Air Noise Environment
Environmental Monitoring and Assessment

Air Quality Assessment - Proposed Resource Recovery Facility & Truck Parking Depot

REMONDIS Australia Pty Ltd

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Executive Summary

REMONDIS Australia propose to develop a Resource Recovery Facility and Truck Parking Depot at 21D and 21F School Drive, Tomago. The proposed development involves the re-use of two existing warehouse buildings on the site and a workshop building, as well as the construction of a Truck Parking Depot. Air Noise Environment were commissioned by Jackson Environment and Planning on behalf of REMONDIS to assess potential air quality impacts on the surrounding area as a result of the proposed development. The assessment has been undertaken in accordance with the requirements of the Port Stephens Council, the New South Wales Environmental Protection Agency (EPA) and the Secretary's Environmental Requirements (SEARs).

The Resource Recovery Facility is proposed to include the following recycling processes:

- *Materials Recovery Facility for sorting and processing commercial and industrial mixed general solid waste (non-putrescible) and construction building waste from residential and commercial construction;*
- *Cardboard Baling Facility;*
- *Drill Mud Recycling Facility;*
- *Packaged Food Recycling Plant;*
- *Garden Organics Primary Processing plant;*
- *Hazardous Waste Recycling Facility;*
- *Copper Processing Area; and*
- *Metals Recycling Facility.*

Key air emissions associated with the recycling processes above include particulates ($PM_{2.5}$, PM_{10} and TSP) and odour (from the Garden Organics Primary Processing Plant, Drill Mud Recovery Recycling Facility and the Packaged Food Recycling Plant). Particulate emissions are also associated with the onsite haul routes. VOC and odour emissions are expected to occur from the waste oil unloading which is associated with the truck parking depot. The site is surrounded primarily by industrial uses. Sensitive uses, including the historic Tomago House, are located to the south east and south west of the proposed development site.

To assess the potential for air quality impacts as a result of the proposed development, computational air dispersion modelling was undertaken using the CALPUFF modelling system. The modelling has utilised meteorological data derived from CALMET, and emission rates estimated from published emission factors (e.g. NPI, US EPA AP 42) and proposed operational data (e.g. throughputs, air emission controls). CALMET was run in no-observation mode using a prognostic site-specific data set developed by TAPM for the year 2019. Comparison of predicted wind roses with those derived from the Williamstown RAAF Bureau of Meteorology Station, as well as the Beresfield and Mayfield air quality monitoring stations, for the years 2015 – 2019 indicates that the CALMET model is predicting local wind fields accurately. Background particulate concentrations have been reviewed *for the Hunter region and the Mayfield station has been adopted as it is the most representative of the subject site.*

The results of the modelling demonstrate compliance with the air quality criteria for the proposed development for VOC and odour at the property boundary and nearby sensitive receptors by a significant margin. Cumulative PM_{10} *and* $PM_{2.5}$ *predictions are indicating exceedances to the 24 hour and annual criteria.* PM_{10} *and* $PM_{2.5}$ *24-hour exceedances for 2019 at the Mayfield station have been reviewed. It is noted that no additional exceedances are predicted as a result of the emissions from the proposed development.*

It is noted that highly conservative modelling assumptions have been made, such as emission factors not accounting for activities occurring within buildings. The emissions factors which have been adopted are also based on material handling and processing from the mining industry. It is therefore noted that pollution concentrations from the development are likely to be lower in practice.

To minimise potential dust and odour emissions from the site, best practice measures are proposed including buildings to enclose all material handling, shredding and sorting activities, paved truck routes and an odour control system on the Food De-packaging Plant.

Overall, the site represents a suitable location for the proposed resource recovery facility and truck parking depot from an air quality perspective. Based on the findings of the air dispersion modelling and proposal air quality mitigation measures, the contribution of the proposed development to the local and regional air quality environment is expected to be low and within relevant targets.

Table of Contents

Index of Tables

Index of Figures

1 Introduction

1.1 Scope of Study

Jackson Environment and Planning commissioned Air Noise Environment on behalf of REMONDIS Australia Pty Ltd to undertake an air quality assessment for a proposed truck parking and resource recovery depot at 21 D and 21 F School Drive, Tomago (Lot 11 on DP270328, Lot 8 on DP270328 and part of Lot 301 on DP634536).

The study had been undertaken to assess potential impacts from the proposed site operations on the nearest sensitive receptors. The study has been undertaken in accordance with the requirements of Port Stephens Council, the New South Wales Environmental Protection Authority (EPA) and the Secretary’s Environmental Requirements (SEARs), Application Number 10447. Specifically, the following documents have been referenced:

- SEAR Number 10447;
- NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2017);
- NSW Assessment and Management of Odour from Stationary Sources in NSW (November 2006) and
- Generic Guidance and Optimum Model Setting for the Calpuff Modeling System for Inclusion into the ‘Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia’.

Computational modelling has been undertaken for assessing potential air quality and odour impacts. A level 2 dispersion modelling assessment (also equivalent to a Level 3 odour assessment) has been completed.

1.2 Information Requests

The following sections provide responses in relation to air quality, dust and odour from the information requested by SEAR, Port Stephen Regional Council and the NSW EPA.

1.2.1 SEAR Requested Information

A copy of the SEAR 10447 requirements for the air quality and odour assessment as well as the responses based on this Air Quality Assessment are presented in Table 1.

Table 1 - SEAR 10447 Information Request Items and Responses

Requested Information	Response
A qualitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines. This is to include the identification of existing and potential future	A review of air quality, odour and dust impacts of the proposed development operations is presented in Section 2.3. Cumulative impacts from existing and

Requested Information	Response
sensitive receivers and consideration of approved and/or proposed developments in the vicinity.	proposed industry are reviewed in Section 3.3.
The details of building and air handling systems and strong justification (including quantitative evidence) for any material handling, processing or stockpiling external to a building	All material handling operations are proposed to occur within the existing Building 1 and 2 on the site. Final design details of air handling systems are not available at this stage of the project. Building ventilation is likely to be in the form of a ridge vent or roof mounted mechanical fans. A rooftop exhaust for the odour control unit is proposed (further details of the exhaust vents are presented in Section 7.4). Quantitative air dispersion modelling shows full compliance with the air quality criteria (Section 8). The modelling is conservative by assuming no building enclosure around the air emission sources.
A greenhouse gas assessment	A greenhouse gas assessment is presented in Appendix D.
Consideration of the Tomago Aluminium Buffer Area and whether the proposed development would result in the release of sulfur	The Tomago Aluminium Buffer Area has been considered further in Section 3.3.1 Despite the low level of sulfur emissions from the onsite truck route and machinery, modelling has been completed. Refer to Section 6.5 for further details of the adopted emissions rates.
Details of proposed mitigation, management and monitoring measures.	Refer to Section 9 for further details of the recommended mitigation methods of the proposed development.

1.2.2 Port Stephens Council Requested Information

A copy of the Port Stephens Council requested information relating to air quality along with the responses based on this Air Quality Assessment are presented in Table 2.

Table 2 - Port Stephens Council Information Request Items and Responses

Requested Information	Response
Tomago Aluminium Buffer Area The proposal is located within the Tomago Aluminium buffer area. The buffer area was established as part of the 1981 approval and 1991 expansion (as modified) of the Tomago Aluminium Smelter. The buffer area was identified land likely to be affected by Sulphur (SO_2) and Fluoride emissions from the Smelter. As such, the application should identify whether the development result in the release of any sulphur. It is expected this will be addressed as part of an Air Quality Impact Assessment.	The Tomago Aluminium Buffer Area has been considered further in Section 3.3.1 Despite the low level of sulfur emissions from the onsite truck route and machinery, modelling has been completed. Refer to Section 6.5 for further details of the adopted emissions rates. It is noted that fluoride emissions are not expected as part of the site operations.
Air Quality An Air Quality Impact Assessment is required where the development has potential to adversely impact surrounding areas in terms of air quality under section B3 of the Port Stephens Development Control Plan 2014 (PS DCP). This will also need to identify if there is any sulphur produced given the sites location within the Tomago Aluminium Buffer, as noted above.	This air quality assessment addresses the impacts of the proposed development during the construction and operational phases. Potential construction emission sources are identified in Section 2.3. Potential operational air, odour and dust emissions are identified in Section 2.3. The adopted emissions factors and rates for the modelling are presented in Sections 6.2 and 6.3. The location of the sensitive receptors considered in the modelled is presented in Section 7.5. This air quality modelling has been completed in accordance with the *NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2017).

1.2.3 NSW EPA Requested Information

A copy of the NSW EPA requested information relating to air quality and odour along with the responses based on this Air Quality Assessment are presented in Table 3.

Table 3 - NSW EPA Information Request Items and Responses

Requested Information	Response
B The proposal 1. *Identify all sources or potential sources of air emissions from the development.* *Note: emissions can be classed as either:* *- Point (e.g. emissions from stack or vent) or* *- fugitive (from wind erosion, leakages or spillages, associated with loading and unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).* 2. *Provide details of the project that are essential for predicting and assessing air impacts including:* a. *the quantities and physio-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes etc) of material to be used, transported, produced and stored* b. *an outline of procedures for handling, transport production and storage* c. *the management of solid, liquid and gaseous waste streams with potential to generate emissions to air*	1. All air emission sources considered in this air quality assessment along with the source type and parameters are presented in Section 7.4. 2. a. Refer to Section *2.3* for further details of the materials to be received by the proposed development. b. The proposed procedures for the receival, handling and storage of materials is presented in Section 2.3. c. The management practices for the received waste are presented in Section 9.
C The Location 1. *Describe the topography and surrounding land uses. Provide details of the exact location of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.* 2. *Describe surrounding buildings that may affect plume dispersion.*	1. Details of the topography immediately surrounding the site are presented in Section 3.1. The terrain and land use for the domain used in the modelling is presented in Section 5.3.3. Surrounding proposed and existing uses with the potential to overlap with the proposed site emissions are discussed in Section 3.3. Further details

Requested Information	Response
3. *Provide and analyse site representative data on following meteorological parameters:* a. *temperature and humidity* b. *rainfall, evaporation and cloud cover* c. *wind speed and direction*	are presented in Appendix B. 2. Details of downwash structures considered in the modelling are presented in Section 7.6. 3. As measured site specific meteorology is not available for the subject site, a prognostic dataset has been developed using TAPM and CALMET. For further details of the parameters adopted for the TAPM and CALMET meteorological modelling refer to Section 5 a. A box plot of predicted temperature is presented in section 5.6.4. b. Analysis has not been completed on the predicted rainfall dataset; this data is not considered relevant to the dispersion modelling as deposition has not been assessed. As CALMET does not provide output for cloud cover or evaporation, these parameters have not been analysed. c. Wind roses for predicted wind speed and wind direction are presented in Section 5.6.1. Additionally, predicted wind roses have been validated against measured datasets.
D Identification and prioritisation of issues/scoping of impact assessments 1. *Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:* a. *relevant NSW government guidelines* b. *industry guidelines*	1. A Level 3 Air Quality Assessment has been completed in accordance with the NSW Approved Methods. This is the most detailed assessment level and includes air dispersion modelling to quantify the impacts of the proposed development on the surrounding area. 2. A Level 2 air dispersion modelling assessment has been undertaken

Requested Information	Response
c. *EISs for similar projects* d. *relevant research and reference materials relevant preliminary studies or reports for the proposal* e. *consultation with stakeholders* 2. *Provide a summary of the outcomes of the process including:* a. *all issues identified including local, regional and global impacts (e.g. increased/decreased greenhouse emissions)* b. *key issues which will require a full analysis (including comprehensive baseline assessment)* c. *issues not needing full analysis though they may be addressed in the mitigation strategy* d. *justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).*	to predict pollutant concentrations at the nearest sensitive receptors. This is the highest type of modelling assessment as defined by the NSW EPA in the Approved Modelling Methods guideline. Emission sources which have been considered in the modelling are identified in Section 2.3. Greenhouse emissions are discussed further in Appendix D.
E The environmental issues ***Describe baseline conditions*** 1. *Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.* ***Assess Impacts*** 1. *The EIS must include an Air Quality Impact Assessment (AQIA) to identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge points.*	**Describe baseline conditions** 1. The existing environment conditions including meteorology, ambient air quality data, existing and proposed surrounding uses are presented in Section 0. **Assess Impacts** 1. This air quality assessment accounts for emissions from the proposed development (Section 6) and identifies significant emission sources (Section 7.4). 2. All actives with the potential to cause air, dust or odour emissions are identified in Section 4. Processing occurring both during construction

Requested Information	Response
2. *The AQIA must identify and describe in detail all possible sources of air pollution and activities or processes with the potential to cause air pollutants including odours and fugitive dust emissions beyond the boundary of any pipeline route. This should cover both the construction and operational phases of the development. The AQIA should include cumulative impacts associated with existing developments and any developments having been granted development consent but which have not commenced.* 3. *The EIS must describe in detail the measures proposed to mitigate the impacts and quantify the extent to which the mitigation measures are likely to be effective in achieving the relevant environmental outcomes.* 4. *Estimate the resulting ground level concentrations of all pollutants. This should include fumes and particulates from diesel plant and equipment at the facility. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.* 5. *Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.* 6. *Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.* 7. *For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.* *Note: with dust and odour, it may be possible to use data from*	and operations have been considered. The potential for cumulative impacts has been reviewed in Section 3.3.1 for existing uses and Section 3.3.2 for proposed uses. Further details of the review are presented in Appendix B. It is noted that no existing or proposed developments were considered as cumulative in the assessment as there was no or minimal overlap in emissions with the proposed development. 3. Mitigation measures to be adopted for the development are presented in Section 9. Air dispersion modelling shows minimal air quality impacts. 4. The CALPUFF dispersion model has been used to predict ground level concentrations. CALPUFF has been set up in accordance with the *"Generic Guidance and Optimum Model Setting for the Calpuff Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'"* document. Further details of the CALPUFF model and adopted settings are presented in Section 7. Predicted ground level concentrations at the nearby sensitive receptors are presented in Section 8. Ground level concentration plots for the surrounding area are also presented in Section 8. 5. A discussion of the predicted concentrations and their associated impacts is presented in Section 8. 6. A discussion of the predicted concentrations in relation to the existing ambient air quality is presented in Section 8. Greenhouse emissions are discussed further in Appendix D. 7. Emissions rates for odorous sources have been developed based on available literature. No specific sampling has been undertaken. Further details of the odour emissions adopted in the assessment are presented in Section 6.3.

Requested Information	Response
existing similar activities to generate emission rates. 8. *Consider and assess odour impacts from the various waste types such as putrescible wastes (food, garden organics), liquid wastes, hazardous wastes and chemicals.* ***Describe Management and mitigation measures*** 1. *The applicant should design management and mitigation measures to ensure* a. *emissions do not cause adverse impacts on human health and the environment* b. *there are no offensive odours from the facility beyond the boundary of the premises* 2. *Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for odour and both point and fugitive emissions. Where possible, this should include cleaner production processes.* 3. *The EIS must describe in detail the measures proposed to mitigate the impacts and quantity the extent to which the mitigation measures are likely to be effective in achieving the relevant environmental outcomes.*	8. Sources of odour from the packaged food recycling plant, drill mud recycling facility, garden organics primary processing area and waste oil unloading have been modelled. Further details of the adopted emissions rates for the odour sources are presented in Section 6.3. **Describe Management and mitigation measures** 1. a. Section 8 presents the predicted ground level concentration plots and predicted concentrations for the nearby sensitive receptors. All pollutants are predicted to be below the NSW EPA criteria and therefore emissions are not expected to impact adversely on human health or the environment. b. Appendix C presents the predicted ground level odour concentration plots. The plots indicate that the odour concentrations are predicted to be below the adopted (refer to Section 4 for justification of the adopted odour criteria) NSW EPA odour criteria of 2 beyond the proposed development site boundary. 2. Details of the pollution control equipment is presented in the Mitigation section (Section 9) of the this assessment. 3. Mitigation measures to be adopted for the development are presented in Section 9. Additional model runs have been completed to quantify the reduction efficiency of the recommended measures.

1.3 This Report

This report presents the methodology, results and recommendations of the air quality assessment. Report sections are summarised below:

- Section 2
- Section 0
- Section 4
- Section 5
- Section 6
- Section 7
- Section 8
- Section 9
- Section 10

A glossary of terms is provided in Appendix A to assist the reader.

2 Proposed Operations

2.1 Site Location

The subject site is located at 21D and 21F School Drive, Tomago and is described as Lot 11 DP270328, Lot 8 DP270328 and part of Lot 301 on DP634536. The site and surrounding area is currently zoned as General Industry under the Port Stephens Local Environment Plan 2013.

The nearest sensitive receptors include:

- 1.2 km from the eastern property boundary to the rural residential dwellings to the north east.
- 500 m from the southern property boundary to Tomago House, a historical house open to visitors (no permanent residents).
- 1.1 km from the southern boundary of the property to the Hunter Corrective Services Academy.
- 1.5 km from the western boundary of the property to the Tomago Bowling Club.
- 2.7 km from the north western boundary of the property to the Tomago Village Van Park.

Figure **Error! Reference source not found.** presents an aerial photo identifying the site location and nearby sensitive receptors.

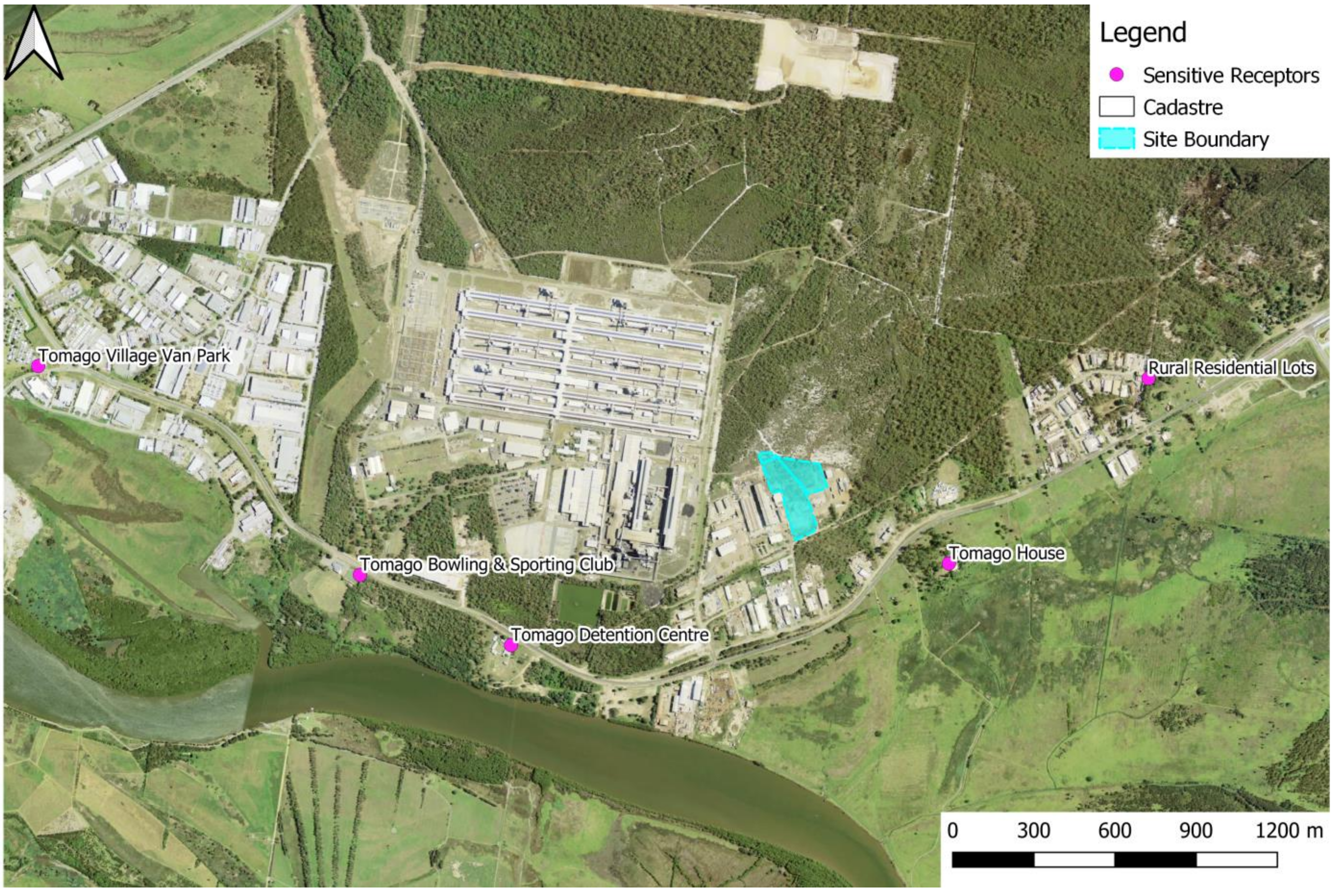

Figure 1 - Site Location and Sensitive Receptors

2.2 Proposed development

The subject site is currently occupied by two disused warehouse buildings and a workshop building. The site was previously occupied by Midal Cables, an aluminium rod and conductor manufacturing facility (MP_003). The proposal is to re-use the existing buildings located on 21D School Drive (Lot 11 DP270328) for a resource recovery facility with a processing capacity of 98,201 tonnes per annum of solid and liquid waste. The resource recovery facility is proposed to include the following:

- Receive dry domestic, commercial and industrial non-putrescible waste;
- Receive small amounts of putrescible waste from packaging of food and drinks;
- Receive and recycle of liquid wastes including drill muds from hydro-excavation; and
- Receive and recycle of oily wastes from mining and industrial activities.

The recycling process is proposed to be undertaken in the existing buildings on site. The recycling services proposed for the site include:

- Materials Recovery Facility for sorting and processing commercial and industrial mixed general solid waste (non-putrescible) and construction building waste from residential and commercial construction;
- Cardboard Baling Facility;
- Drill Mud Recycling Facility;
- Packaged Food Recycling Plant;
- Garden Organics Primary Processing plant;
- Hazardous Waste Recycling Facility;
- Copper Processing Area; and
- Metals Recycling Facility.

A Truck depot is proposed to be constructed on the currently vacant land at 21F School Drive (Lot 8 DP270328). The truck depot will include paved parking for the collection fleet (24 rigid trucks and 9 semi-trailers), a maintenance workshop (located in the existing workshop building) and self-bunded storage tanks for liquid waste, fuels and oils.

The facility is proposed to operate 24 hours per day, 7 days per week. It is however noted that most vehicle movements and waste processing will occur from 6 am to 10 pm.

Figure **Error! Reference source not found.** presents the current site layout. Figure **Error! Reference source not found.** presents the proposed site layout.

