AIR QUALITY IMPACT ASSESSMENT REPORT
FOR
SPF DIANA AUSTRALIA PTY LTD
91 GARDINER STREET, RUTHERFORD NSW

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Benbow ENVIRONMENTAL

Engineering a Sustainable Future for Our Environment

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1. INTRODUCTION

Benbow Environmental has been engaged by SPF Diana Australia Pty Ltd to undertake an air quality impact assessment of the proposed development located at Lot 206, 91 Gardiner Street, Rutherford. The proposed development manufactures a liquid palatability enhancer which is a liquid petfood ingredient supplied to petfood manufacturers.

1.1 SCOPE OF WORKS

The scope of this report is limited to the following:

- Identification of significant emission sources from proposed operations on site;
- Air dispersion modelling using AERMOD to determine the worst-case ground level concentrations;
- Assessment of the air quality impacts from the facility; and
- The compilation of a report which summarises the methodology, findings, and any recommendations required to minimise the extent of impacts.

2. DESCRIPTION OF THE SITE AND SURROUNDS

2.1 SITE LOCATION

The proposed facility will be located at Lot 206, 91 Gardiner Street, Rutherford. Figure 2-1 present the location of the site. Figure 2-2 shows the site is situated on parcel of land being subdivided (subject to a separate development application handled by the developer of the industrial park (not SPF Diana Aust. Pty Ltd)). Figure 2-3 shows the land zoning, this site is in an IN1 general industrial zone.

Figure 2-1: Site Location (Aerial View)

Source: SixMaps 2021

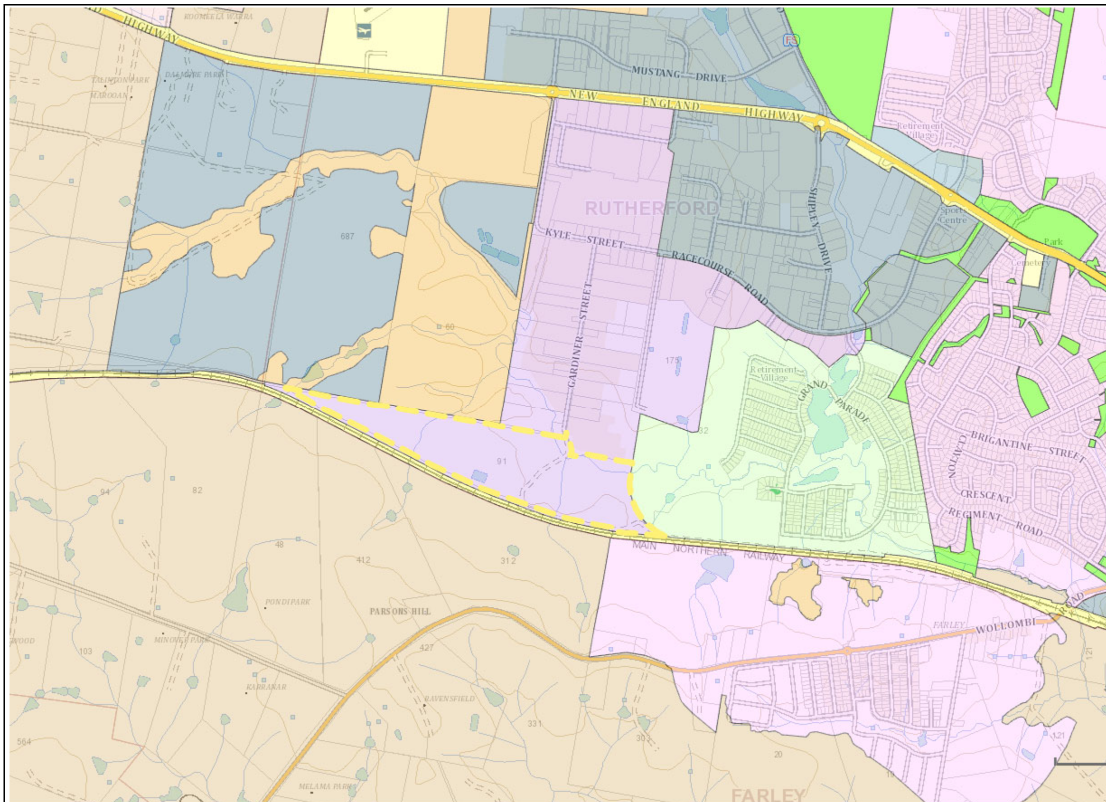
↑N Not to scale	LEGEND: Site location:	Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

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

Source: GoogleEarth Pro 2022

↑N Not to scale		Benbow Environmental 25-27 Sherwood Street, Northmead NSW 2152

Figure 2-3: Land Use Zoning Map



Source: NSW ePlanning Spatial Viewer 2021

↑N
Not to scale

LEGEND:

Site Boundaries

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
- E4 Environmental Living
- IN1 General Industrial
- R1 General Residential
- R5 Large Lot Residential
- RE1 Public Recreation
- RE2 Private Recreation
- RU1 Primary Production
- RU2 Rural Landscape
- SP1 Special Activities
- SP2 Infrastructure
- SP3 Tourist

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2.2 Site Description and Adjacent Land Use

The site is zoned as 'IN1 – General Industrial' under the Maitland Local Environmental Plan 2011. The site is currently surrounded by undeveloped land. However, the site itself is being subdivided (subject to a separate development application) and commercial/industrial site's will occupy this area in the future. The site is bordered to the south by a corridor of SP2 infrastructure zoning for the railway, beyond that the land south is zoned RU2 Rural Landscape. The lot immediately to the north of the site is zoned B5 business development, except for a tributary of stony creek and its banks. These areas are zoned E3 and covers a portion of the land to the north and north east of the site. This creek runs through the tip (western corner) of the subject site. The nearest residences are approximately 748 m to the south.

2.3 Nearest Sensitive Receptors

The subject site is surrounded by existing rural developments which are subject to development in future. Table 2-1 identifies the nearest sensitive receptors and future receptors that have the potential to be affected by the proposal. The aerial photographs of the sensitive receivers are shown in Figure 2-4. These receptors were selected based on their proximity and directional bearing from the subject site.

Table 2-1: Nearest Sensitive Receptors

Receptor ID	Address	Lot & Plan	Type	Approximate Distance from site
Existing				
R1	398 Wollombi Rd, Farley	4/DP234367	Residential	838 m
R2	412 Wollombi Rd, Farley	5/DP634525	Residential	748 m
R3	48 Old North Rd, Farley	4/DP634525	Residential	889 m
R4	94 Old North Rd, Farley	2/DP634522	Residential	1 km
R5	Cowhill Rd, Lochinvar	5/DP2397541	Residential	1 km
R6	669 New England Highway Lochinvar	5/DP846960	Residential	1.3 km
R7	641 New England Hwy, Lochinvar	2/DP749144	Residential	1.2 km
R8	60 Kyle St, Rutherford	4/DP790460	Commercial/ Industrial	482 m
R9	72 Gardiner St, Rutherford	191/DP809485	Industrial	548 m
Future				
R10	91 Gardiner St, Rutherford	2/DP1197299	Industrial	55 m
R11	687 New England Hwy, Lochinvar	1413/DP1141534	Commercial	251 m
R12	687 New England Hwy Lochinvar	6871/DP1121957	Commercial	40 m

