Level 3, GHD Tower, 24 Honeysuckle Drive,
Newcastle NSW 2300
Australia
www.ghd.com

Your ref: DA/1940/2013/B
Our ref: 12563453

24 January 2023

The General Manager
Lake Macquarie City Council
PO Box 1906
Hunter Regional Mail Centre, NSW, 2310

Att: Rosie Turner, Development Planner

DA/1940/2013/B – Awaba ORRF Modification

Dear Rosie

Reference is made to our discussions regarding the above application and the recent odour dispersion modelling for the proposed modification completed by The Odour Unit (TOU).

1. Background

Following the recommendation of the Regional Planning Panel (the Panel) briefing in June 2022, Council engaged EMM Consulting to independently review the Odour Assessment Report (prepared by TOU, December 2021) submitted in support of the modification together with the Odour Impact Assessment (dated November 2016) prepared by GHD which supported the previously approved modification (DA/1940/2013/A).

The review concluded revised odour dispersion modelling should be undertaken by TOU to determine the potential odour impacts associated with the proposal, based on site specific odour sampling data.

The Panel and Council subsequently requested further information be provided with the modification application to respond to the findings of the EMM report.

2. Revised Odour Modelling

TOU has since completed revised odour dispersion modelling for the windrow turner composting proposal at the REMONDIS Lake Macquarie Organics Resource Recovery Facility (the ORRF) attached to this letter (Attachment 1). The revised odour modelling is based on more recent odour emission testing and refined options to modify the current operation and management protocols to enable open windrow composting to continue at the ORRF. The revised odour modelling was based on the following:

– The ORRF will be processing at its current design capacity of 44,000 tonnes per year of compost and soil amendment products.
– TOU expects that the odour performance of the leachate dam will be equivalent to the current operation. This is on the basis that the leachate dam has been determined to be capable of managing the flow and organic loadings under the proposed modification conditions.

- The assumed open-windrow composting profile is based on a general understanding of open windrow composting trend from an odour emissions perspective. The odour emission values for the existing MAF area, as obtained in the 2022 Odour Emissions Testing, have been transposed and reprocessed to reflect this trend profile.
- The receival hall will be enclosed on two sides, and all emissions from this source will be discharged via vertically mounted roof fans. The front-end loader entrance and tunnel apron accessway will be retrofitted with ceiling-mounted plastic strips and remain open, acting as the fresh make-up air supply to support the operational function of the roof fans.
- The existing biofilter system treatment capacity will remain unchanged and be refurbished to restore and achieve its design-treated odour concentration discharge target of 500 ou.

The revised odour modelling has found that the proposed modification has the potential to reduce the predicted odour concentration (99%, P/M60) at nearby receptors in Toronto and Awaba between approximately 52% and 82% compared with the current operation. TOU suggest with the proposed modifications to the ORRF this should lead to a significant improvement in the amenity outcome for the community surrounding the ORRF.

3. Proposed modification

In line with the revised odour modelling, the proposed modification sought under DA/1940/2013/B is revised to include not only the modification of the existing MAF composting area and maturation area into an open windrow composting pad that utilises a windrow turner for the management of the windrow stockpiles, following pasteurisation in the existing aerated tunnels, but also the following:

- The enclosure of the receival hall on two sides (final design to be confirmed), with all emissions discharged via vertically mounted roof fans. The front-end loader entrance and tunnel apron accessway will be retrofitted with ceiling-mounted plastic strips and remain open, acting as the fresh make-up air supply to support the operational function of the roof fans.
- The refurbishment of the existing biofilter system.

4. Summary

The revised proposed modification as presented and assessed as part of the revised odour modelling is considered to satisfy Condition 43 of Development Consent DA/1940/2013/A and the relevant conditions of EPL 20949.

We trust the revised modelling results are adequate for the assessment of the revised proposed modification to proceed but please contact the undersigned, if you have any questions.

Regards

Shaun Lawer
Technical Director – Planning and Environment

+61 2 6650 5605
shaun.lawer@ghd.com

Attachment 1 Revised Odour Modelling (TOU, Dec, 2022)

SYDNEY
Level 3 Suite 12
56 Church Avenue
MASCOT, NSW, 2020
Phone: +61 2 9209 4420
A C N 091 165 061
A B N 53 091 165 061

BRISBANE
Unit 2
57 Neumann Road
CAPALABA QLD 4157
Phone: +61 7 3245 1700
A C N 87 102 255 765
A B N 102 255 765
Website: www.odourunit.com.au

Attn: Amrish Trivedi
Environmental Manager – Swanbank Clean Energy and Resource Recovery Precinct
REMONDIS Australia Pty Ltd

11 January 2023

by email: amrish.trivedi@remondis.com.au

REMONDIS AUSTRALIA – AWABA ORRF OPEN WINDROW COMPOSTING PROPOSAL REVISED ODOUR MODELLING RESULTS

Dear Amrish,

As requested, The Odour Unit (**TOU**) has completed revised odour dispersion modelling (the **Revised Odour Modelling**) for the open windrow composting proposal (the **Proposed Modification**) at the REMONDIS Lake Macquarie Organics Resource Recovery Facility located at 413 Wilton Road, Awaba, New South Wales (the **ORRF**). The Revised Odour Modelling is based on more recent odour emission testing and refined options to modify the current operation (the **Current Operation**) and management protocols to enable open windrow composting at the ORRF. This will be achieved, amongst other technical-related matters, by the preparation and lodgement of an application with Lake Macquarie City Council (**LMCC**) to modify Development Consent No. DA/1940/2013/B under *Section 4.55(2)* of the *Environmental Planning and Assessment Act* 1979 by GHD on behalf of REMONDIS Australia Pty Ltd (**REMONDIS**). The following letter-style report outlines the refined options for Proposed Modification and provides the methodology results and findings of the Revised Odour Modelling.

1. Relevant Documentation

In preparing the Revised Odour Modelling, TOU has relied upon the following information:

- The original odour impact assessment report for the ORRF titled *Awaba AWT Facility – Odour Impact Assessment dated November 2016*, completed by GHD (the **2016 Odour Report**);

- The odour investigation study report completed at the ORRF titled *Lake Macquarie Organics Resource Recovery Facility – Odour Investigation Study – Final Report* dated August 2019 completed by TOU (the **2019 Odour Report**);

- The open windrow composting odour assessment report completed for the Proposed Modification titled *REMONDIS Australia – Awaba ORRF Open Windrow Composting Proposal Odour Assessment Report* dated 16 December 2021 completed by TOU (the **2021 Odour Report**);

- The peer review of the odour assessment for the *Proposed Modification to the ORRF titled Peer review of odour assessment - organic recycling facility* dated 6 September 2022 conducted by EMM (the **2022 Peer Review**); and

- Odour emissions testing completed by TOU that represented recent operations at the ORRF in November 2022 (the **2022 Odour Emissions Testing**).

2. Revised Odour Modelling Approach

The Revised Odour Modelling was carried out using the CALPUFF system and undertaken in accordance with the methods outlined in the following documents:

- *Approved Methods for the Modelling and Assessment of Air Pollutants (revised 2016, published 2017)* (the **Approved Modelling & Assessment Methods**)*;*
- *Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, Australia* (the **Further CALPUFF Guidance**)*;*
- *Technical Framework for the Assessment and Management of Odour from Stationary sources in NSW* (the **Odour Technical Framework**)*;* and
- *Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW* (the **Odour Technical Notes**)*.*

3. Meteorological Dataset

A meteorological dataset was prepared by Air Quality Support (**AQS**) using a modelling system that employed the Weather Research and Forecast (**WRF**) prognostic model and the CALMET diagnostic model, which converted the data into a format suitable for direct use with the CALPUFF dispersion model. The dataset incorporated observations from the Bureau of Meteorology Automatic Weather Station (**AWS**) site at Cooranbong, the REMONDIS on-site station, as well as the Maitland AWS station. The year 2020 was selected as the representative year to be used in the Revised Odour Modelling. Further technical information on the meteorological dataset is contained within the **attached** AQS memorandum *D22A-3: Meteorological Dataset – REMONDIS Waste Facility, Awaba NSW*.

4. Key Dispersion Model Options

CALPUFF default model options were set except for the following, as recommended in *Table A*-4 contained and explained within the Further CALPUFF Guidance:

- Dispersion coefficients (MDISP) = dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (2);
- Probability Density Function used for dispersion under convective conditions (MPDF) = Yes (1); and
- Minimum turbulence velocities sigma v for each stability class over land and water (SVMIN) = 0.2 m/s for A, B, C, D, E, F (0.200, 0.200, …, 0.200).

5. Receptors

The discrete receptors are in the same position as in the 2016 Report, with the addition of Receptor 8 in the R2 Low-Density Residential zone to the north of the ORRF as recommended in the 2022 Peer Review for consideration of impacts at potential future residences. The discrete receptor locations are depicted on an aerial map in **Figure 1**. The sampling grid resolution used was 50 m by 50 m across a 5 km by 5 km domain.

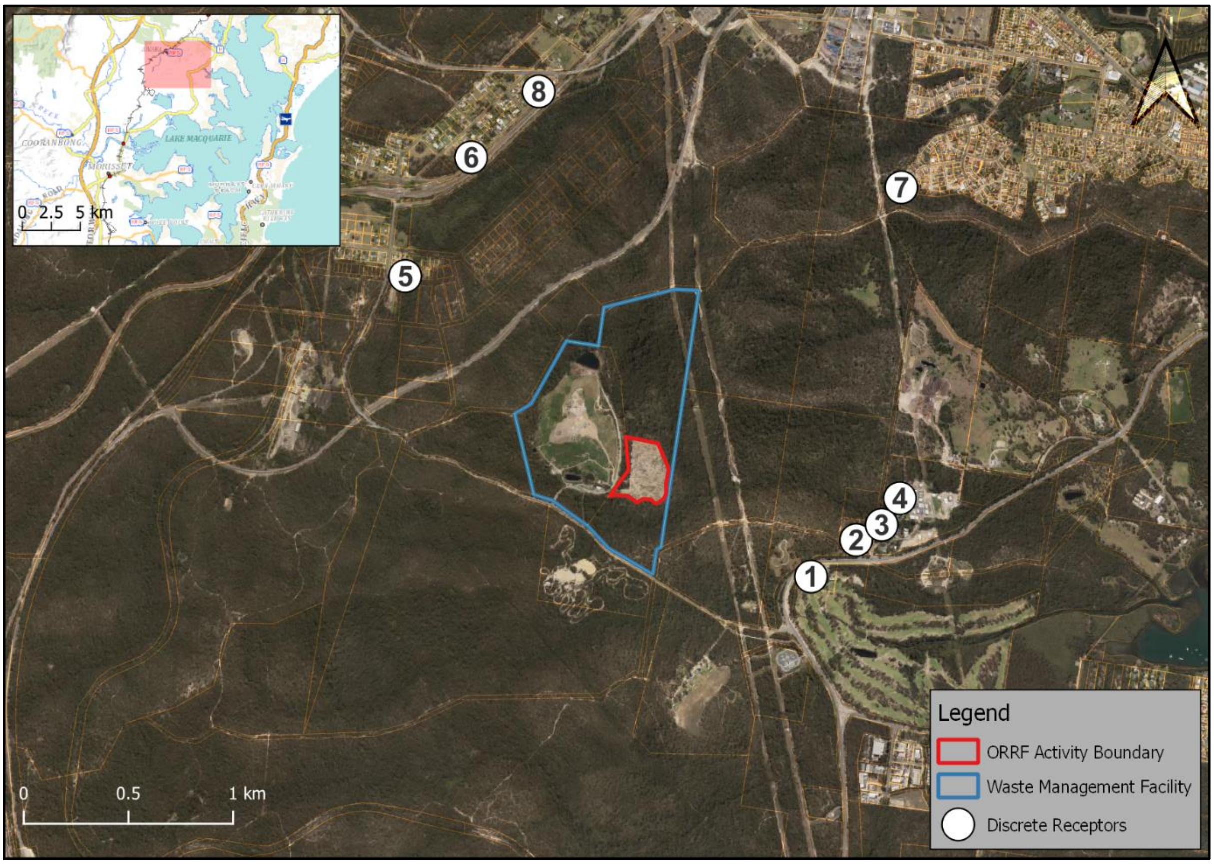


Figure 1 – Discrete receptor locations for the Revised Odour Modelling

6. Source Emissions Inventory and Layout

The source emissions inventories prepared for the Current Operation and the Proposed Modification are outlined in **Section 6.1** and **Section 6.2**, respectively.

6.1. Current Operation

The Current Operation source emission inventory is provided in **Table 1**, **Table 2** and **Table 3,** and the source layout is illustrated in **Figure 2**. In summary, the details applicable to the Current Operation are as follows:

- The ORRF processes organic waste, including food organics and garden organics (**FOGO**), into compost and soil amendment product using a combined aerated compost tunnel and Mobile Aerated Floor (**MAF**) composting system;
- Shredded FOGO material is pasteurised in five (5) aerated compost tunnels for a period of one (1) week with process air treated by a biofilter system;
- Pasteurised material is laid out on MAF windrow piles, each approximately 45 metres (**m**) in length, 15 m wide, and 4.5 m high;
- The composted product is moved to the Maturation Area for stabilisation, followed by screening and transportation off-site as compost and soil amendment product;

- The specific odour emission rates (**SOER**) measured during the 2022 Odour Emission Testing were adopted for all area sources except the Leachate Dam;
- The SOER value for the Leachate Dam has been sourced from the 2016 Odour Report;
- The odour emission rates (**OER**) measured during the 2022 Odour Emission Testing were adopted for point and volume sources in the Revised Odour Modelling; and
- All odour emissions are assumed to be constant (i.e., 24/7).

6.2. Proposed Modification

The Proposed Modification source emission inventory is provided in **Table 4** and **Table 5**, and source layout illustrated in **Figure 3.** In summary, the details applicable to the Proposed Operation are as follows:

- The ORRF will be processing at its current design capacity of 44,000 tonnes per year of compost and soil amendment products;
- TOU expects that the odour performance of the Leachate Dam will be equivalent to the Current Operation. This is on the basis that the Leachate Dam has been determined to be capable of managing the flow and organic loadings under the Proposed Modification conditions;
- The assumed open-windrow composting profile is based on a general understanding of open windrow composting trend from an odour emissions perspective. The odour emission values for the existing MAF area, as obtained in the 2022 Odour Emissions Testing, have been transposed and reprocessed to reflect this trend profile;
- The Receival Hall will be enclosed on two sides, and all emissions from this source will be discharged via vertically mounted roof fans. The front-end loader entrance and tunnel apron accessway will be retrofitted with ceiling-mounted plastic strips and remain open, acting as the fresh make-up air supply to support the operational function of the roof fans; and
- The existing biofilter system treatment capacity will remain unchanged and be refurbished to restore and achieve its design-treated odour concentration discharge target of 500 ou.

