

Leachate Management Plan - Woodlawn Bioreactor

MAN-13303-2

Issue Date: 15/03/2023

PURPOSE	This Leachate Management Plan (LMP) has been prepared in accordance with conditions 48 - 56, 61, 62, 65 - 67, 70, 132, 134 and 159 of the COCs for the Woodlawn Bioreactor (the Bioreactor) to ensure that leachate is successfully controlled and managed during the operation of the Bioreactor.
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Scope	This LMP has been prepared to provide the management measures implemented to minimise potential leachate related adverse impacts during the operation stage of the Bioreactor.
Review Frequency	Yearly

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Definitions/Abbreviations

See definitions in the [BMS Dictionary](#) - Only definitions directly pertaining to this document are included.

Term	Definition
AECOM Report	Woodlawn Evaporation Dams ED1 and ED2 Investigation Report (2017)
AEMR	Annual Environmental Management Report
AHD	Australian Height Datum
Bioreactor	Woodlawn Bioreactor
BMS	Business Management System
BTT	Banksmeadow Transfer Terminal
CTT	Clyde Transfer Terminal
CLC	Community Liaison Committee
DA	Development Application
DPIE	NSW Department of Planning, Industry and Environment
DPI	Department of Primary Industries
EA	Environmental Assessment
ED1 Cofferd Dam 1	Evaporation Dam 1 Cofferd Dam No. 1
ED1 Cofferd Dam 2	Evaporation Dam 1 Cofferd Dam No. 2
EMR	Environmental Management Representative
EIS	Environmental Impact Statement
EP & A	Environmental Planning and Assessment Act 1979 (and Regulations)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
GMC	Goulburn Mulwaree Council
GHG	Greenhouse Gas
IMF	Crisps Creek Intermodal Facility
ISO	International Standard Organisation
LEMP	Landfill Environmental Management Plan
LEP	Local Environment Plan

LGA	Local Government Area
LTP	Leachate Treatment Plan
MSW	Municipal Solid Waste
MBT	Woodlawn Mechanical Biological Facility
MWOO	Mixed Waste Organics Outputs
OEMP	Operational Environmental Management Plan (MBT)
PA	Project Approval
POEO	Protection of the Environment Operations Act 1997 (and Regulations)
RTA	Roads and Transport Authority
SEPP	State Environmental Planning Policy
SHEQ	Safety Health Environment Quality
TPA	Tonnes per Annum
Veolia	Veolia Australia and New Zealand
WARR Act	Waste avoidance & Resource Recovery Act

intersection with Bungendore Road. The operations that form part of the Eco-Precinct are described in **Table 1.1**.

Table 1.1 Eco-Precinct Operations

Operation	Description
The Bioreactor, including the Woodlawn Bioenergy Power Station (the Power Station);	The Bioreactor was the first stage of the Eco-Precinct developed by Veolia. Landfilling operations, which commenced in September 2004 are located in the Bioreactor of the former open cut Woodlawn Mine. Waste is deposited in the Bioreactor and with the use of optimal moisture and temperature conditions, achieves enhanced degradation to produce landfill gas, collected through a vast network of infrastructure within the Bioreactor. Methane is extracted from the landfill gas within the Power Station for conversion and supply as electricity into the energy grid. The Bioreactor forms part of Veolia's integrated waste management services and is augmented with the following transfer facilities: • The Crisps Creek Intermodal Facility (IMF). • The Clyde Transfer Terminal (CTT) in Sydney; and • The Banksmeadow Transfer Terminal (BTT) in Sydney
The Crisps Creek Intermodal Facility (IMF);	The IMF, which forms an integral part of the logistical operations of the Eco-Precinct, is located 8km from the Bioreactor in the township of Tarago, adjacent to the Goulburn-Bombala Railway line. Waste containers transported from the Sydney region via rail are unloaded and transferred onto road trailers at the IMF for transport to the Bioreactor. The IMF was approved to accept 1,180,000 TPA from Sydney when the Bioreactor was granted expanded operations.
Aquaculture and horticulture operations;	In keeping with the objectives of utilising as many resources as possible within the Woodlawn Eco-Precinct, Veolia has been looking for ways to utilise the waste heat created through the production of renewable energy from the landfill gas. As a part of this project, Veolia is using waste heat from the Power Station's engines in aquaculture operations to cultivate fish, with a horticultural system operating to remove excess nutrients.
Woodlawn and Pylara farms;	The original Woodlawn mine site included an operating farm on the property, which acted as a buffer zone during the mine operations. When Veolia was granted development consent for the Woodlawn Bioreactor, the condition of the development consent required Veolia to acquire the neighbouring farm Pylara to create a larger buffer zone around the Bioreactor operations. The surrounding land on the 3,000 ha Woodlawn property is utilised either for farming practices or requires rehabilitation from former mining activities. Adjacent to the south of the Woodlawn property is the 3,000 ha Pylara property, a working farm which utilises sustainable farming practices such as a sheep breeding program that includes genetic

	selection, nutrition and grazing rotation, to increase meat and wool productivity and reduce impacts on soils.
The Woodlawn Wind Farm (the Wind Farm) operated by Infigen Energy and;	The 48 MW Woodlawn Wind Farm comprises 23 turbines and is located along a ridgeline running through both the Woodlawn and Pylara properties. This operation commenced in 2011. While on Veolia land it is owned and operated by Infigen Energy and supplements the Eco-Precinct's renewable energy production.
The Woodlawn Mechanical Biological Treatment (MBT) Facility (operational from mid 2017);	The MBT Facility was approved in 2007 and is located to the north-west of the Bioreactor as illustrated in 1. At full capacity, it will receive up to 280,000 tpa of mixed waste from Councils (SSROC and NSROC) in the Sydney Metropolitan Area. The waste is processed to extract recyclable materials or produce compost. The compost is matured on site and is approved to be trialled for use in the rehabilitation of mine tailings dams. Changes to site layout, technology and operating hours were approved in 2014. Stage 1 of the facility is able to process up to 184,000 TPA, which includes 144,000 TPA of mixed waste and 40,000 TPA of food and garden waste (FO/GO) as specified within the EPL.
The Woodlawn Leachate Treatment Plant (LTP) (operational from end of 2018)	Veolia's modification application with the Department of Planning and Environment (DPE) for construction and operations of leachate treatment plant (LTP) to process leachate was approved on 22 December 2017. The LTP was built and commenced accepting leachate on 4th October 2018. The LTP facilitates better environmental and operational performance by allowing greater volumes of leachate to be extracted from the Bioreactor. This, in turn, enables more efficient gas extraction maximising the waste to energy benefits of the Bioreactor and minimises generation of odour. Biological treatment at the LTP removes odorous components from leachate prior to being evaporated.

In addition to these operations, Heron Resources Limited (formerly TriAusMin Pty Ltd) was granted planning approval for the Woodlawn Mine Project (Application No. 07_0143) to recommence mining operations within the Eco-Precinct for both re-mining of existing tailings dams and further underground mining.

