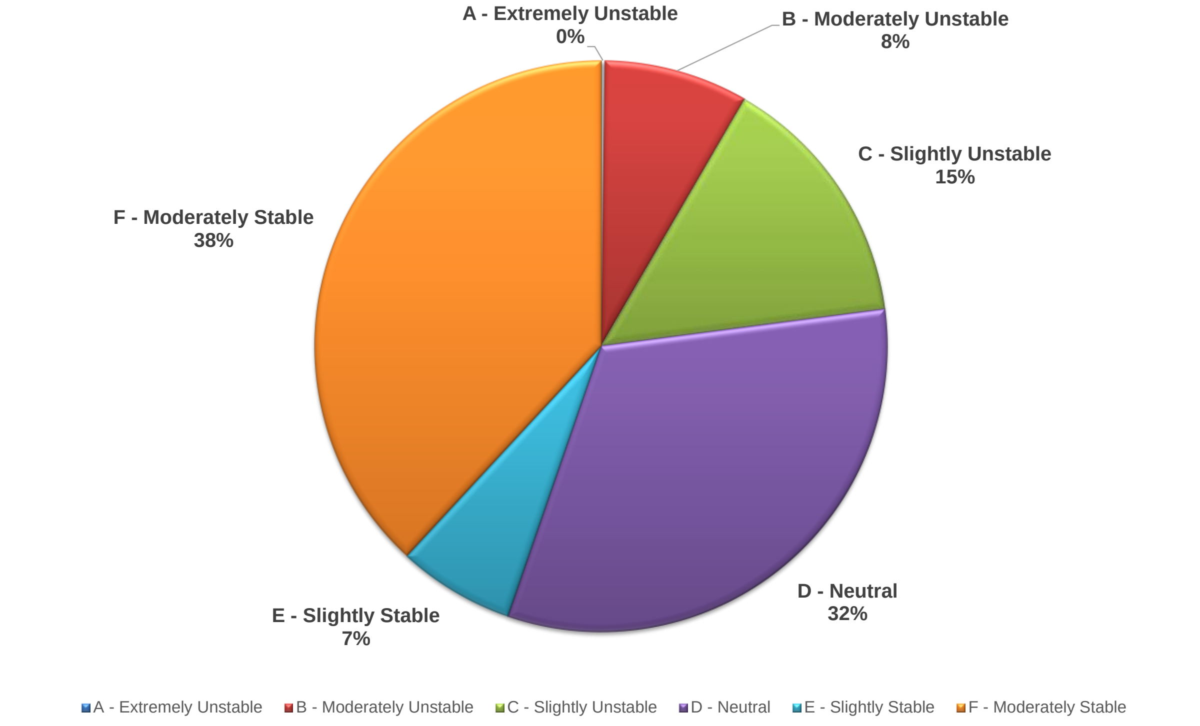


Figure 4-4: Atmospheric Stability

4.1.3 Atmospheric Mixing Height

The mixing height is the height of vertical mixing of air and suspended gases or particles above the ground. A parcel of air rising from the surface of the Earth will rise at a given rate (called the dry adiabatic lapse rate). As long as the parcel of air is warmer than the ambient temperature, it will continue to rise. However, once it becomes colder than the temperature of the environment, it will slow down and eventually stop (University of Michigan , 2004).

The mixing height is commonly referred to as an inversion layer. It is an important parameter when assessing air emissions as in simple terms, it defines the vertical mixing of a plume. This is because the air below the layer has restricted dispersion vertically and therefore the higher the mixing height, the more potential for dispersion.

The estimated variation of mixing height over time predicted at the site by CALMET is shown in Figure 4-5. The diurnal cycle is clear in this figure whereby at night the mixing height is normally relatively low and after sunrise, it increases as a result of heat associated with the sun on the Earth's surface. Overall, the estimated mixing height shown below is as expected.

