Veolia Australia & New Zealand

Woodlawn Bioreactor Expansion Project

Independent Odour Audit #5

February 2017

Final Report

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CONTENTS

LIST OF FIGURES, PHOTOS & TABLES

FIGURES

PHOTOS

TABLES

APPENDICES

LIST OF DEFINITIONS & UNITS

AS4323.3:2001	Australian Standard 4323.3: 2001: Determination of odour concentration by dynamic olfactometry
AS4323.4:2009	Australian Standard 4323.4:2009. Stationary source emissions - Area source sampling - Flux chamber technique.
BWMS	Bioreactor Waste Management System
C & D	Construction & Demolition
$CaSO_4$	calcium sulphate
CH_4	methane
CO_2	carbon dioxide
DPI	Department of Planning & Infrastructure
EA 2010	Environmental Assessment Woodlawn Expansion Report (August 2010)
ED3N	Evaporation Dam 3 North
ED3S	Evaporation Dam 3 South
EPL	Environment Protection License
$FeCl_3$	ferric chloride
FAOA	Field Ambient Odour Assessment
GC-FID	Gas Chromatography-Flame Ionisation Detector
GC-MS	Gas Chromatography-Mass Spectrometry
GC-SCD	Gas Chromatography-Sulphur Chemiluminescence
H_2S	hydrogen sulphide
H_2SO_4	sulphuric acid
ha	hectare
HRT	hydraulic retention time
IFH	Isolation Flux Hood
IMF	Crisps Creek Intermodal Facility
IOA	Independent Odour Audit
Jerome Analyser	Jerome ® 631-X H_2S Analyser
IOA	Independent Odour Audit
L	litres
L/day	litres per day
L/min	litres per minute
L/s	litres per second
LAT	Leachate Treatment Dam
LMS	Leachate Management System
LOM	Liquid Odour Method
lpm	litres per minute
m	metres
m^2	square metres
m^3	cubic metres
m/s	metres/sec

mm	millimetres
MLP	Measurement Location Point
MSW	Municipal Solid Waste
MW	Megawatts
NATA	National Association of Testing Authorities
N_2	nitrogen gas
NO_x	nitrogen oxides
NGERS	National Greenhouse Emissions Reporting Scheme
OER	odour emission rate
ou	odour concentration
ou.$m^3/m^2/s$	specific odour emission rate
ou.m^3/s	odour emission rate
ppm	parts per million, by volume
PTFE	polytetrafluoroethylene
RH	relative humidity
RL	reduced level
SOER	specific odour emission rate
Solid Waste Guidelines 2016	NSW EPA Environmental Guidelines: Solid Waste Landfills (2016)
SO_3	sulphur trioxide
the Audit	2016 Independent Odour Audit
the Site	Woodlawn Bioreactor Facility, Collector Road, Tarago, NSW
TWL	Top Water Level
TOU	The Odour Unit Pty Ltd
tpa	tonnes per annum
US EPA	United States Environment Protection Agency
VENM	Virgin Excavated Natural Material
Veolia	Veolia Australia & New Zealand
VOC	Volatile Organic Compounds
WALTER	Woodlawn Aerated Leachate Treated Effluent Refiner
WIP 2012	Woodlawn Infrastructure Plan - Phase 1: April 2012
WIP post-2014	Woodlawn Infrastructure Plan - Phase 2: 2015-IP 2017
WIP 2017	Woodlawn Infrastructure Plan - Phase 3: March 2017

1 INTRODUCTION

In January 2017, Veolia Australia & New Zealand (**Veolia**) engaged The Odour Unit Pty Ltd (**TOU**) to carry out the fifth Independent Odour Audit (**the Audit**) of the Woodlawn Bioreactor Facility located at Collector Road, Tarago, NSW (**the Site**).

The specific scope of works for the Audit is detailed in *Condition 7* of *Schedule 4* in the *Specific Environmental Conditions - Landfill site* and enforced by *Section 75J* of the *Environmental Planning and Assessment Act 1979* as part of the project approval for the Woodlawn Waste Expansion Project.

1.1 WOODLAWN WASTE EXPANSION PROJECT BACKGROUND

In March 2010, Veolia issued an application to the Department of Planning & Infrastructure (**DPI**) seeking approval to increase the maximum throughput rate of the Woodlawn Bioreactor from 500,000 to 1.13 million tonnes per annum (**tpa**). Simultaneously, Veolia was also seeking to increase the maximum throughput rate of the nearby Crisps Creek Intermodal Facility (**IMF**) to 1.18 million tpa.

In addition to the above, the proposal application entailed:

- Installing additional lighting at the Site;
- Extending the approved hours of operation at the Bioreactor and the IMF;
- Increasing the number of truck movements transporting waste to the Bioreactor from the IMF; and
- Increasing the amount of waste transported to the Site by road from regional councils from 50,000 to 130,000 tpa.

Veolia received approval for the Woodlawn Waste Expansion Project on 16 March 2012.

1.2 OBJECTIVES

In accordance with the project approval requirements of *Condition 7* of *Schedule 4* in the *Specific Environmental Conditions - Landfill sites* (DA 10_0012), Veolia is required to carry out an Independent Odour Audit three months from the date of project approval and annually thereafter, unless otherwise agreed by the Director-General. The Audit must:

a. *Consult with OEH and the Department;*

b. *Audit the effectiveness of the odour controls on-site in regard to protecting receivers against offensive odour;*

c. *Review the proponents' production data (that are relevant to the odour Audit) and complaint records;*

d. *Review the relevant odour sections of the Air Quality and Greenhouse Gas Management Plan for the project and assess the effectiveness of odour control;*

e. *Measure all key odour sources on-site including:*

   i. *consideration of wet weather conditions providing all raw data used in this analysis;*

   ii. *consideration of (but not limited to) all liquid storage area, active tipping faces, waste cover area, aged waste areas and recirculation of leachate onto waste in the Void;*

   iii. *a comparison of the results of these measurements against the predictions in the EA*

f. *Determine whether the project is complying with the requirements in this approval to protect receivers against offensive odour*

g. *Outline all reasonable and feasible measures (including cost/benefit analysis, if required) that may be required to improve odour control at the site and; and*

h. *Recommend and prioritise (mandatory and non-mandatory) recommendations for their implementations.*

This is the fifth Independent Odour Audit (**IOA**) commissioned since the Woodlawn Waste Expansion project approval was granted.

1.3 COMPLIANCE WITH AUDIT OBJECTIVES

The Audit has been undertaken by TOU and endorsed by the Director-General of the DPI, and consists of the following:

- ***Fieldwork****:* collection of odour samples from key sources (as per *Condition 7 (e)),* recording of relevant field observations and measurements, and discussions with Veolia Woodlawn staff in regards to the operations of the Bioreactor and IMF. The odour emissions inventory developed in the previous IOAs was used by the audit team as a basis for the sampling program in the Audit;

- ***Reviewing****:* a comprehensive review of all new relevant assessments undertaken and documentation since the 2015 IOA. In the Audit, this included a review of:

- Landfill gas capture since the previous audit;
- Leachate quality data;
- Odour complaints register and responses by Veolia;
- Stack emissions compliance survey for Generator No. 1;
- Landfill gas inlet fuel quality testing for Generator No. 1;
- Waste Infrastructure Plan – Phase 3 (**WIP 2017**); and
- Mechanical Evaporator Operation Protocol

- ***Reporting****:* a comprehensive summary of all aspects of the Audit, complying with the Audit objectives specified in **Section 1.2**.

1.3.1 Additional Work to Audit requirements

In addition to the approval requirements, the following work components were included in the Audit:

- Consideration and commentary on the IMF;
- Quantification of odour emissions between waste covered areas with and without a biofiltration cover; and
- Completion of field ambient odour assessment (**FAOA**) surveys during specific times over the course of the Audit, as required by the New South Wales Environment Protection Authority (**NSW EPA**). Specifically, the FAOA surveys were required to be undertaken during the following time periods:
  - Before 0730 hrs; and
  - After 2100 hrs.

The above additional work to the approval requirements for the Audit is documented in this report.

The following report summarises the Audit carried out by the auditors at the Site.

2 THE SITE

2.1 WOODLAWN BIOREACTOR FACILITY BACKGROUND

The Site is located 250 km south of Sydney, within the 6,000 hectares (**ha**) Woodlawn Eco-Precinct, in the Southern Tablelands near Goulburn in New South Wales. An aerial view of the Site, highlighting the key areas as they currently stand, is shown in **Figure 2.1**.

Prior to waste operations, Woodlawn operated as a base metals open-cut mine site during the 1970s and 1990s, processing copper, lead and zinc. Since September 2004, the mine void has been operated as an in-situ Bioreactor, historically receiving putrescible waste solely from the Sydney metropolitan area via the Clyde Transfer Terminal Facility. Since early 2012, receival of waste from local regional areas had commenced.

Waste received and contained within the Bioreactor undergoes anaerobic decomposition, which is supplemented by leachate recirculation, resulting in the production of landfill gas. The landfill gas, predominately rich in methane (**CH_4**) and carbon dioxide (**CO_2**), is continuously extracted from the Bioreactor and directly consumed via purpose built landfill gas-fired engines that form the Site's power plant. Each landfill gas-fired engine is capable of generating up to 1.065 Megawatts (**MW**) of 'green' electricity. All electricity generated is exported to the main grid. The Bioreactor process is described in further detail in **Section 2.2**.

Aside from generating electricity from waste at the Site, Veolia is also undertaking mine rehabilitation works and has established an innovative wind farm, aquaculture and horticulture projects within the Eco-Precinct. Veolia has also commenced construction of a mechanical biological treatment facility at the Site, which falls under a separate development consent and environment protection licence. These undertakings are not relevant to the Audit and thus have been excluded.

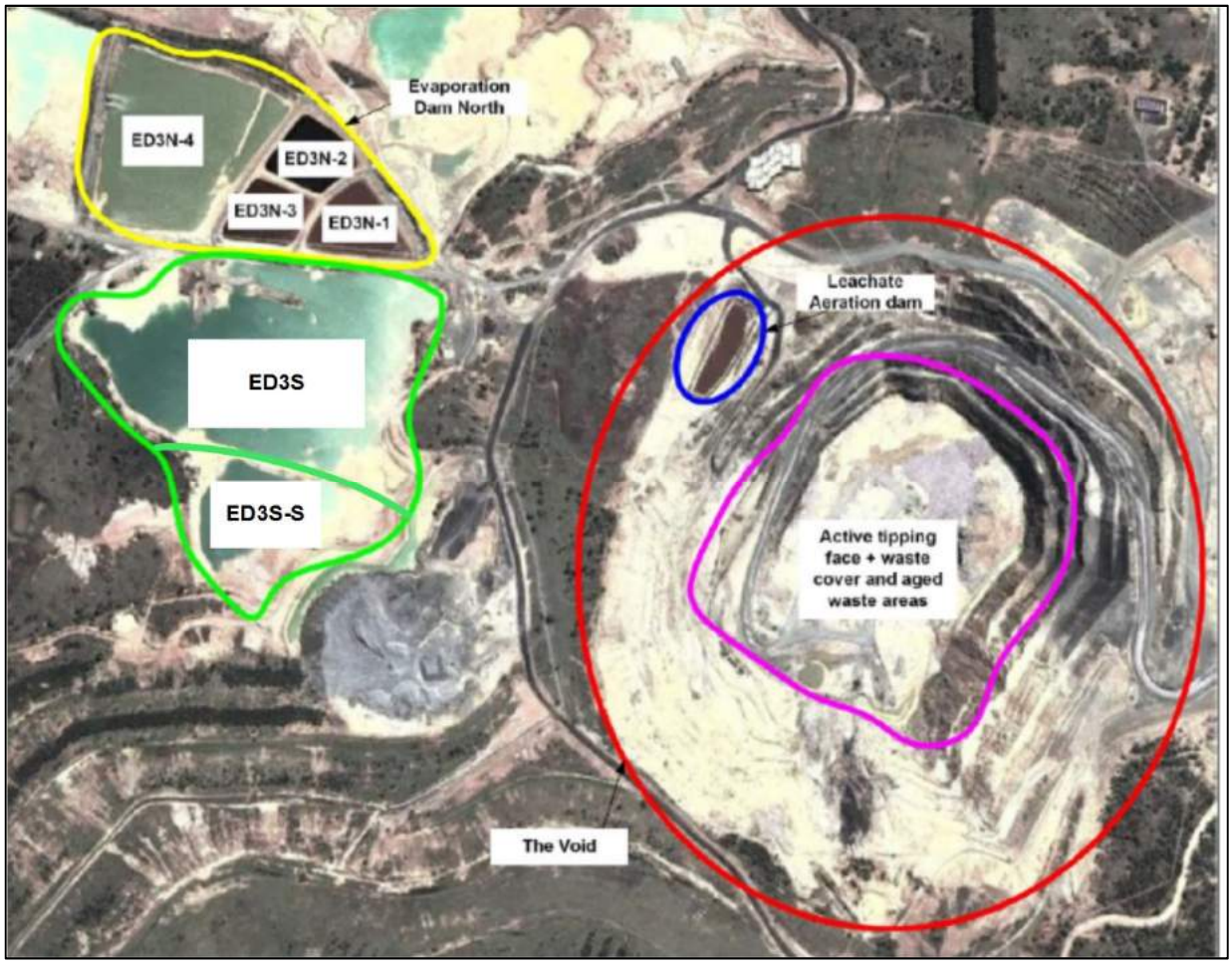


Figure 2.1 – An aerial view illustrating the layout of the Site as of the Audit (**Map source:** Google Earth ®)

2.2 PROCESS OVERVIEW

The Site has the approval to operate between 0600hrs to 2200hrs on Mondays to Saturdays, with no activities on Sundays, Good Friday or Christmas Day. For the purpose of the Audit, the operational processes at the Site have been categorised under two primary management systems, namely:

1. The Bioreactor Waste Management System (**BWMS**); and

2. The Leachate Management System (**LMS**).

The above management systems are described in concise detail in **Section 2.3 & Section 2.4,** respectively. Further details in regards to these systems are contained in the *Environmental Assessment Woodlawn Expansion Report* dated August 2010 (**EA 2010**).

2.3 BIOREACTOR WASTE MANAGEMENT SYSTEM

At first glance, the Bioreactor surface layout appears to be a simple landfilling operation, consisting of the following:

- An active tipping face;
- Waste covered areas;
- Aged waste areas;
- A mobile tipping platform;
- A leachate recirculation system, which is currently now in limited use as advised by Veolia personnel (see **Section 2.3.1**); and
- A gas extraction system.

On closer inspection, however, it is clear that there are complex operating procedures for the Bioreactor that result in a dynamic site layout that varies with time and operational demands, such as the requirement of covering areas of waste, the provisions for a given waste lift, and setup of gas extraction and/or a leachate extraction/recirculation systems.

The Void layout and operations prevalent at the time of the Audit are shown in **Figure 2.2**.

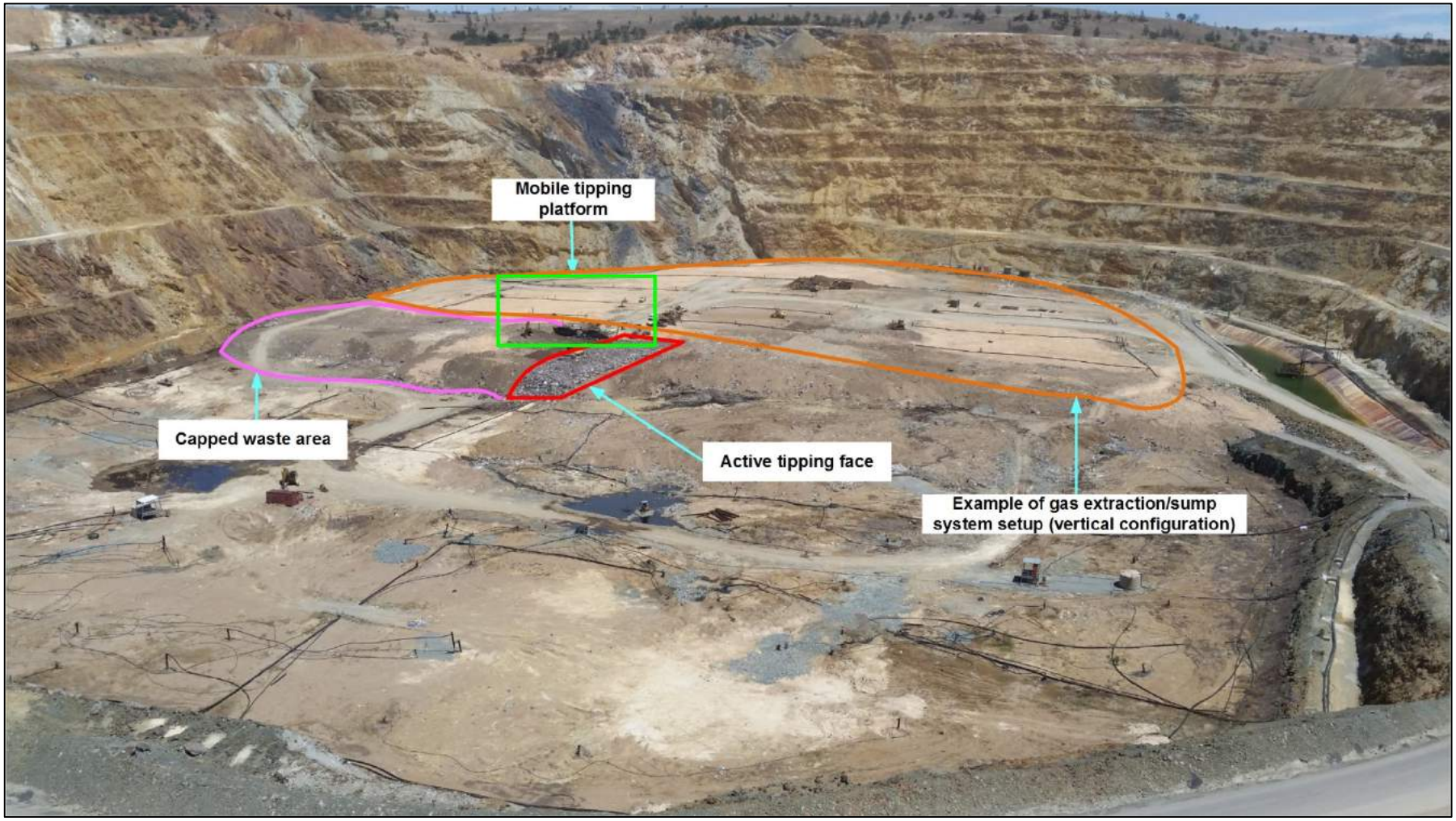


Figure 2.2 – Void layout and operations as found on 31 January 2017

The current procedure for operating the Bioreactor consists of the receival of putrescible waste transported to Woodlawn by rail from Sydney, after being containerised at the Veolia Transfer Terminal situated in Clyde, NSW. The fully sealed containerised waste is received at the IMF and transported by a series of trucks to the Bioreactor, where waste is unloaded via a mobile tipping platform and subsequently transported by a dozer prior to compaction at the active tipping face area. The active tipping face area is progressively covered on a daily basis. As advised by Veolia in previous audits, covering the active tipping face is an on-going operational process, although the area of exposed waste on a daily basis will vary depending on positioning in the Void, gas infrastructure and weather conditions. It was evident in the Audit that the size of the active tipping face was still well below the area size specified in the EA, discussed in further detail in **Section 8.2.1.7**.

It is understood by the Audit that the tipping process is supplemented by a hydrogen sulphide (**H_2S**) emission control measure which involves the periodic in-situ addition of metal oxide (haematite and/or magnetite) to the waste as placed. Once a waste area is covered, leachate recirculation is promoted to optimise degradation rates and, in turn, encouraging the generation of landfill gas which is continuously extracted by the landfill gas infrastructure within the waste. The landfill gas collection system is constantly expanded to promote better gas capture as waste filling progresses around the Void.

2.3.1 Leachate recirculation

The main principle of leachate recirculation within the Void is to move leachate from aged waste areas, especially those that are in a more advanced stage of anaerobic decomposition, to new waste areas to increase retained moisture levels and biological activity to enhance the waste decomposition process. This process has the effect of promoting higher and faster volumes of landfill gas generation within the Bioreactor.

The leachate recirculation method currently practised within the Void continues to be via direct injection into deep gas wells. This has the effect of minimising the exposure of leachate partitioning from the liquid phase to the gas phase through aerosol generation and/or evaporation pathways and subsequently leading to the generation of odorous emissions. As the leachate percolates through the upper layers of waste, a proportion of the liquid is retained in the upper layers of waste. Veolia had previously utilised covered reinjection trenches as part of the leachate recirculation process; however, this is understood to have been discontinued as part of the normal operations of the Bioreactor.

As of the Audit, leachate is recirculated in two locations along the northern and eastern edges of the Void perimeter. The locations were selected for operational convenience and based on experience gained by Veolia that at these locations the effective movement of recirculated leachate is favoured towards fresh waste.

2.3.2 Landfill gas extraction

The operational management and instalment of landfill gas extraction infrastructure in the Void have been extensively described in *the Woodlawn Infrastructure Plan Phase 3 - March 2017* (**WIP 2017**). The configuration during placement of waste on the surface of the Void and during a waste lift is designed to ensure streamlined gas (and leachate) extraction. Landfill gas that is extracted is directed to the on-site power station, with moisture removal undertaken via a series of knock-out vessels along the landfill gas flow lines and the main header line.

2.4 LEACHATE MANAGEMENT SYSTEM

The key features of the LMS include:

- Evaporation Dam 3 North (**ED3N**), also known as evaporation lagoon 1-4;
- Evaporation Dam 3 South (**E3DS**), used for stormwater run-off;
- Evaporation Dam 3 South-South (**ED3S-S**), also known as evaporation lagoon 5; and
- Leachate Treatment Dam (**LTD**).

Each of these features is described in **Section 2.4.1** to **Section 2.4.3**, respectively. Storage Pond 7, a previous feature of the LMS, no longer exists (see **Section 2.4.4** for details). Further details on the LMS can be found in *Chapter 8* of the *EA 2010*.

It is a condition of the Site's Environmental Protection Licence (**EPL**) that no leachate (treated or untreated) can be directly discharged from the Site. The only means of volume reduction is through mechanical and/or natural evaporation processes. The details pertaining to the mechanical evaporation process of treated leachate are discussed in **Section 2.4.1.1.**

2.4.1 Evaporation Dam 3 North (ED3N)

ED3N pond system covers a total surface area of 3.6 hectares (**ha**), at top water level (**TWL**), and is divided into four discrete lagoons, namely:

1. **ED3N–1:** receives treated leachate from the leachate treatment dam. The pond surface area, as of the Audit, is approximately 0.6 ha;
2. **ED3N–2***:* receives treated leachate from the LTD. The pond surface area, as of the Audit, is approximately 0.55 ha;
3. **ED3N–3**: receives treated leachate from the LTD. The pond surface area, as of the Audit, is approximately 0.55 ha. Any overflow from this pond is directed to ED3N-1; and

4. **ED3N–4**: receives treated leachate overflow from ED3N–2, ED3N-3, or treated leachate direct from the LTD. The pond surface area, as of the Audit, is approximately 2.5 ha. There are up to five mechanical evaporators available which draw treated leachate from ED3N-4 to promote evaporation as a means of volume reduction. Further details on the mechanical evaporation process at the Site are described in **Section 2.4.1.1.**

2.4.1.1 Mechanical evaporation system

The mechanical evaporation system is currently active after not being in use since the 2013 IOA, due to the growing need for volume reduction in the ponds to retrieve storage capacity. The mechanical evaporation system is operated as per Veolia's *Mechanical Evaporator Operation Protocol* document, which was made available and reviewed as part of the Audit. A photo showing the operation of the evaporations during the Audit is shown in **Photo 2.1**.

Photo 2.1 – The operation of the mechanical evaporation system at the Site as found on 1 February 2017

The mechanical evaporation system at the Site consists of five Turbomist ® evaporation pump units, each capable of spraying 350 litres per minute (**L/min**) of liquid into the air. The evaporator units are automated and controlled by on-site sensors that are programmed to operate the evaporator units under the following conditions:

- Favourable wind directions (i.e. when wind direction favours air movement back over the dam);

- When ambient relative humidity (**RH**) levels are less than 75%; and
- When wind speed is more than 0.2 metres per sec (**m/s**).

Information provided by Veolia from previous audits indicate that approximately 20% to 30% of the pumped water is evaporated, depending upon ambient temperature and RH conditions. The evaporator units can be relocated to different areas within ED3N. As will be discussed in **Section 8.2.1.5,** mechanical evaporation of treated leachate stored in ED3N is assessed to be of suitable quality from an odour viewpoint.

2.4.2 Evaporation Dam 3 South (ED3S)

ED3S pond system currently consists of predominately stormwater runoff which is managed as acid mine drainage. At TWL, ED3S can cover a total surface area of approximately 118 ha. Recently, the Site received approval to divide ED3S into two discrete lagoons for the purposes of providing supplementary reserve capacity for the storage of treated leachate from the LTD, namely:

1. **ED3S:** continues **to** receive stormwater runoff which is managed as acid mine drainage. It also receives stormwater water run-off from Stormwater Pond 3 (see **Section 2.5**). The pond surface area at TWL is 89.4 ha. A photo of ED3S as found during the Audit is shown in **Photo 2.2**; and

2. **ED3S–S***:* receives treated leachate from the LTD. The pond surface area at TWL is 28.3 ha. At the time of the Audit, ED3S was judged to be at 2.5% volume capacity or 0.71 ha. A photo of ED3S-S as found during the Audit is shown in **Photo 2.3**.

Photo 2.2 – ED3S as found on 2 February 2017

Photo 2.3 – ED3S-S as found on 2 February 2017

2.4.3 Leachate Treatment Dam

The LTD is located in the upper north-western edge of the Void and is an integral part of the LMS at the Site. Leachate from the Void is pumped directly to the LTD as required. Since the 2012 IOA, the LTD was upgraded from a batch-based wastewater treatment system to a continuous configuration. The upgraded system was commissioned in April 2013. Following this upgrade, the LTD process was modified since the previous audit to consist of aeration and anoxic zones and a reduction to the dam level as a means to increase the efficiency of the leachate treatment process. **Photo 2.4** shows the LTD as found during the Audit and **Figure 2.3** illustrates the current continuous treatment configuration for the LTD.

The LTD has a hydraulic retention time (**HRT**) of 33 days and is capable of the continuous treatment of approximately 259,000 L/day of untreated leachate, equivalent to a current maximum treatment capacity of 3 L/s. The effluent from the LTD is dosed in-situ with ferric chloride (**$FeCl_3$**) and a polymer to facilitate with coagulation and flocculation processes before passing through a settling tank (known as the Woodlawn Aerated Leachate Treated Effluent Refiner or **WALTER**). The sludge from the settling tank is returned to the LTD and when required can be transported to the Void. Under this treatment configuration, the LTD requires desludging at a frequency that is determined by Veolia experts. The sludge from the desludging process (and any excess sludge that is generated) is returned to the waste in the Bioreactor where it is buried and covered.

Photo 2.4 – The LTD as found on 2 February 2017

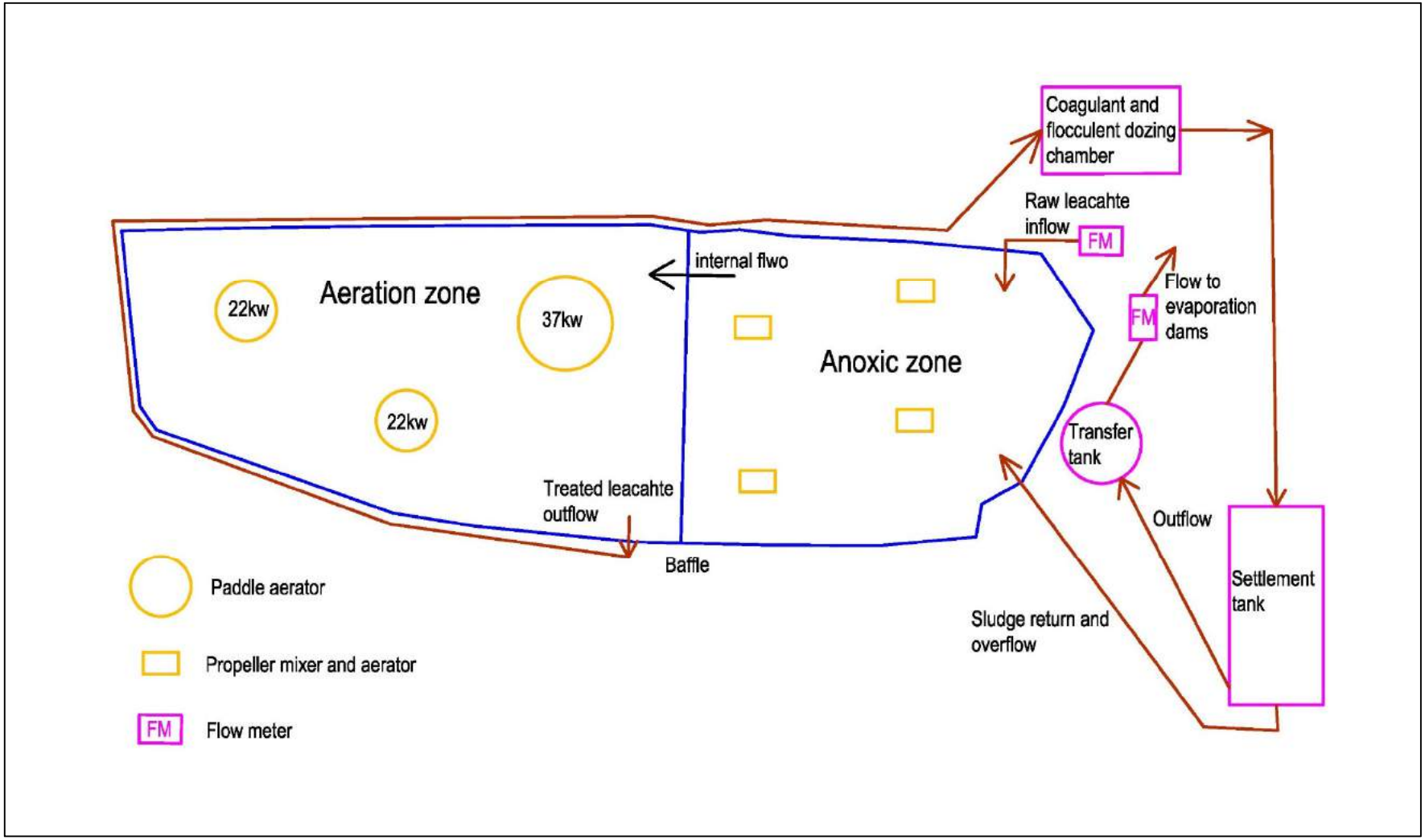


Figure 2.3 – A flow schematic of the current continuous treatment configuration for the LTD at the Site (**Source:** Veolia)

2.4.4 Storage Pond 7 (inside the Void)

At the time of the Audit, Storage Pond 7 remains decommissioned (previously located in the Void). As a result, it has been excluded as a valid odour emission source for the purposes of the Audit.

2.5 STORMWATER POND 3

Stormwater Pond 3 is located at reduced level (**RL**) 725 on the berm at the top of the Void (see **Photo 2.5**). It has a capacity to store approximately 7,700 m^3 of liquid including 0.5 m freeboard. Within this pond are three 120 L/s pumps operated on separate float switches. Water is pumped from Stormwater Pond 3 via two transfer tanks to ED3S for storage.

Photo 2.5 – Stormwater Pond 3 as found on 2 February 2017

According to the information provided in the WIP 2017, The Audit understands that Stormwater Pond 3 has been converted to a stormwater dam following a desludging of the pond, between the period of March 2016 and April 2016, to enable greater capacity of retaining stormwater during storm events. One excavator was used to remove the sludge out of the pond. The total volume of sludge pumped out of the pond was approximately 2,500 m^3, representing approximately two-thirds of the total volume of sludge present in the collection pond at the time. The pumped out sludge was disposed in the Void. This desludging process may be repeated once every year in order to maximise the surface water storage capacity of the pond.

Surface water collected on the covered Void surface is drained to temporary storage ponds and subsequently transferred to Stormwater Pond 3. The purpose of utilising Stormwater Pond 3 is to minimise the amount of surface water flow from the Void perimeter onto the waste. Once surface water comes in contact with waste or leachate, the water must be managed as leachate through the LMS.

As a precautionary measure, the Audit has included this source as part of its odour emission inventory to monitor the quality of stormwater contained in this pond from an odour viewpoint (see **Section 3**).

3 SAMPLING PROGRAM

As per *Condition 7 (e)* of *Schedule 4* in the *Specific Environmental Conditions - Landfill site,* this Audit measured all current and key sources at the Site. As previously highlighted **in Section 1.3**, the odour emissions inventory developed in the 2014 IOA by the audit team was used as a basis for the sampling program in the Audit.

3.1 SAMPLING SCOPE

A total collection of twenty-six samples were collected in the Audit, namely:

- Twenty-four gas samples for odour concentration measurement; and
- Two liquid samples for odour concentration measurement testing using an in-house NATA-accredited Liquid Odour Concentration Determination Method (see **Section 4.2 & Appendix D** for details). The liquid samples, whilst not being a requirement for the purposes of the Audit, were collected from ED3N-4, Stormwater Pond 3 to quantify the odour emissions caused by the natural or mechanical evaporation of the lagoons liquid contents (see **Section 8.2.1.5** for further details and results).

3.2 SAMPLING SCHEDULE

The sampling program schedule for the Audit is summarised in **Table 3.1.** As shown in **Table 3.1**, there are several key sampling locations at the Site. This includes:

- The Bioreactor;
- ED3N System;
- ED3S System;
- The Landfill Gas System; and
- Other sources in the Void.

The sampling program schedule includes all key sources requested in *Condition 7 (e) of Schedule 4 in the Specific Environmental Conditions - Landfill site* with the following exceptions:

- *Leachate recirculation:* Similarly to the 2012 IOA, the Audit was unable to observe and thus collect representative samples for this scenario. Since the completion of the *EA 2010* was undertaken, Veolia has developed a leachate recirculation system that involves direct injection of leachate into the waste which

eliminates the need for spraying over the surface (see **Section 2.3.1**). The audit team understands this will continue to remain normal practice, both for the Audit and future IOAs. Therefore, no suitable access points for the collection of odour samples from this source is, and will continue to be, possible.

3.2.1 Wet Weather Conditions

Unlike previous audits conducted since 2012, the Audit encountered wet weather conditions where rainfall occurred for a major portion of 1 February 2017. As a result, the Audit was able to collect odour samples under wet weather conditions and observed the effects of wet weather in terms of the need to handle increased levels of leachate.

3.2.2 IMF

No samples were collected from the IMF as all waste transportation is a fully contained process until displacement of the contents into the Void via the mobile tipping platform.

The Audit notes that it is a requirement that all waste containers be designed, constructed, and maintained to prevent the emission of odour and be water tight to prevent the leakage of leachate from waste containers during transport and handling activities. This is a condition of consent for the Clyde Transfer Terminal Facility; that is, where the waste containerisation process occurs. As such, and as per previous audits, the Audit team classifies the IMF as a very low risk source in terms of odour. Moreover, and as per previous audits, there are virtually no active pathways for odour emission release from this operation that can be practically measured. Therefore, and as will be discussed in **Section 8.2.1.9** and noted in previous audits, the IMF is not considered to be a significant contributor to the Site's overall odour emissions profile.

Table 3.1 – The Site sampling program schedule: 31 January 2017 – 2 February 2017		
Location	**Source Type^**	**No. of samples collected**
The Bioreactor		
Active Tipping Face	Area source	1
Waste Covered Area		8
Stormwater Pond 3	Liquid odour measurement (1)	1
Leachate Treatment Dam		
Leachate Treatment Dam	Area source	2
ED3N Pond System		
ED3N - 1	Area Source	2
ED3N - 2	Area source	2
ED3N - 3	Area source	2
ED3N - 4	Area source (2) + Liquid odour measurement (1)	3
ED3S Pond System		
ED3S	Area Source	2
ED3S-S	Area source	3
TOTAL		**26**

^ see **Section 4** for details

4 SAMPLING METHODOLOGY

The following sampling methodologies are associated with the 'Source Type' descriptions presented in **Section 3.2** - **Table 3.1**. Given the nature and characteristics of the emission sources sampled, the following sampling techniques were adopted in the Audit:

- Area source sampling, as detailed in **Section 4.1**; and
- Liquid odour measurement method, as detailed in **Section 4.2**.

4.1 AREA SOURCE SAMPLING METHOD

The objective of the area source sampling was to collect representative odour samples from the settling pond and wastewater dam surface area. This was undertaken using an isolation flux hood (**IFH**). All sampling using the IFH was carried out according to the method described in the United States Environment Protection Agency (**US EPA**) technical report '*EPA/600/8-86/008*', from which Australian Standard 4323.4:2009 (AS4323.4:2009) is based upon and is considered an '*Other Approved Method (OM-8)' by EPA (DEC, 2007)*. TOU's IFH adheres to the design specifications, materials of construction and supporting equipment that the US EPA report '*EPA/600/8-86/008*' defines. The IFH has a diameter of 0.406 metres (**m**), a chamber surface area of 0.126 square metres (**m^2**) and a chamber volume of 30 litres (**L**), equivalent to 0.03 cubic metres (**m^3**), when the skirt of the hood is inserted into the liquid or solid surface by the specified 25 millimetres (**mm**). Dry nitrogen is then introduced to the IFH at a sweep rate of 5 litres per minute (**lpm**).

As these area sources are open to the atmosphere, wind is a major factor in the release of odorous pollutants from the surface and conveying the pollutant from the source to areas beyond the boundary. The IFH system is designed to simulate the transfer of odorous pollutants by the wind, resulting in a controlled and consistent sampling environment. This is achieved by the flux of near pure nitrogen gas into the IFH that is positioned on the liquid or solid surface. On a liquid surface this is achieved by floating the IFH within an inflated tyre inner tube. The nitrogen gas then transports the odour from the surface in the same way the wind does, albeit at a very low sweep velocity. This odorous air is then collected for odour and/or chemical analysis. As the IFH has a constant 5 lpm inflow of nitrogen gas to it, the sampling chamber remains under positive pressure and produces a net outflow through the vent on top of the IFH, therefore eliminating any chance of contamination of external air from the atmosphere. The IFH's volume of 30 L and the 5 lpm nitrogen sweep rate results in a gas residence time of six minutes. The US EPA method prescribes a minimum of four air changes in order to achieve optimum purging and equilibrium in the hood, and therefore a total of 24

minutes is allowed before sampling commences. The sample is then collected over a 10-minute period to obtain a 20 L sample for odour and/or chemical analysis.

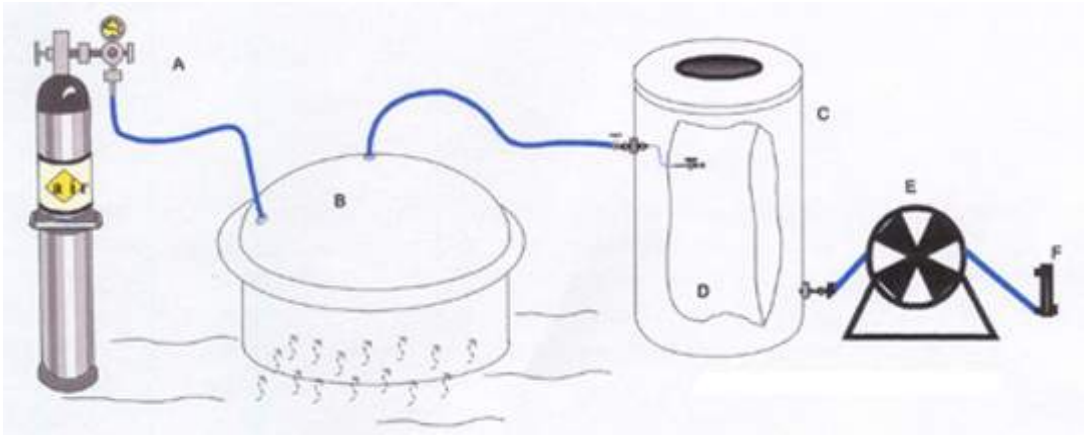
The US EPA method followed by TOU may be summarised as follows (and as described in the schematic of the sampling equipment shown in **Figure 4.1**):

- Dry nitrogen is directed into the IFH via odour free PTFE tubing until it has reached equilibrium. The nitrogen is channelled to a manifold fitted with small outlets above the surface, which direct the air towards the centre of the surface;

- The nitrogen flow (5 lpm) purges the flux hood with a residence time of four times the chamber volume occurring before sampling begins; and

- The odorous sample is drawn through a Teflon tube, into a single use, odour-free Nalophan sample bag secured inside a drum that is under vacuum. The balance of the gas flow is vented to atmosphere.

The IFH is manufactured from acrylic resin to ensure it does not contribute to the odour sample. All other surfaces in contact with the sample are made from PTFE or stainless steel. An example of IFH sampling on a solid surface and a liquid surface is shown in **Photo 4.1** & **Photo 4.2**, respectively.

