



McGraths Hill, Mulgrave, Windsor Field Ambient Odour Assessment Study

*Prepared for the NSW Environment
Protection Authority*

McGraths Hill, Mulgrave, Windsor,
NSW

Final Report

August 2013

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1 INTRODUCTION

In May 2013, NSW Environment Protection Authority (NSW EPA) engaged The Odour Unit Pty Ltd (TOU) to conduct a baseline regional odour assessment covering the McGraths Hill/Mulgrave/Windsor area of North Western Sydney. The request for this assessment was in response to community odour complaints and concerns over an extended period regarding the level of odours suspected to be originating from the activities undertaken in facilities within the McGraths Hill/Mulgrave/Windsor area. The facilities in the area that had been previously identified as being potential odour sources and were therefore covered in this assessment included:

- ELF Farm Pty Ltd
- South Windsor Sewage Treatment Plant
- McGraths Hill Sewage Treatment Plant

As will be discussed in this report, a number of other odour-generating industries were identified and their odour impacts quantified during the assessment, including a poultry broiler farm and a pet food plant.

It is understood that odour complaints received by EPA relating to the McGraths Hill/Mulgrave/Windsor area have generally identified a range of odour characteristics that make it difficult to link each complaint back to a particular odour source or activity. As a result, the objective of the study was to identify, with some certainty, the source of any odours that could be detectable during the assessment. A secondary objective was to identify, where possible, the likely process source within each plant of each type of odour that was detected, as a basis upon which future mitigation strategies could be developed and implemented. For this reason the FAOA surveys did not extend to determining the full extent of the odour impact area on each occasion odour was detected, and therefore did not always extend into the residential areas, once a clear indication of the odour and its likely source had been made closer to the plant. TOU understands that NSW EPA will use the information generated in this assessment in ongoing community and industry consultation, and to assist in prioritising odour mitigation efforts at those facilities where the need for improvement is identified.

The assessment commenced by the undertaking of a reconnaissance visit to the ELF Farm facility on 20 May 2013 by TOU's Managing Director, Terry Schulz, and one of the assessment team, in order to become familiar with the on-site production processes and to evaluate the nature and character of odours that could be generated at the facility. During this plant visit a senior EPA representative accompanied the TOU team. There was no need to familiarise the assessment team with the two sewage treatment plants as TOU has extensive experience with a wide range of similar plants and is familiar with the type of odours likely to be emitted. The reconnaissance visit was followed by a series of Field Ambient Odour Assessment (FAOA) surveys over a four week period, namely 27 May – 24 June 2013, with the intention of covering as many wind variations as possible. As will be explained, this was not able to be fully achieved.

The results presented in this study reflect the prevailing atmospheric conditions and the odour emission circumstances in the area during the undertaking of the FAOA surveys, and it should not be presumed that they would necessarily represent conditions or impacts prevailing at any other time.

This odour assessment report describes the FAOA methodology and presents and discusses the results for each the FAOA surveys conducted, before concluding with the main findings of the study. While suggestions are offered regarding possible odour mitigations options, further investigation will be needed to confirm the problematical odour sources before any detailed mitigation strategy can be finalised.

2 ASSESSMENT TIMELINE

2.1 ASSESSMENT PROGRAMME

Four FAOA surveys were intended to be carried out over a relatively short timeframe of 2-3 weeks, from the initial reconnaissance visit on 20 May. However the unseasonal near-calm wind conditions that prevailed for much of late-May and June required an extension of the study, in order to assess the ambient odours under higher wind conditions. Notwithstanding this extension, it was not possible to test under wind speeds of more than 5.8 m/s (21 km/hr) and the bulk of the surveys were under winds less than 2 m/s.

For the first four surveys two assessors were used for each survey conducted. For the subsequent three surveys one assessor was used. All four assessors are trained, highly experienced and calibrated for this type of work. For this reason, the use of one or two assessors for each survey is considered acceptable. The assessment team members included:

- Terry Schulz (TS);
- Wayne Westwood (WW);
- James Schulz (JS); and
- Alex Schulz (AS)

The schedule for the project is summarised in **Table 2.1**. In total, **7** surveys were carried out on **6** different occasions over the survey assessment period.

The surveys were often carried out at short notice, in response to wind conditions. No prior notice of the times or dates for the surveys was given to any party.

Table 2.1 – Assessment programme: May 2013 – June 2013			
FAOA Survey No.	Date	Time (hrs)	Assessors
-	20 May	Reconnaissance visit by TOU assessors	
1	27 May	1545 – 1752	TS & WW
2	29 May	1440 - 1632	JS & WW
3		1712 - 1845	JS & WW
4	3 June	1350 - 1548	JS & AS
5	13 June	1434 - 1710	JS
6	14 June	1402 - 1625	JS
7	24 June	1120 - 1415	JS

3 THE FACILITIES

3.1 ELF FARM

The Elf Farm plant prepares mushroom compost from its component ingredients and sells inoculated compost, ready for mushroom production. The facility is large by Australian standards. During the reconnaissance visit TOU were shown around the plant in a thorough manner, with all main processing activities inspected.

To the layman the plant consists of two sections, comprising the compost production activities in two older buildings (known as Phase 1) on the southern side of the site, and the more-recent mushroom compost tunnel building to the north of these buildings (Phase 2/3).

In the compost production area compost is produced from baled straw, chicken manure, cottonseed, recycled water and other materials. It consists of an open bale-wetting area, a semi enclosed storage area for the materials, an enclosed pre-wet building, where the compost process commences, and a fully enclosed tunnel-composting building. Emissions from the open bale-wetting area vent directly to atmosphere. TOU were advised by management that Elf Farm plans to enclose this area. The pre-wet building is fitted with a rudimentary extraction system that extracts air from within the building and directs it to the odour control bioscrubber. Initial observations by TOU suggest that this airflow may be inadequate for the size and design of the building. There is no likelihood of negative pressure conditions being achieved with the pre-wet building, under normal operation as the main opening to the building is open. Conditions within the building at the time of the TOU visit were very odorous, with ammonia the dominant odorant and an underlying chicken manure odour.

The composting tunnels in the older tunnel composting building are understood to be maintained under negative pressure conditions, with the extracted air treated in a bioscrubber and discharged to atmosphere through a tall stack. It is understood that the bioscrubber was designed and constructed 'in-house', based on a European design. A large compost conveyor conveys partially composted material to load the

tunnels. This conveyor is mounted outside the tunnel composting building and can be seen to produce a steamy discharge to atmosphere, during the tunnel loading operations.

The second, more modern section of the plant is to the north of the site, and consists of a large tunnel-composting facility. In this building mushroom spawn material is added to the compost and further composting takes place, in a series of enclosed 'tunnels', under highly process-controlled conditions. The entire composting process is maintained under negative pressure conditions, with a steady bleed of composting air to the atmosphere, through roof vents. These vented emissions appear as steamy vapours emanating from the roof of the building. It was apparent to TOU during the site visit that the level of odour within the building was relatively low.

In total there are at least five types of air emissions from the Elf plant including:

- The elevated and treated stack emission;
- The fugitive emissions from the open bale wetting area;
- The fugitive emissions from the pre-wet building;
- The emissions from the exposed loading conveyor; and
- The steamy roof vent emissions from the mushroom tunnel-composting building.

3.2 SOUTH WINDSOR SEWAGE TREATMENT PLANT

The South Windsor Sewage Treatment Plant (South Windsor STP) is located at Fairey Rd, at the southern extremity of this study's assessment area. It appears to be of relatively modern design, and based on the activated sludge treatment process. It was apparent from the front entrance to the plant that parts of it are equipped with an odour control system, with treated air discharging through a stack.

3.3 MCGRATHS HILL SEWAGE TREATMENT PLANT

The McGraths Hill Sewage Treatment Plant (McGraths Hills STP) is located on a site bordered by Mulgrave Rd and Windsor Rd. It was not inspected during this study and no details are available on its design or operation. It appears to be an older-style plant, using trickling filters rather than aeration tanks. The treated effluent discharges

into an extensive pond and wetland system. The level of odour control at this plant is not known.

4 FIELD AMBIENT ODOUR ASSESSMENT METHODOLOGY

4.1 PREAMBLE

The undertaking of a FAOA survey by TOU is based on a truncated form of the German Standard VDI 3940 “Measurement of Odour Impact by Field Inspection”. This standard prescribes the methods by which field technicians (assessors) determine, define and document observed ground level odours and the manner in which the determination of these odours is defined in relation to odour character, frequency of odours observed and the odour intensity of those individual observations as a quantitative scale of measure.

With this method, the calibrated and experienced assessors conduct a single measurement at discrete measurement points (a grid defined within the surveyed odour plume) within a pre-determined assessment area downwind of the odour source(s). Each assessment area was selected on the basis of the prevailing wind condition as it related to the odour source being assessed. For the facilities under investigation, and given the mainly light wind conditions prevailing during the study, each assessment area tended to be 100-500 metres from each facility. There was one exception to this, for the survey on 24 June 2013, where the odour was detected more than 1,100 metres from the subject facility.