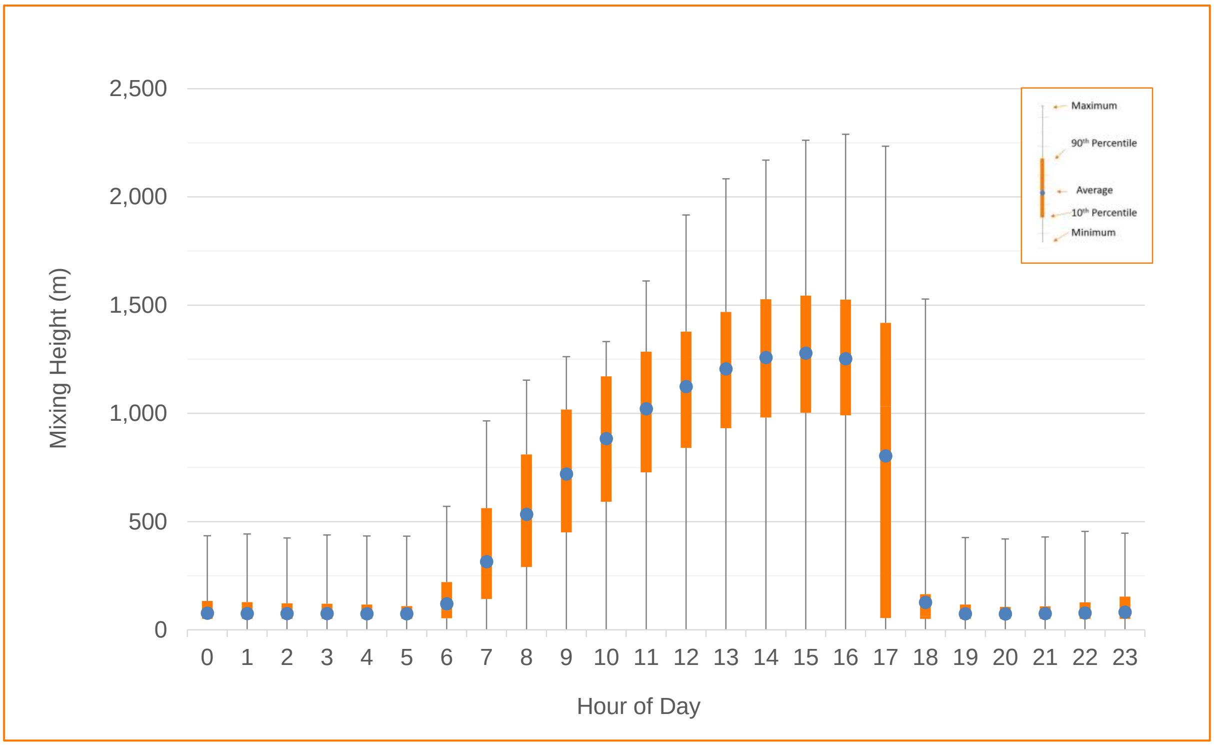


Figure 4-5: Atmospheric Mixing Height

4.2 Background Air Quality Data

Existing air quality in the region surrounding the site is influenced by, but not limited to the following sources:

- exhaust emissions from the local road infrastructure, heavy vehicles and construction equipment;
- emissions from industrial and manufacturing sources in the area;
- natural features of the local environment such as wind erosion of exposed soil; and
- dust emissions from unsealed roads and construction sites.

The Department of Environment and Science (DES)[3] currently operates four monitoring stations in the Townsville area. These are known as Coastguard, Environment Park, Lennon Drive and North Ward. There are also several historical stations that have been closed. The North Ward site was selected for NO_2 as it is the only current monitoring station that analyses for this pollutant.

As air toxics concentrations are not measured at Townsville, data was sourced from the Springwood and Boyne Island stations for Benzene and carbon. The use of data from these regional stations is consistent with DES (2019).

A summary of the ambient air pollutant measurements from 2017 to 2021 from the monitoring sites for inclusion in the dispersion modelling predictions as background concentrations is presented in Table 4-1. The pollutants, their monitoring location and averaging periods and statistics are included in the table.

[3] Formerly referred to as DEHP

Table 4-1: Ambient air monitoring data

Station	Pollutant	Averaging Period	Statistic	Value (µg/m³)
North Ward (2017-2021)	NO_2	1 – hour	70th percentile	6.2
			99th percentile	26.7
			Maximum	84.2
		Annual	Average	4.9
Boyne Island (2017-2021)	CO	8 – hours	Average	8.0
			99th percentile	125
			Maximum	297
Springwood (2017-2021)	Benzene	Annual	Average	4.0

Note: Different sites are used as not all sites measure all pollutants.

4.3 Sensitive Receptors

Sensitive receivers are locations that have the potential to be impacted by air emissions from a project. The nearest sensitive receptors for the site are show graphically in Figure 4-6 and their co-ordinates are provided in Table 4-2.