There are remnant mining degraded areas within the Eco-Precinct that are subject to remediation requirements under the SML20 mining lease. The compost derived from the MBT Facility shall provide for the undertaking of this remediation in agreement between Veolia and Heron.

Heron Resources suspended operations in March 2020, entering a care and maintenance phase followed by voluntary administration on 16 July 2021.

1.1.2 Auxiliary Operations

The Eco-Precinct and its operations form part of Veolia's integrated waste management services and are augmented with the following transfer facilities in Sydney:

- The Clyde Transfer Terminal (CTT); and

- The Banksmeadow Transfer Terminal (BTT).

The CTT is approved to receive up to 600,000 TPA of putrescible waste from within the Sydney Metropolitan Area (SMA) from municipal, commercial and industrial sectors of the SMA, which is unloaded, screened, compacted and containerised into shipping containers for transport via rail to the IMF.

In order to facilitate the expansion of the Eco-Precinct through the increased waste receipt capability of the Bioreactor and the MBT Facility, Veolia has constructed an additional waste transfer station and associated rail infrastructure at an existing industrial site in Banksmeadow (southern Sydney).

The Banksmeadow Transfer Terminal (BTT) in Sydney is approved to receive up to 500,000 TPA of putrescible waste similarly to the CTT. Waste from the BTT is destined for either the Bioreactor or the MBT Facility, depending on Veolia's contractual obligations with its customers.

On 16 March 2012, the Department of Planning, Industry and Environment (DPIE) granted approval for the Bioreactor to increase its annual maximum input rate from 500,000 tonnes per annum (TPA) to 1,130,000 TPA, referred to as the expanded operations.

On 9 September 2016, DPIE approved the long-term leachate management strategy (LTLM Strategy) for improving the extraction and treatment of leachate from the waste mass by installing a new membrane bioreactor (MBR) treatment plant to treat leachate at a faster rate and produce a much higher quality effluent.

Modification of the MP 10_0012 MOD 2 & DA 31-02-99 MOD 3 for the construction and operations of the long-term leachate management strategy including the Leachate Treatment Plant was approved by DPE on 22 December 2017. Construction of the LTP commenced following approval and was commissioned on 4th October 2018. MP 10_0012 MOD 3, enabling the construction and operation of a Solid Recovered Fuel (SRF) processing area within the Woodlawn Eco Precinct and SSD 10_0012 MOD 4 for the acceptance of waste from bushfire impacted areas were approved in 2019.

This Leachate Management Plan (LMP) has been prepared in accordance with the regulatory requirements pertaining to the Bioreactor. This LMP details potential leachate impacts from Veolia's operations and details the relevant mitigation measures to be undertaken to minimise the chances of the impacts occurring. This plan incorporates contingency measures for managing leachate levels within the Bioreactor.

This plan supersedes any previous versions of the LMP.

1.2 Scope and Objectives

The objective of the LMP is to document how Veolia intends to manage leachate at the Bioreactor so that it is contained within the appropriate management systems to minimise potential impact on the local environment.

The key goals of the LMP are to:

- Facilitate compliance with the relevant state legislations, regulations and/or approvals
- Detail the existing leachate barrier systems at the site
- Outline measures to minimise the potential for leachate migration from the Bioreactor
- Outline measures to minimise potential leachate migration from storage dams
- Detail a suitable monitoring program for characterising leachate quality
- Detail contingency measures to lower leachate levels below the level of the natural groundwater table
- Detail the management measures for the LTP and associated infrastructure.
- Detail the management measures for the LTP during an emergency or system failure.

The management strategies detailed within the LMP shall be reviewed in accordance with condition 9 of schedule 7 of the conditions of the Woodlawn Expansion Project – Project Approval.

1.3 Legal and Other Requirements

The following regulatory framework applies to this LMP:

- Project Approval (PA) – Woodlawn Expansion Project (10-0012) as modified, issued under the Environmental Planning and Assessment Act 1979 (EP&A Act)
- Development Consent (DA-31-02-99) as modified, issued under the Environmental Planning and Assessment Act 1979 (DA)
- Environment Protection Licence 11436 issued under the Protection of the Environment Operations (POEO) Act 1997 in particular Section 120 (EPL)
- Water Access Licence: Willeroo Borefield (# 40BL106422-106425)
- Licence to Operate an Onsite Sewerage Treatment Plant - Goulburn Mulwaree Council

1.3.1 Project Approval 10-0012

The relevant conditions of consent (COC) from the PA are provided in **Table 1.1**.

Table 1.1 PA Conditions

Relevant COC	Requirement	LMP Reference
13	Pollution of Waters Except as may be expressly provided in the EPL for the site, the Proponent shall comply with Section 120 of the POEO Act.	1.3.4
18	a) Leachate Management b) The Proponent shall prepare and implement a Leachate Management Plan for the Landfill to the satisfaction of the Secretary. This plan must: c) (a) be prepared in consultation with EPA, Water NSW and DPI Water by a suitably qualified and experienced expert whose appointment has been endorsed by the Secretary; d) (b) be approved by Secretary prior to the commencement of expanded operations; e) (c) describe in the detail the leachate barrier system installed on site; f) (d) detail measures to collect and store all leachate generated by the landfill; g) (e) detail measures to prevent leachate from escaping to surface water, groundwater or the surrounding subsoils; h) (f) ensure all surface water from areas not subject to waste disposal or leachate disposal is directed away from the leachate management system; i) (g) treat all water that has entered areas filled with waste, or been contaminated by leachate, as leachate; j) (h) detail the management measures for the LTP, pipeline and coffer dam(s); and	(a) Noted (b) Noted (c) 4.1.1 (d) 3.1.3 (e) Section 4 (f) 4.1.4 (g) Section 4.2.4 of SWMP (h) 4.2 and 4.3 (i) 3.1.2.1 and Refer to the ERP

	k) (i) detail how the LTP would be managed during an emergency or system failure.	
18A	The Proponent shall update the Leachate Management Plan for the landfill by including the proposed changes to the leachate management in MOD 1 and MOD 2. The Plan shall be prepared in accordance with the requirements of Condition 18, in consultation with Water NSW and the EPA and to the satisfaction of the Secretary. Prior to the operation of the LTP or as otherwise agreed by the Secretary, the Proponent must submit a revised Leachate Management Plan to the satisfaction of the Secretary.	Noted
18AA	Coffer Dam(s) Should any additional coffer dam in ED1 be required, the Applicant must submit revised management plans in accordance with conditions 17 and 18 to the satisfaction of the Secretary prior to any treated leachate being discharged to the coffer dams. The plans must be prepared in consultation with the EPA and Water NSW and be documented in the Landfill LEMP.	Noted
18 C	Treated leachate must not be discharged to any part of ED3S, other than ED3S-S, until such time as the Long-term Leachate Management Strategy has been approved by the Secretary and the EPA.	Noted
18E	The Longterm Leachate Management Strategy must be operational no later than 30 September 2018 or as otherwise agreed by the Secretary.	Noted
18F	Leachate Treatment Plant The proponent must construct the Leachate Treatment Plant (LTP) and associated infrastructure in accordance with the Construction Environment Management Plan prepared by Veolia dated 12 December 2017.	Noted
18G	All run-off during construction must be contained on the site, no discharges off-site are permitted.	Noted
18H	The LTP must be: (a) capable of processing at least 4 litres per second of leachate; and (b) bunded to contain 110% of the facility's largest sized tank.	(a) 3.1.2.1 (b) 4.2
18I	The sludge skip bin must be bunded and covered to prevent contaminants entering surface water.	4.2
18J	Coffer Dam(s) Treated Leachate must not be discharged to any part of ED1, other than within lined coffer dam(s).	3.1.2.1 and 3.1.3
18K	The coffer dam(s) in ED1 must be designed and constructed: (a) by a suitably qualified and experienced person(s);	Noted