4.2 FAOA SURVEYS OBJECTIVE

In general, the objective of a survey was more about determining the intensity, character, and likely source of each odour detected, and less about defining the actual odour impact and the impact range. It is important to understand that it was not necessary for the odour to be present at problematic odour levels at either the assessment point or in neighbouring residential areas during the surveys for the assessment procedure to be successful, since the primary objective of the project was to identify those waste facilities with the potential to be a cause of a portion of the odour complaints received. As it happened, the relatively light winds encountered during the surveys resulted in clear indications of air and odour movement from several facilities into the community, due to the sensitivity of the assessment

methodology, and the lack of overlapping or cumulative odours from adjacent facilities. It is reasonable to qualitatively extrapolate survey findings under light wind conditions to winds of stronger intensity, as it is to project what is likely to happen if odour emission rates from the waste facility sources were to be greater than those prevailing during the survey period.

4.3 FAOA SURVEY MEASUREMENTS METHODOLOGY

Each measurement event comprised the assessor(s) carrying out an olfactory assessment at a specific location. For those surveys with two assessors the results for the two were averaged. When plotted each grab measurement resulted in a single data point. Where no odours were detectable the measurement event was truncated to a 1-2-minute period. Where odour was present the assessment was extended to 2-5 minutes. This truncation was necessary to cover a reasonable amount of ground, given the extent of survey coverage, and focus mainly on those locations where odour was most likely to be prevalent. For surveys 5, 6 and 7 the assessment methodology was expanded to include more than a single assessment at key locations, with a series of assessments carried out every 10 seconds over a 5-minute period. The results of these longer assessments enabled any variation in odour intensity to be quantified and plotted.

For every single measurement the assessors determined the presence, character and intensity of any observed odours, and recorded the prevailing wind direction and speed.

The results of the surveys are tabulated in the FAOA log sheets (appended to this report) and summarised visually in a series of aerial plots of the assessment area. While the legend for each plot is given underneath the aerial photos, the colour within each plot circle represents the intensity of any odour present, while the coloured annulus around the circle shows the character of the odour present. For Surveys 5, 6 and 7 certain locations have a pie-chart showing variation in odour intensity.

4.4 SURVEYS ASSESSMENT PERIOD

The seven surveys were carried out from 27 May to 24 June 2013. All were carried out in the afternoon.

4.5 SURVEYS METEOROLOGICAL CONDITIONS

Ideally, FAOA surveys should be carried out over a range of meteorological conditions, from near-calm to moderate to strong wind speeds, and under differing wind directions. The result of each FAOA survey would then determine the impact range within that assessment area for that survey, and the overall finding represent a broader picture of possible adverse odour impacts.

Unfortunately, the relatively short duration of the project coincided with an unusually narrow range of wind speeds, although there was a reasonable range of wind directions available for assessment. The findings of this project are therefore restricted to the wind and weather conditions prevailing at the time of the assessment, and the nature and condition of the various processes and activities carried out at each of the facilities under investigation.

4.6 FAOA ODOUR KEY DESCRIPTORS

The odour sources at the facilities have their origins from the processes occurring at each individual facility. Based on TOU's experience, the reconnaissance visit and early FAOA fieldwork, key odour descriptors were allocated, as shown **Figure 4.1**.

ODOUR CHARACTERISATION

- Chicken Manure
- Earthy, Compost
- Meal
- Sewage, Musty
- Poultry

Figure 4.1 – Key odour descriptors used for the Mulgrave-Windsor Odour Assessment

The definition for each odour character presented in **Figure 4.1** is as follows:

- **A = Chicken manure:** refers to a chicken manure odour that was evident within and immediately outside the ELF plant. In this application it has a sour, unpleasant manure character;
- **B = Earthy/Compost:** refers to any odour having a matured compost character;
- **C = Meal:** refers to a characteristic animal meal feed product odour. This odour was evident immediately downwind of a pet food factory in Curtis Rd, McGraths Hill;
- **D = Sewage/Musty:** refers to any odour of obvious sewage origin; and
- **E = Poultry:** refers to the odour found in and around poultry production facilities. It is the smell of the birds themselves rather than that of the chicken manure.

4.7 ODOUR INTENSITY CATEGORIES

The observed off-site odours are quantified according to the German Standard VDI 3882 Part 1. The category scale for judging odour intensity in the field is a quantitative reference scale where assessors award one of the attributes in the **Table 4.1** to the assessor's odour impression.

Table 4.1 - VDI 3882 (Part 1) Odour Intensity Categories		
Odour Strength	Intensity Rank (code)	TOU Interpretation (meaning)
Not detectable	0	No odour detected
Very Weak	1	Odour recognised and where possible assigned to the odour source
Weak	2	Odour is weak but not yet distinct
Distinct	3	Odour is clearly distinct
Strong	4	Strong odour detectable
Very Strong	5	Very strong odour detectable
Extremely Strong	6	Extremely strong odour detectable

An odour is clearly recognised (category of intensity 1) when the odour quality can be clearly assigned.

4.8 ODOUR INTENSITY & FREQUENCY CRITERION

Although outside the scope of work for this project, and referring to the Odour Intensity Categories listed and described in **Table 4.1** above, a particular odour intensity level can often be linked to a possible odour impact from the facilities. This criterion, whether it is Category 2 (Weak) or Category 3 (Distinct), will be dependent upon the sensitivity of the receptor areas, the nature / offensiveness of the odours present and the frequency of exposure. Odour Intensity Category 1 (very weak) would rarely, if ever, correspond to adverse odour impacts.

4.9 SELECTION OF ASSESSORS

For the selection of assessors, as it relates to the VDI 3940 standard, the most important selection criterion is that the assessor must have a 'normal' sense of smell. This is defined in terms of odour sensitivity to the reference odorant compound n-butanol.

TOU specialises in, and stringently carries out Dynamic Olfactometry according to Australian Standard AS/NZS4323.3:2001. TOU performs assessor n-butanol calibrations before all olfactometry testing sessions in our laboratories, in addition to

the required primary calibration where each assessor is calibrated against n-butanol from at least 10 dilution series collected on 3 different, non-consecutive days.

As a general rule, TOU's Sydney office undertakes dynamic olfactometry assessments within the range of 500 – 900 odour tests annually. As a consequence TOU's assessors are highly skilled for olfactory analyses. As part of TOU's laboratory olfactometry analyses, TOU also undertakes laboratory derived intensity assessments on individual odour samples where the assessors are exposed to laboratory conditions of odour intensity determination. Additionally, TOU also undertakes a large number of FAOA surveys each year, which exposes assessors to a variety of odour sources in the field.

For three of the seven surveys a single assessor, James Schulz, was used. James, as the Manager of the Sydney Olfactometry Laboratory, oversees all odour testing in that facility. He is experienced in the execution of FAOA surveys. Three other assessors were used, Terry Schulz, Alex Schulz and Wayne Westwood. Terry is the Principal of The Odour Unit and internationally recognised for his work in the odour field. Alex is the Sydney Office Olfactometrist, responsible for conducting the bulk of the olfactometry tests carried in the Sydney laboratory. Wayne is a contracted sub-consultant to the company who previously participated in a major FAOA study for EPA in western Sydney in 2012. Terry and Wayne carried out the reconnaissance visit on 20 May and the first assessment on 27 May 2013. James and Wayne carried out the second and third assessments on 29 May, with James and Alex carrying out the fourth on 3 June. Following that assessment a decision was made to extend the number of surveys from four to seven, using a single assessor only. TOU is satisfied that this move did not decrease the validity or findings of these assessments.

James and Alex did not attend the reconnaissance visit to the Elf Farm plant on 20 May 2013 with the other members of the team but were able to familiarise themselves with the odour characteristics of the emissions from that plant by near-field assessments immediately downwind of the Elf Farm site. Like the other assessors, they were both experienced and very familiar with the odours associated with sewage treatment plants.

4.10 RECORDING OF METEOROLOGICAL CONDITIONS

Meteorological conditions were recorded using a Kestrel 4500 Pock Weather Tracker Anemometer (see **Photo 4.1** for illustration of setup). At each measurement point on the maps, the team would setup the anemometer apparatus enabling for real-time measurement of local temperature, wind speed and direction at a measurement location point over each assessment measurement event. This was undertaken during every survey at each measurement point.



Photo 4.1 – Kestrel Anemometer apparatus in operation

There is a range of factors that determine wind direction and speed at a given point in time, and therefore the local wind condition experienced at particular MLPs may have differed slightly from the prevailing winds reported for the survey period by local meteorological stations. This has been discussed in **Section 5.2**.

5 INTERPRETATION OF RESULTS

5.1 FAOA MAP PLOT RESULT

Section 5 contains the findings of each of the FAOA surveys. The logsheets for each FAOA survey, showing the raw field data, are appended as **Appendix A**.

5.2 INTERPRETATION OF SURVEY FINDINGS

Each map plot result shown consists of several features. These are generally depicted on a pie chart and wind vane indicator on each map plot. The features include:

- **A measurement location point (MLP):** these are strategic points on the map were designed to enable assessors to pursue upwind and downwind effects from the facilities;
- **Location wind conditions:** the local wind direction and speed at each MLP has been indicated by a yellow arrow. In the event a wind direction has not been indicated, the conditions at the time were calm (i.e. < 1 m/s) and wind direction was unable to be accurately determined. The recorded wind conditions at each MLP may have varied at the time of the assessment from the prevailing wind conditions that existed in the general Sydney precinct recorded by local meteorological stations. Given the complex meteorological dynamics that can occur arising (such as local terrain, topography, katabatic channelling and effects from natural and built environments) affecting wind direction and speed, the local wind conditions experienced at some MLP varied from the prevailing wind condition; and
- **Odour descriptors:** at each MLP where a measurement cycle was undertaken, key parameters were recorded in the event an odour was detected (methodology for this has been previously described in **Section 3**). The key descriptors shown on the maps includes the intensity of odour (how strong the smell was) based on the VDI 3882 German Odour Intensity Scale. In addition, the odour character was also recorded based on an odour character inventory developed by TOU to describe the range of odours encountered throughout the course of the surveys.