Figure 2-4: Receptor Locations

↑N

Source: Google Maps 2021

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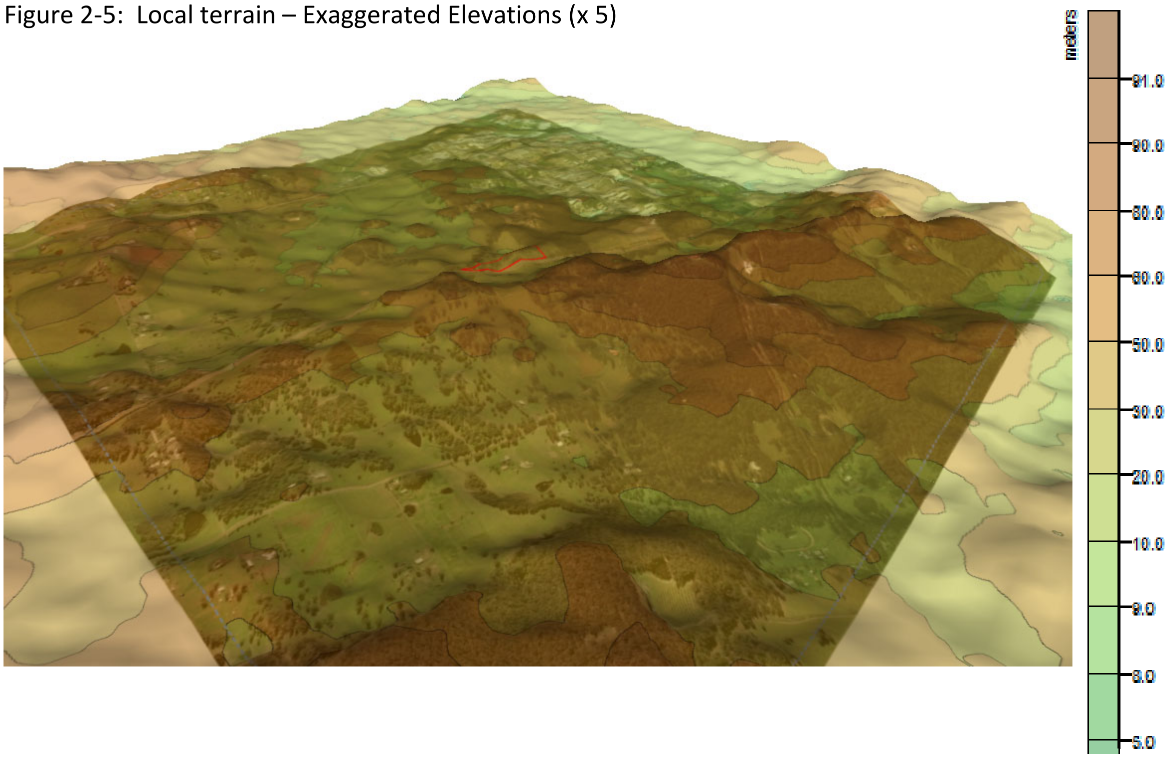
2.4 Terrain of the Local Region

Figure 2-5 shows the terrain with the z-axis (i.e. vertical axis) exaggerated by a factor of 5 in order to provide a clearer description of the topography. A coloured scale bar shows elevations corresponding to the colours used in the figures. The site itself is relatively flat and gradually slopes downward to the tip (western corner). The site is located on the northern side of a ridgeline that runs east-west. The closest residential receiver is located on the top of this ridge to the south. The residential receivers to the northwest are on a lower elevation.

Figure 2-5: Local terrain – Exaggerated Elevations (x 5)



3. PROPOSED SITE OPERATIONS

The proposed development manufactures a liquid palatability enhancer which is a liquid petfood ingredient supplied to petfood manufacturers.

3.1 PROCESS DESCRIPTION

The process consists of:

- Receiving
  Trucks arrive at the facility to drop off pallets of raw materials including:
  - Beef Livers
  - Chicken Livers
  - Chicken Guts
  - Chicken MDM (Mechanically deboned meat)
  - Salmon
  - Kangaroo

  The packaging of the incoming material is manually removed and the raw material is transferred into plastic lined crates.

- Unfreezing (if required)
  Most of the incoming material is delivered frozen. Frozen raw materials crates get moved into a tempering room(Unfreezing room) which is heated with steam from the boiler.

- Grinding
  Other material and frozen material once thawed gets tipped into a grinder and the resultant slurry gets transferred into a mixing tank.

- Cooking and adding ingredients
  The mixing tank receives flavour additives before being transferred to the heated processing tank (reactor) where the pH and temperature is controlled (pH with dosing phosphoric acid and caustic soda) and temperature from the steam from the boiler. Strict control of these parameters are necessary for the efficacy of the enzymes which are added as a powder manually via a hatch at the top of the tank. The enzymes and temperature liquify the slurry. Typical temperature of the liquid is 100°C, and max is 130°C.

- Sifting
  This liquid is then sifted (screened using a vibrating screen) which removes solids such as bits of bone etc (material that the enzymes cannot break down) which is transferred directly into a bin as solid waste which is removed offsite by a licensed waste contractor.

- Transfer to storage tanks
  The product is cooled to 40°C transferred to bulk storage tanks where it is either decanted into IBCs, BIBs, Pallecons, or Drums (mostly IBCs) or it is unloaded directly from the bulk storage via a tanker truck.

- Quarantine (if required)
  Some of the products are quarantined for a designated period within the facility.

3.2 WATER USE

The majority of water is used for cleaning purposes, some of the water is also added into the product. The cleaning water ends up as waste water to be processed in the site's waste water treatment plant before being discharged to trade waste.

Water is fed to a boiler which generates steam. This steam is used for cleaning, in the cooking process and for heating the tempering room (unfreezing room).

3.3 HOURS OF OPERATION

The proposed development will operate 24/7.

4. METEOROLOGY AND LOCAL AIR QUALITY

The meteorological data used in the modelling of this assessment was no-observation prognostic meteorological data. A prognostic meteorological data file created by Lakes Environmental with WRF using a representative year was pre-processed using AERMET for use in AERMOD. The representative year is selected based on the evaluation of weather monitoring stations for their proximity to the site, completeness of data, and similarity of topography to the subject site

4.1 REPRESENTATIVE YEAR METEOROLOGICAL DATA

The nearest weather monitoring station to the subject site is Maitland Airport AWS, however data from this station is only available from 2016, therefore, to assess weather against long-term trends the Paterson (Tocal AWS) has been utilised. This monitoring station is located approximately 13.5 kilometres away to the north east of the subject site and was considered to be the most appropriate source of data for determining the representative year due to its proximity to the site, completeness of data, and similar topography to the subject site.

The representative meteorological year of 2020 was selected based on long term averages from Paterson (Tocal AWS). Meteorological data for 2020 was compared with long term averages for minimum temperature, maximum temperature, and wind run, and found to be consistent.

A 2020 prognostic meteorological data file was created by Lakes Environmental using the WRF model. This data file was used as input into AERMET pre-processor to create onsite Surface and profile met data.

4.2 WIND ROSE PLOTS

Wind rose plots show the direction from which the wind is coming with triangles known as "petals". The petals of the plots in Figure 4-1 summarise wind direction data into 8 compass directions ie. north, north-east, east, south-east, etc.

The length of the triangles, or "petals", indicates the frequency that the 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. Thus, the segments of a petal show what proportion of wind for a given direction falls into each class.

The proportion of time for which wind speed is equal to or less than 0.5 m/s, 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 time that they make up 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 axis varies 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 wind rose.

4.3 LOCAL WIND TRENDS

Seasonal wind rose plots for this site utilising Paterson (Tocal AWS) 2020 data have been included as Figure 4-1.

Based on the information presented from the 2020 data for Paterson (Tocal AWS), annual average wind speeds of 2.36 m/s and a calms frequency of 24.07% were estimated. Annual winds from the north-west and south-east were found to be dominant at frequencies approximately 16% and 15% respectively of the time. The remainder contributed 8% or less each.

The average summer wind speed was estimated to be 2.68 m/s, with a calms frequency of 12.37%. South-easterly winds were dominant at 26% frequency. Southerly winds were approximately ~16% frequent while the remainder have contributions of less than 12% each.

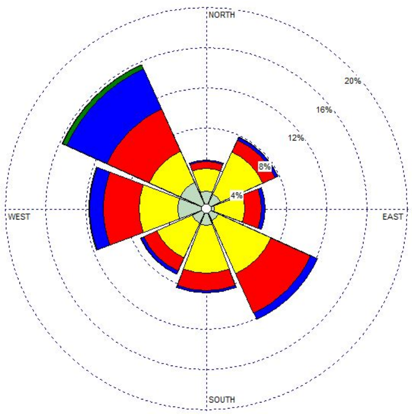
The average autumn wind speed was 2.03 m/s with a calms frequency of 33%. In autumn, dominant winds are blowing from the north-west 15% of the time, west 11% and south-east 9% . The remainder contributed less than 8% each of the time.

The average winter wind speed was determined to be 2.43 m/s with a calms frequency of 27.87%. The winter season data showed dominant strong winds from the north-west, at 25%. Westerly winds occurred at a 13% frequency, and all other winds occurred at less than 8% prevalence.

