



ELF FARM SUPPLIES

Annual Biofilter Testing

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Revision Record

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TR01R01	4 September 2023	Danny Echeverri	Graeme Starke	
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Basis of Report

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1.0 Introduction

SLR Consulting Australia (SLR) was commissioned by Elf Farm Supplies (EFS) to conduct annual odour emission testing on the Biofilter Control System serving the EFS substrate facility located at 108 Mulgrave Road, Mulgrave NSW.

The purpose of the annual odour emission testing was to measure the odour concentration, odour emission rate and odour removal efficiency of the EFS biofilter and compare these against measurements taken in 2018 (as part of a site wide odour audit completed by SLR) and those adopted by the Odour Impact Assessment prepared by The Odour Unit dated 28 August 2015 (the OIA).

This report outlines the methodology and results of the biofilter odour monitoring. This report is limited to factual presentation of the monitoring data with minimal interpretation of results. This test report only includes the results from the locations nominated in **Section 1.1**.

1.1 Biofilter Testing Methodology

SLR conducted representative Biofilter odour testing in general accordance with:

- AS/NZS 4323.4:2009 Stationary source emissions - Area source sampling - Flux chamber technique; and
- Australian Standards and New Zealand Standards (AS/NZS) 4323.3:2001 Stationary source emissions – Determination of odour concentration by dynamic olfactometry; and
- AS4321.1:2021 and NSW EPA method TM-2 (USEPA method M2 “*Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)*”).

1.1.1 Biofilter Outlet Odour and Flow Testing

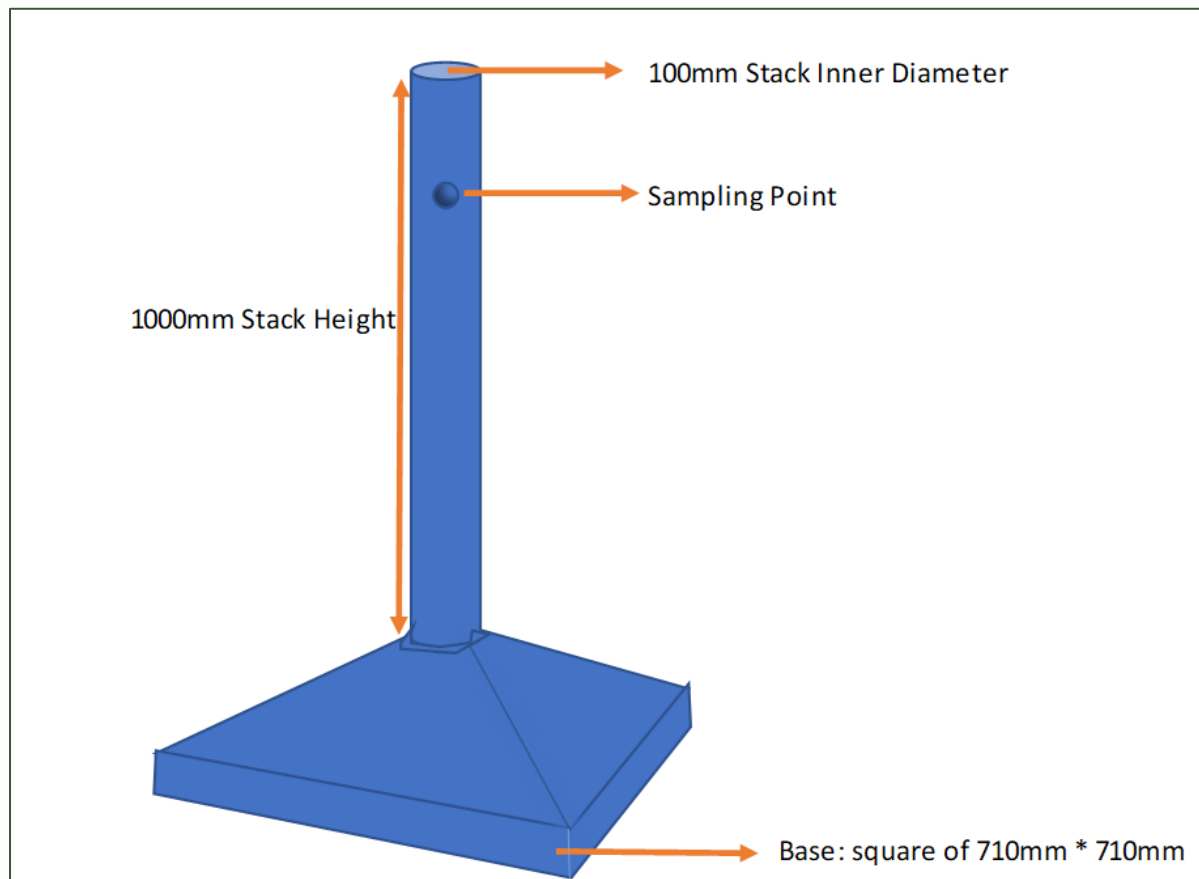
The AS/NZS 4323.4 Flux chamber technique is typically used for non-aerated surfaces such as landfill sites, ponds etc. An equilibrium hood is placed on the surface and nitrogen supply sweep air is used to stimulate the odorous surface within the equilibrium hood and therefore allowing a sample to be collected. However, a Biofilter system is aerated by a pressurised ventilation system. Therefore, SLR adopted the use of a Witches Hat hood (WHH) to conduct representative measurements that do not require nitrogen sweep air to collect a representative sample. Refer to **Figure 1** for an illustration of the Witches Hat hoods being used on the EFS Biofilter bed. Refer to **Figure 2** for a schematic of the Witches Hat hood used. Air flow measurements were undertaken using an anemometer to directly read average air flow rate and velocity from the outlet of the witches hat hoods, and to calculate the flow from each nominated location using the stack inner diameter.



Figure 1 Illustration of Witches Hat Hoods being used on EFS Biofilter Beds



Figure 2 Illustration of Witches Hat Hood Dimensions



In order to ensure consistency with the testing across the whole Biofilter bed and to minimise the variability that is typically associated with biofilters, SLR divided the EFS biofilter system into two (2) beds. SLR has identified these as the Eastern bed and the Western bed. SLR then further divided these two beds into evenly distributed rows (length and width).