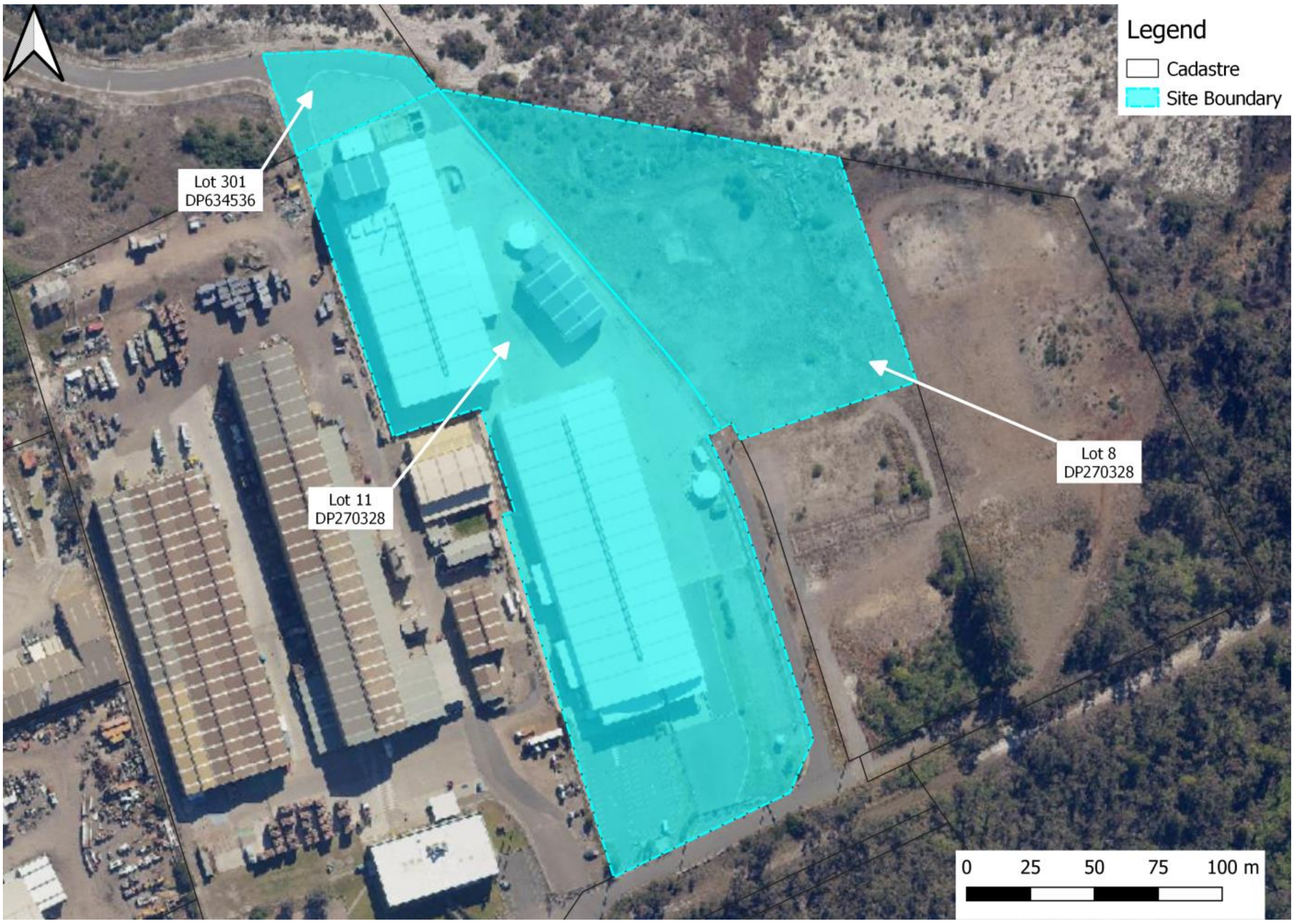

Figure 2 - Existing Site Layout

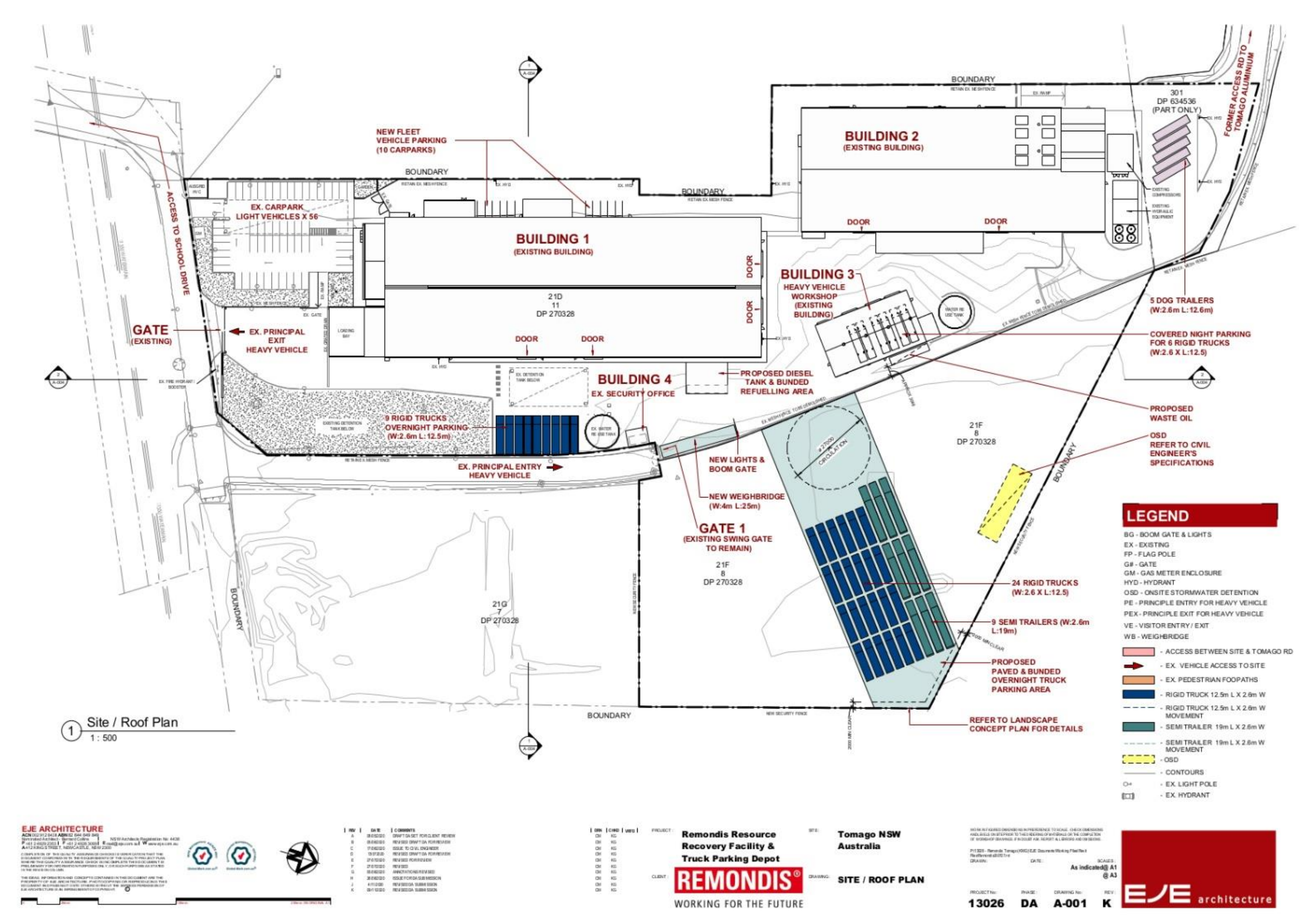

Figure 3 - Proposed Site Layout

2.3 Air Emission Sources

The key air quality indicators identified for operational phase of the proposed waste management facility are associated with particulate/dust emissions (described by Total Suspended Particulates (TSP), PM_{10} and $PM_{2.5}$) and odour emissions. The potential for particulate emissions is associated with material unloading and handling, material sorting, shredding and truck movements over paved surfaces. The potential for odour emissions are associated with the Food De-packaging Plant, Drill Mud Recycling Facility (soil and water mixture), Garden Organics Primary Processing and Waste Oil Unloading from the heavy vehicle workshop.

Particulate emissions are also associated with the construction phase of the proposed development. However, impacts from the construction phase are considered to be minimal as construction is anticipated to occur for 4 -6 weeks. As the transfer station will utilise existing buildings, the potential for emissions will be limited. Particulate emissions are expected to be low for the truck park area given the small area and short duration of works. Therefore, construction air quality impacts are expected to be low.

Table 4 presents expected air and odour emission sources associated with the operation of the proposed resource recovery facility and truck parking depot. Figures **Error! Reference source not found.** and **Error! Reference source not found.** present the layouts of Buildings 1 and 2 respectively.

Table 4 - Emission Sources

Source	Throughput (tonnes per annum)	Description
Material Recovery Facility	31,000	The material recovery facility will receive general solid waste (non-putrescible) including plastics, glass, timber, mixed dry general waste, paper and cardboard. Collection vehicles will deliver waste to a bunded concrete inspection bay in building 1. Gross physical contaminants will be removed by a mobile telehandler and placed into a waste disposal bin. Waste will be loaded into a hopper for sorting by material type (paper/cardboard, plastics, aluminum, steel and glass). The following equipment will sort the material further: screens, near infrared sorter, magnet, eddy current separator, conveyors, shredders and balers. Baled paper/cardboard, steel, aluminum, plastics, glass and refuse derived fuel (shredded loose or baled plastic, paper and cardboard) will be stored onsite in the product storage area for transfer offsite. Expected emissions include particulates from material unloading and handling, sorting and shredding. Particulate emissions from the Material Recovery Facility have been included in the air quality modelling.
Cardboard baling facility	30,000	The facility will receive separated cardboard from businesses. Collection vehicles will deliver waste to building 1 for unloading. Trucks will then manoeuver cardboard to the concrete bunker cardboard receival area. Cardboard will be spread using a telehandler to remove contaminants. Removed contaminates will be placed in a general waste bin for disposal off site. A Bobcat or front-end loaded will be used to load the cardboard baler. The cardboard is to be baled in a hydraulic brake press and secured via steel wire into one tonne blocks. Baled cardboard will be stored on site before transport off site. Expected emissions include particulates from material handling. Particulate emissions from the Cardboard baling facility are considered to be minimal, however due to the large throughput, material handling emissions have been included in the air quality modelling.
Drill Mud Recycling Facility	5,000	The Drill Mud Recycling Facility will receive drill mud including soil and water mixture from industry (category 1 trackable liquid waste). Drill mud is a mixture of water, clays, fluid loss control additives, density control additives and viscosifiers. Drill mud will be received from various commercial activities including hydro excavation, exploration drilling and horizontal boring. Drill mud will be transferred by liquid tanker to the drill mud facility in building 2. Tanker trucks will be pumped into a bunded 50,000 L holding tank. The contents of the holding tank will be pumped at a specific rate into a centrifuge to separate solids. Dewatered solids will be transferred into a hook lift bin and moved to the drill mud storage area for compliance testing. The remaining liquid (supernatant) will be pumped to a 50,000 L holding tank for testing. The supernatant may be transferred offsite for treatment or recycling. Expected emissions include odour emissions from the holding tank, centrifuge dewatered solids bin and

Source	Throughput (tonnes per annum)	Description
		supernatant holding tank. Particulate emissions are expected to be minimal based on the moist nature of the operations.
Packaged Food Recycling Plant	2,000	The facility will receive packaged food products from business and industry. Waste materials received include putrescible and non-putrescible general solid waste. Collection vehicles carrying packaged food on pallets will deliver to building 2. Onsite trucks will manoeuvre the pallets to the Packaged Food Recycling Plant to be stored in the bunded storage bay. Forklifts will transfer the contents of the pallets into a receiving hopper of the food de-packaging unit. The de-packaging unit 'chops and squeezes' the food or drink item to separate the food contents from its packaging. The liquidised food is pumped into a 20,000 L on site liquid food waste holding tank. The holding tank will be pumped out twice weekly and transported offsite. Plastics removed during the de-packaging will be stored in a hooklift bin and transferred to the Materials Recycling Facility for processing. The de-packaging unit and food waste holding tank will be vented via an odour control unit, such as an activated carbon system. Expected emissions include odour emissions from the liquid food waste holding tanks and particulates from material handling. Odour emissions from the Packaged Food Recycling Plant are considered to be most significant relative to other sources on site, and have been included in the air quality modelling. Particulate emissions are considered to be minimal, but included in the modelling nonetheless.
Garden Organics Primary Processing	5,000	The facility will receive woody garden organics from residential and business sources. Collection vehicles will unload the garden organics to building 2. Trucks will then manoeuvre the woody garden organics to the concrete bunker receival area of the Garden Organics Primary Processing facility. Garden organics will be spread with a telehandler to remove any contamination prior to transfer to the pre-processing storage bunker. The de-contaminated garden organics will be loaded using a telehandler or front end loaded into a shredding plant. The shredding plant will grind the garden organics to <50mm particle size. Shredded garden organics will be moved to a storage bunker for regular transport offsite. Expected emissions include odour emissions from garden waste shredding and particulates from material handling and shredding. Odour emissions from the Garden Organics Primary Processing have been included in the air quality modelling. Particulate emissions are also considered to be significant and have been included in the air quality modelling.
Metals Recycling	4,000	Both ferrous and non-ferrous materials from residential and business sources are to be received by the facility. Trucks will manoeuver the Metal Recycling waste to the concrete bunker of the Metal Recycling area.

Source	Throughput (tonnes per annum)	Description
		Materials will be spread by a telehandler to remove contaminants. Materials will be cut with a shear and placed into a baling area or directly into hook lift bins for transfer off site. Minimal emissions are expected from the metals recycling process and therefore the metals recycling facility has not been considered in the modelling.
Copper Processing Area	1,000	The facility will receive copper wire from mine sites, building and communications centres. Collection trucks will deliver the copper wires to building 2 where trucks will maneuver the received wires to the concrete bunker of the Copper Processing Area. Cables will be spread with a material handler to remove contaminated materials. Cables will subsequently be cut with a shear and placed in separate storage bins for the copper and plastics for offsite transport. Minimal emissions are expected from the Copper Processing Area and therefore the facility has not been considered in the modelling.
Hazardous waste recycling facility	20,201	The hazardous waste recycling facility will receive a range of solid and liquid waste materials containing chemicals and oils will be collected from mining and manufacturing sources in the Hunter region. Materials will be aggregated and stored according to chemical group in building 2 where appropriate materials will be hand sorted and bunded into closed containers by material category type. Material categories include: drained oil filters (general solid waste), containers & drums containing controlled waste residues (Category 1 trackable solid waste N100), contaminated soils(Category 1 trackable solid waste N120), lead acid batteries (Category 1 trackable solid waste D220), batteries (general solid waste), fluorescent tubes (general solid waste), Gyproc (general solid waste), used fire extinguishers and pressure vessels (general solid waste), and E-waste. Periodically, vehicles will enter the Hazardous Waste Materials Recycling Facility to collect aggregate materials for processing offsite. Liquid waste including Waste mineral oils (Category 1 trackable solid waste J100), oily water (Category 1 trackable solid waste J120), residual solvents (Category 1 trackable solid waste N100), thinners and paints will be delivered to the HWMR area in tankers or specialised containers on collection trucks. Liquid waste will be unloaded into a bunded storage area for assessment and classification. Liquid waste will subsequently be decanted into holding tanks which will be periodically emptied and transported off site for treatment. Minimal emissions are expected from the hazardous waste recycling facility as the facility is for the storage of materials only, before transport offsite for further processing. The decanting of liquid into holding tanks is not expected result in significant odour emissions as the liquid will be pumped and not manually decanted. Furthermore, the pumping is proposed to occur within building 2 and not external to the atmosphere. Therefore odour and particulate emissions have not been modelled.

Source	Throughput (tonnes per annum)	Description
Haul Route	171 truck movements per day	The onsite haul route includes semi-trailers and rigid trucks delivering waste and collecting waste for transfer to offsite processing. All haul routes are proposed to be paved. Particulate emissions are associate with haul routes have a potential to be significant due to the large number of truck movements per day, and have been included in the modelling.
Truck Parking Depot	-	To support the truck parking depot storage tanks for fuels, liquid waste and waste oils are proposed for the site. The self-bunded tanks are proposed to be constructed outdoors. Emissions from the Truck Parking Depot and storage tanks are considered to be minimal and have not been considered in the modelling.
Maintenance Workshop	-	A maintenance workshop is proposed for the site for vehicle maintenance to the REMONDIS Truck collection fleet. The workshop will store fuels, oils and cleaning chemicals. All maintenance operations are proposed to occur within the workshop building. Emissions from the maintenance workshop are expected to be minimal. Emissions from the waste oil unloading to the rear of the workshop have been included in the modelling. Odour and VOC emissions are expected to be associated with the unloading process.

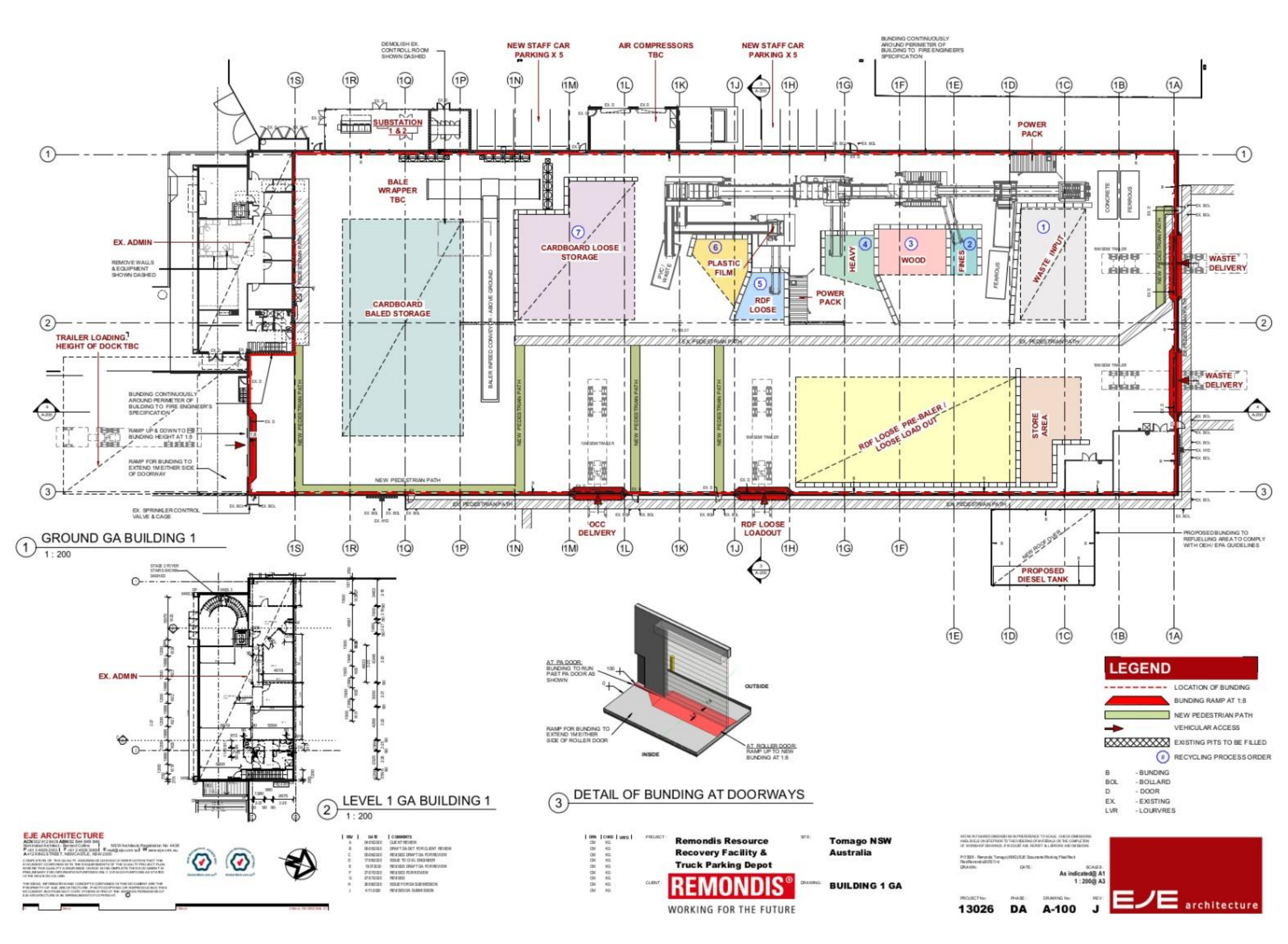

Figure 4 - Building 1 Layout

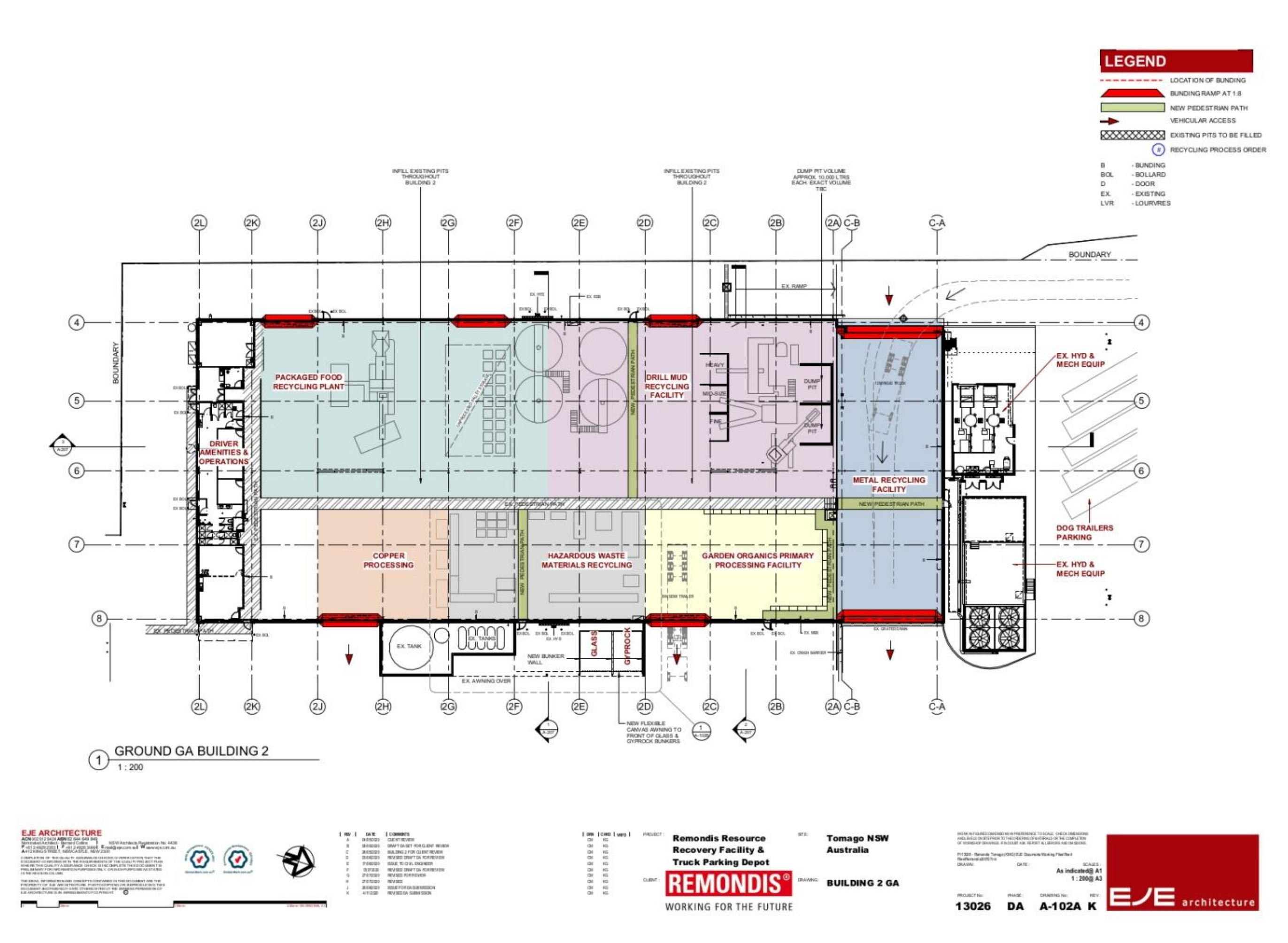

Figure 5 - Building 2 Layout

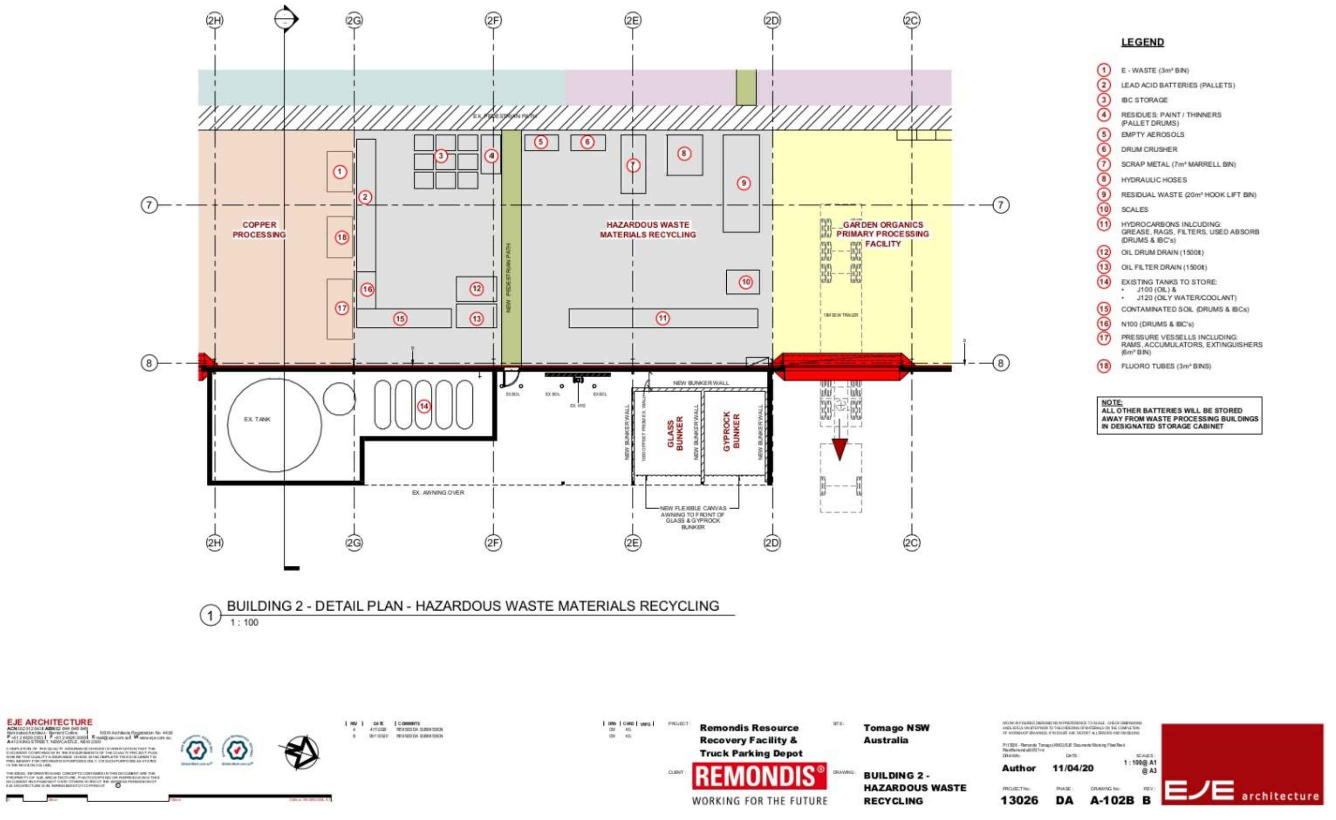

Figure 6 - Building 2 – Detailed Plan – Hazardous Waste Materials Recycling

3 Existing Environment

3.1 Topography

The subject site is located on the floodplain of the Hunter river and is characterised by flat terrain. Small hills exist to the north and north east of the proposed development site. Figure 7 presents ground contours of the site and surrounding area.

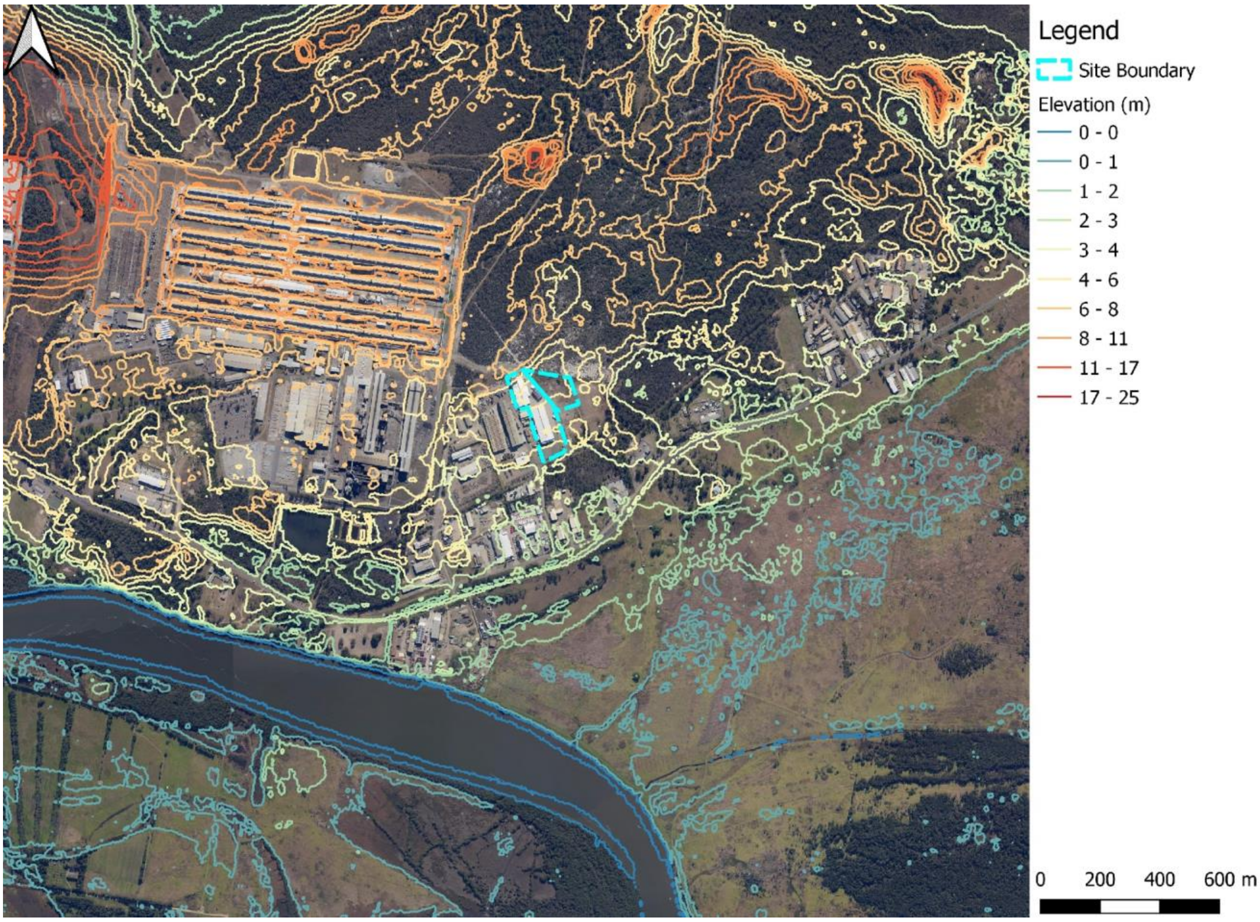

Figure 7 - Site Topography

3.2 Meteorology

The Hunter region is characterised as having a humid subtropical climate climate. Based on the nearest Bureau of Meteorology station at Williamstown RAAF (10.6 km north east of the proposed development site), historical temperatures range from 7.1 - 17.9 ºC in winter to 18.2 – 2.8 ºC in summer, and the mean annual rainfall is 1118 mm.