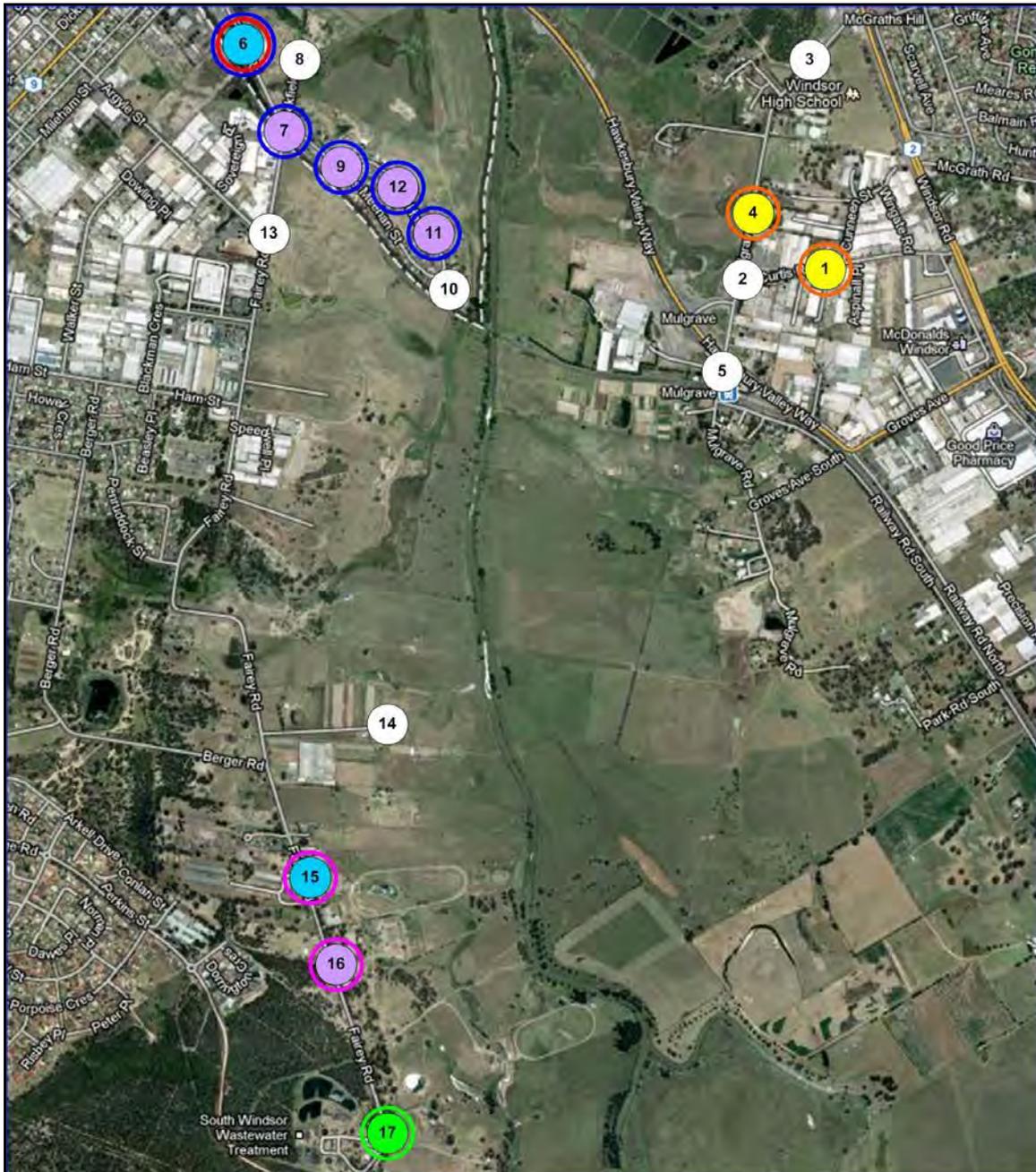
6 RESULTS

The following comments on results should be read in conjunction with their corresponding FAOA Map Plots. The likely source/s mentioned in these results is based on the odour character/s detected and position of the facilities relative to the wind direction i.e. whether the facility was upwind or downwind of a positive detection event.

6.1 FAOA SURVEY NO. 1 - 27 MAY 2013

FAOA Survey No. 1 was carried out on 27 May 2013 between 1545 hrs - 1752 hrs. The wind conditions at the time of this assessment session were calm to very light winds, tending predominately from the east. Local wind direction varied during the survey.

- There was an instance at MLPs 1 and 4 whereby a Very Weak intermittent Meal odour was detected. The likely source was identified as the Pet Food plant in Curtis Rd.
- At MLP 6 in Fairey Rd and MLPs 7, 9, 11 and 12 in Harris and James Meehan Streets Distinct to Strong odours were present on a continuous basis during the assessment period. The character of this odour was predominantly chicken manure with some compost undertones. These MLPs are to the north-west of the Elf Farm, and the odour was judged to be emanating from that facility. The level and unpleasant nature of this odour in a residential area was considered to be offensive, by the assessment team.
- Further along Fairey Rd to the south there were instances of Distinct to Strong poultry shed odours at MLPs 15 and 16. The odour detected was that of the live birds, rather than that of chicken manure/manure. These locations were close to the boundary of a broiler chicken farm. The absence of any measurable wind at these locations is thought to be the reason for the detection of the poultry shed odours at these locations.
- At MLP 17, at the front gate of the South Windsor Sewage Treatment Plant, a Weak sewage odour was detected.



DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 0 Not detectable 1 Very weak 2 Weak 3 Distinct 4 Strong 5 Very strong 6 Extremely strong		ODOUR CHARACTERISATION Chicken Manure Earthy, Compost Meal Sewage, Musty Poultry		CLIENT/PROJECT NSW EPA Mulgrave-Windsor Regional Field Ambient Odour Assessment Date: 27/05/2013 Time: 1545 – 1752 hrs		N LOCAL WEATHER CONDITIONS: Calm conditions (0.1 – 0.5 m/s) with predominantly easterly winds LOCAL WIND DIRECTION: 	
 THE ODOUR UNIT Aust Tech Park, Locomotive Workshop, Suite 16012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No.1 - Field Ambient Odour Assessment		Plot No. N1893L_001 Revision: A JOB No. N1893L.02			

FAOA Survey Map Plot 5.1 – FAOA Survey No.1: 27 May 2013

6.2 FAOA SURVEY NO. 2 – 29 MAY 2013

FAOA Survey No. 2 was carried out on 29 May 2013 between 1440 hrs – 1632 hrs. The wind conditions at the time of this assessment session were calm to very light winds, tending predominately from the south-west. Local wind direction varied during the survey.

- At MLP 2 on the corner of Mulgrave Rd and Curtis Rd a Distinct odour was present on a continuous basis during the assessment period. The character of this odour was a mixture of chicken manure and earthy/compost. This MLP is approximately 300m from the nearest Elf Farm building. The odour was judged to be clearly emanating from that facility.
- This odour was also detected on an intermittent basis at intensity level Weak in the industrial estate (MLP 5, Cunneen St).
- At MLP 3 in the industrial estate a Distinct but intermittent Meal odour was detected. The likely source was identified as the Pet Food plant in Curtis Rd.
- At MLP 8 at the junction of Harris and James Meehan Streets in the residential area to the west of the Elf plant, a Very Weak and intermittent ammonia odour was detected. The source of this odour could not be clearly determined.
- In Fairey Rd at MLP 11 a Strong and constant poultry shed and ammonia odour was detected, consistent with the location being close to the poultry broiler farm
- Similarly, at MLP 12, at the front gate of the South Windsor Sewage Treatment Plant, a Very Weak sewage odour was intermittently present.