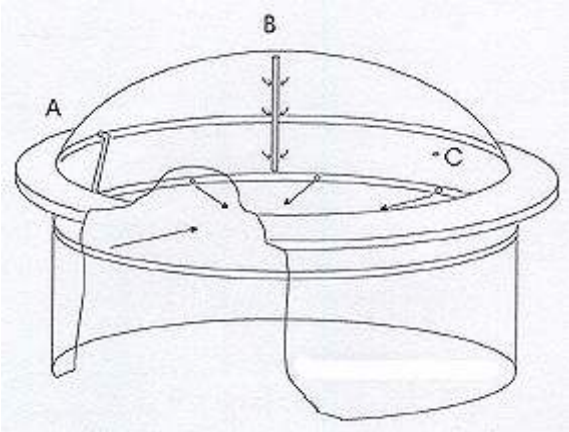


Source: Odotech - Odoflux Isolation Flux Hood Manual

Key

A	Cylinder of medical air, nitrogen or any neutral gas.
B	Isolation Flux Hood (a detailed diagram is shown in **Figure 4.2**)
C	Lung chamber (sampling drum)
D	Nalophan sampling bag
E	Sampling pump
F	Air flow meter

Figure 4.1 - Isolation flux hood setup schematic



Key

A	Inlet gas from gas cylinder.
B	Outlet to sample bag.
C	Additional gas outlet points for other sampling, or temperature and moisture monitoring.

Source: Odotech - Odoflux Isolation Flux Hood Manual

Figure 4.2 - Isolation flux hood chamber details

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Photo 4.1 – An example of IFH sampling in the Void

Photo 4.2 – An example of IFH sampling at ED3S-S

4.2 LIQUID ODOUR METHOD

4.2.1 Overview

The Liquid Odour Method (**LOM**) was developed by TOU for measurement of the odour release potential from process liquors, which is universally applicable to aqueous solutions containing odorous substances. In simple terms, it measures the odour released when an odorous liquid evaporates. It is directly relevant to the mechanical evaporation units in use at the Site and natural evaporation processes for volume reduction of treated leachate (see **Appendix D** for details on methodology).

5 ODOUR & CHEMICAL MEASUREMENT METHODS

5.1 ODOUR MEASUREMENT LABORATORY

All samples collected for the Audit were tested at TOU's NATA Accredited Sydney Odour Laboratory.

5.1.1 Odour Concentration Measurement

TOU's odour laboratory operates to the Australian Standard for odour measurement '*Determination of odour concentration by dynamic olfactometry'* (**AS4323.3:2001**) which prescribes a method for sample analysis that provides quality assurance/quality control and ensures a high degree of confidence in the accuracy, repeatability and reproducibility of results.

The concentration of the gaseous odour samples were measured using a technique known as dynamic olfactometry. Dynamic olfactometry involves the repeated presentation of both a diluted gaseous odour sample and an odour-free air stream to a panel of qualified assessors through two adjacent ports on the olfactometer (known as the Odormat™). TOU utilises four to six trained assessors (or panellists) for sample analysis, with the results from four qualified panellists being the minimum allowed under the Australian Standard AS4323.3:2001. For the Audit, four panelists were used.

The method for odour concentration analysis involves the odorous gas sample initially being diluted to the point where it cannot be detected by any member of the panel. The assessor's step- up to the olfactometer in turn, takes a sniff from each port, then choose which port contains the odour and enter their response. At each stage of the testing process, the concentration of the odorous gas is systematically increased (doubled) and re-presented to the panellists. A round is completed when all assessors have correctly detected the presence of the odour with certainty. The odour is presented to the panel for three rounds and results taken from the latter two rounds, as stated in AS4323.3:2001.

The results obtained give an odour measurement measured in terms of odour units (ou). One (1) ou is the concentration of odorous air that can be detected by 50% of members of an odour panel (persons chosen as representative of the average population sensitivity to odour). It is effectively the concentration of an odour at detection threshold level. The odour concentration of a sample expressed in odour units is the number of times the sample must be diluted to elicit a physiological response (the detection threshold level) from a panel. For example, twenty (20) odour units would mean that the odour sample will need to be diluted 20 times for the concentration to be at detection threshold level. This process is defined within AS/NZS 4323.3:2001. This process is defined within AS4323.3:2001. The odour units can be subsequently multiplied by an emission rate or volumetric flow to obtain an Odour Emission Rate (**OER**, ou.m^3/s) or a

specific odour emission rate (**SOER**, ou. $m^3/m^2/s$) for area source samples collected using the IFH method (see **Section 4.1** & **Section 5.1.2**).

5.1.2 Specific Odour Emission Rate

For area source samples collected using the IFH method, the results from odour concentration testing, derived in odour units (see **Section 4.1** for details), are multiplied by an emission rate to obtain a SOER. SOER is a measure of odour released from a representative point at a source. The SOER is multiplied by the area of the source to obtain the OER, or the total odour released from each source, that is:

- SOER ($ou.m^3\,m^{-2}\,s^{-1}$) = OC × Q / A; and
- OER ($ou.m^3\,s^{-1}$) = SOER × area of source (m^2)

where:

- OC = odour concentration of compound from air in the chamber (ou)
- Q = sweep gas volumetric flow rate into chamber ($m^3\,s^{-1}$)
- A = sample source total surface area (m^2)

The SOER is presented in the units $ou.m^3/m^2/s$ as per convention, and as referred to in the document – Klenbusch, M.R., 1986. USEPA Report No. EPA/600/8-86/008 '*Measurement of gaseous emission rates from land surfaces using an emission isolation flux chamber, - Users Guide'*. The OER is presented in the units' $ou.m^3/s$ as referenced in the AS4323.3:2001.

5.1.3 Odour Measurement Accuracy

The repeatability and odour measurement accuracy of the Odormat™ is determined by its deviation from statistically reference values specified in AS4323.3:2001. This includes calculation of instrumental repeatability (r), where r must be less than 0.477 to comply with the standard criterion for repeatability. Its accuracy (A) is also tested against the 95^{th} percentile confidence interval, where A must be less than 0.217 to comply with the accuracy criterion as mentioned in the Standard.

The Odormat™ V02 was last calibrated in March - May 2016 and complied with all requirements set out in the AS4323.3:2001 (see **Appendix A** – Result sheets: *Repeatability and Accuracy*). The calibration gas used was 51.5 parts per million (**ppm**), by volume, n-butanol in nitrogen gas ($\mathbf{N_2}$).

5.2 IN-SITU H_2S TESTING USING JEROME 631-X H_2S ANALYSER

All collected samples using the area source sampling method, as described in **Section 4.1**, were analysed for hydrogen sulphide (**H_2S**) using a calibrated Jerome ® 631-X H_2S Analyser (**Jerome Analyser**). The Jerome is a portable ambient air analyser with a range of 0.003 ppm to 50 ppm. All samples were measured on-site using the Jerome (see **Photo 5.1**), except where H_2S concentrations of greater than 50 ppm were encountered which necessitated the use of colorimetric tubes were used).

Photo 5.1– TOU's portable Jerome 631-X H_2S Analyser

5.2.1 Principle of Operation

A thin gold film, in the presence of H_2S, undergoes an increase in electrical resistance proportional to the mass of H_2S in the sample.

When the SAMPLE button is pressed, an internal pump pulls ambient air over the gold film sensor for a precise period. The sensor absorbs the H_2S. The instrument determines the amount absorbed and displays the measured concentration of H_2S in ppm. During normal sampling, the ambient air sample is diluted in the flow system at a ratio of 100:1. When sampling in Range 0 (where low levels of H_2S is expected) undiluted air samples are drawn across the gold film sensor.

The instrument's microprocessor automatically re-zeros the digital meter at the start of each sample cycle and freezes the meter reading until the next sample cycle is activated, thus eliminating drift between samples.

During the sample mode cycle, bars on the LCD represent the percentage of sensor saturation. Depending on the concentrations, 50 to 500 samples may be taken before the sensor reaches saturation. At that point, a 10-minute heat cycle must be initiated to remove the accumulated H_2S from the sensor. During the sensor regeneration cycle,

both solenoids are closed to cause air to pass through a scrubber filter and provide clean air for the regeneration process. The flow system's final scrubber prevents contamination of the environment.

5.2.2 Sample Mode Accuracy

The length of the sample cycle depends on the concentration of H_2S and this determines the level of accuracy in the readings. There are four ranges which have been summarised in **Table 5.1**.

Table 5.1 – Jerome 631-X H_2S analyser: Sample mode

Range	Concentration	Response Time	Accuracy at Mid-range
0	0.001 to 0.099 ppm	30 seconds	± 0.003 ppm at 0.050 ppm
1	0.10 to 0.99 ppm	25 seconds	± 0.03 ppm at 0.5 ppm
2	1.0 to 9.9 ppm	16 seconds	± 0.3 ppm at 5.0 ppm
3	10 to 50 ppm	13 seconds	± 2 ppm at 25 ppm

5.2.3 Zeroing

Prior to testing air samples, the Jerome was zeroed and a blank sample taken using a zero air filter. For each zeroing event in the Audit, the Jerome indicated a nil reading (i.e. 0.000 ppm), indicating that the Jerome was free from any H_2S contamination.

6 ODOUR & H_2S TESTING RESULTS

This chapter is dedicated to addressing the following audit requirement as outlined in **Section 1.2**, namely:

e. Measure all key odour sources on-site including:

i. consideration of wet weather conditions providing all raw data used in this analysis;
ii. consideration of (but not limited to) all liquid storage area, active tipping faces, waste cover area, aged waste areas and recirculation of leachate onto waste in the Void;
iii. a comparison of the results of these measurements against the predictions in the EA.

All key odour sources at the Site were measured in the Audit, with the results presented in several tables, as follows:

- **Table 6.1** summarises the odour emission results obtained from the Audit and compares the results against the EA 2010 predictions. As there are no EA 2010 predictions for the ED3S Pond System, the results are compared with the emissions data used in the odour modelling study titled *Proposed Addition of ED3S to Leachate Management System* and dated 30 May 2016 as well as the results obtained for the ED3N Pond System in the Audit. Moreover, the odour emission results obtained from the Audit in relation to the efficacy of application of a biofiltration cover and a soil cover of 300 mm depth are presented;

- **Table 6.2** summaries the global mean SOER results derived in the Audit and compares these results to those derived in the previous IOAs conducted between 2012 and 2015;

- **Table 6.3** summarises in-situ H_2S concentration measurement results undertaken on all collected samples in the Audit using a calibrated Jerome Analyser. The concentration results in this table have been presented in ppm; and

- **Table 6.4** summarises the liquid odour measurement results.

In **Section 8.5**, **Table 8.4** summarises the odour emission rates from emission sources amenable to quantitative measurements. These sources have been ranked in descending order. The results in **Table 8.4** do not include potential gas pathways and other fugitive emission sources from the waste surface, due to the difficulty in assigning

an appropriate emission area for these sources to calculate an OER derived from the SOER and the area. This was a similar constraint in the previous IOAs.

Table 6.1 - The Audit vs. EA 2010 Odour emissions testing results: 31 January 2017 – 2 February 2017						
Source	**The Audit**				**EA**	
Sample Location	**Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2/s$)**	**Odour Character**	**SOER Range ($ou.m^3/m^2/s$)**	**SOER Model Input ($ou.m^3/m^2/s$)**
Bioreactor (The Void)						
Active Tipping Area						
Sample #16 - Active Tip Face - Fresh Waste (< 1 day old)	SC17027	16,400	8.16	garbage, bin juice	1.0 – 7.3*	7.3 (wet fresh waste emission adopted)
Aged Waste	n/m**				0.5	

* includes dry and wet waste

** unable to be sampled in the Audit due to access and safety concerns prevailing at the time

n/m = not measured

Table 6.1 continued - The Audit vs. EA 2010 Odour emissions testing results: 31 January 2017 – 2 February 2017						
Source	**The Audit**				**EA**	
Sample Location	**Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2/s$)**	**Odour Character**	**SOER Range ($ou.m^3/m^2/s$)**	**SOER Model Input ($ou.m^3/m^2/s$)**
Bioreactor (The Void)						
Waste Covered Area (Soil Cover)						
Sample #19 - Waste Covered Area (150 mm - Cover, less than a week old)	SC17029	512	0.286	dirt, garbage, pine	0.1 - 0.2* (covered)	0.2
Sample #21 - Waste Covered Area (150 mm, aged waste)	SC17031	304	0.172	dirt, earthy		
Sample #17 - Waste Covered Area (300 mm - Cover, less than a week old)	SC17028	431	0.25	dirt, garbage		
Sample #18 - Waste Covered Area (Void perimeter without biocover and with soil)	SC17034	664	0.377	pineapple, earthy	7.5 – 23.9**	23.9**
Sample #22 - Waste Covered Area (F15, without biofilter cover)	SC17035	21,200	13.3	rotten, putrid, pineapple		
Waste Covered Area (Biofiltration Cover)						
Sample #20 - Waste Covered Area (G16, with biofilter cover)	SC17030	4,470	2.36	pineapple, rotten egg, landfill gas	7.5 – 23.9**	23.9**
Sample #23 - Waste Covered Area (Void perimeter with biocover, 1 of 2)	SC17033	724	0.42	pineapple, dirt, earthy		
Sample #24 - Waste Covered Area (Void perimeter with biocover, 2 of 2)	SC17032	197	0.116	dirt, earthy		

* includes dry and wet covered waste
** represents potential gas pathways
n/m = not measured

Table 6.1 continued - The Audit vs. EA 2010 Odour emissions testing results: 31 January 2017 – 2 February 2017						
Source	**The Audit**				**EA**	
Sample Location	**Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2/s$)**	**Odour Character**	**SOER Range ($ou.m^3/m^2/s$)**	**SOER Model Input ($ou.m^3/m^2/s$)**
Bioreactor (The Void)						
Leachate Treatment Dam						
Sample #14 - Leachate Treatment Dam (1 of 2) – Anoxic Zone	SC17025	362	0.223	pungent, ammoniacal, earthy, dirty socks	0.1 - 7.4*	3.6
Sample #15 - Leachate Treatment Dam (2 of 2) – Aerobic Zone	SC17026	512	0.316	pungent, ammoniacal, earthy, dirty socks		
Leachate recirculation system						
Leachate recirculation system	n/m				1.6 – 2.5	2.5
Landfill Gas Extraction System						
Landfill gas inlet	n/m				n/a	
Catchment Pond (leachate)						
Storage Pond 7	n/m				2.1 – 8.8	8.8
Catchment Pond (stormwater)						
LOM Sample #1 - Storage Pond 3 (Stormwater)	SC17093	32	n/a	earthy, musty	n/a	

* includes partially / fully treated leachate (dependent on the treatment stage of the process at the time samples were collected)
n/m = not measured
n/a = not applicable

Table 6.1 continued - The Audit vs. EA 2010 Odour emissions testing results: 31 January 2017 – 2 February 2017						
Source	**The Audit**				**EA**	
Sample Location	**Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2/s$)**	**Odour character**	**SOER Range ($ou.m^3/m^2/s$)**	**SOER Model Input ($ou.m^3/m^2/s$)**
Evaporation Dams						
Evaporation Dam 3 North (ED3N) Pond System						
Sample #9 - ED3N-1 (1 of 2)	SC17017	166	0.119	musty, earthy	2.1 – 8.8	8.8
Sample #10 – ED3N-1 (2 of 2)	SC17018	197	0.141	musty, earthy		
Sample #7 – ED3N-2 (1 of 2)	SC17015	215	0.154	musty, earthy	0.1 – 7.4	0.2*
Sample #8 - ED3N-2 (2 of 2)	SC17016	197	0.141	musty, earthy		
Sample #5 – ED3N-3 (1 of 2)	SC17013	332	0.237	musty, earthy		
Sample #6 - ED3N-3 (2 of 2)	SC17014	235	0.168	musty, earthy		
Sample #3 - ED3N-4 (1 of 2)	SC17011	362	0.259	musty, earthy	0.1 – 0.7	0.7**
Sample #4 – ED3N-4 (2 of 2)	SC17012	332	0.237	musty, earthy		
LOM Sample #2 - ED3N-4	SC17094	38	n/a	rubber, earthy, musty	n/a	

* partially / fully treated leachate

** includes groundwater and fully treated leachate

n/a = not applicable

n/m = not measured

Table 6.1 continued - The Audit vs. EA 2010 Odour emissions testing results: 31 January 2017 – 2 February 2017

Source	The Audit				EA	
Sample Location	**Sample Number**	**Odour Concentration (ou)**	**SOER ($ou.m^3/m^2/s$)**	**Odour character**	**SOER Range ($ou.m^3/m^2/s$)**	**SOER Model Input ($ou.m^3/m^2/s$)**
Evaporation Dam 3 South – South (ED3S-S) Pond System						
Sample #11 - ED3S-S (1 of 3)	SC17022	724	0.473	pungent, ammoniacal earthy	0.159***	
Sample #12 - ED3S-S (2 of 3)	SC17023	724	0.473	pungent, ammoniacal earthy		
Sample #13 - ED3S-S (3 of 3)	SC17024	558	0.365	pungent, ammoniacal earthy, dirty socks		
Evaporation Dam 3 South (ED3S) Pond System						
Sample #1 - ED3S (1 of 2)	SC17009	304	0.217	musty, earthy	0.0 - 0.5	0.5
Sample #2 - ED3S (2 of 2)	SC17010	470	0.336	musty, earthy		

* partially / fully treated leachate

** includes groundwater and fully treated leachate

*** Not obtained from the EA. Source of emission data is the *Woodlawn Bioreactor Facility Odour Modelling Study - Proposed addition of ED3S to leachate management system* - May 2016: Table 2.1

n/a = not applicable

n/m = not measured

Table 6.2 – Global mean SOER results: Comparison between The Audit and previous IOAs					
Source	**The Audit**	**2015 IOA**	**2014 IOA**	**2013 IOA**	**2012 IOA**
Location	**TOU SOER (ou.m³/m²/s)**				
ED3N-1	0.130	0.132	0.017	0.30	394
ED3N-2 & 3^	0.175	0.118	0.049	11.6 ^^^^	0.29
ED3N-2	0.148	0.145	0.066	20.1 ^^^	0.21
ED3N-3	0.20	0.091	0.032	0.2	0.37
ED3N-4	0.248	0.269	0.023	0.0604	0.41
Active Tipping Face	8.16	7.51^^^^^	4.28	3.04	8.36
Leachate Treatment Dam	0.27	0.276	0.026	0.323	0.46
Construction and Demolition Tip Face	n/m	0.326	n/a	0.293	n/a
ED3S	0.277	No previous measurements available as ED3S, ED3S-S, and Stormwater Pond 3 are new sources			
ED3S-S	0.437				
Stormwater Pond 3	n/a				
Storage Pond 7	n/a	n/m^^	n/a#		85

^ as specified in *EA 2010*
^^ no longer exists - see **Section 2.4.4** for details
^^^ represents the sub-optimal pond contents that has now been treated (see **IOA 2013 Report** for details)
^^^^ bulk of emissions originating from ED3N-2 (see **IOA 2013 Report** for details)
^^^^^ includes testing results reflecting sampled areas with the polymer slurry applied
# There was no designated area for this location (see **IOA 2014 Report** for details)
n/a = not applicable
n/m = not measured

Table 6.3 – Global Jerome H_2S measurement results: 31 January 2017 – 2 February 2017

Sample Location	TOU Sample Number	H_2S concentration measurement in bag (ppm)
Sample #1 - ED3S (1 of 2)	SC17009	0.005
Sample #2 - ED3S (2 of 2)	SC17010	0.003
Sample #3 - ED3N-4 (1 of 2)	SC17011	0.17
Sample #4 – ED3N-4 (2 of 2)	SC17012	0.16
Sample #5 – ED3N-3 (1 of 2)	SC17013	0.037
Sample #6 - ED3N-3 (2 of 2)	SC17014	0.047
Sample #7 – ED3N-2 (1 of 2)	SC17015	0.21
Sample #8 - ED3N-2 (2 of 2)	SC17016	0.19
Sample #9 - ED3N-1 (1 of 2)	SC17017	0.075
Sample #10 – ED3N-1 (2 of 2)	SC17018	0.073
Sample #11 - ED3S-S (1 of 3)	SC17022	1.2
Sample #12 - ED3S-S (2 of 3)	SC17023	1.2
Sample #13 - ED3S-S (3 of 3)	SC17024	1.9
Sample #14 - Leachate Treatment Dam (1 of 2) - Anoxic Zone	SC17025	0.48
Sample #15 - Leachate Treatment Dam (2 of 2) - Aerobic Zone	SC17026	1.3
Sample #16 - Active Tip Face - Fresh Waste (< 1 day old)	SC17034	0.06
Sample #17 - Waste Covered Area (300 mm - Cover, less than a week old)	SC17028	0.06
Sample #18 - Waste Covered Area (Void perimeter without biocover and with soil)	SC17034	0.003
Sample #19 - Waste Covered Area (150 mm - Cover, less than a week old)	SC17029	0.019
Sample #20 - Waste Covered Area (G16, with biofilter cover)	SC17030	0.01
Sample #21 - Waste Covered Area (150 mm, aged waste)	SC17031	0.009
Sample #22 - Waste Covered Area (F15, without biofilter cover)	SC17035	0.26
Sample #23 - Waste Covered Area (Void perimeter with biocover, 1 of 2)	SC17033	0.002
Sample #24 - Waste Covered Area (Void perimeter with biocover, 2 of 2)	SC17032	0.037

Table 6.4 – LOM derived odour emission rates for mechanical and natural evaporation methods: 31 January 2017 – 2 February 2017						
Sample Location	**TOU Sample Number**	**Odour Concentration (ou)**	**Calculated Liquid Odour Potential (ou/mL)**	**Mechanical Evaporation Rate (L/min) per evaporator^ η = 20% / 30%**	**Mechanical Evaporation Odour Emission Rate ($ou.m^3/s$) per evaporator η = 20% / 30%**	**Mechanical Evaporation Odour Emission Rate ($ou.m^3/s$) ALL evaporators^^^ η = 20% / 30%**
Evaporation method: Mechanical						
LOM Sample #2 - ED3N-4	SC17094	38	2.3	70 / 105	2,680 / 4,030	13,400 / 20,200
Evaporation method: Natural						
Sample Location	**TOU Sample Number**	**Odour Concentration (ou)**	**Calculated Liquid Odour Potential (ou/mL)**	**Current Surface Area (m^2)**	**Natural Evaporation rate (L/s) ^^**	**Natural Evaporation Odour Emission Rate ($ou.m^3/s$)**
LOM Sample #1 - Storage Pond 3 (Stormwater)	SC17093	32	1.94	1,650 ^^^^	0.058	113
LOM Sample #2 - ED3N-4	SC17094	38	2.3	25,000	0.882	2,030

^ Mechanical evaporation rate is based on 20% / 30% evaporation efficiency per evaporator.

^^ The natural evaporation rate is based on the mean evaporation rate recorded between May 2007 to June 2012, equivalent to 92.67 mm/month.

^^^ Based on five active and identical evaporators as is the current mode of operation.

^^^^ Stormwater Pond 3 was close to empty during the Audit due to active work in this area. Therefore, the surface area presented is at TWL.

6.1 COMMENTS ON RESULTS

The following sections comment on the results presented in **Table 6.1**, **Table 6.2**, **Table 6.3**, and **Table 6.4.**

6.1.1 The Void Samples

- The sampling locations inside the Void have been nominally shown in **Figure 6.1**. The sample numbers presented in **Figure 6.1** correspond with those in the sampling location column in **Table 6.1**. The conditions prevailing in the Void at the time of the Audit is visually presented in **Photo 6.1**.

- As presented in **Table 6.2**, the measured SOER result for the Active Tipping Area (SC17034) in the Audit is 8.16 ou.$m^3/m^2/s$, representing only a marginal change since the previous 2015 IOA. However, it should be noted that, compared to the previous odour results for the Active Tipping Area, this derived result represents a single data point and more samples would be necessary to increase the confidence of this result. Notwithstanding this, the odour character for the active tipping face sample collected in the Audit was reported as 'garbage, bin juice'. When considering the SOER in the Audit and the odour character, this finding may possibly elucidate the field ambient odour assessment survey results where a 'garbage' odour was detectable downwind of the Site.

- The Waste Covered Area samples (SC17028 – SC17031 & SC17033-SC17035) were collected from areas within the Void identified by the audit team as potential gas pathways (i.e. areas identified in this Audit as potentially having a higher fugitive emission level than other areas around the Void and/or were covered with biofilter material) and other strategic locations designed to quantify the general emissions emanating from the Void.

- The results for odour measurements collected from the Void perimeter indicated that areas with a biofiltration cover had an average SOER result of 0.27 ou.$m^3/m^2/s$ compared with 0.38 ou/$m^3/m^2/s$ for a clay lined area. This minor difference could be related to: 1) the conditions prevailing in the Void at the time of sampling i.e. minimal fugitive gas emissions were occurring; and/or 2) the effectiveness of the clay liner and soil cover application in this area at the time. Notwithstanding this, it is clear from the SOER results obtained between bore hole locations G16 and F15 (i.e. sample number SC17030 and SC17035, respectively) that a biofiltration cover is an effective method at minimising fugitive gas emission release from the Void surface, when adequately moist and maintained in optimum condition.

In the Audit, there were three types of Waste Covered Area samples collected, including:

Void Covered Surface Type 1

The Void perimeter under two cover systems, as follows:

- A biofiltration cover of up to 500 mm depth. This represents the continued implementation by Veolia of one of the non-mandatory recommendations in the previous 2015 IOA; and
- Clay lining.

Void Covered Surface Type 2

Areas covered with 150 mm and 300 mm of virgin excavated natural material (VENM) to evaluate the covers efficacy at minimising fugitive odour emissions from the Void surface at different depths. The results were as follows:

- There was a minor difference between a soil cover of 150 mm depth (0.286 ou.$m^3/m^2/s$) and 300 mm depth (0.2 ou.$m^3/m^2/s$) on waste that was less than 1 week old.
- An area with aged waste (approximately 1-3 weeks old) and a 150 mm depth of VENM cover returned an SOER result of 0.172 ou.$m^3/m^2/s$. This suggests that the current VENM cover application is effective.
- Notwithstanding the above results, the Audit recommends that a cover of at least 300 mm should be applied as a safety margin and in the interest of further managing fugitive gas release from the Void surface from aging waste.

Void Covered Surface Type 3

Areas known as having a high risk for potential fugitive gas emissions release without a biofiltration cover. A comparison was made between a gas well with and without a biofilter cover, where the gas wells measured included G16 and F15 respectively. The area without a biofiltration cover returned a result of 13.3 ou.$m^3/m^2/s$ whereas a relatively equivalent area with biofiltration cover returned a result of 2.36 ou.$m^3/m^2/s$. Interestingly, the H_2S result for the area without a biofiltration cover was 0.26 ppm, whereas with a cover it was 0.01 ppm. This suggests that:

- The H_2S gas levels being emitted from the fugitive gas pathways from the area without a biofiltration were low at the time of sampling. Previous IOA normally indicated an elevated level of H_2S when a high SOER result was derived. The odour character was ‘rotten, putrid, pineapple’, consisting of decomposing waste; and/or
- The biofiltration cover is effective at treating emissions from potential fugitive gas pathways.

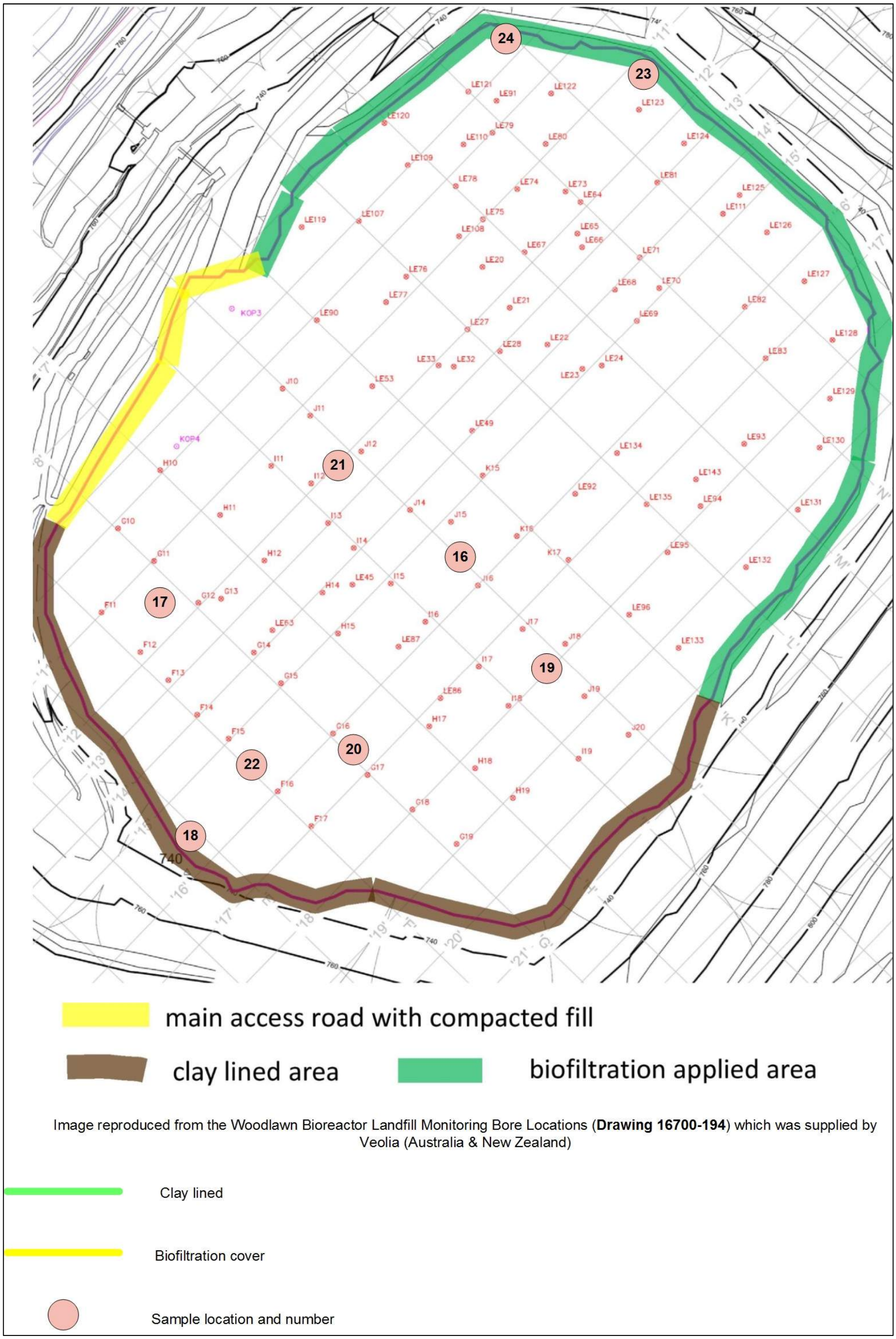


Figure 6.1 - Nominal sampling locations within the Void: 31 January 2017 – 2 February 2017

Photo 6.1 – Conditions prevailing in the Void during the Audit on 31 January 2017

6.1.2 Pond Source Samples – ED3N Pond System

- The leachate recirculation system continues to operate as a direct injection system that does not have suitable access points for sampling.

- All samples from the ED3N system were collected from the bank of the dams. The nominal sampling locations are shown in **Figure 6.2**.

- All samples collected and tested from the ED3N Pond system (i.e. SC17011 – SC17018) were found to be below the EA 2010 SOER model inputs for each individual dam. The very low SOER values for all ponds (between 0.119 - 0.259 ou.$m^3/m^2/s$) indicate that the leachate treatment quality is high and that the LMS at the Site is performing very well from an odour emissions viewpoint.

6.1.3 Pond Source Samples – ED3S Pond System

- Unlike previous IOAs to date, the Audit sampled the ED3S Pond System given that it is now part of the LMS (i.e. ED3S-S).

- The SOER results for ED3S were found to below the EA 2010 SOER model input of 0.5 ou.$m^3/m^2/s$, with all measured results (i.e. 0.22 & 0.34 ou.$m^3/m^2/s$) below this value.

- Similarly, the SOER results for ED3S-S were found to be low and relatively consistent with results obtained from ED3N and ED3S. This indicates that the treated leachate quality flowing to ED3S-S is of a quality that is conducive with low odour.

- The SEOR input from the May 2016 Report used a SOER of 0.159 ou.$m^3/m^2/s$ for the modelling of ED3S-S. The mean result derived in the Audit is 0.437 ou/$m^3/m^2/s$ (see **Table 6.2**). Whilst this result is slightly higher than that modelled, it is characterise by an emission rate which is unlikely to cause any adverse impact beyond boundary of the Site. This view is supported by the FAOA survey results presented in **Section 7** that highlighted no pond-related sources were detectable off-site.

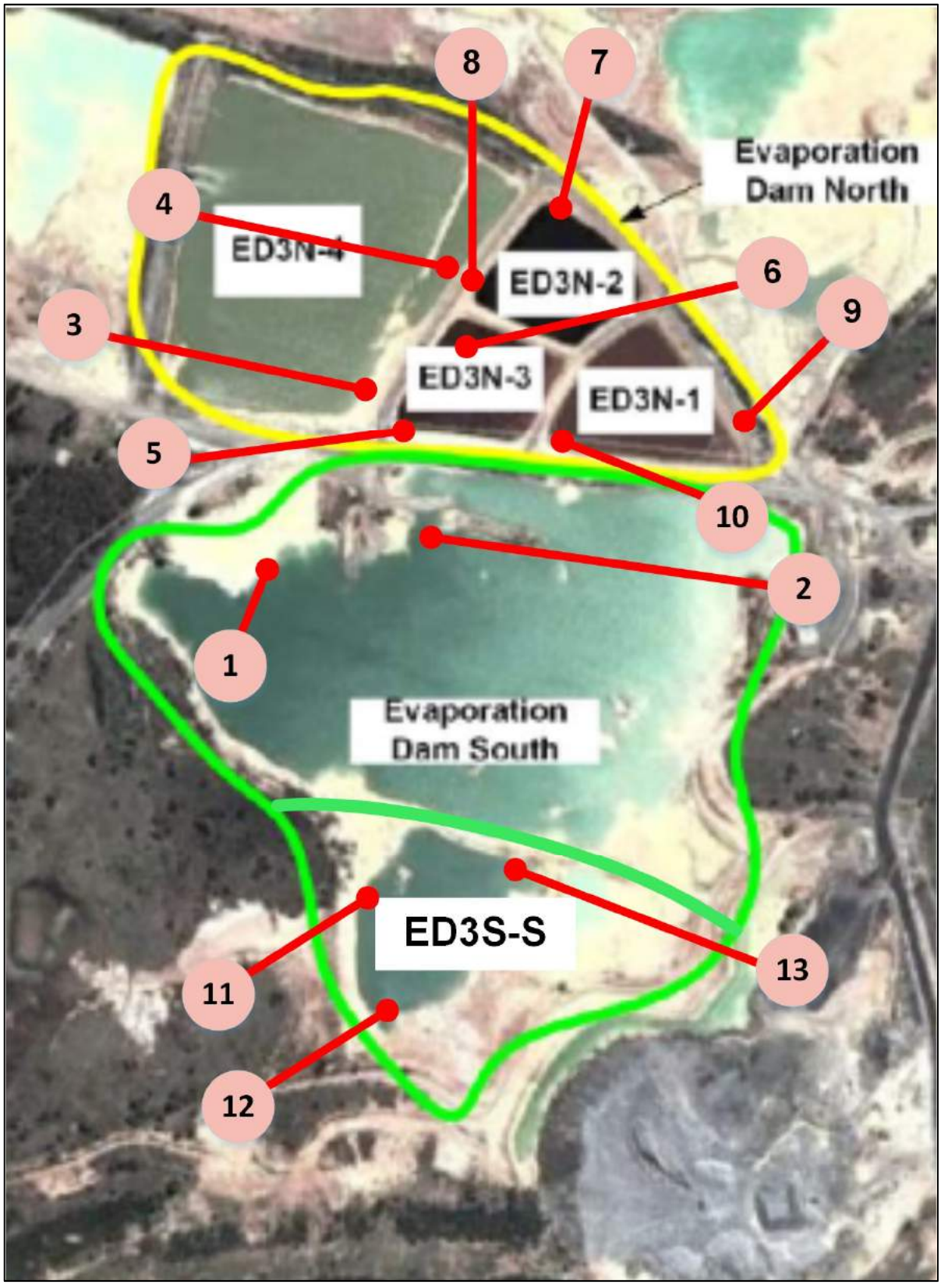


Figure 6.2 – Pond sources nominal sampling locations: 31 January 2017 – 2 February 2017

6.1.4 Leachate Treatment Dam Samples

- The LTD was found to be operating under normal operating conditions at the time of the Audit. There are clearly now two treatment zones in the LTD including an anoxic zone and an aerobic zone. Both zones were sampled as part of the Audit.

- The SOER results suggest that the LTD is not a significant odour emission source. This implies that the LTD was operating in optimum conditions at the time of the Audit from an odour viewpoint.

- The mean SOER result derived in the Audit for the LTD is 0.27 ou.$m^3/m^2/s$. This value is well below the EA 2010 SOER value of 3.6 ou.$m^3/m^2/s$ for the LTD.

- Five aerators were online at the time of the Audit. **Photo 6.2** shows the LTD as found during the Audit.

Photo 6.2 – The LTD as found on 2 February 2017

6.1.5 Landfill Gas Samples

- The Audit determined that it was not necessary to collect an inlet landfill gas sample to the Void based on the testing carried out during the emissions testing survey conducted on 2 June 2016 at Generator No. 1 (see **Appendix C**).

6.1.6 Liquid Odour Measurement Samples

- The Liquid Odour Measurement results represent the odour that would be released if the sample were evaporated, either by natural or mechanical means.

For the purposes of this Audit the mechanical and natural evaporation has been used in calculations.

- The natural evaporation rate shown is based on the mean rate at the Site between May 2007 to June 2012.

- The collected liquid samples were a grab sample from ED3N-4 and Stormwater Pond 3.

- The liquid odour sample result for ED3N-4 (SC17094), tested using the LOM, indicate that the treated leachate stored in ED3N-4 is very low in odour. This outcome is consistent with the results from the collected gas samples from the area source sampling (see **Section 6.1.2**). The implication of this result is discussed in **Section 8.2.1.5**.

- A liquid odour sample was collected from Stormwater Pond 3 to validate that this source was low in odour (SC17093). This was found to be the case, with a derived result consistent very low odour.

7 FIELD AMBIENT ODOUR ASSESSMENT SURVEY

A series of FAOA surveys were conducted as part of the Audit. It is understood that the completion of these FAOA surveys were required at specific times over the course of the Audit, as requested by NSW EPA. Specifically, the FAOA surveys were required to be undertaken during the following time periods:

- Before 0730 hrs; and
- After 2100 hrs.

The FAOA were conducted over the period between 30 January 2017 and 1 February 2017. All surveys were carried out by two calibrated and experienced TOU field assessors.

The following section summarises the methodology and results from the FAOA surveys conducted as part of the Audit.

7.1 FAOA SURVEY SCHEDULE

The FAOA survey schedule undertaken for the Audit is summarised in **Table 7.1.**

Table 7.1 – FAOA survey schedule: 30 January 2017 – 1 February 2017

FAOA Survey Session No.	Survey Date	Survey Time
1	30 January 2017	Evening, 2100 hrs – 2227 hrs
2	31 January 2017	Morning, 0630 hrs – 0753 hrs
3	31 January 2017	Evening, 2100 hrs – 2242 hrs
4	1 February 2017	Morning, 0625 hrs – 0730 hrs

7.2 PREAMBLE

At present, no Australian Standard exists for FAOA surveys. Consequently, TOU utilises a method for assessing the ground level impacts of odour emissions using a modified version of the German Standard VDI 3940 (1993) – '*Determination of Odorants in Ambient Air by Field Inspections'*. This standard prescribes the methods by which field technicians (or 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, the frequency of odours observed and the odour intensity of those individual observations as a quantitative scale of measure.

FAOA surveys are considered a valuable odour impact assessment tool as previous experience with ambient odour sampling and subsequent olfactometry testing suggests that accurate and useful ambient odour concentration data is difficult to obtain.

Therefore, TOU has adopted a more practical approach based on the field measurement of odour intensity. With this method, calibrated and experienced odour assessor/s traverse the general area and downwind surrounds of odour sources in a strategically mapped pattern, assessing the presence, character and intensity of any odours encountered and recording these observations along with wind speed and direction (when applicable). For the FAOA surveys conducted at the Site, all accessible downwind areas were assessed. The assessed areas were based on the wind conditions prevailing at the time of the FAOA Survey.

7.3 FAOA SURVEY MEASUREMENTS METHODOLOGY

The techniques employed in the surveys were able to quantify and/or qualify the following:

- Odour intensity:
- Odour character;
- Frequency;
- Extent of odour plume; and
- Likely source of odours detected near and far-field from the Facility

For the surveys undertaken at the Site, each TOU assessor spent five- to ten-minutes at each Measurement Location Point (**MLP**) in order to gauge the effects of any odour impact. Each measurement cycle comprised of 30 individual 'grab' assessments of odour, one every ten seconds for a single measurement cycle of five minutes. When plotted each grab measurement resulted in a single data point.