In the spring time, average wind speeds of 2.40 m/s with a frequency of calms of 22.78% were recorded. Most winds were found in the south-east, north west and west with a frequency of approximately 14%, 13% and 11%. The rest of the wind directions were found to be present at frequencies less than 10%.

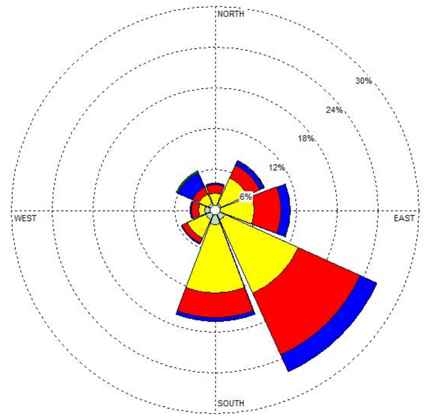
Figure 4-1: Wind Rose Plots for the Referenced Meteorological Station – Bureau of Meteorology Paterson AWS (2020)

All Seasons



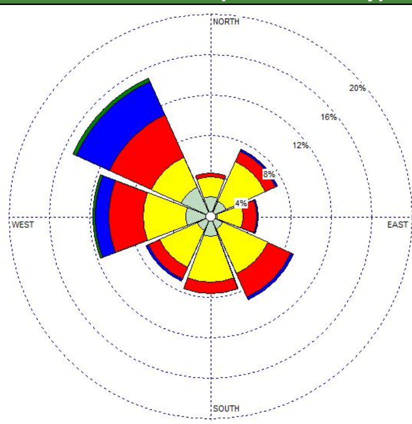
Average Wind Speed: 2.36 m/s
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Summer Season (December – February)



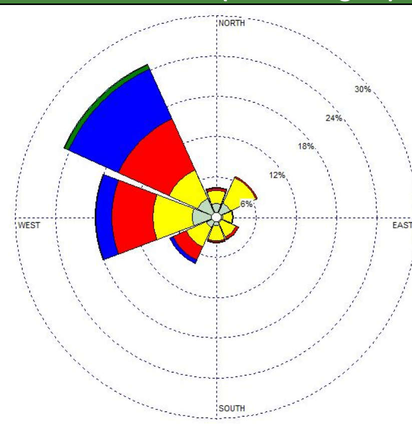
Average Wind Speed: 2.68 m/s
Axis Frequencies: 6%, 20%, 18%, 24%, 30%

Autumn Season (March – May)



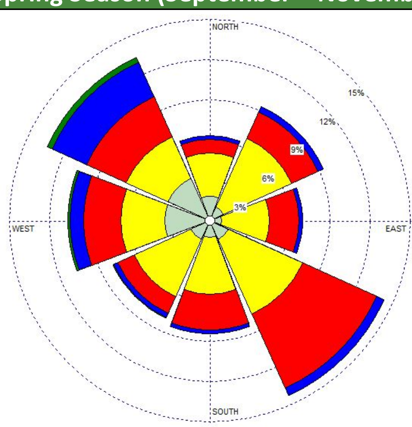
Average Wind Speed: 2.03 m/s
Axis Frequencies: 4%, 8%, 12%, 16%, 20%

Winter Season (June – August)



Average Wind Speed: 2.43 m/s
Axis Frequencies: 6%, 20%, 18%, 24%, 30%

Spring Season (September – November)



Average Wind Speed: 2.40 m/s
Axis Frequencies: 3%, 6%, 9%, 12%, 15%

Legend

4.4 Local Climate Data

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 Table 4-1.

Table 4-1: Climate data from the Paterson (Tocal 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
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**

4.5 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.

Terrain is shown in Figure 2-5. As can be seen the site is located on the northern slope of a ridgeline to the south. The closest residents are either on this ridgeline or on the other side. The nearest residences to the north are on a lower elevation which may cause cold air drainage and increased impacts.

Katabatic flow may influence some impacts on sensitive receptors due to emissions from the subject site and the surrounding terrain.

4.6 LOCAL 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.

4.6.1 Dust

Ambient air quality data for $PM_{2.5}$ and PM_{10} were obtained from NSW OEH ambient air monitoring station located at Beresfield, NSW (approximately 18 km from the site). Those in red in January 2020 are during the 2019-2020 bushfires. The relevant data is summarised in Table 4-2.

Table 4-2: Summary of 2020 Data for $PM_{2.5}$ and PM_{10} - NSW EPA Monitoring Station at Beresfield (2020)

Pollutant	Averaging period	Date for 2020	Concentration (µg/m³)
$PM_{2.5}$	Maximum 24 hr	08/01/2020	**49.7**
	2nd highest 24 hr	04/01/2020	**45.6**
	3rd highest 24 hr	05/01/2020	**39.3**
	4th highest 24 hr	02/01/2020	**35.2**
	5th highest 24 hr	03/01/2020	**31.8**
	6th highest 24 hr	12/01/2020	**28.2**
	7th highest 24 hr	24/01/2020	**27.6**
	8th highest 24 hr	09/01/2020	**27.4**
	9th highest 24 hr	07/01/2020	23.7
	10th highest 24 hr	04/02/2020	22
	Annual average	-	7.66
PM_{10}	Maximum 24 hr	08/01/2020	**77.7**
	2nd highest 24 hr	24/01/2020	**75.1**
	3rd highest 24 hr	05/01/2020	**69.3**
	4th highest 24 hr	04/01/2020	**54.5**
	5th highest 24 hr	02/01/2020	**51.7**
	6th highest 24 hr	01/01/2020	**51.4**
	7th highest 24 hr	03/01/2020	47.1
	8th highest 24 hr	19/02/2020	46.4
	9th highest 24 hr	19/08/2020	45.2
	10th highest 24 hr	23/01/2020	42.1
	Annual average	-	18.51

Note: Bold values exceed the *Approved Methods* criteria; dates in red in January 2020 are during the 2019-2020 bushfires.

No ambient air quality data for Total Suspended Particulates (TSP) is available from the referenced monitoring station. Therefore, the worst-case particle size distribution data from the AP-42 Emissions Database provided by the U.S. Environmental Protection Agency (US EPA, 1995), a PM_{10}-to-TSP ratio of 0.51, was used to estimate the annual TSP background concentration level of 36.29 µg/m³.

4.6.2 NO_2

The relevant assessable pollutant parameters available from the monitoring station are NO_2 hourly values for 2020. A summary of the background NO_2 data is provided in the table below.

The AMMAAP pphm conversion factors have been used to transform the OEH measured background data into µg/m³. Conservatively factors for 0°C have been adopted rather than the 25°C factors.

Table 4-3: Referenced Background NO_2 Data – NSW EPA Monitoring Station at Beresfield (2020)

Pollutant	NO_2
Peak hourly concentration pphm	3.5
Peak hourly concentration 0°C (µg/m³)	71.75
Peak hourly concentration 25°C (µg/m³)	65.8
Average hourly concentration pphm	0.68
Average hourly concentration 0°C (µg/m³)	13.92
Average hourly concentration 25°C (µg/m³)	12.76

5. AIR QUALITY CRITERIA AND GUIDELINES

5.1 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 sections of this Act have most relevance to the site:

- *Section 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.

- *Section126 Dealing with Materials*

(1) The occupier of any premises who deals with materials 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 occupiers failure to deal with those materials in a proper and efficient manner.

(2) In this section:

deal *with materials means process, handle, move, store or dispose of the materials.*

Materials *includes raw materials, materials in the process of manufacture, manufactured materials, by-products or waste materials.*

- *Section 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.

- *Section 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.

(2) Where neither such a standard nor rate has been so prescribed, 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.

- *Section 129 Standards of air impurities not to be exceeded*

(1) The occupier of any premises at which scheduled activities are carried on under the authority conferred by a licence must not cause or permit the emission of any offensive odour form the premises to which the licence applies.

(2) It is a defence in proceedings against a person for an offence against this section if the person establishes that:

(a) The emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of the licence directed at minimising the odour, or

(b) The only persons affected by the odour were persons engaged in the management or operation of the premises.

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

The proposed development is required to comply with this Act.