The Eastern bed has a surface area of approximately 1,500 square meters (m²). SLR divided this bed into six (6) equal rows along its length and three (3) equal rows along its width (approximately 10 m by 9 m grid cells). This resulted in a total of 18 sample points evenly distributed across the Eastern biofilter bed.

The Western Bed has a surface area of approximately 1,278 m². SLR divided this bed into five (5) equal rows along its length and three equal rows along its width (approximate 9 m by 9 m grid cells). This resulted in a total of 15 sample points evenly distributed across the Western biofilter bed.

EFS confirmed the total surface area of the Biofilter bed is 2,778 m².

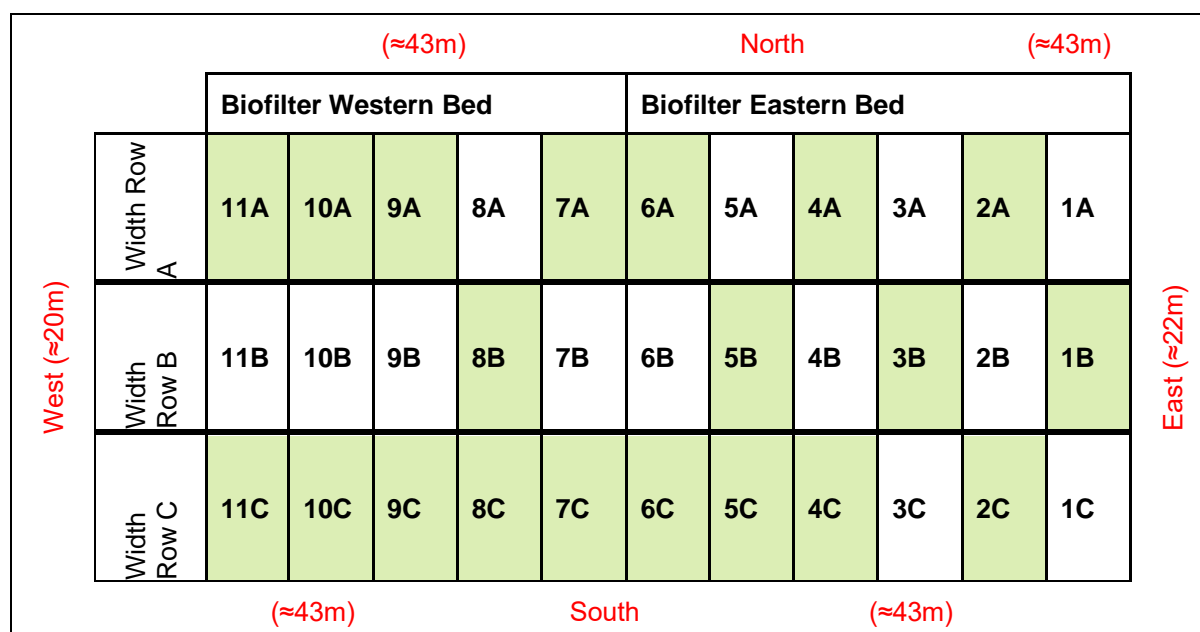
It is noted that at the time of the sampling, part of the eastern and western beds were inactive as the bedding material was being replaced. The active area of the beds was measured as follows:

- Eastern bed: approximately 22 m by 43 m
- Western bed: approximately 20 m by 43 m

The number of sample points for each bed was kept consistent with sampling conducted as part of a site wide odour audit completed by SLR in 2018. The smaller active surface area resulted in a tighter grid (approximately 7 m by 7 for the Eastern bed and 7.5 m by 7.5 for the Western bed).

Refer to **Figure 3** for an illustration of the Biofilter beds (as sampled) distributed into their grids.

Figure 3 Illustration of the Biofilter Distributed into 33 Grids



Note: the image above does not represent actual layout.

Note 2: odour samples were collected from cells highlighted green



Each grid cell was measured, as a minimum, for temperature and surface velocity at approximately the centre of each grid cell. The data was then assessed to determine if surface velocities measured for each north to south row were consistent or if there was evidence of breakthrough (high velocity) or blockage (low velocity). Should the scenario exist that a north to south row demonstrated inconsistency, SLR collected from that north to south row a single odour sample from the grid with the highest surface velocity measured and a single odour sample from the grid with the lowest surface velocity measured. SLR considered inconsistency to exist when there was a difference of greater than 20% from the average velocity measured. For all north to south rows with consistent surface velocities, SLR collected single samples from the middle grids (Row B).

A total of 20 samples were collected from the biofilter outlet. The locations where samples were collected are indicated in **Figure 4**.

Duplicate or triplicate samples, to quantify odour emission variability, at each nominated grid point were deemed not required as each odour sample is based on the same source gas distributed consistently across the biofilter based on the velocities measured. Hence repeatability of the odour samples has already been considered in the 20 samples measured across the biofilter.

The samples were analysed by a NATA accredited odour laboratory, The Odour Unit (TOU) within the specified 30 hours from sample collection. All samples were delivered to TOU as blind samples.

1.1.2 Biofilter Inlet Odour Testing

The 'lung method' was used to collect representative samples from the Biofilter Inlet. SLR collected the gas samples from the Biofilter Inlet in accordance with AS/NZS 4323.3:2001 *Stationary source emissions – Determination of odour concentration by dynamic olfactometry*. The samples were analysed by a NATA accredited odour laboratory (TOU) within the 30 hours specification. One (1) sample was collected for the inlet into the Eastern bed and one (1) sample was collected for the inlet into the Western bed.

A sample access point compliant with the requirements of AS/NZS 4323.1:2021 *Stationary source emissions - Method 1: Selection of sampling positions* is available for the western biofilter (see **Figure 4**). However, due to the design of the eastern bed, such an access point could not be installed on the inlet to this biofilter and a large number of sample access points would need to be installed along the aluminium ducting to each section of the eastern bed to obtain total flow.

For the western biofilter, air flow measurements were undertaken and reported in accordance with AS4321.1:2021 and NSW EPA method TM-2 (USEPA method M2 "*Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)*"). The velocity profile was obtained across the ventilation duct from the western inlet utilising an S-Type pitot tube. Wet bulb and dry bulb temperature measurements were collected and used for the estimation of moisture content.