Table 4-2: Sensitive Receptors

ID	Easting (m)	Northing (m)	Description	Easting (m)	Northing (m)
SR1	487,131	7,860,292	SR17	484,063	7,860,774
SR2	487,003	7,860,189	SR18	484,011	7,860,820
SR3	486,881	7,859,842	SR19	484,014	7,860,844
SR4	486,921	7,859,535	SR20	484,027	7,860,877
SR5	486,427	7,859,220	SR21	483,901	7,860,953
SR6	485,808	7,859,174	SR22	483,724	7,860,982
SR7	485,339	7,860,629	SR23	483,366	7,860,854
SR8	485,258	7,860,626	SR24	482,546	7,861,036
SR9	485,232	7,860,629	SR25	482,916	7,861,575
SR10	485,042	7,860,657	SR26	482,904	7,861,608
SR11	484,935	7,860,675	SR27	482,204	7,862,032
SR12	484,745	7,860,704	SR28	482,054	7,862,342
SR13	484,683	7,860,775	SR29	481,864	7,862,774
SR14	484,635	7,860,780	SR30	481,790	7,863,222
SR15	484,465	7,860,731	SR31	482,903	7,863,789
SR16	484,290	7,860,776	SR32	483,106	7,864,113

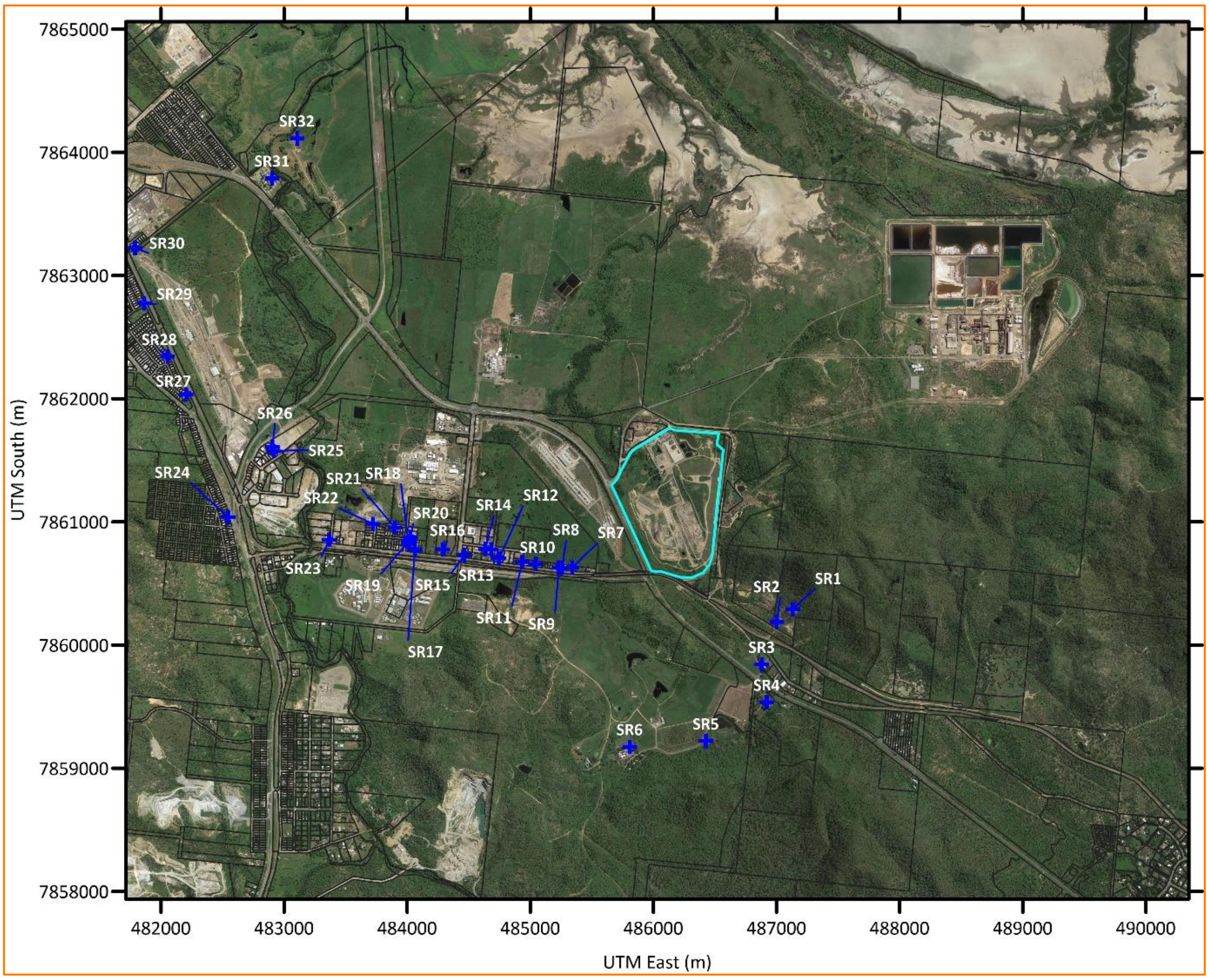


Figure 4-6: Sensitive Receptors

5 RESULTS

The modelling was completed for 32 identified sensitive receptors. Where a group of receptors were present, the closest point to the site was modelled as discrete receptors. The predicted ground level concentration for the most affected receptors (the maximum concentration predicted at any of the receptors modelled) have been presented below as follows:

- LMS in Isolation (Table 5-1); and
- LMS facility with background concentrations as described in Section 4.2 (Table 5-2); and

Contour plots showing the predicted ground level concentrations as well as receptor locations are presented below as follows:

- Figure 5-1: Predicted 1 hour maximum average NO2 – Gas engine and flare with background;
- Figure 5-2: Predicted annual average NO2 – Gas engine and flare with background;
- Figure 5-3: Predicted 8 hour maximum average CO – Gas engine and flare with background; and
- Figure 5-4: Predicted annual average Benzene – Gas engine and flare with background.

The full results for all sensitive receptors for all three scenarios are included in APPENDIX A.

The results show:

- the most potentially affected receptors are near SR24. These are located approximately 4 km to the west of the LMS site. The impact at these locations is a function of the terrain in the area and the prevailing winds;
- predicted ground level concentrations for the 1 hour maximum and annual average NO_2 for the three modelled scenarios comply with the air quality objective;
- predicted ground level concentrations for the 8 hour maximum CO comply with the air quality objective;
- predicted ground level concentrations for the annual average TVOCs as benzene comply with the air quality objective; and
- the results for both CO and TVOCs as benzene are dominated by the inclusion of the background concentrations from the Boyne Island and Springwood DES monitoring station respectively[4].

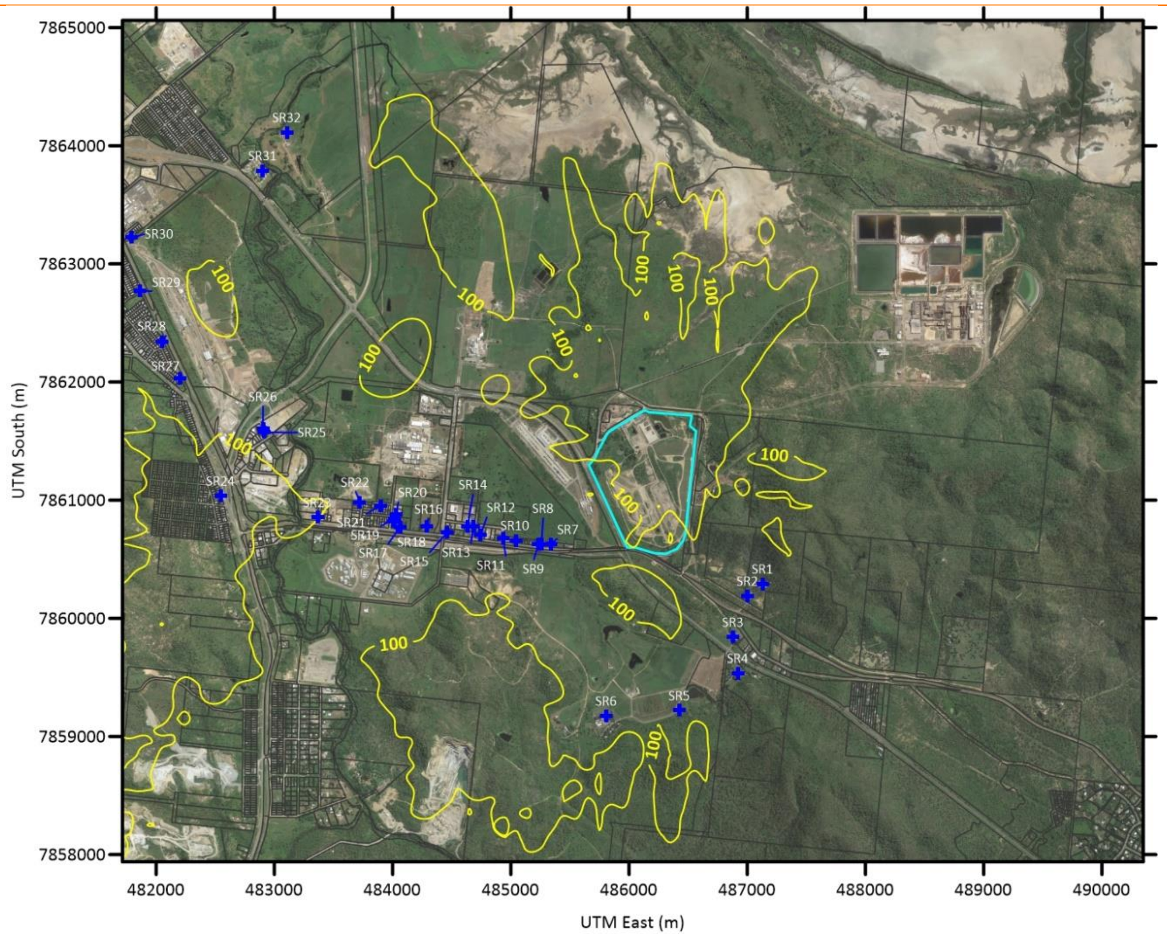
[4] The background concentration is higher than that modelled from the LMS site. This is a function of the location of the background measurement locations, that are located near large roads, which are impacted by benzene from vehicle exhaust.