Table 1 – Area source configuration for the Current Operation											
Description	Source ID	Elevation (m)	UTM east (km)	UTM north (km)	Area (m^2)	SOER ($ou.m^3/m^2.s$)	SOER P/M60 2.5 ($ou.m^3/m^2.s$)	SOER P/M60 2.3 ($ou.m^3/m^2.s$)	OER ($ou.m^3/s$)	OER P/M60 2.5 ($ou.m^3/s$)	OER P/M60 2.3 ($ou.m^3/s$)
MAF 1 East	AREA01	38.8	364.9365	6345.0153	750	0.99	2.5	2.3	739	1,847	1,699
			364.9864	6345.0183							
			364.9873	6345.0033							
			364.9374	6345.0003							
MAF 1 West	AREA02	35	364.9897	6345.0185	750	0.99	2.5	2.3	739	1,847	1,699
			365.0396	6345.0216							
			365.0405	6345.0066							
			364.9906	6345.0035							
MAF 2 East	AREA03	38.8	364.9354	6345.032	750	0.37	0.91	0.84	274	684	630
			364.9854	6345.0351							
			364.9863	6345.0201							
			364.9364	6345.0171							
MAF 2 West	AREA04	35.3	364.9886	6345.0352	750	0.37	0.91	0.84	274	684	630
			365.0385	6345.0383							
			365.0395	6345.0233							
			364.9896	6345.0202							
MAF 3 East	AREA05	39.3	364.9344	6345.0494	750	0.23	0.56	0.52	169	422	388
			364.9843	6345.0524							
			364.9852	6345.0375							
			364.9353	6345.0344							
MAF 3 West	AREA06	35.3	364.9876	6345.0526	750	0.23	0.56	0.52	169	422	388
			365.0375	6345.0557							
			365.0384	6345.0407							
			364.9885	6345.0376							
Screened Product	AREA07	39.8	364.9494	6345.0889	200	0.20	0.50	0.46	40	100	92
			364.9694	6345.0902							
			364.97	6345.0802							
			364.95	6345.079							
Unscreened Matured Stockpile (Disturbed)	AREA08	37.9	364.9997	6345.0705	25	0.17	0.43	0.39	4	11	10
			365.0047	6345.0708							
			365.005	6345.0658							
			365	6345.0655							
Unscreened Matured Stockpile (Undisturbed)	AREA09	36.4	364.979	6345.1066	1,926	0.23	0.56	0.52	433	1,083	997
			365.0339	6345.11							
			365.036	6345.0751							
			364.9811	6345.0717							
Leachate Dam	AREA10	33.5	365.0579	6345.0017	3,738	0.07	0.18	0.16	262	654	602
			365.0641	6344.9009							
			365.0272	6344.8986							
			365.021	6344.9994							

Table 2 – Point source configuration for the Current Operation

Description	Source ID	UTM east (km)	UTM north (km)	Height (m)	Elevation (m)	Diameter (m)	Velocity (m/s)	Temperature (K)	Flowrate (m3/h)	Discharge Conc. (ou)	OER ($ou.m^3/s$)	OER P/M60 (2.3) ($ou.m^3/s$)
Biofilter Section 1	STCK01	364.9949	6344.9841	1.5	36.6	11.73	0.039	303.15	15,000	1,578	6,575	15,123
Biofilter Section 2	STCK02	365.0039	6344.9846	1.5	36.6	11.73	0.039	303.15	15,000	1,578	6,575	15,123

Table 3 – Volume source configuration for the Current Operation

Description	Source ID	UTM east (km)	UTM north (km)	Height (m)	Elevation (m)	Sigma Y (m)	Sigma Z (m)	OER ($ou.m^3/s$)	OER P/M60 (2.3) ($ou.m^3/s$)
Receival Hall (unprocessed FOGO and shredding)	VOLS01	364.9666	6344.9414	4.75	37.5	8.82	4.42	24,760	56,948

Figure 2 – The Current Operation layout

Table 4 – Area source configuration for the Proposed Modification

Description	Source ID	Elevation (m)	UTM east (km)	UTM north (km)	Area (m^2)	SOER ($ou.m^3/m^2.s$)	SOER P/M60 2.5 ($ou.m^3/m^2.s$)	SOER P/M60 2.3 ($ou.m^3/m^2.s$)	OER ($ou.m^3/s$)	OER P/M60 2.5 ($ou.m^3/s$)	OER P/M60 2.3 ($ou.m^3/s$)
Leachate Dam	AREA10	33.5	365.0579	6345.0017	3,738	0.07	0.18	0.16	262	654	602
			365.0641	6344.9009							
			365.0272	6344.8986							
			365.021	6344.9994							
Screening & Product Storage	AREA11	40.2	364.9374	6345.1081	1,200	0.20	0.49	0.45	237	592	545
			364.9773	6345.1106							
			364.9791	6345.0806							
			364.9392	6345.0782							
Windrow 1	AREA12	38.4	365.0275	6345.1137	300	1.4	3.5	3.2	420	1,050	966
			365.0279	6345.1077							
			364.978	6345.1047							
			364.9776	6345.1107							
Windrow 2	AREA13	38.4	365.0279	6345.1072	300	1.3	3.3	3.0	395	989	909
			365.0283	6345.1012							
			364.9784	6345.0981							
			364.978	6345.1041							
Windrow 3	AREA14	38.4	365.0284	6345.1005	300	0.63	1.6	1.5	190	474	436
			365.0287	6345.0945							
			364.9788	6345.0915							
			364.9784	6345.0975							
Windrow 4	AREA15	37.9	365.0287	6345.0941	300	0.41	1.03	0.95	123	309	284
			365.0291	6345.0881							
			364.9792	6345.085							
			364.9788	6345.091							
Windrow 5	AREA16	37.9	365.0291	6345.0876	300	0.30	0.76	0.70	91	227	209
			365.0295	6345.0816							
			364.9796	6345.0786							
			364.9792	6345.0846							
Windrow 6	AREA17	37.9	365.0295	6345.0813	300	0.24	0.60	0.55	72	180	165
			365.0299	6345.0753							
			364.98	6345.0723							
			364.9796	6345.0783							
Windrow 7 West	AREA18	39.8	364.9853	6345.0654	270	0.20	0.49	0.45	53	133	123
			364.9857	6345.0594							
			364.9408	6345.0567							
			364.9404	6345.0626							
Windrow 7 East	AREA19	35.8	365.0303	6345.0681	270	0.20	0.49	0.45	53	133	123
			365.0307	6345.0622							
			364.9858	6345.0594							
			364.9854	6345.0654							
Windrow 8 West	AREA20	39.3	364.9857	6345.0589	270	0.20	0.49	0.45	53	133	123
			364.9861	6345.0529							
			364.9412	6345.0501							
			364.9408	6345.0561							
Windrow 8 East	AREA21	35.3	365.0307	6345.0616	270	0.20	0.49	0.45	53	133	123
			365.0311	6345.0556							

Table 4 – Area source configuration for the Proposed Modification

Description	Source ID	Elevation (m)	UTM east (km)	UTM north (km)	Area (m^2)	SOER ($ou.m^3/m^2.s$)	SOER P/M60 2.5 ($ou.m^3/m^2.s$)	SOER P/M60 2.3 ($ou.m^3/m^2.s$)	OER ($ou.m^3/s$)	OER P/M60 2.5 ($ou.m^3/s$)	OER P/M60 2.3 ($ou.m^3/s$)
			364.9862	6345.0529							
			364.9858	6345.0589							
Windrow 9 West	AREA22	39.3	364.9861	6345.0523	270	0.20	0.49	0.45	53	133	123
			364.9865	6345.0463							
			364.9416	6345.0436							
			364.9412	6345.0496							
Windrow 9 East	AREA23	35.3	365.0311	6345.0551	270	0.20	0.49	0.45	53	133	123
			365.0315	6345.0491							
			364.9866	6345.0463							
			364.9862	6345.0523							
Windrow 10 West	AREA24	39.3	364.9865	6345.0457	270	0.20	0.49	0.45	53	133	123
			364.9869	6345.0397							
			364.942	6345.037							
			364.9416	6345.043							
Windrow 10 East	AREA25	35.3	365.0315	6345.0485	270	0.20	0.49	0.45	53	133	123
			365.0319	6345.0425							
			364.987	6345.0397							
			364.9866	6345.0457							
Windrow 11 West	AREA26	39.3	364.9869	6345.0392	270	0.20	0.49	0.45	53	133	123
			364.9873	6345.0332							
			364.9424	6345.0305							
			364.942	6345.0365							
Windrow 11 East	AREA27	35.3	365.0319	6345.042	270	0.20	0.49	0.45	53	133	123
			365.0323	6345.036							
			364.9874	6345.0332							
			364.987	6345.0392							
Windrow 12 West	AREA28	39.3	364.9873	6345.0328	270	0.20	0.49	0.45	53	133	123
			364.9877	6345.0268							
			364.9428	6345.024							
			364.9424	6345.03							
Windrow 12 East	AREA29	35.3	365.0323	6345.0355	270	0.20	0.49	0.45	53	133	123
			365.0327	6345.0295							
			364.9878	6345.0268							
			364.9874	6345.0328							
Windrow 13 West	AREA30	38.8	364.9877	6345.0263	270	0.20	0.49	0.45	53	133	123
			364.9881	6345.0203							
			364.9432	6345.0176							
			364.9428	6345.0236							
Windrow 13 East	AREA31	35	365.0327	6345.0291	270	0.20	0.49	0.45	53	133	123
			365.0331	6345.0231							
			364.9882	6345.0203							
			364.9878	6345.0263							
Windrow 14 West	AREA32	38.8	364.9881	6345.0199	270	0.20	0.49	0.45	53	133	123
			364.9885	6345.0139							
			364.9436	6345.0111							
			364.9432	6345.0171							

Table 4 – Area source configuration for the Proposed Modification											
Description	**Source ID**	**Elevation (m)**	**UTM east (km)**	**UTM north (km)**	**Area (m^2)**	**SOER ($ou.m^3/m^2.s$)**	**SOER P/M60 2.5 ($ou.m^3/m^2.s$)**	**SOER P/M60 2.3 ($ou.m^3/m^2.s$)**	**OER ($ou.m^3/s$)**	**OER P/M60 2.5 ($ou.m^3/s$)**	**OER P/M60 2.3 ($ou.m^3/s$)**
Windrow 14 East	AREA33	35	365.0331	6345.0226	270	0.20	0.49	0.45	53	133	123
			365.0335	6345.0166							
			364.9886	6345.0139							
			364.9882	6345.0199							
Windrow 15 West	AREA34	38.8	364.9885	6345.0133	270	0.20	0.49	0.45	53	133	123
			364.9889	6345.0073							
			364.944	6345.0046							
			364.9436	6345.0106							
Windrow 15 East	AREA35	35	365.0335	6345.0161	270	0.20	0.49	0.45	53	133	123
			365.0339	6345.0101							
			364.989	6345.0073							
			364.9886	6345.0133							
Windrow 16 West	AREA36	38.8	364.9889	6345.0069	270	0.20	0.49	0.45	53	133	123
			364.9893	6345.0009							
			364.9444	6344.9981							
			364.944	6345.0041							
Windrow 16 East	AREA37	35	365.0339	6345.0096	270	0.20	0.49	0.45	53	133	123
			365.0343	6345.0036							
			364.9894	6345.0009							
			364.989	6345.0069							

Table 5 – Point source configuration for the Proposed Modification												
Description	**Source ID**	**UTM east (km)**	**UTM north (km)**	**Height (m)**	**Elevation (m)**	**Diameter (m)**	**Velocity (m/s)**	**Temperature (K)**	**Flowrate (m^3/h)**	**Discharge Conc. (ou)**	**OER (ou.m^3/s)**	**OER P/M60 2.3 (ou.m^3/s)**
Biofilter Section 1 (refurb)	STCK01	364.9949	6344.9841	1.5	36.6	11.73	0.039	303.15	15,000	500	2,083	4,792
Biofilter Section 2 (refurb)	STCK02	365.0039	6344.9846	1.5	36.6	11.73	0.039	303.15	15,000	500	2,083	4,792
Roof Fan 1	STCK07	364.9655	6344.9491	9.5	36.6	0.965	17.4	273.15	45,853	389	4,952	11,390
Roof Fan 2	STCK08	364.9661	6344.9392	9.5	36.6	0.965	17.4	273.15	45,853	389	4,952	11,390
Roof Fan 3	STCK09	364.9668	6344.9292	9.5	36.6	0.965	17.4	273.15	45,853	389	4,952	11,390
Roof Fan 4	STCK10	364.9562	6344.9386	9.5	36.6	0.965	17.4	273.15	45,853	389	4,952	11,390
Roof Fan 5	STCK11	364.9761	6344.9398	9.5	36.6	0.965	17.4	273.15	45,853	389	4,952	11,390

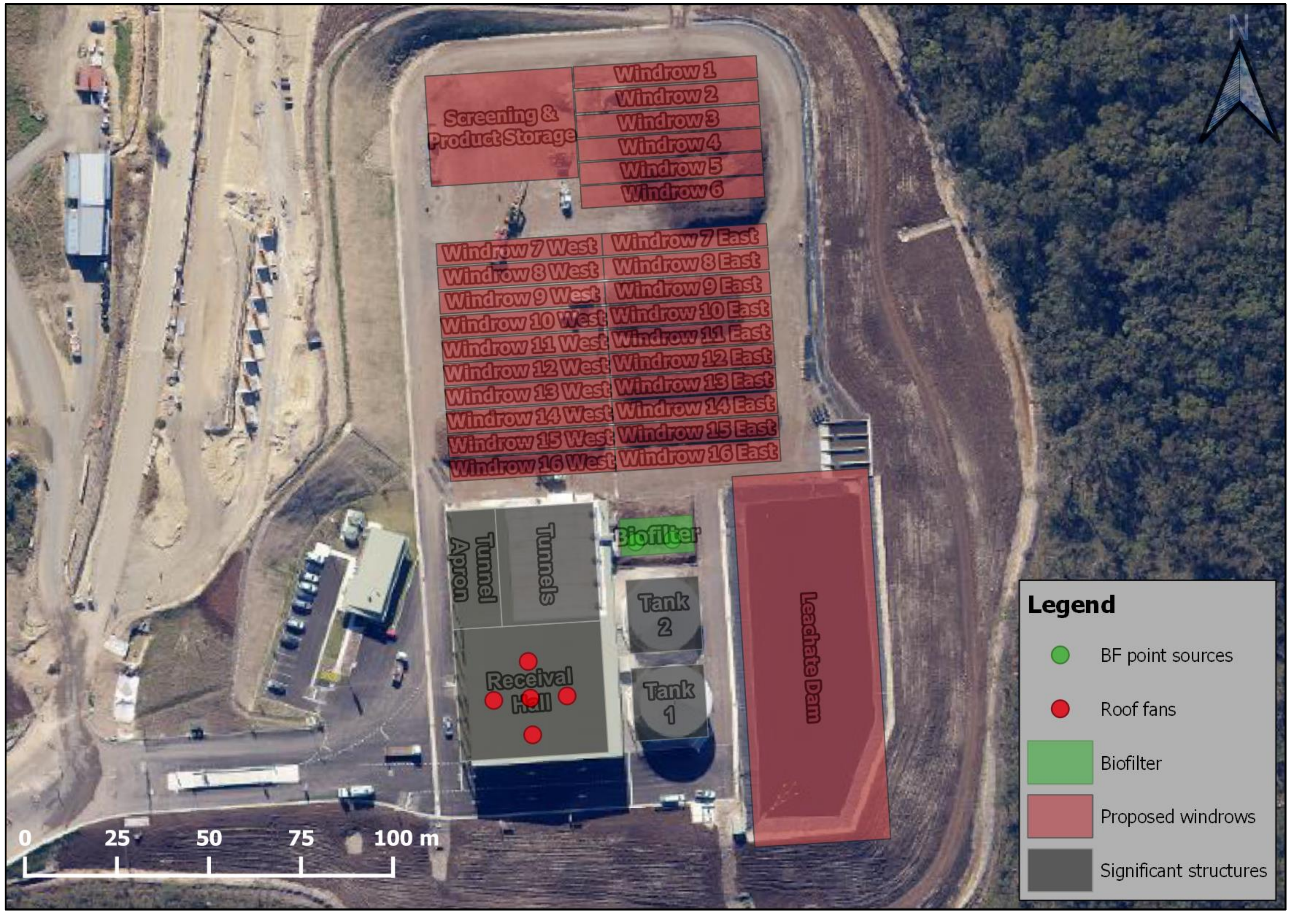


Figure 3 – The Proposed Modification layout (note: roof fan locations are indicative only and the exact location will be subject to engineering design)

7. Revised Odour Modelling Results

The Odour Dispersion Modelling results for the discrete receptors in **Table 6** shows predicted ground-level odour concentration (99%, P/M60) reduction of:

- Between 80% to 82% for Receptors 1, 2, 3 and 4 at Toronto in the southeast direction;
- 65% at Receptor 7 at Toronto in the northeast direction; and
- Between 52% to 62% for Receptors 5, 6 and 8 at Awaba in the northwest direction.