Overall, each survey utilised two assessors, with each assessor undertaking measurements over the assessment area at different MLPs over the duration of each survey session. The derived results of the surveys were then illustrated visually on odour impact maps, which are based on the field log sheets for the survey (see **Appendix E**).

At each MLP, wind velocity and direction was checked using a Vane Anemometer. In the event of a positive detection of odour at an MLP, the TOU assessor attempted to evaluate the odour intensity, odour character and likely source (whenever possible). In this way, the FAOA method enables the determination and extent of the impact of odour around the area of interest, rank their intensity and likely source.

7.3.1 Odour Intensity Categories

The ranking scale for the observed off-site odours detected beyond the facility boundary was quantified according to the *German Standard VDI 3940 'Determination of Odorants*

in Ambient Air by Field Inspections'. The standard's ranking system is based on the following 7-point intensity scale as shown in **Table 7.2**.

Table 7.2 - 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

Locations assessed that are assigned an odour intensity score of '0' (not detectable) were still be recorded in order to outline the presence and extent of the odour present at the assessment location. The 'distinct' level is that at which the odour character (e.g. landfill gas, garbage) is clearly definable.

7.3.2 Odour intensity and frequency criterion.

Although outside the scope of work for the Audit, and referring to the Odour Intensity Categories listed and described in **Table 7.2** above, a particular odour intensity level can often be linked to a possible odour impact from an assessed facility. 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.

As previously mentioned in Section 7.3, the FAOA surveys conducted downwind of the Site resulted in two assessors generating 60 sniffs per measurement cycle per MLP. From this, the data was benchmarked against a suitable frequency impact criterion of 10% i.e. a positive detection of an odour is measured for more than or equal to 10% of the time (equivalent to 3 sniffs over 5 minutes) during the measurement cycle at an odour intensity of 1 or greater. This criterion was selected based on previous FAOA studies conducted by TOU and considered to be the event in which adverse odour impact is likely.

7.3.3 FAOA Key Odour Descriptors

The odour sources at the Site have their origins from the processes occurring in each key area such as the Void and LMS. Based on TOU's extensive experience at the Site, key odour descriptors were allocated and subsequently standardised to represent the quality of odours detected within the assessed area (as shown in **Figure 7.1**). The odour descriptors used in the surveys enabled for the characterisation of the detected odour/s and determination of likely source, by strategically undertaking the surveys upwind, downwind and closer to the Site boundary, when required.

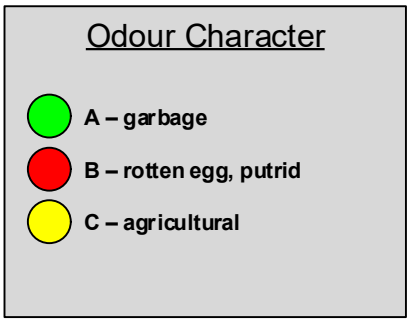


Figure 7.1 - Key odour characters/descriptors used for the FAOA assessment

The definition for each odour character/descriptor used in the FAOA surveys are as follows:

- **A - garbage**: based on the observations and findings made in the Audit, the likely source for this odour descriptor is the Void, specifically the active tipping face and possibly fugitive gas emissions from the waste surface;
- **B – rotten egg**: based on the observations and findings made in the Audit, the likely source for this odour descriptor is the Void, specifically fugitive landfill gas emissions from the waste surface. These emissions are distinctly different to the garbage odour descriptor which has its origins from waste areas that are not in the methanogenetic phase; and
- **C - Agricultural:** this characterises and refers to odour that is not related to the Site but from the activities conducted around the assessed area at the time of the FAOA survey.

7.3.4 Survey 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 findings representing a broader picture of possible adverse odour impacts. For the FAOA Surveys conducted as part of the

Audit, the focus was on the times of the day when calm to light winds are prevalent i.e. early mornings and late evenings and cooler temperatures. These meteorological conditions are suspected to be the most problematical, based on logged odour complaints.

The general prevailing local wind conditions at the time of conducting the FAOA surveys were broadly calm to light wind speeds with westerly, north-westerly, east-north easterly, and easterly wind directions encountered. There was some rainfall encountered infrequently during the day, prior to the surveys being conducted.

7.3.5 Recording of Meteorological Conditions

Local meteorological conditions prevailing over the duration of the FAOA surveys were recorded using a Kestrel 4500 Pocket Weather Tracker Anemometer (see **Photo 7.1** for an illustrated setup). At each MLP assessed, the assessors would set up the anemometer apparatus enabling for a grab measurement of wind speed and direction at an MLP. This was undertaken during every survey at each MLP.

Photo 7.1 - Illustrated setup of the Kestrel Anemometer apparatus in operation (**Source**: The Odour Unit Pty Ltd)

7.3.6 Interpretation of Survey Findings

Each map plot result 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 Site;

- **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. < 0.5 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 Tarago 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 is undertaken, key parameters are recorded where an odour is detected. The key descriptors shown on the maps includes the intensity of odour (how strong the smell is) based on the VDI 3882 German Odour Intensity Scale. In addition, the odour character is also recorded based on an odour character inventory developed by TOU to describe the range of odours encountered throughout the course of the surveys.

7.4 FAOA SURVEY RESULTS

The FAOA survey results are presented on odour impact map plots, as follows:

- **FAOA Survey Map Plot 7.1** – Survey Session #1: Evening of 30 January 2017 between 2100 hrs and 2227 hrs;

- **FAOA Survey Map Plot 7.2 –** Survey Session #2: Morning of 31 January 2017 between 0630 hrs and 0753 hrs;

- **FAOA Survey Map Plot 7.3 –** Survey Session #3: Evening of 31 January 2017 between 2100 hrs and 2242 hrs; and

- **FAOA Survey Map Plot 7.4 –** Survey Session #4: Morning of 1 February 2017 between 0625 hrs and 0730 hrs.

7.4.1 Commentary on FAOA Results

Based on the FAOA survey map plot results, the following comments are made:

- A garbage odour was intermittently detectable for the bulk of FAOA surveys conducted during the Audit and detectable between an odour intensity of very weak (1) to distinct (3). This odour was found in the direction of the Tarago community. The likely source was determined to be the Site, specifically the Void;

- A rotten egg, putrid odour was detectable once on 30 January 2017 in the evening FAOA session #1 at an odour intensity of very weak (1) to weak (2). It was not detectable over the course of the other survey sessions conducted in the Audit. The likely source was likely the Site, specifically the Void;

- An agricultural-based odour was detectable at distinct for a major portion at MLPs 18 & 22 on FAOA Survey #3 conducted on the evening of 31 January 2017. The likely source was identified to be from agricultural activities around the assessed area. Interestingly, this odour was detectable at a distinct (3) odour intensity for an extensive period over MLP 18; and

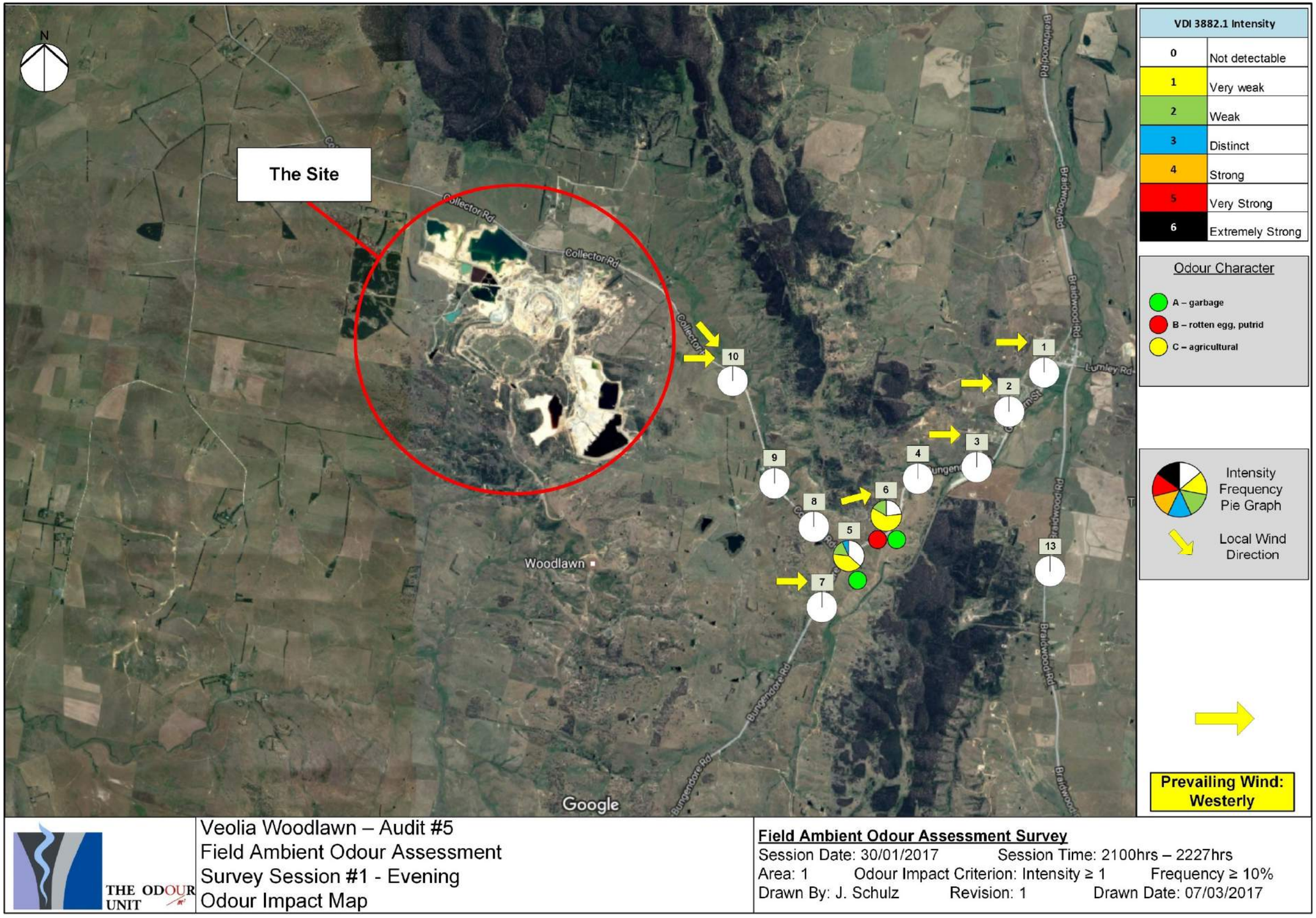
- No pond related sources including ED3N Pond System, ED3S Pond System and LTD were detectable over the course of the FAOA surveys conducted in the Audit. This supports the derived odour emissions results found in the Audit, which show that all pond sources at the Site are very unlikely to lead to off-site impacts under the current treatment and storage conditions.

Overall, odour that can be traced back to the Site were detectable downwind at moderate distances from the Site during the FAOA Surveys conducted in the Audit. The major odour that was intermittently detectable was garbage-based at odour intensities that varied between very weak (1) and distinct (3). Based on the derived odour measurements, extensive experienced gained by the Audit team of the Site and at other landfill operations, this odour is likely related to two sources at the Site, including:

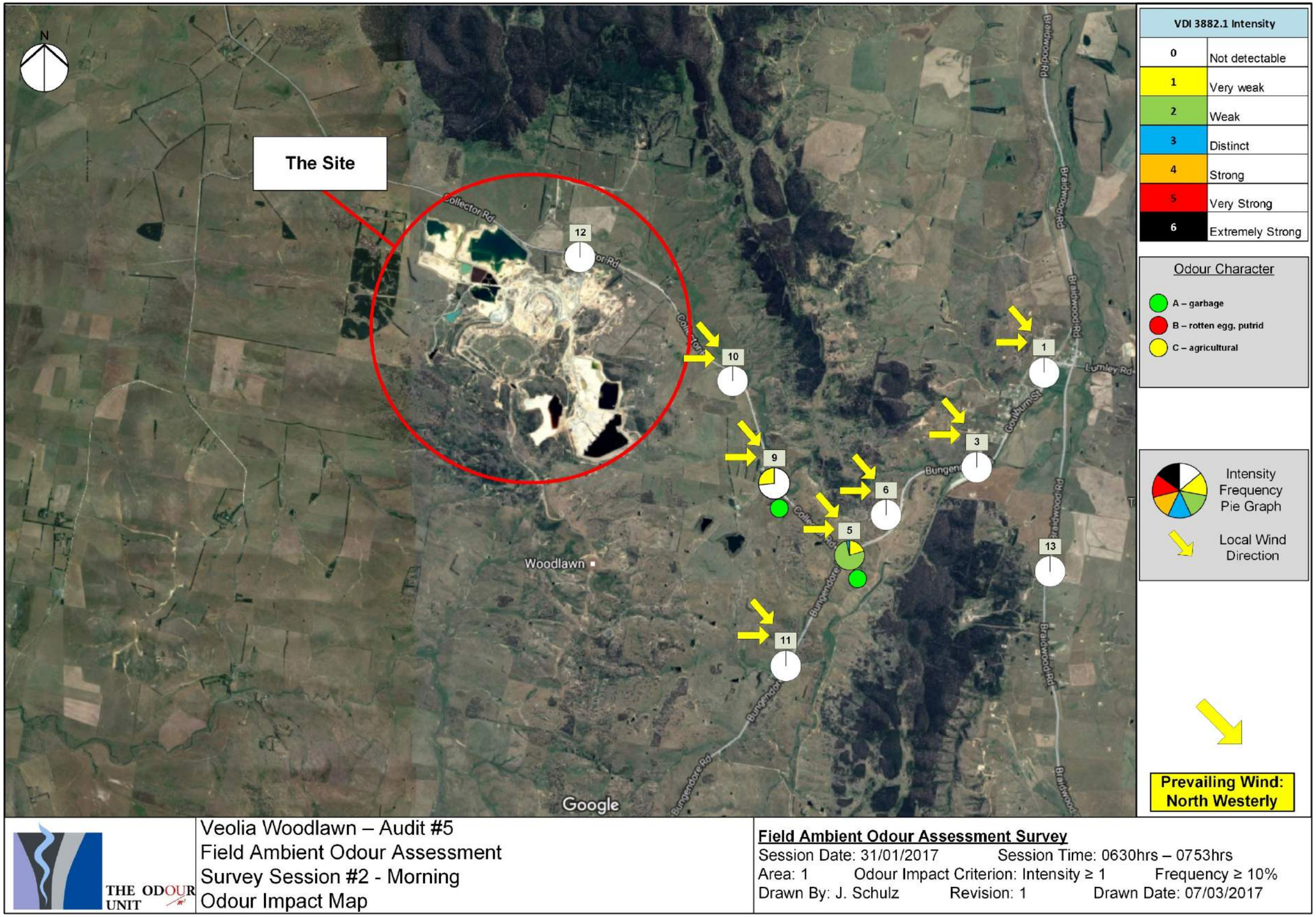
- The activities conducted in the active tipping face; and

- Aged waste that is has not approached the methanogenic phase.

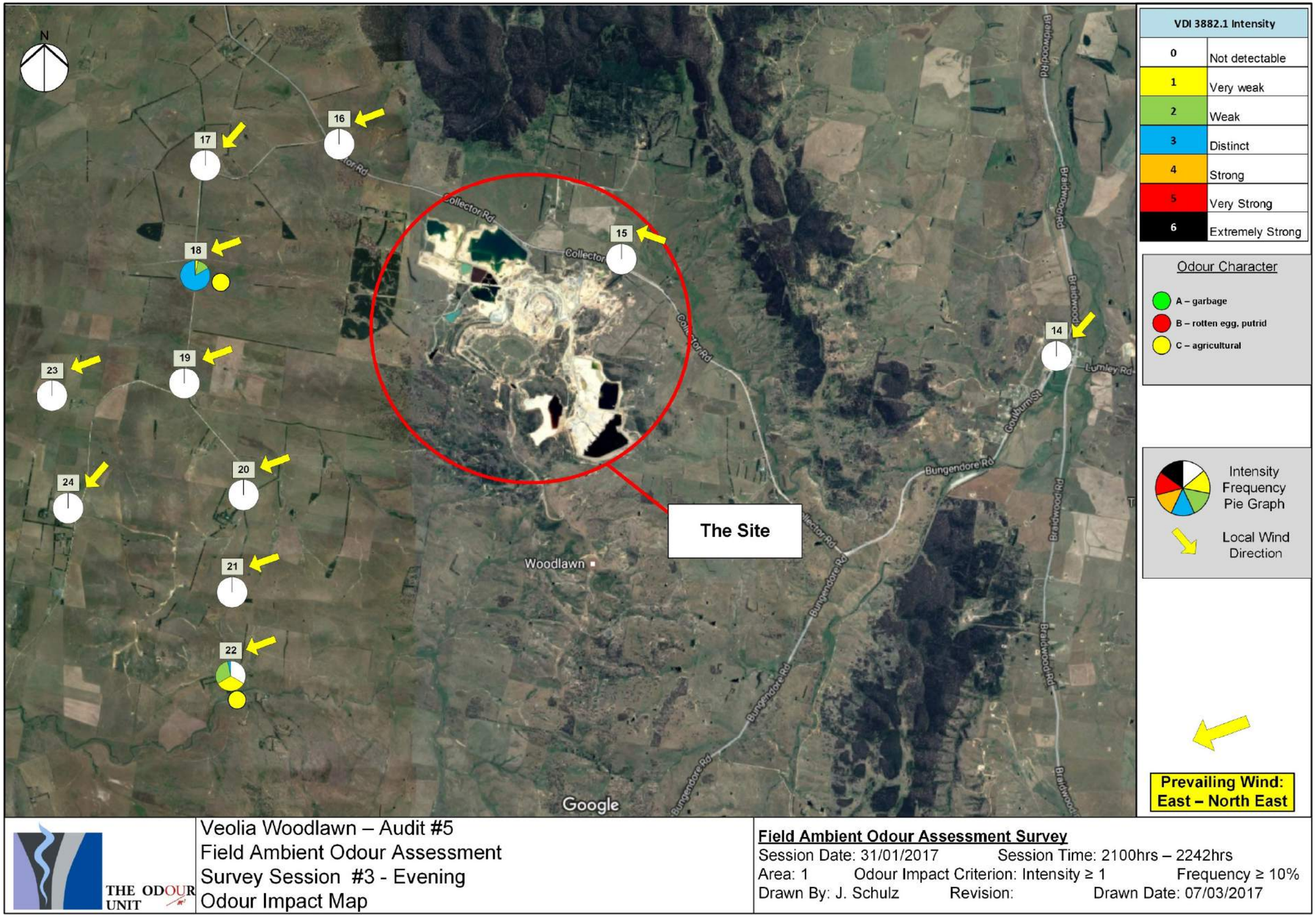
It is unclear and difficult to determine without further studies if the garbage character can be related to fugitive gas emissions from the Void and/or the active tipping face. Notwithstanding this, it should be noted here that fugitive landfill gas emissions are still judged to be the major contributor to the risk of odour emission release from the Void, as previously highlighted in **Section 8.2.1.3** & **Table 8.3**.



FAOA Survey Map Plot 7.1 – Survey Session #1: Evening of 30 January 2017 between 2100 hrs and 2227 hrs



FAOA Survey Map Plot 7.2 – Survey Session #2: Morning of 31 January 2017 between 0630 hrs and 0753 hrs



FAOA Survey Map Plot 7.3 – Survey Session #3: Evening of 31 January 2017 between 2100 hrs and 2242 hrs

FAOA Survey Map Plot 7.4 – Survey Session #4: Morning of 1 February 2017 between 0625 hrs and 0730 hrs

8 AUDIT DISCUSSION

8.1 PREVIOUS AUDIT RECOMMENDATIONS

Table 8.1 & **Table 8.2** outline the mandatory and non-mandatory recommendations documented in the 2015 IOA, respectively, and Veolia's response to those recommendations since that time.

It is important to note that some of these recommendations are, and will continue to remain, an integral part of the on-going process operations and plans at the Site. These on-going process operations and plans are part of the WIP 2017 and include, but are not limited to:

- Planned infrastructure instalments within each waste lift;
- Landfill gas collection system including:
    - The design philosophy for the system of wells beneath the waste profile in the Void;
    - Well extensions;
    - Horizontal infrastructure and condensate management;
- Continuous monitoring of leachate and gas extraction;
- The implementation of operational management programs including:
    - Leachate management;
    - Pumps and pumping solutions;
    - The expansion of wells in the Void for improved/minimisation of leachate recirculation and landfill gas extraction;
    - De-sludging of the LTD and Stormwater Pond 3;
- Specific management techniques for:
    - H_2S management;
    - Covering of waste;
    - The design, location and implementation of the biofiltration cover on the waste surface;
    - Managing stormwater events as to minimise the generation of leachate;

- Management of leachate eruptions, power failures; and

- Details on current issues and long-term plan for the Site.

The above on-going process operations (and others) have been comprehensively documented in the WIP 2017, with the relevant sections extensively reviewed by the Audit. The Audit notes that the WIP is a 'live' document that is constantly updated as the volume of waste into the Void increases over time.

Veolia made the full document of the WIP 2017 available for review in the Audit. The relevant components of the WIP 2017 are incorporated into the Audit Report, where required, as this is a commercial-in-confidence document.

8.1.1 Mandatory recommendations

The mandatory recommendations from the 2015 IOA are summarised in **Table 8.1** and include Veolia's response since that time.

8.1.2 Non-mandatory recommendations

The non-mandatory recommendations from the 2015 IOA are summarised in **Table 8.2** and include Veolia's response since that time.

Table 8.1 – 2015 IOA Mandatory Recommendations		
No.	**2015 Independent Audit Recommendations**	**Veolia Response**
1	*Fugitive landfill gas emissions* *Veolia should continue to improve landfill gas capture from the Bioreactor. This continuation is already underway with Veolia completing an updated version of its WIP, which outlines a comprehensive plan that is being implemented to increase gas capture. It also seeks to address current areas of concern and the potential solution outcomes that can be implemented. This is considered to be an active (and effective) management approach that will result in a continual improvement in gas capture efficiency and ultimately reduce odour/landfill gas emissions from the Void. The Audit endorses this strategy as the primary measure to reduce odour emissions from the Void and recommends that Veolia continues the implementation of the gas systems detailed in the WIP post-2014, including the proposed leachate and gas extraction expansion around the Void. The landfill gas capture efficiency should continue to be monitored and recorded and the surface of the Void monitored to determine the effectiveness of capture within specific areas of the Void.* *It should be noted that the WIP is a live document that will be continual updated. Therefore, it will continue to remain a part of the IOA.*	The improvement in gas capture from within the Void is an on-going planning and operational exercise that Veolia will continue to be implemented. This is evident given the generation of the WIP 2017, an updated plan for the operations at the Site. The WIP 2017 outlines the operational issues and plans to: improve leachate flow/recirculation, improve gas capture, reduce fugitive gas emission; optimise tipping strategy, and the proposal to connect more wells/trenches. The document is 'live' and designed around both a proactive and reactive approach to addressing operational issues.
2	*Active tipping face* *Investigate emissions arising from the active tipping face operations. Given the positive outcomes from the preliminary trial testing, the efficacy of the sprayable polymer slurry mixture should be further investigated as a means of odour mitigation from the waste surface including the effect of blending other odour suppression products (such as haematite). This investigation should also take into consideration the potential effects that the applied mixture may have on landfill gas capture, if any.*	It is understood that the polymer slurry trial was discontinued considering the release of the *Environmental Guidelines: Solid Waste Landfills 2016* (**Solid Waste Guidelines 2016**) by the NSW EPA. Based on the WIP 2017, disposed waste is covered daily and at intermediate stages of operation to minimise dust, litter, the presence of scavengers and vermin, fire risk, rainwater infiltration into the waste (and therefore the amount of leachate generated) and the emission of landfill gas at the Site. In accordance with the Solid Waste Guidelines 2016, daily cover is applied to the waste each day before the close of business. VENM soil is used as daily cover material, where a minimum cover depth of 150 mm applied. Intermediate cover is applied to areas that have not been landfilled for more than 90 days. VENM soil is used as intermediate cover material, where a minimum cover depth of 300 mm applied.
3	*Leachate management system* *Continue to adequately maintain and manage the upgraded leachate management system to ensure it is operating in an optimum state and meeting the leachate quality monitoring targets as outlined in the Leachate Treatment Operation Manual and recommended by Veolia Water. This manual should be considered as a 'live' document to reflect any variation in quality and operational demands and identifications of new constraints and/or issues. This should continue to attenuate the potential for significant odour generation from the leachate stored in ED3N both now and in the future*	Veolia continues to actively manage and improve the LMS. This is evident in Veolia's proposed long-term leachate management solution where an Membrane Bioreactor (**MBR**) Treatment Plant is planned to further improvement the quality of treated leachate as well as the WIP 2017.

Table 8.2 - 2015 IOA Non-mandatory recommendations		
No.	**2015 IOA Non-Mandatory Recommendation**	**Veolia Response**
1	*Biofilter cover material* *The Audit recommends continuation and expansion of the biofilter cover material in areas where there is an identified risk of fugitive odour emissions from the Void surface. Moreover, development of an action strategy to streamline the application and management of this material is recommended.*	The biofilter medium cover has shown that it can be effective at attenuating odour from fugitive emission pathways, however, proper management of the biofilter medium is necessary. This includes the regularly watering and topping-up of biofilter medium as required. It is understood that regularly watering has been practically difficult to implement and will require more time to streamline. Nevertheless, the use of biocover material has reduced odorous gas emissions from potential gas pathways at the Site. It was noted by Veolia in the WIP 2015 that the biocover material does not contribute to any significant degree in improving gas capture and as such focus should continue to be on capturing the landfill gas. The Audit agrees and notes that the biocover materials intent is to reduce odorous gas emissions from the exposed waste surface. The Audit also notes that the use of biocover material around the Void walls has been effective at mitigating odorous emissions (see **Section 8.2.1.6**). Therefore, Veolia will continue to implement the use of biocover material and has developed an action strategy to streamline the management of this material. This is detailed in the WIP 2017.
2	*Pilot-scale biofilter system* *As per the previous 2014 IOA recommendation, the development of a pilot-scale biofilter system to evaluate the effect of medium depth on landfill gas emissions is also recommended. A pilot-scale biofilter unit could be setup in an appropriate location (possibly in the Void) where safe and easy flow diversion of landfill gas is possible. Only small and continuous gas volumes would be required for this exercise. The conditions should address the effect on landfill gas odour at varying medium depths. A suitable medium depth range to trial would be between 0.5 – 1.0 m given the outcomes from the previous audit and the Audit. The medium would need to be keep adequately moist and possibly inoculated with sludge/leachate to assist with the acclimatisation of suitable microorganisms in the biofilter bed. Veolia has already indicated that it intends on undertaking this trial and is in consultation with TOU.*	This study may not be necessary considering the release of the S*olid Waste Landfills 2016 by the NSW EPA*. It provides extensive details on the use and application of biocover for landfill operations. The Audit understands that Veolia has adopted this guideline document as part of its operations in the Void and in the WIP 2017.
3	*Refine investigation of odour issues in the community* Veolia should consider refining its investigation of odour issues in the community, particularly surrounding the most common complainants, as to assess the extent to which odour is present in the community. Such an investigation could include, potential odour transport pathways, undertaking of field ambient odour surveys, assess topography of surrounding land, analysis of climatic data and a detailed review of odour complaint data.	The Audit has undertaken several FAOA Surveys as part of the Audit. The results are presented in **Section 7** of the Audit Report.
4	*Gas speciation analysis of emissions from the Void* *As part of the next audit, gas speciation analysis of fugitive landfill gas and active tipping face emissions should be conducted to identify the dominant gas compounds that are likely contributing to odour emissions from the Void. Collection of samples for gas speciation analysis may also assist in future planning of the odour audit at the Site*.	This study was complete don 16 August 2016 and issued in a technical memorandum report dated 11 October 2016 to Veolia titled *Woodlawn Bioreactor Facility – Odour and gas speciation analysis results.*

8.2 DISCUSSION OF AUDIT FINDINGS

The following discussion examines the results of the Audit against each of the conditions of consent.

8.2.1 Condition 7 (B & D)

Condition 7 (B & D) of the Audit requirements stipulates that the following will be carried out in the IOA:

- *Audit the effectiveness of the odour controls on-site in regard to protecting receivers against offensive odour; and*
- *Review the relevant odour sections of the Air Quality and Greenhouse Gas Management Plan for the project and assess the effectiveness of odour control*.

As mentioned in the previous IOAs, and complemented by the Audit's on-site experience and discussions with Veolia personnel, there continues to be a range of current and on-going odour controls implemented at the Site designed to mitigate off-site impacts arising from its waste management operations. These revolve around:

1. The leachate recirculation method (see **Section 8.2.1.1**);
2. Optimisation and continuous treatment of excess leachate from the Void (see **Section 8.2.1.2)**;
3. Improvement of landfill gas extraction from the Bioreactor (see **Section 8.2.1.3**);
4. Adequate combustion of landfill gas (see **Section 8.2.1.4**);
5. Improve evaporation capability (see **Section 8.2.1.5**);
6. The implementation of alternative capping material in the form of a biofilter medium (see **Section 8.2.1.6**);
7. Using the minimal active tipping face as practically possible (see **Section 8.2.1.7**);
8. Water cart to control dust (see **Section 8.2.1.8**);
9. Transportation of waste in sealed containers until unloading at the Bioreactor (see **Section 8.2.1.9**);
10. The minimisation of leachate generation during stormwater events (see **Section 8.2.1.10**).

8.2.1.1 Leachate recirculation method

In order to maximise the recirculation potential of the waste, leachate generated within the Bioreactor is removed when it becomes excess to the field capacity or interferes with gas extraction infrastructure. Any excess leachate that is extracted from the Void flows directly to the LTD for primary leachate treatment (see **Section 2.4** for further details).

The leachate recirculation method currently practised within the Void continues to be via direct injection techniques, when required (see **Section 2.3.1**). As explained in previous IOAs, this has the effect of minimising the potential exposure of leachate partitioning from the liquid phase to the gas phase, through aerosol generation and/or evaporation pathways, and subsequently leading to the generation of odorous emissions. The 2012 IOA indicated that Veolia's adoption of this recirculation technique is more effective at minimising odours than previously utilised techniques (such as spray sprinklers). The previous 2013 IOA concurred with this finding. The Audit notes that this continues to be the technique employed for leachate recirculation, when required. Moreover, as noted in **Section 2.3.1**, leachate is now recirculated from two locations along the northern and eastern edges of the Void perimeter. The locations were selected for operational convenience and based on experience gained by Veolia that at these locations the effective movement of recirculated leachate is favoured towards fresh waste.

On this above basis, no further action by Veolia is required on this matter.

8.2.1.2 Optimisation and continuous treatment of excess leachate from the Void

The Audit understands that there is no longer a need to store untreated leachate in the evaporation dams following the upgrade improvements made to the LTD system since April 2013 (see **Section 2.4.3** for background details) and the growing waste volumes in the Bioreactor. Moreover, since the 2014 IOA, Veolia has further modified the leachate treatment process by dividing the LTD into two treatment zones, namely, an anoxic zone and an aerobic zone. The splitting into these zones appear to suggest that the Site is converting the LTD into an activated sludge treatment process, which is generally aimed at optimising BOD reduction and/or nitrification/denitrification processes through the increasing of sludge age in the process. This modification reflects Veolia's on-going efforts in optimising the treatment process. From an odour emissions viewpoint, the optimisation of leachate treatment has significantly improved the Site's odour emissions profile from pond-related sources. On this basis, the Audit continues to support this modification from a leachate treatment perspective, provided that optimum conditions in the LTD are sustained and continue to result in good quality treated leachate that contains none of the original odour characteristics of untreated leachate.

It is understood that Veolia continues to regularly monitor the treated leachate quality and performance.

Based on the above analysis, no further action is required by Veolia on this matter. If however there are future operational issues with the LMS, Veolia should take the precautionary measures of notifying the EPA (and any other relevant stakeholders), until the issue is rectified.

8.2.1.3 Improvement of landfill gas extraction from the Bioreactor

Landfill gas extraction at this Site is an ongoing operational process. The WIP 2012 has clearly indicated that there is a comprehensive plan by Veolia to increase gas capture by undertaking the following key items:

1. Continuous expansion of the new drainage systems to promote gas collection; and

2. Management of leachate – including recirculation and continuous treatment.

Further information regarding the design and operation of the Landfill Gas Extraction System has been previously documented in extensive detail in the 2012 IOA Report. As such, it has not been documented in the Audit report.

As outlined in the previous IOAs, it is difficult to calculate a representative odour emission rate from the Void given the dynamic virtue of the surface layout. Therefore, an alternative approach has been taken where improvement in landfill gas capture efficiency is used as an indicator of reduced potential for fugitive gas emissions from the Void surface.

Table 8.3 summarises the results in landfill gas capture over the period between January 2016 and March 2017 and compares the results with those obtained in the 2014 & 2015 IOAs. As can be derived from the results **Table 8.3**, the monthly averaged landfill gas extraction over the period between January 2016 and March 2017 was approximately 1,086,927 m^3 (gas to generators plus flared). In comparison to the gas extraction result obtained from the previous period in the 2015 IOA (i.e. 1,990,500 m^3), this represents a relative decrease of approximately 45% in total gas extraction volume (equivalent to 903,527 m^3). However, landfill gas collection has been steadily increasing since January 2017, as observed in **Figure 8.1**, following an improvement in gas extraction capability (discussed later).

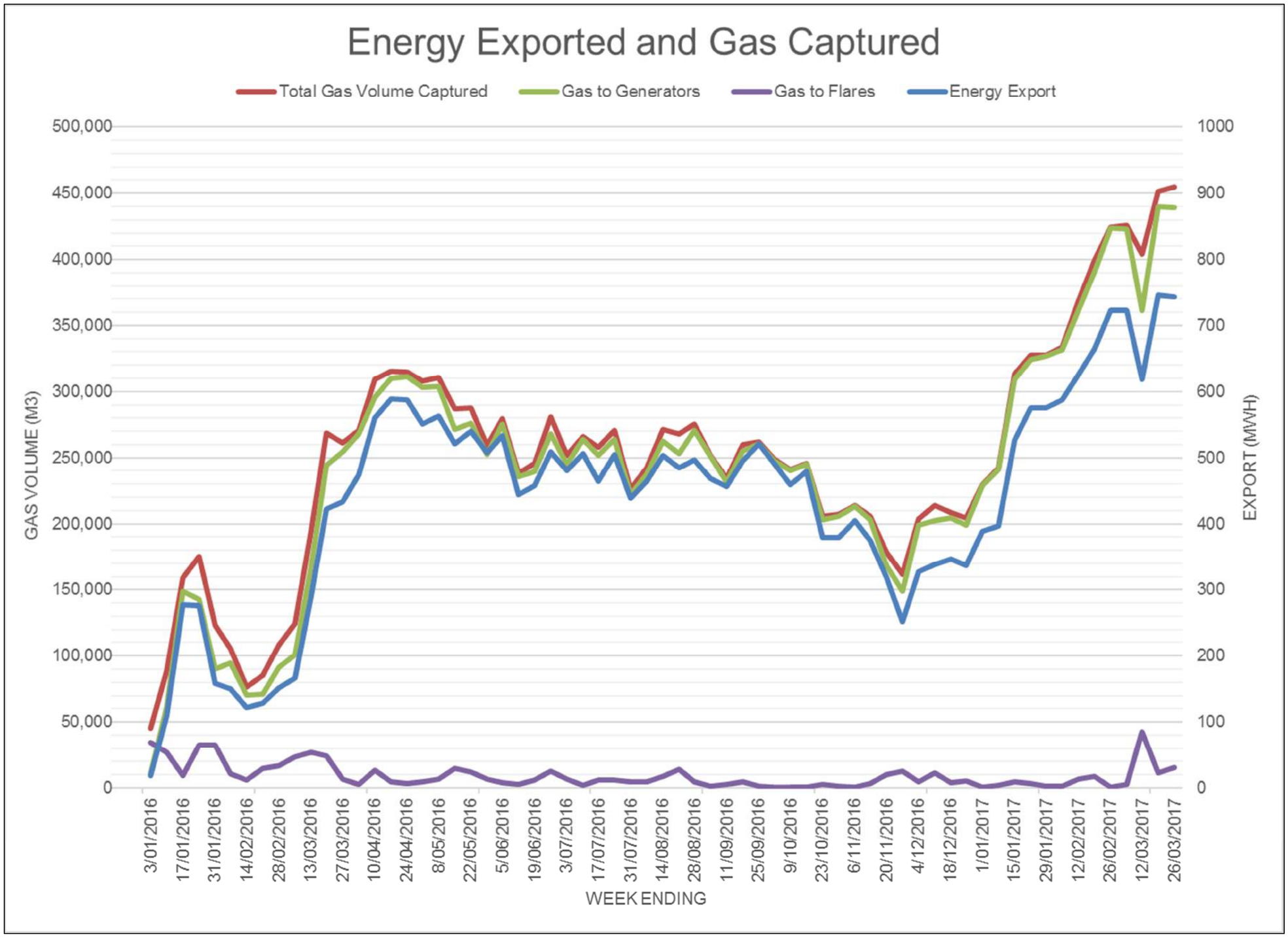


Figure 8.1 - Total energy exported and landfill gas captured between 3 January 2016 and 26 March 2017

As noted in the previous 2015 IOA, the Audit understands that gas capture is measured against a calculated emissions model issued by the Australian Government – Clean Energy Regulator. This aspect is outside the scope of the Audit and is therefore not discussed further. Nevertheless, it remains clear that fugitive landfill gas emissions emitted from the Void surface have a very high odour emission potential, between 420,000 ou.m^3/s and 1,620,000 ou.m^3/s as found in the Audit, at varying gas extraction efficiencies (70% to 90%). Therefore, the Audit continues to endorse Veolia's plan to actively improve gas extraction capability from the Bioreactor and the items addressed in the WIP 2017 to achieve this including:

- The integration of vertical extraction pipe to improve landfill gas capture;
- The linkage of horizontal drain lines to vertical wells to enable gas and leachate extractions to function within the same system; and
- The implementation of individual gas wells on the perimeter of the void to capture gas in isolated areas.

As per previous IOAs, it should be noted that the odour emission rates at each gas extraction efficiency presented in **Table 8.3** should be considered a conservative, worst-case scenario estimate, that represent potential emissions from the Void surface only. In reality, the extent of odour emission rates is likely to be much lower than that estimated, based on field observations, previous IOAs, and the Audit.

8.2.1.3.1 Landfill gas capture decline explanation

Despite landfill gas production increasing with rising waste volumes in the Void, any uncaptured landfill gas has a high risk of escaping from the wells and through the waste surface as fugitive gas emissions, wasting a potential resource and contributing to odour emissions from the Void.

With this mind, it is understood that excess leachate in the Void, both above and below the waste surface, is the main factor contributing to declining gas collection volumes observed in the landfill gas capture trends over 2016/early-2017. This is expected to improve over the 2017 period, with the on-going works pertaining to the vertical gas well installation and minimisation of leachate recirculation and generation as highlighted in **Section 8.2.1.3** & **Section 8.2.1.10** respectively.

Table 8.3 – Gas capture volumes and estimated odour remission rate from Void surface: The Audit vs. previous IOAs

Landfill gas capture efficiency (%)	Mean landfill gas capture/month (m^3/month)			Landfill gas from surface (m^3/month)			Landfill gas from Void Surface (m^3/s)			Landfill gas Odour Concentration (ou)^	Landfill gas OER from surface (ou.m^3/s)		
	Jan 2016 – Mar 2017	Oct 2014 – Oct 2015	Nov 2013 – Sep 2014	Jan 2016 – Mar 2017	Oct 2014 – Oct 2015	Nov 2013 – Sep 2014	Jan 2016 – Mar 2017	Oct 2014 – Oct 2015	Nov 2013 – Sep 2014		Jan 2016 – Mar 2017	Oct 2014 – Oct 2015	Nov 2013 – Sep 2014
90	1,086,927	1,990,455	1,542,829	121,000	221,000	171,000	0.05	0.09	0.07	9,000,000	420,000	767,000	594,000
80	1,086,927	1,990,455	1,542,829	272,000	498,000	386,000	0.10	0.19	0.15	9,000,000	944,000	1,730,000	1,340,000
70	1,086,927	1,990,455	1,542,829	466,000	853,000	661,000	0.18	0.33	0.26	9,000,000	1,620,000	2,960,000	2,300,000

^ mean of 2012 & 2013 IOA

8.2.1.4 Landfill gas combustion exhaust quality

According to the recent Stephenson Stack Emission Survey on Generator No. 1 carried out in June 2016, all combusted gas emissions from this generator comply with the EPL Limits for NO_x, SO_3/H_2SO_4 and H_2S. On this basis, and provided the landfill gas engines continue to operate under optimal conditions, and there is no significant deterioration in combustion performance and operating temperature, the landfill gas engine exhaust stacks are not considered to be significant odour emission sources at the Site. These results are consistent with the judgements made in the previous IOAs in that the engine stacks are considered to be a minor source of odour (given the operating combustion temperatures) and highly unlikely to result in adverse odour impact beyond the Site boundary. This finding continues to remain valid in the Audit.

8.2.1.5 Improve evaporation capability

Veolia has only recently had the capacity to recommence mechanical evaporation since this activity was ceased following the 2012 IOA finding of the odorous quality of the leachate previously stored in ED3N lagoons. The background for this has been well documented in the previous IOAs. The Audit observed that the mechanical evaporators are now active and automated to operate under specific ambient and wind conditions (see **Section 2.4.1.1**).