5.1.1 EPL Licence/Scheduled Activity

Under schedule 1 of the POEO Act clause 23:

23 Livestock processing activities
(1) This clause applies to the following activities—
general animal products production*, meaning the manufacture of products derived from the slaughter of animals occurring in plants producing products such as hides, adhesives, pet food, gelatine, fertiliser or meat products.*
greasy wool or fleece processing*, meaning the scouring, topping or carbonising of greasy wool or fleeces.*
rendering or fat extraction*, meaning the manufacture of products derived from the slaughter of animals occurring in rendering or fat extraction plants.*

> ***slaughtering or processing animals***, *meaning the slaughtering or processing of animals (including poultry and fish).*
> ***tanneries or fellmongeries***, *meaning the manufacture of products derived from the slaughter of animals occurring in tanneries or fellmongeries (that is, operations that process animal skins or other animal products to produce leather or other similar products).*
>
> *(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.*
> *Table*

Column 1	*Column 2*
Activity	*Criteria*
general animal products production	*capacity to produce more than 5,000 tonnes of animal products per year*
greasy wool or fleece processing	*capacity to process more than 200 tonnes of wool or fleece per year*
rendering or fat extraction	*capacity to produce more than 200 tonnes of tallow, fat or their derivatives or proteinaceous matter per year*
slaughtering or processing animals	*capacity to slaughter or process more than 750 tonnes live weight per year*
tanneries or fellmongeries	*capacity to process more than 2 tonnes of skins or hides per yea*

As the site will produce more than 5,000 tonnes of product per year it is considered a scheduled activity which is relevant to the limits stipulated by the Clean Air Regulation in the following section. As the site is a scheduled activity it will also require an environment protection licence.

5.2 PROTECTION OF ENVIRONMENT OPERATIONS (CLEAN AIR) REGULATION 2021

In accordance with Part 5 of the *Protection of the Environment Operations (Clean Air) Regulation 2021* (herein referred to as the Clean Air Regulation), the plant would belong to Group 6 (Standards for scheduled premises) as the activity is to be "commenced to be carried on, or to operate, on or after 1 September 2005 as a result of an environment protection licence granted under the *Protection of the Environment Operations Act 1997* pursuant to an application made on or after 1 September 2005".

Schedule 4 of the Clean Air Regulation provides standards of concentration for scheduled premises general activities and plant, any boiler operating on gas:

> *Nitrogen dioxide or nitric oxide or both as NO_2 equivalent = 350 mg/m^3*

Schedule 4 of the Clean Air Regulation provides standards of concentration for scheduled premises general activities and plant, any activity or plant:

> *Solid Particles (total) = 50 mg/m^3*
>
> *Nitrogen dioxide or nitric oxide or both as NO_2 equivalent = 350 mg/m^3*

The boiler stack would be required to meet the above standards of concentration.

5.3 NSW Environment Protection Authority Guidelines

The document, "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*" (AMMAAP) published by the NSW Environment Protection Authority (NSW EPA) provides guidance on methodology and thresholds that are to be used for the air impact assessment of a proposed development. This air impact assessment has been conducted in accordance with this guideline. Assessable pollutants (along with their corresponding limits) are summarised in Table 5-1 and Table 5-2.

Table 5-1: Relevant Limits from the Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (2016)

Pollutant	Averaging Period	Percentile	Concentration		Application of Criteria?
			pphm	µg/m³	
PM_{10}	24 Hours	100th	-	50	At the nearest existing or likely future off-site sensitive receptor
	Annual	100th	-	25	At the nearest existing or likely future off-site sensitive receptor
$PM_{2.5}$	24 Hours	100th	-	25	At the nearest existing or likely future off-site sensitive receptor
	Annual	100th	-	8	At the nearest existing or likely future off-site sensitive receptor
TSP	Annual	100th	-	90	At the nearest existing or likely future off-site sensitive receptor
Nitrogen dioxide (NO_2)	1 Hour	100th	12	246	At the nearest existing or likely future off-site sensitive receptor
	Annual	100th	3	62	At the nearest existing or likely future off-site sensitive receptor

In NSW the odour impact assessment criteria is determined using a statistical approach based on population size. This criteria as specified in the AMMAAP is based on size of the affected community and is summarised in Table 5-2. The criteria is applicable at the nearest existing or likely future off-site sensitive receptor.

Table 5-2: Relevant odour impact assessment criteria from the Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales (2016).

Size of Affected Community	Odour Performance Criteria (Odour Units) (to be complied with for 99.0% of the time)
Urban (Population ≥ ≈ 2000)	2.0 OU/m^3
Population ≈ 500	3.0 OU/m^3
Population ≈ 125	4.0 OU/m^3
Population ≈ 30	5.0 OU/m^3
Population ≈ 10	6.0 OU/m^3
Single residence (≤ ≈ 2)	7.0 OU/m^3

Defining an affected community is based on the population within the 2 OU contour taken from dispersion modelling. As can be seen in Section 6.2.5, no residential receivers fall within the 2 OU contour, therefore a criteria of 7.0 OU/m^3 has been adopted. This is the generally accepted criteria for industrial/commercial areas.

6. AIR QUALITY IMPACT ASSESSMENT

6.1 DISPERSION MODEL

The new generation air dispersion model, AERMOD was used for the prediction of off-site impacts associated with the air emissions from the sites operations. AERMOD uses air dispersion based on planetary boundary layer turbulence structure and scaling concepts.

6.1.1 Meteorological Data

Meteorological files were provided by Lakes Environmental. The WRF model is used to compute accurate windfields of a selected area. The MMIF program is used to convert WRF output into AERMOD-Ready Surface & Profile files.

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 Center for Atmospheric Research 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 metres to thousands of kilometres.

The Mesoscale Model Interface Program (MMIF) converts prognostic meteorological model output fields to the parameters and formats required for direct input into supported dispersion models such as AERMOD.

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'.

6.1.2 Model Inputs

A domain size of 4 x 4 km was used using elevated terrain with SRTM1 Global 30 m (version 3) terrain input data. Surface heating from urban heat island has not been included in the model; hence "Rural Mode" has been selected.