Table 6 – Discrete receptor results

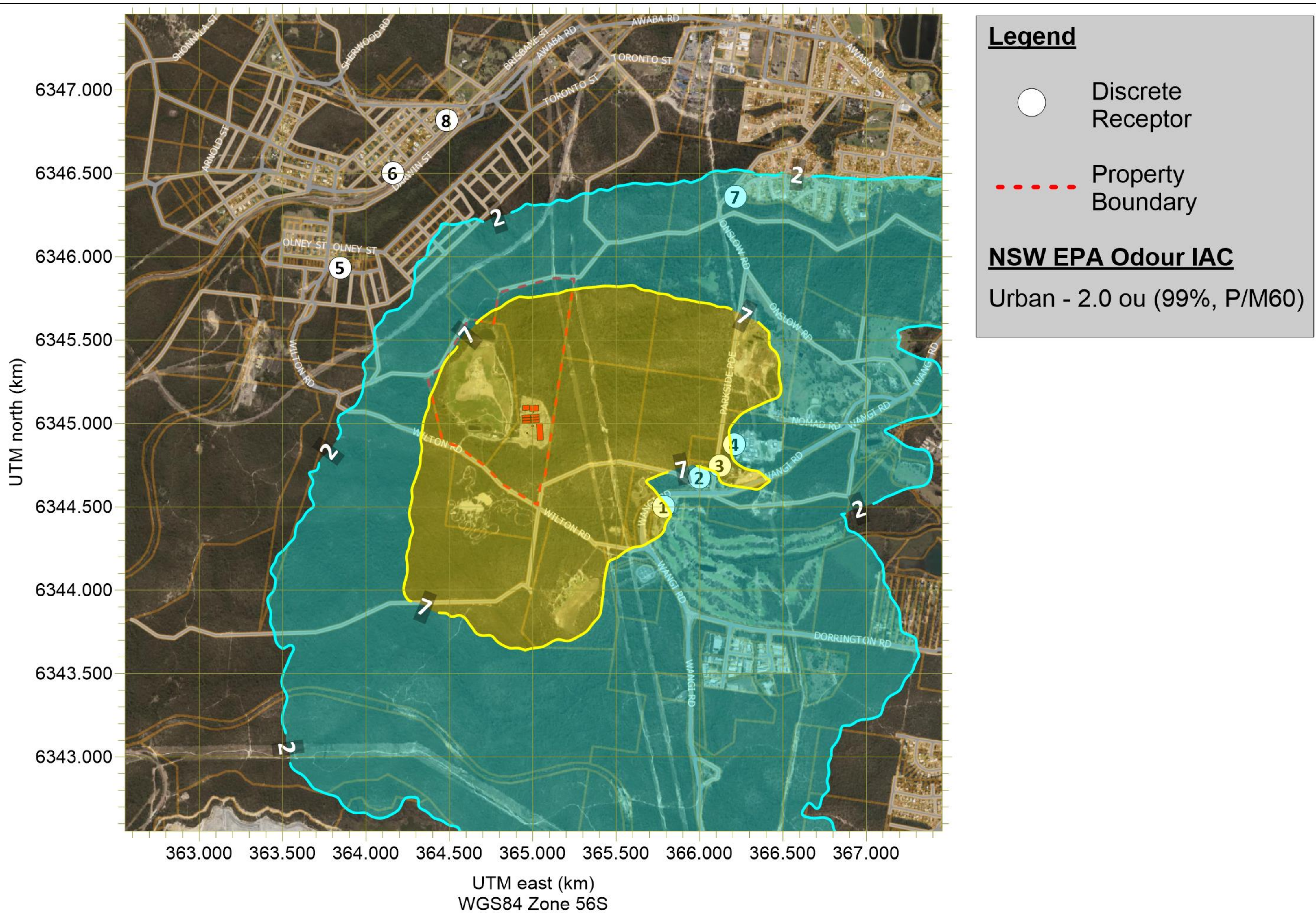
Receptor ID	Location	Current Operation (ou)	Proposed Modification (ou)	Change (%)
1	Golf Club	8.7	1.6	-82%
2	Toronto Adventist Public School	9.2	1.9	-80%
3	Site 4/3 Parkside Parade, Toronto	8.5	1.7	-80%
4	Unit 32/3 Parkside Parade, Toronto	8.6	1.7	-80%
5	12 Sydney Street, Awaba	0.9	0.4	-61%
6	25 Brisbane St, Awaba	1.1	0.4	-62%
7	34 Correa Court, Toronto	2.4	0.8	-65%
8	5 Brisbane St, Awaba	0.8	0.4	-52%

The Revised Odour Modelling results are visually presented as follows:

- **Figure 4** – Current Operation odour contour plot cumulative all sources;
- **Figure 5** – Current Operation odour contour plot by source group;
- **Figure 6** – Proposed Modification odour contour plot cumulative all sources; and
- **Figure 7** – Proposed Modification odour contour plot by source group.

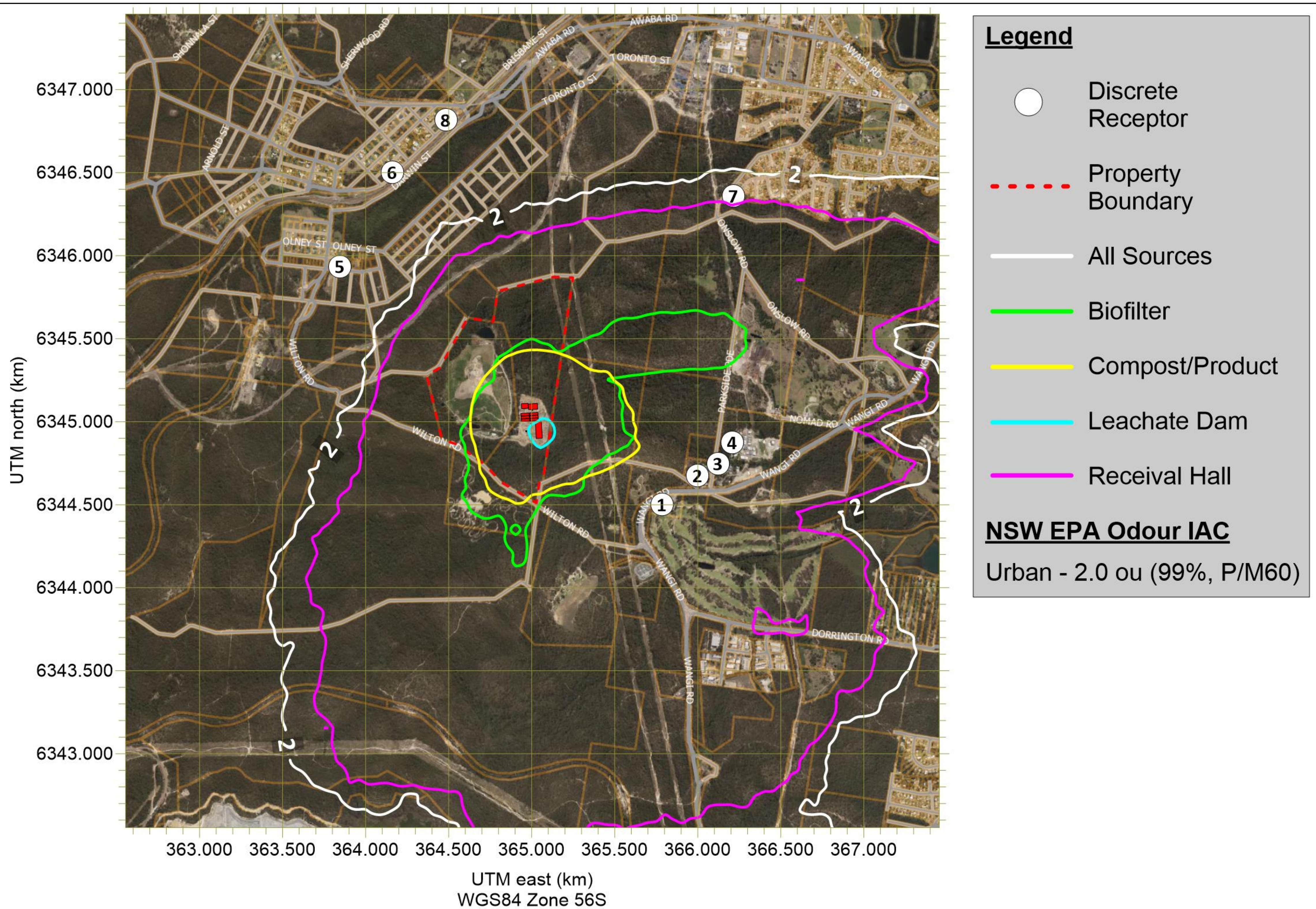
The cumulative odour contour plots for all sources show the 2 ou (99% P/M60) and 7 ou (99% P/M60) isopleths representing the range of New South Wales Environment Protection Authority (**NSW EPA**) odour impact assessment criteria for single rural residence to urban area, respectively. The cumulative plots show a reasonable reduction in the predicted odour footprint from the Current Operation to the Proposed Modification.

The source group odour plots show the individual contribution of the sources by process type. The majority of the predicted odour footprint can be largely attributed to the Open Composting Area, followed by the Receival Hall.



CALPUFF Modelling System REMONDIS Modelled by: S. Hayes 11/12/22 Checked by: M. Assal	**Remondis LMORR Facility Awaba NSW Existing (2022) - All Sources Predicted Odour Impact**	Ground level odour concentrations (ou, 99%, P/M60) Contour levels indicated 2020 meteorology

Figure 4 – Current Operation odour contour plot cumulative all sources



CALPUFF Modelling System REMONDIS Modelled by: S. Hayes 11/12/22 Checked by: M. Assal	**Remondis LMORR Facility Awaba NSW** **Existing (2022) - Source Groups** **Predicted Odour Impact**	Ground level odour concentrations (ou, 99%, P/M60) Contour levels indicated 2020 meteorology

Figure 5 – Current Operation odour contour plot by source group

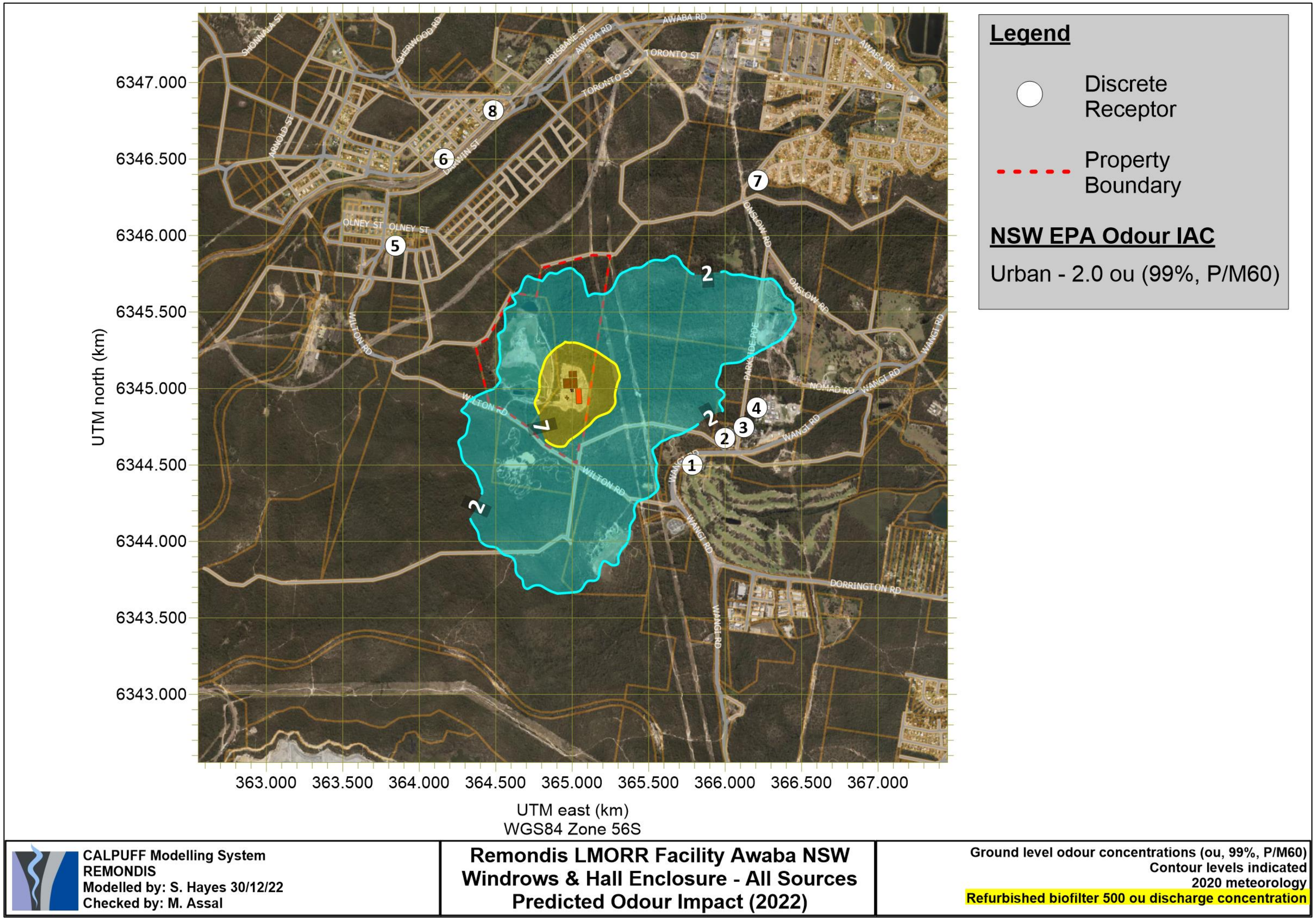


Figure 6 – Proposed Modification odour contour plot cumulative all sources

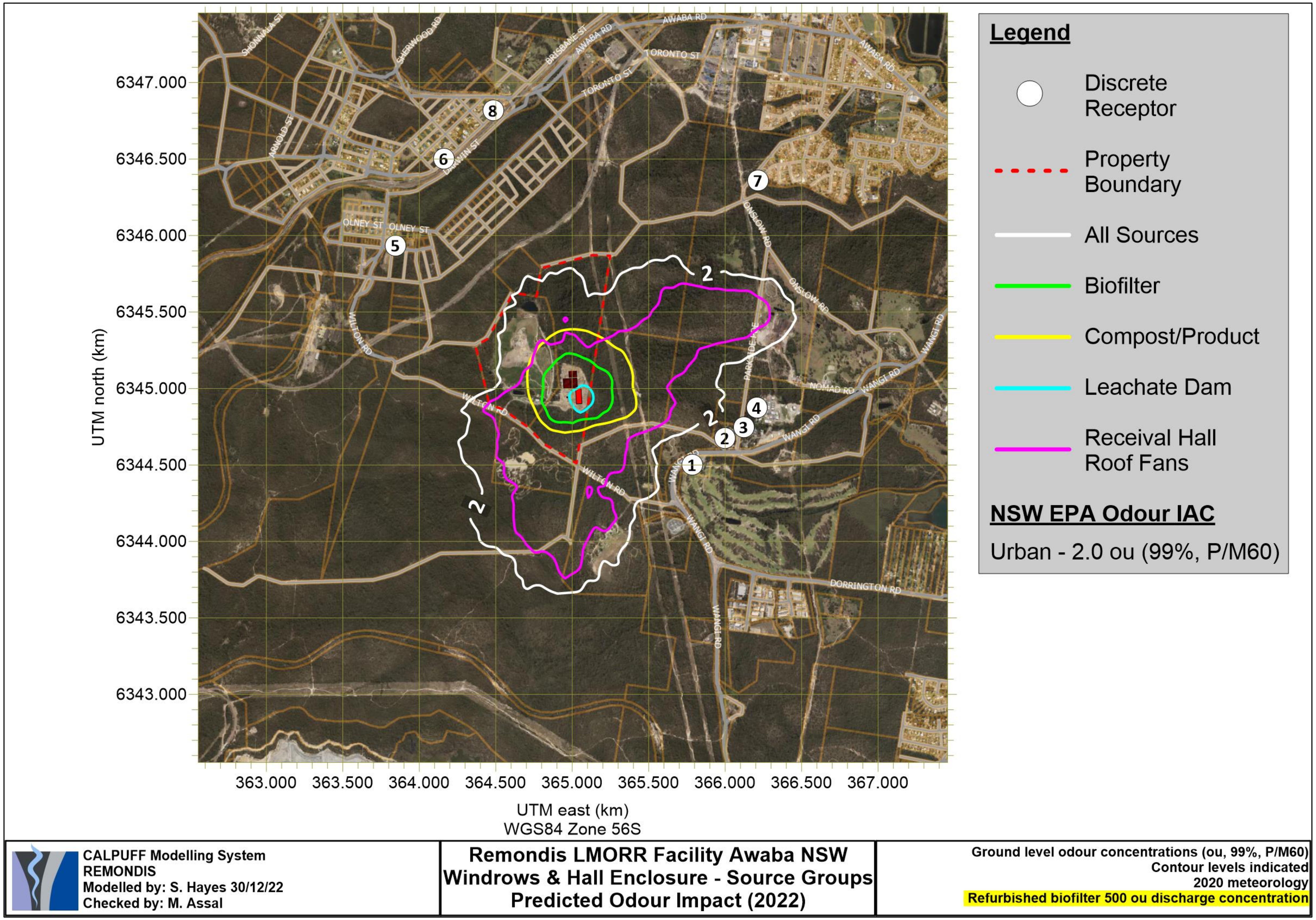


Figure 7 – Proposed Modification odour contour plot by source group

8. Concluding Remarks

The Revised Odour Modelling has found that the Proposed Modification has the potential to reduce the predicted odour concentration (99%, P/M60) at nearby receptors in Toronto and Awaba between approximately 52% and 82% compared with the Current Operation. This should lead to a significant improvement in the amenity outcome for the community surrounding the ORRF.

Yours sincerely,

The Odour Unit

Steve Hayes BSc	Michael Assal MEngSc, B. Eng (Hon)/B.Sc, AMIChemE, MIEAust, CAQP
Principal Atmospheric Scientist	Operations Manager

Attachments:

- Odour laboratory analysis results report: 30 November 2022; and
- Meteorological dataset memorandum.