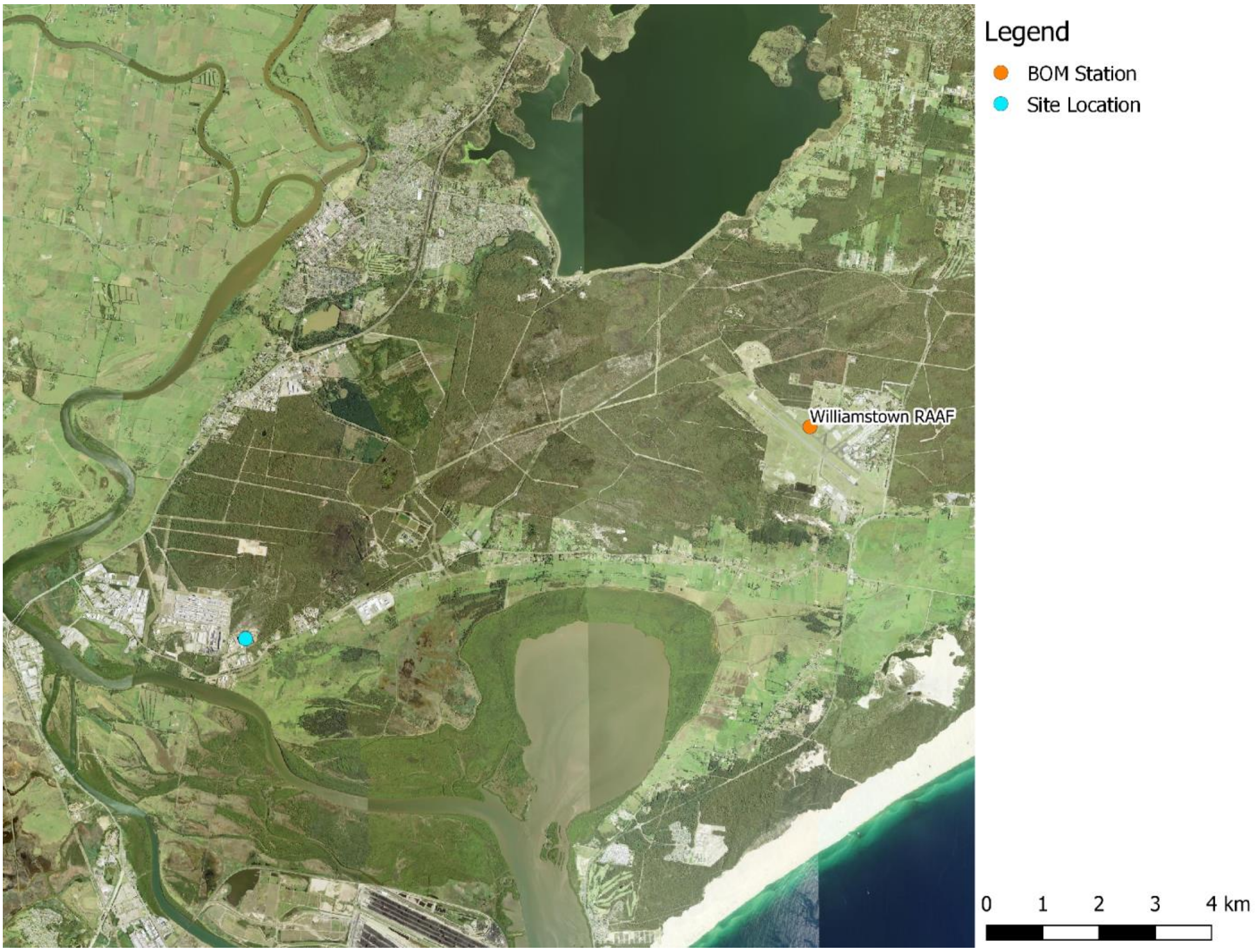

Figure 8 - Williamstown RAAF Bureau of Meteorology station

With regards to wind conditions, the Williamstown RAAF station shows that the area is dominated by north westerly winds. South westerly winds are noted to be minimal. Average wind speeds for Williamstown RAAF are 4.3 m/s. Calms are not considered to be a major feature of the area, with the proportion of calms being 6.4%.

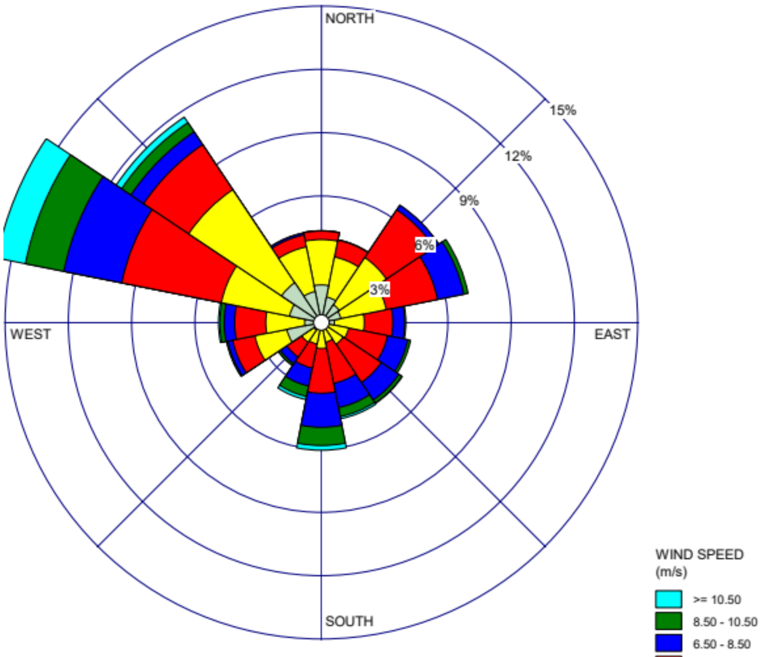

Figure 9 - 2016 - 2019 Williamstown BOM Station Wind Rose

3.3 Potential Constraints

Proposed emissions sources and existing emissions sources have been reviewed to determine whether there will be any cumulative impacts from the proposed development (proposed operations plus existing sources). The following sections outline the existing and proposed emissions sources in the area surrounding the site.

3.3.1 Existing Emission Sources

The subject site and surroundings are currently zoned General Industry under the Port Stephens Local Environment Plan 2013. A survey of existing industry within 500 m buffer of the property boundary has been completed. Further details of this survey are presented in Appendix B. There is anticipated to be an overlap with odour and particulate sources with surrounding industries. However, given the large number of surrounding industries and difficulty of obtaining detailed information for each industry, a cumulative assessment of the surrounding industry is not considered practical.

It is noted that the results of the air dispersion modelling show that contribution of the proposed operations to local pollutant concentrations is very low and the modelling has considered background monitoring data from the Mayfield station (which is close to existing industry in the Newcastle area). Refer to Section 8 for further details of the predicted concentrations of the proposed development.

A buffer zone of 4 km exists for the Tomago Aluminium smelting facility. The facility was constructed in 1983 and has expanded over time. Currently the facility has three potlines each containing 280 pots and operates at a capacity of 580,000 tonnes per year. The 4 km buffer zone was introduced during the approval process for the third potline and aims to reduce sensitive uses around the aluminium smelter and associated infrastructure. Any proposed development within the buffer zone with the potential to increase sulphur concentrations must be assessed cumulatively with the Tomago Aluminium facility. There are expected to be some sulphur emissions from the diesel machinery (i.e. forklifts, loaders and material handlers) and trucks operating on site[1].

3.3.2 Proposed Emission Sources

All Major Projects and Development Applications in Tomago with the potential to overlap on pollutants from the proposed facility have been reviewed. Further details of this review are presented in Appendix B. The proposed aluminium extrusion facility at 606 Tomago Road and SPL potlining facility at 638 Tomago Road are noted to emit sulphur emissions. As per Section 3.3.1, the emissions of sulphur from the diesel machinery at the proposed development is expected to be low and therefore cumulative impacts for the aluminium extrusion facility and potlining facility have not been considered. The approved transport depot and galvanising plant are noted to be over 1 km from the proposed development, therefore cumulative dust and odour emissions as a result of the proposed development are expected to be low and have not been considered further. The proposed gas fired power station is located over 2 km away from the proposed development. Overlapping pollutants for the power station include particulate matter. Cumulative impacts have not been considered further, given the large separation distance to the proposed gas fired power station.

3.4 Background Air Quality Monitoring

Besides contribution from the industrial area of Tomago, ambient particulate concentrations in the Hunter region area are defined by local traffic, coal mining and coal fired power plants. To allow for the assessment of cumulative pollutant concentrations, the assessment has considered ambient concentrations from the New South Wales Office of Environment and Heritage air quality monitoring stations at Beresfield, Wallsend, Mayfield, Carrington, Stockton and Newcastle.

The location of the New South Wales Office of Environment and Heritage monitoring stations considered in this assessment are presented in Figure 10.

1 Predicted SO_2 emissions from the trucks and diesel machinery onsite are low with an estimate of < 1 kg emitted per year for the haul route and 16 kg per year for the diesel machinery. This is based on the equipment specifications and sulfur dioxide emission factors from the National Pollution Inventory Emission Technique Manual for Combustion (Version 3).

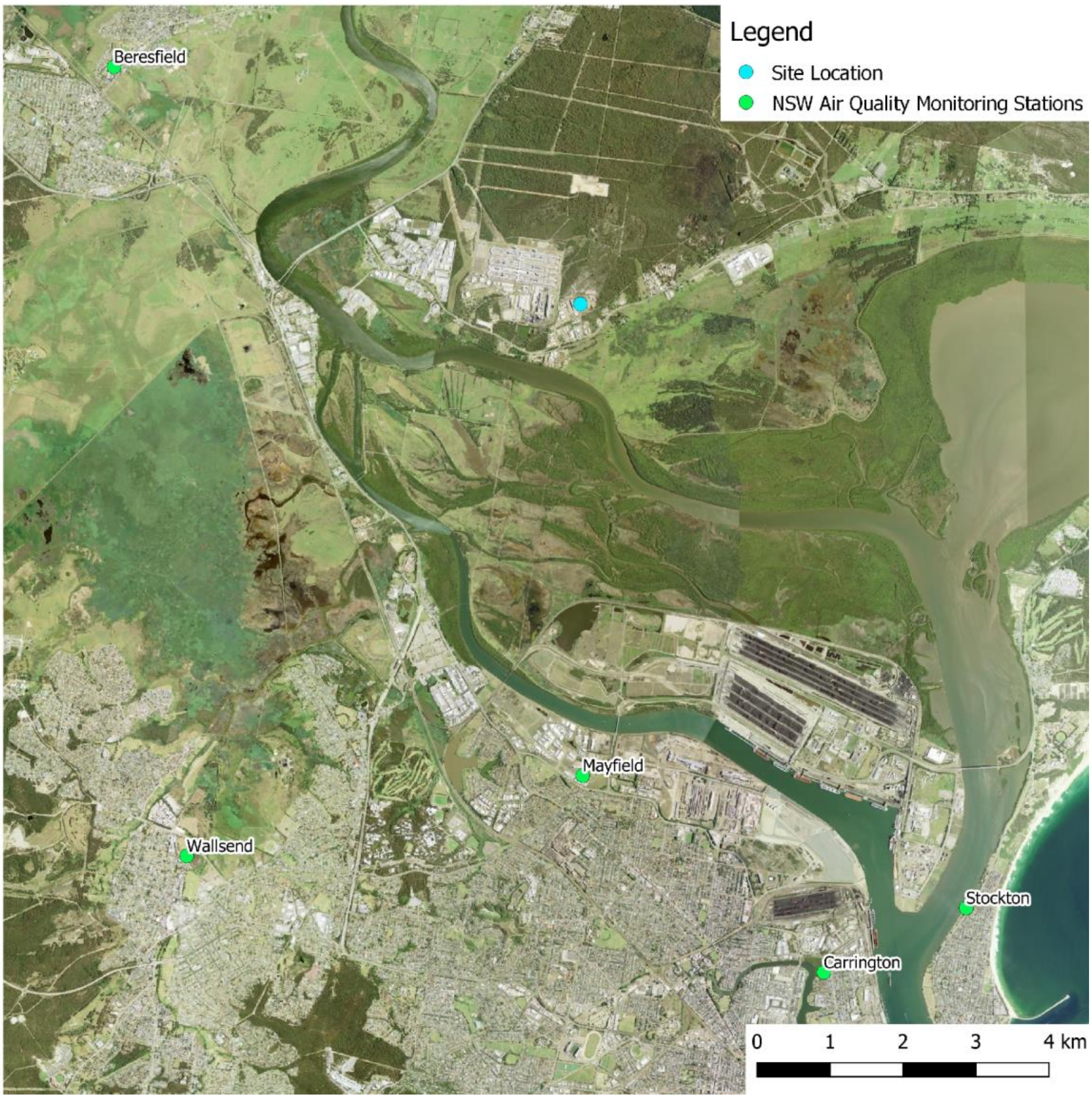

Figure 10 - NSW OEH Monitoring Station Locations

Table 5 presents the ambient monitoring data from the nearby NSW OEH Monitoring Stations.

Table 5 - Ambient 2017 – 2019 monitoring data from NSW OEH Monitoring Stations

Monitoring Station	Measured Concentration (µg/m³)					
	$PM_{2.5}$	$PM_{2.5}$	PM_{10}	PM_{10}	SO_2	
	24-hour	Annual Average	24-hour	Annual Average	24-hour	Annual Average
Beresfield	9.4	9.5	22.4	22.4	4.4	4.4
Wallsend	8.4	8.3	20.1	20.0	3.9	3.8
Mayfield	9.0	9.0	27.4	27.3	4.4	4.4

Monitoring Station	Measured Concentration (µg/m^3)					
	$PM_{2.5}$	$PM_{2.5}$	PM_{10}	PM_{10}	SO_2	
	24-hour	Annual Average	24-hour	Annual Average	24-hour	Annual Average
Carrington	9.2	9.3	27.7	27.6	5.8	5.8
Stockton	10.9	10.9	39.5	39.5	8.5	8.5
Adopted Background	24-hourly background from Mayfield has been adopted	9.0	24-hourly background from Mayfield has been adopted	27.3	5.4	5.4

To provide an assessment of cumulative PM_{10} and $PM_{2.5}$ impacts, the background concentrations from the Mayfield air quality monitoring station has been adopted (in the absence of site-specific data). Mayfield has been selected as the station is considered to be representative of the site with nearby industrial and residential land uses. For the year 2019 at the Mayfield station, there are noted to be 37 exceedances to the PM_{10} criteria and 6 exceedances to $PM_{2.5}$ criteria (refer to section 4 for criteria). The annual average criteria for both PM_{10} and $PM_{2.5}$ are also noted to be exceeded at the Mayfield station. As the criteria is being exceeded prior to the proposed development going ahead, best practice measures are to be adopted to minimise impacts of the proposed development.

A contemporaneous assessment has been completed to determine whether the number of 24-hour exceedances would increase at the modelled sensitive receptors as a result of the proposed development operations. Monitoring data from the Mayfield station has been analysed against the predicted cumulative pollutant concentrations (Mayfield station plus concentrations as a result of the proposed development) for each sensitive receptor to determine if the number of exceedances increases.

4 Assessment Criteria

The results of the modelling have been compared to ambient air quality goals defined in the *NSW Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2017).*

Table 6 summarises the air quality criteria.

Table 6 - Air Quality Criteria

Compound	Air Quality Criteria (µg/m^3)	Averaging Period
TSP	90	Annual
PM_{10}	50	24-hour
	25	Annual
$PM_{2.5}$	25	24-hour
	8	Annual
SO_2	570	1 hour
	228	24-hour
	60	Annual
Toluene	360	1 hour
Xylenes	190	1 hour
Benzene	29	1 hour
Cumene	21	1 hour
Ethylbenzene	8000	1 hour
Trimethylbenzene	2200	1 hour

In addition to the above, odour from the proposed facility has been assessed in accordance with the odour criteria presented in *NSW Assessment and Management of Odour from Stationary Sources in NSW (November 2008)*. The document comprises of two parts – a technical framework (which defines the criteria) and technical notes (that discuss assessment methodologies). In the policy document, the OEH note that odour assessment criteria need to be designed to take into account the range of sensitivities to odours within the community, and to provide additional protection for individuals with a heightened response to odours. Therefore, the odour assessment criteria allows for population size, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity. Table 7 presents the odour criteria for various population sizes as specified by the OEH.

Table 7 - NSW EPA Odour Criteria

Compound	Odour Assessment Criteria (OU)
Rural single residence (<)	7
~ 10	6
~ 30	5

Compound	Odour Assessment Criteria (OU)
~ 125	4
~ 500	3
Urban area (> 2000) and/or schools and hospitals	2

Alternatively, the NSW EPA identifies that the following equation may be applied:

$$\text{Odour assessment criterion (OU)} = (\log_{10}(\text{population}) - 4.5)/-0.6$$

The above odour criteria is applicable at sensitive receptors. The NSW EPA air modelling and odour guidelines define a sensitive receptor as:

> *"...a location where people are likely to work or reside; this may include a residential dwelling, school, hospital, office or public recreational area."*

While the definition includes 'where people are likely to work', industry (or industrial premises) however are generally not considered to be sensitive receptors. The activities undertaken in industrial areas are often inherently odorous. For example, the use of paints and other coatings in panel repair facilities often results in odours being emitted beyond the boundary of the facility of the site. Despite this, these odours would not usually be considered as offensive by the neighbouring industrial uses. It is also noted that industrial uses are not mentioned in the glossary of terms for a Sensitive Receptor under the Approved Methods guideline.

The nearest residential or community uses are located in isolated areas at least 500 metres from the site. Despite the isolated nature of sensitive receptors, a conservative 2 OU criterion has been adopted for the sensitive receptors.

For comparison to the assessment criteria, impacts in odour units are reported as peak concentrations (i.e. approximately one second average) and as the 99^{th} percentile of predicted concentration based on a Level 3 odour assessment methodology.

5 Meteorological Modelling

5.1 Overview

The following sections discuss the methodology, input data and recommendations of the air dispersion modelling.

5.2 Modelling Methodology

Atmospheric dispersion modelling involves the mathematical simulation of the dispersion of air contaminants in the environment. The modelling utilises a range of information to estimate the dispersion of pollutants released from a source including:

- meteorological data for surface and upper air winds, temperature and pressure profiles, as well as humidity, rainfall, cloud cover and ceiling height information;
- emissions parameters including source location and height, source dimensions and physical parameters (e.g. exit velocity and temperature) along with pollutant mass emission rates;
- terrain elevations and land use both at the source and throughout the surrounding region;
- the location, height and width of any obstructions (such as buildings or other structures) that could significantly impact on the dispersion of the plume; and
- sensitive receptor locations and heights.

For the purpose of the assessment, meteorological modelling has been undertaken using TAPM (The Air Pollution Model) and CALMET to predict localised meteorological conditions. The meteorological data derived from these models has been used as an input for the CALPUFF dispersion modelling.

5.2.1 TAPM Predictions

A site-specific meteorological dataset has been determined using the prognostic model TAPM (The Air Pollution Model). Prognostic models, such as TAPM, permit the development of localised meteorological datasets, based on synoptic weather conditions. The model predicts the regional flows important to dispersion, such as sea breezes and terrain induced flows, against a background of larger-scale meteorology provided by synoptic analyses. The output of this model provides a meteorological dataset suitable for introduction into a diagnostic meteorological model, such as CALMET. Where good quality prognostic data is available for a site, this methodology is the recommended approach for the modelling of contaminant concentrations using CALMET[2].

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2 TRC Environmental Corporation (March 2011) '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' prepared on behalf of the NSW Office of Environment and Heritage.

The 3D prognostic data was derived using TAPM (Version 4.05). The model was configured with a series of nested grids chosen to provide an appropriate communication and transfer of information from the broad synoptic to the local scale. The model was configured to use a domain consisting of 25 x 25 x 25 grid points with nesting spacings of 30 km, 10 km, 3 km and 1 km. Table 8 presents a summary of the TAPM settings.

Table 8 - TAPM Settings

Setting/Input	Value
Latitude, Longitude	-32deg49.5min, 151deg43.5min
Easting X, Northing Y (m)	380656, 6367393
Date	2019
Grid Points	25 x 25
Outer Grid Spacing	30 km x 30 km
Vertical Grid Levels	25 grid levels 10, 25, 50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 1000, 1250, 1500, 1750, 2000, 2500, 3000, 3500, 4000, 5000, 6000, 7000, 8000 All levels stored in output
Number of Grid Domains	4 (30 km, 10 km, 3 km, 1 km)

5.3 CALMET Predictions

5.3.1 Overview

As discussed in the previous section, a three-dimensional prognostic dataset derived from the TAPM model was input to CALMET to predict meteorological conditions at the development and surrounding area. The following sections provide an overview of the data utilised in the CALMET modelling, along with details of some of the key parameters selected to establish calculation limits within CALMET.

5.3.2 Vertical Stations

For the purposes of the modelling, CALMET was initialised with a total of 10 vertical layers with layer boundaries at 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1,200 m, 2,000 m, 3,000 m and 4,000 m respectively. The vertical levels used in the modelling were selected to provide the model with the ability to predict atmospheric conditions at a range of heights. A greater resolution of vertical heights has been adopted nearer to the ground, given the ground level sources considered in the assessment.

5.3.3 Terrain and Land Use Data

Terrain data for the area surrounding the development was obtained from the SRTM-derived 1 Second Digital Elevation Model. The 1 Second Digital Elevation Model represents ground surface topography and has been smoothed to reduce noise. Data for a 20 km x 20 km area (0.1 km spacing) has been extracted for use in the modelling.

The TERRAD value in CALMET is used to determine the radius of influence for terrain features within the model domain. The TERRAD value has been calculated based on the rule 'ridge-to-ridge divided by 2, rounded up' recommended by the NSW Office of Environment and Heritage[3]. A TERRAD value of 2 km has been adopted after review of the surrounding terrain features.

Land use data was also created based on New South Wales land use data from the New South Wales Government Department of Planning, Industry & Environment [4] and satellite imagery and incorporated into the CALMET model. Where land use categories do not correspond with the CALMET land use input file categories, satellite imagery has been reviewed to determine the most appropriate land use category. Figure 11 and Figure 12**Error! Reference source not found.** present the modelled terrain and land use in CALMET.

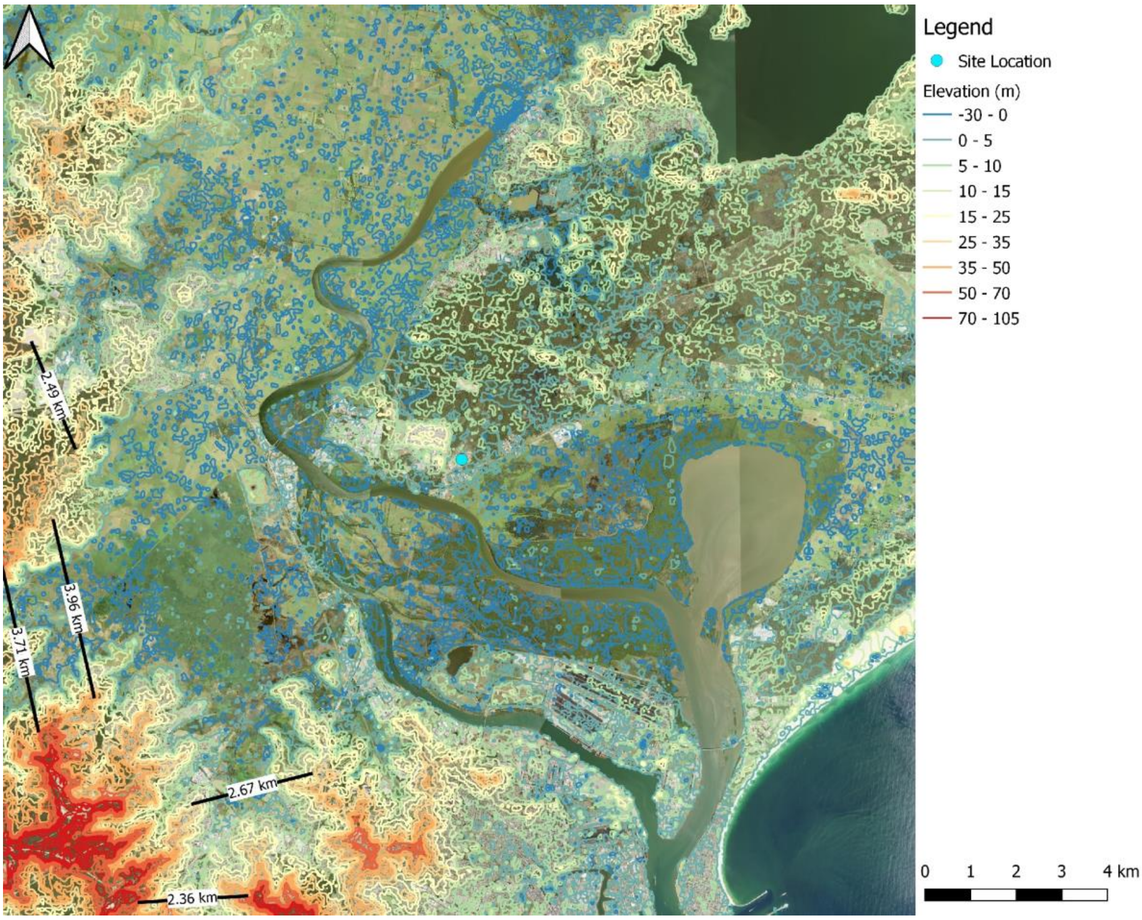


Figure 11 - Modelled Terrain

3 TRC Environmental Corporation (March 2011) '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' prepared on behalf of the NSW Office of Environment and Heritage.