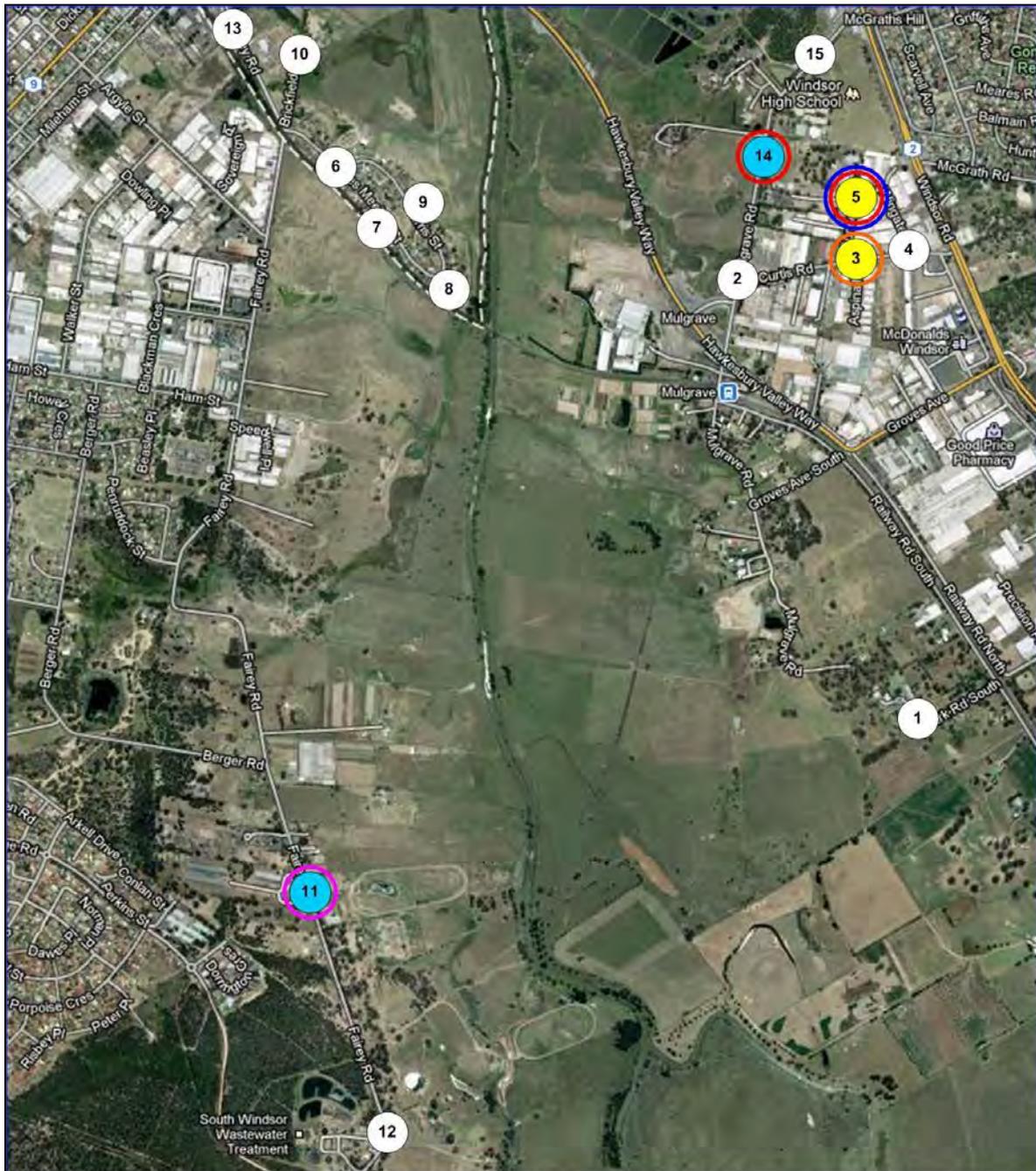
DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 0 Not detectable 1 Very weak 2 Weak 3 Distinct 4 Strong 5 Very strong 6 Extremely strong		ODOUR CHARACTERISATION Chicken Manure Earthy, Compost Meal Ammonia Poultry		CLIENT/PROJECT NSW EPA Mulgrave-Windsor Regional Field Ambient Odour Assessment Date: 29/05/2013 Time: 1440 – 1632 hrs		N LOCAL WEATHER CONDITIONS: Calm conditions (0.2 - 1 m/s) with predominantly south-westerly winds LOCAL WIND DIRECTION: 	
 THE ODOUR UNIT PTY LTD Aust Tech Park, Locomotive Workshop, Suite 16012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No. 2 Field Ambient Odour Assessment		Plot No. N1893L_002 Revision: A JOB No. N1893L.02			

FAOA Survey Map Plot 5.2 – FAOA Survey No. 2: 29 May 2013

6.3 FAOA SURVEY NO. 3– 29 MAY 2013

FAOA Survey No. 3 was carried out on 29 May 2013 between 1712 hrs - 1845 hrs, which was 40 minutes after the completion of FAOA Survey No. 2. The same wind conditions prevailed, being calm to very light winds, tending predominately from the south-west. Local wind direction varied during the survey.

- Overall, there was less odour present in this survey than identified in FAOA #2.
- The odour previously detected at MLP 2, on the corner of Mulgrave Rd and Curtis Rd, was no longer present. Instead this same Chicken manure/Compost odour was detected at MLP 5 in Cunneen St, but at the Very Weak level and intermittently.
- At MLP 3 on the corner of Curtis and Cunneen Streets a Very Weak and intermittent Meal odour was detected. The likely source was again identified as the Pet Food plant in Curtis Rd.
- Towards the end of this survey, at MLP 14 in Mulgrave Rd, a constant and Distinct Compost odour was found to be present. This odour had none of the Chicken manure character found previously in the area, and was judged to have emanated from the Elf Farm, possibly the tunnel composting building.
- In Fairey Rd at MLP 11 a Strong and constant poultry shed and ammonia odour was again present, consistent with the location being close to the poultry broiler farm
- There was no odour at MLP 12, outside the front gate of the South Windsor Sewage Treatment Plant.



DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 0 Not detectable 1 Very weak 2 Weak 3 Distinct 4 Strong 5 Very strong 6 Extremely strong		ODOUR CHARACTERISATION Chicken Manure Earthy, Compost Meal Ammonia Poultry		CLIENT/PROJECT NSW EPA Mulgrave-Windsor Regional Field Ambient Odour Assessment Date: 29/05/2013 Time: 1712 - 1845		N 	
THE ODOUR UNIT PTY LTD Aust Tech Park, Locomotive Workshop, Suite 16012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No. 3 - Field Ambient Odour Assessment		Plot No. N1893L_003 JOB No. N1893L.02		LOCAL WEATHER CONDITIONS: Calm conditions (0.2 - 1 m/s) with predominantly south-westerly winds LOCAL WIND DIRECTION: 	

FAOA Survey Map Plot 5.3 – FAOA Survey No. 3: 29 May 2013

6.4 FAOA SURVEY NO.4 – 3 JUNE 2013

FAOA Survey No. 4 was carried out on 3 June 2013. The wind conditions at the time of this assessment session were once again calm to very light winds, varying between south-west to easterly. Local wind direction often changed suddenly during the survey, with the result that swirling light winds were often present in the built-up areas.

- At MLP 3 on the corner of Curtis and Cunneen Streets a Distinct and constant Meal odour was detected. The likely source was again identified as the Pet Food plant in Curtis Rd.
- At MLPs 3 and 4, in Curtis and Cunneen Streets respectively, a mixed odour was detected constantly at Weak to Distinct levels. This odour was judged to consist of the Chicken manure Elf Farm odour combined with the Meal odour from the pet food factory. Approximately 90 minutes later the survey team returned to this area and found the same odour at MLP 13 in Mulgrave Rd. This odour was not pursued further than these locations.
- A transient similar odour was detected at MLP 8 at the junction of Harris and James Meehan Streets in the residential area to the west of the Elf plant, at intensity level Very Weak. The wind direction at that time was from the east. This odour was not considered to be significant.
- There was no odour at MLP 12, outside the front gate of the South Windsor Sewage Treatment Plant or at MLP 11, outside the broiler poultry farm in Fairey Rd.



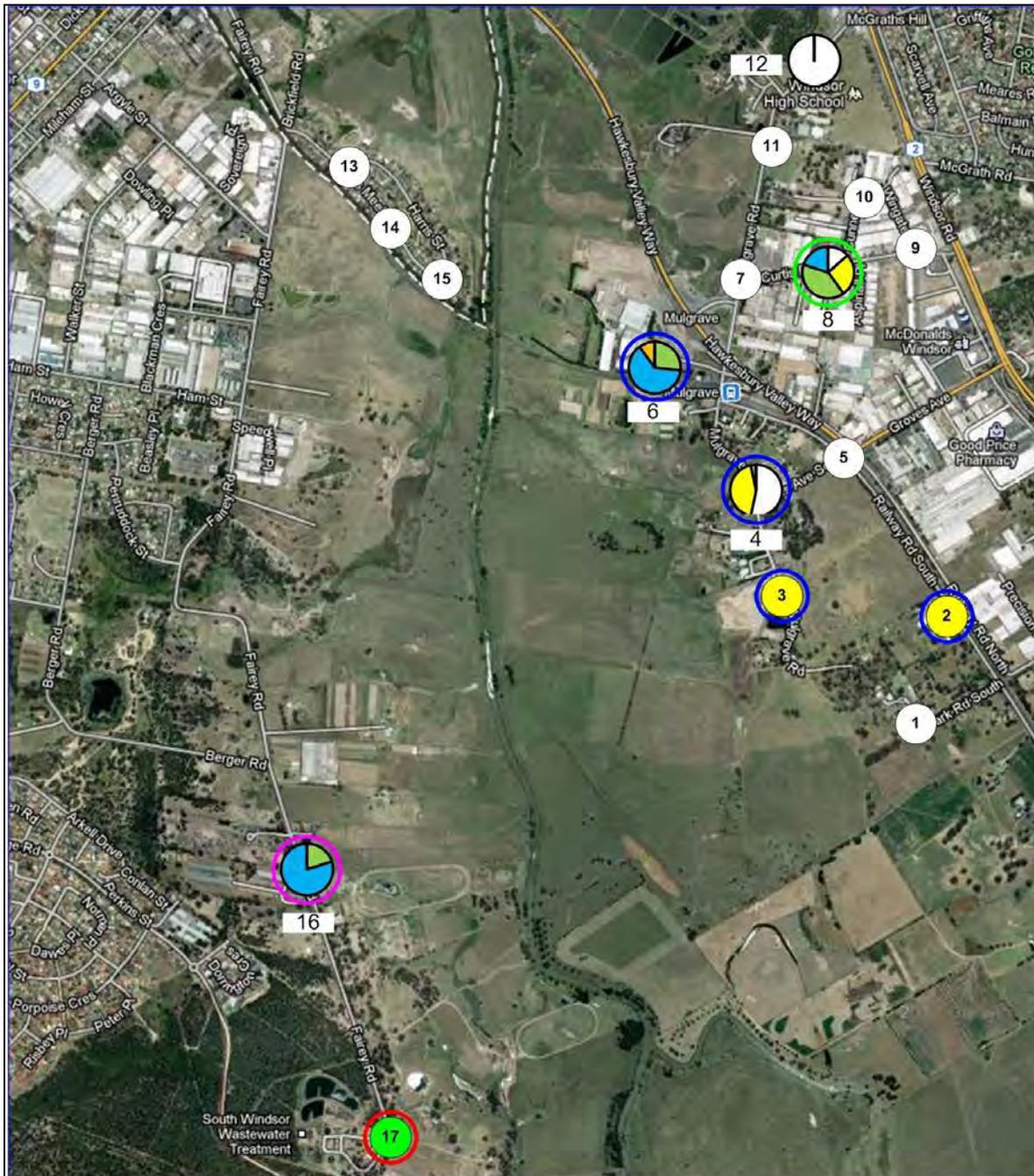
DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 0 Not detectable 1 Very weak 2 Weak 3 Distinct 4 Strong 5 Very strong 6 Extremely strong		ODOUR CHARACTERISATION Chicken Manure Earthy, Compost Meal Ammonia Poultry		CLIENT/PROJECT NSW EPA Mulgrave-Windsor Regional Field Ambient Odour Assessment Date: 03/06/2013 Time: 1350 – 1548 hrs		N 	
THE ODOUR UNIT THE ODOUR UNIT PTY LTD Aust Tech Park, Locomotive Workshop, Suite 16012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No. 4 Field Ambient Odour Assessment		Plot No. N1893L_004 JOB No. N1893L.02		LOCAL WEATHER CONDITIONS: Light conditions (0.2 - 2 m/s) with south-west to easterly winds LOCAL WIND DIRECTION: 	