☑ **Sydney Laboratory**
The Odour Unit Pty Ltd
Level 3, 12/56 Church Avenue
MASCOT NSW 2020
P: +61 2 9209 4420
E: info@odourunit.com.au
ABN: 53 091 165 061

☐ **Brisbane Laboratory**
The Odour Unit (QLD) Pty Ltd
2/57 Neumann Road
CAPALABA QLD 4165
P: +61 7 3245 1700
E: qldinfo@odourunit.com.au
ABN: 87 102 255 765

Odour Concentration Measurement Report

Sampling and Laboratory Information

Organisation	REMONDIS Australi Pty Ltd	Telephone	+61 459 825 465
Contact	A. Trivedi	Email	amrish.trivedi@remondis.com.au
Sampling Site	Awaba, NSW	Sampling Personnel	TOU (JS & IF)
Sampling Method	AS/NZS 4323.3 & AS/NZS 4323.4	Laboratory Location	Mascot, NSW

Order and Project Information

Order requested by	A. Trivedi	Order accepted by	M. Assal
Date of order	23.11.2022	TOU Project #	N2267L.03
Order number	Refer to correspondence	Project Manager	M. Assal
Signed by	Refer to correspondence	Panel Operator	A. Schulz / I. Farrugia

Investigated Item — Odour concentration in odour units 'ou', determined by sensory odour concentration measurements, of an odour sample supplied in a sampling bag.

Identification — The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification), sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.

Method — The odour concentration measurements were performed using dynamic olfactometry according to the Australian/New Zealand Standard: Stationary source emissions – *Part 3*: '*Determination of odour concentration by dynamic olfactometry* (AS/NZS 4323.3). The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.

Measuring Range — The measuring range of the olfactometer is $2^2 \leq \chi \leq 2^{18}$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted. The machine is not calibrated beyond dilution setting 2^{17}. This is specifically mentioned with the results.

Environment — The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained at 22 ºC ±3 ºC.

Measuring Dates — The date of each measurement is specified with the results.

Instrument Used — The olfactometer used during this testing session was:
TOU-OLF-004

Laboratory Precision — The precision of this laboratory (expressed as repeatability) for sensory quality must be $r \leq 0.477$ in accordance with the AS/NZS 4323.3.
$r = 0.365$ Compliance – Yes

Laboratory Accuracy — The accuracy of this laboratory for sensory quality must be $A \leq 0.217$ in accordance with the AS/NZS 4323.3.
$A = 0.216$ Compliance – Yes

Lower Detection Limit (LDL) — The LDL for the olfactometer has been determined to be 16 ou, which is 4 times the lowest dilution setting.

Traceability — The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. The assessors are individually selected to comply with fixed criteria and are monitored in time to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen. Note Disclaimers on last page of this document.

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced, except in full.

Date: Friday, 30 December 2022

Panel Roster Number: SYD20221201_088

A. Schulz
Authorised Signatory

THE ODOUR UNIT

Odour Sample Measurement Results
Panel Roster Number: SYD20221201_088

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution	Dilution Equipment ID	Diluted Odour Concentration (ou)	Final Odour Concentration (ou)
#1 – MAF 1 East: Middle	SC22623	30.11.2022 1115 hrs	01.12.2022 1003 hrs	4	8	--	--	--	939	939
#2 – MAF 1 – East: Top	SC22624	30.11.2022 1128 hrs	01.12.2022 1027 hrs	4	8	--	--	--	2,440	2,440
#3 – MAF 3 East: Middle	SC22625	30.11.2022 1208 hrs	01.12.2022 1110 hrs	4	8	--	--	--	395	395
#4 – MAF 3 East: Top	SC22626	30.11.2022 1209 hrs	01.12.2022 1140 hrs	4	8	--	--	--	362	362
#5 MAF 2 East: Top	SC22627	30.11.2022 1259 hrs	01.12.2022 1247 hrs	4	8	--	--	--	790	790
#6 MAF 2 East: Middle	SC22628	30.11.2022 1254 hrs	01.12.2022 1319 hrs	4	8	--	--	--	431	431
#7 Matured: Screened Compost	SC22629	30.11.2022 1408 hrs	01.12.2022 1355 hrs	4	8	--	--	--	332	332

Samples Received in Laboratory – From: I. Farrugia & J. Schulz Date: 30/11/2022 & 01/12/2022 Time: 1800 hrs & 1300 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit:

1. The collection of samples by a method that is not prescribed by AS/NZS 4323.3.
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit have performed the dilution of samples.

THE ODOUR UNIT

Accreditation Number:
14974

Odour Sample Measurement Results
Panel Roster Number: SYD20221201_088

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution	Dilution Equipment ID	Diluted Odour Concentration (ou)	Final Odour Concentration (ou)
#8 Matured: Unscreened Compost (Disturbed)	SC22630	30.11.2022 1408 hrs	01.12.2022 1426 hrs	4	8	--	--	--	279	279
#9 Biofilter Outlet (further from inlet)	SC22631	30.11.2022 1438 hrs	01.12.2022 1500 hrs	4	8	--	--	--	256	256
#10 – Biofilter Outlet (closet to inlet)	SC22632	30.11.2022 1449 hrs	01.12.2022 1608 hrs	4	8	--	--	--	2,900	2,900
#11 – Receival Area (Unshredded)	SC22633	01.12.2022 0823 hrs	01.12.2022 1635 hrs	4	8	--	--	--	15,000	15,000
#12 – Shredder Area: Downwind	SC22634	01.12.2022 0857 hrs	01.12.2022 1706 hrs	4	8	--	--	--	5,790	5,790

Samples Received in Laboratory – From: I. Farrugia & J. Schulz Date: 30/11/2022 & 01/12/2022 Time: 1800 hrs & 1300 hrs

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit:

1. The collection of samples by a method that is not prescribed by AS/NZS 4323.3.
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit have performed the dilution of samples.

THE ODOUR UNIT

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS 4323.3 (Yes / No)
n-butanol	SYD20221201_088	51,000	$20 \leq \chi \leq 80$	724	70	Yes

Comments: Odour characters (non-NATA accredited) as determined by odour laboratory panel:

SC22623 dirt, soil, grassy
SC22624 dirt, soil, grassy, herbaceous
SC22625 dirt, soil, grassy
SC22626 dirt, soil
SC22627 dirt, soil, herbaceous
SC22628 dirt, soil, herbaceous
SC22629 dirt, soil, herbaceous
SC22630 dirt, soil,
SC22631 dirt, soil, herbaceous
SC22632 dirt, soil, herbaceous
SC22633 herbaceous
SC22634 herbaceous, dirt, soil

Departures: Clause 9.5.3 (d) – Cross-sectional distribution of airflow and concentration from port-openings are not checked due to impracticality of the requirement.

Disclaimers:
1. Parties, other than The Odour Unit, responsible for collecting odour samples have advised that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit for the purpose of odour testing.
2. The collection of odour samples by parties other than The Odour Unit relinquishes The Odour Unit from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.
3. Any comments included in, or attachments to, this Report are not covered by the NATA Accreditation issued to The Odour Unit.
4. This report shall not be reproduced, except in full, without written approval of The Odour Unit.

Report Status

Status	Version	Prepared by	Date	Checked by	Date	Change	Reason
Draft	0.1	A. Schulz	09/12/2022	M. Assal	09/12/2022	--	--
Final	1.0	A. Schulz	09/12/2022	M. Assal	09/12/2022	--	--
Revised	1.1	--	--	--	--	--	--

END OF DOCUMENT

Kyle Gilchrist
Senior Consultant
Air Quality Support
kyle@airqualitysupport.com.au

3 October 2022

Steve Hayes
Senior Atmospheric Scientist & Consultant
The Odour Unit (Qld) Pty Ltd

By email: shayes@odourunit.com.au

D22A-3: Meteorological Dataset – Remondis Waste Facility, Awaba NSW

Dear Steve

Air Quality Support (AQS) was commissioned by The Odour Unit Pty Ltd (The Odour Unit) to generate a three-dimensional meteorological dataset for Remondis Waste Facility, Awaba NSW.

The meteorological dataset was generated using a modelling system which employed the Weather Research and Forecast (WRF) prognostic model and the CALMET diagnostic model, which converted the data into a format suitable for direct use with the CALPUFF dispersion model.

WRF and CALMET were configured based on best practices. CALMET was configured based on principles discussed in the CALPUFF users' manual (TRC, 2009) and the New South Wales (NSW) Modelling Guidance document (Barclay and Scire, 2011), prepared specifically for NSW, but which also cover general principles of dispersion modelling that are applicable to any location.

This memorandum summarises the methodology, assumptions, of the various models and includes results of the validation study in the appendix. This memo accompanies the CALMET meteorological dataset uploaded to the AQS FTP server, available for download at https://we.tl/t-EB4IhsFe7g. The files will be available for download for four weeks. Should you require an extension, please let us know.

If you have any questions or comments, please feel free to contact the undersigned.

Kind regards,

Kyle Gilchrist

Senior Consultant
Air Quality Support
E: kyle@airqualitysupport.com.au
M: +61 410 894754

1 Selection of representative year

The selection of representative year for modelling considered observations of meteorological variables critical to dispersion. Temperature, relative humidity, wind speed and direction collected from the BoM AWS site at Cooranbong (station ID: 61412) from 1 January 2016 to 31 December 2021 were analysed in order to determine the most suitable representative year for dispersion modelling purposes.

In addition to these, the El Niño Southern Oscillation Index (SOI), which indicates the development and intensity of El Niño and La Niña events, was also considered. SOI values in the range of -7 to 7 in the SOI is indicative of a neutral period. SOI values below -7 are indicative of El Niño, causing a reduction in winter and spring rainfall. On the other hand, SOI values above 7 are typically associated with La Niña events, generally related to wetter than normal rainfall conditions. SOI values were sourced from the BoM website (2022).

The selection of representative year was based on the following:

- Distributions of temperature, relative humidity, wind speed and direction (U- and V- components of wind) should be as close to the mean distribution as possible.
- Sustained El Niño and La Niña events should be avoided.

The year 2020 was selected as the representative year to be used in the assessment. This is based on the following reasons:

- The Pearson correlation coefficients for all variables are generally greater than 0.99 for most years.
- The years 2016, 2017, and 2018 have the greatest number of neutral months.
- While SOI values 2020 exceeded the threshold for individual months, these are not sustained and tend to be closer to the threshold value compared to other periods.
- The year 2020 is the most recent period where the criteria for selection of representative period are suitable.

Table 1-1 Statistics used in selection of representative year

Statistics	Parameter	2016	2017	2018	2019	2020	2021
Pearson Correlation Coefficient	Temperature	0.9971	0.9936	0.9976	0.9931	0.9990	0.9923
	Relative Humidity	0.9982	0.9933	0.9949	0.9986	0.9956	0.9454
	Wind speed	0.9988	0.9983	0.9992	0.9992	0.9994	0.9982
	U-component of wind	0.9997	0.9996	0.9986	0.9997	0.9999	0.9981
	U-component of wind	0.9966	0.9995	0.9980	0.9988	0.9995	0.9997
	Average Coefficient	0.9981	0.9969	0.9977	0.9979	0.9987	0.9867
# Neutral Years	SOI	8	8	8	7	7	6

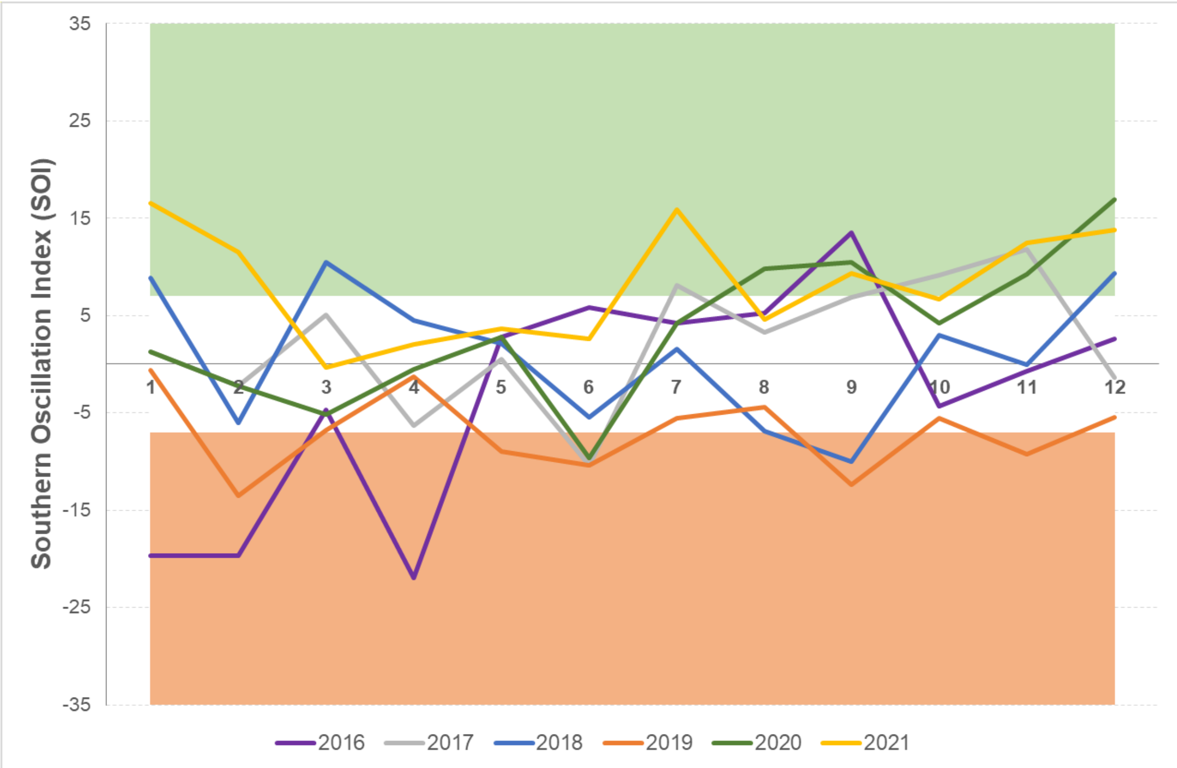


Figure 1-1 Southern Oscillation Index (SOI) from 2016 to 2021

2 Prognostic model

2.1 Weather Research and Forecasting model

The prognostic WRF model was used to generate a three-dimensional meteorological dataset for January to December 2016 and 2020.

The WRF model is a next-generation meso-scale numerical weather prediction system designed to serve both atmospheric research and operational forecasting needs. It features two dynamical cores, a data assimilation system and a software architecture allowing for parallel computation and system extensibility. WRF was developed as a collaboration partnership principally among the United States based National

Centre for Atmospheric Research (NCAR), the National Oceanic and Atmospheric Administration (represented by the National Centres for Environmental Prediction (NCEP) and the (then) Forecast Systems Laboratory (FSL)), the Air Force Weather Agency (AFWA), the Naval Research Laboratory, the University of Oklahoma, and the Federal Aviation Administration (FAA).

The WRF model is used in a growing number of applications that include national meteorological services, military applications, governments, and universities worldwide. The model serves a wide range of meteorological applications across scales ranging from metres to thousands of kilometres.

The core components of the WRF system are the WRF Pre-processor (WPS) and the Advanced Research WRF (ARW) solver.

WPS covers all the processing preliminary information required by the WRF model, which includes establishing the model domain and initialising meteorological conditions. The usual process involves formatting geographical and meteorological data available with the model. However, due to the open-source code nature of the WRF model, it is possible to customise the data for input to represent more accurately these features in the model.

The ARW component of WRF includes extended capabilities for nesting, uses a terrain-following sigma coordinate system, and uses a pressure-based system to define the vertical levels. The pressure levels are based on the reanalysis files used to initialise the WRF model.

WRF provides extensive physics options on model parameterisation. For this domain, the CONUS Physics suite was used. These settings considered appropriate to use for temperate locations with a similar geographical profile.

WRF (version 4.2.2) was configured as follows:

- Modelling period from 1 January to 31 December 2020
- Four nested domains (Figure 2-1), with resolutions of 8.1 km, 2.7 km, 900m, 300 m.
- Estimated centre of the innermost domain located close to the Awaba township (33.009° S, 151.547° E).
- WRF analysis was initialised using NCEP Final Analysis (ds083.3), reanalysis data provided at 6-hourly temporal resolution at 0.25° spatial resolution.
- Mercator projection to ensure compatibility with the CALMET/CALPUFF models.