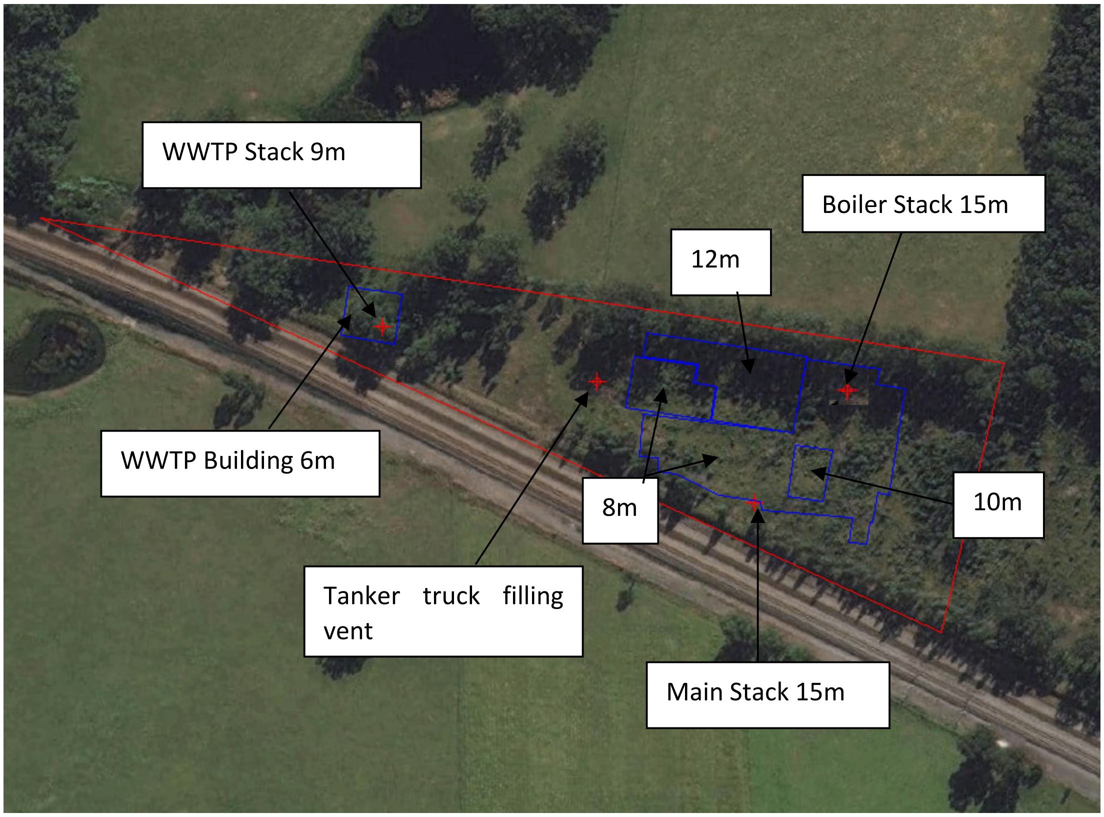
6.1.2.1 Receptors

Two uniform Cartesian grids were input into the model. The first grid was input to cover the area reaching the furthest sensitive receptor. This grid has 441 receptors, with a length of 3,858 m x 3,915 m (centre coordinates X: 358253.24, Y: 6378808.75). An additional grid was input around the immediate site area and emission sources to ensure that the predicted maximum concentrations were not underestimated. This grid has 441 receptors, with a length of 1161.8 m x 991.8 m (centre coordinates X: 358345.33, Y: 6378796.97). The discrete receptors shown in Figure 2-4 were also input into the model.

6.1.3 Building Wake Effects & Source Locations

Building wake effects have been included in the model utilising the BPIP Prime algorithm. A key feature of the building design is the warehouse area located at the north-eastern portion of the building. This is the tallest part of the building (expected to be approximately 12 m). As can be seen in Figure 6-2, building wake effects caused by this tall portion of the warehouse cause highest 99th percentile levels from the main stack to the north of this location.

Figure 6-1: Building & Stack Locations



6.2 Odour Impact Assessment

6.2.1 Odour Sources

Odour is the primary concern for petfood ingredient manufacture. Sources of odour include:

Internal Production Process

- Raw materials/animal products handling and storage;
- Raw materials/animal product grinding;
- Processing and mixing tanks: odour is generated from:
  - Raw materials/animal product odour;
  - Odour from additives;
  - Odour from odorous particles generated from enzyme breakdown;
- Sifting/vibrating screens;
- Waste bins including:
  - General solid waste bins containing raw material product residue;
  - Sifting/screening bins.

- Storage tanks (primarily displace air when filling);
- Decanting operation (primarily displace air when filling);
- Internal wastewater collection pits;

External Filling
- The displace air from the bulk collection tanker trucks filling;

Wastewater Treatment Plant/Storage Area
- Bin storage
- WWTP DAF
- WWTP Storage tanks
- WWTP Dosing tank
- WWTP Bioreactor
- WWTP Sludge tank
- WWTP solid filter

6.2.2 Odour Control Measures

The odour control measures used on site as follows:

- Majority of odour generating process rooms are wholly contained within the building such that there is no frequently used doorways that could allow for diffuse emission to be released from the building.
- Automatic closing doors for the processing facility and WWTP.
- Air quality control extraction ventilation system will be installed in the processing building and the wastewater treatment/waste bin storage room building.
- All odours sources that can be directly vented to the air quality control extraction ventilation system will be. These include the mixing tanks, processing tanks, storage tanks, WWTP dosing tank, WWTP storage tanks, WWTP DAF, and WWTP Bioreactor.
- The majority of diffuse emission sources in the process building occur in rooms that connect to the receivals hall including bins, thawing, grinder, and raw materials handling. The receival hall will have doorways which are regularly opened for the receipt of raw materials and for the transfer of waste bins to the waste bin storage area. Therefore, this room will have extraction registers which are located on the eastern side of this area which will draw air in from the surrounding rooms and from the outside preventing diffuse emission release from the building. This process building ventilation system is expected to extract approximately 2.7 m^3/s. The majority of this extraction will occur in the receivals hall. Extraction registers will also be located close to the following diffuse sources (not serviced by the receival hall extraction system) including:
  - The sifting machine and collection bin and,
  - The IBC/Drum filling station.
- The stack mouth for the processing building will be located 3 m above the apex of the processing building roofline.
- The diffuse emission sources from the bin storage area and the WWTP gross pollutant filter will be serviced by extraction registers. This WWTP/bin storage ventilation system is expected to extract approximately 0.14 m^3/s.
- The stack mouth for the WWTP will be located 3m above the apex of the WWTP building roofline.

Contingency measures are included in section 6.2.6.

6.2.3 Peak-to-mean Ratio

The evaluation of odour impacts requires the estimation of peak ground level concentrations on the time scale of less than one second. However, dispersion model predictions are typically valid for averaging periods of one hour or longer. As such, dispersion models need to be supplemented in order to simulate more accurately the atmospheric dispersion of odours and the instantaneous perception of odours by the human nose - humans detect odour over a period of approximately one second or less.

Peak concentrations can be estimated from ensemble means by use of peak-to-mean ratios (ratios between extreme short-term concentrations and longer-term averages), which help to account for any odour fluctuation above and below the mean odour level of the 1-hour averaging period. Peak-to-mean ratios depend on the type of source, atmospheric stability and distance downwind. Table 6-1 shows the EPA-recommended factors for estimating peak concentrations for different source types, stabilities and distances, as developed by Katestone Scientific (1995 and 1998) and reproduced in the *Approved Methods* (NSW EPA, 2016).

A P/M60 ratio of 2.3 was selected for this assessment both wake-affected point sources and applied to the odour emission rates entered into the dispersion model so that they vary with wind speed and stability class. The peak-to-mean ratio adjusted figures and the source types are shown in Table 6-1.

Table 6-1: Peak to Mean Ratio for Estimating Peak Odour Concentrations

Source Type	Pasquill-Gifford Stability Class	Near-field P/M60*	Far-field P/M60*
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A – F	6	6
Surface wake-free point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A – F	2.3	2.3
Volume	A – F	2.3	2.3

Note: * Ratio of peak 1-second average concentrations to mean 1-hour average concentrations.
Source: NSW EPA Approved Methods, Section 6.6.

6.2.4 Odour Emission Rate Derivation

Determining the odour emission rates from the proposed facility is challenging due to the variability from in raw materials received and variability in products produced. Odour emission rates are drawn from Benbow Environmental's data from similar facilities.

6.2.4.1 Benbow Environmental Data

Odour impacts from a WWTP servicing a chicken processing facility, that vented the DAF and dosing and storage tanks to a stack:

Table 6-2: 2021 - WWTP Stack testing results

Test Location	Odour concentration (OU)	Odourant Flow Rate (OUm^3/min)	Hedonic Tone	Character
WWTP Exhaust Stack - Test 1	8200	15000	Very unpleasant	Wet, sewage
WWTP Exhaust Stack - Test 2	5800	11000	Very unpleasant	Wet, sewage
WWTP Exhaust Stack - Test 3	7600	14000	Very unpleasant	Sewage, rotten egg

Odour concentration in the airspace above a filter box receiving of liquid wastewater containing slightly putrefied bits of chicken at a liquid waste facility was measured as **2,660 OU.**

Air within the scalding and grinding processing room in a chicken abattoir **5,582 OU.**

Airspace within offal storage area at a poultry processing facility **2,531 OU.**

These odour concentrations are very similar to the odour concentration measured at a pet food manufacturer in New Zealand (PDP, 2019) and is therefore considered appropriate for the assessment.

6.2.4.2 Emission Rates Calculations

The odour emission rates utilised in this assessment are provided in the following table. Theses emission rates are considered conservative due to the assumptions utilised to determine emission rates from internal diffuse sources. For example, the odour emission rate from a similar WWTP measurements presented in Table 6-2 correspond to a rate of 180-250 OUm^3/s, whereas this assessment utilises a release rate of 1093 OUm^3/s for the WWTP.

NOTE: odour emission rates provided in Table 6-3 are based on odour emission rates from sources. A forced airflow fan will be installed as described in section 6.2.2 this governs the stack discharge velocity presented in Table 6-4.