	(b) based on a geotechnical investigation and any recommendations prepared by a suitable qualified person(s); and ensuring that all coffer dams are lined with a High Density Polyethylene liner to the satisfaction of the EPA and in consultation with Water NSW.	
18L	The proponent must provide works-as-executed drawings signed by a registered surveyor demonstrating that the coffer dam(s) have been constructed in accordance with the design required by Condition 18K. The proponent must submit the works-as-executed drawings to the EPA, Water NSW and Secretary prior to the discharge of treated leachate into the coffer dam(s).	Noted
18M	Prior to the discharge of treated leachate into any coffer dam(s) in ED1, the Proponent must confirm in writing and provide a quality assurance report to the EPA, Water NSW and the Secretary that the High Density Polyethylene dam lining has been adequately installed. From the commencement of discharge of treated leachate into the coffer dam(s), the Proponent shall provide quarterly updates to the EPA, Water NSW and the Secretary of the leachate volume in the coffer dam(s) and the remaining leachate storage volume.	Noted
18N	Prior to the discharge of treated leachate to any coffer dam(s), the Proponent must install a leak detection system which monitors flows along all pipelines which carry leachate. Any leaks must be investigated, contained and rectified.	Noted
18O	Only treated leachate from the LTP is permitted to be stored within coffer dam(s) in ED1 unless otherwise agreed to by the Secretary.	3.1.3
18P	The coffer dam(s) are not permitted to exceed 80 per cent capacity until either: (a) a new coffer dam has been designed and constructed in accordance with condition 18K to 18N and is ready to accept treated leachate from the LTP and a revised management plan has been submitted to the satisfaction of the Secretary in accordance with Condition 17 and 18; or sections of ED3N have been emptied of partially treated leachate, had its liner assessed and, if necessary, repaired, and is capable of receiving treated leachate from the LTP.	4.3.1
18Q	No interaction between the treated leachate in the coffer dam(s) and the mine stormwater in ED1 is permitted.	3.1.8 of SWMP
18R	Within six months of commissioning the LTP and annually thereafter, unless otherwise agreed to by the Secretary, the Proponent shall commission and pay the full cost of an independent assessment of the leachate and water management system. This audit must be conducted by a	5.2

	suitably qualified, experienced and independent expert whose appointment has been endorsed by the Secretary. During the audit, this expert must: (a) consult with the EPA, Water NSW and the Secretary; (b) assess actual performance against the assumptions and predictions made in the project water balance prepared by WSP dated September 2017. This must include: (i) actual versus predicted inputs and outputs into and out of each dam; (ii) actual versus predicted mechanical evaporation from each dam; (iii) actual versus predicted rainfall and evaporation; and (iv) the actual versus predicted volume of water or treated leachate stored in each dam. (c) assess actual versus predicted performance of the LTP. This must include: (i) actual versus target effluent quality; and (ii) actual versus target throughput. (d) determine whether the leachate and water management system is achieving its intended objectives; and (e) outline all reasonable and feasible measures that may be required to improve water and leachate management at the site.	
18T	ED3N ED3N must be emptied of effluent from the existing leachate system by 31 December 2022.	3.1.3
18U	Prior to discharging treated leachate into sections of ED3N from the LTP, the Proponent must verify the integrity of the dam and prepare an integrity assessment of the ED3N liner to demonstrate the dam is not leaking and is suitable for the storage of treated leachate.	Noted
18V	Should the integrity assessment identified in Condition 18U find that the liner in ED3N is not adequate for treated leachate storage, the Proponent must submit management options to the Secretary, Water NSW and the EPA which will be adopted to rectify any integrity issues.	Noted
18W	The Proponent must not store treated leachate from the LTP in ED3N until the Secretary and the EPA are satisfied that either ED3N is not leaking or the management options identified in Condition 18V are acceptable.	Noted

1.3.2 Veolia's Statement of Commitments

The relevant statement of commitments for leachate made by Veolia and incorporated into the PA consent are detailed in **Table 1.2** below

Table 1.2 PA Statement of Commitments

Condition	Mitigation Measure	SWMP Reference
Leachate	Management of leachate in accordance with the Leachate Management Plan	Noted
	Recirculate leachate on top of the waste to, ensuring maximum evaporative discharge capacity	Section 4.1.2

1.3.3 Development Consent (DA-31-02-99)

The relevant COC from the development consent are provided in **Table 1.3**. Where conditions are similar to the PA, the PA takes precedence.

Table 1.3 DA Conditions

Relevant COC	Requirement	LMP Reference
SCHEDULE 2		
Water Quality and Management		
Waste Management Facility Site		
48	The mine void must be managed to ensure the groundwater gradient directs groundwater flows towards the mine void, unless otherwise approved in writing by the EPA.(EPA GTA)	Section 3.1.1
49	Maintenance of the groundwater gradient post closure of active landfill operations (including a period of after-care) must ensure that impact of any degraded residue from the landfill on groundwater represents no threat to human health or the environment.	Section 5 of Landfill and Rehabilitation Closure Plan
50	A leachate collection/storage/recirculation/treatment system must be designed, installed and operated to: (a) accept other waste-waters and contaminated storm-waters generated as a result of the operation of the facility; (b) efficiently operate, notwithstanding the settlement of the waste; (c) ensure that all liquid (including rainwater, surface water, groundwater and leachate) introduced into the waste is monitored to determine its chemical composition and quantity;	a) 3.1.1 b) 3.1.1 c) 5.1 d) 3.1.3 e) 4.1.2