Moreover, the Audit finds that the quality of the treated leachate currently stored in ED3N pond system is relatively comparable to that found in the previous 2015 IOA, where it was found to contain minimal odour emission potential and no evidence of untreated leachate character present in any of the samples collected. This finding is broadly valid in the Audit, however, a slight 'ammoniacal' character was present in the samples collected from ED3S-S (see samples SC17022 & SC17024 in **Table 6.1**). Notwithstanding this result, no odour from the ED3N or ED3S Pond Systems Were detectable beyond the Site boundary during the Audit (see FAOA Survey results in **Section 7.4**). The derived SOERs for the ED3N & ED3S Pond System support this finding, ranging between 0.119 ou.$m^3/m^2/s$ – 0.473 ou.$m^3/m^2/s$. These values are very low and well within the EA 2010 target values for the storage of treated leachate. This finding is also consistent with the liquid test results which provide an indication of the liquid odour potential if the liquid was to partition to gas phase either by natural or mechanical evaporation processes. This is discussed below.

The results derived using the LOM testing is summarised in **Table 6.4** The odour testing results found in the Audit via conventional area source sampling and the liquid odour measurement potential techniques indicate very low SOERs and odour concentration values respectively. In addition, the evaporation liquid odour character as determined by the panellists during laboratory testing indicated an 'earthy, musty, rubber' character suggesting that there is no original untreated leachate character and favourable treatment of the stored effluent in the ED3N & ED3S Pond Systems. The exceptions

are ED3S-S samples which indicated a slight 'ammoniacal' character in the conventional area source samples. As previously mentioned, this is not considered problematical given the very low odour emission rates, however, Veolia should investigate the cause behind this as it is likely related to the leachate treatment process conditions (possibly pH). There was virtually no H_2S detectable in the gas samples collected from all pond sources.

The leachate testing data supplied by Veolia appears to be consistent with the odour testing results observed. All key target parameters appear to be within ranges that result in a high quality treated effluent that is very low in odour (discussed further in **Section 8.5.1**). The leachate quality results (i.e. for treated leachate) provided by Veolia to the Audit are presented in **Appendix C.**

Overall, the Audit deduces that the pond sources at the Site continue to be a minor source of odour at the Site and unlikely to cause adverse odour impacts beyond the boundary. Moreover, the stored contents in ED3N Pond System continues to be suitable for mechanical evaporation and is unlikely to result in adverse odour impact, provided the effluent quality continues to remain of high quality as found in the Audit. The adequate management of the LMS continues to be in the Audit as a mandatory recommendation (see **Section 9.2.2**).

8.2.1.6 The implementation of improved capping material in the form of a biofilter trial program

The Audit found that the biofilter trial program has been extended and continues to be used as a means of managing odour emissions from the Void surface. The biofilter medium cover has shown that it can be effective at attenuating odour from fugitive emission pathways, however, proper management of the biofilter medium is necessary. This includes the regularly watering and topping-up of biofilter medium as required. To achieve this, Veolia has developed an action strategy to streamline the management of this material. This is detailed in the WIP 2017.

An example of the adoption of biofilter trial program in the Void is shown in **Photo 8.1 & Photo 8.2**. The Audit endorses its continued use on the waste surface, where required.

Photo 8.1 – Biofilter cover material applied on a gas well as found on 2 February 2017

Photo 8.2 – Biofilter cover material applied on Void perimeter as found on 2 February 2017

8.2.1.7 Using the minimal active tipping face as practically possible

As identified in the previous IOAs, the active tipping face can vary depending on the tonnage input and how the waste is managed. Since the 2015 Audit, the exposed active tipping face was revised to reflect more realistic conditions that are prevalent in the Void (discussed further below). In addition to this, minimising the active tipping face continues to be one of the key performance indicators at the Site for the following reasons (as outlined in previous IOAs):

1. Reduces surface area of potential odour source;
2. Minimises temporary decommissioning of gas extraction infrastructure;
3. Minimises fuel usage, particularly in dozer and compactor; and
4. To meet EPA benchmark techniques.

Photo 8.3 provides a visual indication of the active tipping face area size at the time of the Audit field visit. The original value adopted in the EA 2010 for the active tipping face was 40,000 m^2. This value was later revised to between 4,000 m^2 and 6,000 m^2 in the 2013 IOA to reflect realistic and previous operating conditions occurring at the time. As of the Audit, the current active tipping area is now approximately between 1,000 m^2 and 1,500 m^2, reflecting Veolia's continued efforts at minimising the active tipping face in the Void.

Photo 8.3 - A visual indication of the active tipping face area size as found on 2 February 2017

The SOER value determined during this Audit was approximately 8.2 ou.m^3/m^2/s. Without factoring in the error margins from odour laboratory testing, this represents an exceedance of the SOER value used in the EA 2010 modelling (7.3 ou.m^3/m^2/s). On the basis of these results, it appears that the active tipping face is likely at times to be a contributing source to downwind odour emissions from the Void under the appropriate meteorological conditions. This finding is consistent with the FAOA Survey results conducted as part of the Audit (see **Section 7**). Notwithstanding this, it should be noted here that fugitive landfill gas emissions are still judged to be the major contributor to odour emissions from the Void, as previously highlighted in **Section 8.2.1.3** & **Table 8.3**.

8.2.1.8 Water cart to control dust

Use of the water cart is an ongoing operational activity, which is effective at minimising dust generation. This was visually evident during the fieldwork component of the Audit. The Audit observed that the operating practice of using a water cart to control dust will be a continued practice at the Site. An example of this activity is shown in **Photo 8.4**. On the above basis, no further action is required by Veolia for this component of the Site's operations.

Photo 8.4 – Water carting in progress as found on 2 February 2017

8.2.1.9 Transportation of waste in sealed containers until unloading at the Bioreactor

Similar to the previous IOAs, the Audit has found that the current measures used for the waste transport operations are very effective at mitigating any odour emissions. The Audit team inspected the IMF and conducted a brief downwind olfactometry assessment to determine any presence of waste-based odour. The inspection did not find any evidence of any waste-based odour being emitted at the IMF. On this basis, the Audit determines that there is still no need to sample the IMF as it is very unlikely to generate problematical odour emissions. This is provided that the waste containers used in the process continue to be adequately maintained and remain fully sealed during waste transportation. As such, current practices should be continued and monitored. A photo of the IMF as found during the Audit on 1 February 2017 is shown in **Photo 8.5** & **Photo 8.6.**

No additional actions are required by Veolia for this component of the Site's operations.

Photo 8.5 - The IMF facing south-west as found during the Audit inspection visit on 1 February 2017

Photo 8.6 - The IMF facing south-east as found during the Audit inspection visit on 1 February 2017

8.2.1.10 The minimisation of leachate generation during stormwater events

As indicated in **Section 2.5**, Stormwater Pond 3 has been reinstated as an active storage pond for stormwater interception. The purposes of this pond will be to minimise leachate generation by diverting stormwater to this pond. The Audit supports this strategy, given the need to improve excess leachate levels in the Void.

8.3 CONDITION 7 (C)

Condition 7 (C) of the Audit requirements stipulates that the following will be carried out in the IOA:

- *Review the proponents' production data (that are relevant to the odour audit) and complaint records*

The production data that is relevant to the Audit includes:

- Waste throughput to the Bioreactor;
- On-site evaporation data (from the 2012 IOA); and
- Landfill gas consumption in the generators and flare system.

This Audit obtained updated data relating to waste throughput to the Bioreactor, complaint records, and evaporation data from Veolia for the Site since the previous 2015 IOA. These were reviewed as part of the Audit and are appended as **Appendix C.** Complaint log records indicate that the necessary fields required by the *EPL Condition M4 Recording of pollution complaints* are being documented by Veolia.

On the above basis, the Audit is satisfied that all relevant record-keeping duties continue to be adequately maintained.

8.4 CONDITION 7 (F)

Condition (F) of the Audit requirements stipulates that the following will be carried out in the IOA:

- *Determine whether the project is complying with the requirements in this approval to protect receivers against offensive odour.*

This Audit has examined compliance or otherwise with *Condition 7(F)* from three perspectives, namely:

- Odour complaints data review and analysis and associated response letters from Veolia (discussed in **Section 8.4.1**); and

- Compliance with the modelling-based, project-specific odour performance goal of 6 ou (discussed in **Section 8.4.2.1**).

The above points have been discussed in the following sections.

8.4.1 Odour complaints analysis and response from Veolia

The odour complaints data logged by Veolia and associated response letters were reviewed and analysed in the Audit. **Figure 8.2** illustrates the odour complaints between 8 October 2010 and 30 January 2017, and the seasonal variations in the number of odour complaints logged over that period.

The odour complaints analysis indicated the following:

- Since the previous 2015 IOA, over the period of 17 November 2015 and 30 January 2017, there were 92 logged odour complaints, equivalent to a 35% increase in complaints. On face value, this suggests that there could possibly be an increase in odour levels present in the community. As such, this should be addressed via Veolia's established community liaison program (see **Section 9** for details);

- Unlike previous years where the bulk of logged complaints occurred in the winter and autumns periods, the bulk of complaints between 17 November 2015 and 30 January 2017 was in summer and winter as illustrated in **Figure 8.2**. The reason for this is uncertain and should be investigated by Veolia through its established community liaison program and in the next IOA;

- The logged odour complaints data continue to not assist in identifying the nature or likely source of the problematic odours. This matter should be addressed with the re-establishment of the odour diaries, as discussed further in **Section 8.4.2**; and

- Veolia provided a response to each logged complaint over the period between 17 November 2015 and 30 January 2017. All responses can be found in **Appendix C**.

Given the number of logged complaints since the previous IOA, Veolia should consider refining its investigation of odour issues in the community, particularly surrounding the most common complainants, as to assess the extent to which odour is present in the community. This could assist the Site with its on-going odour mitigation strategies. As such, this has been put in as a non-mandatory recommendation in the Audit (see **Section 9.3.2** for more details).

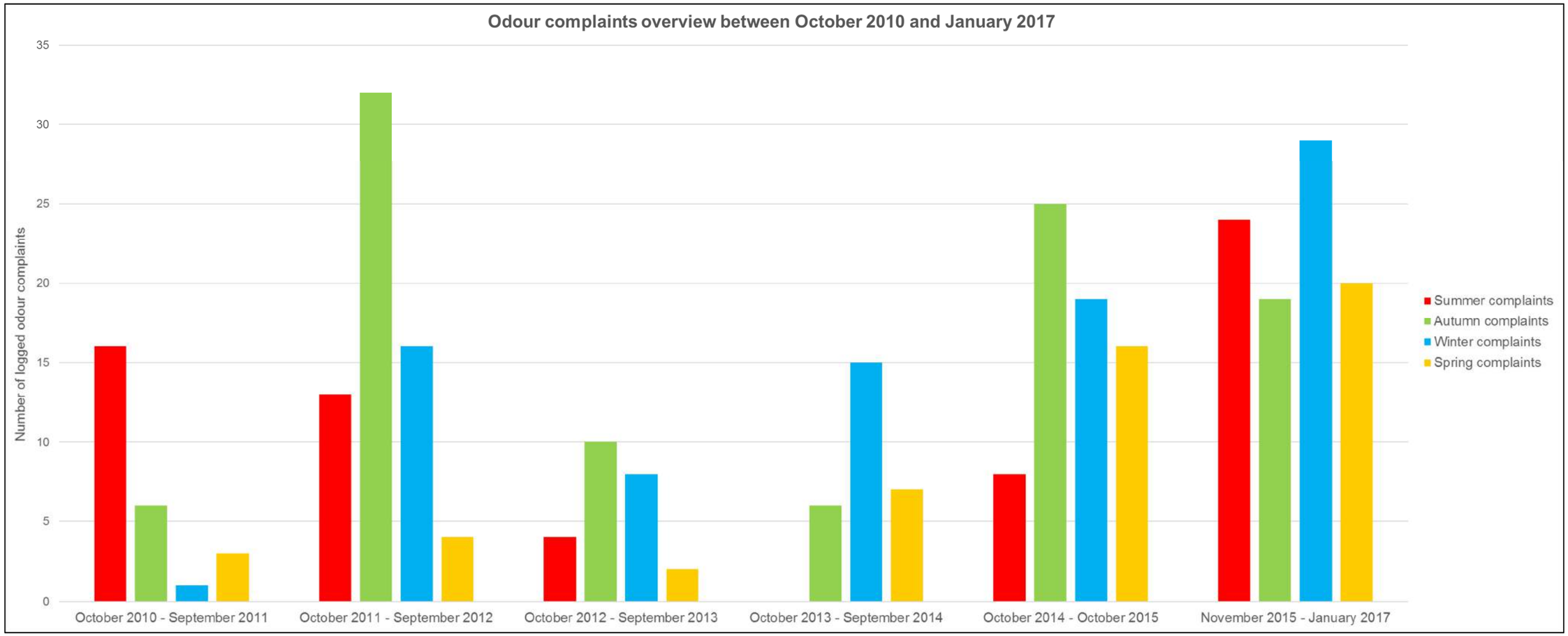


Figure 8.2 - Number of logged odour complaints between October 2010 and January 2017

8.4.2 Odour diary entries analysis

The Odour Diary project is a joint initiative between TOU and Veolia in early-2014 and was complete and issued to the community in May/June 2014. The purpose of the Odour Diary is to collect real-time data on ambient odour levels at residential properties. Whilst not being an Audit requirement, the odour diaries are relevant to the discussion of the Audit as it provides a better understanding on the nature and likely source of odours that are emitted beyond the Site boundary and experienced by the community. The Odour Diary will also open another direct communication channel between Veolia and the community in a standardised feedback format. This information will be assessed and a formal response provided to the community.

No odour diary entries were made available to the Audit. It is understood that Veolia has plans to roll-out the odour diaries in late-2017/2018.

8.4.2.1 Compliance with the project-specific odour performance goal of 6 ou

Similar to previous IOAs, the Audit did not have access to the site-specific odour dispersion model used in the EA 2010 and did not carry out modelling, using the odour emission rates determined in the Audit. It is therefore unable to determine whether compliance with the 6 ou criterion is being achieved, based on the approach used in odour dispersion modelling, whereby the modelled emission rates prevail over an entire year. Following the substantial improvement in measured odour emissions for both pond and non-pond sources over previous audits, a re-run of the existing dispersion model to quantitatively check compliance should perhaps be undertaken. The Audit results suggest that compliance is likely to be achieved given that the majority of SOER results in this Audit are within the ranges used in the EA 2010 (see **Section 8.5** for further details), despite the marginal exceedance of the active tipping face (as this would be compensated by the significant reduction to the originally modelled area, see **Section 8.2.1.7** for details). It is unclear if there is a correlation between the active tipping face operations and odour complaints.

Broadly speaking, the Audit finds that Veolia continues to actively undertake measures to minimise odour emissions from the Site, including participation in a community consultation process designed to provide the necessary odour impact feedback. This feedback will continue to be important given the recent increase in odour complaints. The Audit recommends that this continue in the future as a means of determining compliance or otherwise with the project-specific goal.

8.5 ODOUR EMISSIONS INVENTORY DISCUSSION

As per recommendation of the previous IOAs, the Audit recommends using an overall odour emissions inventory for the Site and examined it in order to place into context the emissions from any single source.

Table 8.4 details the odour emission inventory for the Site as determined by the testing carried out in this Audit, and compares these results with predictions of emissions contained in the EA. It also makes a comparison with the impact of the revised areas (where applicable) for each odour emission source as found in the Audit.

It is acknowledged that there are odour emissions not listed in this inventory, emanating mostly from sources where quantitative measurement or even estimates are difficult. These include the fugitive odour releases from the Void, previously described as potential gas pathways, arising from gas leakages from the covered areas and around the walls of the Void and leachate recirculation air pressure relief vent. Despite these omissions it is considered that the incomplete inventory remains to have real value and is discussed later (see **Section 8.5.2**).

Table 8.4 - Measurable odour emission rates for the Site ^

Parameters				The Audit		2015 IOA		2014 IOA		2013 IOA			2012 IOA		EA		
Location	Current Area (m^2)	2014 Area (m^2) ^^	2012 Area (m^2)	SOER ($ou.m^3/m^2/s$)	OER - Current Area ($ou.m^3/s$)	SOER ($ou.m^3/m^2/s$)	OER - Current Area ($ou.m^3/s$)	SOER ($ou.m^3/m^2/s$)	OER - Current Area ($ou.m^3/s$)	SOER ($ou.m^3/m^2/s$)	OER 2012 Area ($ou.m^3/s$)	OER - Current Area ($ou.m^3/s$)	SOER ($ou.m^3/m^2/s$)	OER ($ou.m^3/s$)	SOER ($ou.m^3/m^2/s$)	OER ($ou.m^3/s$)	OER - Current ($ou.m^3/s$)
ED3N-1	6,000	6,000	7,000	0.130	780	0.132	794	0.017	104	0.30	2,100	1,800	394	2,760,000	8.8	61,600	52,800
ED3N-2 & 3 ^^^	11,000	11,000	13,000	0.175	1,930	0.118	1,300	0.049	543	11.6	150,000	127,000	0.29	3,800	7.4	96,200	81,400
ED3N-2	5,500	5,500	6,500	0.148	811	0.145	797	0.066	365	20.1	131,000	111,000	0.21	1,350	n/a^^^		
ED3N-3	5,500	5,500	6,500	0.20	1,110	0.091	500	0.032	178	0.2	1,010	852	0.37	2,430			
ED3N-4	25,000	25,000	16,000	0.248	6,200	0.269	6,720	0.023	575	0.0604	966	1,510	0.41	6,600	0.7	11,200	17,500
ED3S	89,435	n/a		0.277	24,700	No previous measurements available as ED3S & ED3S-S are new sources									0.5	44,700	24,700
ED3S-S**	1,420			0.437	621										0.159	4,510	226
Active Tipping Face	6,000	6,000	40,000 *	8.16	49,000	7.51	45,100	4.28	25,700	3.04	122,000	18,200	8.36	334,000	7.3	292,000	43,800
Leachate Treatment Dam	5,000	5,000	2,000	0.27	1,350	0.276	1,380	0.026	129	0.323	647	1,620	0.46	920	3.6	7,200 #	18,000
Construction and Demolition Tip Face	900	500	900	n/a	n/a	0.326	294	n/a^	n/a	0.293	264	147	n/a	n/a	n/a	n/a	n/a
Storage Pond 7	n/a	n/a	1,200	n/a	n/a	n/a	n/a	n/m^^	n/a	n/m	n/m	n/m	85	102,000	n/m	n/m	n/m

n/a = not applicable
n/m = not measured
^ All odour emission rates represent the derived mean SOER values for each location
^^ As advised by Veolia
^^^ reported in the EA 2010 as a single emission source i.e. ED3N-2 & ED3N-3 as a single area
# represents mean result for different batches of leachate between 2007 and 2011
* as per AAQMP estimate
** Not obtained from the EA. Source of emission data is the Woodlawn Bioreactor Facility Odour Modelling Study - Proposed addition of ED3S to leachate management system - May 2016: Table 2.1

Based on the result in **Table 8.4**, the following comments are made:

- The total measurable odour emission rate from the Site found in the Audit was 86,500 ou.m^3/s, representing an increase of 56,900 ou.m^3/s. This represents almost a 52% increase since the 2015 IOA, with the bulk of this increase stemming from the inclusion of ED3S to the emission inventory as it is now part of the LMS;
- The active tipping face is contributing to approximately 57% of the Site's total measurable odour emissions, without consideration of fugitive landfill gas emissions (see **Section 8.2.1.3**);
- The LMS continues to operate under very low odour emission conditions and is unlikely to be contributing to any significant odour impact beyond the Site boundary;
- From a comparative viewpoint, the SOER results show close agreement between the Audit results and the EA 2010 value for all emission sources (see **Table 6.1**). This is a significant result as it shows that the SOER predictions in the EA 2010 are suitable for current and future operations at the Site. As previously mentioned in **Section 8.4.2.1**, the exception is active tipping face where there is an exceedance of the EA 2010 emissions; and
- Similarly, to the previous 2012 IOA, ED3N-2 & ED3N-3 have been reported both as separate emission sources and a single source (as per the EA 2010) in order to determine the relative contribution of odour emission from each pond separately.

The following sections discuss the results from the odour emissions inventory and Audit in the context of pond and non-pond sources (see **Sections 8.5.1 & 8.5.2** respectively).

8.5.1 Pond sources

All pond sources at the Site sampled in the Audit are considered area sources, including:

- ED3N Pond System: this includes ED3N-1, 2, 3 and 4;
- ED3S Pond System: this includes ED3S & ED3S-S;
- LTD; and
- Storage Pond 7

The following sections discuss each of the above pond sources.

8.5.1.1 ED3N Pond System

In the context of the odour emissions inventory for the Site, the Audit finds that at the current and above performance targets for leachate quality, leachate effluent stored in ED3N represents very low odour emissions since the IOAs began in 2011. The derived mean SOER's for ED3N-1, 2, 3 & 4 in the Audit is 0.130 ou.$m^3/m^2/s$, 0.148 ou.$m^3/m^2/s$, 0.20 ou.$m^3/m^2/s$, and 0.248 ou.$m^3/m^2/s$, respectively. At these values, the stored contents of ED3N continue to be a minor odour emission source at the Site.

On the above basis, the Audit finds that the leachate performance targets set by Veolia are appropriate in attenuating odour emissions from pond-related sources. It can be considered that any significant deviation of the leachate quality monitoring targets would be a reasonable indicator that there will be an increase in risk potential for odour emission generation from the ED3N Pond System.

8.5.1.2 ED3S Pond System

In the context of the odour emissions inventory for the Site, the Audit finds that at the current and above performance targets for leachate quality, leachate effluent stored in ED3S represents very low odour emissions when compared with ED3N Pond System. The derived mean SOER's for ED3S and ED3S-S in the Audit is 0.28 ou.$m^3/m^2/s$ and 0.437 ou.$m^3/m^2/s$, respectively. At these values, the stored contents of ED3S Pond System represent a minor odour emission source at the Site.

On the above basis, the Audit finds that the leachate performance targets set by Veolia are appropriate in attenuating odour emissions from pond-related sources. It can be considered that any significant deviation of the leachate quality monitoring targets would be a reasonable indicator that there will be an increase in risk potential for odour emission generation from the ED3S Pond System.

8.5.1.3 Leachate Treatment dam

The LTD was found to be very effective in treating the incoming leachate prior to storage in ED3N Pond System. The SOER derived in the Audit from this source is 0.27 ou.$m^3/m^2/s$, well below the EA 2010 value of 3.6 ou.$m^3/m^2/s$ and almost identical to that found in the 2015 IOA. On this basis, Veolia should continue to work with Veolia Water in optimising the treatment process. The Audit endorses this continuation.

8.5.1.4 Storage Pond 7

Storage Pond 7 remains non-existent (previously located in the Void) and is therefore not a valid odour emission source in the Audit. The Audit understands that Veolia has no intention in recommissioning this pond system in the future. The WALTER system is a fully enclosed system with no exposed area. On this basis, it is not considered a significant odour emission source at the Site.

8.5.2 Non-pond sources

The activities within the Void were judged to be similar in terms of process operations to that found in the 2015 IOA, apart from the installation of the vertical gas extraction well as highlighted in **Photo 8.7**.

Photo 8.7 – The Void as found on 31 January 2017. Highlighted in red is an example of a new area consisting of the vertical gas well pipes.

The Audit odour testing results indicate that the Void continues to remain as the major contributor to odour emissions at the Site, by virtue of the consistent improvement to leachate management at the Site and pond-related sources. Based on discussions with Veolia and field observations by the Audit team, this appears to be related to gas capture capabilities within the Void and the need to meet the shortfalls with the currently applied cover material (previously discussed in **Section 8.2.1.6**) in areas where existing cover materials are not performing adequately and managing excess leachate within the waste profile. Despite this, the quantitative emissions data appears to suggest that fugitive landfill gas emissions are not the sole source of downwind odour release, based on the garbage character that was readily detectable in the collected odour samples and FAOA survey results. This was as similar finding in the 2015 IOA and it was hypothesised that this could be related to several factors including, but not limited to:

- The physical and chemical characteristics of received waste;
- The physical and chemical characteristics of C & D waste. It is known that cement and plasterboard can have a significant influence on the degradation of waste and odour emissions. A key component would be plasterboard that

contains calcium sulphate (**$CaSO_4$**). This can result in a drop to pH in the recirculated leachate causing accelerated degradation of waste before adequately capping is possible of the active tipping face. This was identified in the sulphur balance study and the Audit concurs with this finding;

- Volumes of waste;
- Time of waste disposal in the Void; and
- The on-going landfill gas capture and implementation of biocover material has reduced the potential gas pathways leading to the active tipping face emissions to become more readily detectable. This can be attributed to the very low detection threshold of H_2S, contained in significant quantities in landfill gas from the Bioreactor, when compared to other chemical compounds found in active tipping face emissions.

It is unclear and difficult to determine without further studies, if the garbage character can be related to fugitive gas emissions from the Void. Notwithstanding this, it should be noted here that fugitive landfill gas emissions are still judged to be the major contributor to the risk of odour emission release from the Void, as previously highlighted in **Section 8.2.1.3** & **Table 8.3**.

8.5.2.1 Fugitive landfill gas emissions

The fugitive landfill gas emissions that arises due to wall effects and cracks in the capping of waste, particularly near landfill gas extraction wells, are an on-going operational issue at the Site. Since the previous 2015 IOA, Veolia has adopted the use of biofiltration-based organic medium (a non-mandatory recommendation in the 2013 IOA and discussed in **Section 8.2.1.6**) in known problematically areas including the leachate extraction sump surface areas and Void perimeter. As can be shown in the Audit, this has proven to be successful when the medium material is maintained in an optimum manner such as the controlling of medium moisture and depth. Veolia should continue the implementation of the biocover material, alongside with improving gas capture, as a means of reducing fugitive gas emissions from the Void surface given that this is judged to be the major contributor to odour emissions from the Site (see **Section 8.2.1.3**).

9 AUDIT RECOMMENDATIONS

9.1 CONDITION 7 (G & H)

The following section is designed to address the following Audit requirement:

- *Outline all reasonable and feasible measures (including cost/benefit analysis, if required) that may be required to improve odour control at the site; and*
- *Recommend and prioritise (mandatory and non-mandatory) recommendations for their implementations.*

Based on the findings from this Audit, the following mandatory and non-mandatory measures have been recommended. In addition to these measures, Veolia should continue the current community liaison program (including the Woodlawn Community Liaison Committee and the Tarago and District Progress Association Inc.) to notify affected/nearby residents of works and address concerns. Veolia should also continue to log and monitor odour complaints in the current odour complaints register. The Audit team is not aware of the status regarding the odour diary project.

9.2 MANDATORY RECOMMENDATIONS

The mandatory recommendations in this Audit revolve around the leachate management system and the continuation of odour mitigation from the Void. These have been discussed in the following sections.

9.2.1 Odour mitigation from the Void

Fugitive landfill gas emissions

Veolia should continue to improve landfill gas capture from the Bioreactor. This continuation is underway with Veolia completing its WIP 2017, which outlines a comprehensive plan that is being implemented to increase gas capture. It also seeks to address current areas of concern and the potential solution outcomes that can be implemented. This is considered to be an active (and effective) management approach that will result in a continual improvement in gas capture efficiency and ultimately reduce odour/landfill gas emissions from the Void. The Audit endorses this strategy as the primary measure to reduce odour emissions from the Void and recommends that Veolia continues the implementation of the gas systems detailed in the WIP 2017, including the proposed leachate and gas extraction expansion around the Void. The landfill gas capture efficiency should continue to be monitored and recorded, and the surface of the Void monitored to determine the effectiveness of capture within specific areas of the Void.

It should be noted that the WIP 2017 is a live document that will be continual updated. Therefore, it will continue to remain a part of the IOA.

9.2.2 Leachate management system

Continue to adequately maintain and manage the upgraded LMS to ensure it is operating in an optimum state and meeting the leachate quality monitoring targets as outlined in the *Leachate Treatment Operation Manual* and recommended by Veolia Water. Moreover, continue the implementations planned in the WIP 2017. Both the manual and WIP 2017 should be considered as a 'live' document to reflect any variation in quality and operational demands and identifications of new constraints and/or issues. This should continue to attenuate the potential for significant odour generation from the leachate stored in ED3N & ED3S Pond Systems both now and in the future.

The Audit also endorses Veolia's plan to upgrade the LMS via the implementation of an MBR Facility, which is understood to have the capacity to treat leachate to a very high quality that will be conducive to very minimal levels of odour (based on the projected BOD and ammonia levels).

9.2.3 Active Tipping Face

Investigation feasible options for managing odour emissions from the active tipping face. Veolia should also continue to develop strategies for the minimising the exposed active tipping face surface area at all times.

9.3 NON-MANDATORY RECOMMENDATIONS

The non-mandatory recommendations in this Audit revolve around odour mitigation strategies for the Void, odour complaints, and fugitive gas emissions from the Void. This has been discussed in the following sections.

9.3.1 Odour mitigation strategies for the Void

Fugitive gas emissions

Further, investigate if the garbage character detectable downwind as found in the Audit is attributable to a single source or other sources (such as fugitive gas emissions from ageing to aged waste). A suggested problem definition for this investigation could be framed around determining if the odour character of fugitive landfill gas emissions from the Void and/or the active tipping face are similar in characteristic i.e. are both sources being detected downwind as garbage, or is this solely attributable to the active tipping face operations in the Void. A study that investigates this matter may be beneficial as it could assist with contextualising the FAOA survey results and odour complaints.

9.3.2 Refine investigation of odour issues in the community

Veolia should consider refining its investigation of odour issues in the community, particularly surrounding the most common complainants, as to assess the extent to which odour is present in the community. Such an investigation could include: potential

odour transport pathways; undertaking of field odour surveys; assess topography of surrounding land; analysis of climatic data; and a detailed review of odour complaint data.

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REPORT SIGNATURE PAGE

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Veolia Australia & New Zealand

Woodlawn Bioreactor Expansion Project

Independent Odour Audit #5

February 2017

Appendices

APPENDIX A:

ODOUR CONCENTRATION LABORATORY TESTING RESULT SHEETS

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

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Email: info@odourunit.com.au
Internet: www.odourunit.com.au
ABN: 53 091 165 061

NATA

Accreditation Number: 14974

Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	Veolia	Telephone	02 8588 1366
Contact	Ark Du	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	ark.du@veolia.com
Sampling Method	Isolation Flux Hood	Sampling Team	TOU

Order details:

Order requested by	Ark Du	Order accepted by	M. Assal
Date of order	19.01.2017	TOU Project #	N1806L
Order number	7100015204	Project Manager	M. Assal
Signed by	Refer to correspondence	Testing 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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry' AS/NZS4323.3:2001. Accredited for compliance with ISO/IEC 17025 – Testing. 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 between 22ºC and 25ºC.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES V02
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: r = 0.1902 (March - May 2016) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: A = 0.2081 (March - May 2016) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (4 times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. 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.

Date: Tuesday, 7 February 2017

Panel Roster Number: SYD20170202_003

J. Schulz
NSW Laboratory Coordinator

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20170202_003

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
Sample #1 – ED3S (1 of 2)	SC17009	01.02.2017 0910 hrs	02.02.2017 1018 hrs	4	8	--	--	304	304	0.217
Sample #2 – ED3S (2 of 2)	SC17010	01.02.2017 0910 hrs	02.02.2017 1054 hrs	4	8	--	--	470	470	0.336
Sample #3 – ED3N-4 (1 of 2)	SC17011	01.02.2017 1000 hrs	02.02.2017 1133 hrs	4	8	--	--	362	362	0.259
Sample #4 – ED3N-4 (2 of 2)	SC17012	01.02.2017 1030 hrs	02.02.2017 1208 hrs	4	8	--	--	332	332	0.237
Sample #5 – ED3N-3 (1 of 2)	SC17013	01.02.2017 0955 hrs	02.02.2017 1324 hrs	4	8	--	--	332	332	0.237
Sample #6 - ED3N-3 (2 of 2)	SC17014	01.02.2017 1105 hrs	02.02.2017 1402 hrs	4	8	--	--	235	235	0.168
Sample #7 – ED3N-2 (1 of 2)	SC17015	01.02.2017 1230 hrs	02.02.2017 1438 hrs	4	8	--	--	215	215	0.154
Sample #8 - ED3N-2 (2 of 2)	SC17016	01.02.2017 1230 hrs	02.02.2017 1516 hrs	4	8	--	--	197	197	0.141
Sample #9 – ED3N-1 (1 of 2)	SC17017	01.02.2017 1320 hrs	02.02.2017 1553 hrs	4	8	--	--	166	166	0.119
Sample #10 – ED3N-1 (2 of 2)	SC17018	01.02.2017 1320 hrs	02.02.2017 1623 hrs	4	8	--	--	197	197	0.141

Note: NATA accreditation does not cover the performances of these services:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than the Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20170202_003	51,500	$20 \leq \chi \leq 80$	861	60	Yes

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

SC17009	musty, earthy	SC17014	musty, earthy
SC17010	musty, earthy	SC17015	musty, earthy
SC17011	musty, earthy	SC17016	musty, earthy
SC17012	musty, earthy	SC17017	musty, earthy
SC17013	musty, earthy	SC17018	musty, earthy

Disclaimer Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

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NATA

Accreditation Number: 14974

Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	Veolia	Telephone	02 8588 1366
Contact	Ark Du	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	ark.du@veolia.com
Sampling Method	Isolation Flux Hood	Sampling Team	TOU

Order details:

Order requested by	Ark Du	Order accepted by	M. Assal
Date of order	19.01.2017	TOU Project #	N1806L
Order number	7100015204	Project Manager	M. Assal
Signed by	Refer to correspondence	Testing 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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry' AS/NZS4323.3:2001. Accredited for compliance with ISO/IEC 17025 – Testing. 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 between 22ºC and 25ºC.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES V02
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: r = 0.1902 (March - May 2016) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: A = 0.2081 (March - May 2016) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (4 times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. 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.

Date: Tuesday, 7 February 2017

Panel Roster Number: SYD20170203_004

J. Schulz
NSW Laboratory Coordinator

A. Schulz
Authorised Signatory

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Sample Measurement Results
Panel Roster Number: SYD20170203_004

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
Sample #11 - ED3S-S (1 of 3)	SC17022	02.02.2017 0930 hrs	03.02.2017 0932 hrs	4	8	--	--	724	724	0.473
Sample #12 - ED3S-S (2 of 3)	SC17023	02.02.2017 0928 hrs	03.02.2017 1007 hrs	4	8	--	--	724	724	0.473
Sample #13 - ED3S-S (3 of 3)	SC17024	02.02.2017 1010 hrs	03.02.2017 1043 hrs	4	8	--	--	558	558	0.365
Sample #14 - Leachate Aeration Dam (1 of 2) - Anoxic	SC17025	02.02.2017 1025 hrs	03.02.2017 1117 hrs	4	8	--	--	362	362	0.223
Sample #15 - Leachate Aeration Dam (2 of 2) - Aerobic	SC17026	02.02.2017 1105 hrs	03.02.2017 1147 hrs	4	8	--	--	512	512	0.316
Sample #16 - Active Tip Face - Fresh Waste (< 1 day old)	SC17027	02.02.2017 1240 hrs	03.02.2017 1233 hrs	4	8	--	--	16,400	16,400	8.16

Note: NATA accreditation does not cover the performances of these services:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than the Odour Unit Pty Ltd have performed the dilution of samples.

Odour Sample Measurement Results
Panel Roster Number: SYD20170203_004

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
Sample #17 - Waste Covered Area (300 mm - Cover, less than a week old)	SC17028	02.02.2017 1230 hrs	03.02.2017 1340 hrs	4	8	--	--	431	431	0.25
Sample #18 - Waste Covered Area (Void perimeter without biocover and with soil)	SC17034	02.02.2017 1318 hrs	03.02.2017 1751 hrs	4	8	--	--	664	664	0.377
Sample #19 - Waste Covered Area (150 mm - Cover, less than a week old)	SC17029	02.02.2017 1325 hrs	03.02.2017 1434 hrs	4	8	--	--	512	512	0.286
Sample #20 - Waste Covered Area (G16, with biofilter cover)	SC17030	02.02.2017 1418 hrs	03.02.2017 1505 hrs	4	8	--	--	4,470	4,470	2.36

Note: NATA accreditation does not cover the performances of these services:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than the Odour Unit Pty Ltd have performed the dilution of samples.

Odour Sample Measurement Results
Panel Roster Number: SYD20170203_004

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
Sample #21 - Waste Covered Area (150 mm, aged waste)	SC17031	02.02.2017 1415 hrs	03.02.2017 1600 hrs	4	8	--	--	304	304	0.172
Sample #22 - Waste Covered Area (F15, without biofilter cover)	SC17035	02.02.2017 1418 hrs	03.02.2017 1505 hrs	4	8	--	--	21,200	21,200	13.3
Sample #23 - Waste Covered Area (Void perimeter with biocover, 1 of 2)	SC17033	02.02.2017 1517 hrs	03.02.2017 1711 hrs	4	8	--	--	724	724	0.42
Sample #24 - Waste Covered Area (Void perimeter with biocover, 2 of 2)	SC17032	02.02.2017 1557 hrs	03.02.2017 1634 hrs	4	8	--	--	197	197	0.116

Note: NATA accreditation does not cover the performances of these services:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than the Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20170203_004	51,500	$20 \leq \chi \leq 80$	1,024	50	Yes

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

SC17022	pungent, ammoniacal, earthy	SC17029	dirt, garbage, pine
SC17023	pungent, ammoniacal, earthy	SC17030	pineapple, rotten egg, landfill gas
SC17024	pungent, ammoniacal, earthy, dirty socks	SC17031	dirt, earthy
SC17025	pungent, ammoniacal, earthy, dirty socks	SC17032	dirt, earthy
SC17026	pungent, ammoniacal, earthy, dirty socks	SC17033	pineapple, dirt, earthy
SC17027	garbage, bin juice	SC17034	pineapple, earthy
SC17028	dirt, garbage	SC17035	rotten, putrid, pineapple

Disclaimer Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

Note This report shall not be reproduced, except in full, without written approval of The Odour Unit Pty Ltd. Any attachments to this Report are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd.

END OF DOCUMENT

THE ODOUR UNIT PTY LTD

THE ODOUR UNIT

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Internet: www.odourunit.com.au
ABN: 53 091 165 061

NATA

Accreditation Number: 14974

Odour Concentration Measurement Results

The measurement was commissioned by:

Organisation	Veolia	Telephone	02 8588 1366
Contact	Ark Du	Facsimile	--
Sampling Site	Woodlawn Bioreactor Facility	Email	ark.du@veolia.com
Sampling Method	Liquid Odour Method	Sampling Team	TOU

Order details:

Order requested by	Ark Du	Order accepted by	M. Assal
Date of order	19.01.2017	TOU Project #	N1806L
Order number	7100015204	Project Manager	M. Assal
Signed by	Refer to correspondence	Testing 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 Standard 'Determination of Odour Concentration by Dynamic Olfactometry' AS/NZS4323.3:2001. Accredited for compliance with ISO/IEC 17025 – Testing. 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 between 22ºC and 25ºC.
Measuring Dates	The date of each measurement is specified with the results.
Instrument Used	The olfactometer used during this testing session was: ODORMAT SERIES V02
Instrumental Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.477$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: r = 0.1902 (March - May 2016) Compliance – Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \leq 0.217$ in accordance with the Australian Standard AS/NZS4323.3:2001. ODORMAT SERIES V02: A = 0.2081 (March - May 2016) Compliance – Yes
Lower Detection Limit (LDL)	The LDL for the olfactometer has been determined to be 16 ou (4 times the lowest dilution setting)
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. 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.

Date: Wednesday, 22 February 2017

Panel Roster Number: SYD20170220_011

J. Schulz
NSW Laboratory Coordinator

A. Schulz
Authorised Signatory

Odour Sample Measurement Results
Panel Roster Number: SYD20170220_011

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate (ou.$m^3/m^2/s$)
LOM Sample #1 – Storage Pond 3	SC17093	02.02.2017 1620 hrs	20.02.2017 1309 hrs	4	8	--	--	32	32	--
LOM Sample #2 – ED3N-4	SC17094	02.02.2017 1632 hrs	20.02.2017 1335 hrs	4	8	--	--	38	38	--

Note: NATA accreditation does not cover the performances of these services:

1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than the Odour Unit Pty Ltd have performed the dilution of samples.

THE ODOUR UNIT PTY LTD

Accreditation Number: 14974

Odour Panel Calibration Results

Reference Odorant	Reference Odorant Panel Roster Number	Concentration of Reference gas (ppb)	Panel Target Range for n-butanol (ppb)	Measured Concentration (ou)	Measured Panel Threshold (ppb)	Does this panel calibration measurement comply with AS/NZS4323.3:2001 (Yes / No)
n-butanol	SYD20170220_011	51,500	$20 \leq \chi \leq 80$	724	71	Yes

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

SC17093 earthy, musty
SC17094 rubber, earthy, musty

Disclaimer Parties, other than TOU, responsible for collecting odour samples hereby certify that they have voluntarily furnished these odour samples, appropriately collected and labelled, to The Odour Unit Pty Ltd for the purpose of odour testing. The collection of odour samples by parties other than The Odour Unit Pty Ltd relinquishes The Odour Unit Pty Ltd from all responsibility for the sample collection and any effects or actions that the results from the test(s) may have.