4 https://data.nsw.gov.au/data/dataset/nsw-landuse-2017

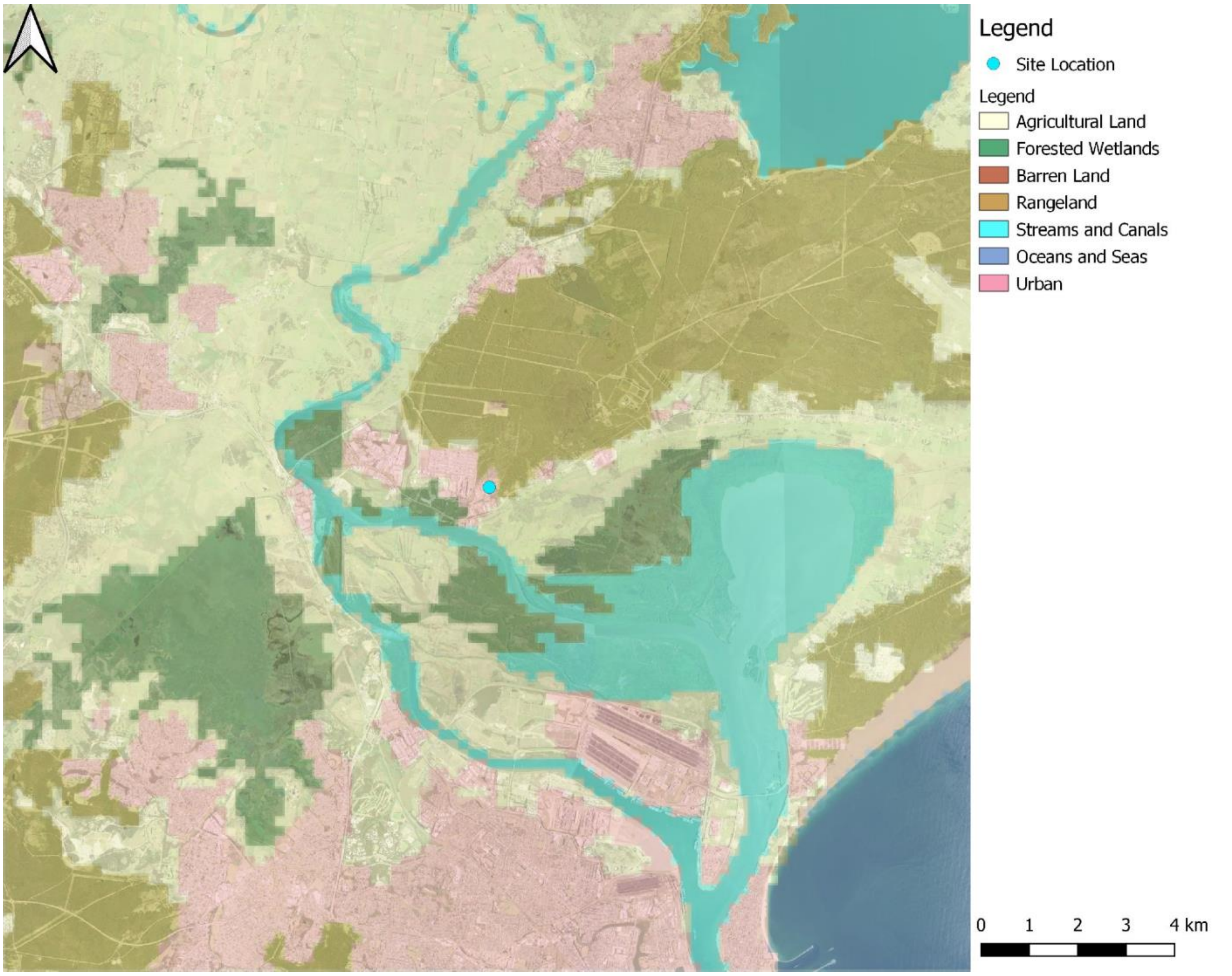


Figure 12 - Modelled Land Use

5.4 CALPUFF Dispersion Modelling

The CALPUFF modelling system treats emissions as a series of puffs. These puffs are then dispersed throughout the modelling area and allowed to grow and bend with spatial variations in meteorology. In doing so, the model is able to retain a memory of the plume's movement throughout a single hour and from one hour to the next while continuing to better approximate the effects of complex air flows.

CALPUFF utilises the meteorological processing and prediction model CALMET to provide three-dimensional wind field predictions for the area of interest. The final wind field developed by the model (for consideration by CALPUFF) includes an approximation of the effects of local topography, the effects of varying surface temperatures (as is observed in land and sea bodies) and surface roughness (resulting from varied land uses and vegetation cover in an area). The CALPUFF model is able to resolve complex terrain influences on local wind fields including consideration of katabatic flows and terrain blocking.

5.5 CALPOST

Post processing of modelled emissions is undertaken using the CALPOST package. This allows the rigorous analysis of pollutant predictions generated by the CALPUFF system. In particular CALPOST is able to provide an analysis of predicted pollutant concentrations for a range of averaging periods from 1 hour to 1 year.

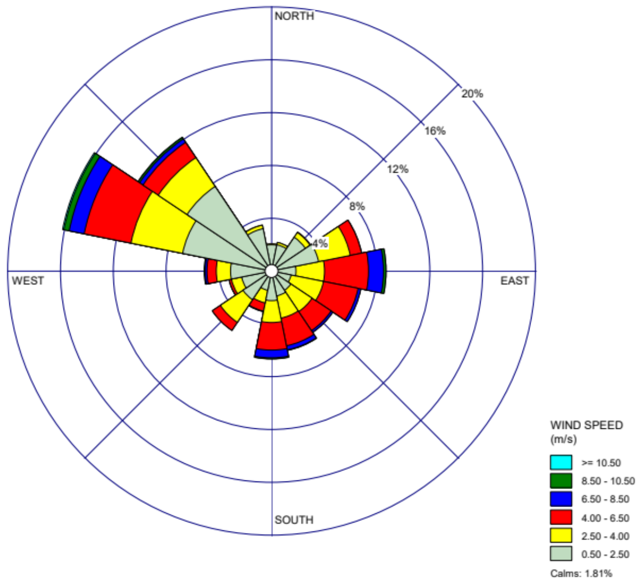
5.6 Meteorological Predictions

5.6.1 Wind Predictions

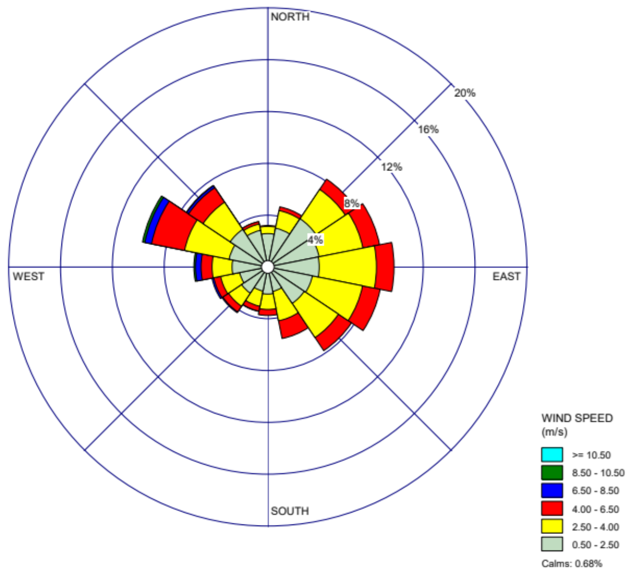
For the purpose of verifying the accuracy of the CALMET modelling, predicted wind roses for the year 2019 have been compared to the New South Wales air quality monitoring station data at Mayfield and Beresfield. These stations are located 6.5 south to 7.1 km north west of the site as shown in Section 3.2. CALMET predictions have also been compared to the Bureau of Meteorology Williamstown RAAF station located 10.6 km north east of the site. The location of the meteorological stations used for comparison are presented in Figure 13.

Figure 13 - Meteorological Stations Used to Validate CALMET Predictions

Figure 14**Error! Reference source not found.** to Figure 16**Error! Reference source not found.** show a comparison of the predicted and measured wind roses for the Mayfield and Beresfield stations Air Quality Monitoring stations and the Williamstown RAAF Bureau of Meteorology station.

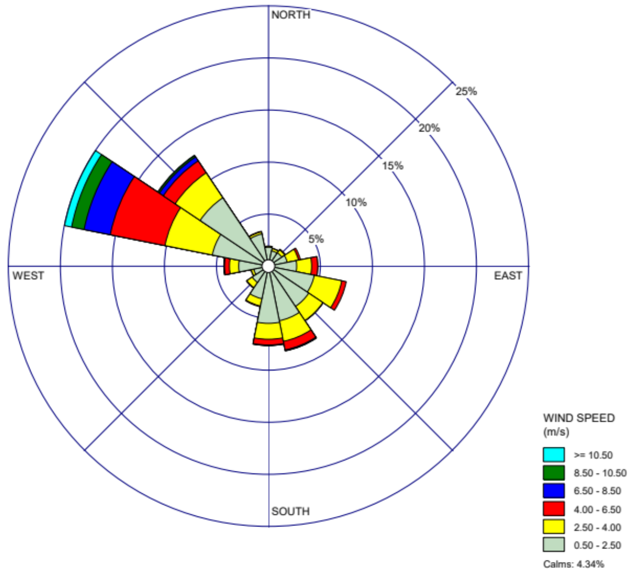


2015 - 2019 Measured

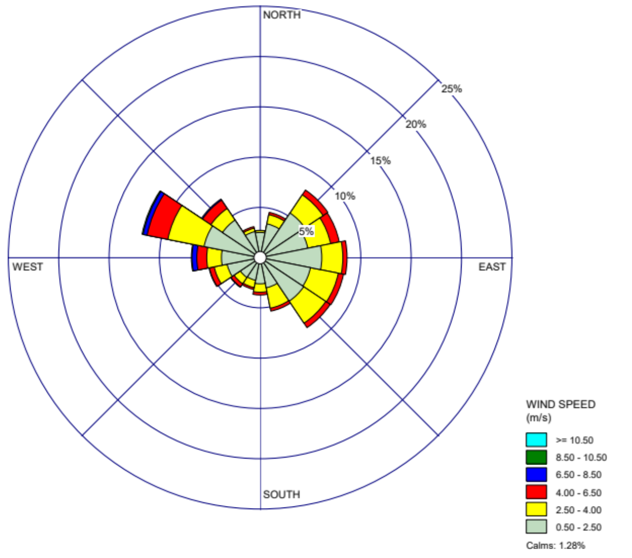


2019 CALMET Predicted

Figure 14 - Mayfield Air Quality Monitoring Station – 2015 - 2019 Measured vs 2019 Predicted Wind Roses

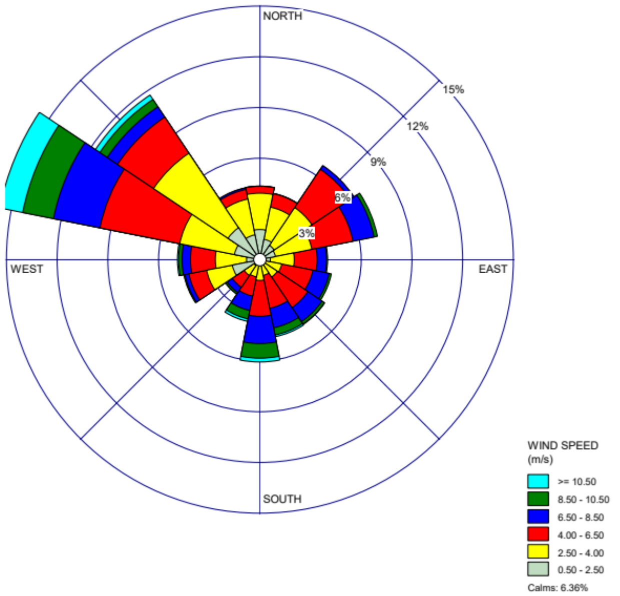


2015 - 2019 Measured

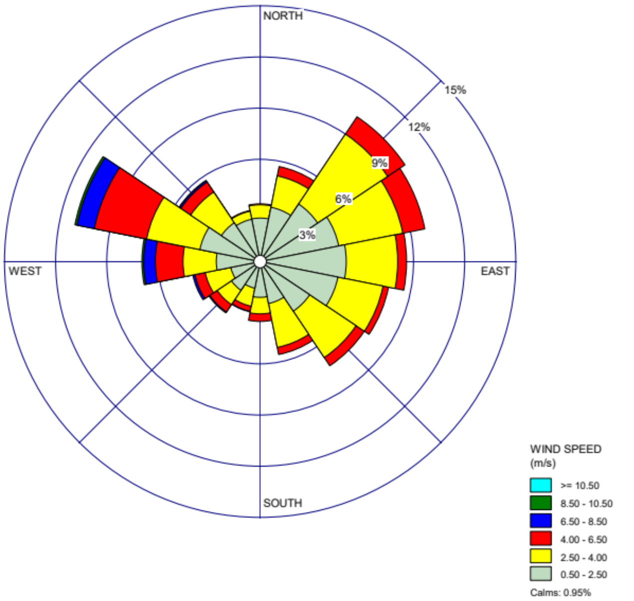


2019 CALMET Predicted

Figure 15 - Beresfield Air Quality Monitoring Station - 2015 – 2019 Measured vs 2019 Predicted Wind Roses



2015 - 2019 Measured



2019 CALMET Predicted

Figure 16 - Williamstown RAAF BOM Station – 2015 - 2019 Measured vs 2019 Predicted Wind Roses

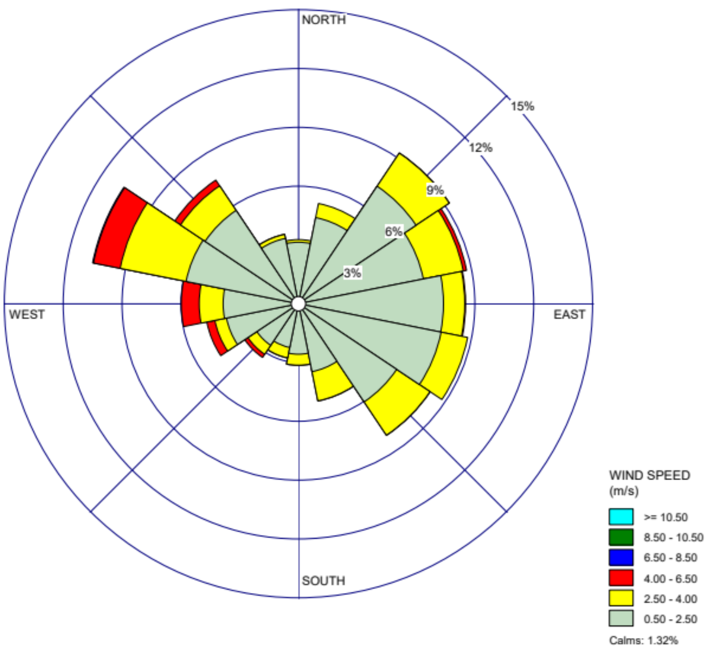


Figure 17 - CALMET Predicted Site Wind Rose 2019

The measured data set shows dominant north-westerly winds and minimal northerly and south-westerly components. The north westerly winds are reflected to a lesser extent in the CALMET predictions. Some differences include a higher proportion of easterly component winds across all stations and a lower proportion of southerly winds at Williamstown RAAF.

Table 9 presents a comparison on the predicted and measured source to receiver wind directions

Table 9 - Comparison of Measured and Predicted Source to Receiver Wind Directions

Wind Direction	Mayfield		Beresfield		Williamstown RAAF	
	Measured	Predicted	Measured	Predicted	Measured	Predicted
NE	3.6%	8.1%	2.0%	8.1%	6.7%	10.2%
ENE	6.9%	8.8%	3.0%	8.0%	7.1%	9.8%
E	8.7%	9.7%	4.7%	8.6%	4.0%	8.6%
WSW	3.3%	4.4%	1.7%	5.2%	4.6%	4.0%
WNW	16.1%	9.8%	19.9%	11.9%	15.7%	11.1%
NW	12.2%	7.6%	12.8%	7.0%	11.7%	5.7%

Overall, a comparison of the wind roses show that predicted and measured wind roses are comparable in terms of wind direction. The predicted wind rose at the subject site show similar wind patterns to those predicted at the 3 monitoring locations.

Table 10 presents a comparison of predicted and measured wind speeds.

Table 10 - Comparison of Measured and Predicted Wind Speed Categories

Category (m/s)	Mayfield		Beresfield		Williamstown RAAF	
	Measured	Predicted	Measured	Predicted	Measured	Predicted
0.50 - 2.50	47.3%	47.7%	55.3%	62.8%	15.4%	49.1%
2.50 - 4.00	24.8%	35.0%	21.2%	25.6%	29.4%	35.3%
4.00 - 6.50	20.1%	14.8%	10.1%	9.0%	28.4%	12.4%
6.50 – 8.50	4.1%	1.4%	3.2%	1.1%	12.5%	2.0%
8.50 - 10.50	0.9%	0.3%	1.4%	0.2%	5.1%	0.3%
>= 10.50	0.2%	0.0%	0.8%	0.0%	2.3%	0.0%
Calms	1.8%	0.7%	4.3%	1.3%	6.4%	0.9%

In terms of wind speeds, the predicted data set is over-predicting lower speed categories (0.5 – 2.5 m/s), particularly at Williamstown RAAF where over prediction is by a factor of 3. This feature of the model has a potential to result in conservative pollutant concentrations, since lower wind speeds are associated with poor pollutant dispersion conditions. In relation to calms, the predicted data set shows lower proportion of calms at all stations. However, all data sets confirm that calms are a minor feature of the area (with measured and predicted proportions being less than 7% at all locations).

Overall, predicted wind conditions are considered appropriate for the assessment of potential air quality impacts from the proposed development.

5.6.2 Atmospheric Stability Class

The amount of turbulence in the ambient air has a major effect upon the rise and dispersion of emissions. The amount of turbulence in the atmosphere is often described using series of six Pasquill stability classes A, B, C, D, E and F. Of these, Class A denotes the most unstable or most turbulent conditions and class F denotes the most stable or least turbulent conditions. Figure 18 provides a summary of the predicted atmospheric stability conditions for the site.

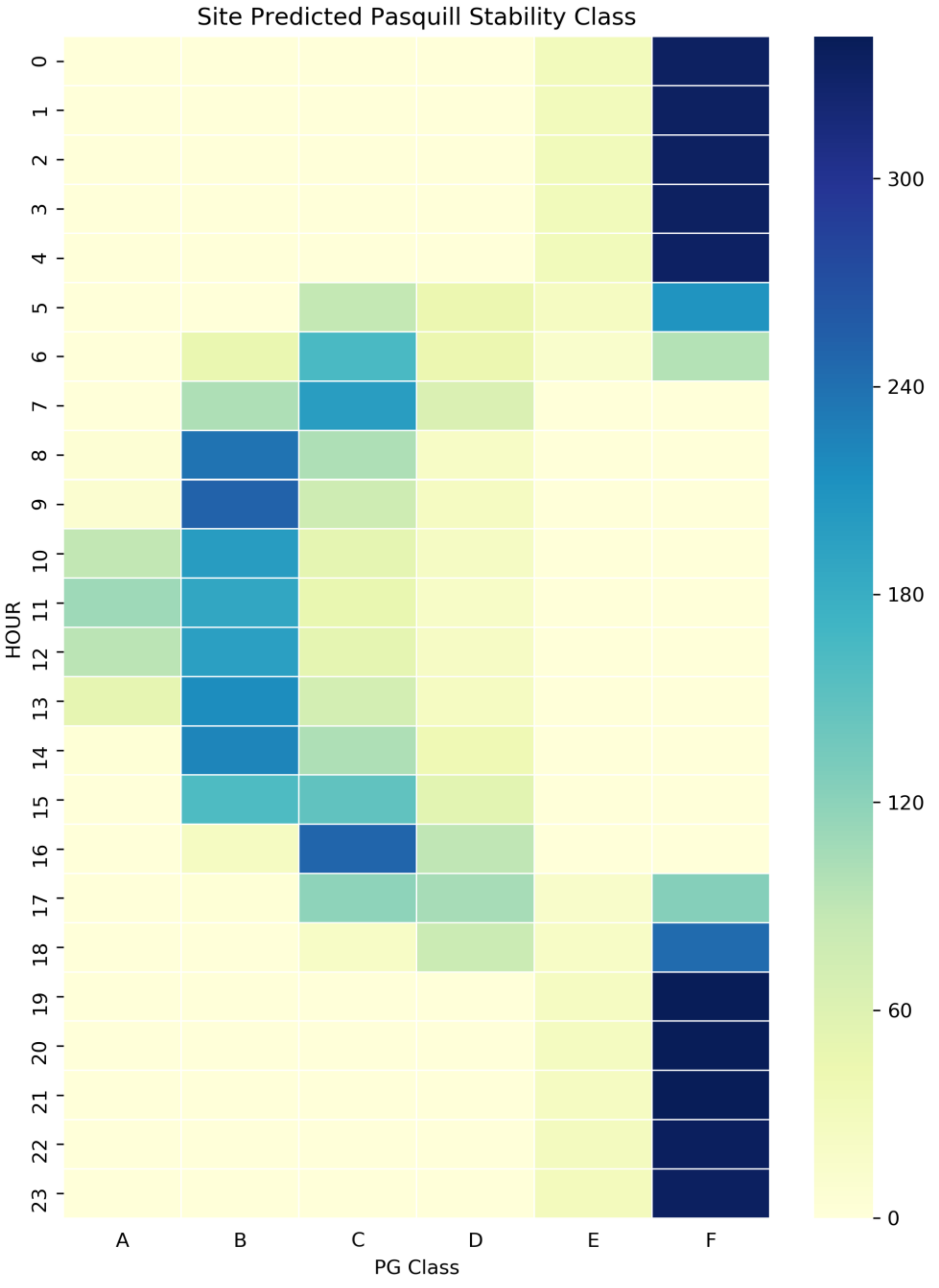


Figure 18 - CALMET Predicted site Stability Class

5.6.3 Mixing Heights

Figure 19 presents a plot showing predicted mixing heights for each hour of the day. The range and pattern of predicted mixing heights are considered typical of a rural area. As expected, higher mixing heights occur during the daytime, while lower mixing heights occur during the night period when stable conditions are dominant and temperature inversions occur.

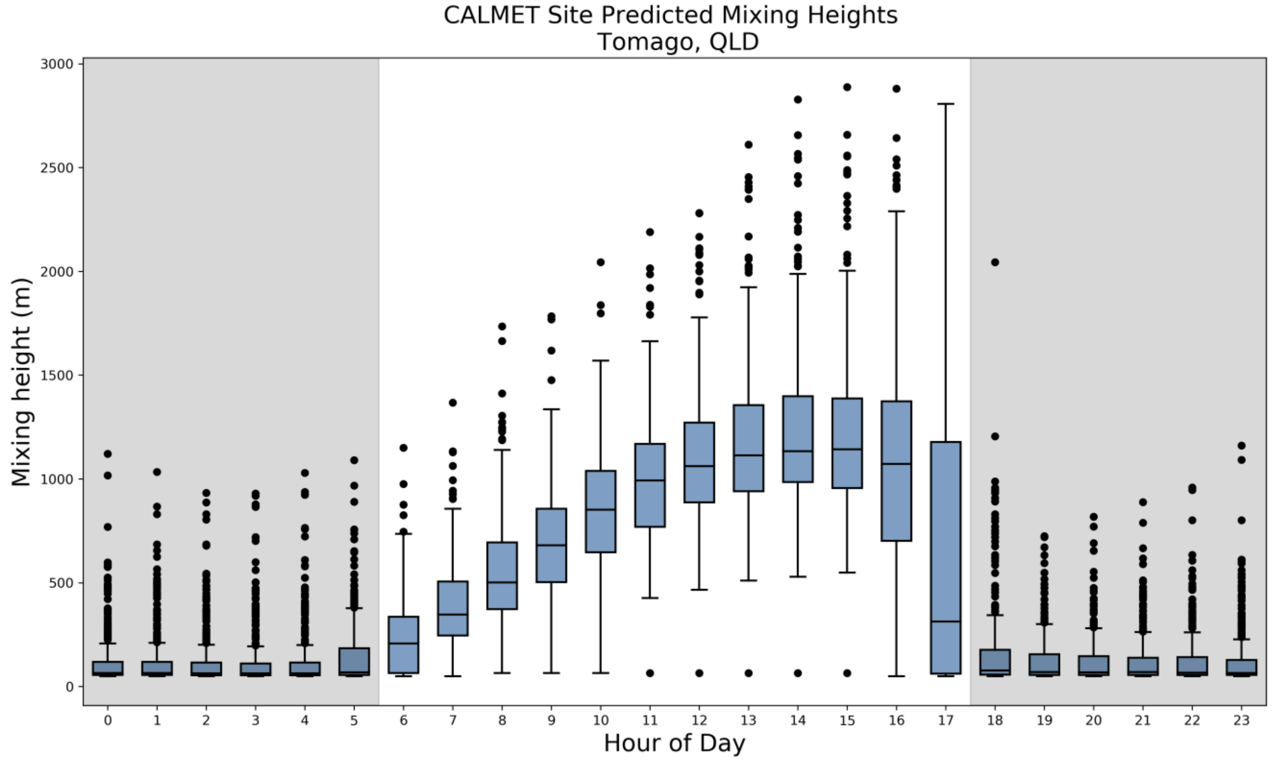


Figure 19 - CALMET Predicted site Mixing Heights

5.6.4 Temperature

Figure 20 presents a plot showing predicted temperatures for each hour of the day. The range and pattern of predicted temperatures are considered typical of an urban area. As expected, higher temperatures occur during the daytime, while lower temperatures occur during the night period when there is no solar radiation. The average predicted temperature at the site is 18.7, which is comparable to the average measured temperatures of 18.5ºC at the air quality monitoring stations and Bureau of Meteorology station.