	(d) ensure that liquid is not deliberately stored in the landfilled waste, unless it is necessary for the efficient decomposition of the landfilled waste. (e) ensure that leachate can be recirculated within the biologically active zones of the landfilled waste; and (f) comply with Conditions 48 and 8(b). Details of this system must be documented in the LEMP. (EPA GTA)	f) Noted 4.1
51	A barrier system must be designed and installed on the surfaces identified in condition 52 to limit the quantity of groundwater flowing into the mine void and to contain leachate over the period of time that the landfilled waste poses a potential environmental risk. The system must be documented in the LEMP. (EPA GTA)	Refer to PA (Sch 4 Cond 18)
52	The Applicant shall install the barrier system on the following surfaces of the mine void wherever these surfaces do not meet the performance requirements of Condition 53: a) the base and the top elevation of the mine void; and b) the localised joints, fracture zones and adits/portals.	Refer to PA (Sch 4 Cond 18)
53	The barrier system must at least achieve the performance of a 900 mm thick recompacted clay liner with an in-situ coefficient of permeability of less than 10^{-9} metres per second.	Refer to PA (Sch 4 Cond 18)
54	A Construction Quality Assurance Plan (CQAP) for the barrier system shall be prepared and included in the LEMP.	Noted
55	The Applicant shall prepare a Leachate Contingency Management Plan (LCMP) that addresses but not necessarily be limited to the following matters: the removal of leachate from the waste and its treatment to remove any metals or compounds at concentration which may inhibit the biological processes of the bioreactor landfill, prior to discharging the leachate back into the landfilled waste; the storage of leachate external to the landfilled waste in the mine void; method/s for removing leachate from the waste and disposing of it to ensure effective operation of the bioreactor landfill and to ensure that the groundwater gradient directs groundwater flows into the mine void; an estimate of the full costs for implementing each aspect of this plan. (EPA GTA) contingency measures in the event that the leachate storage dams reach capacity sooner than anticipated, this should include the provision for the construction and operation of	(a) 3.1.1 and 3.1.2 (b) 3.1.3 (c) 4.1.3 (d) Noted (e) 4.5 (f) Noted

	additional lined coffer dams in ED1 to the satisfaction of the EPA; and contingency measures should the modelling as required by Condition 70G demonstrate that the dams will overflow.	
55A	Prior to operation of the LTP, or as otherwise agreed by the Secretary, the Applicant must submit a revised LCMP to the satisfaction of the Secretary. The LTP is not permitted to operate until the revised LCMP is approved by the Secretary. The plan must be prepared in consultation with the EPA and Water NSW and include contingency measures should the leachate dams fill sooner than anticipated.	Noted
55B	Should additional coffer dam(s) be required to be constructed as part of the LCMP the dam(s) must be designed, constructed and maintained in accordance with Condition 70L to 70P	Noted
56	The Applicant must not import water or other liquids into the mine void, unless otherwise approved by the EPA, except for first flush waters collected at the Intermodal Facility site and waters contained in ED3. (EPA GTA)	Refer Section 3.1.14 of SWMP
Surface Water Management		
61	Contaminated water shall only be applied for dust suppression in the mine void, and in any areas around the perimeter of the void where any contaminated water will drain back into the void.	Refer to Section 4.2.7 of SWMP
62	The evaporation of water by spraying shall not result in the drifting of the sprayed liquid from the area subject to the DA and also shall not cause any adverse impact to public health. The proposed method for the spray evaporation of water shall be documented in the LEMP.	Refer to Section 4.2.8 of SWMP
65	Stormwater collected in the mine void may only be transferred into ED3S sump and ED2 provided that: a) The Applicant can always comply with condition 58; and; b) The stormwater to be transferred contains no leachate, unless otherwise approved in writing by the EPA. (EPA GTA)	Refer to Section 3.1.10 of SWMP
66A	Prior to the operation of the LTP or as otherwise agreed by the Secretary, the Applicant must submit a revised Stormwater Management Plan to the satisfaction of the Secretary. The plan must be prepared in consultation with the EPA and Water NSW and include the changes to stormwater management in MOD 2 and MOD 3, in accordance with the requirements of Condition 66.	Noted

66B	Prior to the operation of the LTP or as otherwise agreed by the Secretary, the Applicant must submit a revised Management Plan for ED3N, ED3S, ED3S-S and the Coffor Dam to the satisfaction of the Secretary. The LTP is not permitted to operate until the revised Management Plan is approved by the Secretary. The plan must be prepared in consultation with the EPA and Water NSW and include the changes to water and leachate management in MOD 2 and MOD 3, in accordance with the requirements of Condition 70. The plan must be documented in the LEMP.	Noted
66C	Should any additional coffer dams in ED1 be required, the Applicant must submit revised management plans in accordance with conditions 70 and 70B to the satisfaction of the Secretary prior to any treated leachate being discharged to the coffer dams. The plan must be prepared in consultation with the EPA and Water NSW and be documented in the LEMP.	Noted
67	Vehicles leaving the area subject to the DA shall not track materials to external surfaces. Details of the equipment or facilities must be specified in the LEMP (EPA GTA)	Section 4.1.3
ED3N, ED3S and ED3S-S Management		
70	ED3N, ED3S and ED3S-S and Coffor Dam(s)– Management The Applicant must prepare a management plan for ED3N, ED3S, ED3S-S and coffer dam(s), ED1, the LTP and pipeline to ensure that: a) each dam is lined in consultation with Water NSW and to the satisfaction of the EPA and maintained to prevent leakage from the dams in order to protect groundwater and surface water; b) a monitoring and inspection program is implemented including installation of monitoring bores, a review of monitoring data and six-monthly inspections to evaluate the integrity of the barrier and to assess if leakage from the dam is occurring; c) adequate capacity is retained in ED3N, ED3S and coffer dam(s) to meet the environmental performance requirements in condition 58 d) measures are identified to maintain adequate capacity within a suitable time period after receiving water from a rainfall event; e) there is an emergency plan for the management of leachate in excess of the capacity of ED3N,ED3S and coffer dam(s);	a) 3.1.3 b) Refer Section 5.1.3 of SWMP c) 4.3 d) 4.3 and 4.5 e) Section 6 of SWMP and refer to ERP f) 3.1.3 g) 5.1.1 h) 3.1.3 i) 4.2 j) (i) 3.1.2.1 (ii) 3.1.2.1 (iii) 3.4.1 and 4.4.1 of the LEMP (iv) 3.1.2.1 (v) 2.1

	f) the sources of leachate that are collected or received in ED3N, ED3S and cofferdam(s) are identified; g) the quantity of leachate from each source that reports to ED3 is monitored and compared in graphical format with rainfall data; h) ED3N is emptied of effluent from the existing leachate system by 31 December 2022; i) all pipelines which transfer leachate and treated leachate are monitored to ensure leaks do not occur; j) the operational details of the LTP include: the leachate quality targets; a description of the performance indicators that would be used to judge the performance of the LTP; a description of the management measures that would be implemented to manage the operational impacts of the LTP including the chemical storage area and sludge skip bin; contingency measures to manage any unpredicted impacts such as the bioreactor membrane failing; and the roles, responsibility, authority and accountability of all key personnel involved in the environmental management of the LTP. k) An updated plan including MOD 2 and MOD 3 must be documented in the LEMP.	
Long-Term Leachate Management		
70F	The Longterm Leachate Management Strategy must be operational no later than 30 September 2018, or as otherwise agreed by the Secretary.	Noted
Future Modelling		
70G	Prior to the operation of the LTP, the Applicant must provide modelling which demonstrates that the evaporation dams will not overflow for the period between 2029 to 2058. Should overflow be predicted, the Applicant must provide contingency measures in accordance with Condition 55A.	Noted and Submitted with DPIE on 28 November 2017
Leachate Treatment Plant		
70H	The Applicant must construct the Leachate Treatment Plant (LTP) and associated infrastructure in accordance with the Construction Environment Management Plan prepared by Veolia dated 12 December 2017.	Noted
70I	All run-off during construction must be contained on the site in accordance with Condition 58.	Noted