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APPENDIX B:

ODOUR EMISSIONS WORKSHEET

THE ODOUR UNIT

VEOLIA ENVIRONMENTAL SERVICES

Odour Emissions Inventory Audit

Client: Veolia (Australia & New Zealand)
Sampling Site: Woodlawn Bioreactor Facility
Project Number: N1806L.03 - Woodlawn Audit #5

Sample Location	TOU Sample Number	Odour Concentration (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)	Odour character	H_2S concentraton measurement in bag (ppm)
Evaporation Dam 3 South (ED3S) System					
Sample #1 - ED3S (1 of 2)	SC17009	304	0.217	musty, earthy	0.005
Sample #2 - ED3S (2 of 2)	SC17010	470	0.336	musty, earthy	0.003
Evaporation Dam 3 North (ED3N) System					
Sample #3 - ED3N-4 (1 of 2)	SC17011	362	0.259	musty, earthy	0.17
Sample #4 – ED3N-4 (2 of 2)	SC17012	332	0.237	musty, earthy	0.16
Sample #5 – ED3N-3 (1 of 2)	SC17013	332	0.237	musty, earthy	0.037
Sample #6 - ED3N-3 (2 of 2)	SC17014	235	0.168	musty, earthy	0.047
Sample #7 – ED3N-2 (1 of 2)	SC17015	215	0.154	musty, earthy	0.21
Sample #8 - ED3N-2 (2 of 2)	SC17016	197	0.141	musty, earthy	0.19
Sample #9 - ED3N-1 (1 of 2)	SC17017	166	0.119	musty, earthy	0.075
Sample #10 – ED3N-1 (2 of 2)	SC17018	197	0.141	musty, earthy	0.073
Evaporation Dam 3 South-South (ED3S-S) System					
Sample #11 - ED3S-S (1 of 3)	SC17022	724	0.473	pungent, ammoniacal earthy	1.2
Sample #12 - ED3S-S (2 of 3)	SC17023	724	0.473	pungent, ammoniacal earthy	1.2
Sample #13 - ED3S-S (3 of 3)	SC17024	558	0.365	pungent, ammoniacal earthy, dirty socks	1.9
Leachate Aeration Dam					
Sample #14 - Leachate Aeration Dam (1 of 2) - Anoxic Zone	SC17025	362	0.223	pungent, ammoniacal earthy, dirty socks	0.48
Sample #15 - Leachate Aeration Dam (2 of 2) - Aerobic Zone	SC17026	512	0.316	pungent, ammoniacal earthy, dirty socks	1.3
Active Tipping Area					
Sample #16 - Active Tip Face - Fresh Waste (< 1 day old)	SC17034	16,400	8.16	garbage, bin juice	0.06
Waste Covered Area					
Sample #17 - Waste Covered Area (300 mm - Cover, less than a week old)	SC17028	431	0.250	dirt, garbage	0.06
Sample #18 - Waste Covered Area (Void perimeter without biocover and with soil)	SC17034	664	0.377	pineapple, earthy	0.003
Sample #19 - Waste Covered Area (150 mm - Cover, less than a week old)	SC17029	512	0.286	dirt, garbage, pine	0.019
Sample #20 - Waste Covered Area (G16, with biofilter cover)	SC17030	4,470	2.36	pineapple, rotten egg, landfill gas	0.01
Sample #21 - Waste Covered Area (150 mm, aged waste)	SC17031	304	0.172	dirt, earthy	0.009
Sample #22 - Waste Covered Area (F15, without biofilter cover)	SC17035	21,200	13.30	rotten, putrid, pineapple	0.26
Sample #23 - Waste Covered Area (Void perimeter with biocover, 1 of 2)	SC17033	724	0.42	pineapple, dirt, earthy	0.002
Sample #24 - Waste Covered Area (Void perimeter with biocover, 2 of 2)	SC17032	197	0.116	dirt, earthy	0.037

THE ODOUR UNIT

VEOLIA

Liquid Odour Measurement Emission Results (Mechanical Evaporators)

Liquid Odour Measurement - Calculation (25L N_2 with 413 µL sample)	TOU Sample Number	Odour Concentration (ou)	Volume of Liquid (mL)	Volume of dry N_2 (L)	Odour Concentration (ou/m^3)	Calculated Liquid Odour Concentration (ou/mL)	Mechanical Evaporation Rate (L/min) @ 20% efficiency	Odour Emission Rate ($ou.m^3/min$)	Odour Emission Rate ($ou.m^3/s$)	Mechanical Evaporation Rate (L/min) @ 30% efficiency	Odour Emission Rate ($ou.m^3/min$)	Odour Emission Rate ($ou.m^3/s$)	Odour Character
LOM Sample #1 - Storage Pond 3 (Stormwater)	SC17093	32	0.413	25	32	1.94	70	136,000	2,270	105	204,000	3,400	earthy, musty
LOM Sample #2 - ED3N-4	SC17094	38	0.413	25	38	2.3	70	161,000	2,680	105	242,000	4,030	rubber, earthy, musty

Mechanical evaporation rate is based on 20 % / 30% evaporation efficiency per evaporator

	per evaporator		All evaporators	
Evaporation efficiency	**20%**	**30%**	**20%**	**30%**
LOM Sample #1 - Storage Pond 3 (Stormwater)	2,270	3,400	11,400	17,000
LOM Sample #2 - ED3N-4	2,680	4,030	13,400	20,200

Liquid Odour Measurement Emission Results (Natural Evaporation)

Liquid Odour Measurement - Calculation (25L N_2 with 413 µL sample)	TOU Sample Number	Odour Concentration (ou)	Volume of Liquid (mL)	Volume of dry N_2 (L)	Odour Concentration (ou/m^3)	Calculated Liquid Odour Concentration (ou/mL)	Area (m^2)	Natural evaporation rate (mm/month)	Natural evaporation rate (L/s)	Odour emission rate ($ou.m^3/s$)
LOM Sample #1 - Storage Pond 3 (Stormwater)	SC17093	32	0.413	25	32	1.94	1,650	92.67	0.058	113
LOM Sample #2 - ED3N-4	SC17094	38	0.413	25	38	2.3	25,000	92.67	0.882	2,030

The natural evaporation rate is based on the mean evaporation rate recorded between May 2007 to June 2012 i.e. 92.67 mm/month

APPENDIX C:

TECHNICAL DOCUMENTATION RELEVANT TO THE AUDIT

ODOUR COMPLAINTS REGISTER:

17 NOVEMBER 2015 AND 30 JANUARY 2017

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
30/01/2017	11:10:00 PM	Letter	Braidwood Road, Tarago	The complainant reported that "the stench from Woodlawn is coming through my house again".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn are well underway with its implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void that is being enacted. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also commenced in an attempt to manage any fugitive gas between the void's wall and waste mass.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
9/01/2017	7:30:00 AM	Letter	Roseview Road, Tarago	The Complainant reported that they "couldn't go outside as the smell was so bad".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn have commenced the implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also been presented for approval by the EPA in an attempt to manage any fugitive gas between the void's wall and waste mass. Currently research is being undertaken with regards to the opportunity to use a geo-synthetic cover material as another means of control.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
8/01/2017	11:30:00 PM	Letter	Braidwood Road, Tarago	The Complainant reported that "the stench from Woodlawn has been coming through my house again tonight".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn have commenced the implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also been presented for approval by the EPA in an attempt to manage any fugitive gas between the void's wall and waste mass. Currently research is being undertaken with regards to the opportunity to use a geo-synthetic cover material as another means of control.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
30/12/2016	Not specified	Letter	Tarago Village	The Complainant reported that the odour was “ongoing issue for him and he is unable to open windows or doors at night and is often unable to use air-conditioning in his car.”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn have commenced the implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also been presented for approval by the EPA in an attempt to manage any fugitive gas between the void’s wall and waste mass. Currently research is being undertaken with regards to the opportunity to use a geo-synthetic cover material as another means of control.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
29/12/2016	Not specified	Letter	Tarago Village	The Complainant reported that the odour was “ongoing issue for him and he is unable to open windows or doors at night and is often unable to use air-conditioning in his car.”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn have commenced the implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also been presented for approval by the EPA in an attempt to manage any fugitive gas between the void’s wall and waste mass. Currently research is being undertaken with regards to the opportunity to use a geo-synthetic cover material as another means of control.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
25/12/2016	Not specified	Letter	Tarago Village	The Complainant reported that the odour was “ongoing issue for him and he is unable to open windows or doors at night and is often unable to use air-conditioning in his car.”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn have commenced the implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also been presented for approval by the EPA in an attempt to manage any fugitive gas between the void’s wall and waste mass. Currently research is being undertaken with regards to the opportunity to use a geo-synthetic cover material as another means of control.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
24/12/2016	Not specified	Letter	Tarago Village	The Complainant reported that the odour was “ongoing issue for him and he is unable to open windows or doors at night and is often unable to use air-conditioning in his car.”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia Woodlawn have commenced the implementation of a contoured waste profile that allows for better control of storm water flows on the waste surface to minimise the ability for surface storm water to enter the waste. In addition to the aforementioned AECOM Pty Ltd have been engaged to model stormwater ingress and have developed a strategy to minimise surface water from entering the void. Due to leachate levels within the waste mass a new perforated well design has been implemented and is being installed to maximise the opportunity for gas collection compared with that of solid wells. A bio-filter trial has also been presented for approval by the EPA in an attempt to manage any fugitive gas between the void’s wall and waste mass. Currently research is being undertaken with regards to the opportunity to use a geo-synthetic cover material as another means of control.
5/12/2016	9:30:00 PM	Letter	Taylors Creek Road, Tarago	The Complainant reported that the odour was ‘particularly bad’ and had to close up the house which resulted in a five degree temperature difference between the inside and outside of the house.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
2/12/2016	12:30:00 AM	Letter	Tarago Village	The Complainant reported that the odour was “overpowering” when he arrived home at 12:30am on 2 December. He said he is affected by landfill odour at his house on average 4 days a week.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
1/02/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a “phenomenal stench” on the night of 1 December and morning of 2 December. He also said it has been bad in general over the past two months.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
17/11/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported “an unbearable stench” at his house allegedly coming from the Woodlawn Bioreactor.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
15/11/2016	Not specified	Letter	Tarago Village	The Complainant spoke directly to the Woodlawn Facilities Manager. He stated that he was experiencing a “putrid smell ”at his residence. He stated the conditions where very still.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network
9/11/2016	7:00:00 PM	Letter	Taylors Creek Road, Tarago	The Complainant reported that there was a “strong stench around last night around 7pm” when they called the Feedback Line.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
2/11/2016	Not specified	Letter	Tarago Village	The Complainant described the odour as “putrid, decomposing garbage odour from the Woodlawn Bioreactor”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
27/10/2016	10:00:00 AM	Letter	Taylors Creek Road, Tarago	The Complainant reported that the odour was “strong at their residence all morning” and was in their opinion ranked at about a number four when they called the Feedback Line.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to the community and EPA executives in April 2016 as a key requirement to improve gas capture. Key to this strategy is the recent consent modification approval allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
19/10/2016	10:00:00 AM	Letter	Tarago Village	The Complainant said that the “odour occurs every day regardless of wind direction or speed and that it is worst at night”. He also said “they have another property located further away from the landfill from where they also experience the odour”. They rated the odour at 4/6.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network
29/09/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a “really bad stench coming from Woodlawn”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
28/09/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a "really bad stench coming from Woodlawn"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
27/09/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a "really bad stench coming from Woodlawn"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
21/09/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a "really bad stench coming from Woodlawn"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
20/09/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a “really bad stench coming from Woodlawn”	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
17/09/2016	17:36	Letter	Braidwood Road, Tarago	The Complainant reported that “the stench is invading my home again”.		Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
24/09/2016	Not specified	Letter	Roseview Road, Tarago	The Complainant reported that the odour was strong at his residence at the time he called the Feedback Line.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia’s water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
18/08/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant reported a "toxic chemical stench coming from Veolia Bio Reactor"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
17/08/2016	6:50:00 PM	Letter	Braidwood Road, Tarago	The Complainant reported a "very strong stench/putrid odour"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
16/08/2016	9:20:00 AM	Letter	Braidwood Road, Tarago	The Complainant reported a "landfill odours"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
15/08/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant informed the EPA Environment Line that the odour had been present every day during this week.	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
1/08/2016	8:00:00 AM	Letter	Braidwood Road, Tarago	The Complainant reported a ""terrible stench".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
30/07/2016	Not specified	Letter	Roseview Road, Tarago	The Complainant reported "the Woodlawn Veolia stink is revolting this afternoon."	Not specified.	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
30/07/2016	11:40:00 AM	Letter	Braidwood Road, Tarago	The Complainant reported a "putrid odour from water being pumped from rotting matter into landfill from a Veolia bioreactor".	08:30-11:40	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
22/07/2016	Not specified	Letter	Tarago Village	The Complainant reported to the EPA that there was a "strong rubbish odour and said it smells like he is living next to a rubbish dump". The EPA spoke to the complainant further and he said the odour he smelt on 21 and 22nd July was the "worst he has ever experienced in his time living in Tarago. He said that his wife is more sensitive to the odour than he is and she couldn't go outside because it was too strong outside the house". He told the EPA he often smells landfill odours at his house and doesn't usually ring to complain, but on this occasion the odour was so strong he decided to call the Environment Line.	17:00 on Thursday 21/07/2016 until unspecified time of complaint to the EPA on 22/07/16	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
21/07/2016	5:02:00 PM	Letter	Braidwood Road, Tarago	The Complainant reported a "foul odour"	15:30-16:00	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
20/07/2016	9:35:00 AM	Letter	Taylors Creek Road, Tarago	The Complainant described the odour as "smelly"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
17/07/2016	7:14:00 PM	Letter	Braidwood Road, Tarago	The Complainant said "the stench from Woodlawn is invading my home again and it's enough to make you spew". The Complainant called again at 19:31hrs to report that their partner had "just arrived home from the village and nearly spewed."	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
15/07/2016	8:54:00 PM	Letter	Braidwood Road, Tarago	The Complainant said "tthe stench from Veolia is invading my home. It's enough to make you sick"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
5/07/2016	4:00:00 PM	Letter	Braidwood Road, Tarago	The Complainant said "the odour was so bad that they had to leave the Tarago area to escape the smell"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
3/07/2016	08:30 & 09:00	Letter	Braidwood Road, Tarago	The Complainant said "The stench is invading my home again. I am sick of it. Get something done about it".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
2/07/2016	1:54:00 PM	Letter	Braidwood Road, Tarago	The Complainant said "the smell was phenomenal"	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
1/07/2016	Not specified	Letter	Braidwood Road, Tarago	The Complainant said there was a "very strong landfill odour"	Afternoon	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
5/07/2016	8:15:00 AM	Letter	Taylors Creek Road, Tarago	The Complainant said their nephew had advised them of an odour at the front gate of her property "and it might not have been quite that bad" as the previous evening. The Complainant advised Veolia that "they just wanted to let you know you still have a problem up there".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
4/07/2016	10:30:00 PM	Letter	Taylors Creek Road, Tarago	The Complainant advised Veolia that during the event they had stepped outside and "could hardly breathe. It was right off the scale".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
26/06/2016	7:50:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that "The smell was that bad here last night that you wouldn't believe it. I want something done about it".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
23/06/2016	2:30:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that "I have a gutful of this odour out here now. I am sick of it. Do something about it".	Not specified	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
20/06/2016	10:33:00 PM	Letter	Braidwood Road, Tarago	The Complainant said "This stench is coming through my place again out here today. Do something about it."	Not specified	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
17/06/2016	10:38:00 PM	Letter	Braidwood Road, Tarago	The Complainant said "this <expletive> is coming into my house again tonight."	Not specified	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
16/06/2016	10:30:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA's Environment line that there was "ongoing complaint relating to strong offensive odour present inside callers home since 9pm" He stated that it was a "foul offensive stench and sickening odour, making [the] entire household feel ill".	21:00-22:30	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
16/06/2016	6:00:00 AM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA it was "another bad early morning. Smell hit me as soon as I opened the back door. Approximately 6 am".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
15/06/2016	6:00:00 AM	Letter	Roseview Road, Tarago	The Complainant informed the EPA that "odour from the Veolia Woodlawn Bioreactor is again present tonight and is the worst it has ever been".	Not specified	Veolia continues to address the challenges of water management within the Bioreactor as we have previously outlined to EPA executives in April 2016 and the community as a key requirement to improve gas capture. Key to this strategy is the current consent modification application allowing the use of an additional storage dam within the ED3 South dam system and the development and implementation of a longer term treatment solution being advanced by Veolia's water division. Run Energy Pty Ltd has also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
13/06/2016	9:15:00 AM	Letter	Braidwood Road, Tarago	The Complainant reported a "sickening stench" permeating his house at 07:30 on Monday 13 June and later that morning returned a call at 09:15 saying it was still very strong and coming into his house	07:30-09:15	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
13/06/2016	9:15:00 AM	Letter	Braidwood Road, Tarago	The Complainant reported that the odour from Woodlawn was "horrific" during this same period.	07:30-09:15	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
13/06/2016	8:31:00 AM	Letter	Roseview Road, Tarago	An unknown Complainant advised the EPA at 08:31 that "the odour from the Veolia Bioreactor is disgusting this morning. There is no wind. This problem is chronic every winter."	Not specified.	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
13/06/2016	11:28:00 PM	Letter	Braidwood Road, Tarago	The Complainant rang again on Monday evening at 23:28 saying "the stench is coming into my house again".	Not specified.	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
29/05/2016	30/05/2016	Letter	Braidwood Road, Tarago	The Complainant informed the EPA on Monday 30th June "The last three mornings, cold mornings, have been phenomenal. It nearly makes you spew. I am jack of it."	Not specified.	The Woodlawn Facilities Manager will be visiting the Complainant shortly to discuss his recent odour complaints. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
28/05/2016	28/05/2016	Letter	Braidwood Road, Tarago	The Complainant informed the EPA on Monday 30th June "The last three mornings, cold mornings, have been phenomenal. It nearly makes you spew. I am jack of it."	Not specified.	The Woodlawn Facilities Manager will be visiting the Complainant shortly to discuss his recent odour complaints. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
26/05/2016	8:42:00 AM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA on Thursday 26th May that "the stench this morning down here is phenomenal. Do something about it, for Christ's sake".	Not specified.	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
25/05/2016	9:45:00 AM	Letter	Braidwood Road, Tarago	The Complainaint informed the EPA on Wednesday 25th May that he noticed the odour at about 08:30am out in his paddock when he was feeding the cattle. He said the odour was "phenomenal" and was that bad it made him feel sick. He said he got on with feeding the cattle anyway as the job had to be done and then got home at about 9:45am. He said the odour was present at his house too, but not as strong as it was in the paddock.	08:30 to 09:45.	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
22/05/2016	11:27:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that there was a "phenomenal odour" present at their house and alleged it was coming from the Woodlawn Bioreactor. They said the odour had also been phenomenal that morning, and the night before (Saturday).	Not specified	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
14/05/2016	11:05:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that he returned home from a trip to Sydney at 7pm and "when he got out of his car it nearly knocked him over".	4 hours	Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
4/05/2016	10:49:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that "The stench is coming through my house again tonight. I am getting sick of this".	Not specified	Veolia attempted to contact the Complainant to discuss the complaint however contact could not be made. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
29/04/2016	9:28:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that "I was coming back from Canberra tonight and when I reached the Collector Road intersection the odour nearly killed me. And when I got back here [home] it was as bad here too".	Not specified	Veolia attempted to contact the Complainant to discuss the complaint however contact could not be made. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
28/04/2016	6:52:00 PM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that he had "just walked out the back and the smell nearly knocked me over". They also stated they "had to close all the windows and doors. This is getting ridiculous".	Not specified	Veolia attempted to contact the Complainant to discuss the complaint however contact could not be made. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
27/04/2016	19:30-22:20.	Letter	Braidwood Road, Tarago	The complainant informed the EPA "this stench is coming through my house again. Do something about it for God's sake". They described the smell as "a gassy stench from rubbish and gas".	2 hours 50min	Veolia attempted to contact the Complainant to discuss the complaint however contact could not be made. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
20/04/2016	07:00 and 09:00.	Letter	Taylors Creek Road, Tarago	The Complainant advised Veolia that the odour was present at 07:00 when they left their property and present when they returned at approximately 09:00 and was 'coming and going'. They said that when present it was 'enough to make you feel sick'.	2 hours	Veolia spoke to the Complainant this morning and she described how the odour was intermittent during the duration of the reported period. We also discussed the significant efforts currently being undertaken by Veolia to improve gas capture as detailed below. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
19/04/2016	8:48:00 AM	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that they smelt "a phenomenal stench" at their house this morning and alleged to the EPA that it is coming from the Woodlawn Bioreactor.	Not specified	Veolia attempted to contact the Complainant to discuss the complaint however contact could not be made. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
15/04/2016	6:30:00 AM	Letter		The complainant left a message on the complaints line informing Veolia that at approximately 00:15 "<they> can smell an odour."	Not specified	Veolia attempted to contact the Complainant to discuss the complaint however contact could not be made. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
1/04/2016	8:30:00 AM	Letter	Braidwood Road, Tarago	The EPA advised Veolia that the caller described the odour as 'overpowering rotting garbage' that was first noticed at 8.30 am.	Not specified	Contact details for the complainant were not supplied. If contact details are provided a Veolia representative will contact the complainant to discuss the event. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
30/03/2016	7:00 - 9:00	Letter	Tarago Village	The Complainant said that the odour event began at approximately 07:00 and had dissipated between 08:30-09:00 when she called. They said that it was more evident on foggy days when dew was present and was "pretty bad' this morning.	2 hours	Veolia discussed the complaint with the Complainant. She said that the odour event began at approximately 07:00 and had dissipated between 08:30-09:00 when she called. She said that it was more evident on foggy days when dew was present and was "pretty bad' this morning. Veolia discussed the below mentioned strategies currently being undertaken to improve gas capture. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
25/03/2016	10:00 - 11:29	Letter	Braidwood Road, Tarago	The Complainant informed the EPA that they smelt “a phenomenal stench” when they went down to their paddock at 10am. They said “it nearly knocked me over and nearly made me vomit that’s how bad it was and I’ve got work to do down there”.	1 hour 29	Veolia rang the Complainant this afternoon and we discussed the odour events last Wednesday and Friday. We also discussed the short term strategies currently being deployed to increase gas capture within the Bioreactor and clarified that the new leachate pond being constructed is located within Evaporation Dam 3 which is dedicated to leachate treatment under our EPL and not an extension as suggested. Veolia continue to address the challenges of water management within the Bioreactor. Veolia’s Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
23/03/2016	08:00 - 9:20	Letter	Tarago Village	The Complainant informed the EPA that there was a “very strong landfill stench”. They said they first noticed it at 6am when they went outside their house. He said the smell was “so strong it nearly knocked me over”. They said the odour was dissipating at 9:20am (still present at his house but not strong).	1 hour 20	The Complainant was unavailable to speak with Veolia today however I spoke with their partner this morning who left the location at 8am and indicated that odour was present in the Tarago township during her visit yesterday morning. Veolia continue to address the challenges of water management within the Bioreactor. Veolia’s Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network. Veolia met directly with the EPA on 9th of March to discuss the progress of gas capture and approval required to further develop our leachate treatment objectives, which is critical to the objectives behind improving gas capture.
23/03/2016	08:00 - 9:20	Letter	Braidwood Road, Tarago	The Complainant called the EPA at around 9.30am to report that an odour had been detected at the Tarago Public School.	1 hour 20	The conversation with the Principal centered around the activities at the Woodlawn site, including the current train table and future planning with Pacific National when the Banksmeadow Transfer terminal opens in July/August this year. The Principal requested to be involved in communication about the site and the measures Veolia are taking to address odour. Veolia regularly meets with TADPAI about the progress and initiatives in place, the school will now be included in such correspondence in the future.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
14/03/2016	8:56:00 AM	Letter	Braidwood Road, Tarago	In the first instance, the Complainant informed the EPA that there was a "very strong landfill stench" that started at 06:00 and was still present at 08:56 when they called the EPA. They said the odour was coming inside his house.	3 hours	Veolia were unable to attend the site of the odour event when notified by the EPA due to a medical emergency. Attempts were made to contact the Complainant unsuccessfully. Veolia continue to address the challenges of water management within the Bioreactor. Veolia's Water division have been engaged to provide both short and long term strategies to manage water within the waste mass to increase gas capture. Run Energy Pty Ltd have also been engaged to provide expert consultative and operational advice on system improvements to facilitate improved performance of the gas capture network.
25/02/2016	8:45:00 AM	Letter	Tarago Village	The EPA received a call from a Complainant at the Tarago Public School reporting a 'strong waste odour' on arrival at the school at 08:10. Another Complainant arrived at 08:45 and reported that "I feel like gagging". The Complainant informed the EPA that she was unsure whether the odour was coming from the woodlawn landfill or the train.	45 Minutes	Veolia spoke with the first Complainant about the duration and intensity of the odour and she advised me that the odour was present on arrival at the school around 8:10 and dissipated throughout the morning. The second train scheduled for this day was parked at Tarago between 09:15 and departed at 11:20. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
25/02/2016	8:10 - 08:45	Letter	Tarago Village	The EPA received a call from a Teacher at the Tarago Public School reporting a 'strong waste odour' on arrival at the school at 08:10. Another Teacher arrived at 08:45 and reported that "I feel like gagging". The Teacher informed the EPA that they were unsure whether the odour was coming from the woodlawn landfill or the train	35 minutes	Veolia spoke with the first Complainant about the duration and intensity of the odour and she advised me that the odour was present on arrival at the school around 8:10 and dissipated throughout the morning. The second train scheduled for this day was parked at Tarago between 09:15 and departed at 11:20. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
16/02/2016	12:15:00 AM	Letter	Tarago Village	The complainant informed the EPA that at approximately 00:15 "he was woken up by a very strong landfill odour. Upon waking he had to close all the windows to his house to stop the odour coming in. He said the odour was so strong that it woke him from his sleep."	Not specified	Contact details for the complainant were not supplied. If contact details are provided a Veolia representative will contact the complainant to discuss the event. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
8/02/2016	8:45:00 AM	Letter	Braidwood Road, Tarago	In the first instance, the Complainant informed the EPA that the odour was "really strong at their house this morning". On a follow up call, the Complainant advised the EPA that the odour was gone by about 10am and that they had first noticed it at about 8:45am when they opened their doors and windows. They said the odour immediately entered their house at that time. He drove out to the paddocks at 10am and said that the odour was almost completely gone by that time.	Approximately 1 hour	Veolia visited the site of the odour complaint at 10:50-11:10am and there was no odour present at that time. Attempts were made to contact the Complainant unsuccessfully. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
1/02/2016	8:40:00 AM	Letter	Willandra Lane, Tarago	The complainant said the odour started "early this morning" and she "had to shut up the house and it's inside and she's [finding] it difficult to breathe". She stated that "they can smell it going in to Tarago and Veolia should have had it fixed long ago"	Not specified but "early in morning"	Two attempts were made to contact the Complainant this morning via telephone with no response and no telephone message bank. The complainant spoke to a Veolia representative when lodging the complaint. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
22/01/2016	20:00 - 22:55.	Letter	Tarago Village	The complainant said the odour started at 8pm and he described it as "a foul stench". He also said the "odours have been happening for about 8 years, but the recent rains have made the smell worse".	3 hours	Contact details for the complainant were not supplied. If contact details are provided a Veolia representative will contact the complainant to discuss the event. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
19/01/2016	9:15:00 PM	Letter	Braidwood Road, Tarago	The Complainant stated "I'm sitting in my lounge room and the stench is just flying through. Do something about it, for Christ's sake. Heaven's above, it would drive a bloke mad".	Not specified	Attempts were made to contact the Complainant unsuccessfully. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
18/01/2016	9:30:00 AM	Letter	Braidwood Road, Tarago	The Complainant described the odour as very strong. He said his grandchildren were staying with him and they were complaining about the smell.	Not specified	Veolia spoke to the Complainant this afternoon and he acknowledged that he had spoken to the Woodlawn Facilities Manager about actions being taken at the time of the complaint. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
17/12/2015	8:30:00 AM	Letter	Taylors Creek Road, Tarago	The Complainant said that during the event she "had to shut up the house – shocking smell. Doesn't like shutting house in heat with 92 year old Mother. Maybe Veolia should think about putting in air-conditioners, and cost of running them, for us ".	07:30 for an unspecified period.	A telephone conversation was held with the Complainant this morning. She again indicated that she does not like having to shut the house during these events. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
17/12/2015	22:30:00 PM	Letter	Taylors Creek Road, Tarago	The Complainant stated they had to shut up the house – shocking smell. Doesn't like shutting house in heat with 92 year old Mother. Maybe Veolia should think about putting in air-conditioners, and cost of running them, for us ".	20:45 to 22:30.	A telephone conversation was held with the Complainant this morning. She again indicated that she does not like having to shut the house during these events. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
5/12/2015	Not specified	Letter	Braidwood Road, Tarago	The Complainant described the odour as "phenomenal". The Complainant indicated that the odour was detected while cutting hay at an address on Cullulla Road "approximately 20-30km" from the Woodlawn site.	Between 10-11 AM	I received the phone call from the Complainant on 07/12/2015. He indicated that he had arrived at the site at Cullulla Road at 5am to cut hay and had experienced the odour between 10-11am. The Complainant also said his wife experienced the odour at their residential address at the same time during the morning. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
2/12/2015	1:00:00 AM	Letter	Tarago Village	The Complainant said it was a "very strong odour like a rotting orange smell coming from Veolia Environmental Services Woodlawn Landfill". The EPA reported that "the Caller was woken up at 01:00 this morning from the strong odour. Caller says this is an ongoing problem. Caller is very distressed where to the point of having to sell the property."	Not specified	Site management will be contacting the two known complainants over the coming days to discuss the intensity of the odour and the duration. Details of the odour audit process will also be discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
1/12/2015	8:45:00 PM	Letter	Braidwood Road, Tarago	The Complainant reported that "he noticed a very strong landfill odour in the Tarago village".	Not specified	Site management will be contacting the two known complainants over the coming days to discuss the intensity of the odour and the duration. Details of the odour audit process will also be discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
1/12/2015	Evening	Letter	Tarago Village	The Complainant said "better buy us all air conditioners… stink bloody shocking in here tonight".	Not specified	Site management will be contacting the two known complainants over the coming days to discuss the intensity of the odour and the duration. Details of the odour audit process will also be discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
30/11/2015	10:30:00 PM	Letter	Braidwood Road, Tarago	The Complainant said he was sitting in his lounge room and the stench came drifting through his house. He said he "was upset that it was a hot night and he couldn't have any windows or doors open".	Not specified	Site management will be contacting the two known complainants over the coming days to discuss the intensity of the odour and the duration. Details of the odour audit process will also be discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
25/11/2015	12:33:00 AM	Letter	Braidwood Road, Tarago	The Complainant stated "the stench was coming through his house"	Not specified	Site management will be contacting the two known complainants over the coming days to discuss the intensity of the odour and the duration. Details of the odour audit process will also be discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
22/11/2015	21:30-23:30	Letter	Taylors Creek Road, Tarago	The Complainant said that during the event she "had to shut up the house at 9:30pm and was still smelly at 11:30pm" she said that she "doesn't appreciate having to close up the house in this weather".	2 hours	A telephone conversation was held with the Complainant this morning. She indicated that the odour was present for approximately two hours and that it required closing the doors to the house during this period which was inconvenient. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
19/11/2015	10:30:00 PM	Letter	Braidwood Road, Tarago	The Complainant described the odour as "rotting stench of waste".	Not specified	Veolia had a telephone conversation with the Complainant this afternoon. He mentioned his conversation with the Woodlawn Facilities Manager, earlier in the week and his offer to visit the site. The offer was extended again and he said that it would be difficult due to commitments but would be considered. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
18/11/2015	12:00:00 AM	Letter	Braidwood Road, Tarago	The Complainant described the odour as very strong. He said his grandchildren were staying with him and they were complaining about the smell.	Not specified	Veolia spoke to the Complainant this afternoon and he acknowledged that he had spoken to the Woodlawn Facilities Manager about actions being taken at the time of the complaint. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner

Woodlawn Bioreactor Complaints Register

Date	Complaint lodged	Response	Location	Description	Duration	Response/action taken to resolve the complaint
17/11/2015	9:00:00 PM	Letter	Braidwood Road, Tarago	The Complainant said it was " very strong and had come through the air-con vents in his car".	Not specified	The site manager spoke with the Complainant and discussed the intensity of the odour and the duration. Details of the odour audit process was also discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
17/11/2015	10:00:00 PM	Letter	Braidwood Road, Tarago	The Complainant opened the back door to let some breeze in and the stench permeated his house. He said it was much stronger now that when he first reported it to Enviroline"	Not specified	The site manager spoke with the Complainant and discussed the intensity of the odour and the duration. Details of the odour audit process was also discussed and the actions being implemented. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
25/10/2015	10:00:00 PM	Letter	Braidwood Road, Tarago	The Complainant described the odour as a "phenomenal stench"	4 hrs	The knockout system was thoroughly inspected and found to be operating as designed. The leachate spill is currently being pumped back into the landfill mass. The Woodlawn Operations Manager spoke with the Complainant this morning. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner.
20/10/2015	10:30:00 PM	Letter	Braidwood Road, Tarago	The Complainant described the odour as: "dirty rotten egg gas type of smell escaping coming from the Veolia Bioreactor. Smell is extremely invasive when it gets into the house and odour does not shift. Odour worse in the evening and early morning."	Not specified	The Woodlawn Facilities Manager is going to speak with the Complainant within the next week. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner
18/10/2015	8:30:00 PM	Letter	Roseview Road, Tarago	The Complainant stated the odour was "strong"	Not specified	Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner
18/10/2015	10:15:00 PM	Letter	Braidwood Road, Tarago	The Complainant described the odour as 'unbearable'	1 hour	The Woodlawn Facilities Manager is going to speak with the Complainant within the next week. Veolia will continue to maintain the landfill and extract produced gases in an efficient and compliant manner

MECHANICAL EVAPORATOR OPERATIONAL PROTOCOL WOODLAWN BIOREACTOR

Mechanical Evaporator Operation Protocol
Woodlawn Bioreactor

Protocol Objective

This protocol outlines the specific operational requirements for use of mechanical evaporation units to assist in evaporating leachate that has been treated through the onsite leachate treatment system.

Background

Veolia utilise mechanical evaporation to assist in volume reduction of leachate onsite. These units are a critical part of the leachate treatment infrastructure in order to meet the zero discharge conditions under the site Environment Protection Licence 11436 – Condition L1.3. In order to maintain sufficient freeboard in onsite storage dams, mechanical evaporation is required.

Mechanical evaporators (shown below) operate by pumping liquid to a unit, where the liquid is blown through a misting fan and is then dispersed through a chute into the atmosphere. Moisture loss is increased through the phase transition of liquid water to water vapor (evaporation).

Figure 1: Evaporator units in action

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Veolia Operating Protocol

The following set of conditions will need to be satisfied in order to operate the evaporators. These conditions apply to all evaporators, as defined in Figure 2.

1. Evaporation must only be undertaken on leachate that has been treated through a leachate treatment system.

   Under no circumstances is untreated leachate to be pumped into evaporators. All leachate pumped from the waste must first pass through the leachate treatment system prior to storage in the ED3 storage dam system.

2. If monitoring results indicate that leachate treatment targets are not being achieved, any evaporators operating must cease immediately.

   Recommencement of the evaporators from the direct discharge pond will occur once monitoring results indicate that the leachate treatment targets are being achieved.

3. Automated control of the evaporators will be dictated by current weather conditions, specifically wind direction, wind speed and relative humidity.

   Operation of the evaporators is automated by onsite sensors which records, wind speed and wind direction. Veolia have the evaporator units set up to operate under the following conditions

   - Wind direction – Must be directing any spray back over the dams (the actual direction will depend on the location of the evaporators and will be controlled by the onsite weather station).
   - Wind Speed – Must be more than 0.2m/s

   If weather conditions do not meet the criteria specified, then the evaporators will automatically switch off. Once favourable weather conditions return, the evaporators will automatically recommence operation. The automation is based on a timer, where the parameters must reach these criteria before switching on/off.

4. The evaporators must not be run under any circumstances while works adjacent to the ED3 System are being undertaken.

   Veolia will switch control from “automated” to “off” whilst any works are being undertaken in the vicinity of the evaporators. Control will be switched back to automated when works are complete unless otherwise agreed.