Table 5-1: Predicted ground level concentrations for the most affected receptors – LMS in isolation

Pollutant	Averaging Period	Statistic	Units	Criteria	Ground Level concentration	Sensitive Receptor
NO_2	1 hour	Maximum	µg/m³	250	19.4	SR24
	Annual	Average	µg/m³	33/62	0.1	SR24
CO	8 hour	Average	µg/m³	11,000	19.4	SR24
Benzene	Annual	Average	µg/m³	5.4	0.27	SR24

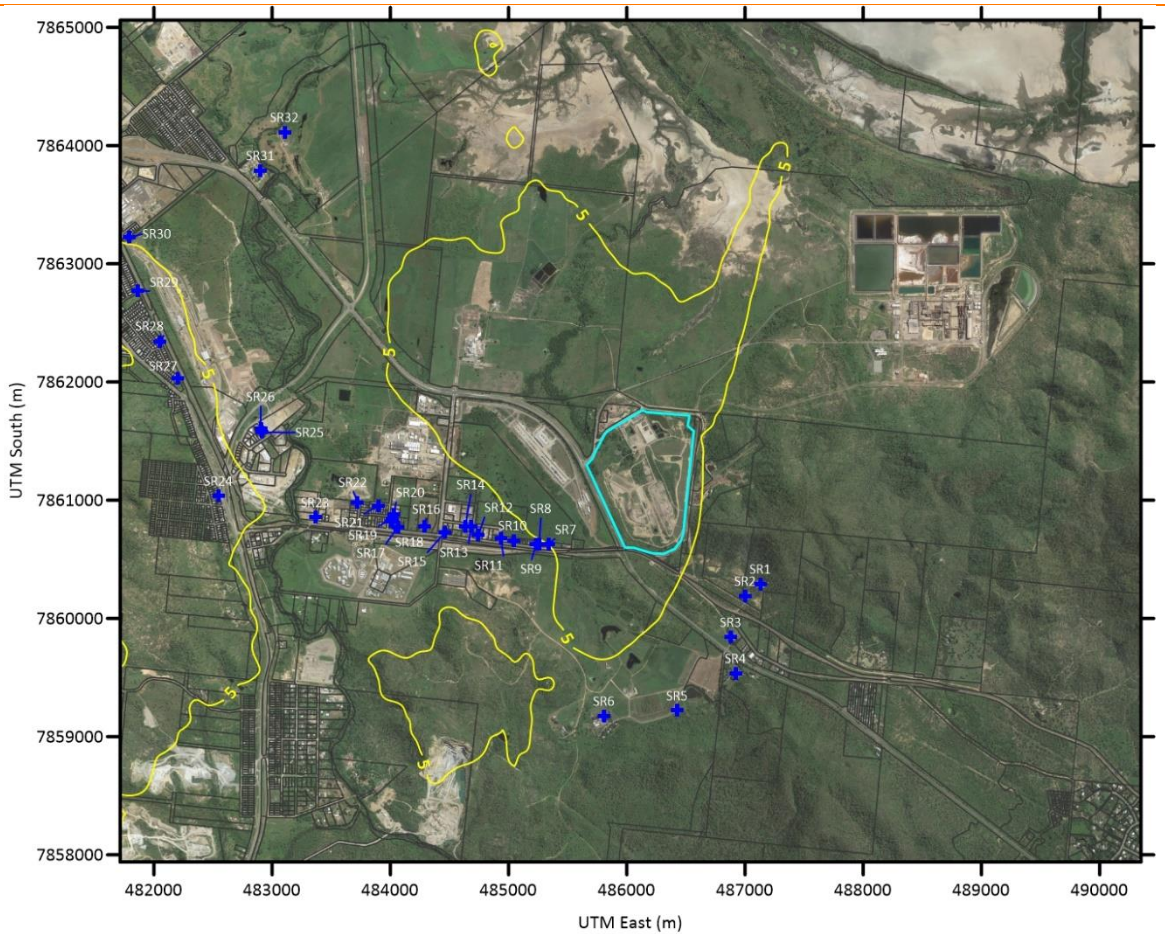
Table 5-2: Predicted ground level concentrations for the most affected receptors – LMS with background concentrations