For the eastern biofilter, the odour sample for the eastern biofilter inlet was collected from a sample point installed approximately midway down the biofilter (see **Figure 5**). SLR assumed that the total air flow at the eastern biofilter inlet was equal to the total air flow at the eastern biofilter. This is deemed appropriate given the similarity between the western biofilter inlet and outlet flows measured (refer **Table 9**).

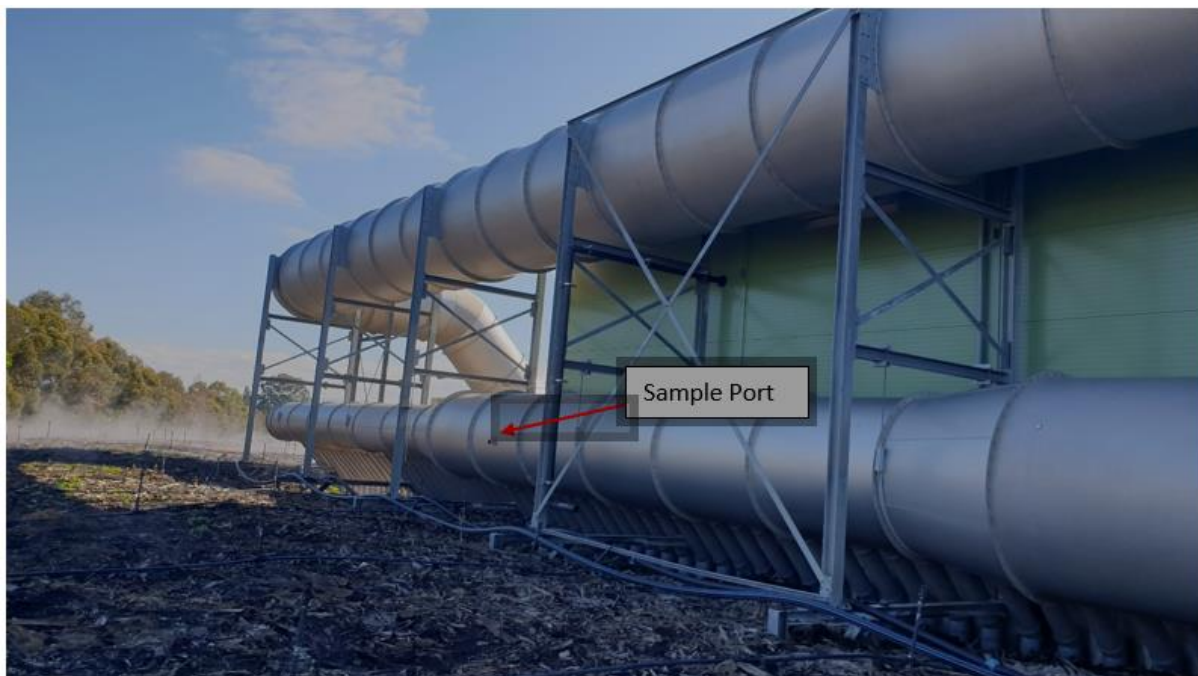
SLR is NATA accredited for the measurement of flow in accordance with AS4323.1:2021 and NSW EPA TM-2.



Figure 4 Illustration of Western Biofilter Inlet Sample Ports



Figure 5 Illustration of Eastern Biofilter Inlet Sample Port



2.0 Measurement of Uncertainty

Table 1 Provides the estimated measurement accuracy associated with the monitoring methods.



Table 1 Measurement Uncertainty

Parameter	Test Method	Uncertainty
Velocity	NSW EPA TM-2, AS 4323.1, USEPA Method 2	±5 %
	Anemometer measurements: AS/NZS 4323.4:2009 Stationary source emissions - Area source sampling - Flux chamber technique	±1.0% of reading ±4 ft/min (±0.02 m/s)
Temperature	NSW EPA TM-2, USEPA Method 2	±2°C
Moisture	Dry/wet bulb temperature	±25%
Odour	AS/NZS 4323.3:2001 Stationary source emissions – Determination of odour concentration by dynamic olfactometry	± 50 - 124% (based upon a single determination)
	AS/NZS 4323.4:2009 Stationary source emissions - Area source sampling - Flux chamber technique	

3.0 Assessment Criteria

No assessment criteria were applicable to the measurements.

4.0 Deviations From the Method

There were no deviations to the specified test reference methodologies.

5.0 Reference Conditions

Method 2 measurements are reported as actual and normalised (dry and referenced to 0°C and 101.3 kpa).

6.0 Sample Plane Requirements (West Inlet)

Ideal sampling positions: In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exit at 7-8 diameters downstream and 2-3 diameters upstream from a flow disturbance. However, in most cases, a suitable sampling plane will be in a position fitting the minimum criteria specified in Table 1 of AS/NZS 4323.1.

Non-Ideal sampling position: If the measurement near a bend is unavoidable, the sampling position shall be greater than one duct diameter upstream of the bend or greater than two duct diameters downstream of the bend. When the criteria in Table 1 of AS/NZS 4323.1 cannot be met, a greater number of sampling points shall be used in order to retain as much accuracy as is practicable.

7.0 Operating Conditions

The Elf Farm was considered to be operating under normal conditions.



8.0 Biofilter Results

8.1 Biofilter Outlet Results

The Biofilter Outlet was tested under normal operating conditions on Wednesday 5 July 2023 and Thursday 6 July 2023. These days were nominated for testing as Wednesday and Thursday are considered the worst case scenario in terms of odours being generated from the typical composting activities occurring on site. All samples were collected using the Witches Hat Hood method.

Refer to **Table 2** and **Table 3** for a tabulated summary detailing sampling times, temperature and air velocities measured within the Witches Hat Hoods.

As mentioned in **Section 1.1**, SLR reviewed all air velocities measured across the biofilter beds to check for consistency along each north to south row (rows 1 to 11) to determine if additional odour samples were required due to variability in the flow through these rows. Flow variations across a row greater than 20% from the average row velocities measured were observed at four north to south rows. Additional odour samples were collected from these identified rows in line with the methodology outlined in **Section 1.1** to ensure a representative data set is collected.

Refer to **Table 4** to **Table 7** for detailed results of the odour concentrations measured for the Eastern and Western biofilter beds. Refer to **Appendix A** for Certificates of Analysis.

In summary, the maximum odour concentration measured was 664 odour units (ou) and the average odour concentration measured was 171 ou.