Table 6-3: Source Emission Rate Derivation

Stack ID	Sources	Odour Concentration (OU)	Calculations	Odour Emission Rate (OUm^3/s)
Production Building Stack	Raw material/animal product handling, raw material thawing grinding, processing/mixing tanks, decanting & final product filling	5,582	Tank vents would displace air at approximately 10 L/s (0.01 m^3/s) resulting in 56 OUm^3/s per tank. Up to 3 tanks (processing and storage) can fill simultaneously, for a total of 168 OUm^3/s. Decanting fills at 7 L/s (0.007 m^3/s) corresponding to 39 OUm^3/s (this will be diffuse and will be picked up by an extraction register). Other diffuse emissions from raw material handling, storage, thawing and grinding would be picked up by negative pressure extraction system in raw material receivals hall. Assuming on $8m^2$ of processing activity and 0.1 m/s diffuse emission release flow rate. Odour emissions from these diffuse emissions is: 4465 OUm^3/s.	4,672
	General solid waste bins, bin cleaning sifting/screening collection bins	2,531	Diffuse emissions from bins: assume 4 m^2 open bin storage with 0.1 m/s diffuse emission release flow rate. Odour emissions rate: 1266 OUm^3/s.	1,266
	Sifting/vibrating screen	2,660	Diffuse emissions from $2m^2$ vibrating screen with 0.1 m/s diffuse emission release flow rate. Odour emissions rate: 532 OUm^3/s.	532
	TOTAL			**6,470**
WWTP Stack	DAF, bioreactor, storage mixing, holding tanks	8,200	Conservatively assuming vented air is displace by filling at 30L/s (which would occur if multiple tanks/vessels are all filling simultaneously) this would correspond to an odour release rate of 246 OU m^3/s.	246
	Bin storage	2,531	Bins will be all closed in bin storage area. Assume a diffuse emission from bins using $1m^2$ open bin storage at 0.1m/s diffuse emission release flow rate. Odour emissions rate: 253 OUm^3/s.	253
	Gross pollutant solids filter	2,660	Diffuse emissions from bins: assume $2m^2$ with 0.1m/s diffuse emission release flow rate.	532
	TOTAL			**1,031**

Table 6-3: Source Emission Rate Derivation

Stack ID	Sources	Odour Concentration (OU)	Calculations	Odour Emission Rate (OUm^3/s)
External Vacuum Truck Release	Displaced air vacuum tanker filling	5,582	Calculated using standard tanker truck fill rate of $0.015m^3/s$ and a standard vacuum tanker truck vent diameter of 80mm.	**84**

6.2.4.3 Source Emission Inventory

The following table presents the source emission inventory utilised in the model.

Table 6-4: Source Emission Inventory

Stack ID	Stack type	Odour Emission Rate (OUm^3/s)	Peak to Mean Ratio	Modelled Odour Emission Rate (OUm^3/s)	Modelled Stack Height (m)	Modelled Stack Exhaust Velocity m/s	Modelled Stack Diameter (m)
Production Building Stack	Vertical point source	6,470	2.3	14,881	15	13.8	0.5
WWTP Stack	Vertical point source	1,031	2.3	2,062	9	8	0.15
External Vacuum Truck Release	Horizontal point source	84	2.3	193	3	3.0	0.08

6.2.5 Odour Modelling Results

The following table and figure present the 99th percentile odour impacts and results. The predicted results comply with the approved methods criteria at all existing and future receptors.

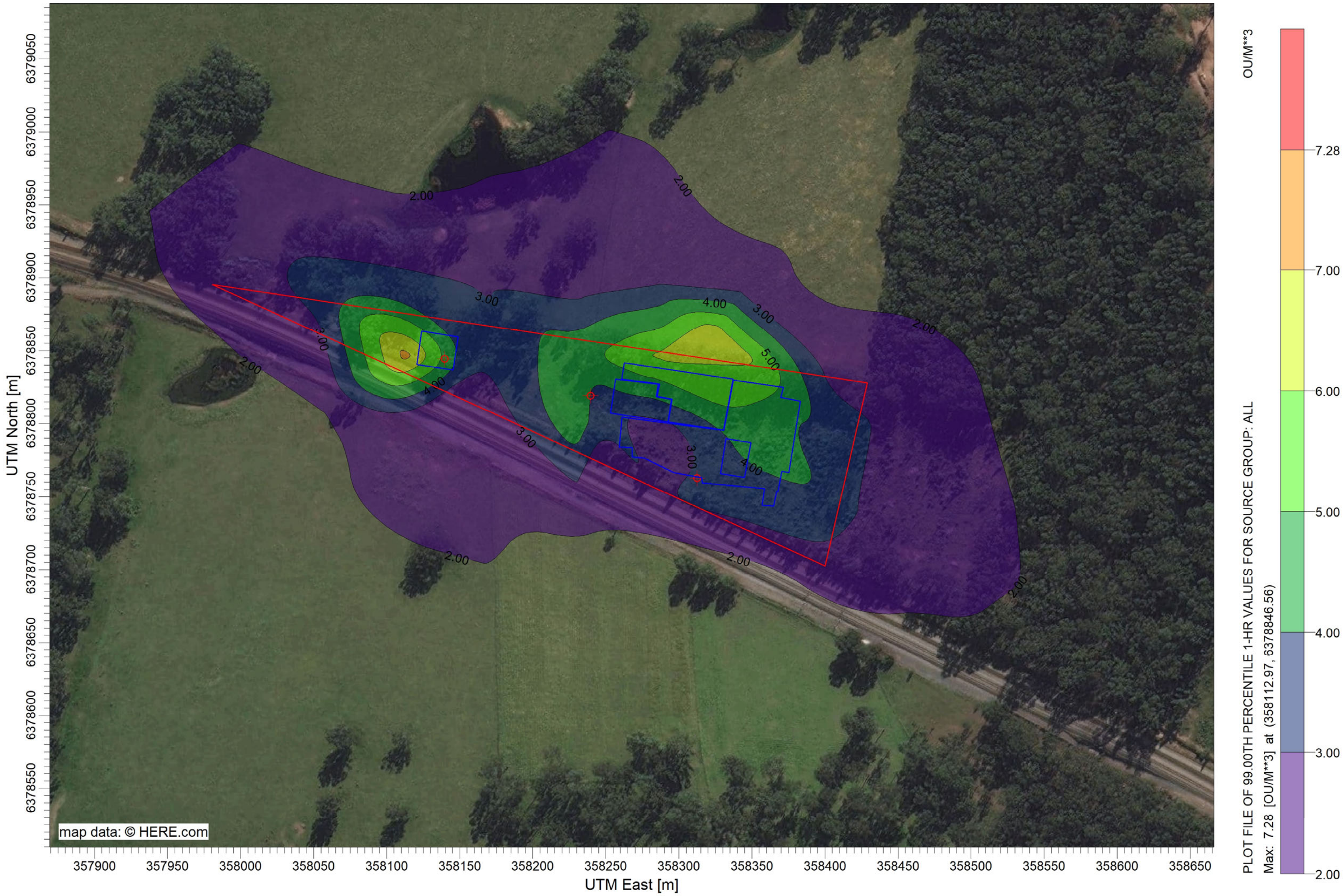
Table 6-5: 99th Percentile Odour Impacts at Receptors

Receptor ID	Type	Criteria (OU)	Predicted Impacts (OU)
Existing			
R1	Residential	7	0.1
R2	Residential	7	0.1
R3	Residential	7	0.4
R4	Residential	7	0.4
R5	Residential	7	0.7
R6	Residential	7	0.3
R7	Residential	7	0.3
R8	Commercial/ Industrial	7	0.5
R9	Industrial	7	0.6
Future			
R10	Industrial	7	2.9

Table 6-5: 99th Percentile Odour Impacts at Receptors

Receptor ID	Type	Criteria (OU)	Predicted Impacts (OU)
R11	Commercial	7	1.9
R12	Commercial	7	6.9

Figure 6-2: 99th Percentile Odour Impacts Contour



6.2.6 Contingency Measures

Given the conservative assumptions utilised in this assessment it is considered unlikely additional control measures would be required. In the event of non-compliance of odour impacts contingency air quality control measures such at carbon scrubbers, biofilters or chemical scrubbers may be investigated. However, as the site is constrained by space, it is recommended that during the detailed construction design phase the building (including foundations) be designed for the potential installation of a mezzanine constructed to bare a minimum of 2 tonnes per square metre.