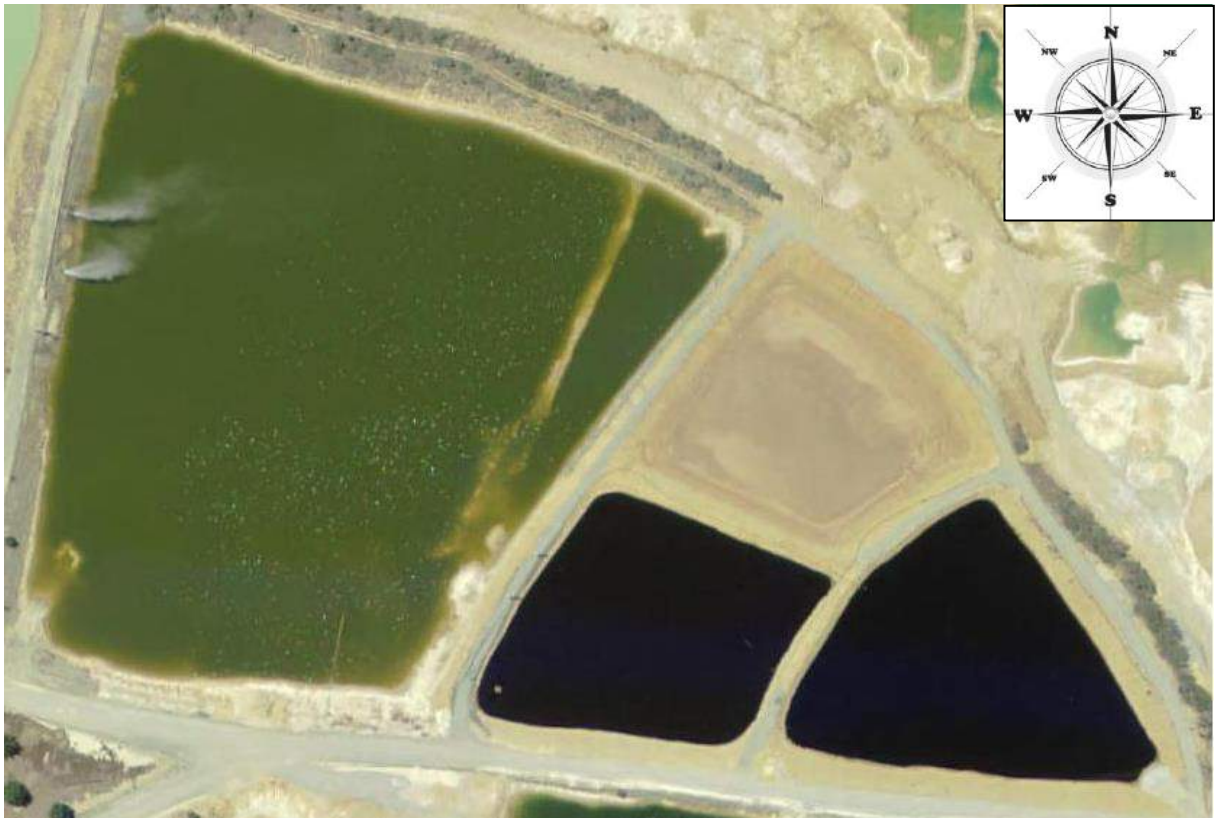


Figure 2 – Woodlawn ED3 North system

RECEIVED WASTE TONNAGE -

DECEMBER 2015 – FEBRUARY 2017

	Waste received (tonne)
2015-12	48623.6
2016-01	52427.6
2016-02	47509.5
2016-03	51587.5
2016-04	47522.2
2016-05	46246.4
2016-06	48033.8
2016-07	44145.3
2016-08	50561.3
2016-09	48471.4
2016-10	48376.1
2016-11	52327.4
2016-12	63973.9
2017-01	56904.3
2017-02	56638.9

EVAPORATION DATA SUPPLIED BY VEOLIA:

MAY 2007 TO JUNE 2012

Evaporation	2006								2006				2007					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	5.60	6.80	5.00	3.00	1.50	1.41
2	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	2.20	2.60	4.80	3.60	2.40	1.04
3	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	2.60	5.00	3.80	3.80	3.19	1.16
4	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	5.00	6.40	7.60	2.80	4.52	1.30
5	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	6.80	7.40	6.60	3.00	2.68	0.69
6	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.20	8.20	3.60	4.60	2.52	1.00
7	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.60	7.00	5.00	2.40	2.43	0.67
8	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	5.80	4.60	3.60	1.40	1.87	0.83
9	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	6.60	6.80	5.00	2.40	1.37	0.48
10	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.40	5.20	4.80	2.00	1.41	0.73
11	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.60	3.60	5.40	3.20	1.48	1.24
12	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	11.40	2.20	7.00	3.60	1.74	0.77
13	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	13.40	3.80	3.60	2.60	2.19	1.23
14	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.40	4.40	2.80	3.00	1.51	1.02
15	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.80	5.80	4.80	3.60	2.03	0.43
16	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.40	6.20	6.20	4.00	2.09	0.64
17	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.80	3.80	4.60	2.80	1.47	0.84
18	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.20	5.60	2.40	3.40	1.49	0.75
19	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	6.00	1.60	2.00	3.80	0.72	0.63
20	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.60	3.60	0.20	2.20	1.53	0.43
21	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	11.00	6.80	2.20	2.60	2.14	1.13
22	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.40	7.40	3.40	2.60	2.21	1.12
23	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.60	5.60	4.40	2.60	1.69	1.35
24	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	9.40	5.20	4.80	1.80	1.59	1.11
25	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	7.20	4.60	4.00	0.60	1.81	1.16
26	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.00	4.20	2.60	1.20	1.75	0.57
27	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	12.40	3.60	2.80	2.40	1.56	0.27
28	6.40	5.40	4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	10.60	3.00	2.80	1.40	2.20	0.42
29	8.20		4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.80		4.20	1.40	1.75	0.79
30	8.20		4.10	2.60	1.70	1.10	1.20	1.90	2.80	3.90	5.00	6.20	8.00		3.00	1.80	2.65	1.27
31	8.20		4.10		1.70		1.20	1.90		3.90		6.20	10.00		3.40		1.24	
Total Month	**203.8**	**151.2**	**127.1**	**78**	**52.7**	**33**	**37.2**	**58.9**	**84**	**120.9**	**150**	**192.2**	**246.8**	**141**	**126.4**	**79.6**	**60.68**	**26.47**
Accumulated Year	**204**	**355**	**482.1**	**560.1**	**612.8**	**645.8**	**683**	**741.9**	**825.9**	**946.8**	**1096.8**	**1289**	**246.8**	**387.8**	**514.2**	**593.8**	**654.48**	**681**

Evaporation data recorded from the Goulburn Tafe W

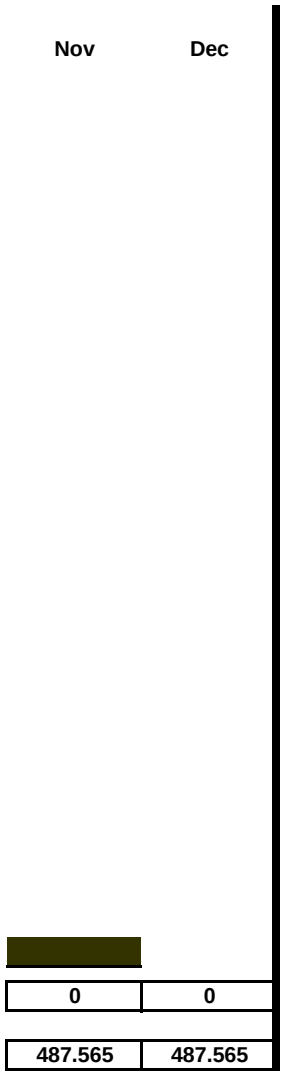
						2008												2009	
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1.21	1.13	4.17	4.49	2.73	2.82	7.058	4.079	4.42	3.876	2.082	1.889	2.563	2.158	1.339	3.822	8.25	5.487	6.915	7.353
0.82	1.27	2.87	5.04	4.66	2.286	7.126	2.908	4.566	3.485	1.918	0.485	1.146	0.953	2.667	4.838	2.408	7.579	8.11	6.754
1.21	2.29	3.26	5.41	4.31	5.675	7.446	4.000	4.257	5.316	1.977	0.828	1.139	1.469	2.828	6.486	3.711	6.729	6.339	6.712
1.75	0.94	2.94	8.39	1.49	4.147	2.006	4.788	4.536	2.663	2.314	0.46	1.32	1.967	1.616	6.588	3.963	6.955	5.254	5.055
1.18	1.59	2.46	5.05	3.30	4.956	7.4	1.496	4.274	3.13	2.225	0.771	0.847	1.659	1.006	1.318	5.035	5.046	6.369	4.618
0.72	1.67	1.44	5.48	2.40	1.109	6.6	1.512	4.457	3.239	2.423	0.76	1.387	1.263	1.288	2.328	3.928	5.442	8.86	6.982
1.06	1.65	1.87	5.68	4.5	4.2	6.883	4.498	5.111	2.656	2.177	1.026	1.22	1.656	1.162	3.205	6.31	7.507	8.46	7.344
1.02	1.71	1.38	3.90	2.097	3.395	6.251	3.381	3.829	2.231	2.323	1.351	1.312	1.147	2.65	3.387	3.199	6.765	8.21	8.81
0.70	2.11	1.61	3.89	2.106	4.31	6.6	2.689	4.053	1.712	2.209	0.5	1.227	1.663	2.508	4.196	3.801	6.172	3.146	8.3
0.90	2.39	2.04	3.91	2.929	6.974	5.175	2.861	4.623	1.81	2.056	1.211	0.51	1.35	3.038	4.017	5.71	6.895	4.802	2.73
1.19	3.15	2.55	4.12	4.648	3.645	6.945	4.415	4.768	2.685	2.026	0.588	0.875	0.664	2.896	4.264	5.541	3.662	4.78	1.038
1.44	3.09	1.69	4.89	5.543	1.426	7.747	4.853	4.954	3.052	1.296	0.865	1.079	1.452	3.56	3.963	5.464	1.874	4.981	4.292
1.09	2.27	2.29	3.87	5.421	5.00	5.179	3	4.862	2.614	1.532	1.672	1.215	1.511	4.341	4.769	6.244	0.951	4.415	1.801
1.02	1.69	3.53	4.15	6.033	4.40	7.447	1.161	4.992	2.11	1.757	1.089	1.621	1.801	5.149	4.463	6.274	4.303	6.69	3.05
0.86	1.02	4.08	4.78	6.794	5.362	1.344	3.54	4.861	2.854	1.874	1.572	2.064	1.693	2.177	1.793	6.243	3.726	9	2.4
1.06	1.08	3.46	6.31	6.455	5.385	6.369	5.299	5.892	2.901	1.997	1.141	1.281	1.726	4.05	3.63	6.192	5.567	9.69	2.225
1.04	1.87	3.82	7.67	5.901	0.933	4.194	5.042	4.894	2.611	1.468	0.794	1.247	1.834	2.663	4.097	4.685	6.225	7.435	3.11
1.34	0.82	2.25	4.52	6.297	4.659	4.4	4.186	4.841	1.902	1.245	1.042	1.28	2.186	2.098	4.755	5.378	3.919	6.079	2.313
1.30	0.95	3.21	4.95	5.31	4.40	2.054	4.73	5.056	2.09	1.432	1.056	1.051	1.361	3.326	4.845	3.55	4.689	6.418	3.187
1.52	0.78	4.30	5.30	6.444	2.116	1.72	4.48	2.672	1.27	1.881	0.842	1.652	2.009	4.809	5.672	2.603	5.48	7.43	5.529
1.49	0.94	1.92	5.45	6.425	1.79	3.779	5.237	4.843	1.596	1.602	0.297	1.258	2.209	5.661	4.572	3.418	4.656	7.28	3.265
1.15	1.14	3.13	7.20	6.425	5.306	2.357	2.445	1.335	2.494	1.74	1.192	1.394	2.44	4.423	3.561	5.702	5.765	7.637	4.303
0.78	0.88	3.23	6.92	0.573	2.921	4.681	5.397	1.763	1.229	1.673	1.271	1.551	1.138	4.422	3.28	2.389	6.683	5.991	3.535
1.51	1.16	3.62	4.15	1.268	4.309	5.547	6.058	3.212	2.211	1.193	1.118	1.17	1.594	2.527	3.602	2.16	3.337	6.481	4.391
1.60	1.70	4.87	1.97	2.786	4.859	6.208	5.649	1.777	1.685	1.456	1.126	1.146	2.284	2.461	4.178	5.332	1.37	7.481	6.763
1.99	2.03	4.68	1.29	5.691	5.20	4.636	4.078	0.872	1.569	1.499	1.623	1.547	2.553	3.68	5.96	4.286	6.181	4.449	5.653
1.86	2.98	3.07	2.36	4.37	6.216	6.022	5.26	2.734	3.338	1.253	1.242	1.2	2.669	4.221	5.949	3.299	7.006	6.364	5.124
1.30	3.73	3.92	4.32	6.6	3.844	6.413	3.85	3.058	2.642	1.484	1.607	0.866	2.212	5.675	8	5.683	4.365	4.688	4.802
1.73	4.86	5.73	4.75	5.35	6.515	5.972	0.894	2.139	1.338	1.37	1.198	1.235	1.744	6.15	5.297	3.178	5.461	6.868	[redacted]
1.18	3.51	3.62	5.87	3.106	6.941	6.752	[redacted]	3.646	2.208	1.425	1.927	1.503	1.283	3.495	1.819	5.458	7.121	7.29	[redacted]
1.56	3.98	[redacted]	5.56	[redacted]	7.736	6.868	[redacted]	3.861	[redacted]	1.726	[redacted]	1.703	2.13	[redacted]	5.019	[redacted]	6.405	7.182	[redacted]
38.56	**60.372**	**92.97**	**151.606**	**131.946**	**132.835**	**169.179**	**111.786**	**121.158**	**74.517**	**54.633**	**32.543**	**40.609**	**53.778**	**97.886**	**133.673**	**139.394**	**163.323**	**205.09**	**131.44**
719.5	**779.88**	**872.8**	**1024.45**	**1156.4**	**1289.23**	**169**	**280.965**	**402.123**	**476.64**	**531.273**	**563.816**	**604.425**	**658.203**	**756.089**	**889.762**	**1029.16**	**1192.48**	**205**	**336.533**

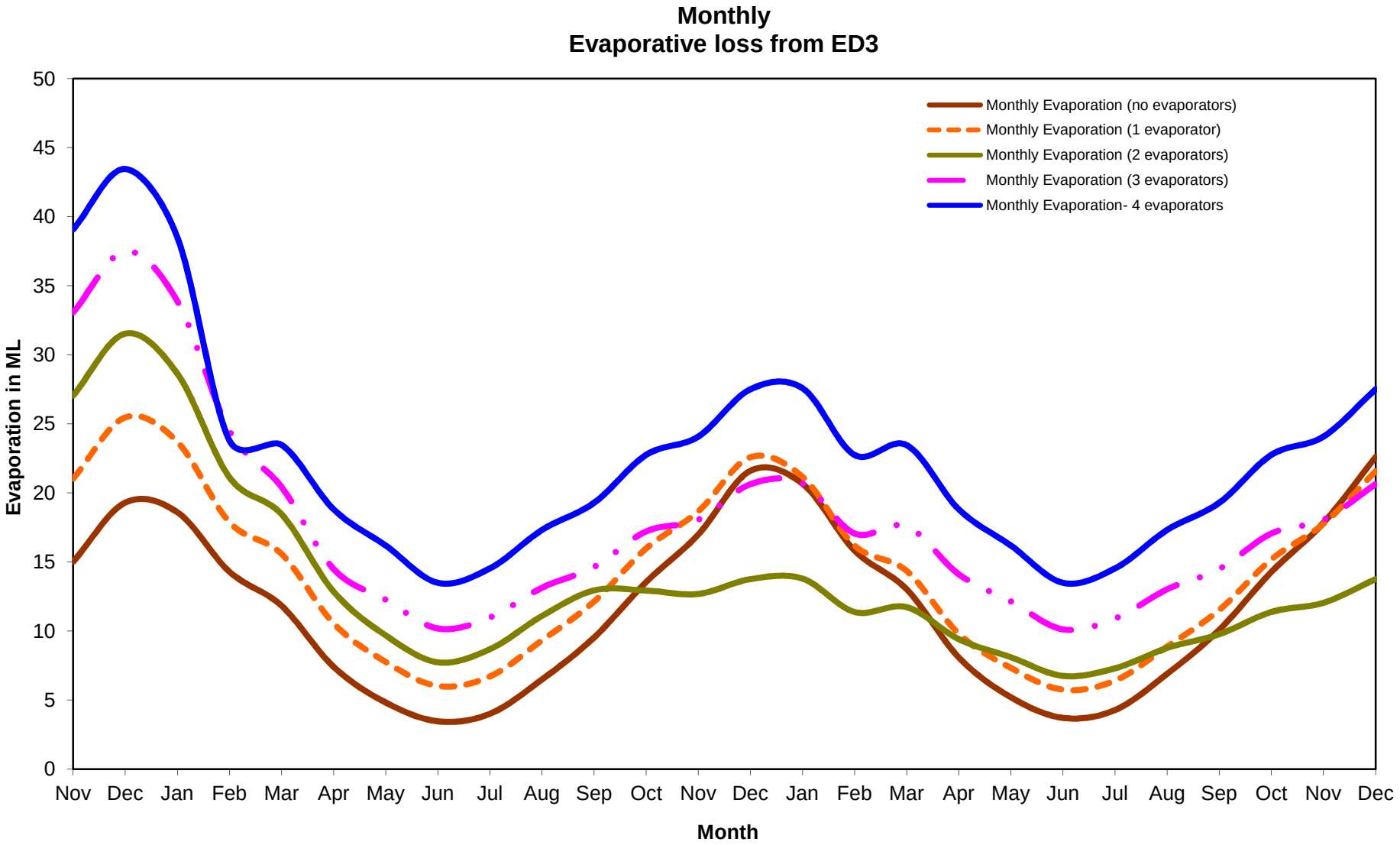
eather Station

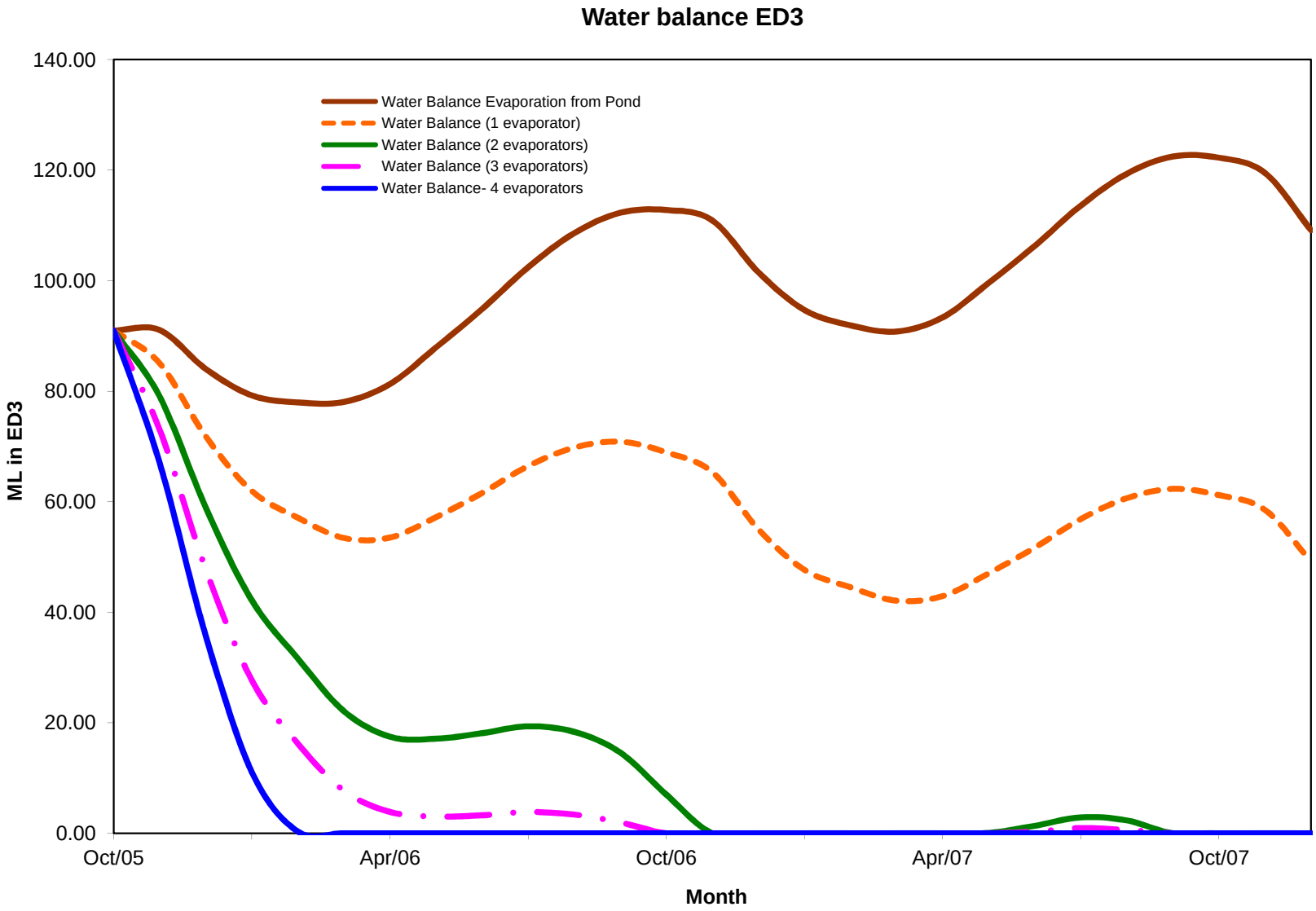
										2010					
Mar	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
6.917	2.423	1.755	1.077	1.847	1.551	1.984	4.057	4.662	2.028	3.998	5.099	3.148	2.332	1.695	0.878
4.472	1.71	2.372	0.801	1.384	1.814	2.912	6.426	5.645	5.513	6.6	6.074	1.88	3.354	1.916	1.125
3.878	1.453	1.88	0.787	1.089	1.202	2.841	1.895	5.112	5.577	4.735	5.207	2.762	2.975	2.831	1.087
3.498	3.908	2.072	0.56	1.165	2.058	1.365	0.766	7.929	7.173	4.158	3.146	3.891	2.655	1.683	0.855
5.725	2.928	2.129	0.701	1.104	1.529	2.454	1.152	5.29	6.583	4.044	3.664	4.055	2.152	2.958	0.907
4.923	3.621	1.981	1.211	1.493	1.623	3.174	2.186	1.641	6.23	5.176	2.508	1.321	3.063	1.433	1.303
4.612	2.546	2.117	1.313	0.921	1.996	3.339	2.677	2.032	6.638	7.148	2.434	3.007	1.81	2.05	1.055
4.945	2.97	2.058	0.786	1.202	2.192	1.115	1.318	4.208	7.695	3.889	1.551	1.534	1.5	1.903	1.346
2.91	3.12	1.763	1.105	0.611	2.206	2.108	3.38	5.156	7.358	5.272	1.77	3.112	3.291	1.955	1.332
3.338	3.284	2.182	0.895	0.771	1.865	1.68	2.502	6.205	4.17	7.378	5.177	3.092	2.66	1.906	0.827
3.617	1.841	1.215	1.285	0.927	1.887	2.787	2.709	6.607	6.303	7.771	4.201	2.743	3.463	2.485	1.431
4.376	2.073	1.848	1.049	0.982	1.502	3.644	2.501	6.865	6.729	7.485	6.063	3.919	3.058	3.087	1.381
3.763	2.514	1.946	0.691	2.192	1.643	5.067	1.654	6.934	7.03	9.3	4.934	2.812	3.207	1.911	1.201
1.961	0.469	2.119	1.578	1.559	2.055	6.87	3.239	4.736	6.693	5.012	0.81	3.277	2.865	2.033	1.074
3.811	1.969	1.581	1.521	0.818	1.996	2.964	2.22	6.605	3.489	2.788	0.918	2.577	3.386	1.734	1.141
4.779	4.187	1.602	1.015	1.049	2.365	3.78	2.346	5.514	6.185	3.759	3.496	3.634	2.66	1.728	1.179
4.66	3.699	1.789	0.784	1.013	3.062	3.287	3.11	7.546	8	3.442	4.03	4.26	2.696	1.379	1.443
4.282	2.983	1.842	1.059	1.434	2.581	3.727	3.306	5.807	11.73	6.841	5.162	4.197	2.758	0.917	0.864
4.783	2.608	1.432	1.027	1.474	2.222	2.763	3.298	5.604	1.331	4.313	4.24	4.181	2.507	1.724	1.379
3.871	1.738	1.076	1.456	1.814	2.725	3.061	4.18	6.838	6.966	6.507	3.96	3.73	2.511	1.701	0.776
4.548	1.094	1.284	1.107	2.203	2.918	3.498	5.517	8	3.649	7.994	4.726	4.999	2.921	0.885	1.32
4.535	1.638	1.287	0.589	2.459	1.673	3.687	5.776	4.833	7.337	7.766	6.52	4.999	2.688	1.165	1.185
4.201	1.488	0.719	1.161	2.013	2.523	2.501	4.272	6.697	6.719	9.95	6.017	3.975	2.918	1.664	0.491
5.067	1.991	1.288	0.863	0.761	2.127	1.283	5.039	0.884	7.524	9.65	5.734	4.213	3.392	1.157	1.154
6.118	1.73	1.478	0.824	1.547	1.984	3.13	5.359	1.841	8.85	4.516	4.929	3.705	1.498	0.839	0.983
5.434	1.438	1.413	1.087	1.784	2.257	4.556	1.522	6.292	0.754	6.134	4.726	4.034	2.387	0.64	1.076
3.611	1.52	0.777	0.838	0.859	2.071	1.988	1.903	5.591	0.895	7.369	4.487	4.923	2.272	0.491	0.995
2.982	1.68	1.037	1.244	1.546	3.473	1.579	2.641	4.326	3.024	6.039	4.945	4.015	1.531	0.891	1.21
3.861	1.917	0.689	0.798	1.562	4.048	2.576	4.087	8.2	4.501	3.961	[redacted]	4.129	2.867	1.166	1.24
4.352	1.667	0.843	0.898	1.621	1.767	3.663	2.571	3.657	6.765	6.124	[redacted]	1.592	2.643	0.628	1.417
2.855	[redacted]	0.777	[redacted]	1.283	2.321	[redacted]	5.037	[redacted]	6.318	3.125	[redacted]	0.785	[redacted]	0.27	[redacted]
132.69	**68.21**	**48.35**	**30.11**	**42.49**	**67.24**	**89.38**	**98.65**	**161.26**	**179.76**	**182.24**	**116.53**	**104.50**	**80.02**	**48.83**	**33.66**
469.218	**537.425**	**585.776**	**615.886**	**658.373**	**725.609**	**814.992**	**913.638**	**1074.895**	**1254.652**	**182**	**298.77**	**403.27**	**483.29**	**532.12**	**565.77**

						2011							
Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**
1.268	1.296	2.57	3.375	4.13	1.186	7.051	7.012	2.274	1.106	1.672	0.987	1.048	1.254
1.044	1.432	3.342	2.595	1.913	1.338	7.866	9.26	4.678	3.107	1.878	1.056	0.911	2.284
0.452	1.033	0.811	2.4	2.259	3.215	3.502	5.421	3.477	3.304	0.655	1.016	1.027	1.942
1.215	1.468	1.109	1.091	4.22	2.258	0.963	3.908	5.296	3.294	1.914	1.53	1.616	3.34
1.111	1.031	0.862	2.602	1.355	3.228	2.593	2.614	5.187	3.215	2.064	0.861	1.293	3.226
1.077	1.714	1.645	4.097	1.948	4.476	5.333	6.545	3.419	1.963	2.11	1.51	1.004	3.188
0.573	1.737	1.99	3.927	2.165	3.351	3.727	1.692	3.268	1.802	1.676	1.527	0.864	1.604
1.348	1.679	2.243	3.864	4.228	5.486	3.458	4.228	4.416	2.223	2.087	1.093	1.247	1.912
1.326	1.577	2.275	3.793	4.414	4.11	4.247	3.948	4.142	3.183	2.375	0.862	1.228	0.946
0.814	1.94	1.779	2.713	3.68	1.728	2.307	3.324	3.978	3.395	1.6	1.092	1.16	1.769
0.855	0.94	2.288	2.238	3.89	4.773	2.736	4.659	1.385	1.308	2.051	1.078	1.079	1.23
0.7	0.917	1.423	2.36	5.513	5.854	1.677	2.874	1.6	2.148	1.193	1.34	1.41	0.462
1.493	0.976	1.389	3.446	5.371	5.957	4.233	2.073	3.28	1.747	1.684	0.956	1.458	1.427
0.631	2.024	1.307	1.812	6.154	5.745	3.408	1.502	4.49	1.923	1.434	0.744	0.815	1.582
1.03	1.39	0.437	3.58	3.953	4.113	3.981	4.138	0.749	2.724	1.743	0.804	1.333	1.771
1.381	1.588	1.027	1.264	1.957	6.395	5.885	3.005	2.157	2.568	1.959	0.557	1.19	1.495
1.225	1.2	3.789	2.281	4.89	3.684	6.391	1.15	2.357	2.236	1.344	0.813	0.589	1.994
1.302	1.883	2.998	3.349	4.525	5.331	7.255	3.479	1.534	2.029	1.467	1.074	1.178	0.561
1.433	1.683	2.743	3.847	6.084	3.731	5.497	2.893	0.69	2.608	1.735	1.222	0.831	0.867
0.826	1.684	2.645	3.02	2.109	3.686	4.004	3.746	1.547	2.338	1.71	1.208	0.475	0.819
1.377	1.882	2.91	3.964	5.642	2.636	4.759	4.729	1.814	1.341	1.56	1.517	1.369	0.957
1.379	1.539	3.202	4.17	6.288	5.074	6.263	4.947	0.758	2.355	1.738	0.914	0.853	1.532
1.336	2.092	2.737	4.903	5.996	5.285	4.855	4.657	3.055	2.246	1.803	0.864	0.721	1.235
1.201	1.533	2.271	3.476	4.515	6.343	6.291	4.763	2.44	2.209	0.854	1.412	1.208	1.695
1.573	1.865	3.718	2.227	5.96	2.143	5.118	4.651	2.026	2.329	1.129	1.207	0.621	2.437
1.431	1.816	2.922	2.794	5.9	5.442	6.436	4.057	3.047	1.251	1.797	1.25	0.674	3.024
1.326	1.186	4.061	4.945	4.33	3.951	7.204	5.033	2.824	1.474	1.694	1.653	1.431	3.163
1.452	1.803	3.858	4.318	5.672	3.478	6.509	2.284	2.365	1.764	1.191	1.369	1.506	2.636
0.515	2.243	3.876	3.221	1.734	5.219	5.086	[redacted]	3.328	1.206	1.303	0.969	2.089	2.91
0.838	2.186	3.174	4.233	1.189	6.065	5.724	[redacted]	2.678	1.313	1.275	0.918	2.003	2.894
0.86	1.966	[redacted]	4.17	[redacted]	6.422	6.781	[redacted]	3.709	[redacted]	0.946	[redacted]	2.083	1.518
34.39	**49.30**	**71.40**	**100.08**	**121.98**	**131.70**	**151.14**	**112.592**	**87.968**	**65.709**	**49.641**	**33.403**	**36.314**	**57.674**
600.17	**649.47**	**720.87**	**820.94**	**942.93**	**1074.63**	**151.14**	**263.732**	**351.7**	**417.409**	**467.05**	**500.453**	**536.767**	**594.441**

				2012									
Sep	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
2.471	2.435	4.777	2.325	5.891	5.284	0.9	3.54	1.227	1.373	1.384			
2.241	1.588	4.316	4.913	6.209	2.501	1.154	2.845	2.177	0.793	0.822			
2.59	1.69	3.187	3.823	6.572	0.926	0.938	2.605	1.285	0.278	1.289			
3.132	3.258	2.896	5.667	7.179	1.351	0.919	3.164	2.134	0.594	1.277			
3.208	3.717	5.035	2.502	3.869	5.308	1.289	2.861	1.909	1.126				
2.879	2.781	6.021	4.276	5.369	6.111	4.487	2.241	1.845	0.44				
3.472	1.184	5.481	2.521	4.112	3.608	2.485	3.182	1.434	1.351				
2.624	1.667	4.105	4.129	6.458	1.226	1.009	3.775	1.077	1.279				
2.148	2.349	3.484	1.996	2.415	1.754	1.291	3.02	2.012	1.112				
1.354	2.354	4.679	5.002	6.068	2.106	3.155	2.901	2.752	1.18				
2.113	3.671	3.949	4.417	5.436	4.055	4.215	2.367	3.317	1.241				
1.992	2.976	4.623	3.436	3.858	2.691	3.676	2.476	2.556	0.629				
3.06	3.96	5.283	2.506	5.435	3.405	1.858	2.471	2.095	0.589				
2.947	3.783	4.932	2.187	6.049	3.371	3.285	2.797	1.384	1.253				
3.867	2.61	7.31	4.185	2.996	4.062	2.97	1.622	1.75	1.101				
3.495	3.47	6.555	5.44	2.083	4.704	4.013	2.658	1.504	1.735				
4.641	4.797	1.852	2.785	4.367	5.012	3.449	2.979	1.687	0.388				
4.808	4.456	4.183	5.786	5.552	3.774	2.386	1.349	1.343	1.027				
5.481	4.215	5.886	3.902	6.141	3.874	3.566	1.094	1.883	1.354				
5.343	4.925	7.084	1.302	6.487	4.644	2.513	2.241	1.763	1.264				
2.999	5.604	2.288	4.018	4.825	2.77	3.803	2.089	0.999	1.125				
3.491	5.794	4.966	2.69	4.856	4.255	4.005	1.749	1.613	1.895				
4.132	4.353	1.416	4.248	4.142	3.313	1.574	1.236	2.124	0.979				
5.552	5.458	2.959	5.868	3.036	4.821	3.37	2.224	2.66	1.068				
0.677	6.477	1.808	6.049	4.872	5.508	3.169	1.13	1.581	1.355				
1.441	0.997	0.889	6.216	2.176	5.785	2.475	0.934	1.061	1.264				
2.871	1.547	4.708	2.701	3.709	2.374	3.162	1.885	0.925	0.88				
3.301	2.761	4.889	4.081	2.485	2.673	1.564	1.73	1.416	0.587				
1.057	4.003	5.752	4.757	4.831	1.274	1.226	2.061	0.983	1.278				
1.649	2.008	5.654	6.255	5.77	[redacted]	3.304	1.868	1.428	1.283				
[redacted]	4.498	[redacted]	3.977	2.548	[redacted]	3.262	[redacted]	1.146	[redacted]			[redacted]	
91.036	**105.386**	**130.967**	**123.96**	**145.796**	**102.54**	**80.472**	**69.094**	**53.07**	**31.821**	**4.772**	**0**	**0**	**0**
685.477	**790.863**	**921.83**	**1045.79**	**145.796**	**248.336**	**328.808**	**397.902**	**450.972**	**482.793**	**487.565**	**487.565**	**487.565**	**487.565**


Nov
Dec
0
0
487.565
487.565


Monthly
Evaporative loss from ED3
Monthly Evaporation (no evaporators)
Monthly Evaporation (1 evaporator)
Monthly Evaporation (2 evaporators)
Monthly Evaporation (3 evaporators)
Monthly Evaporation- 4 evaporators
Evaporation in ML
0
5
10
15
20
25
30
35
40
45
50
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Month


Water balance ED3
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
ML in ED3
Water Balance Evaporation from Pond
Water Balance (1 evaporator)
Water Balance (2 evaporators)
Water Balance (3 evaporators)
Water Balance- 4 evaporators
Oct/05
Apr/06
Oct/06
Apr/07
Oct/07
Month

	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
	30	31	31	28	31	30	31	30	31	31	30	31	30	31	31	28	31	30	31	30	31	31	30	31	30	31
	58.7	46.1	59.8	51.2	55.6	49.3	47.5	37.9	52.4	47.6	65.2	61.9	58.7	46.1	59.8	51.2	55.6	49.3	47.5	37.9	52.4	47.6	65.2	61.9	58.7	46.1
	1.9	1.5	1.9	1.8	1.8	1.6	1.5	1.3	1.7	1.5	2.2	2.0	1.9	1.5	1.9	1.8	1.8	1.6	1.5	1.3	1.7	1.5	2.2	2.0	1.9	1.5
Average Monthly Pan Evaporation (mm- total)	0.1725	0.22165	0.2232	0.1778	0.1488	0.093	0.0589	0.0405	0.04495	0.06975	0.099	0.13795	0.1725	0.22165	0.2232	0.1778	0.1488	0.093	0.0589	0.0405	0.04495	0.06975	0.099	0.13795	0.1725	0.22165
Estimated monthly evaporation (M3) attributed to 1 evaporator (350 l/min)	6019	6875	6895	5686	5862	4701	4046	3371	3632	4330	4820	5687	6019	6875	6895	5686	5862	4701	4046	3371	3632	4330	4820	5687	6019	6875
Estimated monthly evaporation (M3) attributed to 2 evaporators (350 l/min)	12037	13751	13789	11372	11725	9402	8093	6742	7264	8659	9640	11375	12037	13751	13789	11372	11725	9402	8093	6742	7264	8659	9640	11375	12037	13751
Estimated monthly evaporation (M3) attributed to 3 evaporators (350 l/min)	18056	20626	20684	17058	17587	14103	12139	10113	10895	12989	14460	17062	18056	20626	20684	17058	17587	14103	12139	10113	10895	12989	14460	17062	18056	20626
Estimated monthly evaporation (M3) attributed to 4 evaporator(s) (350 l/min)	24075	27502	27578	22744	23449	18804	16186	13484	14527	17318	19280	22750	24075	27502	27578	22744	23449	18804	16186	13484	14527	17318	19280	22750	24075	27502
Estimated Evaporation (M3) attributed to surface evaporation (no evaporator)	15006.3	19291.2	18596.0	14286.3	11827.1	7397.5	4816.0	3457.6	4001.9	6488.1	9529.3	13544.4	16982.3	21601.0	20657.1	15814.9	13016.6	8081.2	5197.2	3706.7	4272.1	6895.5	10083.4	14273.9	17829.0	22594.3
Estimated Evaporation (M3) attributed to surface evaporation (1 evaporator)	15006.3	18586.8	16798.5	12188.2	9715.6	5845.2	3705.0	2647.1	3070.1	4994.2	7313.1	10292.7	12643.1	15705.6	14263.7	10500.7	8482.3	5096.7	3274.3	2374.8	2773.1	4542.8	6698.9	9492.6	11738.3	14684.1
Estimated Evaporation (M3) attributed to surface evaporation (2 evaporator)	15006.3	17777.3	14847.0	9755.6	6725.4	3443.3	1581.8	988.8	1414.3	2427.2	3296.7	1550.3	643.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	32.2	107.1	123.3	0.0	0.0	0.0
Estimated Evaporation (M3) attributed to surface evaporation (3 evaporator)	15006.3	16861.3	13193.4	7424.1	2837.6	382.6	121.3	65.6	78.0	143.4	178.4	144.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	35.5	30.9	0.0	0.0	0.0	0.0
Estimated Evaporation (M3) attributed to surface evaporation (4 evaporator(s))	15006.3	15950.5	10922.7	1049.4	25.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Evaporator evaporation as % of Surface Evaporation (1 evaporator)	40.1%	35.6%	37.1%	39.8%	49.6%	63.5%	84.0%	97.5%	90.8%	66.7%	50.6%	42.0%	35.4%	31.8%	33.4%	36.0%	45.0%	58.2%	77.9%	90.9%	85.0%	62.8%	47.8%	39.8%	33.8%	30.4%
Evaporator evaporation as % of Surface Evaporation (2 evaporators)	80.2%	71.3%	74.2%	79.6%	99.1%	127.1%	168.0%	195.0%	181.5%	133.5%	101.2%	84.0%	70.9%	63.7%	66.8%	71.9%	90.1%	116.3%	155.7%	181.9%	170.0%	125.6%	95.6%	79.7%	67.5%	60.9%
Evaporator evaporation as % of Surface Evaporation (3 evaporator(s))	120.3%	106.9%	111.2%	119.4%	148.7%	190.6%	252.1%	292.5%	272.3%	200.2%	151.7%	126.0%	106.3%	95.5%	100.1%	107.9%	135.1%	174.5%	233.6%	272.8%	255.0%	188.4%	143.4%	119.5%	101.3%	91.3%
Evaporator evaporation as % of Surface Evaporation (4 evaporator(s))	160.4%	142.6%	148.3%	159.2%	198.3%	254.2%	336.1%	390.0%	363.0%	266.9%	202.3%	168.0%	141.8%	127.3%	133.5%	143.8%	180.1%	232.7%	311.4%	363.8%	340.0%	251.2%	191.2%	159.4%	135.0%	121.7%
Evaporation from Pond	15006.33158	19291.2246	18595.96903	14286.305	11827.0785	7397.5361	4815.98473	3457.57676	4001.9273	6488.09051	9529.31306	13544.40844	16982.28	21600.97867	20657.05538	15814.9363	13016.6113	8081.18995	5197.22556	3706.71156	4272.10208	6895.50571	10083.4006	14273.9441	17829.0205	22594.3205
Incident Rainfall	10081.5	7243.5	8819.25	8027.25	6913.5	5626.5	6435	5395.5	6575.25	7656	8217	9050.25	10081.5	7243.5	8819.25	8027.25	6913.5	5626.5	6435	5395.5	6575.25	7656	8217	9050.25	10081.5	7243.5
Water Pumped In	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Initial Volume stored in ED3																										
Progressive Water Balance (no evaporators)	90976	91051	84003	79226	77967	78054	81283	87902	94840	102413	108581	112268	112774	110874	101516	94678	91891	90787	93333	99571	106259	113562	119323	122457	122233	119485	109135
Progressive RL of dam	789.09	789.02	788.96	788.95	788.95	788.99	789.06	789.13	789.21	789.27	789.31	789.31	789.29	789.20	789.13	789.10	789.09	789.11	789.18	789.25	789.32	789.38	789.41	789.41	789.38	789.27
Progressive Water Balance (1 evaporator)	90976	85032	71813	61939	57093	53428	53509	57192	61569	66443	69775	70859	68929	65349	55011	47672	44513	42082	42911	47025	51674	56845	60628	62327	61197	58521	49205
Progressive RL of dam	789.09	789.03	788.87	788.73	788.67	788.62	788.62	788.67	788.73	788.79	788.84	788.85	788.83	788.78	788.64	788.55	788.50	788.46	788.48	788.54	788.60	788.67	788.72	788.74	788.73	788.69	788.57
Progressive Water Balance (2 evaporators)	90976	79013	58919	42151	31618	22091	17471	17108	18114	19355	18358	14622	7005	0	0	0	0	0	0	68	1346	2885	2339	0	0	0	0
Progressive RL of dam	789.09	788.96	788.70	788.46	788.26	788.07	787.81	787.75	787.93	788.02	787.98	787.28	785.83	784.50	784.50	784.50	784.50	784.50	784.50	784.51	784.76	785.05	784.94	784.50	784.50	784.50	784.50
Progressive Water Balance (3 evaporators)	90976	72995	47751	27693	16238	7727	3868	3042	3259	3861	3385	1963	0	0	0	0	0	0	0	0	282	955	587	0	0	0	0
Progressive RL of dam	789.09	788.88	788.55	788.18	787.58	785.97	785.23	785.08	785.12	785.23	785.14	784.87	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.55	784.68	784.61	784.50	784.50	784.50	784.50
Progressive Water Balance- 4 evaporators	90976	66976	35767	11085	320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Progressive RL of dam	789.09	788.80	788.34	786.60	784.56	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50	784.50

	1/11/2005	1/12/2005	1/01/2006	1/02/2006	1/03/2006	1/04/2006	1/05/2006	1/06/2006	1/07/2006	1/08/2006	1/09/2006	1/10/2006	1/11/2006	1/12/2006	1/01/2007	1/02/2007	1/03/2007	1/04/2007	1/05/2007	1/06/2007	1/07/2007	1/08/2007	1/09/2007	1/10/2007	1/11/2007	1/12/2007
Monthly Evaporation (no evaporators)	15.006	19.291	18.596	14.286	11.827	7.398	4.816	3.458	4.002	6.488	9.529	13.544	16.982	21.601	20.657	15.815	13.017	8.081	5.197	3.707	4.272	6.896	10.083	14.274	17.829	22.594
Monthly Evaporation (1 evaporator)	21.025	25.462	23.693	17.874	15.578	10.546	7.752	6.018	6.702	9.324	12.133	15.980	18.662	22.581	21.158	16.187	14.345	9.798	7.321	5.746	6.405	8.872	11.519	15.180	17.757	21.560
Monthly Evaporation (2 evaporators)	27.044	31.528	28.636	21.127	18.450	12.845	9.675	7.731	8.678	11.086	12.937	12.925	12.681	13.751	13.789	11.372	11.725	9.402	8.093	6.744	7.296	8.766	9.763	11.375	12.037	13.751
Monthly Evaporation (3 evaporators)	33.063	37.487	33.877	24.482	20.425	14.485	12.261	10.179	10.973	13.132	14.638	17.207	18.056	20.626	20.684	17.058	17.587	14.103	12.139	10.113	10.902	13.024	14.491	17.062	18.056	20.626
Monthly Evaporation- 4 evaporators	39.081	43.452	38.501	23.793	23.475	18.804	16.186	13.484	14.527	17.318	19.280	22.750	24.075	27.502	27.578	22.744	23.449	18.804	16.186	13.484	14.527	17.318	19.280	22.750	24.075	27.502

Net pan evaporation (inches/month)	Percentage of volume pumped by evaporator	Net pan evaporation (inches/month)	Percentage of volume pumped by evaporator
1.5	20	7.0	40
2.0	28	7.5	41
2.5	29	8.0	42
3.0	30	8.5	43
3.5	32	9.0	44
4.0	34	9.5	45
4.5	35	10	46
5.0	36	10.5	47
5.5	37	11	48
6.0	38	11.5	49
6.5	39	12	50
7.0	40	12+	up to 85

Net pan evaporation	Percentage of volume pumped by evaporator (from manufacturer specifications)			
1.5	20%	38.1	21.8%	21.8%
2	28%	50.8	24.4%	24.4%
2.5	29%	63.5	26.7%	26.7%
3	30%	76.2	28.7%	28.7%
3.5	32%	88.9	30.5%	30.5%
4	34%	101.6	32.2%	32.2%
4.5	35%	114.3	33.8%	33.8%
5	36%	127	35.2%	35.2%
5.5	37%	139.7	36.6%	36.6%
6	38%	152.4	37.9%	37.9%
6.5	39%	165.1	39.1%	39.1%
7	40%	177.8	40.3%	40.3%
7.5	41%	190.5	41.4%	41.4%
8	42%	203.2	42.5%	42.5%
8.5	43%	215.9	43.5%	43.5%
9	44%	228.6	44.6%	44.6%
9.5	45%	241.3	45.5%	45.5%
10	46%	254	46.5%	46.5%
10.5	47%	266.7	47.4%	47.4%
11	48%	279.4	48.3%	48.3%
11.5	49%	292.1	49.1%	49.1%
12	50%	304.8	50.0%	50.0%
12+	up to 86			

STEPHENSON ENVIRONMENTAL STACK EMISSION SURVEY – GENERATOR NO. 1 TESTING REPORTS:

20 JULY 2016

Stephenson

Environmental Management Australia

COMPLIANCE TEST 2016 – GENERATOR NO.1

WOODLAWN BIOREACTOR LANDFILL

VEOLIA ENVIRONMENTAL SERVICES

TARAGO, NSW

PROJECT NO.:	**5656A/S24189A/16**
DATE OF SURVEY:	**2 JUNE 2016**
DATE OF ISSUE:	**24 JUNE 2016**
DATE OF RE-ISSUE:	**20 JULY 2016**

Stephenson

Environmental Management Australia

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COMPLIANCE TEST 2016 – GENERATOR NO.1

WOODLAWN BIOREACTOR LANDFILL

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TARAGO, NSW

PROJECT NO.: **5656A/S24189A/16**

DATE OF SURVEY: **2 JUNE 2016**

DATE OF ISSUE: **24 JUNE 2016**

DATE OF RE-ISSUE: **20 JULY 2016**

P W STEPHENSON

J WEBER

A NAGHIZADEH

A PRADHAN

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF APPENDIX TABLES

TABLE OF FIGURES – APPENDICES

1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Veolia Environmental Services (Veolia) to assess the emissions from one generator associated with the landfill gas power plant at their Woodlawn Bioreactor Landfill near Tarago, New South Wales (NSW).