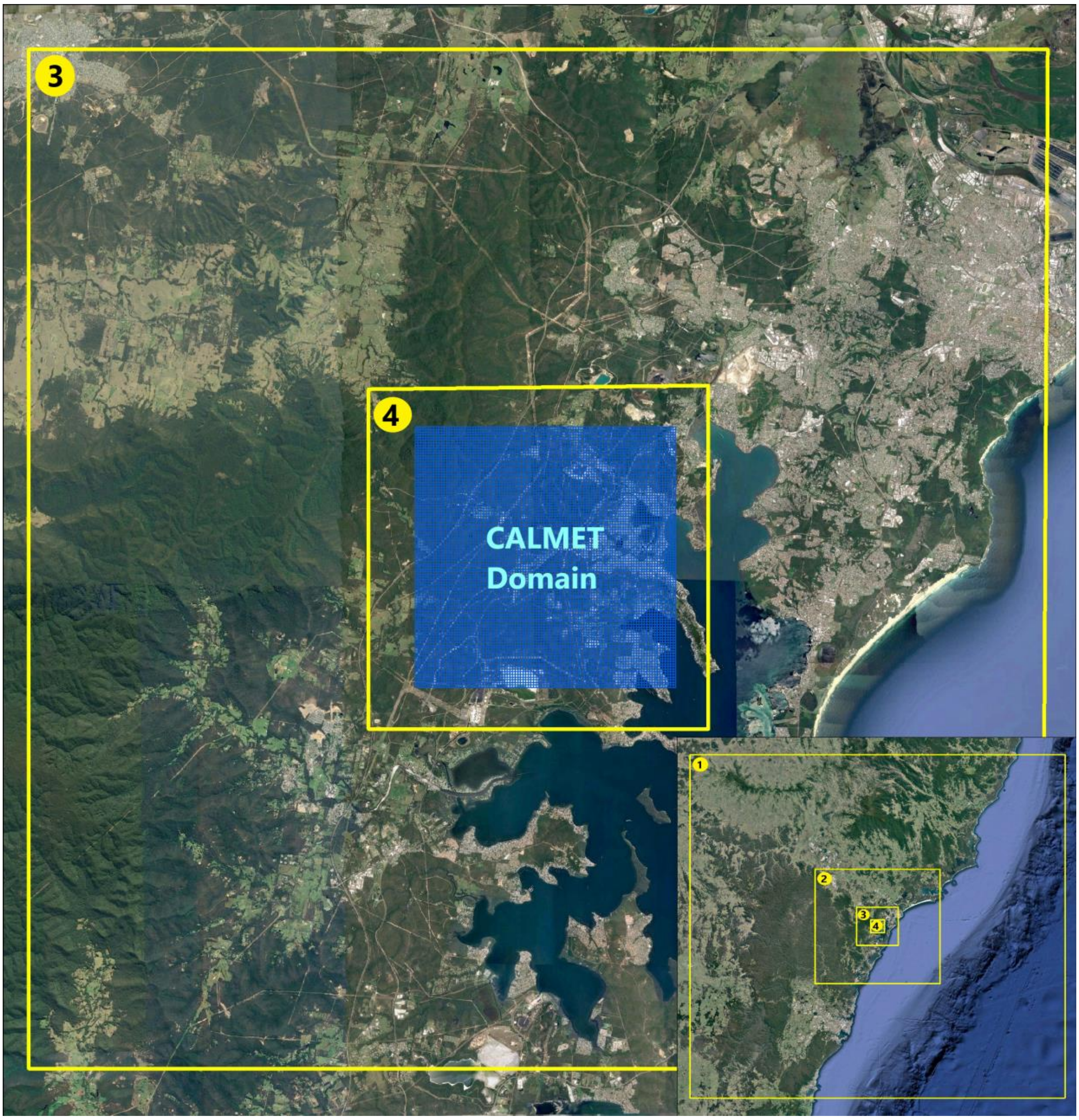


Figure 2-1 WRF and CALMET modelling domains

2.2 CALMET

CALMET (TRC, 2009) is an advanced non-steady-state diagnostic 3D meteorological model typically used as the meteorological pre-processor for the CALPUFF dispersion model. CALMET can read hourly meteorological data from a single or multiple sites within the modelling domain. CALMET can also be initialised with gridded 3D data from prognostic models such as WRF. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was used to simulate meteorological conditions in the region, using a combination of surface observations and WRF-generated 3D meteorological data in hybrid mode. The BoM Cooranbong AWS, the Remondis on-site station, as well as the Maitland AWS station were incorporated into the surface dataset. Despite being outside of the CALMET domain, meteorological data collected at the BoM sites in Coorabnbong and Maitland stations were used to complete the input meteorological data required by CALMET. Locations of all surface stations included are shown in Figure 2-2.

Hourly meteorological data collected at the above stations were used in conjunction with the gridded WRF 3D wind field data from the innermost nest. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was configured in accordance with modelling and assessment guidelines detailed in the Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, Australia (Barclay and Scire, 2011).

CALWRF (version 2.0.3) was used to extract the WRF output and convert to a format (i.e. 3D.DAT) suitable to use as direct input to CALMET.

CALMET (version 6.5.0) was configured as follows:

- Modelling period for one year from 1 January to 31 December 2020;
- Domain area of 99 by 99 grid points at 100 m spacing
- Twelve vertical levels set at 20 m, 40 m, 80m, 160 m, 320 m, 640 m, 1000 m, 1500 m, 2000 m, 2500 m, 3000 m, and 4000 m;
- Extrapolation of surface station information using similarity theory, ignoring layer 1 data;
- Elevation data customised using SRTM 90-m (version 4.0) dataset (CGIAR, 2004);
- Land use data customised using the NSW Land Use Dataset (NSW Gov, 2017)
- Terrain radius of influence set at 2 km;
- Hybrid mode using surface observations and prognostic wind fields generated by WRF input as MM5/3D.dat at upper air as initial guess field;
- Relative weighting of the first guess field and observations in the surface layer (R1) set to 4 km;
- Relative weighting of the first guess field and observations in the layers aloft (R2) set to 4 km;
- Maximum radius of influence over land in the surface layer (RMAX1) set to 4 km;
- Maximum radius of influence over land aloft (RMAX2) set to 8km;
- All other options set to default.

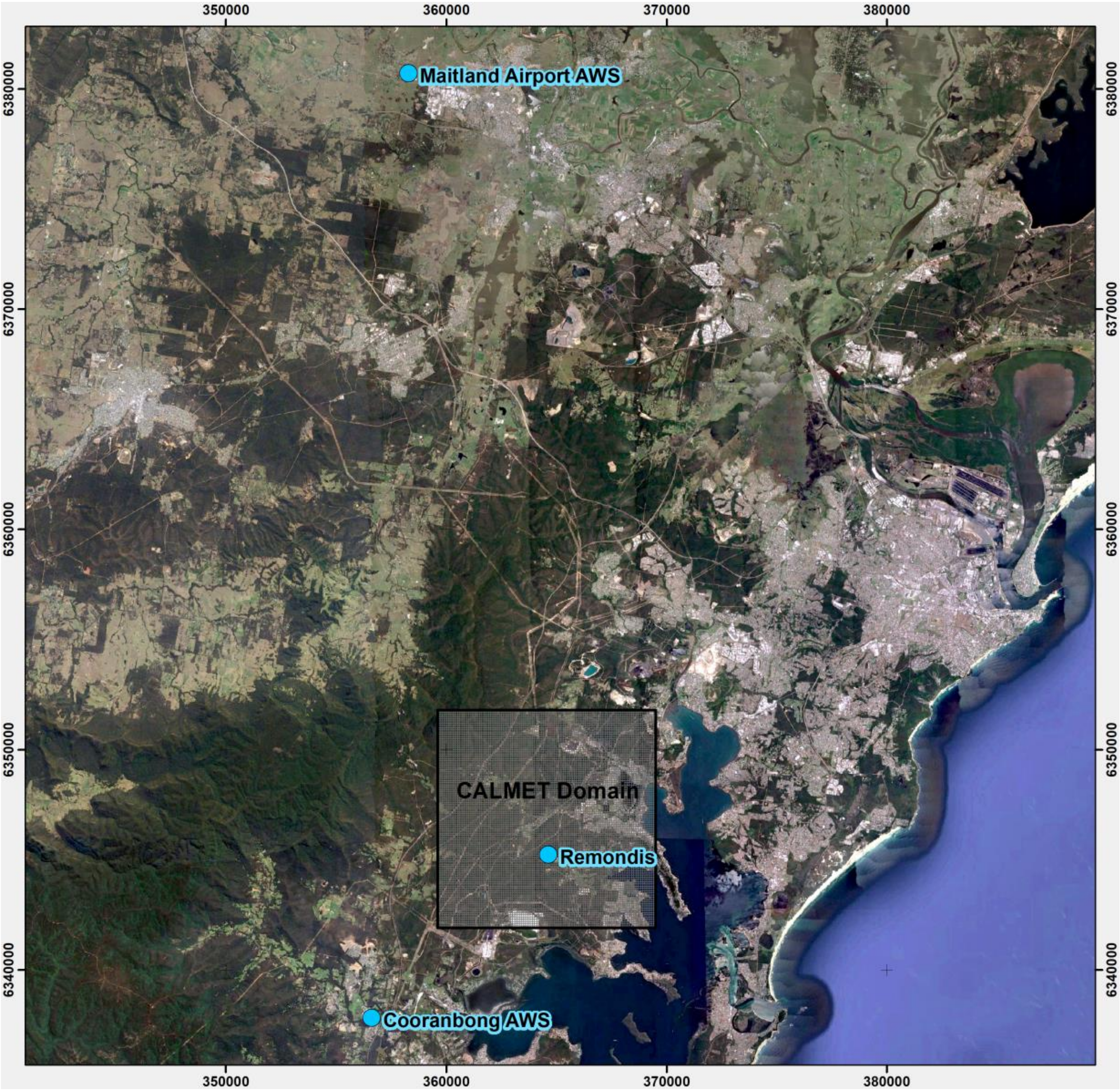


Figure 2-2 Location of the AWS Sites used in CALMET modelling

3 Dispersion Meteorology

This section presents an analysis of the site-specific meteorological data generated by the WRF/CALMET meteorological modelling system. Analysis of meteorological parameters critical to the dispersion of pollutants at the locations of the proposed facilities are presented in the following sections.

3.1 Wind speed and direction

Wind speed and wind direction are important meteorological parameters that drive the dispersion of air pollutants. Distributions of winds predicted at the site location is presented in Figure 3-1.

Figure 3-1 shows that light to moderate winds (0.5 to 4 m/s) occur most frequently, approximately 72% of the time. Winds from the south-west to north north-west sectors (SW to NNW) are most common, occurring approximately 42% of the time. Calm winds occur more than 16% of the time. Strong wind speeds (> 6 m/s) are infrequent, occurring around 1% of the time.

Seasonal wind roses are shown in Figure 3-2, showing that light to moderate winds from the west to the northern sectors are most frequent during winter, spring, and autumn. Winds from the south to east sectors are common during summer.

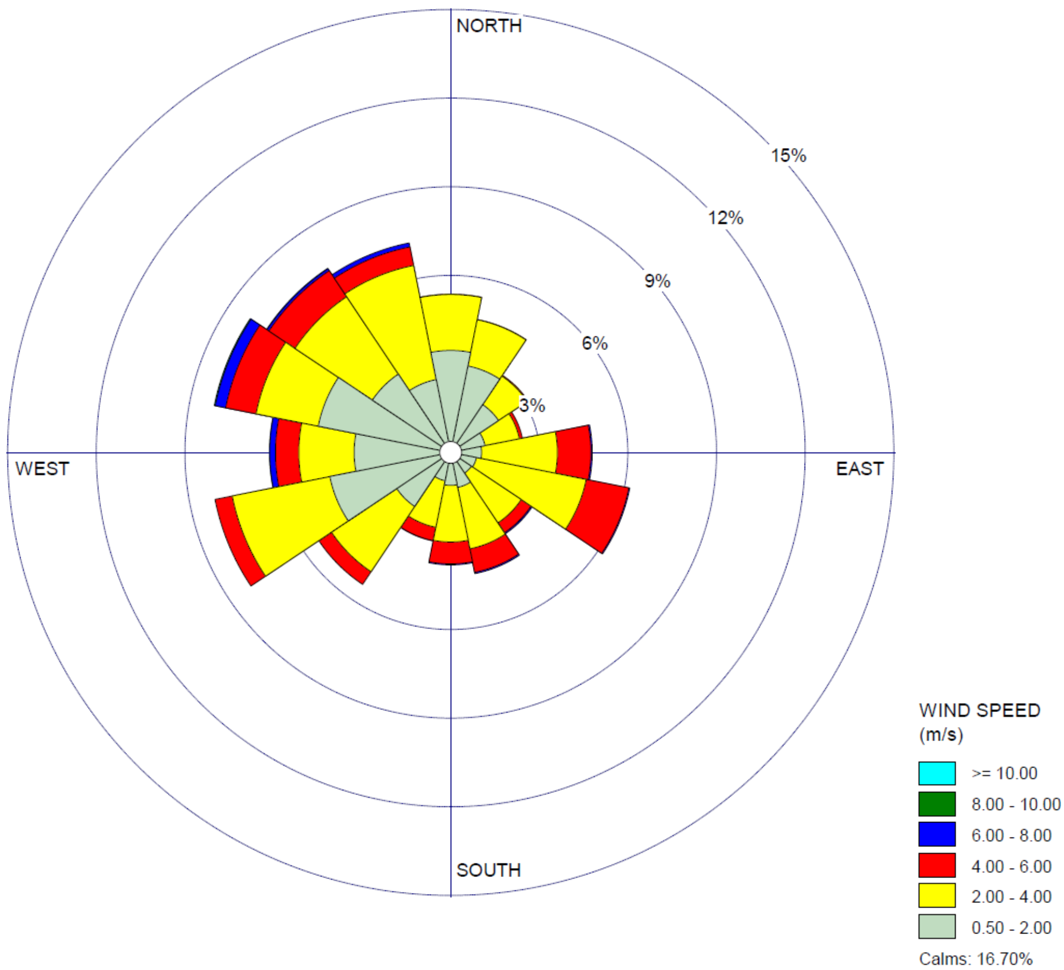


Figure 3-1 Summary of wind distribution at site location

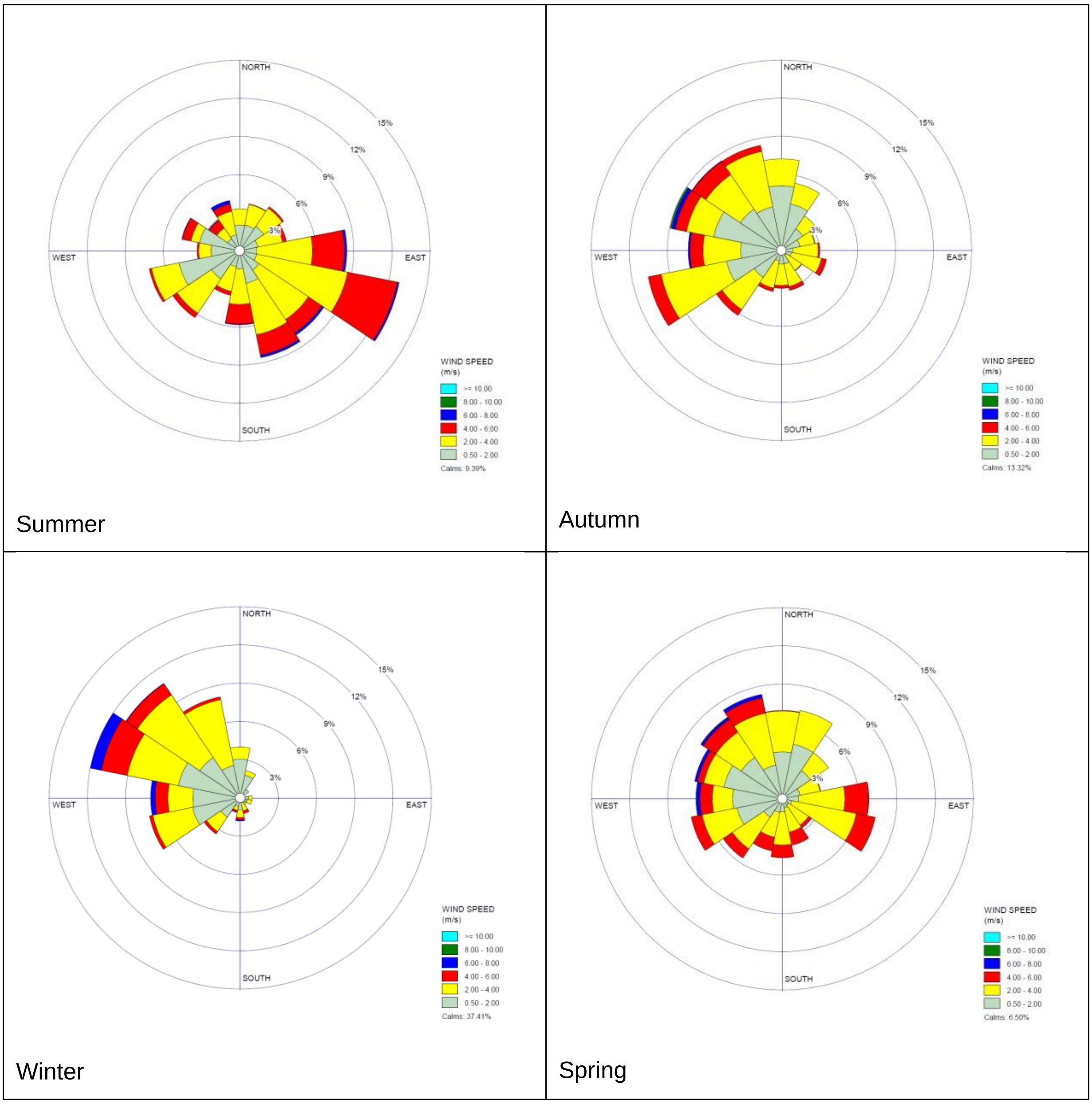


Figure 3-2: Seasonal distribution of wind at site location

3.2 Atmospheric stability

The flow of air in the planetary boundary layer (lowest one kilometre of the atmosphere) is an important factor in the dispersion of air pollutants. This flow is affected by turbulence, which describes the vertical and horizontal motion of air and how a plume may be spread out and diffused. The rate of plume diffusion is proportional to turbulence. Lower diffusion rates resulting from low turbulence results in higher concentrations in the plume.