Table 8 provides detailed results of the Mass Odour Emission Rates (MOER) per biofilter grid cell measured. The measured MOER for the entire biofilter is 7,360 ou.m³/s. It is noted that MOERs presented in **Table 8** for each grid point have been calculated based on a 95 m² area for the Eastern bed samples and 86 m² for the Western bed samples rather than the actual areas, to allow for grids not sampled. As such, the sum of all MOERs is representative of the whole biofilter rather than the grid cells sampled.



Table 2 Summary of Biofilter Measured Results – Temperature and Air Velocities – 5 July 2023

North													
			Biofilter Western Bed					Biofilter Eastern Bed					
Grid Identification	West	Row A	11A	10A	9A	8A	7A	6A	5A	4A	3A	2A	1A
Time of Measurement			10:34	10:25	10:23	10:12	10:10	9:20	9:02	8:58	8:44	8:39	9:50
Air Velocity (m/s)			1.2	0.3	0.8	1.0	1.0	0.8	1.0	0.5	0.9	0.8	0.9
Temp in WHH (°C, dry)			32.3	27.6	28.5	30.8	30.9	26.7	28.5	18.3	26.5	24.4	24.5
Grid Identification		Row B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B
Time of Measurement			10:32	10:26	10:22	10:13	10:09	9:16	9:06	8:53	8:47	8:35	8:21
Air Velocity (m/s)			1.6	1.0	0.9	1.0	1.4	1.0	0.9	1.1	0.8	0.8	1.1
Temp in WHH (°C, dry)			33.5	31.6	30.8	30.4	32.8	26.3	24.4	32.2	25.3	25.3	26.3
Grid Identification		Row C	11C	10C	9C	8C	7C	6C	5C	4C	3C	2C	1C
Time of Measurement			10:30	10:28	10:19	10:16	10:08	9:12	9:08	8:52	8:49	8:31	8:27
Air Velocity (m/s)			2.2	2.1	3.0	1.5	1.9	1.3	1.6	1.3	1.1	1.6	1.2
Temp in WHH (°C, dry)			33.9	33.6	32	30.7	33.2	27.6	28.0	31.8	26.0	27.9	27.8
South													
Avg. Air Velocity (m/s)			1.7	1.2	1.6	1.2	1.4	1.0	1.1	1.0	0.9	1.1	1.1
Avg. Air Velocity across Biofilter (m/s)			1.2										

East



Table 3 Summary of Biofilter Measured Results – Temperature and Air Velocities – 6 July 2023

North														East
		Biofilter Western Bed					Biofilter Eastern Bed							
Grid Identification	West	Row A	11A	10A	9A	8A	7A	6A	5A	4A	3A	2A	1A	
Time of Measurement			1:03	12:29	11:57	11:18	10:42	9:40	9:22	9:12	8:57	8:53	8:34	
Air Velocity (m/s)			1.2	0.5	0.9	1.1	0.7	1.2	1.1	0.6	1.0	0.9	1.0	
Temp in WHH (°C, dry)			32.2	33.6	29.6	36.3	33.5	28.9	24.5	18.9	23.0	20.8	23.3	
Grid Identification		Row B	11B	10B	9B	8B	7B	6B	5B	4B	3B	2B	1B	
Time of Measurement			1:01	12:27	12:00	11:25	10:38	9:43	9:31	9:09	9:00	8:49	8:39	
Air Velocity (m/s)			1.5	0.9	0.9	1.0	1.6	1.1	1.1	1.4	0.9	1.0	1.2	
Temp in WHH (°C, dry)			33.2	33.9	30.8	34.5	35.3	27.5	23.1	29.6	21.4	22.5	22.0	
Grid Identification		Row C	11C	10C	9C	8C	7C	6C	5C	4C	3C	2C	1C	
Time of Measurement			12:59	12:23	11:55	11:16	10:35	9:46	9:37	9:07	9:04	8:45	8:42	
Air Velocity (m/s)			1.8	1.4	2.0	1.9	2.0	1.0	1.6	1.5	1.2	1.2	1.3	
Temp in WHH (°C, dry)			34.5	33.5	33.5	34.0	33.1	25.3	27.8	29.8	23.0	23.5	24.2	
South														
Avg. Air Velocity (m/s)			1.5	0.9	1.3	1.4	1.4	1.1	1.3	1.2	1.1	1.0	1.2	
Avg. Air Velocity across Biofilter (m/s)			1.21											



Table 4 Summary of Biofilter Outlet Results – Eastern Bed – 5 July 2023

Parameter	Sample 1B	Sample 2A	Sample 2C	Sample 3B	Sample 4A	Sample 4C
SLR Sample No.	13535	13536	13537	13538	13539	13540
Sample Start Time	05-07-2023 10:11	05-07-2023 10:32	05-07-2023 10:56	05-07-2023 11:00	05-07-2023 11:25	05-07-2023 11:25
Sample Finish Time:	05-07-2023 10:21	05-07-2023 10:42	05-07-2023 11:06	05-07-2023 11:10	05-07-2023 11:35	05-07-2023 11:35
NATA Laboratory I.D No.	SC23369	SC23370	SC23371	SC23372	SC23373	SC23374
Analysis Date & Time Completed	06-07-2023 10:07	06-07-2023 10:37	06-07-2023 11:04	06-07-2023 11:30	06-07-2023 11:58	06-07-2023 13:13
Sample Analysis Period in Compliance (≤ 30 -hrs)	23.8	23.9	24.0	24.3	24.4	25.6
(D_s WHH) Sample Point WHH Stack Internal Diameter (mm)	100	100	100	100	100	100
(A_s WHH) Sample Plane Cross Sectional Area (m^2)	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079
(T_s WHH) Average Stack (Surface) Temperature ($^{\circ}C$)	30.8	22.8	29.7	30.7	23.0	35.3
(P_s WHH) Average Stack / Surface Pressure (kPa)	101.2	101.1	101.1	101.1	101.0	101.0
(v_s WHH) Average Grid Stack Air Velocity (m/s)	1.30	0.76	1.42	1.20	0.41	1.81
(Q_a WHH) Actual Grid Flow Rate (m^3/s)	0.0102	0.0060	0.0112	0.0094	0.0032	0.0142
(D_B WHH) WHH Base Internal Diameter (mm)	801	801	801	801	801	801
(A_B WHH) WHH Base Cross Sectional Area (m^2)	0.504	0.504	0.504	0.504	0.504	0.504
(Q_{flux}) Actual Grid Surface Flux Velocity (m/s)	0.020	0.012	0.022	0.019	0.006	0.028
Odour Concentration (wet) (ou)	235	118	140	84	59	215
EPL Odour Concentration Limit (ou)	500	500	500	500	500	500
Odour Character	dirt, soil, sewage	musty, dirty	dirt, soil, sewage	dirt, soil	dirt, soil	dirt, soil