70J	The LTP must be: a) capable of processing at least 4 litres per second of leachate; and bunded to contain 110% of the facilities largest sized tank.	3.1.2.1 and 4.2
70K	The sludge skip bin must be bunded and covered to prevent contaminants entering surface water.	4.2
Coffer Dam(s)		
70L	Treated leachate must not be discharged to any part of ED1, other than within lined coffer dam(s).	Section 3.1.2.1
70M	The coffer dam(s) in ED1 must be designed and constructed: c) by a suitably qualified and experienced person(s); d) based on a geotechnical investigation and any recommendations prepared by a suitable qualified person(s); and e) ensuring that all coffer dams are lined with a High Density Polyethylene liner to the satisfaction of the EPA and in consultation with Water NSW.	Noted
70N	The Applicant must provide works-as-executed drawings signed by a registered surveyor demonstrating that the coffer dam(s) have been constructed in accordance with the design required by Condition 70M. The Applicant must submit the works-as-executed drawings to the EPA, Water NSW and Secretary prior to the discharge of treated leachate into the coffer dam(s).	Noted
70O	Prior to the discharge of treated leachate into any coffer dam(s) in ED1, the Applicant must confirm in writing and provide a quality assurance report to the EPA, Water NSW and the Secretary that the High Density Polyethylene dam lining has been adequately installed. From the commencement of discharge of treated leachate into the coffer dam(s), the Applicant shall provide quarterly updates to the EPA, Water NSW and the Secretary of the leachate volume in the coffer dam(s) and the remaining leachate storage volume.	Noted
70P	Prior to the discharge of treated leachate to any coffer dam(s), the Applicant must install a leak detection system which monitors flows along all pipelines which carry leachate. Any leaks must be investigated, contained and rectified.	Section 4.2
70Q	Only treated leachate from the LTP is permitted to be stored within coffer dam(s) in ED1, unless otherwise agreed to by the Secretary.	Section 3.1.2.1
70R	The coffer dam(s) are not permitted to exceed 80 per cent capacity until either:	Section 4.3

	a) a new coffer dam has been designed and constructed in accordance with condition 70M to 70P and is ready to accept treated leachate from the LTP and a revised management plan has been submitted to the satisfaction of the Secretary in accordance with Condition 70; or sections of ED3N have been emptied of partially treated leachate, had its liner assessed and , if necessary, repaired, and is capable of receiving treated leachate from the LTP.	
70S	No interaction between the treated leachate in the coffer dam(s) and the mine stormwater in ED1 is permitted.	Refer to Section 3.1.8 of SWMP
70T	Within six months of commissioning the LTP and annually thereafter, unless otherwise agreed to by the Secretary, the Applicant shall commission and pay the full cost of an independent assessment of the leachate and water management system. This audit must be conducted by a suitably qualified, experienced and independent expert whose appointment has been endorsed by the Secretary. During the audit, this expert must: a) consult with the EPA, Water NSW and the Secretary; b) assess actual performance against the assumptions and predictions made in the project water balance prepared by WSP dated September 2017. This must include: c) actual versus predicted inputs and outputs into and out of each dam; d) actual versus predicted mechanical evaporation from each dam; e) actual versus predicted rainfall and evaporation; and f) the actual versus predicted volume of water or treated leachate stored in each dam. g) assess actual versus predicted performance of the LTP. This must include: h) actual versus target effluent quality; and i) actual versus target throughput. j) determine whether the leachate and water management system is achieving its intended objectives; and k) outline all reasonable and feasible measures that may be required to improve water and leachate management at the site.	Section 5.2
ED3N		
70V	ED3N must be emptied of effluent from the existing leachate system by 31 December 2022.	Section 3.1.3
70W	Prior to discharging treated leachate into sections of ED3N from the LTP, the Applicant must verify the integrity of the dam	Noted

	and prepare an integrity assessment of the ED3N liner to demonstrate the dam is not leaking and is suitable for the storage of treated leachate.	
70X	Should the integrity assessment identified in Condition 70W find that the liner in ED3N is not adequate for treated leachate storage, the Applicant must submit management options to the Secretary, the EPA and Water NSW which will be adopted to rectify any integrity issues.	Noted
70Y	The Applicant must not store treated leachate from the LTP in ED3N until the Secretary and the EPA are satisfied that either ED3N is not leaking or the management options identified in Condition 70X are acceptable.	Noted
Environmental Monitoring (EPA GTAs)		
Surface Water Monitoring		
132	The Applicant shall prepare and implement a surface water-monitoring program to monitor the environmental performance of the construction, operation and rehabilitation of the development on surface water. The surface water-monitoring program must be documented in the LEMP. The program must include details on: a. Monitoring locations including: • Crisps Creek ; • Allianoyonyiga Creek; • Cofferdam (s) • ED1 • ED3N; • ED3S • ED3S-S • ED2 • downstream receiving waters of ED2; • treated leachate effluent discharge line; • discharge line from ED3S to ED2; and • rainwater collected in the mine void; b. monitoring methodologies and standards to be employed; c. monitoring frequency based on rainfall events and creek flow assessment; d. an assessment of the contribution of surface water pollution from the Woodlawn Waste Management Facility as distinct from the Woodlawn Mine site; e. the quantity of water relocated from the mine void into ED3; f. the quantity of water relocated from ED3 into the mine void;	a) Section 5.1.1 of SWMP b) Section 5.1 of SWMP c) Section 5.1 of SWMP d) Noted e) Section 6.1 of SWMP and Section 3.1.3 of LMP f) Section 5.1.3 of SWMP g) Section 5.1.3 h) Section 5.1.3 i) Section 5.1.1 of SWMP j) Section 3.1.3 k) Section 3.1.3 l) Section 3.1.3 m) Not triggered n) Not triggered o) Not triggered p) Section 5.1.3