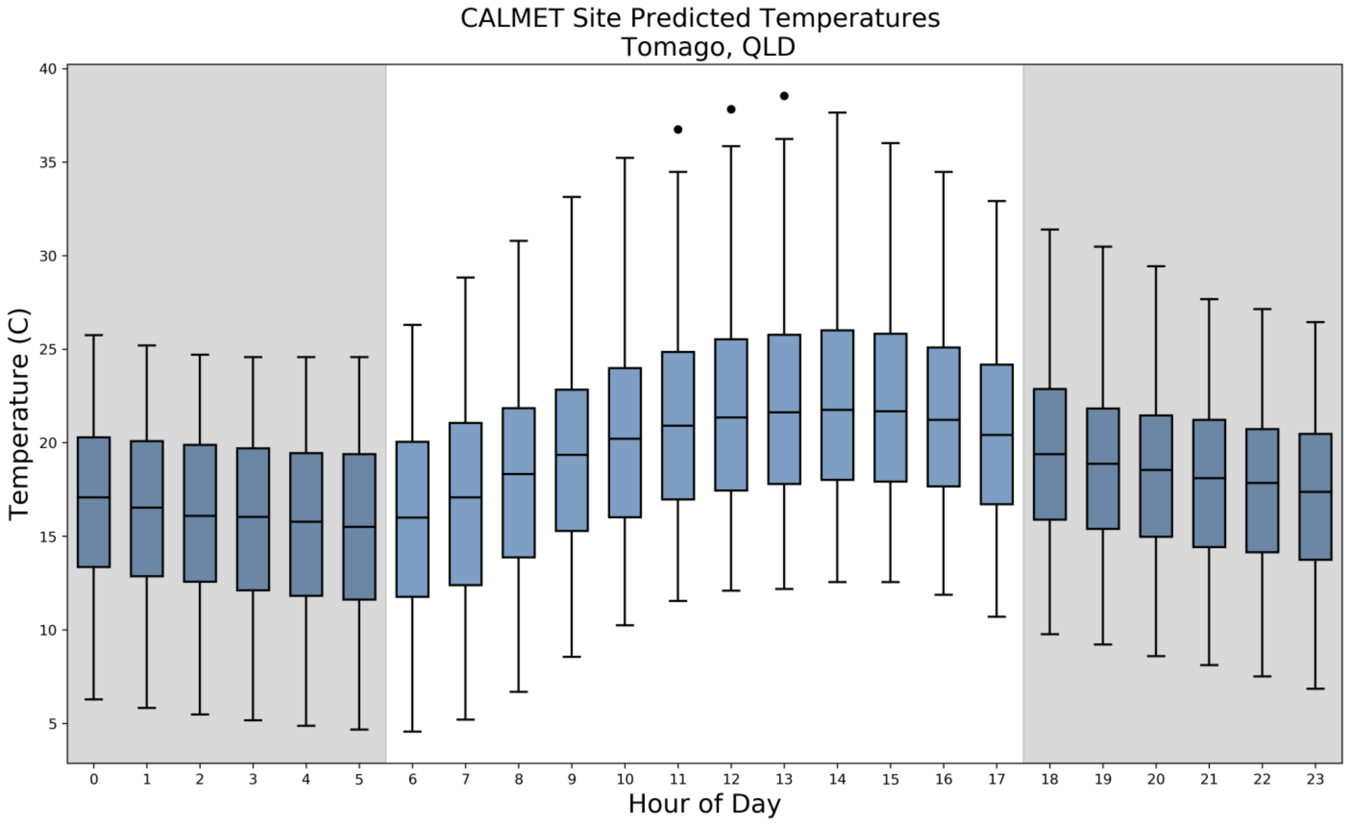


Figure 20 - CALMET Predicted Site Temperature

5.7 Summary of Outcomes

A review of the predicted data set indicates that the outcomes of CALMET model are suitable for predicting potential air quality impacts from the proposed development. Key meteorological parameters including wind field, stability class and temperature are considered to be representative of the subject site and surrounding area based on a comparison to measured data.

6 Air Emissions Data

6.1 Overview

The following sections present the emission factors and emission rates derived for each CALPUFF modelled source. Modelled source parameters are described later in Section 7.

6.2 Dust Emission Factors

In order to predict particulate emission rates for the relevant air emission sources, a review of available published literature relating to resource recovery and truck parking depot operations has been completed. The following documents have been utilised to estimate emissions, and are referenced in Table 11:

1. AP 42 (5th Edition), Compilation of Air Pollutant Emission Factors, Vol. 1 Stationary Point and Area Sources, Chapter 13.2.1, Paved Roads.
2. AP 42 (5th Edition), Compilation of Air Pollutant Emission Factors, Vol. 1 Stationary Point and Area Sources, Chapter 13.2.4, Aggregate Handling and Storage Piles, November 2006.
3. AP 42 (5th Edition), Compilation of Air Pollutant Emission Factors, Vol. 1 Stationary Point and Area Sources, Chapter 11.19.2, Crushed Stone Processing and Pulverised Mineral Processing, August 2004.

It is noted that some of the above documents apply to the mining industry. Particulate emission factors specifically applicable to waste handling (E.g. general waste, cardboard, shredding) are not available. As a conservative approach the US EPA documents have been referred to which provide emission rates for similar processing types (though different in terms of material processed).

Table 11 presents emission factors sourced from the US EPA AP42 literature. Assumptions In selecting or deriving emission factors are also presented in the last column of Table 11.

Table 11 - Particulate Emission Factors

Activity	Units	TSP	PM_{10}	$PM_{2.5}$	Reference	Comments
Materials Recovery Facility						
Material unloading	kg/Mg	0.00041	0.00019	0.00003	Ref 2, Eqn 1	Assumes 5% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Material handling	kg/Mg	0.00041	0.00019	0.00003	Ref 2, Eqn 1	Assumes 5% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Material transfer to process line	kg/Mg	0.00041	0.00019	0.00003	Ref 2, Eqn 1	Assumes 5% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Screening Binder Bivitec	kg/Mg	0.01250	0.00430	0.000025	Ref 3	Screening - uncontrolled
Fine-shredder Metso M&J 1550	kg/Mg	0.00270	0.00120	0.000400	Ref 3	Tertiary crushing - uncontrolled
Shredder Metso M&J 4000s	kg/Mg	0.00270	0.00120	0.00040	Ref 3	Tertiary crushing - uncontrolled
Cardboard Baling						
Material handling	kg/Mg	0.00018	0.00009	0.00001	Ref 2, Eqn 1	Assumes 9% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Food Depackaging Plant						
Material handling	kg/Mg	0.00391	0.00185	0.00028	Ref 2, Eqn 1	Assumes 1% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Garden Organics Primary Processing						
Material unloading	kg/Mg	0.00016	0.00007	0.00001	Ref 2, Eqn 1	Assumes 10% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Material handling	kg/Mg	0.00016	0.00007	0.00001	Ref 2, Eqn 1	Assumes 10% moisture content, 2.6 m/s wind based on measured wind speed at Mayfield (factored down to a height of 2. m)
Shredder Metso M&J 4000s	kg/Mg	0.00270	0.00120	0.00040	Ref 3	Tertiary crushing - uncontrolled
Haul Routes						
Haul route – Onsite Haul Truck	g/VKT	706	136	33	Ref 1 Eqn 1	Silt content of 7.4% as per Table 13.2.2-4 of Ref 3, and average (empty, full) truck weight of 33 tonnes. 7.4% silt content represents the silt content for solid waste.

6.3 Particulate Emission Rates

6.3.1 Overview

Emission rates have been derived for an average throughput operating day and an assumed worst-case operating day. The average throughput operating day is based on client supplied information for foretasted annual waste volumes, averaged over a 365-day year and 24-hour working day. The worst-case throughput day is assumed to be 1.5 times the average throughput operating day.

In order to predict g/s emission rates for use in the air dispersion modelling, it is necessary to multiply the emission factors presented in Table 11 by the relevant multiplying factors:

- kg/Mg emission factors to be multiplied by material throughputs (e.g. Mg/year); and
- g/VKT emission factors to be multiplied by amount of km vehicles travel over the haul route (e.g. km/hr).

The following sections present details of input data used to derive particulate emission rates from the emission factors.

6.3.2 Estimated Emissions

In order to derive maximum emission rates (g/s, for the maximum facility processing rate) for the proposed resource recovery facility operations, the following client information has been considered:

- A summary of calculated average and daily maximum throughputs is provided below (as supplied by client):

	Materials Recovery Facility	Cardboard Baling	Food-Depackaging Plant	Garden Organics Primary Processing	Units
Client Forecast					
Annual Throughput	31000	30000	2000	5000	tpa
Daily Throughput	84.9	82.2	5.5	13.7	T per day
Per Hour	3.5	3.4	0.2	0.6	T per hour
Worst-case Daily Assumed					
Per Day	127.4	123.3	8.2	20.6	T per day
Per Hour	5.3	5.1	0.3	0.9	T per hour

- Truck movement estimations (as supplied by client):

Road Source	Trucks Per Day		Trucks Per Hour	
	Client Forecast	Worst-Case	Client Forecast	Worst-Case
Semi-Trailer	10	15.0	0.4	0.6
Rigid Truck	164.0	246.0	6.8	10.3

Table *12* presents the emission rates derived for the resource recovery facility for a worst-case operating day.

Source IDs are also provided in Column 1 and have been used in the air dispersion modelling. Sources have been run in separate groups according to the source type. The results for each source group have then been added in CALSUM to provide total predicted particulate concentrations in the surrounding area. Some air emission sources have been combined as one source in the modelling based on their close proximity to each other.

Table 12 - Proposed Particulate Estimated Emission Rates (g/s) – Average Daily Throughput

Source ID	Activity	Factoring Value	Factoring Unit	Mitigation Reduction	Mitigation Modelled	TSP	PM_{10}	$PM_{2.5}$	Operating Time
Material Recovery Facility									
V1	Material unloading	5.3	tonnes/hr	0%	None	0.00061	0.00029	0.00004	24 Hours
V1	Material handling	5.3	tonnes/hr	0%	None	0.00061	0.00029	0.00004	24 Hours
V1	Material transfer to process line	5.3	tonnes/hr	0%	None	0.00061	0.00029	0.00004	24 Hours
V1	Screening Binder Bivitec	5.3	tonnes/hr	0%	None	0.00061	0.00029	0.00004	24 Hours
V1	Fine-shredder Metso M&J 1550	5.3	tonnes/hr	0%	None	0.0040	0.00177	0.00052	24 Hours
V1	Shredder Metso M&J 4000s	5.3	tonnes/hr	0%	None	0.0040	0.00177	0.00052	24 Hours
Cardboard Baling									
V2	Material handling	5.1	tonnes/hr	0%	None	0.00026	0.00012	0.00002	24 Hours
Food Depackaging plant									
V3	Material handling	0.3	tonnes/hr	0%	None	0.00037	0.00018	0.00003	24 Hours
Garden Organics Primary Processing									
V4	Material unloading	0.9	tonnes/hr	0%	None	0.00004	0.00002	0.000003	24 Hours
V4	Material handling	0.9	tonnes/hr	0%	None	0.00004	0.00002	0.000003	24 Hours
V4	Fine-shredder Metso M&J 1550	0.9	tonnes/hr	0%	None	0.00064	0.00029	0.000084	24 Hours
Haul Routes									
L1	Onsite Haul Truck – Rigid Truck	4.5	VKT/hour	0%	None	0.00201	0.00039	0.0000934	24 Hours
L2	Onsite Haul Truck – Semi Trailer	0.0913	VKT/hour	0%	None	0.00012	0.000024	0.0000057	24 Hours
L3	Onsite Haul Truck – Semi Trailer	0.069	VKT/hour	0%	None	0.00012	0.000024	0.0000057	24 Hours

6.4 Odour Emissions Rates

Odour emissions have been modelled for the food depackaging plant, drill mud recovery facility, garden organics primary processing and waste oil unloading. In the absence of suitable odour data for food waste, data from grease trap unloading into a storage tank has been adopted. It is noted that the grease trap unloading data presents a conservative approach for odour emissions from the food de-packaging plant (in the absence of more realistic data). An odour control unit is also proposed for the food de-packaging plant. To add further conservatism to the odour emissions, raw grease trap (uncontrolled) odour data has been considered.

Table 13 presents the adopted emissions rates for the modelled odour sources.

Table 13 - Odour Emissions

Source ID	Activity	OUV/s		Source
P1	Food De-packaging Plant	1000	OUV/s	Uncontrolled odour emissions from grease trap unloading into a storage tank, previously completed by Air Noise Environment at a liquid waste facility.
P2	Drill Mud Recovery Facility	517.38[a]	OUV/s	Based on the highest sample undertaken by Airlabs Environmental of a liquid collection recycling truck in September 2013[b]. This data represents the odour concentration of the raw liquid drill mud material that would be transferred to the holding tanks.
P3	Waste Oil Unloading	72[b]	OUV/s	Based on previous sampling undertaken by Air Noise Environment for liquid waste facilities in Brisbane and Sydney. These facilities also involved the treatment of industrial oily water or used oil.
A1	Garden Organics Primary Processing	0.134	$OU/m^2/s$	An odour emission rate of 0.134 $OU/m^2/s$ has been adopted based on sampling completed by PAE Holmes of Greenwaste areas at an existing landfill at Eastern Creek[5]. To derive a total odour emission rate (OUV/s), a waste area of 180 m^2, (roughly half the total floor area of the Garden Organic Primary Processing area) has been considered

[a] Emission rates based on estimated venting flow rate of 5 m/s and diameter of 0.5 m.

[b] Emission rates based on estimated venting flow rate of 0.01 m3/s. This is based on the fact that 12 m^3 of liquid would be unloaded over a period of 20 minutes, and that the amount of air forced out of the tank is equivalent to the volume of liquid unloaded.

[c] Stephenson Environmental Management Australia, Modification to DA for Gross Pollution Trap & Stormwater Waste Recycling Depot – 5-6 Sleigh Place Wetherill Park NSW. Statement of Environmental Effects. 27 April 2018.

6.4.1 VOC Emissions

VOC emissions are associated with the proposed waste oil unloading activity (source P3). VOC emissions for waste oil unloading have been based on previous sampling undertaken by Air Noise Environment for liquid waste facilities in Brisbane and Sydney, involving the treatment of industrial oily water or used oil.

5 Holmes Air Sciences (2003) "Odour Audit: Eastern Creek Stage 2", Prepared by Holmes Air Sciences for National Environmental Consulting Services on behalf of Waste Service NSW, December 2003.

Table 14 presents the VOC emissions data considered in the modelling. The emission rates are associated during unloading activity, when emissions are at a maximum.

Table 14 - Modelled VOC Emission Data (Waste Oil Venting)

Pollutant	Measured Concentration	Modelled Emission Rate
Benzene	46.3 mg/Nm^3	0.000463 g/s
Toluene	335.8 mg/Nm^3	0.003358 g/s
Ethylbenzene	20.8 mg/Nm^3	0.000208 g/s
Xylene	100.4 mg/Nm^3	0.001004 g/s
Cumene	3.6 mg/Nm^3	0.000036 g/s
Trimethylbenzene	15.8 mg/Nm^3	0.000158 g/s

6.5 Sulfur Emissions

Sulfur-related emissions (sulfur dioxide) from the truck routes and onsite machinery have been considered in the assessment. Emissions rates have been sourced from the NPI Emission estimation technique manual for Combustion Engines[6]. Emissions rates have been calculated based on:

- Distance – 0.439 km
- Operating hours – 8760 hours/year
- Speed – 10 km/hour
- Fuel efficiency – 0.6 L/km
- 174 vehicle movements per day
- Continuous operations of heavy machinery assumed at 100% loading factor.

Power ratings for the onside machinery have been calculated based on the power ratings specific to each piece of equipment.

Table 15 presents the sulfur emissions data considered in the modelling. It is noted that the NPI manual does not specify fluoride emissions for diesel industrial vehicles or heavy vehicles as the fluoride content of diesel is unknown, and there are no readily available emission factors from other literature. It is expected that fluoride emissions from the diesel equipment would be negligible and therefore, have not been modelled.

Table 15 – Modelled sulfur emissions

Source ID	Description	SO_2 Emissions Factor		SO_2 Emissions Rate	
		(kg/kWh)	(kg/m^3)	(g/s)	(g/s/m)
L1	Heavy vehicles	-	0.017	-	0.00002
P4	Liebherr L514	0.0000075	-	0.00016	-

[6] NPI Estimation emission technique manual for Combustion engines. Version 3.0, June 2008.0.00021

Source ID	Description	SO_2 Emissions Factor		SO_2 Emissions Rate	
		(kg/kWh)	(kg/m³)	(g/s)	(g/s/m)
P5	Caterpillar IT38G	0.0000075	-	0.00028	-
P6	Liebherr LH22	0.000008	-	0.00023	-
P7	Caterpillar 319D	0.000008	-	0.00021	-
P8	Linde H25D	0.000008	-	0.00007	-
P9	Nissan FD25T	0.000008	-	0.00007	-

6.6 Modelled Source Locations

Figure 21 to Figure 24 present the modelled source locations for the proposed resource recovery facility and truck parking depot. Source IDs are described in Table 12 and 13.