Table 5 Summary of Biofilter Outlet Results – Eastern Bed – 5 July 2023 – Continued

Parameter	Sample 5B	Sample 5C	Sample 6A	Sample 6C
SLR Sample No.	13541	13542	13543	13544
Sample Start Time	05-07-2023 11:51	05-07-2023 12:15	05-07-2023 12:18	05-07-2023 12:38
Sample Finish Time:	05-07-2023 11:54	05-07-2023 12:25	05-07-2023 12:28	05-07-2023 12:48
NATA Laboratory I.D No.	SC23375	SC23376	SC23377	SC23378
Analysis Date & Time Completed	06-07-2023 13:42	06-07-2023 14:09	06-07-2023 14:36	06-07-2023 15:05
Sample Analysis Period in Compliance (≤ 30 -hrs)	25.8	25.7	26.1	26.3
(D_{s WHH}) Sample Point WHH Stack Internal Diameter (mm)	100	100	100	100
(A_{s WHH}) Sample Plane Cross Sectional Area (m ²)	0.0079	0.0079	0.0079	0.0079
(T_{s WHH}) Average Stack (Surface) Temperature (°C)	33.8	36.7	29.4	32.3
(P_{s WHH}) Average Stack / Surface Pressure (kPa)	101.0	101.0	101.0	100.9
(v_{s (WHH)}) Average Grid Stack Air Velocity (m/s)	1.14	1.52	1.20	1.17
(Q_{a WHH}) Actual Grid Flow Rate (m ³ /s)	0.0090	0.0119	0.0094	0.0092
(D_{B WHH}) WHH Base Internal Diameter (mm)	801	801	801	801
(A_{B WHH}) WHH Base Cross Sectional Area (m ²)	0.504	0.504	0.504	0.504
(Q_{flux}) Actual Grid Surface Flux Velocity (m/s)	0.018	0.024	0.019	0.018
Odour Concentration (wet) (ou)	64	64	83	76
EPL Odour Concentration Limit (ou)	500	500	500	500
Odour Character	dirt, soil	dirt, soil	dirt, soil	dirt, soil



Table 6 Summary of Biofilter Outlet Results – Western Bed – 6 July 2023

Parameter	Sample 7A	Sample 7C	Sample 8B	Sample 8C	Sample 9A	Sample 9C
SLR Sample No.	13555	13556	13557	13558	13548	13547
Sample Start Time	06-07-2023 10:54	06-07-2023 10:50	06-07-2023 11:38	06-07-2023 11:34	06-07-2023 12:09	06-07-2023 12:07
Sample Finish Time:	06-07-2023 11:04	06-07-2023 11:00	06-07-2023 11:48	06-07-2023 11:44	06-07-2023 12:19	06-07-2023 12:17
NATA Laboratory I.D No.	SC23380	SC23381	SC23382	SC23383	SC23384	SC23385
Analysis Date & Time Completed	07-07-2023 10:37	07-07-2023 10:02	07-07-2023 11:33	07-07-2023 11:02	07-07-2023 12:58	07-07-2023 11:56
Sample Analysis Period in Compliance (≤ 30 -hrs)	23.6	23.0	23.7	23.3	24.7	23.6
($D_{s\ WHH}$) Sample Point WHH Stack Internal Diameter (mm)	100	100	100	100	100	100
($A_{s\ WHH}$) Sample Plane Cross Sectional Area (m ²)	0.0079	0.0079	0.0079	0.0079	0.0079	0.0079
($T_{s\ WHH}$) Average Stack (Surface) Temperature (°C)	35.2	33.6	34.0	35.8	31.0	33.8
($P_{s\ WHH}$) Average Stack / Surface Pressure (kPa)	101.2	101.2	101.0	101.0	101.0	101.0
($v_{s\ (WHH)}$) Average Grid Stack Air Velocity (m/s)	1.15	1.97	1.16	1.82	0.93	1.92
($Q_{a\ WHH}$) Actual Grid Flow Rate (m ³ /s)	0.0090	0.0155	0.0091	0.0143	0.0073	0.0151
($D_{B\ WHH}$) WHH Base Internal Diameter (mm)	801	801	801	801	801	801
($A_{B\ WHH}$) WHH Base Cross Sectional Area (m ²)	0.504	0.504	0.504	0.504	0.504	0.504
(Q_{flux}) Actual Grid Surface Flux Velocity (m/s)	0.018	0.031	0.018	0.028	0.014	0.030
Odour Concentration (wet) (ou)	215	664	197	235	91	304
EPL Odour Concentration Limit (ou)	500	500	500	500	500	500
Odour Character	dirt, soil, sewage	dirt, soil, sewage	dirt, soil, sewage	sewage	sewage, musty	dirt, soil, sewage



Table 7 Summary of Biofilter Outlet Results – Western Bed – 6 July 2023 – Continued

Parameter	Sample 10A	Sample 10C	Sample 11A	Sample 11C
SLR Sample No.	13549	13550	13551	13552
Sample Start Time	06-07-2023 12:39	06-07-2023 12:37	06-07-2023 13:05	06-07-2023 13:06
Sample Finish Time:	06-07-2023 12:49	06-07-2023 12:47	06-07-2023 13:18	06-07-2023 13:16
NATA Laboratory I.D No.	SC23386	SC23387	SC23388	SC23389
Analysis Date & Time Completed	07-07-2023 13:32	07-07-2023 13:57	07-07-2023 14:18	07-07-2023 14:46
Sample Analysis Period in Compliance (≤ 30 -hrs)	24.7	25.2	25.0	25.5
(D_{s WHH}) Sample Point WHH Stack Internal Diameter (mm)	100	100	100	100
(A_{s WHH}) Sample Plane Cross Sectional Area (m ²)	0.0079	0.0079	0.0079	0.0079
(T_{s WHH}) Average Stack (Surface) Temperature (°C)	26.1	32.9	30.8	34.8
(P_{s WHH}) Average Stack / Surface Pressure (kPa)	100.9	100.9	100.9	100.9
(v_{s (WHH)}) Average Grid Stack Air Velocity (m/s)	0.53	1.97	1.32	1.93
(Q_{a WHH}) Actual Grid Flow Rate (m ³ /s)	0.0042	0.0155	0.0104	0.0152
(D_{B WHH}) WHH Base Internal Diameter (mm)	801	801	801	801
(A_{B WHH}) WHH Base Cross Sectional Area (m ²)	0.504	0.504	0.504	0.504
(Q_{flux}) Actual Grid Surface Flux Velocity (m/s)	0.008	0.031	0.021	0.030
Odour Concentration (wet) (ou)	45	99	99	332
EPL Odour Concentration Limit (ou)	500	500	500	500
Odour Character	Watery, musty	dirt, soil, watery, musty	dirt, soil	dirt, soil, sewage