	g. the chemical composition of liquids added to the landfilled waste; h. the chemical composition of treated leachate in the effluent discharge line; i. the chemical composition of leachate within ED3S-S; j. the quantity of water that reports to ED3 , including its sources; k. the quantity of water removed and/or discharged from ED3, including its destination; l. the total quantity of water contained in ED3; m. the quantity of water transferred from ED3S-S into ED2 n. the quantity of water that reports to ED2 from Woodlawn Waste Management Facility, including its sources; o. the total quantity of water contained in ED2; p. the total quantity of treated leachate contained in the coffer dam (s); q. the total quantity of water contained in ED1; r. the parameters and substances that are proposed to be monitored, including sampling and analysis frequencies; s. reporting and assessment of results; and t. opportunities to integrate the monitoring program with other monitoring programs in the vicinity. The monitoring of ED2 will initially be at weekly intervals once the transfer of stormwater from ED3S to ED2 has commenced and will be reviewed 12 months after commencement of MOD 2.	q) Section 5.1.3 r) Section 5.1.3 s) Section 5.2 t) Noted
Leachate Monitoring		
134	The Applicant shall notify the EPA as soon as practicable after becoming aware that the height of the saturation level in the waste is above the height of the groundwater table that surrounds the mine void.	Section 4.4.3 of LEMP
Emergency Management Plan		
159	In relation to matters identified in Condition 158, as part of the LEMP, the Applicant must prepare an Emergency Management Plan. The Plan shall address, but not necessarily be limited to: a) identification of threats to the environment and/or public health that could arise in relation to the construction and operation of Waste Management Facility and Intermodal Facility including the	Refer to ERP

	transportation of waste. These threats may include fire (waste transportation or within the landfill), overflow, dam failure, power or other utility failure, natural disaster etc; b) identification of strategies to minimise and ameliorate the effects of any groundwater surface water pollution identified from the groundwater and surface water monitoring programs; c) an estimate of the cost of implementation; d) actions to effectively respond to the disruption of operations so the risk of pollution is minimised; e) a communications strategy for alerting relevant agencies and the potentially affected community in the event of the disruption to operations leading to significant pollution; f) ensuring that all relevant employees are familiar with the emergency management plan; and g) any chemical storage required to operate the LTP and be consistent with the Department of Planning and Environment's Hazardous Industry Planning Advisory Paper No. 1, 'Emergency Planning'. The Applicant should regularly review the adequacy of the plan obtaining expert advice as required.	
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1.3.4 Environment Protection Licence

EPL 11436 stipulates the environmental obligations for Veolia under the POEO Act. The relevant conditions to the LMP and Section 120 of the POEO Act are provided in **Table 1.4**.

Table 1.4 EPL Condition

Relevant Condition	Requirement	SWMP Reference
2 – Discharges to Air and Water and Applications to Land		
P1 – Location of monitoring/discharge points and areas		
P1.3 Point 23	Leachate Quality Monitoring Leachate Pond, northwestern side of void - near top. E734189 N6117233	Section 5.1.1
P1.3 Point 24	Leachate Quality Monitoring Leachate Recirculation System (In Void). E734400 N6117233	Section 5.1.1
P1.3 Point 61	Effluent from Leachate Treatment Plant LC1 (discharge from Leachate Treatment Plant) as shown on the map titled "WOODLAWN ENVIRONMENTAL PROTECTION LICENCE SITE MONITORING LOCATIONS" prepared by LandTeam Australia Pty Ltd and dated 21/04/2021 (EPA ref DOC21/307664). E734233 N6117160	Section 5.1.1

3 – Limit Conditions		
L1 – Pollution of Waters		
L1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.	Sections 1.3.4, 3 & 4
L1.3	There must be no discharge of water from the premises unless more than 210 mm of rain falls within a 72 hour time period (1 in 100 year ARI of 72 hours duration).	Section 4.1.3
4 – Operating Conditions		
O5 – Processes and management		
O5.3	Where contaminated water is used for dust suppression, it must only be applied in the landfill void, and in any areas around the perimeter of the void where contaminated water will drain back into the landfill void.	Section 4.1.3
O5.4	The evaporation of water by spraying must not result in the drifting of the sprayed liquid from the premises.	Section 3.1.2
O5.5	Untreated leachate must not be transferred to Evaporation Dam 3 unless approved in writing by the EPA.	Section 3.1.2
O5.6	Containers used for transporting waste must only be washed at the container wash facility as frequently as is necessary to minimise environmental impacts from the containers. The container wash down facility must be designed, installed and operated with the aim of collecting, treating and disposing of any washdown waters to the leachate collection system. Any collected solids must be returned to the active tipping face.	Section 3.1.2
O6 – Waste Management		
O6.2	The landfill void must be managed to ensure the groundwater gradient directs groundwater flows towards the landfill void.	Sections 3.1.5, 4.1.2, 4.1.6, 4.2.1
O6.3	A leachate collection/storage/recirculation/treatment system must be designed, installed and operated to: a) accept, in addition to leachate, other waste-waters and contaminated storm-waters allowed by this licence to be introduced into the waste; b) efficiently operate, despite settlement of the waste; c) ensure that liquid is not deliberately stored in the landfilled waste, unless it is necessary for the efficient decomposition of the landfilled waste; d) ensure that leachate can be recirculated within the biologically active zones of the landfilled waste; e) comply with condition O5.2; and	Refer to Cond 50 of DA

	f) ensure to the maximum extent practicable the biological decomposition of all organic waste and productive capture of methane.	
O6.4	All dams used for the storage of treated leachate must be maintained with a minimum freeboard of 0.5m	Section 3.1.3
O6.5	A barrier system must be installed for localised joints, fractures and rock debris within the landfill, in accordance with the specifications detailed in the letter from Coffey Geotechnics Pty Ltd to the Department of Planning, dated 6 September 2007, reference GEOTLCOV23353AA-AB (DECC reference DOC07/38671). Note: The licensee may propose an alternative barrier system for the different surfaces of the mine void that are required to be lined in accordance with condition O5.4. In order for the EPA to consider varying condition	Section
O6.6	The licensee must install the barrier system referred to in O5.4 in accordance with the Construction Quality Assurance plan in Part 10 of the Barrier System and Quality Assurance Plan in Section 8.1 of the Landfill Environmental Management Plan, dated August 2004.	
O6.7	The licensee must not import water or other liquids into the landfill void, unless otherwise approved by the EPA, except for first flush waters collected at the Crisps Creek Intermodal Facility site (Environment Protection Licence No. 11455), container washdown waters, and raw dam water. The licensee may also import leachate and washdown water generated at the Clyde Intermodal Facility (Environment Protection Licence No. 11763) from the compaction and loading of waste into rail containers that are subsequently transported to the Woodlawn Landfill. The leachate and washdown water generated at the Clyde Intermodal Facility must be able to be classified as Liquid Waste.	
5 – Monitoring and Recording Conditions		
M2 – Requirement to monitor concentration of pollutants discharged		
M2.4 – Water and/ or Land Monitoring Requirements		
Point 23	Monitoring parameters listed for leachate	Section 5.1.1
Point 24	Monitoring parameters listed for leachate	Section 5.1.1
6 – Reporting Conditions		
R3 – Written Report		
R3.5	Whenever the height of the saturation level in the waste is above the height of the groundwater table that surrounds the perimeter of the mine void, the licensee must provide a written report to the EPA within 3 months.	Sections 2.1, 5.1.1