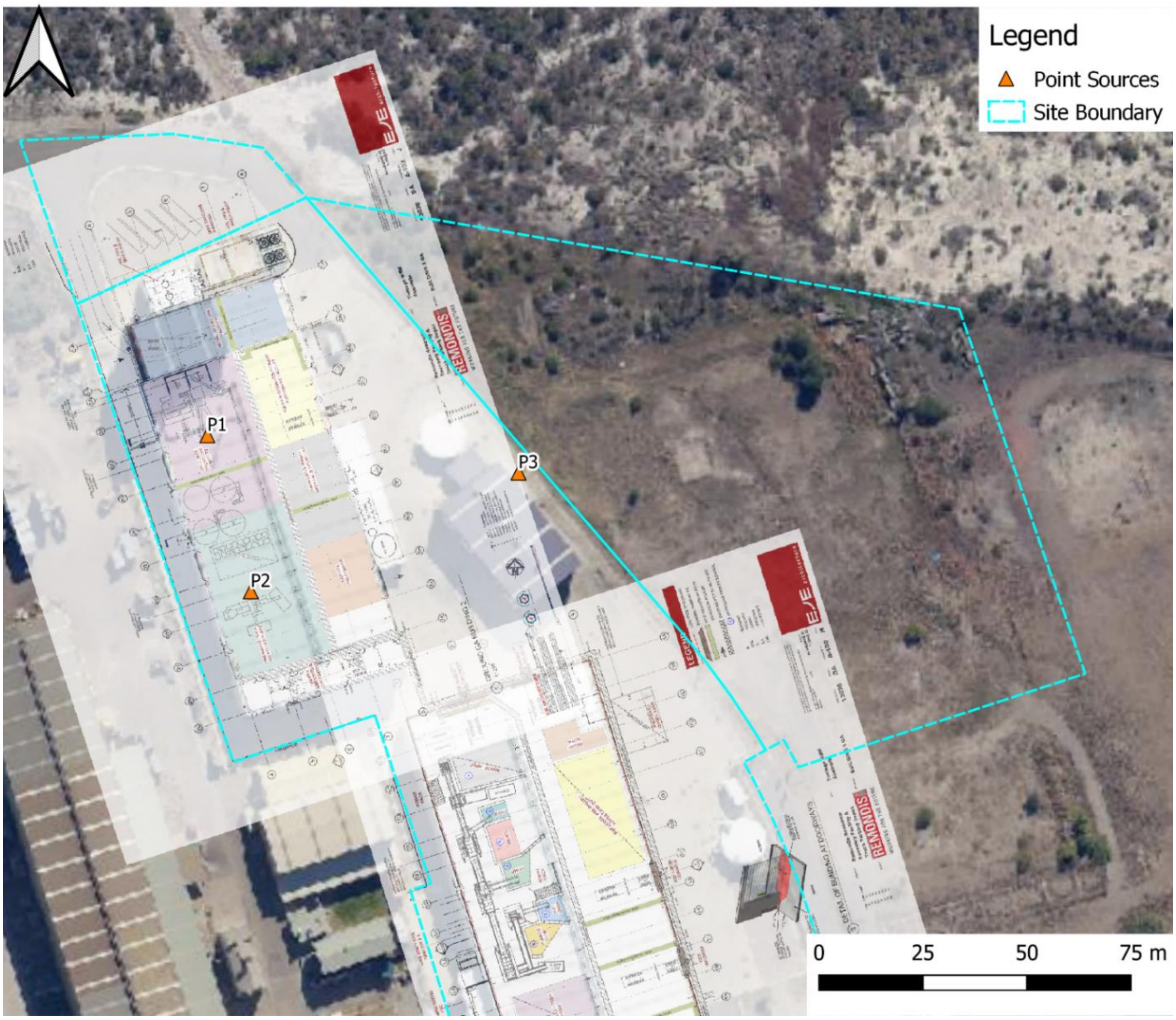


Figure 21 - Modelled Point Sources

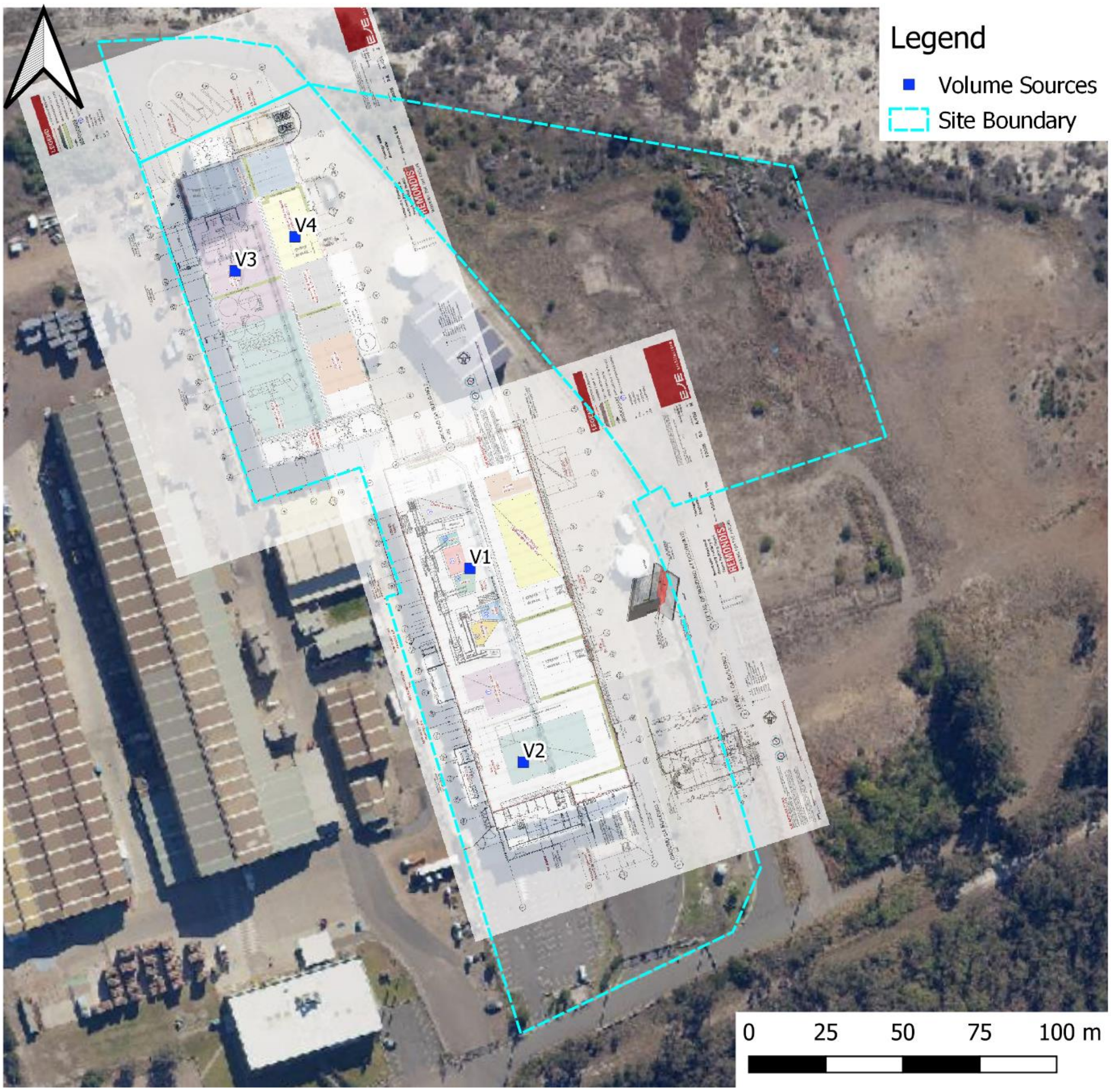


Figure 22 - Modelled Volume Sources

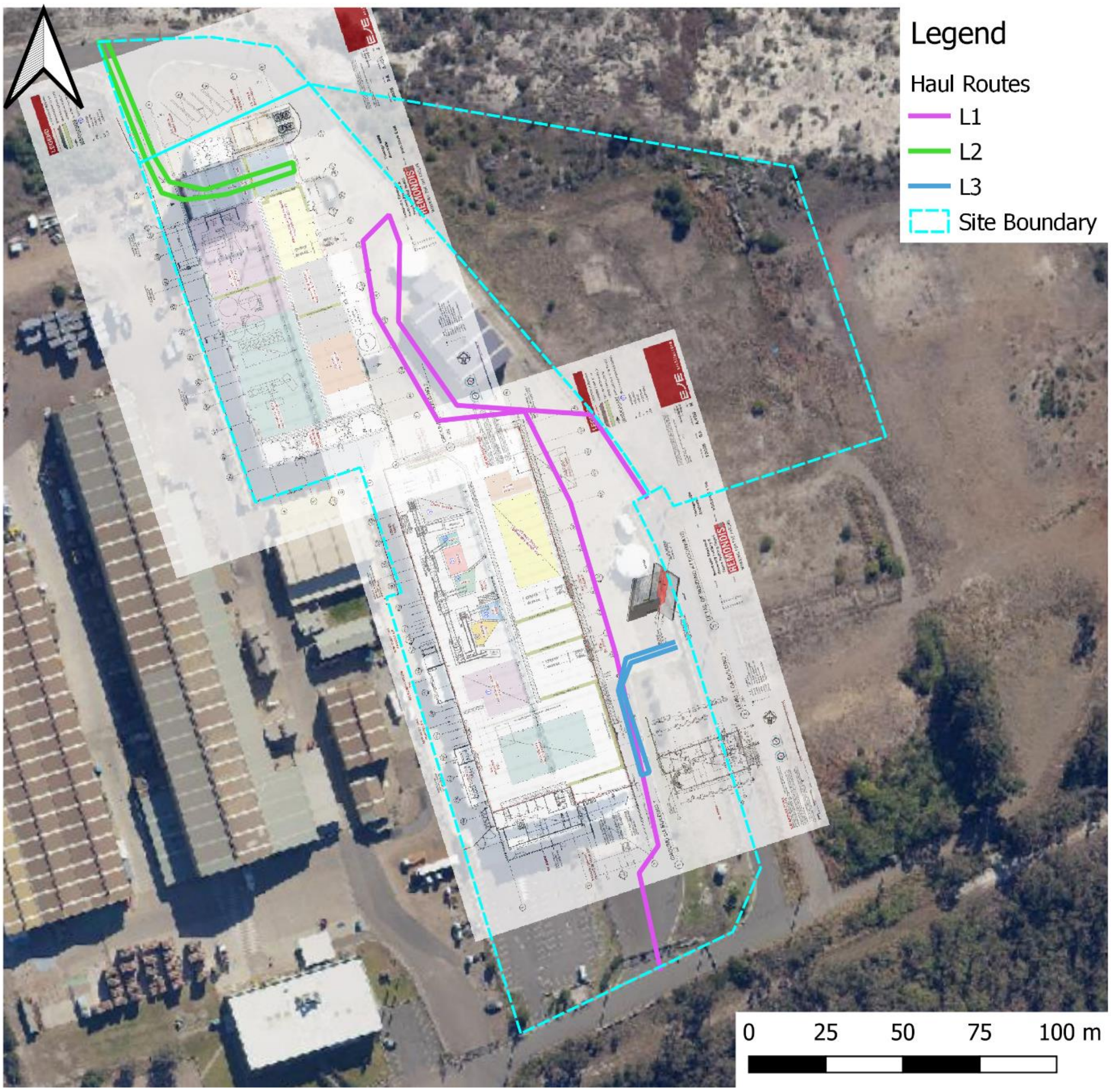


Figure 23 - Modelled Road Sources

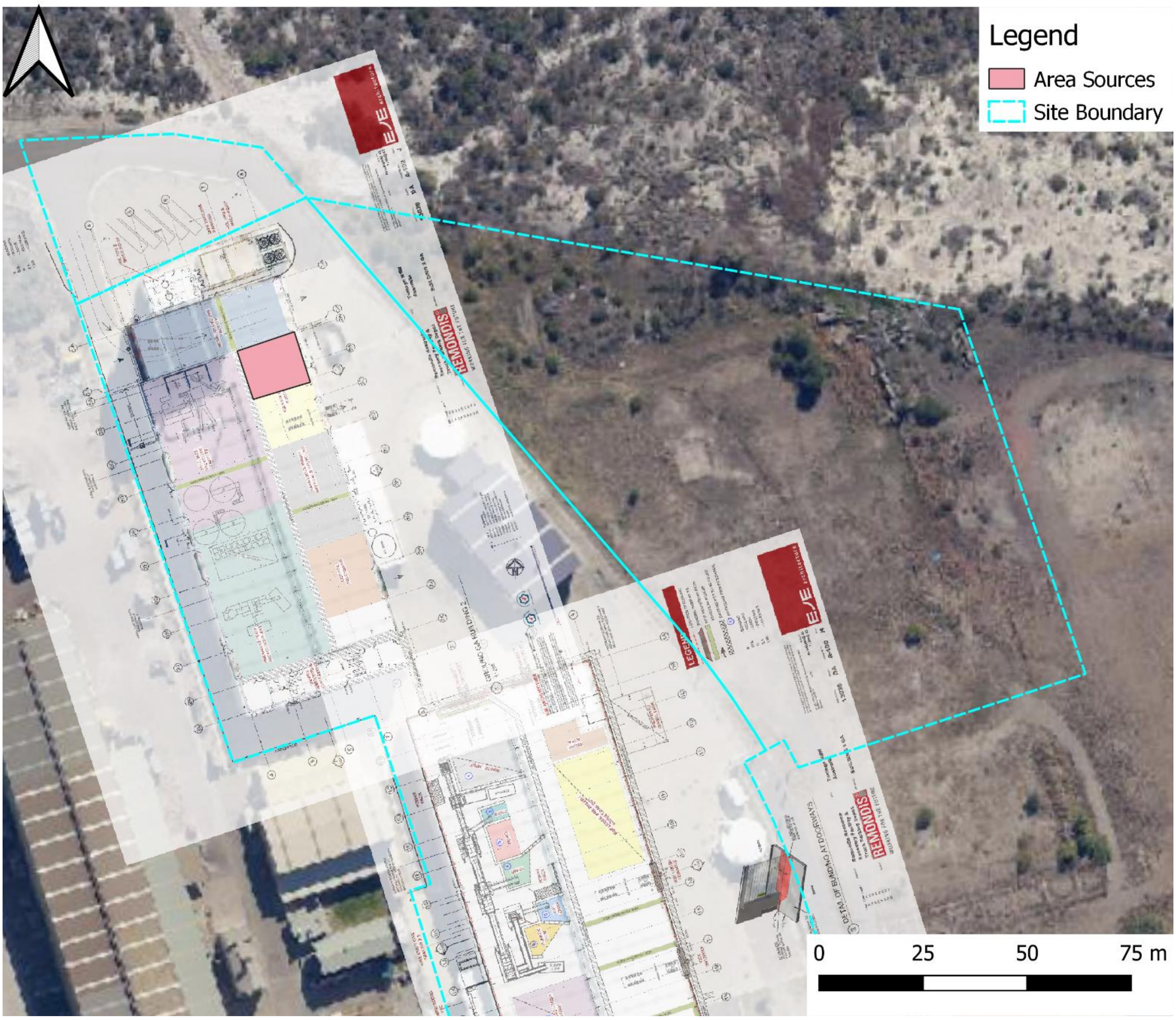


Figure 24 - Modelled Area Sources

7 Air Dispersion Modelling

7.1 Overview

The following sections present details of the CALPUFF air dispersion modelling.

7.2 Meteorological Data

Meteorological data has been derived using CALMET. Full details of the inputs and verification outcomes of the CALMET modelling are provided in Section 5.3.

7.3 Emissions Data

The modelling scenarios and air emissions data used in CALPUFF are provided in the previous Section 6.

7.4 Source Parameters

CALPUFF has been used to model to emission sources for the proposed resource recovery facility and truck parking depot. Volume, area and road sources have been adopted in CALPUFF to represent the range of air emission sources. Area sources have been used for all surface areas. Line sources have been used for all haul routes. Point sources have been used for vented odour and VOC emissions. All other emission sources have been modelled as volume sources. Source Locations are presented in Section 6.5. Table 16 to Table 19 present the modelled source parameters.

Table 16 - Point Source Parameters

Source ID	Elevation (m)	Height (m)	Exit Velocity (m/s)	Diameter (m)	Temperature (°K)
P1	8.11	12.5	5	0.3	Ambient
P2	7.98	12.5	5	0.5	Ambient
P3	7.65	2	2	0.08	Ambient
P4	8.11	2.8	0.1	0.1	531
P5	8.09	3.2	0.1	0.1	
P6	7.95	2.6	0.1	0.1	
P7	7.65	2.6	0.1	0.1	
P8	7.50	2.2	0.1	0.1	
P9	7.34	2.2	0.1	0.1	

Table 17 - Volume Source Parameters

Source ID	Elevation (m)	Height (m)	Initial Sigma Y (m)	Initial Sigma Z (m)
V1	7.52	6.5	1	1
V2	7.26	6.5	1	1
V3	8.11	6.25	1	1

Source ID	Elevation (m)	Height (m)	Initial Sigma Y (m)	Initial Sigma Z (m)
V4	8.01	6.25	1	1

Table 18 - Area Source Parameters

Source ID	Elevation (m)	Height (m)	Initial Sigma Z (m)	Area (m^2)
A1	8.02	2	1	180

Table 19 - Line Source Parameters

Source ID	Height (m)	Initial Sigma Y (m)	Initial Sigma Z (m)	Total Line Length (m)
L1	1	1.7	4.2	439.2
L2	1	1.7	4.2	146.1
L3	1	1.7	4.2	111.0

7.5 Discrete Receptors

Figure 25 presents the modelled existing sensitive use receptors. A total of 5 discrete receptors have been modelled at ground level to represent the nearest sensitive receptors. Additionally, receptors have been modelled around the proposed development boundary for the comparison of VOC concentrations to the air quality criteria. Figure 26 presents the modelled boundary receptors.

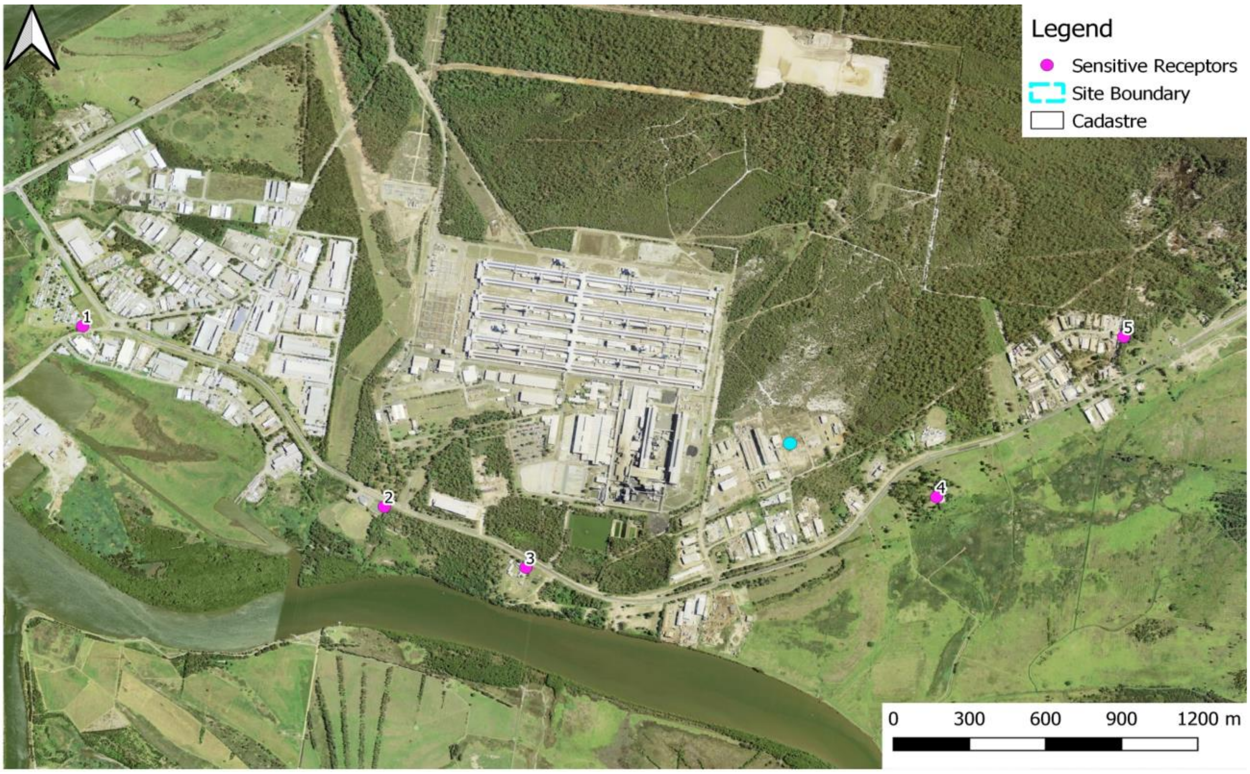


Figure 25 - Modelled Discrete Receptors

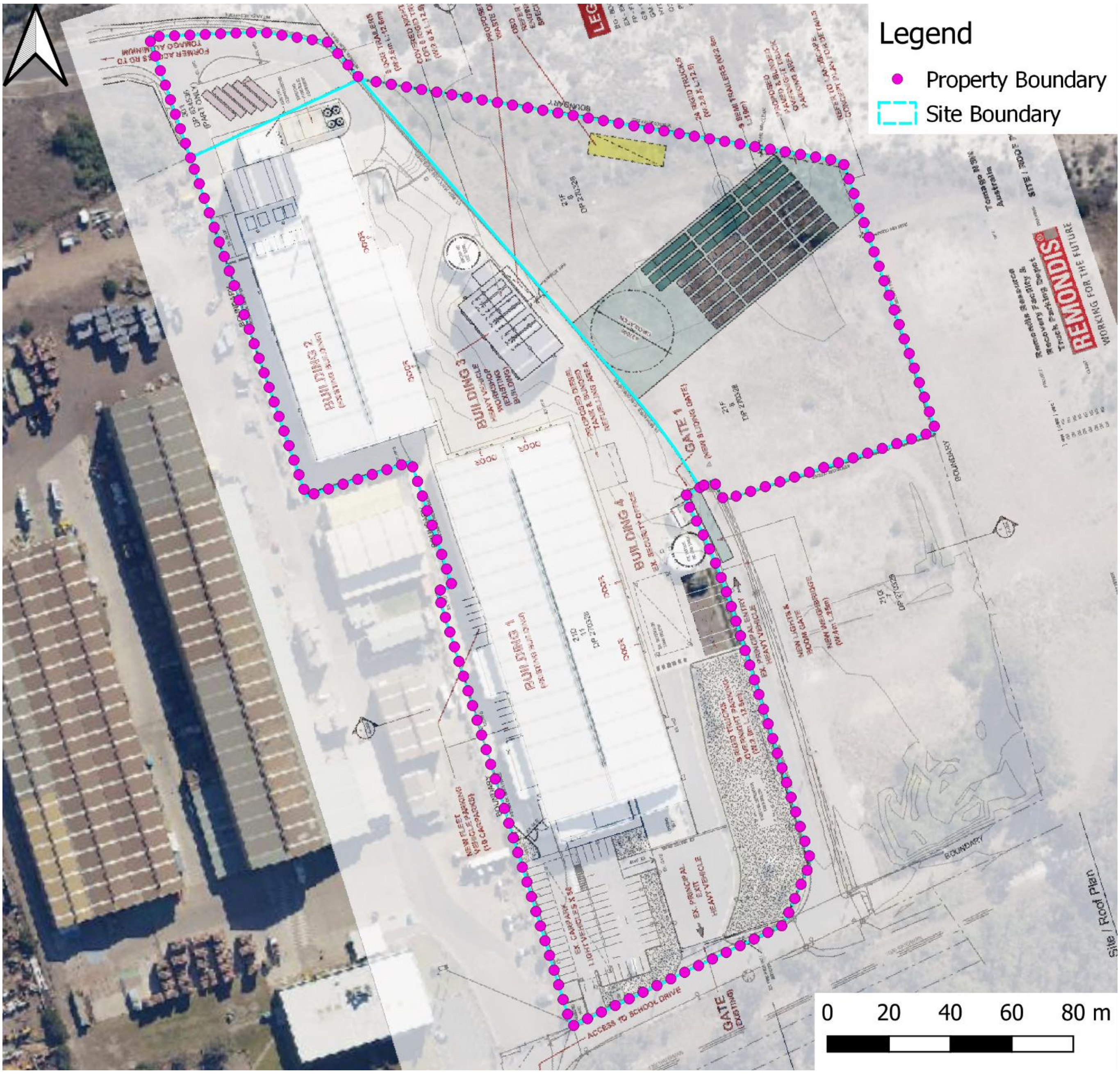


Figure 26- Modelled Discrete Boundary Receptors

7.6 Downwash Structures

Based on a review of the modelled vent height and surrounding area, 5 buildings have been considered as downwash structures. Buildings which are greater than the stack height divided by a factor of 2.5, and within a radius of 5 times the lesser of the building height or projected building width have been considered. Figure 27 presents the downwash structures considered in this assessment.

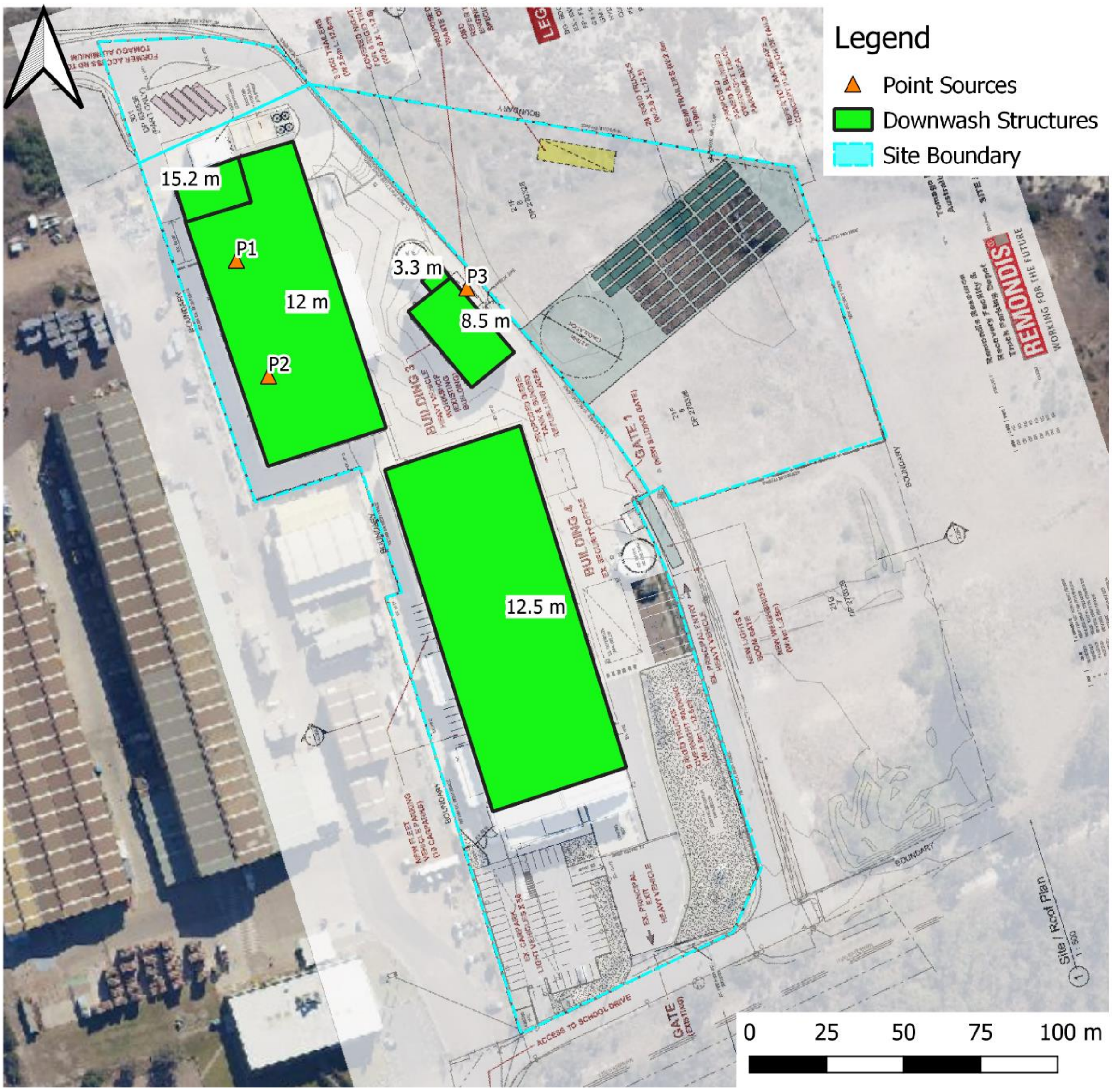


Figure 27 - Modelled Downwash Structures

8 Predicted Results

Table 20 presents the predicted results for the worst-case throughput operating day for each of the 5 sensitive receptors. Ground level concentration plots are presented in Appendix C (plots are shown for pollutants which are predicted to exceed the criteria).

Predicted odour concentrations at the sensitive receptors are noted to be well below the adopted 2 OU criteria. It therefore noted that there are unlikely to be cumulative impacts as a result of the proposed development. It is noted that the neighbouring properties are not considered to be sensitive uses given they are occupied by industrial uses. Nonetheless, the predicted odour concentrations at the property boundary are noted to be a maximum of 5.2 OU, below the maximum criteria of 7 OU adopted for residential receptors within the NSW. It is noted that cumulative predictions exceed the annual average criteria for both PM_{10} and $PM_{2.5}$. This exceedance is due to the annual background concentrations of annual PM_{10} and $PM_{2.5}$ being above the criteria. The predicted cumulative 24-hour average of PM_{10} and $PM_{2.5}$ are noted to also exceed the air criteria. Where exceedances are already occurring, the NSW Approved Modelling Methods guideline requires that no additional exceedances are occurring as a result of a new development and that a demonstration of best practice measures is implemented as far as practicable.

A contemporaneous assessment has been completed for $PM_{2.5}$ and PM_{10} to determine whether the number of exceedances would increase as a result of the predicted concentrations from the proposed development. The predicted 24-hour average time series has been extracted from CALPUFF to determine whether the number of 24-hour exceedances would increase at the modelled sensitive receptors with the proposed development in operations. Table 21 presents the count of predicted exceedances for the Mayfield station alone and the cumulative predicted exceedances (background plus development) for each sensitive receptor. It is noted that no additional exceedances of the 24-hour average criteria are predicted at the modelled sensitive receptors as a result of the proposed development.

A discussion of the best practice measures adopted for the proposed development is presented in Section 9. It is also noted that conservative modelling assumptions have been adopted, such as emissions factors not accounting for activities occurring within buildings and emissions factors being used for material handling and processing from the mining industry. It is therefore noted pollutant concentrations from the development are likely to be lower in practice.

With regards to the TAC buffer area, the predicted sulfur dioxide concentrations are less than 1% of the relevant ambient air quality criteria (i.e. 0.1-0.3% of the criteria). On this basis, it is concluded that the potential impacts of the proposed operations onto the TAC buffer area are expected to be negligible. As discussed earlier, it is noted that fluoride emissions are not expected as part of the site operations.

Overall, the contribution of the proposed development to the local and regional air quality environment is expected to be low based on the findings of the air dispersion modelling.

Table 20: Predicted Air Modelling Results

Receptor	Predicted Ground Level Concentrations at Discrete Receptors ($\mu g/m^3$)														
	SO_2	SO_2	SO_2	TSP	PM_{10}	PM_{10}	$PM_{2.5}$	$PM_{2.5}$	Toluene	Xylene	Benzene	Cumene	Ethylbenzene	Trimethylbenzene	Odour
	1 Hour	24-hour	Annual	Annual	24-hour	Annual	24-hour	Annual	1 Hour	1 Hour	Annual	1 Hour	1 Hour	1 Hour	1-hour, 99^{th}%ile
Source Only															
R1	0.3	0.1	0.01	0.8	1.6	0.1	0.4	0.04	0.08	0.03	0.01	0.00	0.01	0.00	0.1
R2	0.6	0.2	0.02	1.9	2.9	0.3	0.7	0.1	0.22	0.07	0.03	0.00	0.01	0.01	0.1
R3	0.7	0.2	0.03	2.8	4.2	0.5	1.0	0.1	0.32	0.09	0.04	0.00	0.02	0.01	0.1
R4	1.7	0.6	0.08	8.2	10.8	1.5	2.6	0.4	0.56	0.17	0.08	0.01	0.03	0.03	0.2
R5	0.8	0.2	0.02	2.0	4.0	0.4	1.0	0.1	0.29	0.09	0.04	0.00	0.02	0.01	0.1
Boundary Receptors									10.9	3.27	1.51	0.12	0.68	0.51	5.2
Cumulative (Background + Source Only)															
Adopted Background						27.3		9.0							-
R1						27.4		9.0							-
R2						27.6		9.1							-
R3						27.8		9.1							-
R4						28.8		9.4							-
R5						27.7		9.1							-
Boundary Receptors															
Criteria	**570**	**228**	**60**	**90**	**50**	**25**	**25**	**8**	**360**	**190**	**29**	**21**	**8000**	**2200**	**2**

Table 21 - Predicted PM_{10} and $PM_{2.5}$ Cumulative Exceedances

Location	24-hour PM_{10} exceedances	24-hour $PM_{2.5}$ exceedances
Mayfield (Measured)	37	6
R1	37	6
R2	37	6
R3	37	6
R4	37	6
R5	37	6
Outcome	**No additional exceedances are predicted**	

9 Best Practice Measures

The air dispersion modelling shows compliance with the air quality goals using conservative modelling inputs. Although compliance is predicted for the proposed development, best practice measures are considered necessary to minimise particulate emissions in the area (for which background exceedances are already occurring).

In relation to particulate emissions, a best practice approach is proposed, whereby all processing operations will occur within enclosed warehouse buildings. These building structures will assist in containing emissions and wind-blown particulate emissions are expected to be negligible. Additionally, all haul routes are proposed to be paved, reducing particulate emissions further. Haul routes should be regularly cleaned (e.g. street sweeper) to minimise the silt loading content, which has impacts on the total particulate emissions from paved surfaces.

In relation to odour, despite the predicted odour concentrations being well below the odour criteria at the sensitive receptors and property boundary, an odour control system (such as activated carbon) is proposed to reduce emissions from the Food Depackaging Plant. An example of the effectiveness of an activated carbon filter is presented in a report prepared by Air Noise Environment for a grease trap facility in Sydney[7] (and currently published online at the NSW Planning Portal website[8]). This study demonstrated a 97% reduction in odour emission rates. An example of a proprietary product (Bioaction FiltaMod carbon scrubbers) is provided in Appendix E. Design details such as fan flow rate and carbon filter sizing would be determined during the detailed design stage.

This will minimise impacts to the nearby sensitive receptors during normal operations and should upset conditions occur. It is also recommended that day-to-day management measures are adopted, such as:

- implementation of a waste acceptance evaluation procedure to ensure all waste received on site meets the relevant criteria;
- use of odour neutralisers;
- availability of spill kits to allow for prompt containment of spills which could be odorous;
- daily odour survey observations around the boundary of the site;
- work procedures in the event of any particularly odorous loads (e.g. use of odour neutraliser, identifying waste source and investigating possibility of diverting to another waste facility);

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[7] Air Noise Environment, Air and Noise Assessment – Increased Throughput, Liquid Waste Facility, Glendenning, 8 April 2019, Ref: 4022.4-Stage1-report02.pdf.

[8] NSW Government, Glendenning Liquid Waste Facility, Modification 1 Amend Limits of Consent to Increased Used Oil/Industrial Oily Water Throughput, https://www.planningportal.nsw.gov.au/major-projects/project/13721, 2019.

- additional odour control system medium on-site at all times (e.g. additional activated carbon to be stored on site).