Table 8 Summary of Biofilter Mass Odour Emission Rates – 5 July and 6 July 2023

Location	(Q_{flux}) Actual Grid Surface Flux Velocity (m/s)	Odour Concentration (wet) (ou)	(SOER) Surface Odour Emission Rate (wet) (ou.m/s)	Biofilter Grid Cross Sectional Area (m ²)	Flow through Biofilter during Sampling (m ³ /hr)	(MOER) Mass Odour Emission Rate per Section (wet) (ou.m ³ /s)	OIA ¹ MOER Modelled Operations (ou.m ³ /s)
Sample 1B	0.020	235	4.8	49.0	3574	452	NA
Sample 2A	0.012	118	1.4	49.0	2090	133	NA
Sample 2C	0.022	140	3.1	49.0	3904	294	NA
Sample 3B	0.019	84	1.6	49.0	3299	149	NA
Sample 4A	0.006	59	0.4	49.0	1127	36	NA
Sample 4C	0.028	215	6.1	49.0	4976	576	NA
Sample 5B	0.018	64	1.1	49.0	3134	108	NA
Sample 5C	0.024	64	1.5	49.0	4179	144	NA
Sample 6A	0.019	83	1.6	49.0	3299	147	NA
Sample 6C	0.018	76	1.4	49.0	3217	132	NA
Sample 7A	0.018	215.0	3.9	56.3	3630	331	NA
Sample 7C	0.031	664.0	20.4	56.3	6218	1,753	NA
Sample 8B	0.018	197.0	3.6	56.3	3661	306	NA
Sample 8C	0.028	235.0	6.7	56.3	5744	573	NA
Sample 9A	0.014	91.0	1.3	56.3	2935	113	NA
Sample 9C	0.030	304.0	9.1	56.3	6060	782	NA
Sample 10A	0.008	45.0	0.4	56.3	1673	32	NA
Sample 10C	0.031	99.0	3.0	56.3	6218	261	NA
Sample 11A	0.021	99.0	2.0	56.3	4166	175	NA
Sample 11C	0.030	332.0	10.0	56.3	6091	859	NA
Total (scaled)	--	--	--	1,726	128,634	7,360	54,168

¹ Odour Impact Assessment prepared by The Odour Unit dated 28 August 2015



8.2 Biofilter Inlet Results

The biofilter inlets were measured on Wednesday 5 July 2023 and Thursday 6 July 2023 in parallel with the biofilter outlet testing. Refer to **Table 9** for a detailed summary of the biofilter inlet measured results. Refer to **Appendix A** for Certificates of Analysis.

Table 9 Summary of Biofilter Inlet Results – 5 and 6 July 2023

Parameter	Inlet -East	Inlet -West
SLR Sample No.	13545	13553
Sample Start Time	05-07-2023 12:39	06-07-2023 14:30
Sample Finish Time:	05-07-2023 12:49	06-07-2023 14:40
NATA Laboratory I.D No.	SC23379	SC23390
Analysis Date & Time Completed	06-07-2023 15:43	07-07-2023 15:21
Sample Analysis Period in Compliance (≤30-hrs)	26.9	24.7
(A_s) Sample Plane Cross Sectional Area (m ²)	--	4.5
(T_s) Average Stack Temperature (°C)	36.9	37.1
(P_s) Average Stack Pressure (kPa)	--	101.11
(Q_a) Actual Flow Rate (m ³ /hr)	--	69,588
Flow through Biofilter Outlet during Sampling (m ³ /hr)	63,592 ¹	70,934
Odour Concentration (wet) (ou)	6,320	16,400
Mass Odour Emission Rate (MOER) (ou.m³/s)	111,639	317,012
Odour Character	rubber, sewage	rubber, sewage
1 denotes that SLR have assumed that Biofilter Inlet total air flow is equal to Biofilter Outlet due to no suitable access points being available to conduct air velocity measurements for the Eastern Biofilter Inlet.		

8.3 Biofilter Efficiency Results

The efficiency of the Western biofilter bed (for which a suitable sampling port for the measurement of air velocity is available) were assessed through the comparison of Inlet vs Outlet MOERs as follows:

- $\{\text{Inlet MOER (317,012 ou.m}^3\text{/s)} - \text{Outlet MOER (5,188 ou.m}^3\text{/s)}\} \div \text{Inlet MOER (317,012 ou.m}^3\text{/s)}$

Result ≥ 95% efficiency

For the Eastern biofilter, in the absence of a suitable sample point compliant with the requirements of AS 4323.1 for the measurement representative air flow through the inlet duct, efficiency calculations were assessed using the odour concentrations measured and assuming the flows through the biofilter inlet and outlet are similar.

The efficiency of the Eastern Biofilter has been calculated as follows

- $\{\text{Inlet Conc. (6,320 ou)} - \text{Average Outlet Conc. (114 ou)}\} \div \text{Inlet Conc. (6,320 ou)}$

Result ≥ 95% efficiency.



Alternatively:

- $\{\text{Inlet MOER (111,639 ou.m}^3\text{/s)} - \text{Outlet MOER (2,172 ou.m}^3\text{/s)}\} \div \text{Inlet MOER (111,639 ou.m}^3\text{/s)}$

Result \geq 98% efficiency.