Pollutant	Averaging Period	Statistic	Units	Criteria	Ground Level concentration	Sensitive Receptor
NO_2	1 hour	Maximum	µg/m³	250	103.6	SR24
	Annual	Average	µg/m³	33/62	5.0	SR24
CO	8 hour	Average	µg/m³	11,000	316.4	SR24
Benzene	Annual	Average	µg/m³	5.4	4.3	SR24



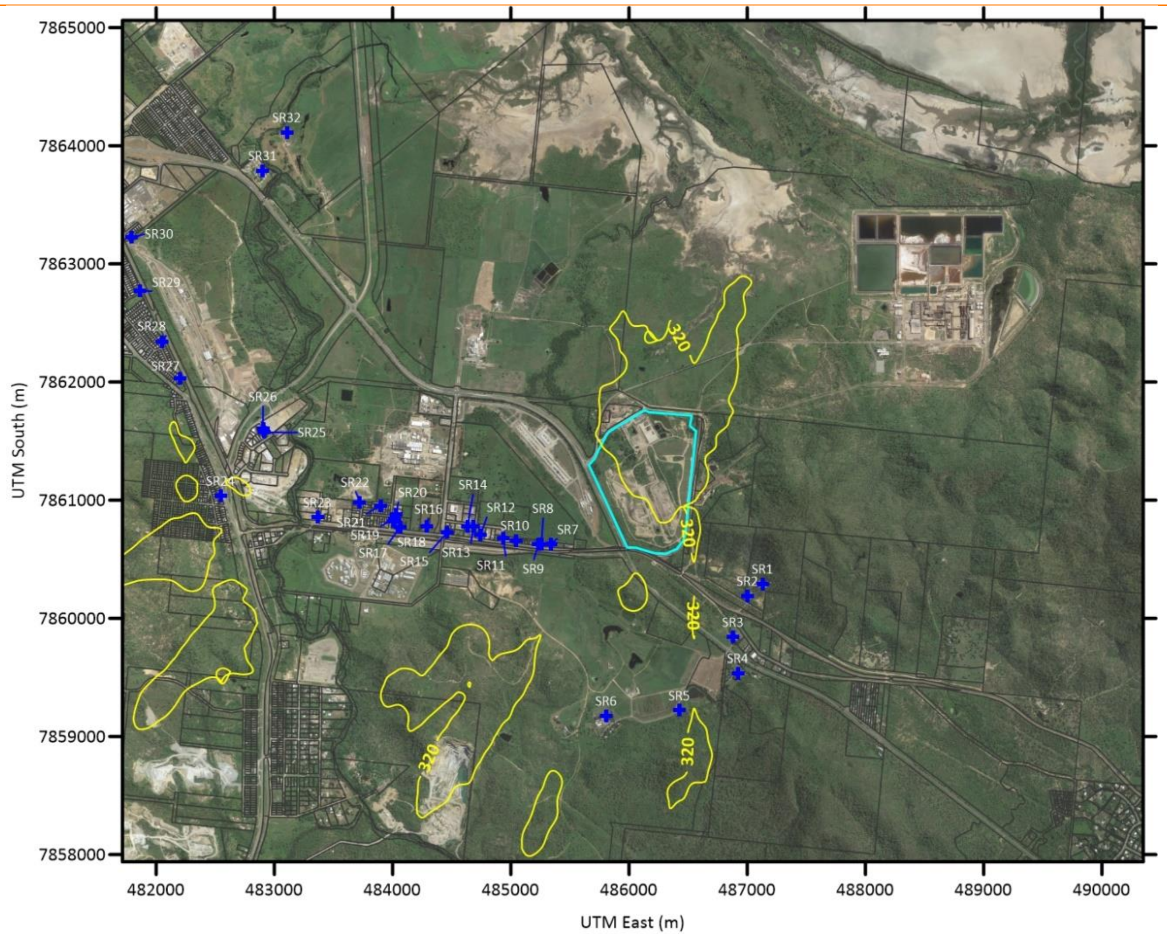
Species:	**Site:**	**Scenario:**	**Averaging Period:**	**Percentile:**
NO_2	Stuart Landfill	Gas engine and flare with maximum background and 100% conversion	1 hour	Maximum
Criterion:	**Units:**	**Meteorology:**	**Model:**	**Author:**
250	µg/m³	2014	CALPUFF v 6.42	W. Shillito

Figure 5-1: Predicted 1 hour maximum average NO_2 – Gas engine and flare with background