10 Conclusion

An air quality assessment using air dispersion modelling has been undertaken for the proposed resource recovery facility and truck parking depot at Tomago. To assess the potential for air quality impacts, computational air dispersion modelling has been undertaken to predict particulate (TSP, PM_{10} and $PM_{2.5}$), VOC and odour concentrations at the nearest sensitive receptors. The conclusions of the assessment are summarised below:

- The nearest sensitive receptors are located to the south west and south east of the proposed development site. The nearest sensitive receptor is located at Tomago House, located approximately 500 metres to the south east of the site boundary.
- The main air emission sources for the site include haul routes, the Material Recovery Facility, Cardboard Baling Facility, Drill Mud Recycling Facility, Packaged Food Recycling Plant, Garden Organics Primary Processing Plant and waste oil unloading. Key air quality indicators for these sources include particulates and odour.
- The results of the modelling indicate full compliance for VOC and odour at the property boundary and nearby sensitive receptors by a significant margin. For particulates matter (PM_{10} and $PM_{2.5}$), background levels are already exceeding the air quality goals. Based on the modelling, no additional exceedances are predicted as a result of emissions from the proposed development.
- To minimise potential dust and odour emissions from the site, measures are proposed including buildings to enclose all material handling, shredding and sorting activities, paved truck routes and an odour control system on the Food De-packaging Plant.

Overall, the site represents a suitable location for the proposed resource recovery facility from an air quality perspective. Due to existing high background particulate concentrations in the region, it is proposed that best practice measures are adopted by the facility. The potential for particulate and odour impacts can be effectively managed by adopting these best practice measures to achieve an appropriate air quality outcome.

Appendix A - Air Quality Glossary

APPENDIX A: GLOSSARY OF AIR QUALITY TERMINOLOGY	
Conversion of ppm to mg/m^3	Where R is the ideal gas constant; T, the temperature in Kelvin (273.16 + T°C); and P, the pressure in mm Hg, the conversion is as follows: mg m^{-3} = (P/RT) x Molecular weight x (concentration in ppm) $= \frac{P \times \text{Molecular weight} \times (\text{concentration in ppm})}{62.4 \times (273.2 + T°C)}$
g/s	Grams per second
mg/m^3	Milligrams (10^{-3}) per cubic metre.
µg/m^3	Micrograms (10^{-6}) per cubic metre.
ppb	Parts per billion.
ppm	Parts per million.
PM_{10}, $PM_{2.5}$, PM_1	Fine particulate matter with an equivalent aerodynamic diameter of less than 10, 2.5 or 1 micrometres respectively. Fine particulates are predominantly sourced from combustion processes. Vehicle emissions are a key source in urban environments.
50th percentile	The value exceeded for 50 % of the time.
NO_x	Oxides of nitrogen – a suite of gaseous contaminants that are emitted from road vehicles and other sources. Some of the compounds can react in the atmosphere and, in the presence of other contaminants, convert to different compounds (e.g., NO to NO_2).
VOC	Volatile Organic Compounds. These compounds can be both toxic and odorous.

Appendix B – Site Survey

Table B22 - Existing Industrial Uses within 500 m of site boundary

No.	Company	Address	Type of Use	Potential Air Emissions	Distance to Subject Site
1	Setco Australia	10 McIntyre Drive	Manufacturing of underground mining vehicles. NSW DII recognised service workshop, mechanical workshop and fabrication workshop	Minimal particulate emissions. Potential VOC and odour emissions if spray booth is used to paint vehicles.	159 m to boundary
2	Varley Group	21 School Drive	Manufacturing of service, health and education vehicles, defence vehicles and arms storage facilities. Includes metal fabrication, precision machining, routing, cutting and folding, fusion welding, vehicle building, fibreglass panelling, spray painting, panel beating. Appears that manufacturing does occur specifically at the Tomago site.	Minimal particulate emissions. Potential VOC and odour emissions if spray booth is used to paint vehicles.	Adjoining western boundary
3	Redicrete	21B School Drive	Concrete batching plant	Particulate emissions	56 m to boundary, 130 m to batching plant
4	Hydromet	25 School Drive	Recycling and recovery of metal contaminants from industrial residues to manufacture of metal chemicals**.** Industrial smelter and waste recovery, recycling facility using hydrometallurgical technology. Chemical production waste generation, chemical storage waste generation, container reconditioning and non-thermal treatment of hazardous and other waste	Copper & compounds, Selenium & compounds, sulfuric acid and VOC	40 m to boundary, 160 to nearest buildings
5	Compass Pools	15 School Drive	Manufacturing pools. Includes fibre glassing and gel coating.	Styrene, MMA, Odour. Appears to be four stacks on the main building.	144 m to boundary 204 m to building with stacks
6	Tyreright	17 School Drive	Tyre maintenance and repair centre.	Negligible emissions.	235 m to boundary
7	Unidentified	33 School Drive	Potential wrecker based on aerial photography.	Negligible emissions.	164 m to boundary
8	Electricity Substation	39 School Drive	Electricity substation	None/minimal	188 m to boundary
9	Custom Chemicals	49 School Drive	Chemical storage. Unclear if includes manufacturing	Potential odour.	420 m to boundary
10	Strang	15A School Drive	Shipping warehouse	Negligible.	215 m to boundary

No.	Company	Address	Type of Use	Potential Air Emissions	Distance to Subject Site
11	Borger Cranes Hire & Rigging Service	13b School Drive	Crane hire and rigging equipment supply	None/minimal	278 m to boundary
12	SMB Engineering	13b School Drive	Potential engineering workshop	Negligible.	320 m to boundary
13	Wheeler Cranes	6 McIntyre Road	Crane hire	None/minimal	155 m to boundary
14	Tomago Aluminium	638 Tomago Road	Aluminium smelter produces 580,000 tonnes of aluminium per year. Occurs 24/7. Aluminium production, metal waste generation, non-thermal treatment of hazardous and other waste, waste storage	Arsenic & compounds, Beryllium & compounds, Cadmium & compounds, Carbon monoxide, Chromium (III) compounds, Chromium (IV) compounds, Copper & compounds, Fluoride compounds, Hydrochloric acid, Lead & compounds, Manganese & compounds, Mercury & compounds, Nickel & compounds, Oxides of nitrogen, PM10, PM2.5, Polychlorinated dioxins and furans, Polycyclic aromatic hydrocarbons, Sulfur dioxide, VOCs, Zinc and compounds	249 m to boundary 280 m to nearest building

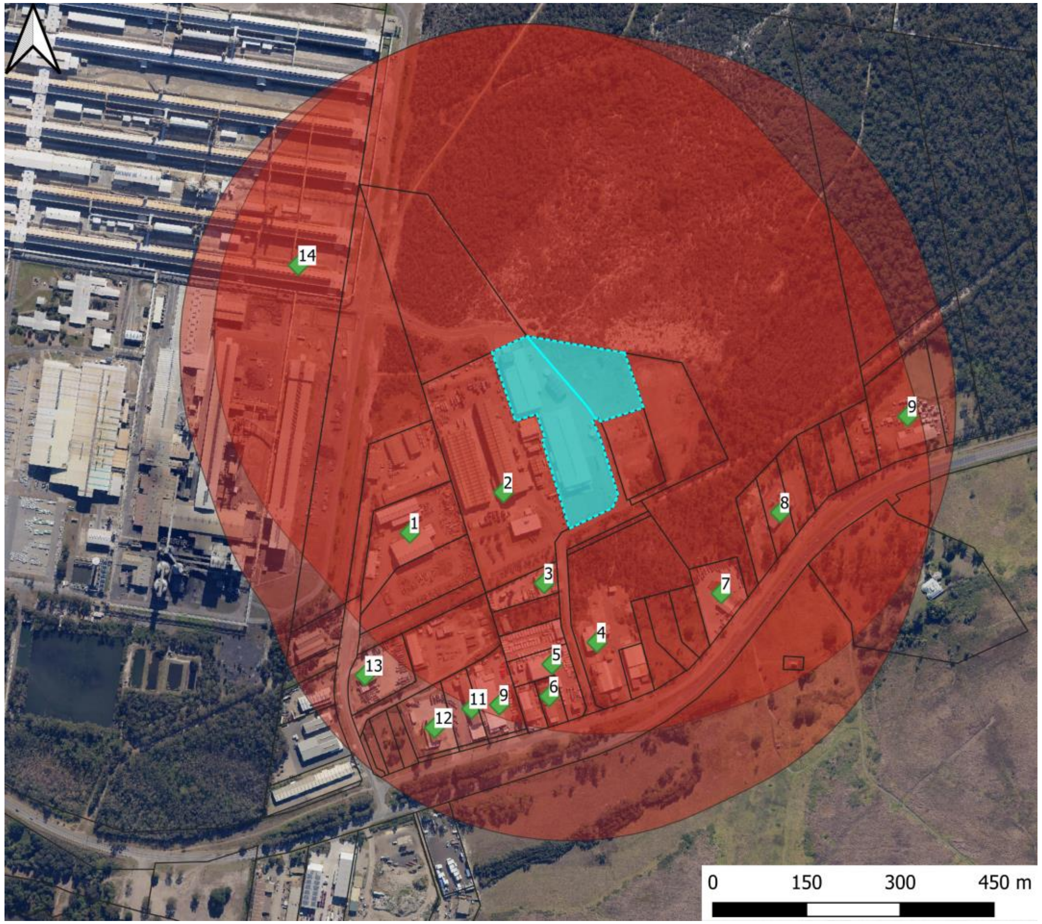

Figure B28 - Site Survey

Table B23 - Proposed and Approved industrial Development Applications (DA) and Major Projects (MP) in Tomago

No.	DA/MP	Approval Date	Address	Proposed Use	Potential Air Emissions	Distance to Subject Site
1	DA	30/4/2015	3 Enterprise Drive	Transport Depot	Dust	1.2 km
2	DA	14/11/14	17 Enterprise Drive	Vehicle Repair Station and Transport Depot	Dust	970 m
3	DA	25/6/20	606 Tomago Road	Aluminium extrusion	Fluoride, SO_2	1.1 km
4	DA	21/11/19	14 Kennington Drive	Transport Depot and truck wash facility	Dust	2.2 km
5	DA	18/6/20	13A Old Punt Road	Galvanising Plant	Dust, zinc, ammonia, NO, CO, Odour	1.6 km
6	MP	22/8/19	638 Tomago Road	SPL Potlining Facility (as part of Tomago Aluminium facility)	VOC, Fluoride, SO_2, PAH, NO, Particulates, Cadmium, Cyanide, Dioxins & Furans	1.2 km
7	MP	Under assessment	1940 Pacific Highway	Gas Fired Power Station	NO, CO, SO_2, Particulates, Acrolein, Benzene, Formaldehyde and PAH	2.1 km

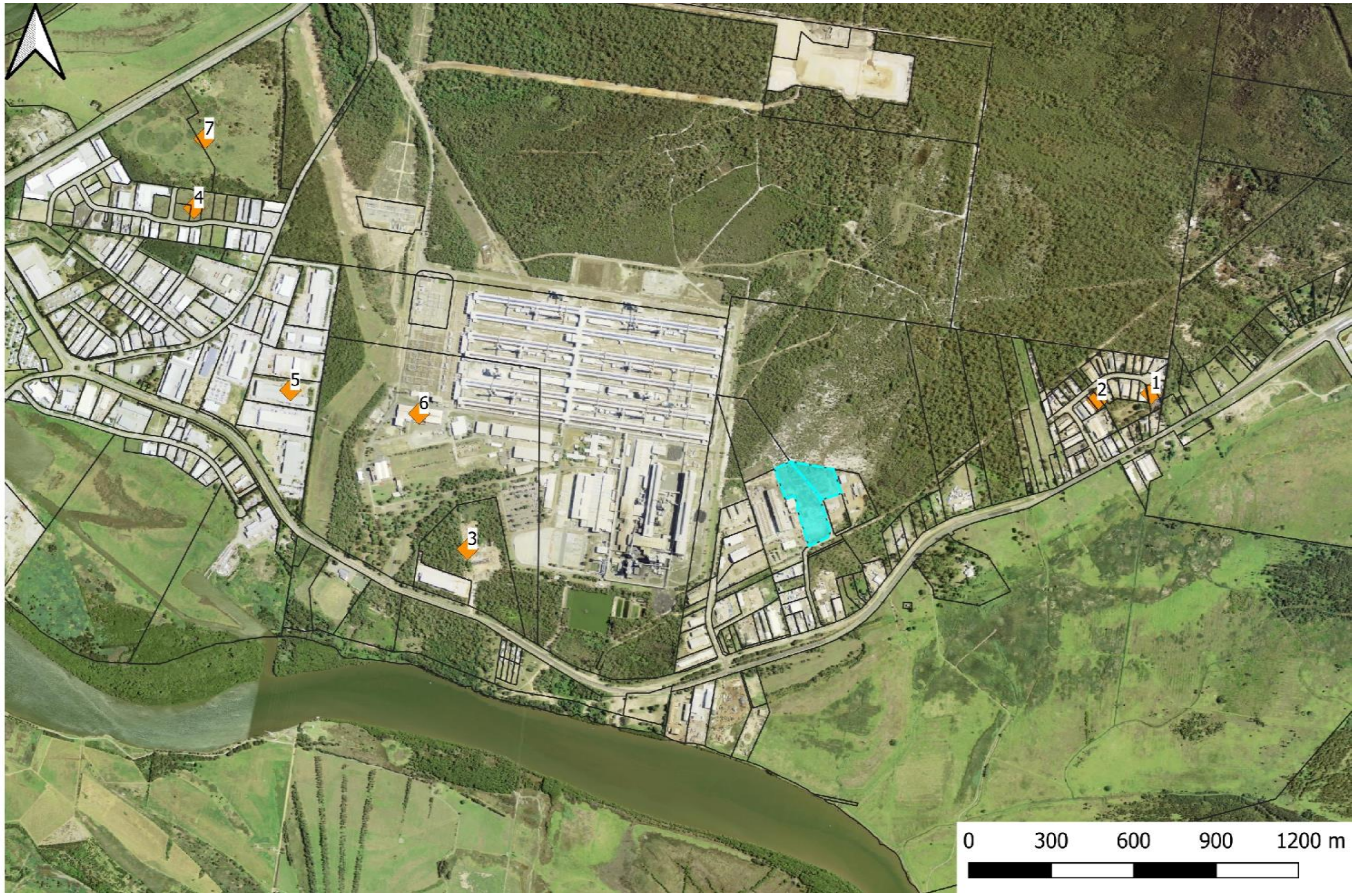

Figure B29 - Proposed Developments in Tomago

Table B24 - Existing NPI industry in Tomago

No.	Company	Address	Type of Use	Potential Air Emissions	Distance to Subject Site
1	Hydromet	25 School Drive	Recycling and recovery of metal contaminants from industrial residues to manufacture of metal chemicals. Industrial smelter and waste recovery, recycling facility using hydrometallurgical technology.	Copper & compounds, Selenium & compounds, sulfuric acid and VOC	40 m to boundary, 160 to nearest buildings
2	Tomago Aluminium	638 Tomago Road	Aluminium smelter produces 580,000 tonnes of aluminium per year. Occurs 24/7. Aluminium production, metal waste generation, non-thermal treatment of hazardous and other waste, waste storage	Arsenic & compounds, Beryllium & compounds, Cadmium & compounds, Carbon monoxide, Chromium (III) compounds, Chromium (IV) compounds, Copper & compounds, Fluoride compounds, Hydrochloric acid, Lead & compounds, Manganese & compounds, Mercury & compounds, Nickel & compounds, Oxides of nitrogen, PM10, PM2.5, Polychlorinated dioxins and furans, Polycyclic aromatic hydrocarbons, Sulfur dioxide, VOCs, Zinc and compounds	249 m to boundary 280 m to nearest building
3	Omega Chemicals	Lot 109 Enterprise Drive	Manufacture of liquid aluminium sulfate and liquid ferric sulfate	Sulfuric Acid	820 m
4	Hunter Galvanising Tomago	13 Old Punt Road	Hot dip galvanising Plant	CO, Hydrochloric acid, Lead, NO, Particulates, PAH, SO2, VOC, Zinc	1.8 km
5	Newcastle Gas Storage Facility	5 Old Punt Road	LNG Storage Facility	Arsenic, Beryllium, Cadmium, CO, Chromium, Copper, Lead, Mercury, Nickel, NO, Particulates, TEQ, PAH, SO2 and VOC	1.4 km

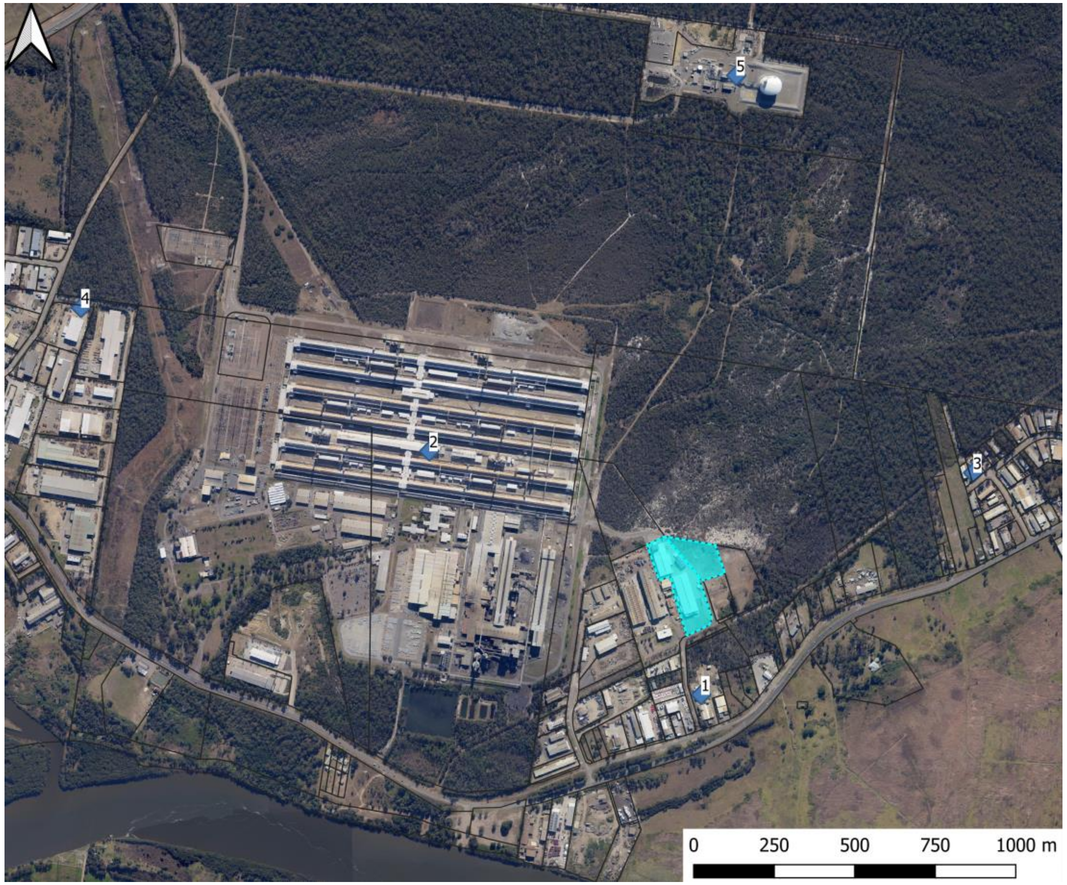

Figure B30 - Tomago NPI Listed sites

Appendix C – Concentration Plots

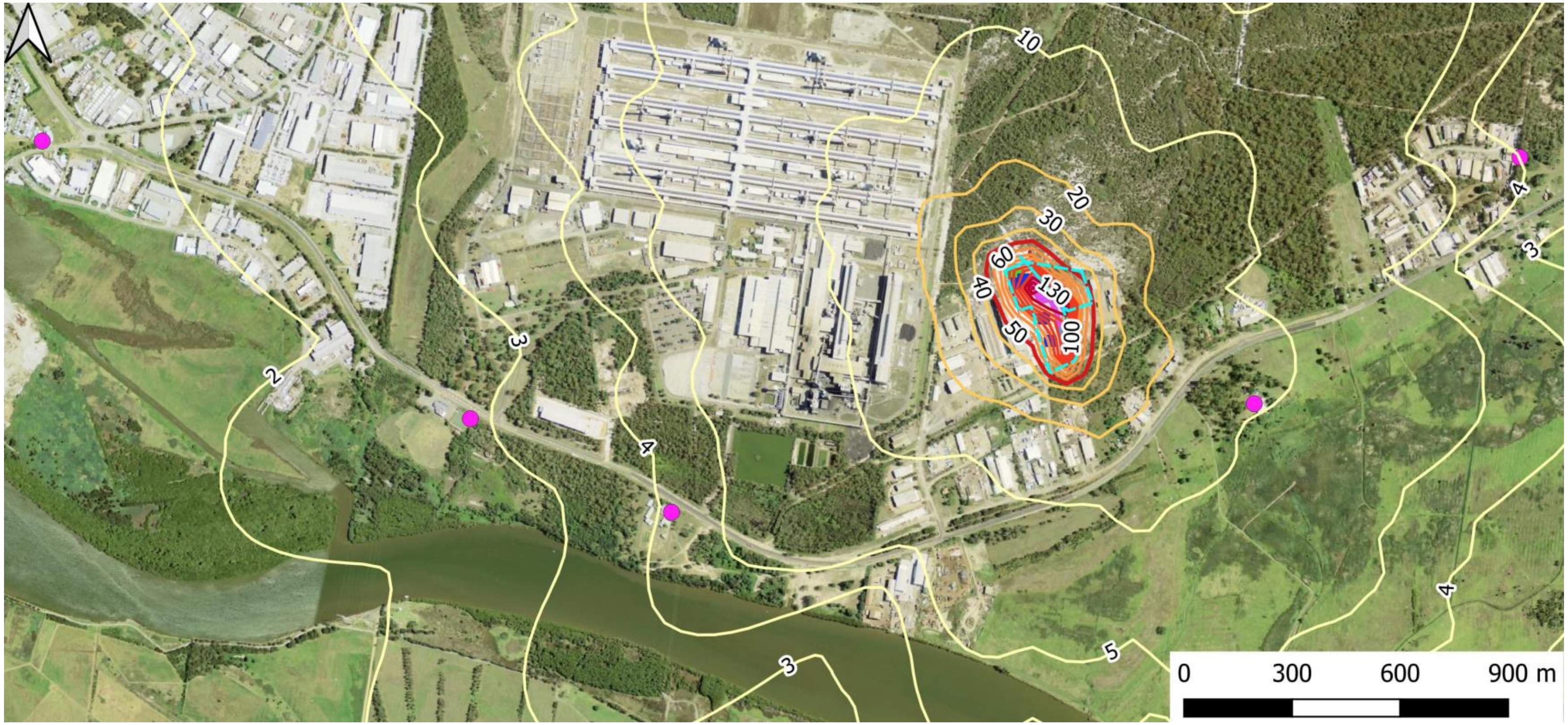

Figure E31: Predicted Ground Level PM_{10} 24-hour Concentrations (Source Only)

Height: Ground level **Location:** Tomago **Pollutant:** PM_{10}	**Averaging Time:** 24-hour **Units:** µg/m^3 **Criteria:** 50

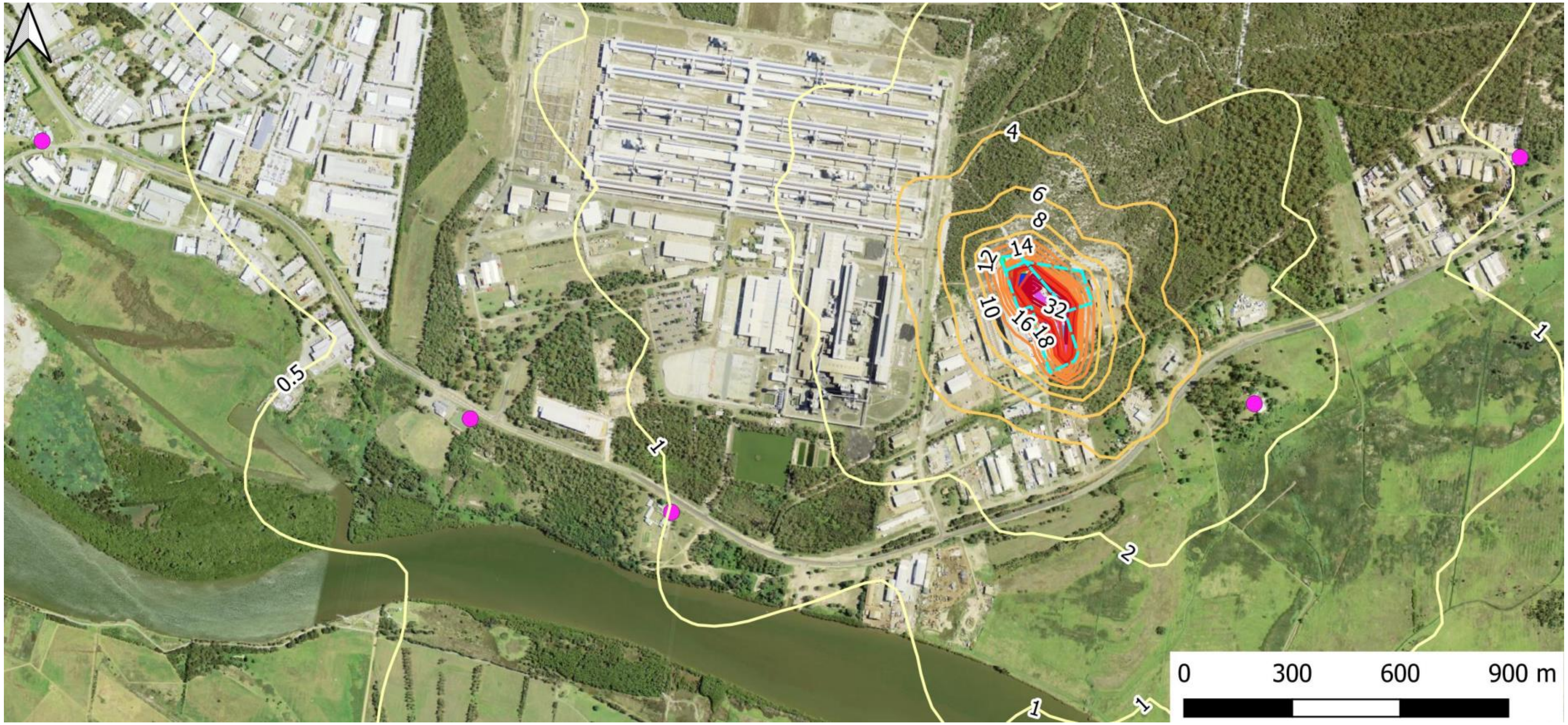

Figure E32: Predicted Ground Level $PM_{2.5}$ 24 Hour Concentrations (Source Only)	
Height: Ground level **Location:** Tomago **Pollutant:** $PM_{2.5}$	**Averaging Time:** 24 Hour **Units:** µg/m^3 **Criteria:** 25