FAOA Survey Map Plot 5.4 – FAOA Survey No. 4: 3 June 2013

6.5 FAOA SURVEY NO. 5 – 13 JUNE 2013

FAOA Survey No. 5 was carried out on 13 June 2013 between 1434 hrs - 1710 hrs. The wind conditions at the time of this assessment session were very light winds, from the north-west. Local wind direction was consistent for the duration of the survey. This was the first survey carried out under north-westerly winds. This was also the first survey in which 5-minute assessments were carried out at key locations

- This survey showed a clear pattern of increasing odour intensity and prevalence as the assessment locations approached the Elf Farm plant from the south-east. The dominant odour character was that of Chicken manure, judged to be emanating from the plant, with that odour detected as far out as MLP 2 in Railway Rd (Very Weak and intermittent).
- At MLP 4, near the junction of Groves Ave South and Mulgrave Rd, the odour was present for approximately 45% of the time, at levels Very Weak to Weak. It was not detectable at MLP 5, slightly to the east. At MLP 6, on the corner of Railway Rd South and Mulgrave Rd, the odour was continuous for the 5-minute assessment period, mostly at intensity score 4 (Strong).
- The pet food factory Meal odour was not detected during this survey. In its place, in Curtis Rd, an intermittent industrial odour was present, at levels from Very Weak to Distinct. This odour had a Chemical/Solvent/Metallic character. Its source could not be identified.
- As with previous surveys, the poultry farm was detected constantly, at levels up to Distinct, outside the farm in Fairey Rd at MLP 16. Similarly, there was a Weak Effluent/Mildew odour present at MLP 17, outside the front gate of the South Windsor Sewage Treatment Plant. While slightly different to previous odour characters determined at this location, this odour is considered to have originated at the plant.



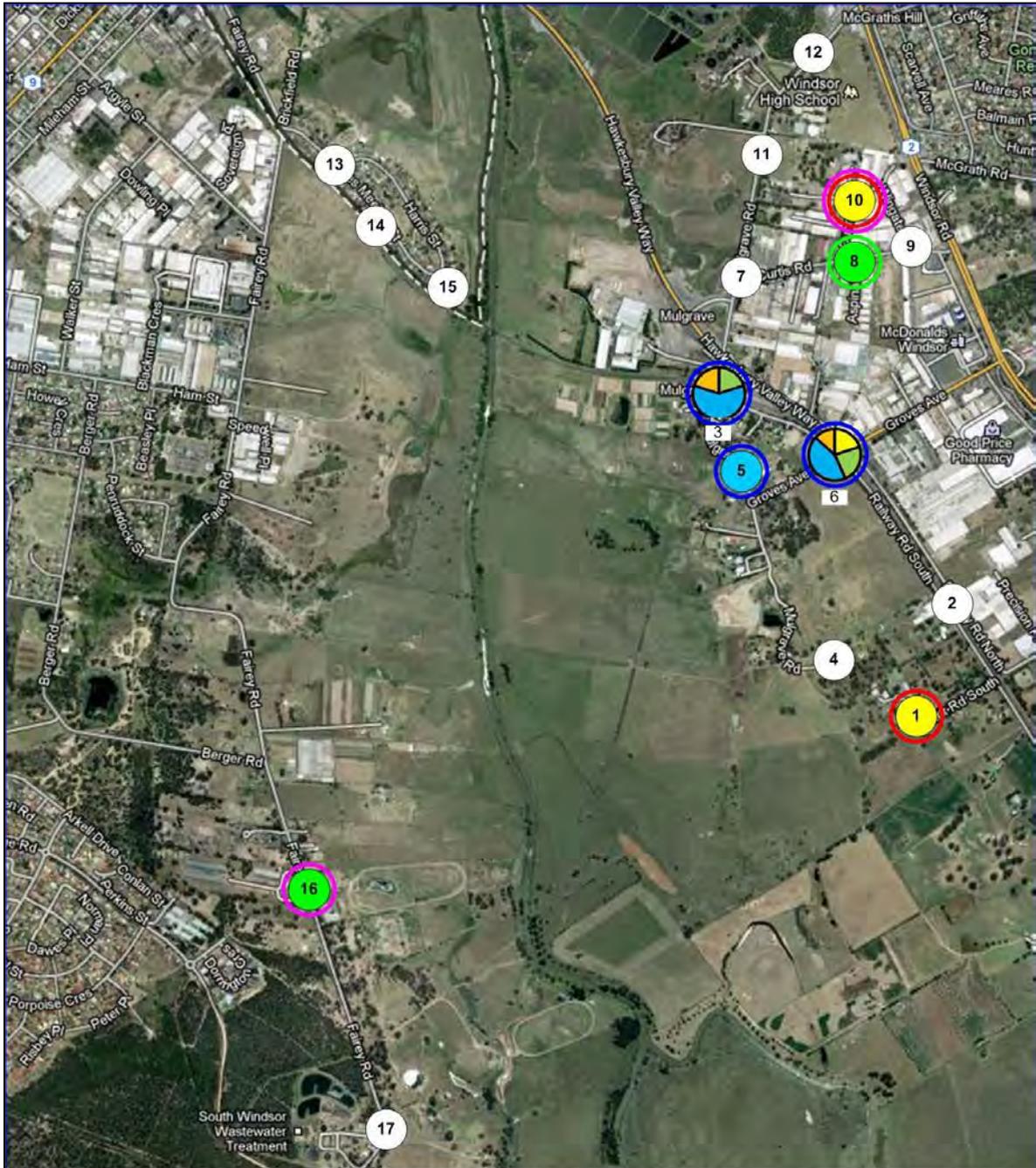
DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 ○ 0 Not detectable ● 1 Very weak ● 2 Weak ● 3 Distinct ● 4 Strong ● 5 Very strong ● 6 Extremely strong		ODOUR CHARACTERISATION ● Chicken Manure ● Earthy, Compost ● Meal ● Ammonia ● Poultry		CLIENT/PROJECT NSW EPA Mulgrave-Windsor Regional Field Ambient Odour Assessment Date: 13/06/2013 Time: 1434 - 1710		N 	
THE ODOUR UNIT PTY LTD Aust Tech Park, Locomotive Workshop, Suite 16012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No. 5 Field Ambient Odour Assessment		Plot No. N1893L_005 JOB No. N1893L.02		LOCAL WEATHER CONDITIONS: Light conditions (0.2 - 2 m/s) with north westerly winds LOCAL WIND DIRECTION: 	

FAOA Survey Map Plot 5.5 – FAOA Survey No. 5: 13 June 2013

6.6 FAOA SURVEY NO. 6 – 14 JUNE 2013

FAOA Survey No. 6 was carried out on 14 June 2013 between 1402 hrs – 1605 hrs. The wind conditions at the time of this assessment session were light to moderate winds, mostly from the north-west. This survey was the only one carried out under winds stronger than 1 m/s.

- At the northern end of the industrial estate a Very Weak and intermittent Poultry/Earthy/Compost odour was detected at MLP 10. Nearby, at MLP 8 the previously reported Chemical odour was detected, as a Resin/ Solvent odour. This also appeared to be localised in its impact.
- To the south-east of the Elf Farm plant at MLPs 3, 5 and 6 the characteristic Chicken manure odour was found to be present at intensity levels up to Distinct. This odour was continuous at MLP 6 near the junction of Groves Ave and Railway Rd North, approximately 600m from the Elf plant.
- The poultry farm in Fairey Rd was again detected on the roadway (MLP 16).
- An unknown intermittent and Very Weak Earthy/Compost odour was detected in Park Rd South (MLP 1). This odour appeared to be from a local source.
- The McGraths Hill STP was not detected during this survey at the downwind locations MLP 11 and MLP12.



DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 0 Not detectable 1 Very weak 2 Weak 3 Distinct 4 Strong 5 Very strong 6 Extremely strong		ODOUR CHARACTERISATION Chicken Manure Earthy, Compost Meal Resin, Solvent Poultry		CLIENT/PROJECT NSW EPA Mulgrave-Windsor Regional Field Ambient Odour Assessment Date: 14/06/2013 Time: 1402 - 1625		N LOCAL WEATHER CONDITIONS: Light - Moderate conditions (0.4 – 5.8 m/s) with north westerly winds LOCAL WIND DIRECTION: 	
THE ODOUR UNIT PTY LTD Aust Tech Park, Locomotive Workshop, Suite 16012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No. 6 Field Ambient Odour Assessment		Plot No. N1893L_006 JOB No. N1893L.02			

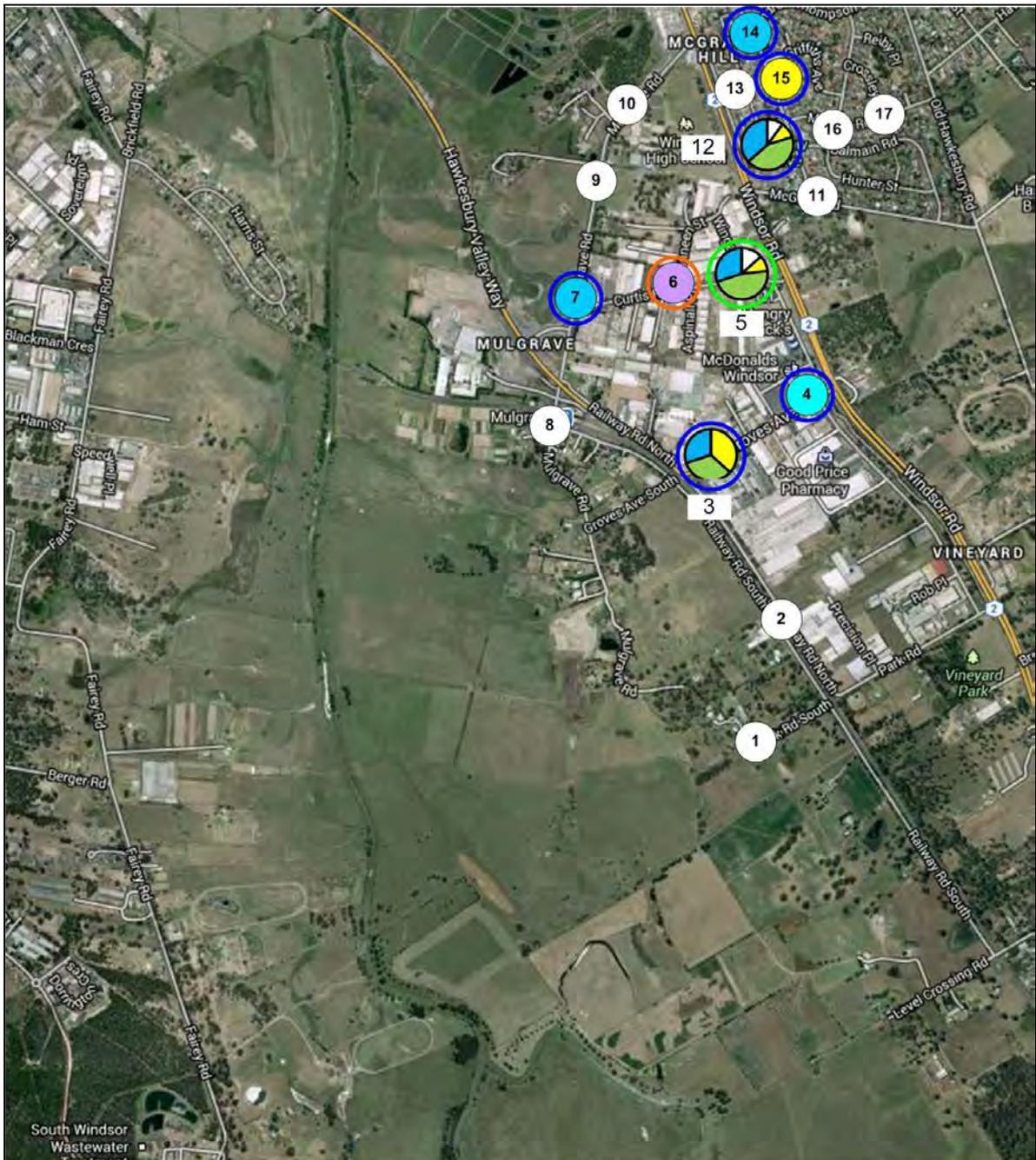
FAOA Survey Map Plot 5.6 – FAOA Survey No. 6: 14 June 2013

6.7 FAOA SURVEY NO. 7 - 24 JUNE 2013

FAOA Survey No. 7 was carried out on 24 June 2013 between 1120 hrs – 1415 hrs. The wind conditions at the time of this assessment session were very light winds, swinging around from the north-east initially to the south-west. The latter part of this survey was the first carried out under consistent south-westerly winds. These winds directed any odours from the Elf Farm and pet food plants towards the McGraths Hill residential area.

- Given the consistent findings from the previous five surveys regarding the prevalence and intensity of odours from the South Windsor STP and the poultry farm in Fairey Rd, this survey focused only on the industrial estate and the McGraths Hill residential area.
- The pet food factory Meal odour was detected at the Strong intensity level in Curtis Rd during this survey (MLP 4) but nowhere else. It was not evident further to the east in Curtis Rd (MLP 5), suggesting that does not travel far from its source. The previously reported Chemical odour was present at this location, as a Resin odour, but also appeared to be localised in its impact.
- At MLP 3, near the junction of Groves Ave South and Railway Rd North, the Chicken manure odour was constantly present, under a north-westerly wind, at levels up to Distinct. This location is approximately 600m from the Elf plant. It was also detectable at a similar intensity at MLP 4, slightly to the east, more than 1,000m from the plant.

As the wind direction changed towards the south-west the same Chicken manure odour was tracked from near the Elf plant at MLP 7 (Distinct) to the corner of Red House Cr and Andrew Thompson Drive, McGraths Hill (MLP 14), a distance of approximately 1,100m from the Elf plant. While intermittent and at intensity Distinct at this location, this odour was also detected more consistently up to this level in the residential area at MLP 12, approximately 950m from the plant.



DESCRIPTION Field Ambient Odour Assessment Survey Modified German Standard VDI 3940		LEGEND German Intensity Scale VDI3882 0 Not detectable 1 Very weak 2 Weak 3 Distinct 4 Strong 5 Very strong 6 Extremely strong		ODOUR CHARACTERISATION Chicken Manure Effluent, Mildew Meal Resin, Solvent Poultry		CLIENT/PROJECT NSW EPA Windsor-Mulgrave Regional Field Ambient Odour Assessment Date: 24/06/2013 Time: 1120 - 1415		N 	
THE ODOUR UNIT		THE ODOUR UNIT PTY LTD Aust Tech Park, Locomotive Workshop, Suite 18012, 2 Locomotive Street, EVELEIGH, NSW 2015 Phone: (02) 9209 4420 Fax: (02) 9209 4421 info@odourunit.com.au www.odourunit.com.au		DRAWN BY J. SCHULZ CHECKED M. ASSAL APPROVED T. SCHULZ		TITLE FAOA Survey No.7 Field Ambient Odour Assessment		Plot No. N1893L_007 JOB No. N1893L.02	
						LOCAL WEATHER CONDITIONS: Light conditions (0.2 - 1 m/s) with west-south westerly winds		LOCAL WIND DIRECTION: 	

FAOA Survey Map Plot 5.7 – FAOA Survey No. 7: 24 June 2013

7 DISCUSSION AND CONCLUSIONS

This study carried out a series of seven independent Field Ambient Odour Assessment surveys in the McGraths Hill/ Mulgrave/Windsor area of north-western Sydney. During the course of the study the primary focus of the field assessors was on the potentially odour-impacting industries in the area, these being the Elf Farm facility and the two Sewage Treatment Plants at South Windsor and McGraths Hill. It soon became apparent during the early surveys that other odour-generating industries were present in the assessment area, including a pet food manufacturing plant in Curtis St McGraths Hill, a Broiler poultry farm in Fairey Rd South Windsor, and at least one unknown source in the McGraths Hill industrial area producing a chemical/solvent/resin odour. The potential for each of these odour sources to impact adversely in the residential areas is discussed below.

In general, the findings from this study were clear and unambiguous, despite the prevalence of a relatively narrow range of wind speeds encountered by the assessment team. This was not considered to be a problem because odour impacts are often found to be worse under light wind conditions, due to the low dispersion and dilution of source odours in the atmosphere, in particular ground level or near-ground level emissions. Whilst it is not possible to definitively extrapolate the findings of this study to strong wind weather conditions, it is reasonable to believe that the problem industries identified in this study will also be problematic under stronger wind conditions.