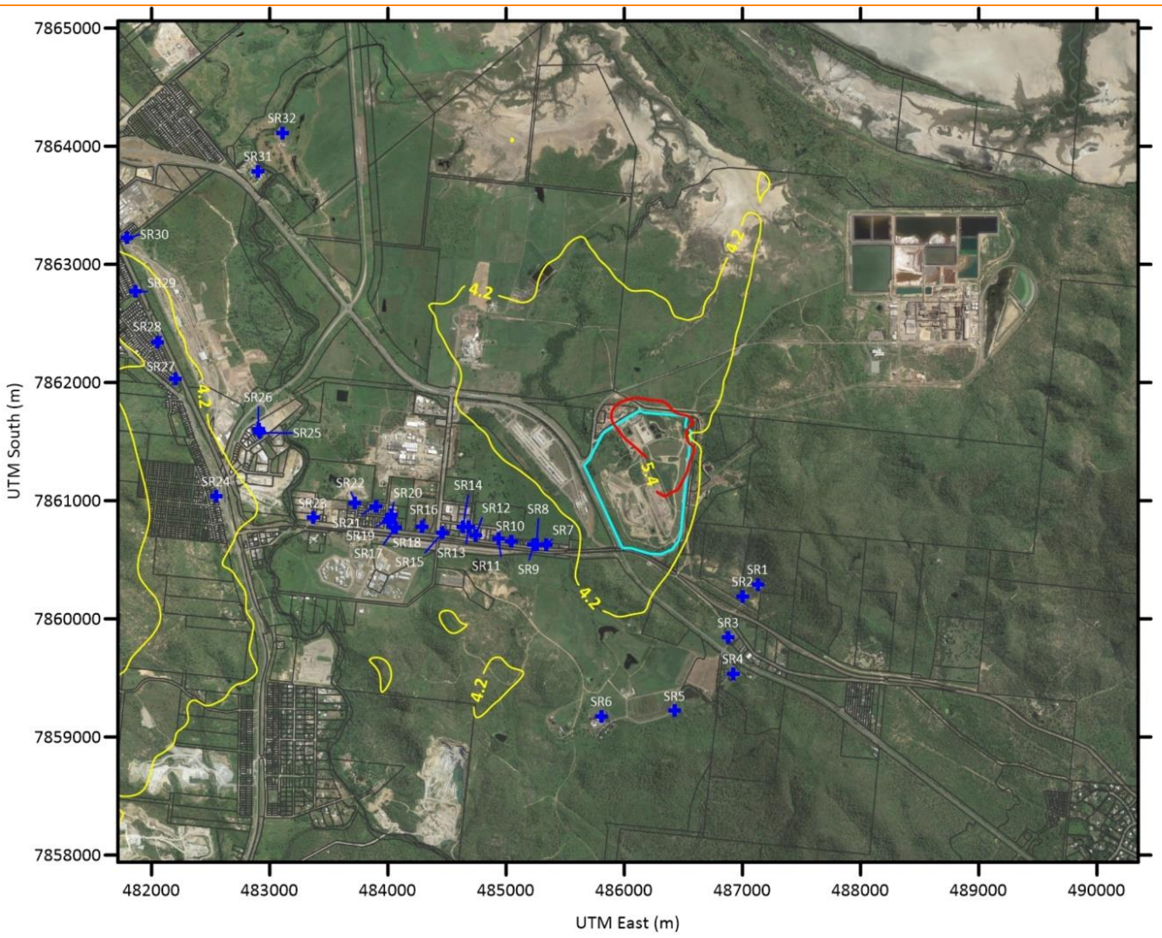
Species: NO2	**Site:** Stuart Landfill	**Scenario:** Gas engine and flare with background and 100% conversion	**Averaging Period:** Annual	**Percentile:** Average
Criterion: 33/62	**Units:** µg/m3	**Meteorology:** 2014	**Model:** CALPUFF v 6.42	**Author:** W. Shillito

Figure 5-2: Predicted annual average NO_2 – Gas engine and flare with background



Species: CO	Site: Stuart Landfill	Scenario: Gas engine and flare with background	Averaging Period: 8 hour	Percentile: Maximum
Criterion: 11,000	Units: µg/m^3	Meteorology: 2014	Model: CALPUFF v 6.42	Author: W. Shillito

Figure 5-3: Predicted 8 hour maximum average CO – Gas engine and flare with background



Species: Benzene	**Site:** Stuart Landfill	**Scenario:** Gas engine and flare with background	**Averaging Period:** 1 year	**Percentile:** Average
Criterion: 5.4	**Units:** µg/m^3	**Meteorology:** 2014	**Model:** CALPUFF v 6.42	**Author:** W. Shillito

Figure 5-4: Predicted annual average Benzene – Gas engine and flare with background

6 CONCLUSION

The modelling presented in this report used a site-specific meteorological dataset generated using a combination of TAPM and CALMET. The meteorological modelling incorporated observational data from the Stuart DES monitoring station.