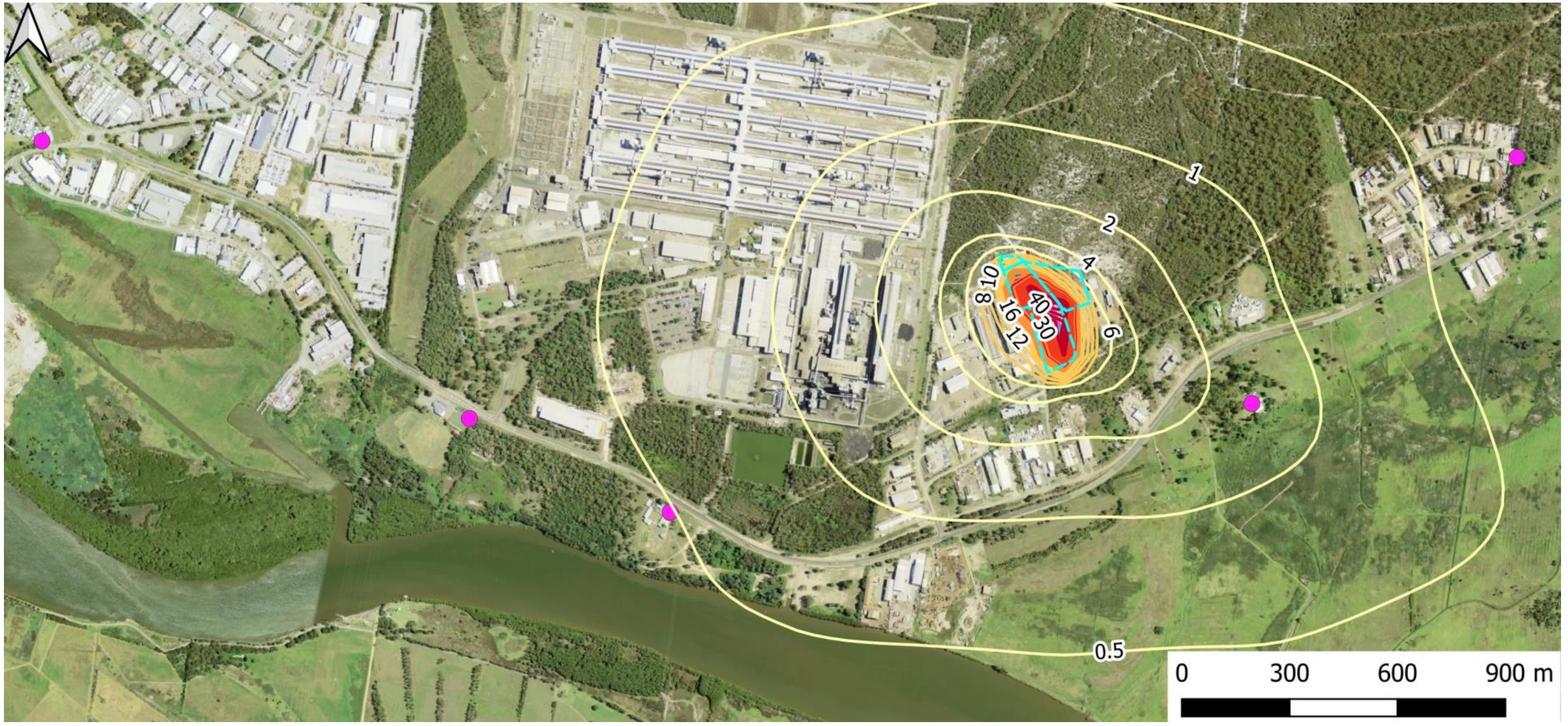

Figure E33: Predicted Ground Level PM_{10} Annual Concentrations (Source Only)

Height: Ground level **Location:** Tomago **Pollutant:** PM_{10}	**Averaging Time:** Annual **Units:** µg/m^3 **Criteria:** 25

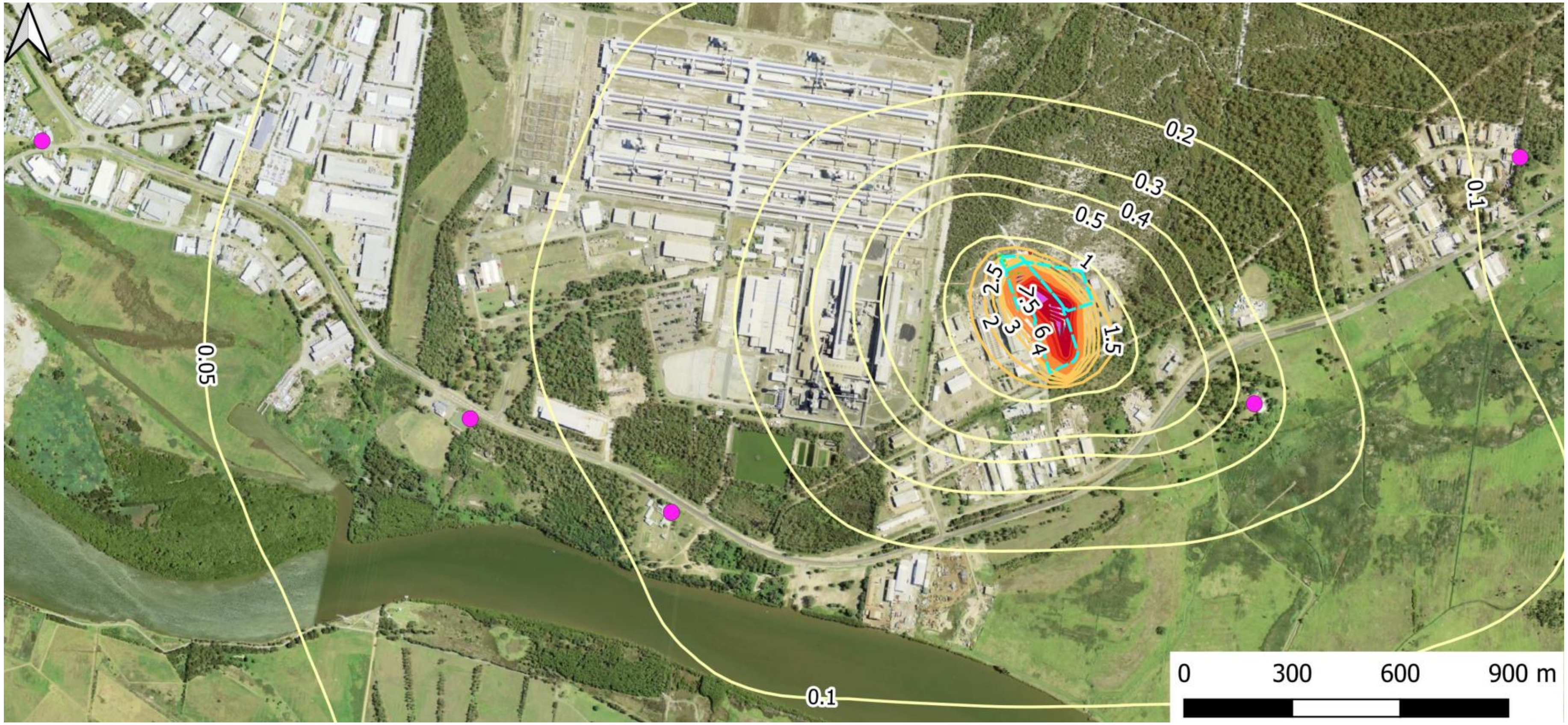

Figure E34: Predicted Ground Level $PM_{2.5}$ Annual Concentrations (Source Only)	
Height: Ground level **Location:** Tomago **Pollutant:** $PM_{2.5}$	**Averaging Time:** Annual **Units:** µg/m^3 **Criteria:** 8

Appendix D – Greenhouse Gas Assessment

Overview

This section provides an assessment of greenhouse gas emissions for proposed Resource Recovery Facility and Truck Parking Depot at Tomago. Estimations of annual greenhouse gas emissions during construction and operation have been estimated based on the methods outlined in the *National Greenhouse Energy Reporting Act 2007* (NGER) and associated technical guidelines.

Regulatory Framework

Kyoto Protocol

The Kyoto Protocol provides a framework by which developed countries (Party to the agreement) have an undertaking to reduce collective greenhouse gas emissions. The first commitment period (to which Australia's ratification came into effect in March 2008) covered the year 2008 to 2012 with the aim to reduce emissions by at least 5 % below 1990 levels. A second commitment period has also been agreed to which aims at reducing emissions to 5% below 2000 levels between 2013 and 2020.

The protocol provides the following "flexible mechanisms" as a means for the Parties to the agreement to cost effectively reduce carbon pollution:

- emissions trading;
- clean development mechanism; and
- joint implementation.

These mechanisms allow for Party countries to sponsor GHG reduction programs in developing (non-Party) countries and claim the associated reductions as part of the binding reductions required under the Protocol.

Australian Climate Change Policy

The Australian Climate Change Policy provides a framework by which GHG emissions can continue to be managed. The policy is based on the under-lying concept of three pillars:

- mitigation – reduce Australia's GHG emissions;
- adaptation – adapt to the climate change we cannot avoid; and
- global solution – help shape a collective international response.

Incorporated into the policy are a number of initiatives and legislative tools including the Clean Energy Future, Australian Carbon Trust and the National Greenhouse Energy Reporting Act 2007 (NGER).

National Greenhouse and Energy Reporting Act 2007 (NGER)

The *NGER Act 2007* introduced a single national reporting framework for the reporting and dissemination of information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production of corporations. The objectives of the Act were to:

- underpin the introduction of an emission trading scheme;
- inform government policy formulation and the Australian public;

- meet Australia's international reporting obligations;
- assist Commonwealth, State and Territory government programs and activities;
- avoid duplication of similar reporting systems in the states and territories.

Under the National Greenhouse and Energy Reporting Act 2007, there are requirements for controlling corporations to register and report if they emit greenhouse gases, produce energy, or consume energy at or above specified quantities in a given financial year. The reporting thresholds have been phased in as follows:

- From 1st July 2008 corporations were required to register and report if:
  - they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2 equivalent) or produces/consumes 100 terajoules or more of energy.
  - their corporate group emits 125 kilotonnes or more of greenhouse gas (CO_2 equivalent) or produces/consumes 500 terajoules or more of energy.
- For the reporting year 2009 – 2010 corporations are required to register and report if:
  - they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2 equivalent) or produces/consumes 100 terajoules or more of energy.
  - their corporate group emits 87.5 kilotonnes or more of greenhouse gas (CO_2 equivalent) or produces/consumes 350 terajoules or more of energy.
- For the reporting years after 2009 – 2010 corporations are required to register and report if:
  - they control facilities that emit 25 kilotonnes or more of greenhouse gas (CO_2 equivalent) or produces/consumes 100 terajoules or more of energy.
  - their corporate group emits 50 kilotonnes or more of greenhouse gas (CO_2 equivalent) or produces/consumes 200 terajoules or more of energy.

Specific guidance with respect to the scope of the reporting requirements has been developed, as well as detailed methodologies for calculating greenhouse gas emissions and/or energy use[9]. Table D25 defines the Greenhouse Gases that must be reported under the Act.

Table D25 - Greenhouse Gases Required for Reporting

Item	Greenhouse Gas	Chemical Formula	Global Warming Potential (GWP)
1	Carbon dioxide	CO_2	1
2	Methane	CH_4	25
3	Nitrous oxide	N_2O	298
4	Sulphur hexafluoride	SF_6	22,800
5	HFC-23	CHF_3	14,800
6	HFC-32	CH_2F_2	672

9 Australian Government, Department of Climate Change - National Greenhouse and Energy Reporting System Measurement, Technical Guidelines for the estimation of greenhouse gas emissions by facilities in Australia, August 2016.

Item	Greenhouse Gas	Chemical Formula	Global Warming Potential (GWP)
7	HFC-41	CH_3F	92
8	HFC-43-10mee	$C_5H_2F_{10}$	1,640
9	HFC-125	C_2HF_5	3,500
10	HFC-134	$C_2H_2F_4$ (CHF_2CHF_2)	1,100
11	HFC-134a	$C_2H_2F_4$ (CH_2FCF_3)	1,430
12	HFC-143	$C_2H_3F_3$ (CHF_2CH_2F)	353
13	HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	4,470
14	HFC-152a	$C_2H_4F_2$ (CH_3CHF_2)	124
15	HFC-227ea	C_3HF_7	3,220
16	HFC-236fa	$C_3H_2F_6$	9,810
17	HFC-245ca	$C_3H_3F_5$	693
18	Perfluoromethane (tetrafluoromethane)	CF_4	7,390
19	Perfluoroethane (hexafluoroethane)	C_2F_6	12,200
20	Perfluoropropane	C_3F_8	8,830
21	Perfluorobutane	C_4F_{10}	8,860
22	Perfluorocyclobutane	c-C_4F_8	10,300
23	Perfluoropentane	C_5F_{12}	9,160
24	Perfluorohexane	C_6F_{14}	9,300

The range of activities that are carried out by a Corporation are divided into groups for the purposes of determining reporting requirements under the Act. These groups are termed Scope 1, Scope 2 and Scope 3, for the purposes of reporting. Examples of the activities that fall within each are identified in Table D26. Only Scope 1 and 2 emission types are included in the NGER reporting requirements. Scope 3, which are outside the scope of the Corporation or facility to control or manage, are excluded from the NGER requirements.

Table D26 - Scope 1, 2 and 3 Activity Examples

Scope 1	Scope 2	Scope 3
The release of greenhouse gas into the atmosphere as a direct result of an activity or series of activities (including ancillary activities) that constitute the facility.	The release of greenhouse gas as a result of one or more activities that generate electricity, cooling or steam that is consumed by the facility but that *do not* form part of the facility.	Emissions that occur outside the boundary of a facility as a result of activities at a facility and are not Scope 2 activities.
E.g. power generation, emissions from haul vehicles operated by the facility, direct emission of greenhouse gases from extraction and processing of raw materials, emissions from on-site waste disposal.	E.g. greenhouse gas emissions caused by electricity use by the facility, where that electricity is not produced at the facility.	E.g. greenhouse gas emissions from off-site waste disposal, transport emissions where the transport is not provided by or managed by the facility.

Scope 1	Scope 2	Scope 3
Mandatory to report under NGER		Not Mandatory to report under NGER

Scope 3 emissions represent GHG emissions resulting from a company's activities but occurring from sources not owned or controlled by the company. Scope 3 emissions can be divided into upstream and downstream components. Upstream emissions for the Project may include manufacturing of processing equipment or production of fuel used on site. No significant downstream emissions have been identified for the proposed project.

Scope 3 emissions are not routinely reported by companies because:

- emissions are difficult to estimate accurately; and
- the company does not have effective control of the emissions sources.

A company's Scope 3 emissions will be reported elsewhere by a second company as their Scope 1 emissions. Therefore, Scope 3 emissions are/are not included in this GHG assessment.

GHG Inventory Methodology

Accounting and Reporting Principles

The GHG emissions inventory for the Project has been prepared in accordance with the accounting and reporting principles detailed within the Greenhouse Gas Protocol[10]. The protocol was developed to provide a framework for internationally accepted accounting and reporting standards for GHG emissions from companies.

The key principles provided in the Greenhouse Gas Protocol include:

- Relevance: The inventory must contain the information that both internal and external users need for their decision making;
- Completeness: All relevant emissions sources within the inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled;
- Consistency: The consistent application of accounting approaches, inventory boundary and calculation methodologies are essential to producing comparable GHG emissions over time;
- Transparency: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used; and
- Accuracy: Data should be sufficiently precise to enable intended users to make decisions with reasonable assurance that the reported information is credible.

10 World Business Council for Sustainable Development and World Resource Institute (2004), 'The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard'

The greenhouse gas emission inventory for the Project is based on the methodology detailed in the Greenhouse Gas Protocol, and the relevant emission factors in the National Greenhouse Accounts (NGA) Factors.

Inventory Organisational Boundary

The organisational boundary of the project is defined as the proposed construction site and operational facilities and includes all GHG emissions controlled or produced by the project.

Reporting Period

For the purpose of the assessment, GHG estimates have been predicted for the following periods:

- Construction only up to 6 weeks); and
- Annual operations.

Scope 1 and 2 Emission Sources

As discussed earlier, GHG emissions are categorised into Scope 1, 2 and 3 emissions. Scope 1 emissions for the construction phase of project are related to fuel usage by construction equipment for the On Site Detention basin and Truck Parking Depot. Diesel equipment will be used during construction, which includes an excavator, front end loader, bulldozer, grader, dump truck and roller. Scope 1 operational emissions include emissions from the following diesel machinery:

- 2 x Loaders used by Material Recovery Facility, Garden Organics Processing and metals recycling facility;
- Material handler used by Material Recovery Facility, Garden Organics Processing and metals recycling facility;
- Excavator used by the Material Recovery Facility; and
- 3 x Forklifts used by the Material Recovery Facility.

In relation to Scope 2, the proposed development will include the following electrical machinery:

- Materials Recovery Facility: shredders, sorting, conveyors, infrared, windshifter and magnet;
- Cardboard Baling Facility: baler;
- Food De-packaging Plant: hopper, conveyor and pump;
- Drill Mud Recycling Facility: pump and centrifuge;
- Hazardous Waste Recycling Facility: pallet scales and electric cable stripper;
- Copper Processing area: hydraulic cable shear and electric cable stripper; and
- Metals Recycling Facility: overhead crane (existing) and bale press (not additional to cardboard baler).

As discussed earlier, Scope 3 emissions have not been considered in this assessment.

Materiality

Materiality is a concept used to minimise the time spent verifying data that does not impact on the inventory in a material way. The exact materiality threshold that is used in GHG emissions accounting and auditing is subjective and dependant on the context of the site and the features of the inventory. Depending on the context, the materiality threshold can be expressed as a percentage of a total inventory, a specific amount of GHG emissions, or a combination of both.

For the purposes of this assessment, all emissions have been accounted for where data is available.

Activity Data Sources

Construction and operational activity data used to estimate Scope 1 and Scope 2 emissions have been based on information provided by the Client. The following information has been provided by the client:

- Construction phase:
  - construction equipment inventory;
  - construction staging and duration;
- Operational phase:
  - anticipated power consumption (kwh);
  - type of fuel gas used.

For Scope 1 emissions, it has been necessary to estimated fuel usage of construction equipment based on the operating duration of equipment, and the type and number of equipment required for construction. Fuel consumption per hour has been based on data presented in the Caterpillar Performance Handbook (Edition 42)[11] and available literature.

Emission Factors

Direct measurement of GHG at the emission source can give the most accurate and precise assessment of GHG emissions. Direct measurement of emissions however is not feasible where a project is still in the design phase. For the purpose of the assessment, emission factors have been used in accordance with the GHG Protocol methodology. Emission factors are a factor expressed as the amount of GHG emissions per unit of activity, which can be used to determine inventories for a site and remove the need for site specific testing of emissions.

Emission factors can be obtained from various sources, for example, the Department of Climate Change, from site-specific information or from operational details obtained from similar emission sources. Emission factors used to calculate GHG emissions (as CO_2-e) from the combustion of diesel and electricity consumption have been sourced from the Department of Climate Change and Energy Efficiency National Greenhouse Accounts Factors – August 2019. The relevant emission factors for the project are associated with fuel-related emissions (Scope 1). Table D27 presents a summary of the emission factors used in the study.

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11 Caterpillar, Caterpillar Performance Handbook, Edition 42, Chapter 20 Estimating Owning & Operating Costs, January 2012.

Table D27 - Emission Factors – Consumption of Fuels (Scope 1)

Use	Fuel Combusted	Energy Content (GJ/m³)	Emission Factor (kg CO_2-e/GJ)		
			CO_2	CH_4	N_2O
Operational and Construction Equipment	Diesel	38.6	69.9	0.1	0.2

Table D28 - Emission Factors - Consumption of Purchased Electricity from the Grid (Scope 2)

State	Emission Factor (kg CO_2-e/kWh)
New South Wales	0.81

Emissions Inventory

Scope 1 Emissions

Tables D29 and D30 present the estimated Scope 1 emissions for construction and annual operations.

Table D29 - Construction - Scope 1 Emissions

Stage	Total Energy Consumed GJ	Total CO_2-e (tonnes)
Construction (up to 6 weeks)	2,197	154

Table D30 - Operations - Scope 1 Emissions

Equipment	Total Energy Consumed GJ	Total CO_2-e (tonnes)
Total Per Annum	7623	535

Scope 2 Emissions

As discussed earlier, the proposed development will utilise the main electricity grid for power. Based on the expected power usage, (542,582 kWh per year) and 0.81 CO_2-e kg/kWh emission factor for the New South Wales region, total emissions are estimated to be 439 CO_2-e tonnes/year.

Summary of Emissions

Based on the estimated emissions presented above, the Project is not expected to trigger the NGER reporting threshold for a single facility of 25 kilotonnes CO_2-e (25,000 tonnes CO2-e) of greenhouse gases and 100,000 MJ of energy consumed.

GHG Mitigation Options

GHG emissions associated with the Project are primarily associated with the combustion of fuels, in particular diesel. Therefore, opportunities for reducing emissions are related to alternative fuel types used, use of low emissions technology (e.g. equipment with latest technology) and maintenance of equipment. In summary, opportunities for reducing GHG emissions for these sources include the followings:

- Minimising the use of fuel by selecting fuel efficient plant and equipment, operating vehicles and machinery in a fuel-efficient manner e.g. turning off idling equipment, and selecting construction techniques that utilise lower amounts of fuel;
- Implementation of a maintenance plan for all fuel and electrically powered equipment;
- Implementation of energy conservation practices by all staff (which can be enforced through appropriate training);
- use of solar panels.

Appendix E – Example Odour Control

bioaction

Dry Adsorption Systems

odour ▪ gas ▪ corrosion ▪ **SOLUTIONS**

Forward

The Bioaction FiltaSorb gas filtration systems have been engineered to the environmental conditions of municipal and industrial installations.

To provide our customers the most suitable solution for their application we can draw on a selection of standard and specialised adsorption media. This is support by the technical resources of PuraFil and their range of media profiles as Bioaction is the exclusive Australian distributor.

We supply a range of dry adsorbent scrubbers that can be used as a primary or secondary application. These include FC75 Series of drum filters, FiltaCube 200lps fully enclosed system and the new FiltaMod range of compact modular adsorption systems. The FiltaMod systems are constructed from the latest 3rd generation HDPE twin-wall composite.

As a company we challenged ourselves to design compact modular systems that reduced logistic and construction costs. What the team has achieved is well beyond my expectations and reflects the company commitment to innovation.

Larry Botham
Co-founder and CEO
Bioaction Pty Ltd

FiltaCube 200lps system

Engineered media solutions

Bioaction can provide specific activated carbon and PuraFil patented media. PuraFil media are spherical porous pellets which are comprised of different chemical compounds such as activated alumina, sodium permanganate, activated carbon, and potassium permanganate. They can remove gaseous pollutants from the air through a unique chemical process known as chemisorption. During chemisorption, the media converts harmful gases from the air into harmless materials that are trapped inside the pellet. This process is instantaneous and irreversible.

bioaction

FiltaMod Series dry adsorption scrubbers

FiltaMod is a modular design concept to facilitate project planning, budgeting and execution. They are constructed using the latest HDPE twin-wall composite to meet the environmental conditions in municipal and industrial applications.
The FiltaSorb range can be arranged to suit most flow requirements and our modelling process will ensure it is designed to comply to the project specifications.
They are supplied as a packaged system, individual filter vessels, or as part of an overall treatment process.

MODEL	LPS	FOOTPRINT
ACF-11	220	*1 x 1m*
ACF-21	350	*2 x 1m*
ACF-22	850	*2 x 2m*
ACF-23	1,350	*2 x 3m*
ACF-24	1,870	*2 X 4m*
ACF-25	2,370	*2 X 5m*
ACF-26	2,875	*2 X 6m*
		Overall height 2.5m

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FiltaCube compact system

FiltaCube FCC200 offers an effective and secure solution for fugitive odours for sewer pump station and industrial applications. The system can be mounted directly above a penetration into the wet well or mounted locally and ducted to the system. The system is supplied complete with extraction fan and sound attenuator. It is a robust construction with high durability and is UV and corrosion resistant. With a 200lps treatment capacity it is suitable for many applications.

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FC75 Series Adsorption Cannisters

The FC75 Adsorption Cannisters have long been a popular solution to odour and corrosion problems. They are totally flexible with each unit designed for 75lps flow capacity and can be installed as a completed system or as individual filters.

Many customer opt for the convenience of using the FC75 to expedite service and maintenance. Spare filters can be stocked for changeout when they have expired.

The poly or optional stainless-steel drum is corrosion proof and be returned for refilling. With a range of adsorbent media available the filters can be tailored to the specific gas treatment application.

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FiltaSorb gallery

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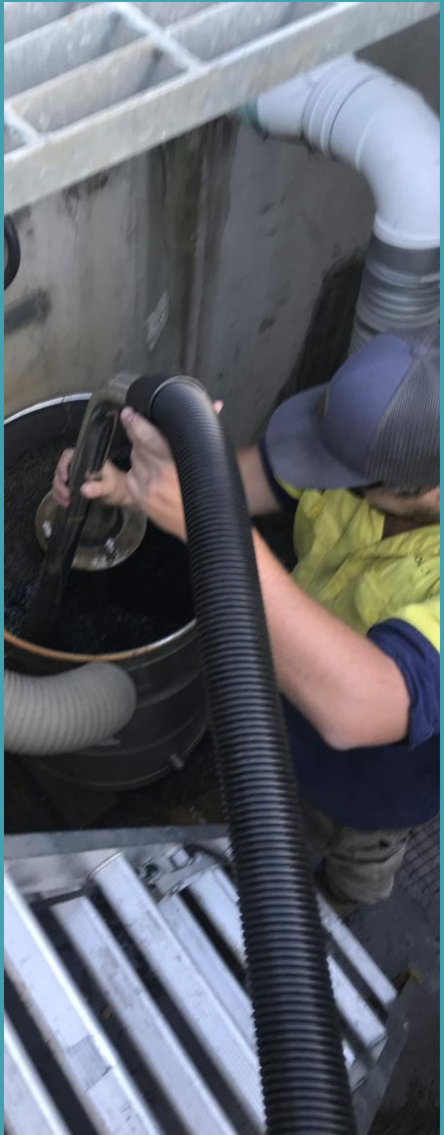
FiltaMod construction

Servicing a relief valve application



FiltaSorb system

FC75 Stainless Steel unit

Installed in conjunction with a biological OCU

PuraFil Positive Pressurisation Unit

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