Turbulence is driven by thermal and mechanical influences as the atmosphere interacts with the land surface. Thermally driven turbulence is generated by convection as the sun heats the ground and the air above it is warmed, causing it to rise. Mechanically driven turbulence is generated by frictional effects as wind passes over the surface or by wind shear, produced at the boundary of two coinciding layers of wind or two different air masses.

A key indicator of thermally driven turbulence or convection in the atmosphere is stability, which is measured by the environmental lapse rate or vertical temperature profile of the atmosphere. Stability is a term applied to the properties of the atmosphere that govern the acceleration of the vertical motion of an air parcel. The acceleration is positive in an unstable atmosphere (turbulence increases), zero when the atmosphere is neutral, and negative (deceleration) when the atmosphere is stable (turbulence is suppressed). The vertical temperature gradient in the atmosphere governs whether a parcel of air or plume, released into it will rise, fall, disperse, or remain relatively still. Plume warmer than the surrounding will tend to rise, while a plume cooler than the atmosphere will sink. Wind, or horizontal air movement, affects mechanical turbulence and therefore also affects atmospheric stability. As the wind speed increases, atmospheric stability will tend toward neutral conditions.

Atmospheric stability is commonly defined in terms of six main stability classifications. This is known as the Pasquill-Gifford (PG) stability classification and is widely used to describe the turbulent state of the atmosphere. The stability classes range from A Class, which represents very unstable atmospheric conditions that may typically occur on a sunny day, to F Class stability which represents very stable atmospheric conditions that typically occur during light wind conditions at night.

Unstable conditions (Classes A-C) are characterised by strong solar heating of the ground that induces turbulent mixing in the atmosphere close to the ground, and usually results in material from a plume reaching the ground closer to the source than for neutral or stable conditions. This turbulent mixing is the main driver of dispersion during unstable conditions. Dispersion processes for neutral conditions (Class D) are dominated by mechanical turbulence generated as the wind passes over irregularities in the local surface, such as terrain features and building structures. During the night, the atmospheric conditions are neutral or stable (Class D, E and F). During stable conditions, plumes from fugitive releases will be subject to minimal atmospheric turbulence. A plume released below an inversion layer during stable conditions that has insufficient vertical momentum or thermal buoyancy to penetrate the inversion will be trapped beneath it and result in elevated ground-level concentrations.

Atmospheric stability classes were derived from the meteorological dataset generated by the WRF/CALMET meteorological modelling system using the Golder (1972) relationship for calculating Pasquill-Gifford stability classes based on surface roughness and Monin-Obukhov length. This method allows for unstable conditions at night and stable conditions during the day, if warranted. The frequency distribution of the PG classes by time of day at the site location during 2017 is presented in Figure 3-3.

The hourly profile of the mixing height predicted by the WRF/CALMET meteorological modelling is shown in Figure 3-4. Figure 3-4 shows that the mixing height develops around 7am, increases to a peak around 3pm before descending rapidly at 4pm.

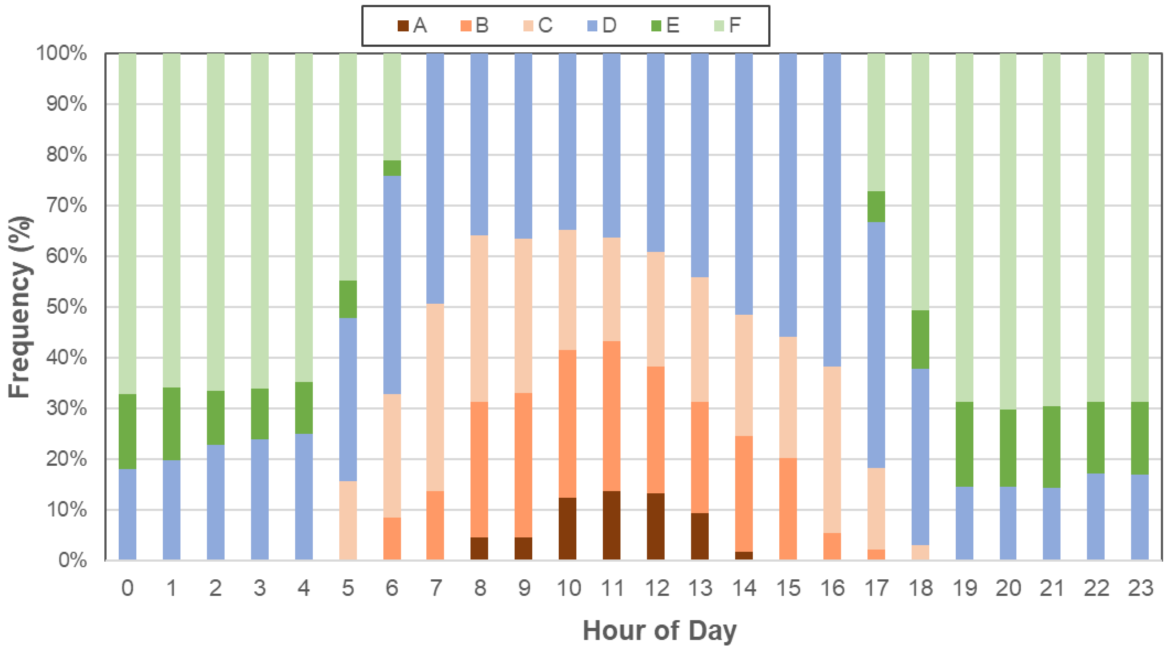


Figure 3-3 Diurnal distribution of atmospheric stability classes

3.3 Mixing height

The mixing height refers to the height above ground within which pollutants released at or near ground can mix with ambient air. During stable atmospheric conditions at night, the mixing height is often quite low, and pollutant dispersion is limited within this layer. During the day, incoming short-wave solar radiation from the sun heats the ground, which in turn re-radiates long wave radiation back into the atmosphere, heating the air above it. The heating of the air near the ground generates the growth of convection cells causing the air, and hence the mixing height, to rise. The air above the mixing height during the day is generally cooler. The growth of the mixing height is dependent on how well the air can mix with the cooler upper levels of air and therefore depends on turbulence, i.e. meteorological factors such as the intensity of solar radiation and wind speed. During strong wind speed conditions, the air will be well mixed, resulting in a high mixing height.

The hourly profile of the mixing height predicted by the WRF/CALMET meteorological modelling is shown in Figure 3-4. Figure 3-4 shows that the mixing height develops around 7am, increases to a peak around 2pm before descending rapidly at 4pm.

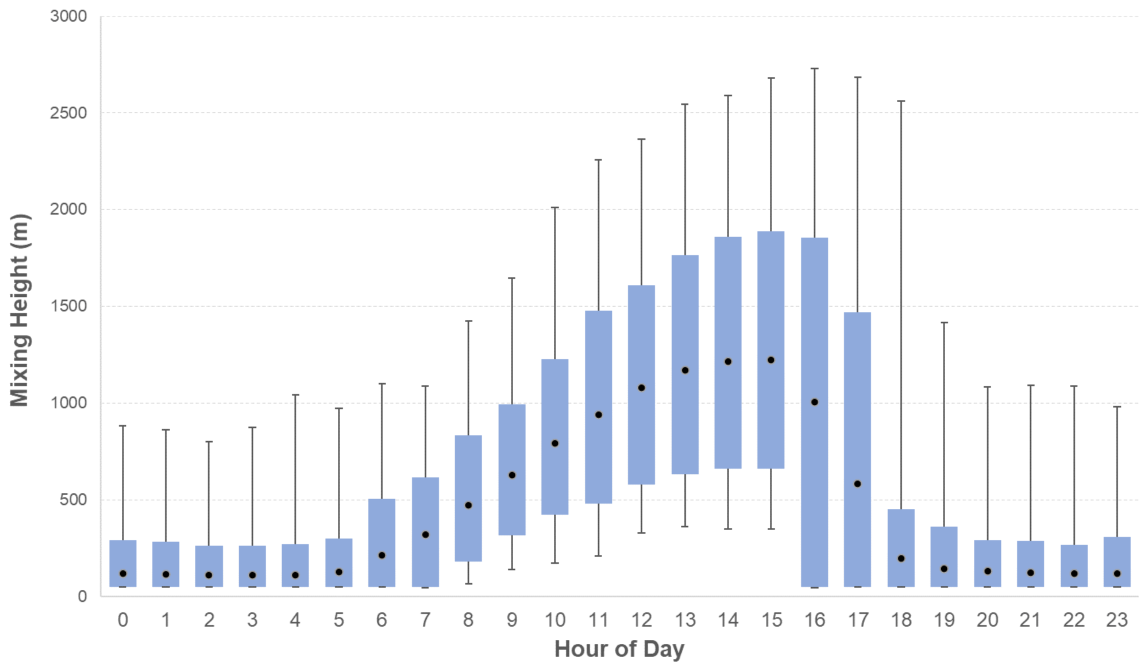


Figure 3-4 Diurnal mixing height profile

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Ground floor 20 Chandos Street
St Leonards NSW 2065

PO Box 21
St Leonards NSW 1590

02 9493 9500

www.emmconsulting.com.au

6 September 2022

Amy Regado
Section Manager Development
Lake Macquarie City Council
126-138 Main Road
SPEERS POINT NSW 2284

Project Name: Peer review of odour assessment - organic recycling facility
Project Number: E220760

Dear Amy,

Please find enclosed our review of the odour assessment for a proposed modification to the Lake Macquarie Organics Resource Recovery Facility at 413 Wilton Road, Awaba.

The review was conducted primarily by my colleague Scott Fishwick, with some additional input from me.

I hope that you find this helpful. We would be happy it to discuss it further if needed.

Yours sincerely

P. Boulter

Paul Boulter
Associate Director, Air Quality
pboulter@emmconsulting.com.au

1 Background

1.1 The AWT facility

Lake Macquarie City Council ('Council') has commissioned EMM to conduct a peer review of an odour assessment for a proposed modification to an alternative waste treatment facility ('the AWT facility') at 413 Wilton Road, Awaba, NSW. The AWT facility – which is owned and operated by Remondis – processes food and green organic waste generated within the Lake Macquarie local government area. The treatment of waste involves three aerobic composting approaches: enclosed tunnel, aerated static pile, and static pile composting.

The AWT facility has been the subject of a significant number of odour complaints since it commenced operations.

1.2 Planning history

In September 2017, Development Consent No. DA/1940/2013/A was approved by Council for the construction and operation of the AWT facility. The Development Consent further approved an increase in capacity of the AWT facility from 30,000 to 44,000 tonnes per annum, and to change the technology used at the AWT facility.

Remondis engaged GHD to prepare and lodge a Development Application (DA/1940/2013/B) with Council to modify the Development Consent. The modification seeks to change the layout and processing operations at the AWT facility in an effort to reduce the risk of odour emissions from the site. No change in capacity is sought.

1.3 Odour assessment

The following reports comprise the odour assessment for the AWT facility:

- the original odour impact assessment, prepared by GHD in 2016 (referred to here as 'GHD report'); and
- an odour assessment report for the proposed modification, prepared by The Odour Unit in 2021 (referred to here as 'TOU report).

1.4 This review

This EMM review addresses the reports by GHD and TOU. The review is designed to advise Council on whether the odour assessment addresses odour issues appropriately, follows a sound methodology with reasonable assumptions, and is well documented.

The review focuses on the technical aspects of the two reports, including:

- compliance with relevant technical guidelines;
- the definition of the existing environment;
- the calculation of odour emissions;
- the dispersion meteorology; and
- the dispersion modelling approach.

2 Review of odour assessment reports

2.1 Regulatory requirements

2.1.1 GHD report

i General

Chapter 2 of the GHD report provides an overview of the existing regulatory requirements for the AWT facility. A discussion is provided with regards to the general regulatory requirements (Section 2.1.1) and specific consent conditions (Section 2.1.1) that are relevant to the AWT facility. A discussion relating to NSW Environment Protection Authority (NSW EPA, then NSW DEC) odour impact assessment criteria is provided in Section 2.2, with the specific criteria for the AWT facility being provided in Section 2.3.

ii Meteorological monitoring

From the conditions of consent, it is understood that Remondis, the operator of the AWT facility, is required to maintain a real-time meteorological monitoring station at the AWT facility. On Page 10, GHD identifies that Remondis proposes to allow Council to utilise data collected from the AWT facility's meteorological station.

No review or analysis of the data from the AWT facility's meteorological station is provided by GHD. It is acknowledged by EMM that sufficient data from the AWT facility's meteorological station may not have been available at the time of reporting. However, this not mentioned in the report. Further discussion of meteorology is provided in Section 2.5.1 of this review.

iii Odour audit

The consent condition E1.4 required Remondis to commission an odour audit for the AWT facility within nine months of the commencement of operations. **From the GHD report, it is not clear whether such an odour audit has been completed, or what the outcomes were**.

iv Odour impact assessment criterion

The odour impact assessment criterion selected by GHD was 3 odour units (OU). This was based on an estimated existing and future impacted population surrounding the AWT facility. On page 12, GHD identifies that there are approximately 600 existing and future residents in the Awaba area to the north-west of the AWT facility, and approximately 250 existing and future residents at the Leisure Life Village to the east of the AWT facility. **GHD has justified the selection of the odour criterion based on the potentially affected population in any direction, rather than the total combined affected population**. In combination, these two populations total approximately 850.

In addition, further afield of the two population areas identified by GHD is the more densely populated suburb of Toronto. **While GHD included a sensitive receptor location (R7) at Toronto, this area was not considered in the calculation of the potentially affected population**. If the developed area of Toronto were included, the potentially affected population of 850 would increase.

To summarise, a more conservative odour impact assessment criterion (2 OU) should be considered to reflect a larger potentially affected population, accounting for the more densely populated areas to the north-west. It is noted that, based on the odour contours presented in Figure 6.1 of the GHD report, compliance with the 2 OU criterion would be achieved at all surrounding sensitive receptor locations. However this is subject to changes in the assumed dispersion meteorology and odour emissions inventory.

2.1.2 TOU report

The report by TOU does not consider regulatory requirements.

2.2 Existing environment

2.2.1 GHD report

Chapter 3 of the GHD report provides an overview of the existing environment, including a discussion of sensitive receptors, climate, and existing sources of odour emissions.

i Receptors

Section 3.1 of the report lists the sensitive receptors used in the odour assessment. These represent the closest identified existing residences or land uses to the AWT facility, and appear to be appropriate. As identified by GHD in Section 2.3 of the report, an R2 Low Density Residential zone is marked to the north of the AWT facility. **In accordance with the Approved Methods for Modelling (NSW EPA 2017), additional receptor points should have been added in this R2 zone for consideration of impacts at potential future residences**.

ii Climate

Section 3.2 discusses long-term climate data from the local area, based on rainfall and temperature measurements from the Bureau of Meteorology (BoM) automatic weather station (AWS) at Newcastle Nobbys Signal Station, located approximately 25 km north-north-east of the AWT facility. While the relevance of this BoM AWS to the AWT facility site is questionable, this is unlikely to have significant bearing on the emission calculations or dispersion modelling and is not considered further.

iii Existing odour sources

Section 3.3 discusses existing sources of odour at the Awaba Waste Management Facility (AWMF) and the AWT facility. GHD decided that the odour emissions inventory from the air quality impact assessment by PAE Holmes (2012) was appropriate for quantifying odour emissions from existing emission sources at the AWMF.