Emissions data was based on technical data provided by LMS for the Caterpillar 3516LE and recent emissions monitoring reports taken from another site operated by LMS site at Swanbank. The dispersion of the emissions was predicted using CALPUFF, and the results were compared to the criteria in the *Environment Protection (Air) Policy 2019.*

The modelling results showed compliance with the air quality objective at all sensitive receptors for the modelling scenario including when background data was included.

Based on our assessment we recommend that the site be approved, and emissions monitoring is conducted post commissioning of the new gas generator to confirm the assumptions adopted here.

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APPENDIX A. SENSITIVE RECEPTOR RESULTS

Table 7-1: Predicted ground level concentrations – LMS in isolation

ID	Maximum 1 hour NO_2 (µg/m^3)	Annual Average NO_2 (µg/m^3)	Maximum 8 hour Carbon Monoxide (µg/m^3)	Annual Average Benzene (µg/m^3)
SR1	3.9	0.01	3.5	0.01
SR2	2.7	0.01	4.1	0.01
SR3	2.7	0.01	3.3	0.01
SR4	2.3	0.01	2.4	0.01
SR5	10.8	0.03	10.7	0.04
SR6	11.9	0.06	10.4	0.09
SR7	13.8	0.10	8.0	0.14
SR8	14.0	0.10	8.0	0.13
SR9	13.9	0.09	8.0	0.13
SR10	11.7	0.09	7.6	0.13
SR11	8.8	0.08	6.7	0.11
SR12	8.0	0.08	5.9	0.11
SR13	8.7	0.08	7.2	0.12
SR14	8.8	0.08	7.5	0.12
SR15	8.8	0.08	8.6	0.12
SR16	10.1	0.07	8.8	0.11
SR17	9.7	0.06	7.9	0.10
SR18	8.6	0.06	6.6	0.09
SR19	8.3	0.06	6.2	0.09
SR20	7.8	0.06	5.7	0.09
SR21	8.1	0.05	5.2	0.08
SR22	12.1	0.05	4.4	0.08
SR23	16.4	0.05	6.4	0.09
SR24	19.4	0.14	19.4	0.27
SR25	13.4	0.06	5.0	0.09
SR26	13.4	0.06	4.9	0.09
SR27	12.5	0.13	13.0	0.24
SR28	12.4	0.12	9.7	0.23
SR29	11.6	0.13	10.2	0.24
SR30	7.6	0.09	7.1	0.17
SR31	5.1	0.06	3.9	0.09
SR32	6.2	0.06	7.1	0.11

Table 7-2: Predicted ground level concentrations – LMS with background concentrations

ID	Maximum 1 hour NO_2 (µg/m^3)	Annual Average NO_2 (µg/m^3)	Maximum 8 hour Carbon Monoxide (µg/m^3)	Annual Average Benzene (µg/m^3)
SR1	88.1	4.9	300.5	4.0
SR2	86.9	4.9	301.1	4.0
SR3	86.9	4.9	300.3	4.0
SR4	86.5	4.9	299.4	4.0
SR5	95.0	4.9	307.7	4.0
SR6	96.1	5.0	307.4	4.1
SR7	98.0	5.0	305.0	4.1
SR8	98.2	5.0	305.0	4.1
SR9	98.1	5.0	305.0	4.1
SR10	95.9	5.0	304.6	4.1
SR11	93.0	5.0	303.7	4.1
SR12	92.2	5.0	302.9	4.1
SR13	92.9	5.0	304.2	4.1
SR14	93.0	5.0	304.5	4.1
SR15	93.0	5.0	305.6	4.1
SR16	94.3	5.0	305.8	4.1
SR17	93.9	5.0	304.9	4.1
SR18	92.8	5.0	303.6	4.1
SR19	92.5	5.0	303.2	4.1
SR20	92.0	5.0	302.7	4.1
SR21	92.3	5.0	302.2	4.1
SR22	96.3	5.0	301.4	4.1
SR23	100.6	5.0	303.4	4.1
SR24	103.6	5.0	316.4	4.3
SR25	97.6	5.0	302.0	4.1
SR26	97.6	5.0	301.9	4.1
SR27	96.7	5.0	310.0	4.2
SR28	96.6	5.0	306.7	4.2
SR29	95.8	5.0	307.2	4.2
SR30	91.8	5.0	304.1	4.2
SR31	89.3	5.0	300.9	4.1
SR32	90.4	5.0	304.1	4.1
Air Quality Objective	**250**	**33/62**	**11,000**	**5.4**