The findings of this study, with respect to the individual industries are as follows:

Elf Farm

This plant was found to emit a range of odours, broadly described in this study as either 'chicken manure' or 'earthy/compost'. The chicken manure odour was defined as having a sour, unpleasant manure character, rather than that of fresh chicken litter. The earthy/compost odour was defined as having a matured compost character. It is the judgement of TOU that the sources of the chicken manure odour are likely to be the compost preparation activities carried out in the open bale-wetting area, the pre-wet building and the external compost loading conveyor. Similarly, the

earthy/compost odour was most likely emanating from the roof vents in the newer tunnel composting building.

With one exception, in FAOA Survey No. 3 on 29 May 2013, the earthy/compost odour was not detected, and on the occasion that it was, it was found to be present relatively close to the Elf Farm plant in Mulgrave Rd and no further distant. On this basis the tunnel composting building roof vents are not considered problematical, in the context of the history of odour nuisance in the area.

In contrast, the chicken manure odour originating in the older section of the plant was by far the dominant odour detected during all seven FAOA surveys. This odour was detected at intensities consistent with adverse odour impact (Distinct and above) in Harris and James Meehan Streets Windsor in FAOA Survey No. 1 on 27 May, and in the McGraths Hill residential area in FAOA Survey No. 7 on 24 June. During this final survey this odour was detected at this intensity up to 1,100 metres from the Elf Farm plant in the McGraths Hill area. In all other surveys the odour was present at different assessment locations and clearly identifiable as originating from the Elf Farm plant. Based on these findings it is considered that the chicken manure odour is most likely to be the source the odours responsible for a large proportion of the complaints in recent times.

The emission from the Bioscrubber Stack at the plant was not specifically assessed during this study and any odour testing results for this emission will need to be considered in any subsequent investigations. However, having regard to the height of this stack, the light wind conditions prevailing during this study and the proximity and longitudinal continuity of odours detected at ground level, this stack is unlikely to be the source of the odours detected during this study.

McGraths Hill STP

This plant was not detected at all during the study and is therefore most unlikely to be a problematical odour source in the McGraths Hill area, under normal operating conditions.

South Windsor STP

This plant was only detected at or near the entrance gate during the study and gave no indications that it would be the cause of adverse odour impacts in the South Windsor area, under normal operating conditions.

Fairey Rd Broiler Farm

This farm was found to be a consistent source of a poultry/bird odour on every occasion that it was assessed in a downwind position. The odour character was that of the birds themselves and easily distinguished by the assessment team from the chicken manure odour judged to be emanating from the Elf plant. While there was little evidence that the poultry odour would travel any substantial distance from the farm, it is noted that the nearest residences are less than 100m from the poultry sheds. It is possible that some of the odour complaints recorded in the area could be due to this farm.

Pet Food Plant, Curtis St McGraths Hill

This plant produces a characteristic 'mealy' odour similar to that of dried dog food and poultry feed mills. Its source was unambiguously the plant in Curtis St, McGraths Hill. It was detected on five of the seven surveys, up to intensity level Distinct. While not detected beyond the McGraths Hill industrial area, it is considered to have the potential to be detected in the McGraths Hill residential area.

8 PRELIMINARY MANAGEMENT PRACTICE REVIEW

This study has identified certain odour emissions from the Elf Farm plant that have the potential collectively or singly to cause odour impacts in the Windsor and McGraths Hill residential areas. While the development of an odour mitigation strategy for the plant is outside the scope of work for this study, it is possible to provide preliminary comments, based on TOU's experience, on how each of the odour source areas might be addressed. This is clearly not a definitive or optimised set of mitigation measures, but would serve as a basis for future discussion and consideration. These comments are given below.

Bale Wetting Area Emissions

This activity occurs in an open area between the Pre-wet building and the older Phase 1 tunnel composting building. The activity consists of wetting the straw bales with recycled water from several sources, including the bale-wetting process, the addition of various additives, including chicken manure, and the storage of these additive materials. The leachate from the bale-wetting process drains to a pit into which a larger quantity of non-odorous make-up water is added as required. This water is understood to be recycled during the week, after which it is discharged to the wastewater system. It is likely that the bale-wetting water gets progressively stronger as the week progresses. It is applied to the straw bales with a travelling spray-bar system mounted high above the bale area.

The entire bale wetting operation gives rise to odour emissions, though the leachate pit itself, the spray application of the potentially odorous leachate and the commencement of composting in the bales. It is understood that Elf Farm has plans to enclose the bale wetting area. In doing so odour emissions would certainly decrease but it is questionable whether full enclosure, foul air extraction and treatment will also be required.

Pre-Wet Building

This building is highly odorous, due to the initial composting that is taking place. While there were high levels of ammonia present during the site visit, this compound is rarely

an odour problem and tends to mask other offensive odours that are also present. The building is enclosed but has a large opening/doorway required for multiple loader access events each day. This doorway is considered to provide an opportunity for fugitive odour release. The building is equipped with a foul air extraction system consisting of four flexible ducts that direct air to the Bioscrubber system. The size of these ducts appeared to be small, for the volume of the building, and unlikely to be effective in preventing fugitive odour emission from the building. Ideally, this building should be maintained under negative pressure and connected to an odour treatment unit, such as a biofilter, bioscrubber or chemical scrubber.

External Loading Conveyor

This conveyor transports freshly made and blended compost to the tunnel loading system on the roof of the old tunnel building. The material was observed to be hot and steaming during the site visit, and assumed to be odorous. The conveyor runs on the outside of the building and is uncovered. The extent to which it is a significant odour source needs to be determined. It may need to be fully enclosed and possibly connected to the odour Bioscrubber system.

The Bioscrubber

The Bioscrubber performance was briefly assessed during the site visit by sniffing the odour in an inspection port. It was found to have relatively low odour and free of the chicken manure odour found in the community. The performance of this system should be evaluated as part of any mitigation study, as it is a key element in the odour management system at the plant. Its potential for increased loadings and/or optimisation should also be assessed.

The Stack

The Bioscrubber stack is a vital and valuable element of the odour control system. Its potential for increased throughput should also be investigated.

The Tunnel Composting Building (Phase 2/3)

This newer facility was assessed during the site visit and found to represent best-practice in the areas of process control and design. Based on this finding, and the

results of the FAOA survey, this facility requires no attention in the area of odour emission mitigation.

9 REPORT SIGNATURE PAGE

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ABN: 53 091 165 061



Terry Schulz
Managing Director
5 August 2013



McGraths Hill, Mulgrave, Windsor Field Ambient Odour Assessment Study

Appendix A: FAOA FIELD LOGSHEETS

FAOA Survey No.	Date	Time (hrs)
1	27 May	1545 – 1752
2	29 May	1440 - 1632
3		1712 - 1845
4	3 June	1350 - 1548
5	13 June	1434 - 1710
6	14 June	1402 - 1625
7	24 June	1120 - 1415

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N1893L_001 - Field Ambient Odour Assessment Log Sheet

DATE: 27/05/2013 ASSESSORS: T. Schulz, W. Westwood WEATHER CONDITIONS: Calm/light conditions with easterly winds

FAOA Map Plot No. N1893L_001							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
1	1545	70°	0.2	Y	Mealy	1	Intermittent odour detected
2	1547	147°	0.4	N	-	0	-
3	1551	-	0	N	-	0	-
4	1558	102°	0.2	Y	Mealy	1	Intermittent odour detected
5	1602	70°	0.5	N	-	0	-
6	1642	95°	0.3	Y	Chicken Manure, Compost	3	Constant odour detected
7	1645	95°	0.2	Y	Chicken Manure	4	Constant odour detected

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DATE: 27/05/2013 ASSESSORS: T. Schulz, W. Westwood WEATHER CONDITIONS: Calm/light conditions with easterly winds

FAOA Map Plot No. N1893L_001							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
8	1650	75°	0.1	N	-	0	-
9	1652	75°	0.1	Y	Chicken Manure	4	Constant odour detected
10	1655	75°	0.1	N	-	0	-
11	1657	75°	0.1	Y	Chicken Manure	4	Constant odour detected
12	1700	75°	0.1	Y	Chicken Manure	4	Constant odour detected
13	1704	85°	0.1	N	-	0	-
14	1709	85°	0.1	N	-	0	-

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 Eveleigh NSW 2015 ABN: 53 091 165 061

DATE: 27/05/2013 ASSESSORS: T. Schulz, W. Westwood WEATHER CONDITIONS: Calm/light conditions with easterly winds

FAOA Map Plot No. N1893L_001							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
15	1715	-	0	Y	Poultry	3	Constant odour detected
16	1718	-	0	Y	Poultry	4	Constant odour detected
17	1721	213°	0.1	Y	Sewage, Musty	2	Constant odour detected
18	1734	100°	0.1	Y	Chicken Manure	2	Constant odour detected Not shown on map (Crn Hawkesbury Valley Way & Macquarie St)
19	1740	100°	0.1	N	-	0	Not shown on map (Crn Windsor Rd & Pitt Town Rd)
20	1752	100°	0.1	N	-	0	Not shown on map (Crn Mulgrave Rd & Windsor Rd)

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N1893L_002 - Field Ambient Odour Assessment Log Sheet

DATE: 29/05/2013 ASSESSORS: J. Schulz, W. Westwood WEATHER CONDITIONS: Calm conditions with south westerly winds

FAOA Map Plot No. N1893L_002							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6	COMMENTS
1	1440	150°	0 – 0.1	N	-	0	-
2	1446	250°	0.5 – 1	Y	Chicken Manure, Earthy, Compost	3	Constant odour detected
3	1451	271°	0 – 0.5	Y	Meal	3	Intermittent odour detected
4	1500	270°	0 – 0.1	N	-	0	-
5	1504	248°	0 – 0.3	Y	Chicken Manure, Earthy, Compost	2	Intermittent odour detected
6	1515	270°	0 – 0.3	N	-	0	-
7	1519	273°	0 – 0.2	N	-	0	-