R3.6	The report must contain the following information: a) the height of the saturation level of the leachate in the mine void and the height of the groundwater at the perimeter of the mine void; and a) a program of actions to reduce the height of leachate in the mine void and the expected time duration for the actions and works.	Noted
R4 – Other Reporting Conditions		
R4.2	Within 24 hours of receipt of an odour complaint, the Licensee must provide the EPA with a written report. The report must include the following information: a) The date, time and duration of the odour incident; b) A description of the nature of the odour; c) The meteorological conditions prevailing at the same time the odour was reported; d) The location(s) of the place where the odour was detected; e) The circumstances in which the odour incident occurred (including the cause of the odour, if known); f) Time and date stamped photographs of the active landfill cell showing intermediate and daily cover; g) The action taken or proposed to be taken to deal with the incident, including follow-up contact with any complainants; h) Details of any measures taken or proposed to be taken to prevent or mitigate against a recurrence of such an incident; and i) The current level of leachate in each pond.	Section 4.4.3 of LEMP
8 – Pollution Studies and Reduction Programs		
U1 – Longterm Leachate Treatment Solution		
U1.1	By 30 September 2018, the licensee must install, commission and implement the longterm leachate management solution detailed in the report titled "Longterm Leachate Treatment Solution Submission Report" submitted to the EPA on 5 August 2016 (as revised).	Noted
U1.2	The membrane bioreactor (MBR) leachate treatment plant component of the longterm leachate management solution must be capable of continuously treating at least 4L/s of leachate.	Section 3.1.2.1
U1.3	Unless otherwise agreed to in writing by the EPA, the licensee must submit a monthly report detailing progress on the Longterm Leachate Treatment Solution project required by condition U1.1. The report must include, but not necessarily be limited to, the following: 1. a brief narrative on the progress of the project;	Noted

	2. photographs of construction work completed; and 3. a description of any anticipated or actual risks to the project timeline and the measures being implemented to mitigate those risks. The report must be submitted electronically on the fifth business day of the month for the previous month's activities.	
U3 – Leachate Minimisation Plan		
U3.1	By 30 December 2016, the licensee must submit a plan to the EPA detailing how it will reduce the amount of water entering the landfill void and making contact with the waste. The plan must: a) identify groundwater recharge points outside of the void; b) Identify groundwater seepage points within the void; c) Identify any other inputs; and d) Include a program of works aimed at minimising water ingress into the landfill void and increasing the capture and diversion of runoff from the walls of the void.	Noted

1.4 Stakeholder Consultation

Veolia is committed to meaningful stakeholder engagement and has worked in collaboration with relevant government agencies and the local community in the township of Tarago since the commencement of operations of the Bioreactor to resolve issues that impact local environmental amenity, as a result of operations at the Bioreactor.

1.4.1 Government Agencies

The following government agencies have been consulted with in association with the operations of the Bioreactor pertaining to leachate management:

- DPIE
- EPA
- NSW Department of Primary Industries – Water (DPI Water)
- Water NSW;
- Goulburn Mulwaree Council

1.4.2 Community Consultation

Veolia has formed a Community Liaison Committee (CLC), which acts as an interface between the residents of Tarago and Veolia to proactively resolve issues that potentially impact on local amenity from operations at the Bioreactor.

The key objectives of the communication and consultation program include:

- Educating stakeholders regarding key aspects of the Bioreactor; and
- Informing community groups and neighbours to help Veolia understand concerns.
- Meeting quarterly with Tarago and District Progress Association Incorporated (TADPAI) representatives on the CLC to provide updated information on odour incidents, leachate management, gas extraction and resolution of incidents related to the community.

Community consultation activities include:

- A dedicated Veolia webpage, offering general information on the Bioreactor: <http://www.veolia.com/anz/our-services/services/municipal-residential/recovering-resources-waste/woodlawn-bioreactor>
- A community telephone line to provide a central point of contact for community enquiries;
- Providing regular updates in the local newspaper, the Tarago Times, which is non-profit community service published monthly by the Tarago Sporting Association Inc. The newspaper is distributed throughout Tarago, Lake Bathurst, Mayfield, Boro, Taylors Creek and the surrounding district.
- Active participation in the TADPAI, which is a community group aimed at promoting the district and assisting the community in the development and maintenance of a rural lifestyle.

Veolia makes the following information publicly available on their website:

- Statutory approvals:
- Environmental Management Plan required under this approval
- Annual Environmental Management Report (including monitoring results (over the past 5 years)
- Independent Environmental and Odour Audit, and the Applicants' response to the recommendations in any audit
- A copy of the minutes of the Community Liaison Committee Meetings: and
- any other matters required by the Director-General.
- report of the complaints and the response/action taken to resolve the complaint as required by Condition 7 of the PA.

Section 2 Goals of the LMP

The goals of the LMP is to:

- Detail the leachate barrier systems installed at the Bioreactor
- Detail how leachate is managed at the Bioreactor, including extraction, recirculation, treatment and storage
- Detail measures to prevent leachate contamination of the surrounding environment
- Detail measures to separate storm water and leachate management systems at the Bioreactor
- Detail operations and management measures of the LTP

2.1 Roles and Responsibilities

Table 2.1 outlines the responsibilities of Veolia personnel with respect to leachate management.

Table 2.1 LMP Responsibilities

Action	Responsibility
Overall implementation of the LMP	Woodlawn Facilities Manager and Operational Personnel
Technical input to leachate barrier systems and leachate treatment system	National Technical and Engineering team
Construction of the leachate barrier system in accordance with the approved design	Woodlawn Facilities Manager / Site Engineer
Undertake inspections and maintenance of leachate management controls	Woodlawn Facilities Manager / Woodlawn Environmental Officer
Diversions of the storm water into surface water capture system to minimise the leachate generation	Woodlawn Facilities Manager and Operational Personnel
Operations and Maintenance of LTP	LTP Supervisor
Coordinate monitoring, compile reports and maintain internal records of monitoring	Woodlawn Environmental Officer
Collate and maintain records of complaints, respond to complainants. Community contact	Woodlawn Environmental Officer
Identify non-conformances and notify Facility Manager/ Safety Health Environment Quality (SHEQ) Representative	Woodlawn Environmental Officer
Contingency measures to manage leachate levels in the event they rise above the natural groundwater table	Woodlawn Facilities Manager
Authorise and confirm the implementation of mitigation measures	Woodlawn Facilities Manager / Woodlawn Environmental Officer
Liaise with government agencies and regulators, notify EPA when leachate in waste exceeds natural groundwater table	Woodlawn Facilities Manager / Woodlawn Environmental Officer / SHEQ Representative

Section 3 Environmental and Operational Impacts

3.1 Existing Environment

For the details for the existing environment for the Woodlawn Eco-Precinct, refer to section 3.1 of the LEMP.