9.0 Summary and Comparison against OIA and Previous Measurements

Table 10 presents a comparison of odour concentrations and emission rates collected as part of this study and compares these against those assumed by the OIA and collected in 2018, 2020, 2021 and 2022. In summary:

- The measured biofilter outlet odour emissions are 86% lower than those assumed by the OIA.
- Peak biofilter outlet odour emissions (based on measured concentrations and maximum flow through the biofilter) are estimated to be 55% lower than those assumed by the OIA.
- The average biofilter outlet odour concentration measured is 171 ou which is 66% lower than the odour concentration assumed by the OIA.
- The average biofilter odour removal efficiency is greater than 95%.

Table 10 Summary of Biofilter results and Comparison against OIA and Previous Measurements

Year	Average Flow through Biofilter during Sampling (m ³ /hr)	Average Odour Concentration (wet) (ou)	Total Biofilter MOER (wet) (ou.m ³ /s)	Average Biofilter Efficiency	Maximum Flow through Biofilter (m ³ /hr)	Maximum Estimated Biofilter MOER (wet) (ou.m ³ /s)	Change Compared to OIA (%)
OIA		500			390,000	54,168	
2018	204,610	165	9,482	> 95%	390,000	18,073	-67%
2020	189,717	150	8,767	> 95%	402,000	18,576	-66%
2021	193,070	82	4,578	> 95%	402,000	9,533	-82%
2022	233,506	183	11,752	> 95%	402,000	20,231	-63%
2023	122,178	171	7,360	> 95%	402,000	24,215	-55%



10.0 Feedback

At SLR, we are committed to delivering professional quality service to our clients. We are constantly looking for ways to improve the quality of our deliverables and our service to our clients. Client feedback is a valuable tool in helping us prioritise services and resources according to our client needs.

To achieve this, your feedback on the team's performance, deliverables and service are valuable and SLR welcome all feedback via <https://www.slrconsulting.com/en/feedback>. We recognise the value of your time and we will make a \$10 donation to our 2023 Charity Partner - Lifeline, for every completed form.





Appendix A Certificate of Analysis

ELF FARM SUPPLIES

Annual Biofilter Testing

Elf Farm Supplies Pty Ltd

SLR Project No.: 610.031285.00001

1 September 2023

Odour Concentration Measurement Report

Sampling and Laboratory Information

Organisation	SLR Consulting	Telephone	+61 2 9427 8100
Contact	D. Echeverri	Email	decheverri@slrconsulting.com
Sampling Site	Not disclosed	Sampling Personnel	SLR Consulting
Sampling Method	AS 4323.3	Laboratory Location	Mascot, NSW

Order and Project Information

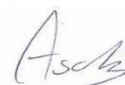
Order requested by	D. Echeverri	Order accepted by	A. Schulz
Date of order	04/07/2023	TOU Project #	N1869
Order number	33344	Project Manager	A. Schulz
Signed by	D. Echeverri	Panel Operator	A. Schulz

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: <i>Determination of odour concentration by dynamic olfactometry</i> (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 $22^\circ\text{C} \pm 3^\circ\text{C}$.
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. $r = 0.461$ 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: Tuesday, 18 July 2023

Panel Roster Number: SYD20230706_049



A. Schulz
Authorised Signatory

THE ODOUR UNIT

Odour Sample Measurement Results Panel Roster Number: SYD20230706_049

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Final Odour Concentration (ou)
1B – ID 13535	SC23369	05.07.2023 1011-1021 hrs	06.07.2023 1007 hrs	4	8	235
2A – ID 13536	SC23370	05.07.2023 1032-1042 hrs	06.07.2023 1037 hrs	4	8	118
2C – ID 13537	SC23371	05.07.2023 1056-1106 hrs	06.07.2023 1104 hrs	4	8	140
3B – ID 13538	SC23372	05.07.2023 1100-1110 hrs	06.07.2023 1130 hrs	4	8	84
4A – ID 13539	SC23373	05.07.2023 1125-1135 hrs	06.07.2023 1158 hrs	4	8	59
4C – ID 13540	SC23374	05.07.2023 1125-1135 hrs	06.07.2023 1313 hrs	4	8	215

Samples Received in Laboratory – From: SLR Consulting (D. Echeverri)

Date: 05.07.2023

Time: 1450 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

Odour Sample Measurement Results Panel Roster Number: SYD20230706_049

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Final Odour Concentration (ou)
5B – ID 13541	SC23375	05.07.2023 1158-1208 hrs	06.07.2023 1342 hrs	4	8	64
5C – ID 13542	SC23376	05.07.2023 1215-1225 hrs	06.07.2023 1409 hrs	4	8	64
6A – ID 13543	SC23377	05.07.2023 1218-1228 hrs	06.07.2023 1436 hrs	4	8	83
6C – ID 13544	SC23378	05.07.2023 1238-1248 hrs	06.07.2023 1508 hrs	4	8	76
Inlet East – ID 13545	SC23379	05.07.2023 1239-1249 hrs	06.07.2023 1543 hrs	4	8	6,320

Samples Received in Laboratory – From: SLR Consulting (D. Echeverri)

Date: 05.07.2023

Time: 1450 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

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	SYD20230706_049	44,800	$20 \leq \chi \leq 80$	724	62	Yes

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

Laboratory ID	Odour Character	Laboratory ID	Odour Character	Laboratory ID	Odour Character
SC23369	dirt, soil, sewage	SC23373	dirt, soil	SC23377	dirt, soil
SC23370	musty, dirty	SC23374	dirt, soil	SC23378	dirt, soil
SC23371	dirt, soil, sewage	SC23375	dirt, soil	SC23379	rubber, sewage
SC23372	dirt, soil	SC23376	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	17.07.2023	M. Assal	17.07.2023	--	--
Final	1.0	A. Schulz	17.07.2023	M. Assal	17.07.2023	--	--
Revised	1.1	--	--	--	--	--	--

END OF DOCUMENT

Odour Concentration Measurement Report

Sampling and Laboratory Information

Organisation	SLR Consulting	Telephone	+61 2 9427 8100
Contact	D. Echeverri	Email	decheverri@slrconsulting.com
Sampling Site	Not disclosed	Sampling Personnel	SLR Consulting
Sampling Method	AS 4323.3	Laboratory Location	Mascot, NSW

Order and Project Information

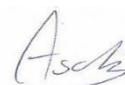
Order requested by	D. Echeverri	Order accepted by	A. Schulz
Date of order	04/07/2023	TOU Project #	N1869
Order number	33344	Project Manager	A. Schulz
Signed by	D. Echeverri	Panel Operator	A. Schulz

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: <i>Determination of odour concentration by dynamic olfactometry</i> (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 $22^\circ\text{C} \pm 3^\circ\text{C}$.
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. $r = 0.461$ 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.