The PAE Holmes (2012) report was briefly reviewed by EMM. The odour emissions inventory was based on odour sampling conducted at the Eastern Creek Landfill in 2009. **It is unclear if the use of odour emissions data from a landfill in Western Sydney in 2009 is appropriate for the quantification of odour emissions from the AWMF in 2022**, especially considering the increased rainfall on the east coast of NSW over the past two years and the associated potential increase in landfill gas generation and resultant odour emissions.

Given the requirement to assess cumulative odour impacts from the facility and the AWMF at surrounding sensitive receptors, the accurate representation of odour emissions from the AWMF is considered an important step.

Chapter 4 of the GHD report also addresses existing and neighbouring sources of odour emissions. In addition to the AWMF, the Oz Landscapes Supplies site located 1.2 km to the east of the facility is referenced by GHD as a possible existing source of odour emissions. GHD concluded that direct cumulative impacts from the Oz Landscapes Supplies site were unlikely to occur, on the basis that the Oz Landscapes Supplies site is unlikely to ever be directly upwind of the facility and surrounding sensitive receptors at the same time. EMM agrees with this view.

2.2.2 TOU report

The report by TOU does not consider the existing environment.

2.3 Odour emission calculations

2.3.1 GHD report

Chapter 4 of the GHD report provides an overview of the odour emission calculations for the facility.

Emission rates are provided for current approved operations at the facility in Section 4.1, and for future proposed operations at the facility in Section 4.2. Summaries of the emission rates are provided in Table 4 and Table 5, respectively.

Firstly, it is noted that different odour emission rate sources are provided for the two scenarios. EMM understands that this is because there is a proposed change in the method of composting, from an open windrow composting method to a compact aerated static pile (ASP) system.

For current approved operations (referred to as GHD Scenario 1), the emission calculations were based largely on measurements recorded at a green waste composting facility in Brooklyn in 2009. Given the absence of kerbside organics at the Brooklyn facility, it is unclear how representative this source of odour emissions is for the AWT facility. This is acknowledged on page 17 of the GHD report:

> a mix of green waste and kerbside organics is expected to have higher odour levels that from straight green waste.

Odour emissions for the future operations scenario (referred to as GHD Scenario 2) were based on a full-scale food and garden organics composting trial conducted by the University of NSW at an operational resource recovery facility near Taree in 2013. GHD states that the Taree trial facility was representative of the AWT facility on the basis that the same ASP technology proposed for the AWT facility was implemented at Taree. However, **it is unclear from the material presented in the GHD report how the scale of the two operations compares**, and if there are any potential implications for odour emissions.

Other points of interest from the GHD odour emissions inventory calculations include:

- no emissions for shredding of organics material are included in either GHD odour emissions scenario;
- it is unclear how the odour emission rates for ASP1 – pile 1 and ASP2 – pile 1 were derived based on the quoted emission rates in the table notes; and
- the leachate dam odour emission rate is based on an emission rate from the Castlemaine Putrescible landfill, rather than a site-specific measurement.

The total calculated odour emission rates from all sources are:

- GHD Scenario 1 - 16,073 OU.m^3/s; and
- GHD Scenario 2 - 7,699 OU.m^3/s.

Further discussion of the GHD odour emissions inventory is provided in Section 2.3.2.

2.3.2 TOU report

The report by TOU presents a revised odour emissions inventory for the AWT facility. The emissions are based largely on odour sampling results collected at the AWT facility (also by TOU) as part of the preparation of *Lake Macquarie Organics Resource Recovery Facility – Odour Investigation Study – Final Report,* dated August 2019.

The 2019 study, referenced throughout the 2021 odour assessment, has not been provided to, or reviewed by, EMM. No additional comment can therefore be made in relation to the validity of the emissions data, and we have taken the data to be representative of the existing and proposed operation of the AWT facility.

The odour assessment report by TOU provides an overview of the proposed changes to the AWT facility with regards to material processing and storage, and the associated implications for odour emission generation. Most notably, TOU's report identifies that the AWF facility would achieve a significant reduction in facility odour emissions through the conversion of the existing mobile aerated floor (MAF) composting area to open-windrow composting stockpiles.

From the odour emissions inventory presented in the Table 1 of the report by TOU, **several numerical issues have been identified by EMM**, possibly due to rounding errors. For example:

- the derived odour emission rate of 22,000 OU.m^3/s for the MAF 1 East emission source was calculated to be 22,012.5 OU.m^3/s from the information presented in Table 1 (average of 56 and 2.7 = 29.35; 29.35 multiplied by 750 = 20,012.5);
- for the maturation area, it seems that the total source odour emission rate that is stated as 307 ou.m^3/s should actually be 312 ou.m^3/s; and
- it is not clear how the derived odour emission rate of 403 ou.m^3/s for the unscreened matured stockpile has been obtained.

A theoretical profile for the reduction in odour emissions with age of open-windrow composting is provided in Table 2 and Figure 4 of the report by TOU. The source of Figure 4 is not provided. **There appear to be further errors in the calculated emission rates in the final column of Table 2**, relative to the specific odour emission rate (SOER) and the quoted area dimension. It is also not entirely clear how the reduction in odour emission rate with time has been derived, nor how the final odour emission rate of 0.26 OU.m^3/m^2/s has been calculated.

It is noted that the odour emission rate for the leachate dam presented in Table 1 of the report by TOU has been retained from the 2016 GHD report. However, as identified in Section 2.3.1, the adopted odour emission rate for the leachate dam in the GHD report comes from the Castlemaine Putrescible landfill, rather than a site-specific measurement. It is unclear how representative this value is to the AWT facility, or why a site-specific odour sample from the leachate dam was not collected during the 2019 odour investigation.

However, the **primary issue identified in relation to the odour emissions inventory presented in the odour assessment by TOU relates to the magnitude of the odour emissions inventory presented relative to the 2016 GHD assessment**, es explained below.

As stated in Table 1 of the report by TOU, the total calculated odour emission rate from all sources are:

- current operations - 62,680 OU.m^3/s (discussed rounding issues notwithstanding); and
- proposed modification operations - 39,416 OU.m^3/s (discussed rounding issues notwithstanding).

Both of these total emission rates are significantly higher than the odour emission rates modelled in the GHD report. For clarity, the total site odour emission rates from the two emission scenarios presented in each report are compared in Figure 2.1.

It is not completely clear which emission scenarios align between the GHD and TOU reports. However, for the purpose of this review, it is assumed that GHD's Scenario 2 corresponds to TOU's current operations scenario. If this is the case, then the total site odour emission rate from TOU's current operations scenario represents a 713% increase in odour emissions relative to GHD's Scenario 2.

Further discussion regarding the implications of this difference in odour emission rates for the predicted odour impacts from the AWT facility is provided in Section 2.6.1.

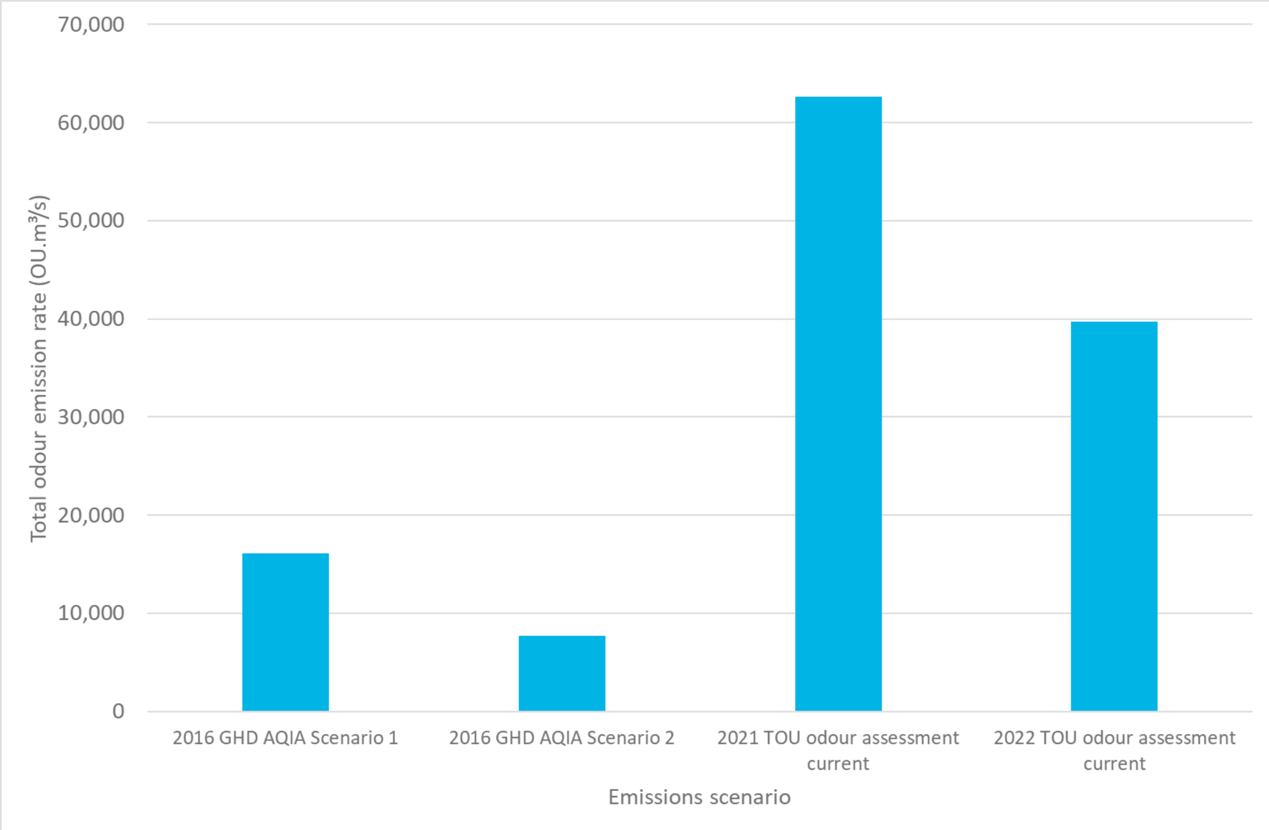


Figure 2.1 Comparison of total site odour emissions in GHD and TOU odour assessments

2.4 Dust emission calculations

2.4.1 GHD report

Chapter 7 of the GHD report provides a discussion of potential dust emission generation from the AWT facility. The GHD report outlines potential sources of dust emissions from the construction and operation of the AWT facility but does not quantify emissions or associated impacts.

EMM considers that the more complete step would be to quantify and assess dust emissions from the AWT facility. However it is likely that these emissions would be low.

2.4.2 TOU report

The report by TOU does not consider dust emissions from the AWT facility.

2.5 Dispersion meteorology

2.5.1 GHD report

Chapter 5 of the GHD report provides an overview of the meteorological modelling undertaken for the study. Accurate meteorological modelling is critical input for the dispersion modelling.

The meteorological modelling period was selected based on the following steps:

- a review of meteorology for the period between 2009 and 2016 (the source and location of the data is not stated), with focus given to rainfall;

- the 12-month period of rainfall closest aligned with the annual average rainfall was selected (again, the source and location of data is not explicitly stated), resulting in the 12-month period between December 2011 and November 2012 being chosen as the meteorological year for the assessment.

While the identification of a representative year based on rainfall is not incorrect, it would be considered more appropriate to justify a modelling year based on comparison with meteorological measurements of wind speed and direction, given the importance of these two parameters on the dispersion of odour emissions. No analysis of recorded sources of meteorological data (eg AWT facility meteorological station, BoM AWS, etc) is provided in the GHD report.

The meteorological modelling by GHD involved the following steps:

- initial modelling using the CSIRO The Air Pollution Model (TAPM) prognostic meteorological model; and
- refined meteorological modelling using the CALMET diagnostic meteorological model, adopting a TAPM-generated 3D.dat dataset as the initial guess input in combination with an integration of surface observations.

The TRC Environmental Corporation (TRC) 2011 document *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'* refers to the adopted CALMET modelling approach as a 'Hybrid' method.

From the settings provided in Table 7 of the GHD report, the configuration of TAPM appears to be appropriate.

The CALMET modelling settings are summarised in Section 5.2.2 and Table 8 of the GHD report. We have several comments in relation to the CALMET meteorological modelling:

- The CALMET grid resolution was set to 400 m. TRC (2011) states that the selection of model grid resolution should:

  > ….allow for at least 10 or more grid points to resolve each terrain feature.

  It is noted that the 2 km extending north between the AWT facility (altitude of 30 m Australian Height Datum [AHD]) and Awaba (altitude of 30 AHD) is a north-east/south-west aligned ridgeline that reaches approximately 110 m AHD. To better resolve this terrain feature in the CALMET model, in keeping with the recommendations of TRC (2011), a CALMET grid cell resolution of 200 m could have been selected for the GHD modelling.

- Page 25 of the GHD report indicates that a value of 4 km was chosen for the terrain influence parameter TERRAD. This is contradicted by Table 8, which states that a TERRAD value of 5 km was selected. In any event, TRC (2011) states that the selection of TERRAD should be guided by the following rule of thumb:

  > 'ridge-to-ridge divide by 2, rounded up'

  Reviewing the local terrain features, the undulating hills show ridge-to-ridge distances of up to 3 km. On this basis, following the TRC (2011) rule of thumb, a TERRAD value of 2 km might be more appropriate for the CALMET modelling.

- It is unclear why the recommended default settings from TRC (2011) for IKINE and IOBR were not selected in the CALMET modelling, as stated on page 25 of the GHD report. In particular, TRC (2011) identifies that activating IKINE (default is off) can occasionally result in anomalous wind speed predictions. It is recommended that the default settings of 'off' for IKINE and IOBR should have been adopted in the CALMET modelling.

- No discussion is provided in the GHD report relating to the user defined (ie no default) values for radius of influence (RMAX) distance or weighting radius (R) distance. Specifically:

  - The RMAX distance centred on the surface observation location(s), and specifies the distance beyond which CALMET ignores input surface observations in meteorological predictions, deferring instead to the Step 1 wind field (ie TAPM 3D.dat file). For surface observations, the RMAX1 distance is critical, with RMAX2 and RMAX 3 relating to over land aloft data and over water data respectively.

  - The R distance defines how quickly the influence of surface observation data decreases in model predictions within the RMAX distance. For surface observations, the R1 distance is critical, with R2 relating to layers aloft.

  The GHD CALMET modelling has incorporated hourly-varying meteorological measurements from the BoM AWS at Lake Macquarie-Cooranbong as an input surface observation dataset. The Lake Macquarie-Cooranbong AWS is located 11 km to the south-south-west of the AWT facility. However, no mention of how these observation data were integrated into the CALMET modelling through RMAX1 and R1 values is provided.

  Based on EMM's review of the terrain and land cover surrounding the BoM Lake Macquarie-Cooranbong AWS, an appropriate RMAX1 distance might be in range of 3 km to 4 km, with a corresponding R1 distance of 1 km to 2 km. Regardless of this selection, it is unlikely that an RMAX1 value of 11 km (ie the distance from the BoM Lake Macquarie-Cooranbong AWS to the AWT facility) would be appropriate. Therefore the CALMET predictions at the AWT facility are likely influenced only by the TAPM 3D.dat file.

- Light wind conditions are typically associated with stable atmospheric conditions and poorer dispersion of air pollutant emissions. The percentage of calm conditions (wind speeds less than 0.5 m/s) is an indicator of prevalence of poor atmospheric dispersion conditions.

  On page 24 of the GHD report, it is stated that TAPM does not predict light wind conditions as well as CALMET. EMM agrees that an accepted drawback with TAPM is the ability of the model to predict low wind speeds, relative to real-world measured data. However, as CALMET is a diagnostic model it will only perform as well as the initial input datasets used in the CALMET configuration.

  Given the separation distance from the BoM Lake Macquarie-Cooranbong AWS from the AWT facility (approximately 11 km) and noting the unconfirmed RMAX1 distance, it is considered likely that the meteorological predictions made by CALMET at the AWT facility are based on the TAPM 3D.dat only with local terrain refinements made. Considering the previously referenced statement by GHD regarding TAPM's ability to predict low wind speeds, it is likely that such conditions are underpredicted in the GHD modelling. As shown in Figure 5.4 of the GHD report, the percentage of calm wind conditions in the CALMET dataset for the AWT facility is 1.3%.