The emission tests were undertaken on 2nd June, 2016 during normal operations on the stack connected to the engine serving Generator No.1, which was nominated by Veolia to be tested. An inlet gas sample was also collected during this emission test.

The landfill gas engine exhaust stack serving Engine/Generator set No.1 is referred to in the EPL as EPA Identification Point (ID) No.8 and the inlet fuel gas sampling point as EPA Identification Point (ID) No.5 referred to as "landfill gas input monitoring".

The objectives of the tests were to:

- Determine compliance of the concentration of emissions to be reported to the Environment Protection Authority (EPA) as specified in their Environment Protection Licence (EPL) No.11436. The EPA is now part of the Office of Environment and Heritage (OEH).
- Sample and analyse the inlet fuel gas which is supplying the engine that is having its emission monitored for compliance purposes.

The stack emission from EPA ID No. 8 was assessed for the following components:

- Exhaust flow, velocity, temperature and moisture
- Dry gas density
- Molecular weight of stack gases
- Oxygen (O_2)
- Carbon monoxide (CO)
- Carbon dioxide (CO_2)
- Hydrogen sulphide (H_2S)
- Oxides of nitrogen (NO_x) (as Nitrogen dioxide (NO_2))
- Sulphur dioxide (SO_2)
- Sulphur trioxide/sulphuric acid mist (SO_3/H_2SO_4)
- Volatile organic compounds (VOCs)

And, landfill gas input monitoring point (EPA ID No.5) was assessed for:

- CO_2, O_2 and VOCs, moisture and dry gas density;
- temperature and volumetric flow (collected from plant monitoring data due to WHS and access limitations to sampling point)

2 LICENCE AND REGULATORY LIMITS

The facility at Woodlawn is licensed by the NSW OEH under EPL No. 11436. Condition L2.4 of the EPL specifies concentration limits from the generator exhaust stack and Condition L3.5 specifies reference conditions. Table 2-1 summarises this and Tables 2-2 and 2-3 specify the monitoring requirements under the EPL for EPA ID Nos.8 and 5 respectively.

TABLE 2-1 CONCENTRATION EMISSION LIMITS & REFERENCE CONDITIONS EPA ID NO. 8 AS PER EPL 11436

Parameter	EPL Emission Limit	Reference Condition
Nitrogen Oxides	450 mg/m^3	Dry, 273 K,101.3, kPa, 7% O_2
Hydrogen Sulphide	5 mg/m^3	Dry, 273 K, 101.3 kPa
Sulphuric Acid Mist & Sulphur Trioxide	100 mg/m^3	Dry, 273 K, 101.3 kPa

TABLE 2-2 EMISSION MONITORING REQUIREMENTS EPA ID NO.8 AS PER EPL 11436

Pollutant	Units	Frequency	Test Method (TM)
Carbon Dioxide	%	Annual	TM-24
Carbon Monoxide	mg/m^3	Annual	TM-32
Dry Gas Density*	mg/m^3 (kg/m^3)	Annual	TM-23
Moisture content	%	Annual	TM-22
Molecular weight of stack gases	g/g mole	Annual	TM-23
Nitrogen Oxides	mg/m^3	Annual	TM-11
Oxygen	%	Annual	TM-25
Sulphur Trioxide/Sulphuric Acid Mist	mg/m^3	Annual	TM-3
Sulphur Dioxide	mg/m^3	Annual	TM-4
Temperature	^{o}C	Annual	TM-2
Velocity	m/s	Annual	TM-2
Volatile Organic Compounds	mg/m^3	Annual	TM-34
Volumetric Flow Rate	m^3/s	Annual	TM-2

Key:

%	=	percent
^{o}C	=	degrees Celsius
g/g mole	=	grams per gram mole
kg/m^3	=	kilograms per cubic metre
m/s	=	metres per second
m^3/s	=	cubic metres per second
mg/m^3	=	milligrams per cubic metre at 0^{o}C and 1 atmosphere and reference conditions

* Note: The unit for Dry Gas Density is normally reported in kilograms per cubic metre (kg/m^3) not milligrams per cubic metre (mg/m^3) as specified in EPL 11436.

TABLE 2-3 INPUT GAS MONITORING REQUIREMENTS EPA ID NO.5 AS PER EPL 11436

Pollutant	Units	Frequency	Test Method (TM)
Carbon Dioxide	%	Annual	TM-24
Dry Gas Density *	mg/m^3 (kg/m^3)	Annual	TM-23
Moisture content	%	Annual	TM-22
Oxygen	%	Annual	TM-25 (Note: EPL specifies TM-2)
Temperature	^oC	Annual	TM-2
Volatile Organic Compounds	mg/m^3	Annual	TM-34
Volumetric Flow Rate	m^3/s	Annual	TM-2

Key:

%	=	percent
^oC	=	degrees Celsius
kg/m^3	=	kilograms per cubic metre
m^3/s	=	cubic metres per second
mg/m^3	=	milligrams per cubic metre @ reference conditions specified in Condition L3.

* Note: The unit for Dry Gas Density is normally reported in kilograms per cubic metre (kg/m^3) not milligrams per cubic metre (mg/m^3) as specified in EPL 11436.

3 PRODUCTION CONDITIONS

Veolia Environmental Services personnel considered the landfill and the associated gas fired power plant to be operating under typical conditions on the day of testing.

Veolia Environmental Services provided the production records for the gas engine being monitored. A copy of these records is included in Appendix D.

4 EMISSION TEST RESULTS

4.1 INTRODUCTION

SEMA completed the sampling for all emission test parameters and the analysis of flow, temperature, moisture, velocity, dry gas density, molecular weight of stack gases, O_2, NO_x, SO_2, CO and CO_2. SEMA is NATA accredited for this sampling and analysis, Accreditation No. 15043. Refer to SEMA's Emission Test Report No. 5656, Appendix C, which includes a summary of results and the associated certificates of analysis.

The VOC sample collected by SEMA was analysed by the NATA accredited (NATA No. 3726) TestSafe Laboratories, Report No. 2016-1638.

Analysis for SO_3/H_2SO_4 and H_2S samples were performed by the NATA accredited (NATA No. 825) ALS Environmental, Report No. EN1602026.

The LFG sample was analysed by the NATA accredited (NATA No. 2901) Envirolab Services MPL Laboratories, Report No. 147856.

Test results are summarised in **Error! Reference source not found.** and etailed in Appendix A. Appendix B presents a graphical logged record of SO_2 and NO_x continuous emission analysis. Appendix E details the calibration of each instrument used to take measurements and the sample location is presented in Appendix F.

4.2 SULPHUR DIOXIDE (SO_2)

The measured SO_2 emission concentration averaged 72 milligrams per cubic metre (mg/m^3) for the one-hour sampling period.

4.3 OXIDES OF NITROGEN (NO_x)

The one-hour average NO_x (expressed as NO_2) emission concentration and corrected to 7% O_2 was 199 parts per million (ppm) 407 mg/m^3) during the sampling period, which is *in compliance* with the EPL NO_x limit of 450 mg/m^3.

4.4 OXYGEN (O_2), CARBON DIOXIDE (CO_2) & CARBON MONOXIDE (CO)

During the monitoring period, the emission concentrations averaged 9.5% for O_2, 9.3% for CO_2 and 898 mg/m^3 for CO.

4.5 SULPHUR TRIOXIDE/SULPHURIC ACID MIST (SO_3/H_2SO_4)

The SO_3/H_2SO_4 emission concentration measured was 18.9 mg/m^3 which is *in compliance* with EPL SO_3/H_2SO_4 limit of 100 mg/m^3.

4.6 HYDROGEN SULPHIDE (H_2S)

The H_2S emission concentration measured was below the limit of detection for the analytical method, thus was *in compliance* with EPL H_2S limit of 5 mg/m^3.

4.7 VOLATILE ORGANIC COMPOUNDS (VOCS)

The Protection of the Environment Operations (Clean Air) Regulation 2010 requires VOCs to be reported as n-propane equivalent. The total VOCs emission concentration (as n-propane equivalent) was less than 3.9 mg/m^3. Refer Appendix C for Certificate of Analysis.

TABLE 4-1 AVERAGE EMISSION CONCENTRATIONS TEST RESULTS EPA ID NO.8

Pollutant	Units	EPA ID No.8
Dry Gas Density	kg/m^3	1.33
Moisture content	%	4.7
Molecular weight of stack gases	g/g mole	29.9
Temperature	^oC	463
Velocity	m/s	47.8
Volumetric Flow Rate	m^3/s	1.64
Carbon Dioxide	%	9.3
Carbon Monoxide	mg/m^3	898
Hydrogen Sulphide	mg/m^3	< 0.35
Nitrogen Oxides @ 7% O_2	mg/m^3	407
Oxygen (O_2)	%	9.5
Sulphur Trioxide / Sulphuric Acid Mist	mg/m^3	18.9
Sulphur Dioxide	mg/m^3	72
Volatile Organic Compounds - (as n-propane equivalent)	mg/m^3	<3.9

Key:

<	=	less than
g/g mole	=	grams per gram mole
kg/m^3	=	kilograms per cubic metre
^oC	=	degrees Celsius
m/s	=	metres per second
%	=	percent
m^3/s	=	cubic metres per second
mg/m^3	=	milligrams per cubic metre at 0^oC (273 K) and 1 atmosphere

4.8 LANDFILL GAS (LFG)

Table 4-2 presents the gas composition of the LFG fuel supply to the engines as collected from EPA ID No.5, Landfill Gas Input Monitoring point.

TABLE 0-1 LANDFILL GAS INPUT MONITORING RESULTS – EPA ID NO.5

Parameter	Unit	LFG Supply(EPA ID 5)
VOC - Methane	%	57
VOC - Ethane	%	<0.01
VOC - Propane	%	<0.01
VOC - Iso-Butane	%	<0.01
VOC - Pentane	%	<0.01
Carbon Dioxide (CO_2)	%	39
Nitrogen (N_2)	%	4.9
Oxygen	%	1.2
Moisture (H_2O)	%	<0.5
Heat value (Superior)	Gj/m^3	0.02
Dry Gas Density	Milligrams per cubic metre as per EPL 11436. (Normally reported in Kilograms per cubic metre)	1,250,000 (1.25)
Volumetric Flow Rate	Cubic metres per hour	1814
Temperature	Degrees Celsius	2.4

Key:

%	=	percent
<	=	less than the detection limit for the analytical method
Gj/m^3	=	Giga joules per cubic metre

5 CONCLUSIONS

The following conclusion can be drawn from the compliance emission test work conducted on Generator No.1 at the Woodlawn Bioreactor Landfill Power Station:

- The engines are fired with landfill gas as the fuel;

- The emissions from Generator No.1 (EPA ID No.8) complied with the EPL 11436 100 percentile emission concentration limits for NO_x, SO_3/H_2SO_4 and H_2S;

- The composition of the landfill fuel gas input used to supply the engines consisted of:

    - Major VOC component was methane at 57% by volume;

    - other short chain VOCs (including ethane, propane, iso-butane and pentane) were each less than 0.01% by volume;

    - CO_2 - 39% by volume;
    - Oxygen - 1.2% by volume;
    - Nitrogen - 4.9% by volume; and,
    - Moisture - 0.5% by volume.

- Heat value of this landfill gas fuel was calculated from the above fuel gas analysis and determined to be 0.02 Gj/m^3.

6 TEST METHODS

6.1 EXHAUST GAS VELOCITY AND TEMPERATURE

(OEH NSW TM-1 & 2)

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and digital manometer. The exhaust gas temperature was measured using a Digital thermometer (0-1200^{o}C) connected to a chromel/alumel (K-type) thermocouple probe.

6.2 CONTINUOUS GASEOUS EMISSION ANALYSIS

(OEH NSW TM- 4, 11, 24, 25 & 32)

Sampling and analysis of exhaust gas were performed using a SEMA mobile combustion and environmental monitoring laboratory. Emission gases were distributed to the analysers via a manifold. Flue gas from each stack was pumped continuously. The following components of the laboratory are relevant to this work:

Sulphur Dioxide, Oxides of Nitrogen Oxygen, Carbon Monoxide, Carbon Dioxide	Testo 350XL
Calibration	BOC Special Gas Mixtures relevant for each analyser. Instrument calibrations performed at start and finish of sampling at all locations.
QA/QC	Calibration (Zero/Span) checks Sample line integrity calibration check

6.3 HYDROGEN SULPHIDE

(OEH NSW TM-5)

Samples were drawn through 3%H_2O_2 then $CdSO_4$ solution in midget impingers, per USEPA Method 11. Sample collection time was increased from 10 minutes to approximately three hours to increase the lower detection limit. Samples in solution were analysed by NATA accredited ALS Environmental.

6.4 SULPHUR TRIOXIDE/SULPHURIC ACID MIST (SO_3/H_2SO_4)

(OEH NSW TM- 3)

SO_3/H_2SO_4 were sampled isokinetically and drawn through a glass probe into four Greenburg Smith impingers in series. The first and second impingers in the train contained 100 ml of 80% isopropanol, the third was empty and the fourth contained silica gel. The impinger train was mounted in an ice water bath. Analysis was performed by the NATA accredited laboratories of ALS Environmental.

6.5 VOLATILE ORGANIC COMPOUNDS (VOCS)

(OEH NSW TM-34)

A sample of stack air is drawn onto an activated carbon adsorption tube and analysed using Gas Chromatography/Mass Spectrometry (GC/MS) performed by the NATA accredited laboratory SafeWork NSW/TestSafe Australia, accreditation number, 3726.

6.6 LANDFILL FUEL GAS COMPOSITION INCLUDING VOCS, CO_2 AND O_2

A sample of landfill input fuel gas was collected from the nominated fuel gas sampling point under high pressure from the raw gas feed manifold into a tedlar sampling bag to condition the bag and then re-sampled into the same pre-conditioned bag for later analysis. The analysis of this sample was performed by the NATA accredited Envirolab Services using GC-FID/TCD techniques according to methods ASTM 1945,1946 and USEPA M3C.

6.7 ACCURACY

All results are quoted on a dry basis. SEMA has adopted the following (Table 6-1) uncertainties for various stack testing methods.

TABLE 6-1 ESTIMATION OF MEASUREMENT UNCERTAINTY

Pollutant	Methods	Uncertainty
Carbon Monoxide	TM-32, USEPA 10	15%
Hydrogen Sulphide	TM-5 USEPA 11	25% ++++
Moisture	AS4323.2, TM-22, USEPA 4	25%
Nitrogen Oxides	TM-11, USEPA 7E	15%
Oxygen and Carbon Dioxide	TM-24, TM-25, USEPA 3A	1% actual
Sulphur Dioxide	TM-4, USEPA 6C	15%
Sulphur Trioxide/Sulphuric Acid Mist (SO_3/H_2SO_4)	TM-3, USEPA 8	20%
Velocity	AS4323.1, TM-2, USEPA 2	5%
Volatile Organic Compounds (adsorption tube)	TM-34, USEPA 18	25%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty).

++++ = Similar to test method for Fluorine and SO_3/H_2SO_4 which is about 25%

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK.*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

APPENDIX A – EMISSION TEST RESULTS

Glossary:

%	=	percent
^{o}C	=	Degrees Celsius
am^3/min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m^3)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am^3	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m^3	=	kilograms per cubic metre
kPa	=	kilo Pascals
m^2	=	square metre
m/s	=	metre per second
m^3/sec	=	cubic metre per second at 0^0C and 1 atmosphere
mg	=	milligrams
mg/ m^3	=	milligrams per cubic metre at 0^oC and 1 atmosphere
O_2	=	Oxygen

Abbreviations of Parameters

H_2S	=	Hydrogen Sulphide
SO_3/H_2SO_4	=	Sulphur Trioxide/ Sulphuric Acid Mist
VOC	=	Volatile Organic Compound
LFG	=	Landfill Gas fuel supply to engine

Abbreviations of Personnel

PWS	=	Peter Stephenson
JW	=	Jay Weber
AP	=	Alok Pradhan
AN	=	Ali Naghizadeh

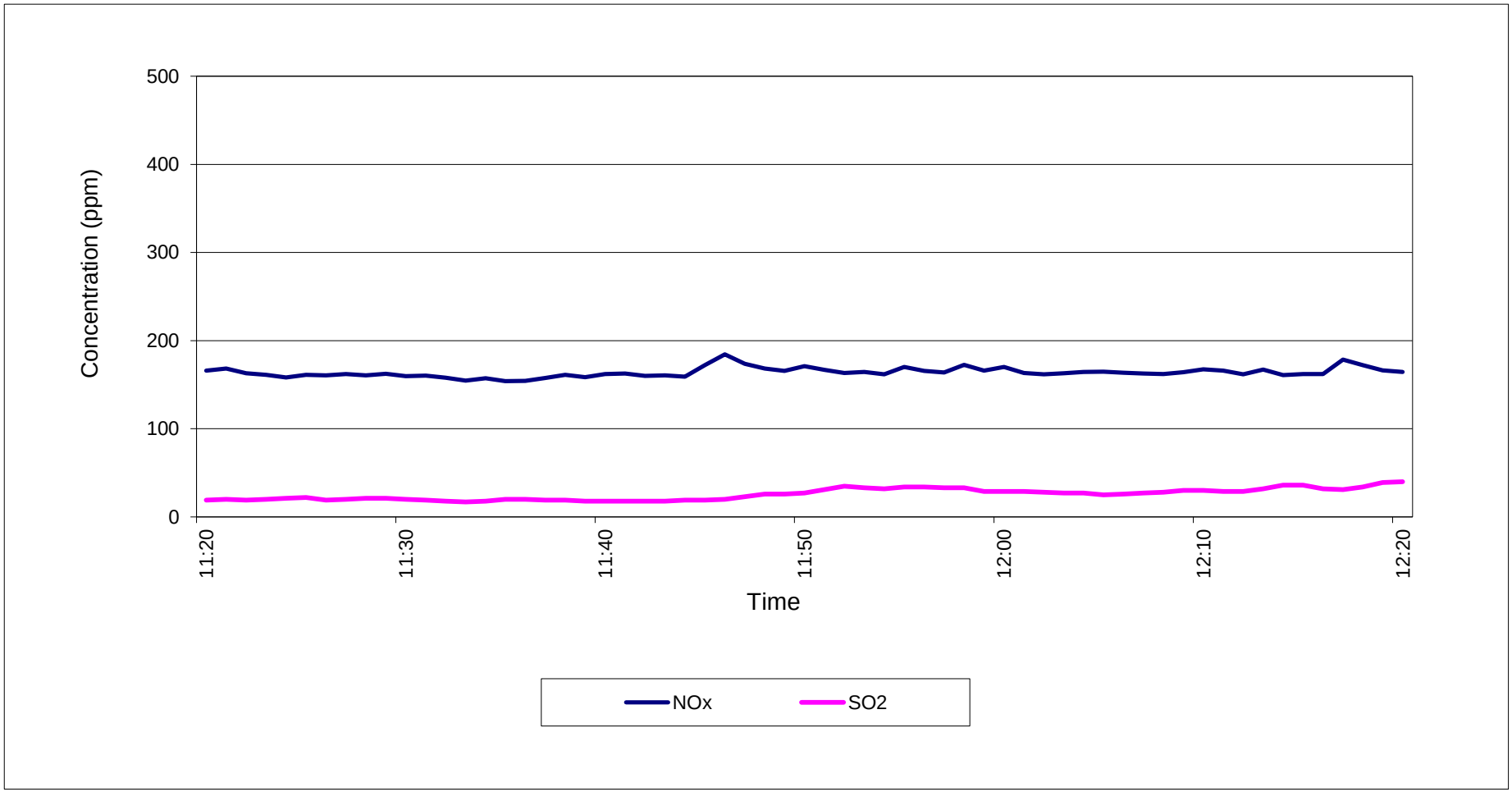
TABLE A-1 DETAILED EMISSION TEST RESULTS – GENERATOR NO. 1 (EPA ID NO. 8)

Emission Test Results	**SO_3/H_2SO_4**	**H_2S**
Project Number	5656	5656
Project Name	Veolia Environmental Services	Veolia Environmental Services
Test Location	Generator No.1 EPA Point 8.1	Generator No.1 EPA Point 8.1
Date	2 June 2016	2 June 2016
RUN	1	1
Sample Start Time (hrs)	11:20	10:45
Sample Finish Time (hrs)	12:20	13:15
Sample Location (Inlet/Exhaust)	Exhaust	Exhaust
Stack Temperature (^oC)	463.0	463.0
Stack Cross-Sectional area (m^2)	0.096	0.096
Average Stack Gas Velocity (m/s)	47.8	47.4
Actual Gas Flow Volume (am^3/min)	276	273
Total Normal Gas Flow Volume (m^3/min)	99	102
Total Normal Gas Flow Volume (m^3/sec)	1.64	1.71
Total Stack Pressure (kPa)	102.25	102.25
Analysis	SO_3/H_2SO_4	H_2S
Method	TM-3	USEPA M11
SEMA Lab Number	725514	725516
Mass In Sample (mg)	20.0	< 0.1
Air Volume Sampled (am^3)	1.11	0.30
Normal Sample Volume (m^3)	1.06	0.29
Concentration at Stack O_2 (mg/m^3)	**18.9**	**< 0.35**
Mass Emission Rate (g/s)	0.03	< 0.0006
Moisture Content (% by volume)	4.7	NA
Molecular Weight Dry Stack Gas (g/g-mole)	29.865	29.865
Dry Gas Density (kg/m^3)	1.33	1.33
EPL Limit (mg/m^3)	**100**	**5**
Isokinetic Sampling Rate (%)	98.6	NA
Sample Storage Period	Consumed in Analysis	Consumed in Analysis
Sampling Performed by	JW, AP	JW, AP
Sample Analysed by (Laboratory)	ALS Newcastle	ALS Newcastle
Calculations Entered by	AN	AN
Calculations Checked by	JW	JW

APPENDIX B – CONTINUOUS LOGS

REPRESENTATIVE SECTION OF CHART SHOWING CONCENTRATIONS OF SULPHUR DIOXIDE AND OXIDES OF NITROGEN

FIGURE B-1 CONTINUOUS LOGGED RECORD OF SO_2 & NO_x , GENERATOR NO.1 (EPA ID NO. 8) JUNE 2, 2016



APPENDIX C – NATA EMISSION TEST REPORT INCLUDING CERTIFICATES OF ANALYSIS

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Tel: (02) 9737 9991
E-Mail: info@stephensonenv.com.au

Emission Test Report No. 5656

The sampling and analysis was commissioned by:

Client	Organisation:	Veolia Environmental Services
	Contact:	Amila Wijedasa
	Address:	610 Collector Road, Tarago, NSW 2850
	Telephone:	02 4844 6262
	Email:	Amila.Wijedasa@veolia.com
	Project Number:	5656/S24189A/16
	Test Date(s):	2 June 2016
	Production Conditions:	Normal operating conditions during testing
	Analysis Requested:	Flow, temperature, moisture, dry gas density, molecular weight of stack gases, Carbon Monoxide, Carbon Dioxide, Hydrogen Sulphide, Oxygen, Nitrogen Oxides, Sulphur Dioxide, Sulphur Trioxide/Sulphuric Acid Mist, and Volatile Organic Compounds
	Sample Locations:	Generator No.1 Stack
	Sample ID Nos.:	Refer to Attachment A

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for Compliance with ISO/IEC 17025

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Carbon Dioxide	TM-24, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report 5656
Carbon Monoxide	TM-32, USEPA M10	SEMA, Accreditation No. 15043, Emission Test Report 5656
Dry Gas Density	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report 5656
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5656
Hydrogen Sulphide	NSW TM-5, USEPA M11	ALS Environmental, Accreditation No. 825, Report No. EN1602026
Moisture	NSW TM-22, USEPA M4	SEMA, Accreditation No. 15043, Emission Test Report 5656
Molecular Weight of Stack Gases	NSW TM-23, USEPA M3	SEMA, Accreditation No. 15043, Emission Test Report 5656
Oxides of Nitrogen	NSW TM-11, USEPA M7E	SEMA, Accreditation No. 15043, Emission Test Report 5656
Oxygen	NSW TM-25, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report 5656
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5656
Sulphur Dioxide	NSW TM-4, USEPA M6C	SEMA, Accreditation No. 15043, Emission Test Report 5656

Sulphuric Acid Mist	NSW TM-3, USEPA M8	ALS Environmental, Accreditation No. 825, Report No. EN1602026
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report 5656
Volatile Organic Compounds	NSW TM-34, USEPA M18	WorkCover, Accreditation No. 3726, Report No. 2016-1638

Deviations from Test Methods	Nil
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.
Reference Conditions	NSW – As per (1) Environment Protection Licence conditions, or (2) Part 3 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date
20 June 2016

P W Stephenson
Managing Director

SUMMARY OF THE AVERAGE EMISSION RESULTS – TEST REPORT NO. 5656

Pollutant	Units	Generator No. 1 EPL Point 8-1
		2 June 2016
Dry Gas Density	kg/m³	1.33
Moisture content	%	4.7
Molecular weight of stack gases	g/g mole	29.9
Temperature	°C	463
Velocity	m/s	47.8
Volumetric Flow Rate	m³/s	1.64
Carbon Dioxide	%	9.3
Carbon Monoxide	mg/m³	898
Hydrogen Sulphide	mg/m³	< 0.35
Nitrogen Oxides @ 7% O_2	mg/m³	407
Oxygen (O_2)	%	9.5
Sulphur Trioxide / Sulphuric Acid Mist	mg/m³	18.9
Sulphur Dioxide	mg/m³	72
Volatile Organic Compounds as n-propane	mg/m³	<3.9

Key:

*	=	corrected to 7% O_2 (oxygen)
°C	=	degrees Celsius
<	=	less than
%	=	percentage
kg/m³	=	kilograms per cubic metre
g/g mole	=	grams per gram mole
m³/s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kpa)
m/s	=	metres per second
mg/m³	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kpa)

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Carbon Monoxide	TM-32, USEPA M10	15%
Hydrogen Sulphide	TM-5, USEPA 11	25% ++++
Moisture	AS4323.2, TM-22, USEPA 4	25%
Nitrogen Oxides	TM-11, USEPA 7E	15%
Oxygen and Carbon Dioxide	TM-24, TM-25, USEPA 3A	1% actual
Sulphur Dioxide	TM-4, USEPA 6C	15%
Sulphur Trioxide/Sulphuric Acid Mist (SO_3/H_2SO_4)	TM-3, USEPA 8	20%
Velocity	AS4323.1, TM-2, USEPA 2	5%
Volatile Organic Compounds (adsorption tube)	TM-34, USEPA 18	25%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

++++ = Similar to test method for Fluorine and SO_3/H_2SO_4 which is about 25%

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Alok Pradhan
Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

Lab. Reference: 2016-1638

SAMPLE ORIGIN: 5656

DATE OF INVESTIGATION: 2/06/2016 **DATE RECEIVED:** 6/06/16

ANALYSIS REQUIRED: TM-34

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.

Martin Mazereeuw
Manager
Date: 14/06/16

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ilac-MRA NATA
Accreditation No. 3726
Accredited for compliance with ISO/IEC 17025

NSW GOVERNMENT | SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Alok Pradhan

Sample ID : 725518 **Sample : 2016-1638-1**

No	Compounds	CAS No	Front µg/section	Back µg/section	No	Compounds	CAS No	Front µg/section	Back µg/section
	Aliphatic hydrocarbons (LOD = 5µg/compound/section)					**Aromatic hydrocarbons** (LOD = 1µg/compound/section)			
1	2-Methylbutane	78-78-4	ND	ND	39	Benzene	71-43-2	ND	ND
2	n-Pentane	109-66-0	ND	ND	40	Ethylbenzene	100-41-4	ND	ND
3	2-Methylpentane	107-83-5	ND	ND	41	Isopropylbenzene	98-82-8	ND	ND
4	3-Methylpentane	96-14-0	ND	ND	42	1,2,3-Trimethylbenzene	526-73-8	ND	ND
5	Cyclopentane	287-92-3	ND	ND	43	1,2,4-Trimethylbenzene	95-63-6	ND	ND
6	Methylcyclopentane	96-37-7	ND	ND	44	1,3,5-Trimethylbenzene	108-67-8	ND	ND
7	2,3-Dimethylpentane	565-59-3	ND	ND	45	Styrene	100-42-5	ND	ND
8	n-Hexane	110-54-3	ND	ND	46	Toluene	108-88-3	ND	ND
9	3-Methylhexane	589-34-4	ND	ND	47	p-Xylene &/or m-Xylene	106-42-3 & 108-38-3	ND	ND
10	Cyclohexane	110-82-7	ND	ND	48	o-Xylene	95-47-6	ND	ND
11	Methylcyclohexane	108-87-2	ND	ND		**Ketones** (LOD #49, #54 & #55 =5µg/c/s; #50, #51, #52 & #53 =25µg/c/s)			
12	2,2,4-Trimethylpentane	540-84-1	ND	ND	49	Acetone	67-64-1	ND	ND
13	n-Heptane	142-82-5	ND	ND	50	Acetoin	513-86-0	ND	ND
14	n-Octane	111-65-9	ND	ND	51	Diacetone alcohol	123-42-2	ND	ND
15	n-Nonane	111-84-2	ND	ND	52	Cyclohexanone	108-94-1	ND	ND
16	n-Decane	124-18-5	ND	ND	53	Isophorone	78-59-1	ND	ND
17	n-Undecane	1120-21-4	ND	ND	54	Methyl ethyl ketone (MEK)	78-93-3	ND	ND
18	n-Dodecane	112-40-3	ND	ND	55	Methyl isobutyl ketone (MIBK)	108-10-1	ND	ND
19	n-Tridecane	629-50-5	ND	ND		**Alcohols** (LOD = 25µg/compound/section)			
20	n-Tetradecane	629-59-4	ND	ND	56	Ethyl alcohol	64-17-5	ND	ND
21	α-Pinene	80-56-8	ND	ND	57	n-Butyl alcohol	71-36-3	ND	ND
22	β-Pinene	127-91-3	ND	ND	58	Isobutyl alcohol	78-83-1	ND	ND
23	D-Limonene	138-86-3	ND	ND	59	Isopropyl alcohol	67-63-0	ND	ND
	Chlorinated hydrocarbons (LOD = 5µg/compound/section)				60	2-Ethyl hexanol	104-76-7	ND	ND
24	Dichloromethane	75-09-2	ND	ND	61	Cyclohexanol	108-93-0	ND	ND
25	1,1-Dichloroethane	75-34-3	ND	ND		**Acetates** (LOD = 25µg/compound/section)			
26	1,2-Dichloroethane	107-06-2	ND	ND	62	Ethyl acetate	141-78-6	ND	ND
27	Chloroform	67-66-3	ND	ND	63	n-Propyl acetate	109-60-4	ND	ND
28	1,1,1-Trichloroethane	71-55-6	ND	ND	64	n-Butyl acetate	123-86-4	ND	ND
29	1,1,2-Trichloroethane	79-00-5	ND	ND	65	Isobutyl acetate	110-19-0	ND	ND
30	Trichloroethylene	79-01-6	ND	ND		**Ethers** (LOD = 25µg/compound/section)			
31	Carbon tetrachloride	56-23-5	ND	ND	66	Ethyl ether	60-29-7	ND	ND
32	Perchloroethylene	127-18-4	ND	ND	67	MTBE (Methyl tert-Butyl ether)	1634-04-4	ND	ND
33	1,1,2,2-Tetrachloroethane	79-34-5	ND	ND	68	Tetrahydrofuran (THF)	109-99-9	ND	ND
34	Chlorobenzene	108-90-7	ND	ND		**Glycols** (LOD = 25µg/compound/section)			
35	1,2-Dichlorobenzene	95-50-1	ND	ND	69	PGME	107-98-2	ND	ND
36	1,4-Dichlorobenzene	106-46-7	ND	ND	70	Ethylene glycol diethyl ether	629-14-1	ND	ND
	Miscellaneous (LOD #37= 5µg & #38=25µg/compound/section)				71	PGMEA	108-65-6	ND	ND
37	Acetonitrile	75-05-8	ND	ND	72	Cellosolve acetate	111-15-9	ND	ND
38	n-Vinyl-2-pyrrolidinone	88-12-0	ND	ND	73	DGMEA	112-15-2	ND	ND
	Total VOCs (LOD =50µg/compound/section)		98	ND		Worksheet check		YES	YES

2016-1638.xlsx Page 2 of 3

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ilac-MRA NATA

Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025

SW08051 12/15

SafeWork NSW

Test Safe AUSTRALIA

Analysis of Volatile Organic Compounds in Workplace Air by GC/MS

Client : Alok Pradhan

Stephenson Environmental Management Australia

ND = Not Detected
VOCs = Volatile Organic Compounds
All compounds numbered 1-73 are included of this analysis in the scope of NATA accreditation. Any additional compounds attested with * are not covered by NATA accreditation.

Method : Analysis of Volatile Organic Compounds in Workplace Air by Gas Chromatography/Mass Spectrometry
Method Number : WCA 207
Detection Limit : 5µg/section; 25µg/section for oxygenated hydrocarbons except acetone, MEK and MIBK at 5µg/section and aromatic hydrocarbon at 1µg/section.
Brief Description : Volatile organic compounds are trapped from the workplace air onto charcoal tubes by the use of a personal air monitoring pump. The volatile organic compounds are then desorbed from the charcoal in the laboratory with CS_2. An aliquot of the desorbant is analysed by capillary gas chromatography with mass spectrometry detection.

Total Volatile Organic Compounds (TVOC) test result in µg/section is calculated by comparison to the average mass detector response of the 73 quantified compounds. The response of a mass detector is dependent on the fragmentation of the molecule. Therefore, the TVOC test result should be interpreted as a semi-quantitative guide to the amount of VOCs present. If the TVOC test result is less than the addition of the total amount of the 73 quantified compounds then the TVOC result is of little value other than for comparative purposes. If the TVOC test result is greater than the addition of all the compounds quantified then this can indicate that there are additional compounds present other than the 73 quantified compounds reported.

PGME : Propylene Glycol Monomethyl Ether
PGMEA : Propylene Glycol Monomethyl Ether Acetate
DGMEA : Diethylene Glycol Monoethyl Ether Acetate

Measurement Uncertainty
The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Quality Assurance
In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:
- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen - Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

2016-1638.xlsx Page 3 of 3

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Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS **147856**

Client:
Stephenson & Associates
Unit 7/2 Holker Street
Newington
NSW 2127

Attention: Alok Pradhan

Sample log in details:

Your Reference:	**5656**		
No. of samples:	1 Air Sample		
Date samples received / completed instructions received	03/06/2016	/	03/06/2016

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	10/06/16	/	6/06/16
Date of Preliminary Report:	Not Issued		

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

Envirolab Reference: 147856
Revision No: R 00

ACCREDITED FOR TECHNICAL COMPETENCE

Client Reference: 5656

Permanent Gas + Hydrogen Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- - ----------	147856-1 725519 Inlet 2/06/2016 Air sample bag
Date analysed	-	03/06/2016
Methane (CH_4)	%	57
Ethane	%	<0.01
Propane	%	<0.01
n-Butane	%	<0.01
Pentane	%	<0.01
Carbon Dioxide (CO_2)	%	39
Oxygen (O_2)	%	1.2
Nitrogen (N_2)	%	4.9

Envirolab Reference: 147856
Revision No: R 00

Client Reference: 5656

Method ID	Methodology Summary
AT-003	Gases determined by GC-FID/TCD using methods ASTM 1945, 1946 and USEPA 3C.

Client Reference: 5656

QUALITY CONTROL Permanent Gas + Hydrogen	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Methane (CH_4)	%	0.01	AT-003	<0.01	147856-1	57 || 58 || RPD: 2	LCS-1	98%
Ethane	%	0.01	AT-003	<0.01	147856-1	<0.01 || <0.01	LCS-1	98%
Propane	%	0.01	AT-003	<0.01	147856-1	<0.01 || <0.01	LCS-1	98%
n-Butane	%	0.01	AT-003	<0.01	147856-1	<0.01 || <0.01	LCS-1	96%
Pentane	%	0.01	AT-003	<0.01	147856-1	<0.01 || <0.01	LCS-1	97%
Carbon Dioxide (CO_2)	%	0.01	AT-003	<0.01	147856-1	39 || 39 || RPD: 0	LCS-1	103%
Oxygen (O_2)	%	0.01	AT-003	<0.01	147856-1	1.2 || 1.2 || RPD: 0	LCS-1	103%
Nitrogen (N_2)	%	0.01	AT-003	<0.01	147856-1	4.9 || 4.9 || RPD: 0	LCS-1	99%

Envirolab Reference: 147856
Revision No: R 00

Client Reference: **5656**

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Client Reference: **5656**

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Envirolab Reference: 147856
Revision No: R 00

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EN1602026	Page	: 1 of 2
Client	: STEPHENSON ENVIRONMENTAL MANAGEMENT AUSTRALIA	Laboratory	: Environmental Division Newcastle
Contact	: MR ALOK PRADHAN	Contact	:
Address	: UNIT 7/2 HOLKER STREET NEWINGTON NSW, AUSTRALIA 2127	Address	: 5/585 Maitland Road Mayfield West NSW Australia 2304
Telephone	: +61 02 97379991	Telephone	: +61 2 4014 2500
Project	: 5656	Date Samples Received	: 06-Jun-2016 15:25
Order number	: 4578	Date Analysis Commenced	: 14-Jun-2016
C-O-C number	: S24280	Issue Date	: 15-Jun-2016 15:29
Sampler	: ---		
Site	: ---		
Quote number	: ---		
No. of samples received	: 4		
No. of samples analysed	: 4		

NATA Accredited Laboratory 825
Accredited for compliance with ISO/IEC 17025.