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This report shall not be reproduced, except in full.

Date: Tuesday, 18 July 2023

Panel Roster Number: SYD20230707_050



A. Schulz
Authorised Signatory

THE ODOUR UNIT

Odour Sample Measurement Results Panel Roster Number: SYD20230707_050

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Final Odour Concentration (ou)
7C – ID 13554	SC23380	06.07.2023 1050-1100 hrs	07.07.2023 1002 hrs	4	8	664
7A – ID 13555	SC23381	06.07.2023 1054-1104 hrs	07.07.2023 1037 hrs	4	8	215
8C – ID 13556	SC23382	06.07.2023 1134-1144 hrs	07.07.2023 1102 hrs	4	8	235
8B – ID 13557	SC23383	06.07.2023 1133-1148 hrs	07.07.2023 1133 hrs	4	8	197
9C – ID 13547	SC23384	06.07.2023 1207-1217 hrs	07.07.2023 1156 hrs	4	8	304
9A – ID 13548	SC23385	06.07.2023 1209-1219 hrs	07.07.2023 1258 hrs	4	8	91

Samples Received in Laboratory – From: SLR Consulting

Date: 06.07.2023

Time: 1600 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

Odour Sample Measurement Results Panel Roster Number: SYD20230707_050

Sample ID / Location	Laboratory ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Final Odour Concentration (ou)
10A – ID 13549	SC23386	06.07.2023 1239-1249 hrs	07.07.2023 1332 hrs	4	8	45
10C – ID 13550	SC23387	06.07.2023 1237-1247 hrs	07.07.2023 1357 hrs	4	8	99
11A – ID 13551	SC23388	06.07.2023 1305-1318 hrs	07.07.2023 1418 hrs	4	8	99
11C – ID 13552	SC23389	06.07.2023 1306-1316 hrs	07.07.2023 1446 hrs	4	8	332
Inlet West – ID 13553	SC23390	06.07.2023 1430-1440 hrs	07.07.2023 1521 hrs	4	8	16,400

Samples Received in Laboratory – From: SLR Consulting

Date: 06.07.2023

Time: 1600 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

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	SYD20230707_050	44,800	$20 \leq \chi \leq 80$	1,024	44	Yes

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

Laboratory ID	Odour Character	Laboratory ID	Odour Character	Laboratory ID	Odour Character
SC23380	dirt, soil, sewage	SC23384	dirt, soil, sewage	SC23388	dirt, soil
SC23381	dirt, soil, sewage	SC23385	sewage, musty	SC23389	dirt, soil, sewage
SC23382	sewage	SC23386	watery, musty	SC23390	rubber, sewage
SC23383	dirt, soil, sewage	SC23387	dirt, soil, watery, musty		

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	17.07.2023	M. Assal	17.07.2023	--	--
Final	1.0	A. Schulz	17.07.2023	M. Assal	17.07.2023	--	--
Revised	1.1	--	--	--	--	--	--

END OF DOCUMENT

Appendix B Equipment and Calibration Details

ELF FARM SUPPLIES

Annual Biofilter Testing

Elf Farm Supplies Pty Ltd

SLR Project No.: 610.031285.00001

1 September 2023



Table B1 summarises the equipment details for the equipment need to complete the testing.

Table B-1

Equipment Type	SLR Asset Number	Manufacturer and Model	Calibration Due Date
Pitot Tube	5076	NA	03-04-2024
Anemometer	5000	TSI Velocicalc – Air Velocity Meter – Model 5725	27-03-2024
Manometer	2815	Dwyer series 475 Mark III digital manometer	07-07-2024
Thermometer (digital)	5085	FLUKE thermometer 53/54 II B	19-07-2024
Thermocouple	5090	FLUKE thermocouple	03-02-2024
Thermocouple	5092	FLUKE thermocouple	03-02-2024
Timepiece - AQ	5082	Apple - Iphone	NA
Measuring Tape	1960	Craft Right	24-05-2028
Witches Hats	NA	Client owned	NA
Odour drum	1622	NA	Inspected
Odour drum	1623	NA	Inspected
Air pump	2775	SKC-Aircheck	26-03-2024
Air pump	2776	SKC-Aircheck	26-03-2024
Drycal	5005	Mesa Labs	24-04-2024



Appendix C Sampling Plane Records and Measurements


ELF FARM SUPPLIES


Annual Biofilter Testing

Elf Farm Supplies Pty Ltd

SLR Project No.: 610.031285.00001

1 September 2023

Description		Results	Measurement Point Pictures
Location		West Inlet	
Date		06-07-2023	
Sampling time		14:10 to 14:30	
Test method		NSW EPA TM-2, AS 4323.1	
Duct diameter		2.4 m	
Upstream requirements			
Type of disturbance		Bend	
Distance from disturbance		8 m	
Number of duct diameters		3.3D	
Ideal minimum distance criterion		2D	
Number of diameters less than ideal		1D	
Sampling Factor		1	
Downstream requirements			
Type of disturbance		Connection	
Distance from disturbance		12 m	
Number of duct diameters		5D	
Ideal minimum distance criterion		6D	
Number of diameters less than ideal		1D	
AS 4323.1 compliance		Compliant, Non-Ideal Sampling Plane	
Sampling Factor		1.05	
Number of sampling points for manual isokinetic sampling			
Minimum number of sampling traverse		2	
Minimum number of access holes		2	
Minimum number of sampling points		2	
Total number of sampling points		24	
Measurements			
Actual volumetric flow		19.33 m ³ /s	
Normal volumetric flow		16.24 m ³ /s	
Average velocity		4.27 m/s	

Description	Results	Measurement Point Pictures
Average Temperature	37.1 °C	
Dry temperature	34.5 °C	
Wet temperature	17.6 °C	
Moisture content	4.4%	
Static pressure	1.02 kpa	
Total absolute stack pressure	101.11 kpa	
BOM ambient pressure	101.9 kpa	
Additional notes	None	
Testing officer	Danny Echeverri	