  In undertaking this review, EMM has reviewed the wind speed and direction data from the BoM Lake Macquarie-Cooranbong AWS and the NSW Department of Planning and Environment (DPE) Wallsend air quality monitoring station, located 18 km north of the AWT facility. Like the AWT facility, both sites are located between 10 km and 15 km from the coastline in undulating terrain. The annual percentage of calm conditions recorded over the past five years is approximately 42% at Lake Macquarie-Cooranbong and 18% at Wallsend. While there may be local factors that influence the percentage of calm conditions at these monitoring stations, we consider that the percentage of calm winds at the AWT facility should be higher than the 1.3% used in the modelling.

In undertaking this review, EMM have received meteorological data from the AWT facility meteorological station from Council. Hourly average data between June 2018 and August 2022 has been collated and reviewed.

Annual and seasonal wind roses have been generated from the AWT facility meteorological data, and are presented in Figure 2.2 and Figure 2.3 respectively. The generated wind roses from the AWT facility meteorological data show the following:

- All years of data show a general dominance of winds from the south-west to north-west, with a less frequent east to south-east component also shown. The 2016 GHD AQIA annual CALMET-generated wind rose for the AWT facility (Figure 5.2 of that report) showed a dominance of winds from north-west and east, with a more even distribution of wind direction across all directions than the measured data.

- For the three complete 12-month periods of data analysed (ie 2019, 2020 and 2021), the annual average frequency of calm winds ranges from 9.9% (2019) to 24.9% (2021).

- It is noted that the seasonal analysis, Figure 2.2 shows that the winter periods in 2020 and 2021 had extremely high calm conditions relative to the other monitoring years. Sensor accuracy issues (ie needing calibration) for these periods of sustained calms cannot be ruled out. It is beyond the scope of this review to determine the exact reason for the elevated calm winds in 2020 and 2021.

- Outside of winter 2020 and winter 2021, the measured frequency of calm winds by season is comparable for each presented year in Figure 2.3.

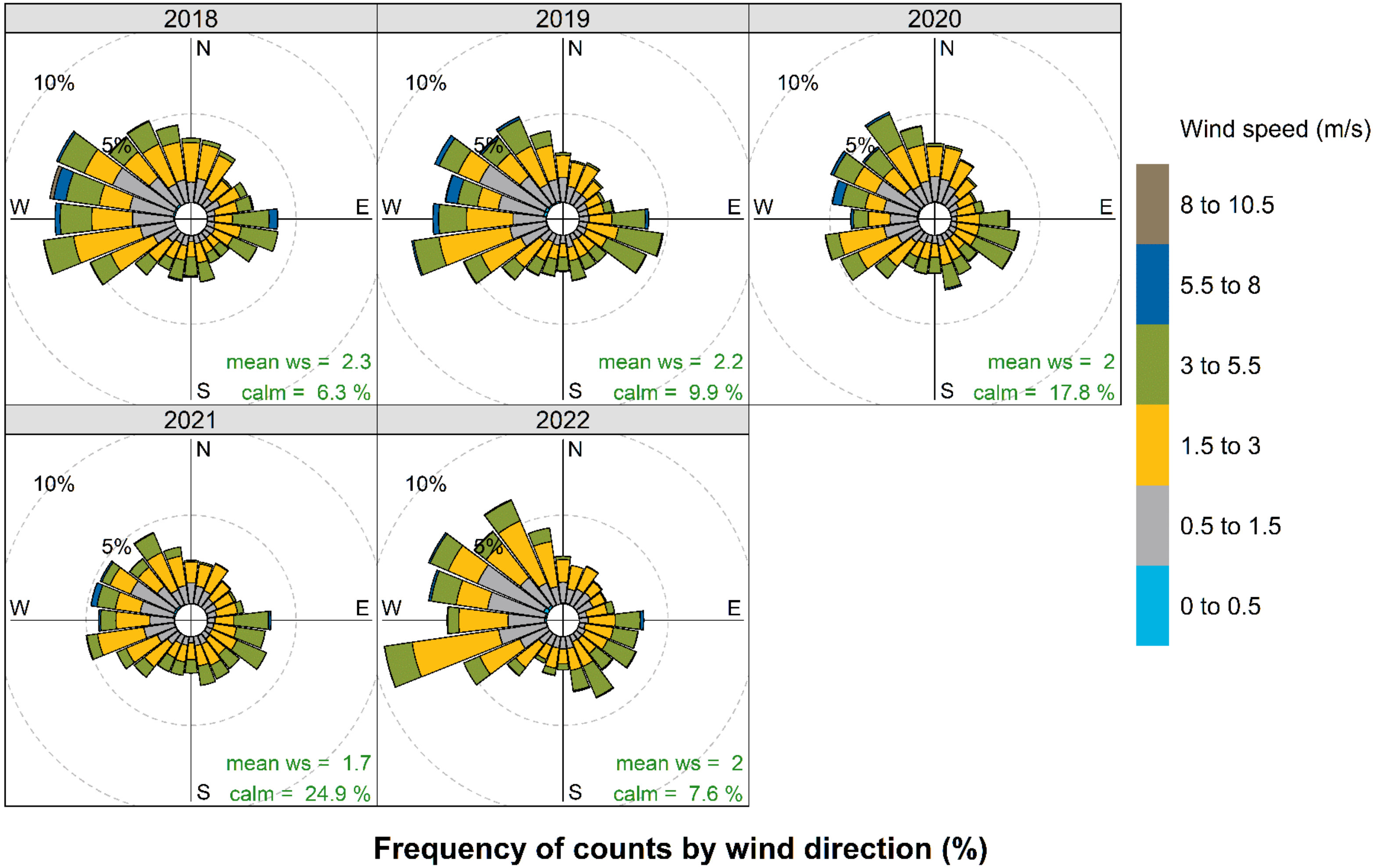
Despite the potential wind speed sensor issues influencing the data in winter 2020 and winter 2021, the recorded frequency of calm winds at the AWT facility is notably higher than the CALMET-predicted dataset from the 2016 GHD AQIA.

Given the importance of calm wind conditions to the dispersion modelling of odour emissions, the underprediction of calm wind conditions at the AWT facility in the GHD modelling represents a key issue for the dispersion modelling.

- No discussion of the selected values for the vertical extrapolation of surface wind observations (IEXTRP) or layer weight factors (BIAS) is provided in the GHD report.

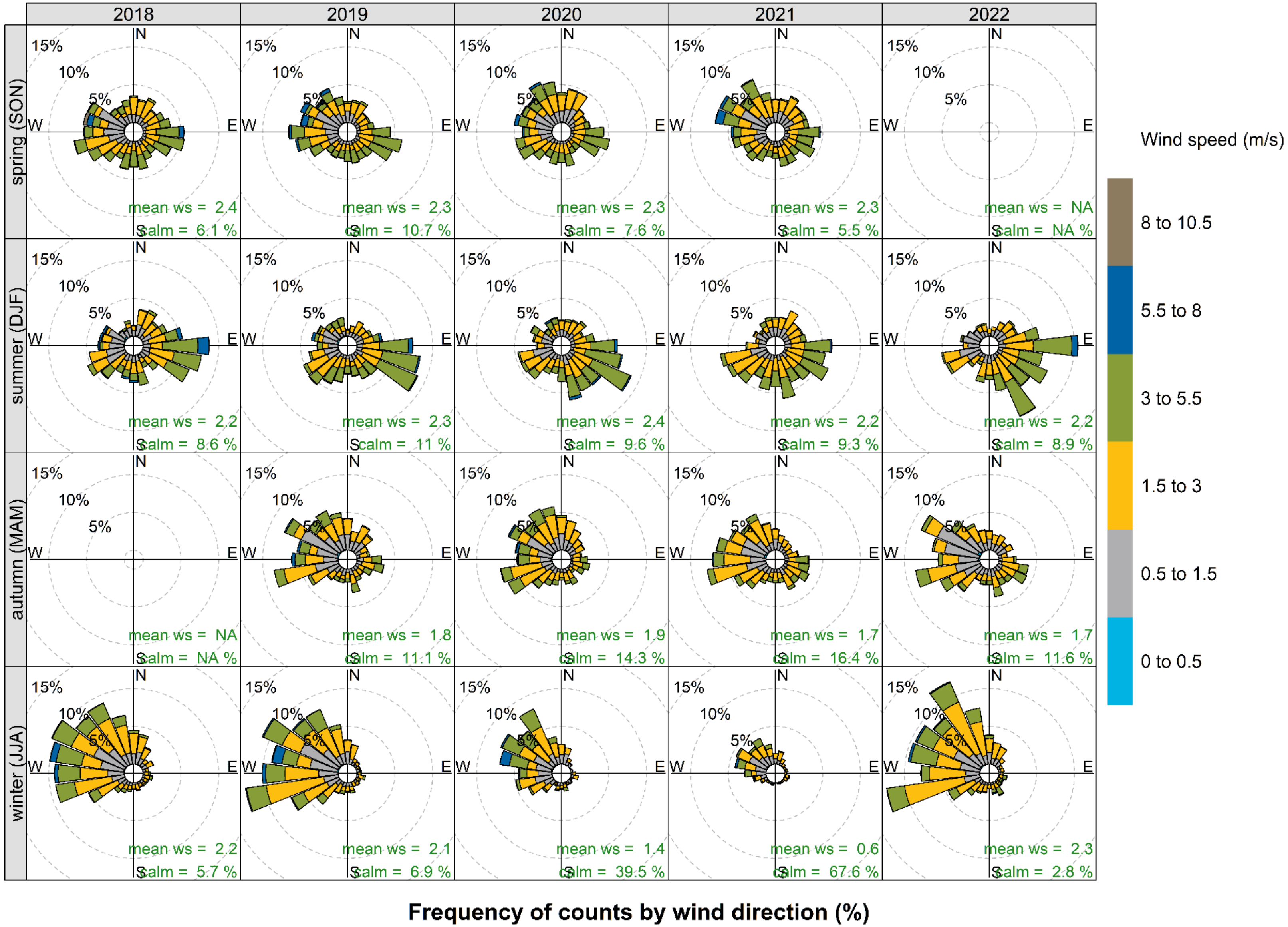
2.5.2 TOU report

The report by TOU does not consider dispersion meteorology.



Note: wind roses for 2018 and 2022 are not based on complete 12-month data periods

Figure 2.2 Annual wind roses – AWT facility meteorological station – June 2018 to August 2022



Note: wind roses for 2018 and 2022 are not based on complete 12-month data periods

Figure 2.3 Seasonal wind roses – AWT facility meteorological station – June 2018 to August 2022

2.6 Atmospheric dispersion modelling and impact assessment

2.6.1 GHD report

Chapter 6 of the GHD report presents the results of the dispersion modelling based on the quantified AWT facility odour emissions. Dispersion modelling has been completed using the CALPUFF dispersion model, linked to the previously discussed CALMET-generated meteorological dataset.

When undertaking odour dispersion modelling at 1-hour time steps, the application of an appropriate peak-to-mean ratio is required to derive 1-second (nose response) odour concentrations for comparison with the relevant NSW EPA odour impact assessment criterion. The need to apply a peak-to-mean ratio is discussed in Section 2.2.2 of the GHD report. However, the specific value(s) adopted are not discussed anywhere in the report. If the incorrect peak-to-mean ratio is applied, the odour emission concentrations could be underpredicted.

The model source types are inferred to be area sources from Figure 6.1. The adopted source configuration dimensions are not documented in the GHD report, and therefore no comment can be made on the validity of the model configuration.

The results of the dispersion modelling for a single modelling scenario are presented in Table 9 of the GHD report. It is not stated which emissions scenario the results correspond to, although it is assumed that the results relate to the GHD Scenario 2.

The predicted odour concentrations presented in Table 9 show compliance with the adopted 3 OU criterion at all selected sensitive receptor locations. Further, Figure 6.1 shows that the 3 OU contour does not encroach on any of the potential future receptors to the south of Awaba, however it is noted that the predicted 2 OU contour (flagged by EMM as a potentially more appropriate odour criterion in Section 2.1.1) does.

More importantly, the predicted odour concentrations presented in GHD report should be viewed in the context of the issues raised in Section 2.5.1 with regards to the accuracy of the CALMET-predicted meteorological dataset in representing calm conditions at the AWF facility. It is EMM's experience that an increase in calm conditions could result in a notable increase in peak odour concentration predictions.

Final discussion relating to predicted odour impacts presented in the GHD report is provided in the discussion of the 2021 TOU odour assessment (Section 2.6.2).

2.6.2 TOU report

The report by TOU does not present revised odour dispersion modelling for the AWT facility. Instead, the report simply identifies that the proposed modifications to site operations will reduce total site odour emissions by approximately 37%, and a 41% reduction for the existing MAF area. **No discussion is provided with regards to resultant odour impacts through updated odour modelling for the AWT facility**.

The primary issue identified by EMM is that the odour emissions quantified for current operations of the AWT facility in the report by TOU are potentially 713% higher than the emissions that were modelled for Scenario 2 in the GHD report, as presented in Section 2.4.2.

Applying a 713% increase to the model predictions in the GHD report would significantly alter the conclusions of that assessment, without taking any of the other identified deficiencies of the GHD modelling (eg under-prediction of calm winds) into consideration.

Instead of relying on a qualitative discussion of odour emission reductions, a revised odour modelling exercise should have been undertaken by TOU to understand the implications of the current odour emissions inventory that is based, in the main, on actual site-specific odour measurements rather than site representative data from the GHD report.

3 Conclusions

Our review has identified a number of potential shortcomings of the assessments presented in the reports by GHD and TOU.

Most importantly, the odour emissions quantified for current operations of the AWT facility in the report by TOU are much higher than the emissions that were modelled for Scenario 2 in the GHD report. This would significantly alter the conclusions of the GHD assessment. Other potential deficiencies of the GHD modelling have been identified, such as the under-prediction of calm winds for the AWT facility.

We are also concerned that the report by TOU does not present revised odour dispersion modelling for the AWT facility. This is an important omission, given the differences in emissions noted above.

Our recommendations for improving the robustness of the odour assessment are provided below.

4 Recommendations

4.1 Meteorological monitoring

- The meteorological modelling for the AWT facility should be revised to incorporate actual observations from the onsite metrological monitoring station.

4.2 Assessment criterion

- A more stringent odour assessment criterion of 2 OU should be applied to dispersion model predictions for the AWT facility.

4.3 Receptors

- Potential future residential receptors in the R2 zone to the north of the AWT facility should have been accounted for in the list of assessment locations.

4.4 Odour emissions inventory

- The odour emissions inventory should be checked and amended if errors are present.
- A clearer justification for the reduction in odour emissions rates for the open-windrow composting stockpiles should be provided.
- A justification for the adoption of a non-site specific leachate dam odour emission rate should be provided.
- The adoption of the 2009 Eastern Creek Landfill odour emissions data as representative for odour emissions from the AWMF in 2022 should be justified and updated where necessary, potentially through site specific odour emissions sampling data collected at the AWMF.

4.5 Dispersion meteorology

- The CALMET modelling should be revisited, with the following changes being made to the model settings:
    - a CALMET grid cell resolution of 200 m should be adopted to better a characterise the terrain feature between the AWT facility and Awaba to the north;

- a TERRAD value of 2 km should be adopted in the CALMET modelling based on the TRC (2011) guidance;
- the RMAX and R distances should be clarified and justified on the basis of the setting of the observation station(s);
- the use of default settings for IKINE and IOBR should be adopted; and
- appropriate values for IEXTRP and BIAS should be discussed and justified.

- As stated previously, data from the AWT facility meteorological station should be incorporated into the revised CALMET modelling.

4.6 Dispersion modelling

- Any revised dispersion modelling undertaken should address the recommendations of this review (eg integration of on-site meteorological monitoring data, revised CALMET settings, revised odour criteria etc).
- The revised odour emissions inventories from the 2021 odour assessment should be explicitly modelled to determine the potential odour impacts associated with the site specific odour sampling data.
- The adopted peak-to-mean ratios should be clarified.
- The odour modelling should be revised to account for any changes to the CALMET meteorology.
- Confirmation of the assumed odour emission source configurations should be provided.
- Consideration should be given to the recommendations made in Section 2.6.2.

5 References

GHD 2016, Awaba AWT Facility Odour Impact Assessment, November 2016.

NSW EPA 2017, Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, NSW Environment Protection Authority, Sydney.

PAE Holmes 2012, Air Quality and odour assessment – Awaba landfill extension.

TOU 2019, Lake Macquarie Organics Resource Recovery Facility – Odour Investigation Study – Final Report, August 2019, The Odour Unit, Sydney.

TOU 2021, Remondis Australia – Awaba ORRF open windrow composting proposal odour assessment report, The Odour Unit, Sydney.

TRC 2011, Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the ‘Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia, TRC Environmental Corporation.