6.3 DUST

Most of the materials used in the process are not dusty. The main source of dust is the enzymes which are in powdered form. These are scooped manually from a bag into a container and then tipped into the processing tank via a hatch. This is all within the building and of negligible quantities and is not expected to cause dust impacts.

The boiler heats water using natural gas. The combustion emissions from burning of natural gas generates particulates. The boiler is 4MW operates at 9-10 bar producing 5,000kg steam/hr, this is a relatively small boiler and is not expected to cause significant particulate impacts.

6.4 COMBUSTION EMISSIONS (NO_2)

The boiler heats water using natural gas. The combustion emissions from burning of natural gas generates NOx and other combustion emission. The boiler is 4MW operates at 9-10 bar producing 5,000 kg steam/hr.

This is a relatively small boiler, and the concentration limit of NOx will be <150 mg/m^3. An assessment of NO_2 is conducted below assuming all NOx emissions are NO_2. Utilising the conservative assumptions presented in Table 6-6 the proposed boiler complies with the approved methods criteria as shown in Table 6-7 to Table 6-8 and Figure 6-3 to Figure 6-6. Stack mouth is recommended to be located 3 m above the apex of the roof. No further controls are considered warranted.

Table 6-6: Boiler Stack Emission Inventory

Boiler Stack Emission Parameter Assumptions	
Diameter	450 mm
Stack Height	15 m (3 m above the apex of the roof)
Air Flow	1 m^3/s
Exit Velocity	6.3 m/s
Exit Temperature	100 °C
Stack Concentration (NOx)	150 mg/m^3
Stack Emission Rate (NO_2)	0.15 g/s

Table 6-7: 100th Percentile – 1hr Averaging Period – NO_2 Impacts at Receptors (µg/m^3)

Receptor ID	Type	Criteria	Predicted Incremental Impacts	Background	Cumulative Impact
Existing					
R1	Residential	246	11.7	71.75	83
R2	Residential	246	14.8	71.75	87
R3	Residential	246	32.9	71.75	105
R4	Residential	246	21.6	71.75	93
R5	Residential	246	14.2	71.75	86
R6	Residential	246	4.8	71.75	77
R7	Residential	246	4.9	71.75	77
R8	Commercial/ Industrial	246	7.9	71.75	80
R9	Industrial	246	9.9	71.75	82
Future					
R10	Industrial	246	147.4	71.75	219
R11	Commercial	246	36.7	71.75	108
R12	Commercial	246	55.7	71.75	127

Table 6-8: 100th Percentile – Annual Averaging Period – NO_2 Impacts at Receptors (µg/m^3)

Receptor ID	Type	Criteria	Predicted Incremental Impacts	Background	Cumulative Impact
Existing					
R1	Residential	62	0.05	13.92	13.97
R2	Residential	62	0.04	13.92	13.96
R3	Residential	62	0.07	13.92	13.99
R4	Residential	62	0.09	13.92	14.01
R5	Residential	62	0.11	13.92	14.03
R6	Residential	62	0.05	13.92	13.97
R7	Residential	62	0.05	13.92	13.97
R8	Commercial/ Industrial	62	0.07	13.92	13.99
R9	Industrial	62	0.10	13.92	14.02
Future					
R10	Industrial	62	1.28	13.92	15.20
R11	Commercial	62	0.49	13.92	14.41
R12	Commercial	62	2.77	13.92	16.69

Figure 6-3: 100th Percentile – 1hr Averaging Period – NO_2 Impacts – Zoomed In

Figure 6-4: 100th Percentile – 1hr Averaging Period – NO_2 Impacts – Zoomed Out

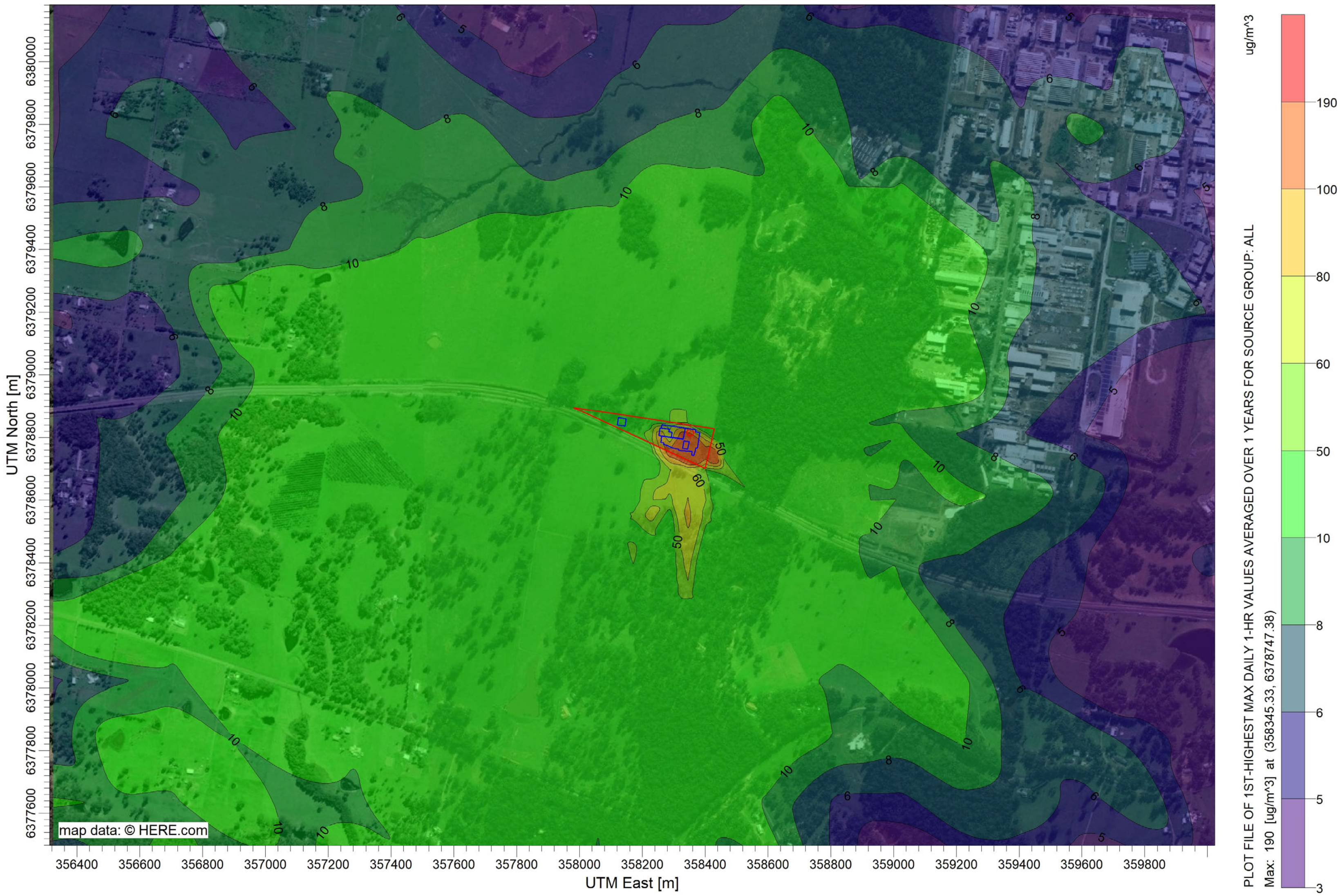


Figure 6-5: 100th Percentile – Annual Averaging Period – NO_2 Impacts – Zoomed In