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 Eveleigh NSW 2015 ABN: 53 091 165 061

DATE: 29/05/2013 ASSESSORS: J. Schulz, W. Westwood WEATHER CONDITIONS: Calm conditions with south westerly winds

FAOA Map Plot No. N1893L_002							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6	COMMENTS
8	1531	270°	0 – 0.2	Y	Ammonia	1	Intermittent odour detected
9	1537	275°	0 – 0.2	N	-	0	-
10	1543	255°	0 – 0.2	N	-	0	-
11	1550	255°	0 – 0.2	Y	Poultry	4	Constant odour detected
12	1555	273°	0 – 0.5	Y	Earthy, Compost	1	Intermittent odour detected
13	1606	341°	0.5 – 1	N	-	0	-
14	1618	244°	0 – 0.2	Y	Compost	1	Intermittent odour detected
15	1632	240°	0 – 0.2	N	-	0	-

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N1893L_003 - Field Ambient Odour Assessment Log Sheet

DATE: 29/05/2013 ASSESSORS: J. Schulz, W. Westwood WEATHER CONDITIONS: Calm conditions with south westerly winds

FAOA Map Plot No. N1893L_003							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6	COMMENTS
1	1712	42°	0 – 0.1	N	-	0	-
2	1720	238°	0 – 0.2	N	-	0	-
3	1725	231°	0 – 0.2	Y	Meal	1	Intermittent odour detected
4	1730	270°	0 – 0.2	N	-	0	-
5	1734	248°	0 – 0.2	Y	Chicken Manure, Earthy, Compost	1	Intermittent odour detected
6	1752	250°	0 – 0.2	N	-	0	-
7	1755	260°	0 – 0.2	N	-	0	-

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 Eveleigh NSW 2015 ABN: 53 091 165 061

DATE: 29/05/2013 ASSESSORS: J. Schulz, W. Westwood WEATHER CONDITIONS: Calm conditions with south westerly winds

FAOA Map Plot No. N1893L_003							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6	COMMENTS
8	1800	270°	0 – 0.2	N	-	0	-
9	1805	265°	0 – 0.2	N	-	0	-
10	1811	255°	0 – 0.2	N	-	0	-
11	1815	270°	0 – 0.2	Y	Poultry	3	Constant odour detected
12	1820	273°	0 – 0.2	N	-	0	-
13	1830	250°	0 – 0.2	N	-	0	-
14	1836	250°	0 – 0.2	Y	Earthy, Compost	3	Constant odour detected
15	1845	240°	0 – 0.2	N	-	0	-

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N1893L_004 - Field Ambient Odour Assessment Log Sheet

DATE: 03/06/2013 ASSESSORS: J. Schulz, A. Schulz WEATHER CONDITIONS: Light conditions with south westerly winds

FAOA Map Plot No. N1893L_004							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6	COMMENTS
1	1350	173°	1.5 – 2	N	-	0	-
2	1358	107°	0.2 – 0.7	Y	Compost, Musty	1	Intermittent odour detected
3	1405	110°	0.2 – 0.5	Y	Meal	3	Constant odour detected
4	1411	235°	0.2 – 0.5	Y	Chicken Manure, Meal	3	Constant odour detected
5	1422	192°	0.5 – 1	Y	Chicken Manure, Meal	2	Constant odour detected
6	1436	112°	0.3 – 0.5	N	-	0	-
7	1442	208°	0.5 – 1.2	N	-	0	-

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DATE: 03/06/2013 ASSESSORS: J. Schulz, A. Schulz WEATHER CONDITIONS: Light conditions with south westerly winds

FAOA Map Plot No. N1893L_004							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6	COMMENTS
8	1450	087°	0 – 0.2	Y	Chicken Manure, Compost	1	Intermittent odour detected <30 second event
9	1458	085°	0 – 0.2	N	-	0	-
10	1509	254°	0.5 – 1	N	-	0	-
11	1517	034°	0 – 0.2	N	-	0	-
12	1530	154°	0 – 0.2	N	-	0	-
13	1545	197°	0 – 0.1	Y	Chicken Manure, Meal	2	Constant odour detected
14	1548	190°	0 – 0.1	N	-	0	-

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N1893L_005 - Field Ambient Odour Assessment Log Sheet

DATE: 13/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Calm / Light conditions with north westerly winds

FAOA Map Plot No. N1893L_005							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
1	1434	287°	0.5	N	-	0	-
2	1439	314°	0.5	Y	Chicken Manure, Manure	1	Intermittent odour detected
3	1447	327°	0.2	Y	Chicken Manure, Manure	1	Intermittent odour detected
4	1454	325°	0.5	Y	Chicken Manure, Manure	2	Intermittent odour detected Intensity fluctuating between 1 – 2
5	1511	287°	0.5	N	-	0	-
6	1515	296°	0.5	Y	Chicken Manure, Manure	4	Constant odour detected Intensity fluctuating between 2 – 4
7	1528	335°	1.1	N	-	0	-

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DATE: 13/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Calm / Light conditions with north westerly winds

FAOA Map Plot No. N1893L_005							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
8	1534	309°	0.6	Y	Solvent, Metallic	3	Intermittent odour detected Intensity fluctuating between 1 – 3
9	1548	312°	0.2	N	-	0	-
10	1603	026°	2	N	-	0	-
11	1607	-	0	N	-	0	-
12	1614	-	0	N	-	0	-
13	1638	-	0	N	-	0	-
14	1642	-	0	N	-	0	-

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DATE: 13/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Calm / Light conditions with north westerly winds

FAOA Map Plot No. N1893L_005							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
15	1652	284°	0.4	N	-	0	-
16	1703	277°	0.1	Y	Poultry	3	Constant odour detected Intensity fluctuating between 2 – 3
17	1710	274	0.3	Y	Treated effluent, Mildew	2	Constant odour detected

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N1893L_006 - Field Ambient Odour Assessment Log Sheet

DATE: 14/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Light - moderate conditions with north westerly winds

FAOA Map Plot No. N1893L_006							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
1	1402	300°	2.6	Y	Earthy, Compost	1	Intermittent odour detected
2	1413	306°	0.9	N	-	0	-
3	1422	298°	4.5	Y	Chicken Manure	4	Constant odour detected
4	1431	330°	3.2	N	-	0	-
5	1436	283°	3.0	Y	Chicken Manure	3	Intermittent odour detected
6	1443	314°	2.2	Y	Chicken Manure	4	Constant odour detected
7	1454	322°	3.6	N	-	0	-

DATE: 14/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Light - moderate conditions with north westerly winds

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FAOA Map Plot No. N1893L_006							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
8	1502	300°	3.3	Y	Resin, Solvent	2	Constant odour detected
9	1516	315°	3.5	N	-	0	-
10	1521	355°	2.6	Y	Poultry, Earthy, Compost	1	Intermittent odour detected
11	1529	291°	5.8	N	-	0	-
12	1535	289°	1.3	N	-	0	-
13	1552	315°	2.0	N	-	0	-
14	1559	315°	1.6	N	-	0	-

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DATE: 14/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Light - moderate conditions with north westerly winds

FAOA Map Plot No. N1893L_006							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
15	1607	315°	1.9	N	-	0	-
16	1615	315°	0.4	Y	Poultry	2	Intermittent odour detected
17	1625	315°	1.3	N	-	0	-

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N1893L_007 - Field Ambient Odour Assessment Log Sheet

DATE: 24/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Calm / Light conditions with west - south westerly winds

FAOA Map Plot No. N1893L_007							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
1	1120	NE	0.5	N	-	0	-
2	1130	NE	0.1	N	-	0	-
3	1218	W – NW	0.4	Y	Chicken Manure	3	Constant odour detected
4	1237	WNW	0.5	Y	Chicken Manure	3	Constant odour detected
5	1244	WNW	0.8	Y	Resin	3	Intermittent odour detected
6	1254	W	1.2	Y	Meal	4	Continuous odour detected
7	1305	W	1.0	Y	Chicken Manure	3	Intermittent odour detected

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DATE: 24/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Calm / Light conditions with west - south westerly winds

FAOA Map Plot No. N1893L_007							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
8	1312	W	1.0	N	-	0	-
9	1318	SW	2.2	N	-	0	-
10	1322	SW	0.6	N	-	0	-
11	1337	WSW	1.1	N	-	0	-
12	1345	SW	1.0	Y	Chicken Manure	3	Intermittent odour detected
13	1352	SW	1.0	N	-	0	-
14	1359	SW	0.8	Y	Chicken Manure	3	Intermittent odour detected

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DATE: 24/06/2013 ASSESSORS: J. Schulz WEATHER CONDITIONS: Calm / Light conditions with west - south westerly winds

FAOA Map Plot No. N1893L_007							
GRID REF. POSITION	TIME (hrs)	WIND DIRECTION	WIND VELOCITY (m/s)	ODOUR PRESENT Y / N	ODOUR CHARACTER	VDI 3940 INTENSITY SCALE 0-6 (Peak value detected)	COMMENTS
15	1404	SW	0.8	Y	Chicken Manure	1	Intermittent odour detected
16	1409	SW	1.1	N	-	0	-
17	1415	SW	1.0	N	-	0	-