NATA
WORLD RECOGNISED ACCREDITATION

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW

RIGHT SOLUTIONS | RIGHT PARTNER

Page	2 of 2
Work Order	EN1602026
Client	STEPHENSON ENVIRONMENTAL MANAGEMENT AUSTRALIA
Project	5656

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

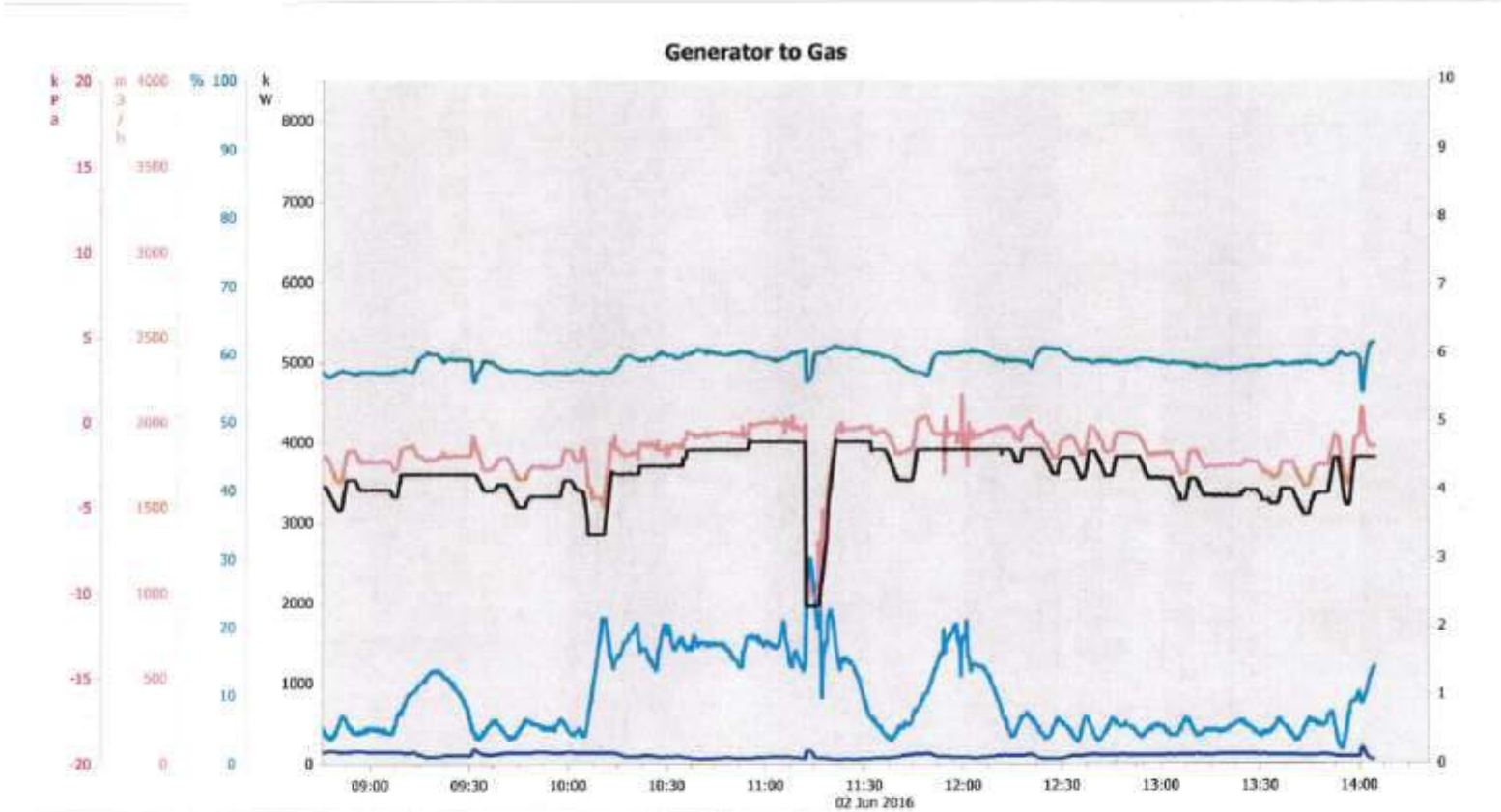
- EK089: Test results indicate the presence of an oxidising interferant.

Analytical Results

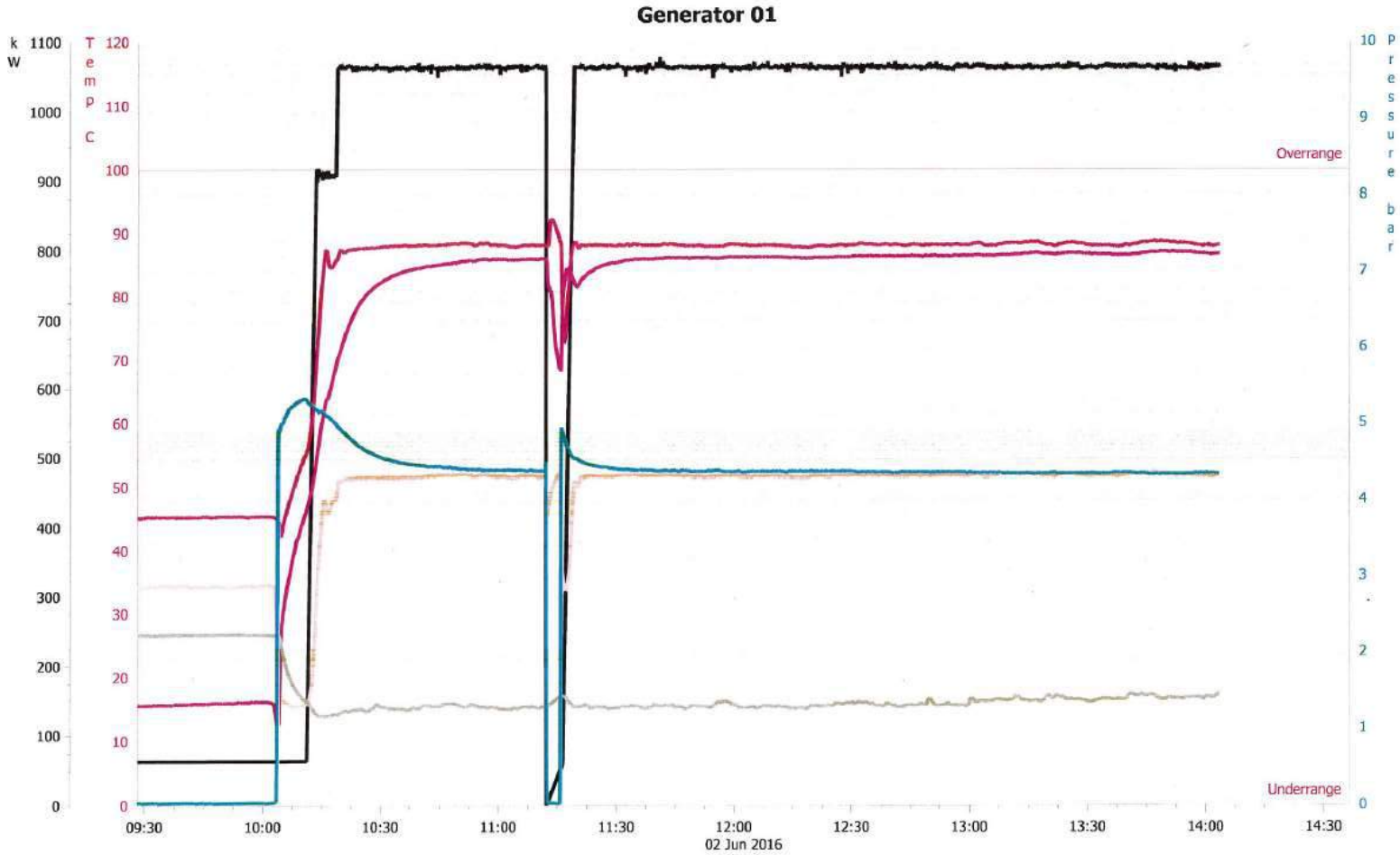
Sub-Matrix: EMISSION (Matrix: AIR)				Client sample ID	725514 Stack	725515 Blank	725516 Stack	725517 Blank	----
				Client sampling date / time	[02-Jun-2016]	[02-Jun-2016]	[02-Jun-2016]	[02-Jun-2016]	---
Compound	CAS Number	LOR	Unit		EN1602026-001	EN1602026-002	EN1602026-003	EN1602026-004	-----
					Result	Result	Result	Result	---
EA143C: Sulfuric Acid and Sulfur Dioxide (as SO3)									
Volume - Impinger	---	1	mL		302	215	---	---	---
Sulfuric Acid as SO3	---	2	mg/sample		20	<2	---	---	---
EK089: Hydrogen Sulfide in Stack Testing Solutions									
Hydrogen Sulphide	7783-06-4	0.1	mg/sample		---	---	<0.1	<0.1	---
Volume - Impinger	---	1	mL		---	---	53	47	---

APPENDIX D – PRODUCTION RECORDS

FIGURE D-1 GENERATOR NO.1 (EPA ID NO. 8)PRODUCTION DATA, JUNE 2, 2016



Trace	Type	Ruler Value	Latest Value		Minimum	Maximum	Mean
Manifold Pressure	Processed Historic	-	2/06/2016 2:04:40.783 PM	13.56	2.08	27.79	13.69
Gas Analyser O2	Processed Historic	-	2/06/2016 2:04:40.802 PM	0.54	0.54	2.36	1.28
Suction Pressure	Processed Historic	-	2/06/2016 2:04:40.831 PM	-14.4	-19.27	-7.9	-16.14
Gas Analyser CH4	Processed Historic	-	2/06/2016 2:04:40.857 PM	61.49	54.22	61.59	58.72
Gas Flow Meter	Processed Historic	-	2/06/2016 2:04:40.899 PM	1857.18	894.49	2178.16	1814.74
Generation kW	Processed Historic	-	2/06/2016 2:04:40.927 PM	3798.1	1957.36	4039.72	3609.56
PID Set point	Processed Historic	-	2/06/2016 2:04:40.947 PM	3800	3092.59	4000	3508.06
Flare1 Flow	Processed Historic	-	2/06/2016 2:04:40.967 PM	0	0	1164.32	292.25
Flare2 Flow	Processed Historic	-	2/06/2016 2:04:40.982 PM	0	0	1540.26	370.43
Total Flow	Processed Historic	-	2/06/2016 2:04:40.997 PM	1856.43	956.09	2973.48	1880.31
Engine Efficiency	Processed Historic		2/06/2016 2:04:41.016 PM	3.33	2.47	3.85	3.35



Trace	Type	Ruler Value	Minimum	Maximum	Mean
Gen 01 Output Power kW	Processed Historic	-	0	1079	1045.49
Gen 01 Jacket Water Temp	Processed Historic	-	42.3	92.2	80.51
Gen 01 Engine Oil Temp	Processed Historic	-	12.5	87.1	72.01
Gen 01 Engine Oil Pressure	Processed Historic	-	0.03	5.33	4.36

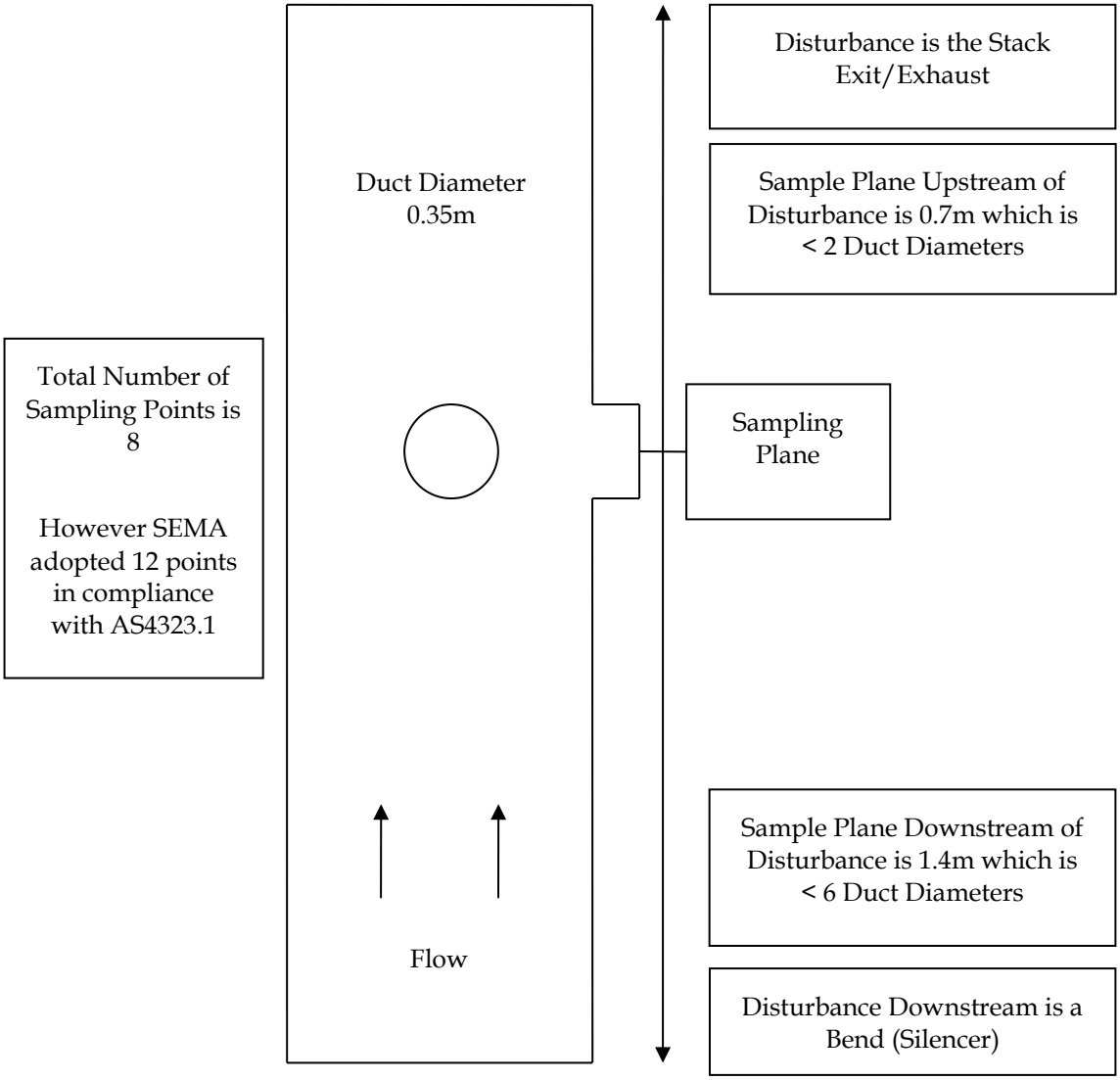
APPENDIX E – INSTRUMENT CALIBRATION INFORMATION

TABLE E-1 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
904	Gas Meter	12-Jun-15	12-Jun-16
946	combustion analyzer	24-Feb-16	24-Aug-16
906	Gas Meter	27-May-16	27-May-17
859	Digital Temperature Reader	06-Jan-16	06-Jul-16
921	Thermocouple	06-Jan-16	06-Jul-16
879	Digital Manometer	26-Feb-16	26-Feb-17
613	Barometer	26-Feb-16	26-Feb-17
594	Pitot	03-Jun-15	03-Jun-2016 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
633	Calibrated Site Mass	06-Aug-15	06-Aug-16
647	Stopwatch	01-Sep-15	01-Sep-16
834	Personal Sampler	22-Mar-16	22-Mar-17
Gas Mixtures used for Analyser Span Response			
Conc.	**Mixture**	**Cylinder No.**	**Expiry Date**
400 ppm 400 ppm 401 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALWB6150	05-May-20
902 ppm 9.8% 10.4%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALSB 4980	07-Feb-18
245 ppm 245 ppm 250 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALSB 1372	05-Jan-20

APPENDIX F – SAMPLE LOCATION

FIGURE F-1 SAMPLE LOCATION – GENERATOR NO.1 (EPA ID NO. 8)



In the absence of cyclonic flow activity ideal sampling plane conditions will be found to exist at 6-8 duct diameters downstream and 2-3 duct diameters upstream from a flow disturbance. The sampling plane does not meet this criterion. Additional sample points were adopted in accordance with AS4323.1 to compensate for the non-ideal sampling plane.

However the sampling plane does meet the minimum requirements; sampling plane conditions will be found to exist at 2 duct diameters downstream and 0.5 duct diameters upstream from a flow disturbance.

The location of the sampling plane complies with AS4323.1 criteria for temperature, velocity and gas flow profile and therefore is satisfactory for gas flow sampling.

LANDFILL GAS PRODUCTION DATA:

3 JANUARY 2017 – 26 MARCH 2016

		Week No	Week 01	Week 02	Week 03	Week 04	Week 05	Week 06	Week 07	Week 08	Week 09	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16
		Week Ending	3/01/2016	10/01/2016	17/01/2016	24/01/2016	31/01/2016	7/02/2016	14/02/2016	21/02/2016	28/02/2016	6/03/2016	13/03/2016	20/03/2016	27/03/2016	3/04/2016	10/04/2016	17/04/2016
Power station	Units	Targets																
Energy Export	MWh	870	19	110	278	276	158	150	122	128	151	167	291	423	433	474	561	589
Energy Generation	MWh	896	22	119	292	289	170	162	133	139	164	180	305	435	448	489	576	606
Gas to Generators	m3	521,914	10,888	61,872	149,056	143,096	90,280	94,552	70,423	70,784	91,592	100,760	168,192	244,504	254,168	267,936	295,968	310,184
Gas to Flares	m3	7,200	34,610	27,089	9,719	32,538	32,789	10,724	6,359	14,701	16,880	23,483	26,960	24,475	6,790	3,037	13,310	5,030
Total Gas Volume Captured	m3	529,114	45,498	88,961	158,775	175,634	123,069	105,276	76,782	85,485	108,472	124,243	195,152	268,979	260,958	270,973	309,278	315,214

		Week 17	Week 18	Week 19	Week 20	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28	Week 29	Week 30	Week 31	Week 32	Week 33
		24/04/2016	1/05/2016	8/05/2016	15/05/2016	22/05/2016	29/05/2016	5/06/2016	12/06/2016	19/06/2016	26/06/2016	3/07/2016	10/07/2016	17/07/2016	24/07/2016	31/07/2016	7/08/2016	14/08/2016
Energy Export	MWh	587	551	563	521	540	508	534	444	458	509	480	506	465	505	439	465	504
Energy Generation	MWh	603	567	578	536	555	523	548	459	473	524	495	521	477	517	451	476	516
Gas to Generators	m3	311,216	303,096	303,864	271,568	275,975	252,640	275,576	235,552	239,536	267,840	245,040	264,056	251,831	264,040	221,840	237,832	262,584
Gas to Flares	m3	3,346	4,647	7,062	15,193	11,910	6,576	4,037	3,002	5,851	12,962	6,947	2,022	6,339	6,427	4,467	4,436	8,731
Total Gas Volume Captured	m3	314,562	307,743	310,926	286,761	287,885	259,216	279,613	238,554	245,387	280,802	251,987	266,078	258,170	270,467	226,307	242,268	271,315

		Week 34	Week 35	Week 36	Week 37	Week 38	Week 39	Week 40	Week 41	Week 42	Week 43	Week 44	Week 45	Week 46	Week 47	Week 48	Week 49	Week 50
		21/08/2016	28/08/2016	4/09/2016	11/09/2016	18/09/2016	25/09/2016	2/10/2016	9/10/2016	16/10/2016	23/10/2016	30/10/2016	6/11/2016	13/11/2016	20/11/2016	27/11/2016	4/12/2016	11/12/2016
Energy Export	MWh	485	497	468	456	496	521	491	459	479	379	379	405	375	319	252	327	338
Energy Generation	MWh	497	508	479	468	508	533	503	471	491	391	391	417	387	329	263	340	350
Gas to Generators	m3	253,328	270,480	250,872	231,328	255,176	260,440	247,768	240,032	245,256	202,856	205,896	213,280	202,848	168,696	148,936	199,088	202,432
Gas to Flares	m3	14,453	4,807	1,111	2,803	4,751	1,527	988	906	347	2,581	1,026	572	3,087	9,988	12,849	4,809	11,458
Total Gas Volume Captured	m3	267,781	275,287	251,983	234,131	259,927	261,967	248,756	240,938	245,603	205,437	206,922	213,852	205,935	178,684	161,785	203,897	213,890

		Week 51	Week 52	Week 01	Week 02	Week 03	Week 04	Week 05	Week 06	Week 07	Week 08	Week 09	Week 10	Week 11	Week 12	Week 13
		18/12/2016	25/12/2016	1/01/2017	8/01/2017	15/01/2017	22/01/2017	29/01/2017	5/02/2017	12/02/2017	19/02/2017	26/02/2017	5/03/2017	12/03/2017	19/03/2017	26/03/2017
Energy Export	MWh	347	337	389	396	526	575	575	587	626	665	723	723	619	746	743
Energy Generation	MWh	361	350	404	409	544	592	593	606	646	683	741	737	631	759	757
Gas to Generators	m3	204,408	198,936	228,600	240,680	309,016	324,464	326,832	331,992	361,552	390,824	424,016	422,840	361,312	440,048	439,168
Gas to Flares	m3	4,358	5,388	944	1,936	4,566	3,186	1,063	1,489	6,850	8,562	505	2,901	42,778	11,755	15,374
Total Gas Volume Captured	m3	208,766	204,324	229,544	242,616	313,582	327,650	327,895	333,481	368,402	399,386	424,521	425,741	404,090	451,803	454,542

APPENDIX D:

LIQUID ODOUR MEASUREMENT METHODOLOGY

Methodology

The Liquid Odour Method (**LOM**) is comprised of the following components:

- Evaporation of a known amount of liquid in a known volume of dry nitrogen contained in a Nalophan odour sample bag;
- Determination of the odour concentration of the gaseous sample by Dynamic Dilution Olfactometry following AS/NZS 4323.3:2001; and
- Calculation of the odour concentration in the liquid from the gaseous odour concentration (ou/m^3) and the volume of liquid evaporated to produce the gaseous sample.

Procedure

Liquid Sample Storage

The liquid samples analysed from the Woodlawn Bioreactor Facility were collected from stored leachate in lagoons ED3N-4 and stormwater in Storage Pond 3. These were refrigerated prior to testing. A liquid sample was extracted immediately from the refrigerated sample bottle and not allowed to warm to room temperature. This is the general procedure when carrying out the liquid odour measurement method for aqueous samples.

Liquid Sample Size

The volume of liquid is determined by the requirement to produce a gaseous sample with a relative humidity of less than 100%. This equates to less than 2.3% v/v water at 20º C, or for a 25 L sample, 413 µL of aqueous sample. The method development work carried out to date has shown that 413 µL of liquid sample in 25 L dry nitrogen will evaporate in approximately 30 mins. The nominal liquid sample size required for the Liquid Odour method can be specified as 340-413 µL, which provides a gaseous sample with 80-100% RH. For the liquids samples collected at the Woodlawn Bioreactor Facility, 413 µL of liquid sample was used in 25 L dry nitrogen.

Table D1 details a range of liquid volumes and approximate evaporation times observed from the method development work carried out to date.

Table D1 - Liquid sample volumes, evaporation and equilibration time

Volume µL (% saturation)	Approximate evaporation time (in 25 L dry nitrogen)	Recommended equilibration time (in 25 L dry nitrogen)
280 µL (60%)	20-30 min	60 min
340 µL (80%)	30-40 min	60 min
413 µL (100%)	40-60 min	60 min

Sample Equilibration and Ageing

The development work to date has shown that condensate derived odour samples are not stable and degrade significantly over time. However, the degradation appears insignificant in the first 2-4 hours after preparation of the gaseous samples. Therefore, samples must be tested within that time period after preparation. For samples prepared at 100% saturation or below, the equilibration time can be standardised to 1 hour.

Sample Preparation and Odour Testing Procedure

The gaseous sample for odour testing is prepared as follows:

1. Dispense 25 L of dry nitrogen into a conditioned Nalophan bag.

2. Place a piece of clear packaging tape (approximately 100 mm long) onto the wall of the bag half way between the ends. Ensure that the a least a 1 cm^2 section of tape completely adheres to the bag with no air bubbles trapped between the tape and bag that could allow a leak of gas to the edge of the tape
3. Remove the liquid sample from cold storage.

4. Rinse the microlitre syringe (5 x) with the liquid sample.

5. Draw up the required volume of liquid sample (see **Liquid Sample Size** and **Table D1**) and record the exact volume in the syringe.

6. Inject the liquid through the tape and wall of the bag at the point where the tape has completely adhered to the bag. Tap the syringe to displace residual drop that adheres to the needle and withdraw the syringe from the bag.

7. Place the second piece of packaging tape over the first piece such that the puncture hole is sealed. Ensure no air bubbles are trapped between the layers of tape such that a leak could occur.

8. Vigorously shake the bag to disperse the liquid droplets inside the bag (to aid in the evaporation rate).

9. Store the bag in the laboratory for the prescribed equilibration time (see **Sample Equilibration and Ageing** and **Table D1**) to allow all the liquid to evaporate.

10. At the completion of the equilibration time, carry out the measurement of odour concentration using AS/NZS 4323.3:2001.

Calculation of Liquid Odour Concentration

The odour concentration from a liquid (ou per mL) is calculated from the gaseous sample odour concentration, the volume of liquid used to prepare the gaseous sample and the volume of dry nitrogen:

$$[odour]_{liquid} = \frac{\left(\frac{OU}{m^3} \times \frac{litres_{Nitrogen}}{1000}\right)}{mL_{liquid}}$$

An example of the calculation is presented in **Table D2**.

Table D2 – Example calculation of liquid odour concentration for ED3N-1

Parameter	Value	Unit
Volume of liquid from ED3N-4	0.413	mL
Volume of dry N_2	25	L
Measured odour concentration	38^	ou
Calculated liquid odour concentration	= (38 x 25/1000)/0.413 = 2.3	ou.m^3/mL

^ TOU Sample Number SC17094 – see **Table 6.4** in Main Report

Calculation of Odour Emission Rates from Evaporation of Liquids

A primary driver for the development of a liquid odour measurement is the requirement to predict odour emission rates from liquids area sources (such as storage ponds) as well as condensates. In particular, evaporation of condensates or other odorous refinery waters in cooling towers has been implicated as a significant contributor to refinery odour. With a measurement of the odour from liquids now available, the estimation of emission rates can be considered.

An example is presented below for treated leachate stored in ED3N-4 which returned a measured odour concentration of 2.3 ou.m^3/mL (see **Table D2**) with an evaporation rate of 0.882 L/s (based on on-site evaporation data collected by Veolia between May 2007 and June 2012):

Odour concentration	= 2.3 ou.m^3/mL
Ambient pond evaporation rate	= 0.882 L/sec
Odour emission rate	= 2.3 ou.m^3/mL x 882 mL/sec = 2,030 ou.m^3/sec (see **Table 6.4** in Main Report)

APPENDIX E:

FIELD AMBIENT ODOUR ASSESSMENT SURVEY LOGSHEETS

FAOA - Session Summary (Odour Intensity)

FAOA Survey Session #1 - Evening (1 of 2)

THE ODOUR UNIT

Date: 30/01/2017 Start Time: 2100 hrs End Time: 2227 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	1			2			3			4			5			6		
Intensity	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%
0	30		100%	30		100%	30		100%	30		100%	11		37%	7		23%
1	0		0%	0		0%	0		0%	0		0%	12		40%	18		60%
2	0		0%	0		0%	0		0%	0		0%	5		17%	5		17%
3	0		0%	0		0%	0		0%	0		0%	2		7%	0		0%
4	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
5	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
6	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
≥ 1's	0	0	0%	0	0	0%	0	0	0%	0	0	0%	19	0	63%	23	0	77%
Freq Exceeded?	NO			NO			NO			NO			YES			YES		
≥ 2's	0	0	0%	0	0	0%	0	0	0%	0	0	0%	7	0	23%	5	0	17%
Freq Exceeded?	NO			NO			NO			NO			YES			YES		

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #1 - Evening Member ID: TOU Date: 30/01/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 21:00 hrs End Time: 22:27 hrs

Measurement Point: **1**
Wind Speed and Direction Light W
Start: 9:00 PM End: 9:05 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **2**
Wind Speed and Direction Light W
Start: 9:08 PM End: 9:13 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **3**
Wind Speed and Direction Light W
Start: 9:17 PM End: 9:22 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **4**
Wind Speed and Direction Calm
Start: 9:24 PM End: 9:29 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **5**
Wind Speed and Direction Calm
Start: 9:32 PM End: 9:39 PM

min-1	3	3	2	2	1	0
min-2	0	0	0	1	1	0
min-3	1	1	1	1	1	0
min-4	0	0	0	2	1	1
min-5	0	0	2	2	1	1

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **6**
Wind Speed and Direction Light WSW
Start: 9:42 PM End: 9:47 PM

min-1	1	1	1	1	1	1
min-2	2	2	2	2	1	1
min-3	1	2	1	1	0	1
min-4	1	1	0	0	0	0
min-5	0	1	1	0	1	1

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

B = rotten egg, putrid

C = agricultural

FAOA - Session Summary (Odour Intensity)

FAOA Survey Session #1 - Evening (2 of 2)

THE ODOUR UNIT

Date: 30/01/2017 Start Time: 2100 hrs End Time: 2227 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	7			8			9			10			5			0		
Intensity	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%
0	30		100%	30		100%	30		100%	30		100%	22		73%	0		#DIV/0!
1	0		0%	0		0%	0		0%	0		0%	8		27%	0		#DIV/0!
2	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
3	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
4	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
5	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
6	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
≥ 1's	0	0	0%	0	0	0%	0	0	0%	0	0	0%	8	0	27%	0	0	#DIV/0!
Freq Exceeded?	NO			NO			NO			NO			YES			#DIV/0!		
≥ 2's	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	0%	0	0	#DIV/0!
Freq Exceeded?	NO			NO			NO			NO			NO			#DIV/0!		

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #1 - Evening Member ID: TOU Date: 30/01/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 21:00 hrs End Time: 22:27 hrs

Measurement Point: **7**
Wind Speed and Direction Light W
Start: 9:50 PM End: 9:55 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **8**
Wind Speed and Direction Calm
Start: 9:58 PM End: 10:03 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **9**
Wind Speed and Direction
Start: 10:06 PM End: 10:11 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **10**
Wind Speed and Direction Light N
Start: 10:14 PM End: 10:21 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **5**
Wind Speed and Direction Light N
Start: 10:22 PM End: 10:27 PM

min-1	1	1	1	1	1	1
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	1	0	1	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

B = rotten egg, putrid

C = agricultural

FAOA - Session Summary (Odour Intensity)

FAOA Survey Session #2 - Morning (1 of 2)

THE ODOUR UNIT

Date: 31/01/2017 Start Time: 0630 hrs End Time: 0753 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	1			3			6			5			11			9		
Intensity	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%
0	30		100%	30		100%	30		100%	0		0%	30		100%	22		73%
1	0		0%	0		0%	0		0%	6		20%	0		0%	8		27%
2	0		0%	0		0%	0		0%	23		77%	0		0%	0		0%
3	0		0%	0		0%	0		0%	1		3%	0		0%	0		0%
4	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
5	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
6	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
≥ 1's	0	0	0%	0	0	0%	0	0	0%	30	0	100%	0	0	0%	8	0	27%
Freq Exceeded?	NO			NO			NO			YES			NO			YES		
≥ 2's	0	0	0%	0	0	0%	0	0	0%	24	0	80%	0	0	0%	0	0	0%
Freq Exceeded?	NO			NO			NO			YES			NO			NO		

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey #2 - Morning Member ID: TOU Date: 31/01/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 06:30 hrs End Time: 7:53 hrs

Measurement Point: **1**
Wind Speed and Direction Moderate W/NW
Start: 6:30 AM End: 6:35 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **3**
Wind Speed and Direction Moderate W/NW
Start: 6:40 AM End: 6:45 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **6**
Wind Speed and Direction Moderate W/NW
Start: 6:48 AM End: 6:53 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **5**
Wind Speed and Direction Moderate W/NW
Start: 6:56 AM End: 7:01 AM

min-1	3	2	2	2	1	2
min-2	2	2	2	2	2	2
min-3	1	1	1	2	2	2
min-4	2	2	2	2	2	2
min-5	2	2	2	1	1	2

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **11**
Wind Speed and Direction Light W/NW
Start: 7:05 AM End: 7:10 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **9**
Wind Speed and Direction Light W/NW
Start: 7:14 AM End: 7:19 AM

min-1	1	1	1	0	0	1
min-2	0	0	1	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	1	0	1	0
min-5	1	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

B = rotten egg, putrid

C = agricultural

FAOA - Session Summary (Odour Intensity)

FAOA Survey Session #2 - Morning (2 of 2)

THE ODOUR UNIT

Date: 31/01/2017 Start Time: 0630 hrs End Time: 0753 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	10			12			13											
Intensity	TOU		%	TOU		%	TOU		%									
0	30		100%	30		100%	30		100%									
1	0		0%	0		0%	0		0%									
2	0		0%	0		0%	0		0%									
3	0		0%	0		0%	0		0%									
4	0		0%	0		0%	0		0%									
5	0		0%	0		0%	0		0%									
6	0		0%	0		0%	0		0%									
≥ 1's	0	0	0%	0	0	0%	0	0	0%									
Freq Exceeded?	NO			NO			NO											
≥ 2's	0	0	0%	0	0	0%	0	0	0%									
Freq Exceeded?	NO			NO			NO											

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #2 - Morning Member ID: TOU Date: 31/01/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 06:30 hrs End Time: 7:53 hrs

Measurement Point: **10**
Wind Speed and Direction Light NW
Start: 7:24 AM End: 7:29 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **12**
Wind Speed and Direction Light NW
Start: 7:32 AM End: 7:37 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **13**
Wind Speed and Direction
Start: 7:48 AM End: 7:53 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

FAOA - Session Summary (Odour Intensity)

FAOA - Survey Session #3 - Evening (1 of 2)

THE ODOUR UNIT

Date: 31/01/2017 Start Time: 2100 hrs End Time: 2242 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	14			15			16			17			18			19		
Intensity	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%
0	30		100%	30		100%	30		100%	30		100%	0		0%	30		100%
1	0		0%	0		0%	0		0%	0		0%	1		3%	0		0%
2	0		0%	0		0%	0		0%	0		0%	4		13%	0		0%
3	0		0%	0		0%	0		0%	0		0%	25		83%	0		0%
4	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
5	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
6	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
≥ 1's	0	0	0%	0	0	0%	0	0	0%	0	0	0%	30	0	100%	0	0	0%
Freq Exceeded?	NO			NO			NO			NO			YES			NO		
≥ 2's	0	0	0%	0	0	0%	0	0	0%	0	0	0%	29	0	97%	0	0	0%
Freq Exceeded?	NO			NO			NO			NO			YES			NO		

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #3 - Evening Member ID: TOU Date: 31/01/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 21:00 hrs End Time: 22:42 hrs

Measurement Point: **14**
Wind Speed and Direction 2 m/s NE
Start: 9:00 PM End: 9:05 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **15**
Wind Speed and Direction 4 m/s ESE
Start: 9:15 PM End: 9:20 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **16**
Wind Speed and Direction 3.5 m/s ENE
Start: 9:23 PM End: 9:28 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **17**
Wind Speed and Direction 2.2 m/s NE
Start: 9:32 PM End: 9:37 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **18**
Wind Speed and Direction 3 m/s ENE
Start: 9:40 PM End: 9:45 PM

min-1	3	3	3	3	3	3
min-2	3	2	2	1	3	2
min-3	3	3	3	3	3	3
min-4	3	3	3	3	3	3
min-5	3	3	3	3	2	3

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **19**
Wind Speed and Direction 3 m/s ENE/NE
Start: 9:47 PM End: 9:52 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

B = rotten egg, putrid

C = agricultural

FAOA - Session Summary (Odour Intensity)

FAOA - Survey Session #3 - Evening (2 of 2)

THE ODOUR UNIT

Date: 31/01/2017 Start Time: 2100 hrs End Time: 2242 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	20			21			22			23			24			0		
Intensity	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%
0	30		100%	30		100%	10		33%	30		100%	30		100%	0		#DIV/0!
1	0		0%	0		0%	10		33%	0		0%	0		0%	0		#DIV/0!
2	0		0%	0		0%	9		30%	0		0%	0		0%	0		#DIV/0!
3	0		0%	0		0%	1		3%	0		0%	0		0%	0		#DIV/0!
4	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
5	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
6	0		0%	0		0%	0		0%	0		0%	0		0%	0		#DIV/0!
≥ 1's	0	0	0%	0	0	0%	20	0	67%	0	0	0%	0	0	0%	0	0	#DIV/0!
Freq Exceeded?	NO			NO			YES			NO			NO			#DIV/0!		
≥ 2's	0	0	0%	0	0	0%	10	0	33%	0	0	0%	0	0	0%	0	0	#DIV/0!
Freq Exceeded?	NO			NO			YES			NO			NO			#DIV/0!		

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #3 - Evening Member ID: TOU Date: 31/01/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 21:00 hrs End Time: 22:42 hrs

Measurement Point: **20**
Wind Speed and Direction 1 m/s ENE
Start: 9:58 PM End: 10:03 PM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **21**
Wind Speed and Direction 1.3 m/s ENE
Start: 10:08 AM End: 10:13 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **22**
Wind Speed and Direction 2 m/s ENE
Start: 10:15 AM End: 10:20 AM

min-1	0	0	0	1	1	2
min-2	2	1	0	0	2	2
min-3	2	2	3	1	1	1
min-4	2	1	0	0	0	0
min-5	1	1	0	1	2	2

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **23**
Wind Speed and Direction 1.6 m/s ENE
Start: 10:28 AM End: 10:03 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **24**
Wind Speed and Direction 4 m/s NE
Start: 10:37 AM End: 10:42 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage
B = rotten egg, putrid
C = agricultural
D =
E =
F =
G =
H =

FAOA - Session Summary (Odour Intensity)

FAOA Survey Session #4 - Morning (1 of 2)

THE ODOUR UNIT

Date: 1/02/2017 Start Time: 0625 hrs End Time: 0730 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	14			15			17			18			19			23		
Intensity	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%	TOU		%
0	30		100%	30		100%	30		100%	16		53%	30		100%	30		100%
1	0		0%	0		0%	0		0%	6		20%	0		0%	0		0%
2	0		0%	0		0%	0		0%	4		13%	0		0%	0		0%
3	0		0%	0		0%	0		0%	4		13%	0		0%	0		0%
4	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
5	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
6	0		0%	0		0%	0		0%	0		0%	0		0%	0		0%
≥ 1's	0	0	0%	0	0	0%	0	0	0%	14	0	47%	0	0	0%	0	0	0%
Freq Exceeded?	NO			NO			NO			YES			NO			NO		
≥ 2's	0	0	0%	0	0	0%	0	0	0%	8	0	27%	0	0	0%	0	0	0%
Freq Exceeded?	NO			NO			NO			YES			NO			NO		

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #4 - Morning Member ID: TOU Date: 1/02/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 06:25 hrs End Time: 7:30 hrs

Measurement Point: **14**
Wind Speed and Direction Light NE/SE
Start: 6:25 AM End: 6:30 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **15**
Wind Speed and Direction Light E/NE
Start: 6:39 AM End: 6:44 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **17**
Wind Speed and Direction Light E/SE
Start: 6:50 AM End: 6:55 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **18**
Wind Speed and Direction Light NE/SE
Start: 7:00 AM End: 7:05 AM

min-1	3	2	1	1	0	0
min-2	0	0	0	3	1	1
min-3	1	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	1	2	2	3	3	2

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **19**
Wind Speed and Direction Light E/SE
Start: 07:08hrs End: 7:13 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point: **23**
Wind Speed and Direction Light E/NE
Start: 7:17 AM End: 7:22 AM

min-1	0	0	0	0	0	0
min-2	0	0	0	0	0	0
min-3	0	0	0	0	0	0
min-4	0	0	0	0	0	0
min-5	0	0	0	0	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

B = rotten egg, putrid

C = agricultural

FAOA - Session Summary (Odour Intensity)

FAOA Survey Session #4 - Morning (2 of 2)

THE ODOUR UNIT

Date: 1/02/2017 Start Time: 0625 hrs End Time: 0730 hrs

Assessment Area: Woodlawn/Tarago, NSW Intensity ≥ 1 Frequency ≥ 10%

Location	18																	
Intensity	TOU		%															
0	20		67%															
1	5		17%															
2	3		10%															
3	2		7%															
4	0		0%															
5	0		0%															
6	0		0%															
≥ 1's	10	0	33%															
Freq Exceeded?	YES																	
≥ 2's	5	0	17%															
Freq Exceeded?	YES																	

FAOA - Field Data Record Sheet (Odour Intensity & Quality)

THE ODOUR UNIT

Name: Survey Session #4 - Morning Member ID: TOU Date: 1/02/2017

Assessment Area: Woodlawn/Tarago, NSW Start Time 06:25 hrs End Time: 7:30 hrs

Measurement Point: **18**
Wind Speed and Direction Light E
Start: 7:25 AM End: 7:30 AM

min-1	2	3	2	1	0	0
min-2	0	0	0	0	0	0
min-3	0	0	1	1	0	1
min-4	0	0	0	0	0	0
min-5	0	2	3	1	0	0

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Measurement Point:
Wind Speed and Direction
Start: End:

min-1						
min-2						
min-3						
min-4						
min-5						

Descriptor(s):	A	B	C	D	E
	F	G	H	I	J

Key Odour Descriptors:

A = garbage

B = rotten egg, putrid

C = agricultural