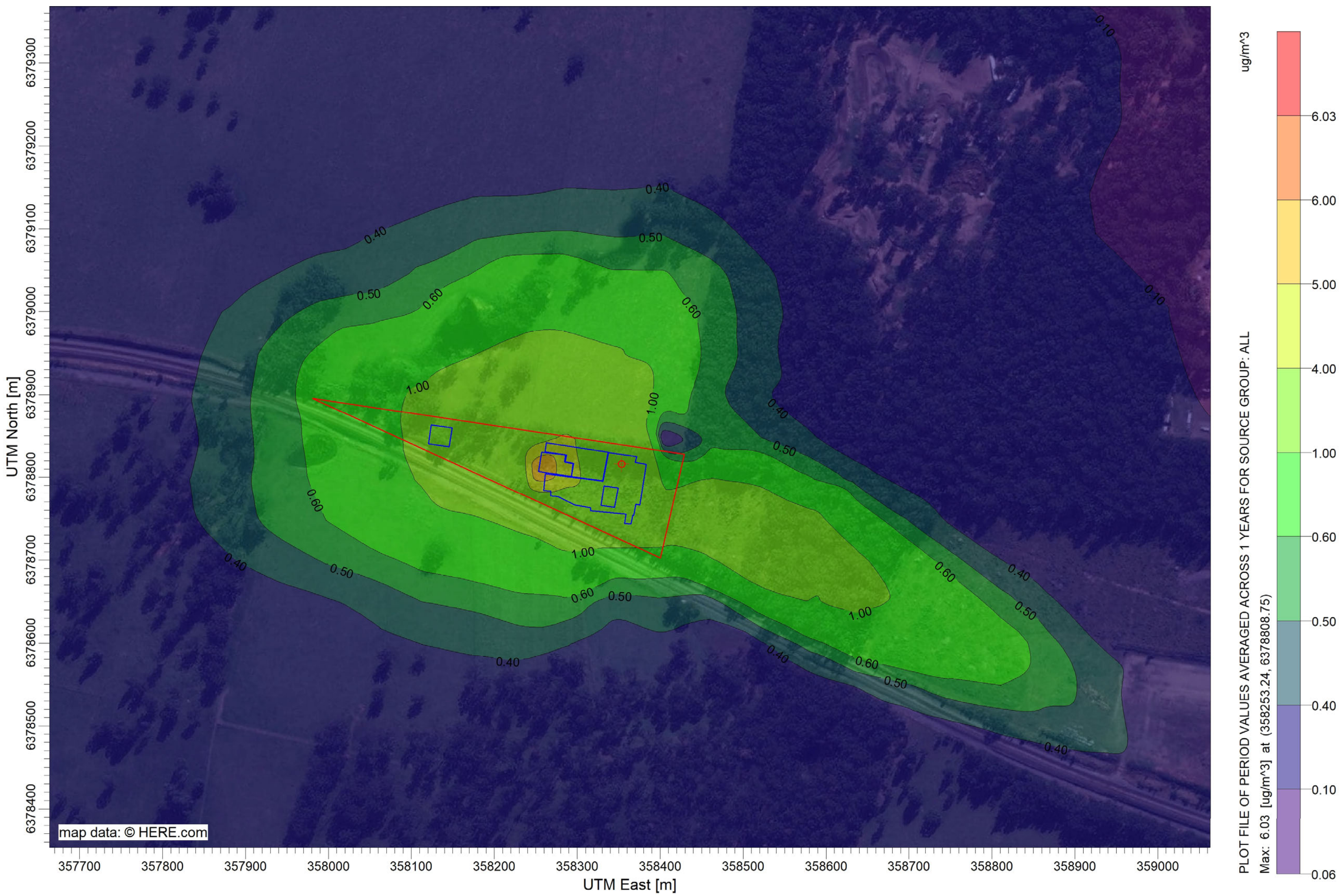
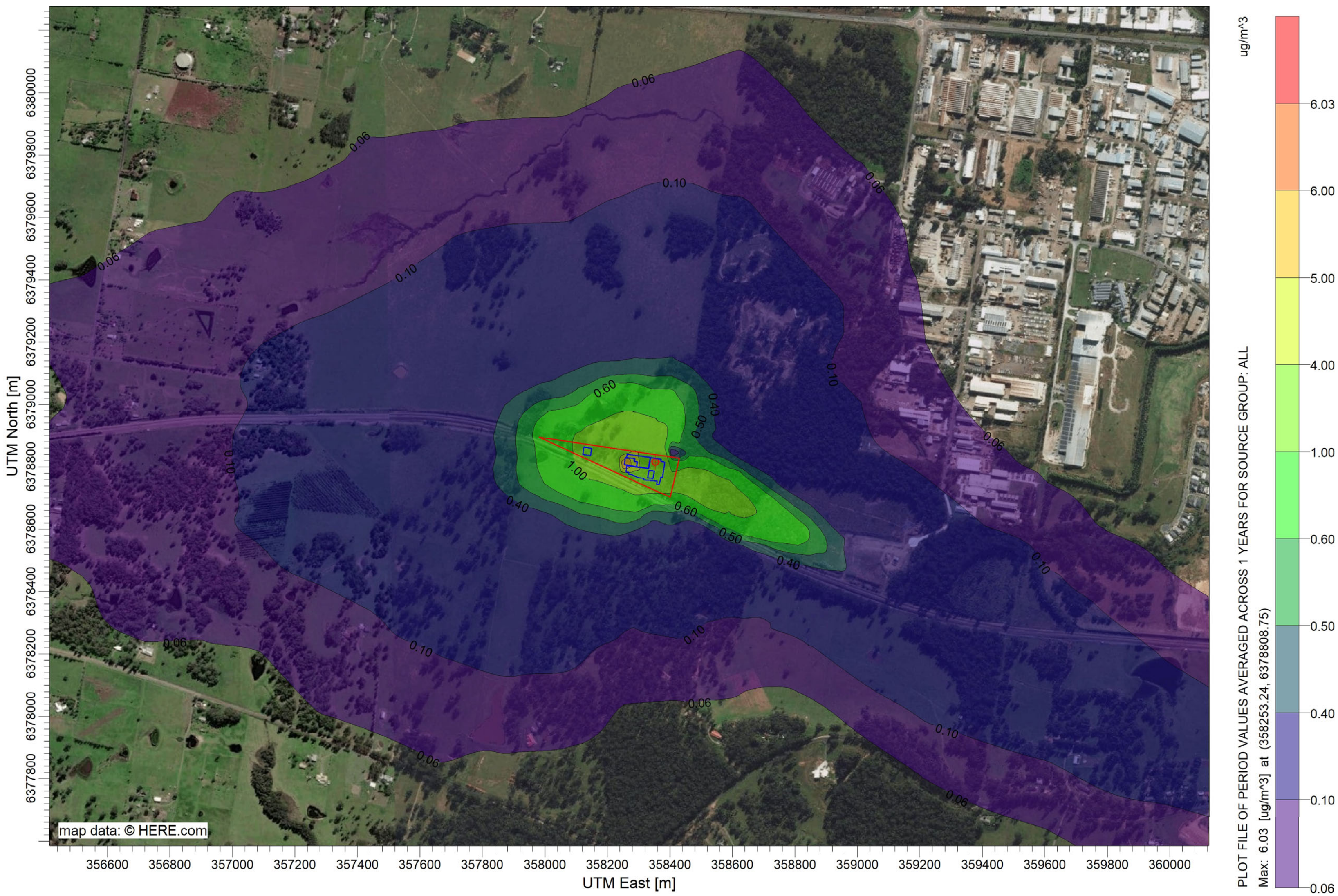


Figure 6-6: 100th Percentile – Annual Averaging Period – NO_2 Impacts – Zoomed Out



6.5 RECOMMENDATIONS

The assessment finds that the proposed development will comply with recommendations in place. The recommendations are as follows:

- Odour controls listed in section 6.2.2 be implemented.
- Odour control contingency measures be considered during detailed construction design (see section 6.2.6).
- Sample ports in the WWTP stack and the Process Building Stack installed in accordance with AS4323.1 with accessible platform should compliance monitoring be required.

No further controls are considered warranted.

7. CONCLUDING REMARKS

Benbow Environmental has been engaged by SPF Diana Australia to undertake an air quality impact assessment of the proposed development located at Lot 206, 91 Gardiner Street, Rutherford. The proposed development manufactures a liquid palatability enhancer which is a liquid petfood ingredient supplied to petfood manufacturers.

This air quality impact assessment considers quantitatively assesses the odour impacts from the proposed development and the NO_2 impacts from the proposed boiler utilising air dispersion modelling software AERMOD. Ground level concentration impacts were found to comply with the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales at all existing and future offsite receptors. Recommendations regarding odour controls to ensure compliance are provided in section 6.5.

This concludes the report.

Emma Hansma	R T Benbow
Senior Engineer	Principal Consultant

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 SPF Diana Australia Pty Ltd, as per our agreement for providing environmental services. Only SPF Diana Australia Pty Ltd 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 SPF Diana Australia Pty Ltd 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.

9. REFERENCES

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