The key components that form the part of Leachate Management system (Appendix D) includes:

- The former mine void / landfill
- Leachate Extraction
- Drainage Infrastructure
- Leachate collection and treatment system and evaporation dams
- Evaporation

Leachate generated within the void is re-circulated within the landfill to encourage biogas, which is recovered for energy generation. Excess leachate is extracted and treated within an LTD or through LTP

Veolia has been operating an activated sludge leachate treatment system in the Leachate Treatment Dam (LTD) since 2012. This system has been consistently improved in terms of process reliability and treatment efficiency since commissioning. While the quality of the treated leachate has steadily improved since 2012, the treatment capacity of the system is still influenced by ambient conditions, which affects the required residence time within the leachate Treatment dam.

The Leachate Treatment Plant (Appendix H) consists of several wastewater treatment elements for treating leachate from the void to a much higher quality effluent than the LTD. The treatment consists of biological processes (activated sludge/biomass) involving chemical addition and removal of potential odour producing compounds.

Treated leachate and treated effluent from LTD and LTP is discharged to the ED3 system and ED1 Coffey Dam(s) respectively and is managed through natural and mechanical evaporation.

3.1.1 Bioreactor Void

3.1.1.1 Void Basal Liner System

The basal liner extends across the entire footprint of the base of the bioreactor and consists of 900 mm thick compacted clay liner achieving a permeability of less than 1×10^{-9} m/s and a high density polyethylene (HDPE) membrane protection layer for the side slopes. At the intersection with the side slopes, the clay extends up to 2 m in height. The basal liner construction is included in **Appendix A**.

3.1.1.2 Clay Lining of Void Walls

Clay lining has been undertaken in sections of the void where the rock formation is discontinuous, such as rock fault and slip areas. At least 1m of clay, with a maximum permeability of 1×10^{-9} m/s, has been compacted against the wall to form a barrier in these areas. The permeability achieved in these areas is proved through testing. Clay lined areas are surveyed to delineate the areas where the barrier has been constructed (shown in **Appendix B**). All clay lining works have been completed in accordance with the Barrier System and Quality Assurance Plan.

3.1.1.3 Joint Fractures and Drill Holes

Joints, fractures and drill holes are visually assessed and suitable diversion systems are implemented to drain this water to surface water collection systems, where required. As the waste level approaches a joint,

fracture or drill hole these points have been sealed using the most appropriate method such as grouting, or lining with clay. All sealing works have been completed in accordance with the Barrier System and Quality Assurance Plan.

3.1.1.4 Sealing of Adits

Two entrances to underground mining tunnels (adits) were present within the mine void at Woodlawn. These are termed the Northern Portal and Southern Portal, based on their location within the mine void. Following termination of mining activities in 1998, the adits were blocked off with waste rock covered by a surface coating of shotcrete, approximately 10 – 15m from the entrance, to prevent access to the abandoned underground mine working.

The Northern Portal dimensions were approximately 5.7m wide by 5.5 m high. The Leachate Barrier System was designed by Golder Associates which is detailed in a Design Report. The barrier system was constructed with a shotcrete plug mixed with a Xypex admixture to form the sealing structure. Waste rock compacted within the adit between the void and the face of the shotcrete plug. Larger rock fragments were filled over the face and above the opening of the adit to distribute forces from landfilling activities onto the void walls.

The southern adit dimensions are approximately 7 m wide by 5 m high. Golder Associates designed the Leachate Barrier System, which is detailed in a Design Report. The design and construction of the barrier system of the Southern adit was similar to Northern adit with exception of pressure injecting the concrete seal to form the sealing structure.

The sealing design for both the northern and the southern adits was approved by the EPA prior to construction and was in general accordance with the Barrier Systems and Quality Assurance Plan). Construction works were approved with a specific Construction Quality Assurance Plan for each of the sealing works completed, submitted and approved by the EPA, prior to covering with waste.

Work as executed drawings are included in Appendix C-1 for the northern adit and Appendix C-2 for the southern adit.

3.1.1.5 Leachate Extraction

Leachate extraction is required to manage the volume and level of leachate within the Bioreactor.

To optimise the gas capturing from void and reduce the leachate levels in the void, leachate will be continuously extracted and treated via leachate treatment infrastructure, including LTD, LTP and discharged to the storage/evaporation dams. In order to maximise landfill gas capture efficiency and minimise odour potential, the extraction rate will be determined by the capacity of the leachate management infrastructure and the climatic conditions. .

Treated leachate from LTD is discharged into ED3N lagoons (1,2,3,4) and ED3SS . Effluent from LTP will be discharged into the ED1 coffer dam(s).

The leachate extraction rates are based on the following variables:

- The treatment capacity and efficiency of the leachate treatment process.
- The demand of leachate extraction for maintaining gas extraction and tipping operation.
- Climate conditions (rain to evaporation ratio)

Leachate extraction is conducted from selected landfill gas extraction wells (based on the gas balancing operation and regular monitoring/observation), surface sumps, knock-out-pots (KOPs) of landfill gas pipeline and any other identified area with potential leachate issues..

3.1.1.6 Drainage Infrastructure

The groundwater flow dynamics at the Bioreactor are defined in a conceptual model (Appendix F) prepared by Earth2Water (2016). The conceptual model shows that groundwater flow is directed towards the Bioreactor

Drainage infrastructure installed within the waste mass forms a critical function in directed landfill gas and leachate within the Bioreactor. Drainage consists of aggregate trenches strategically placed within the waste to interconnect wells into specific drainage zones. These systems enable access to and control of leachate over larger areas of the waste subsurface and are able to detail. Aggregate drainage lines are used as they are less likely to be impacted by waste settlement than pipelines.

To minimise the amount of leachate generated due to rainfall, diversion systems have been installed around the void to control stormwater flows. This is described in detail in the Soil and Water Management Plan (SWMP).

3.1.1.7 Container Wash Down and imported liquids

All liquid used in the wash down of containers is managed as leachate. Washdown liquid is collected and used for dust suppression within the Bioreactor or discharged to the leachate treatment system.

Leachate and wash down liquids from Veolia's Transfer Terminals (Clyde and Banksmeadow) in Sydney are imported for treatment in the onsite leachate treatment system. This is managed through direct discharge into the leachate treatment dam.

Any liquids required to be imported to supplement moisture within the Bioreactor process would be tested to determine the chemical composition, prior to injection into the waste. Approval from the EPA would be obtained prior to undertaking these activities.

Section 4 Leachate Treatment

4.1 Leachate Treatment Plant

The Leachate Treatment Plant (LTP) located on the north side of the void between the Bioreactor and Evaporation Dam 1, consists of a membrane bioreactor (MBR) treatment system with a design capacity of 4.05 L/s (350 m³/d). The MBR system has been designed as a modified activated sludge biological process to treat the main parameters found in the raw leachate extracted from Woodlawn bioreactor to higher quality effluent to achieve target design values listed in **Table 4.1** below.

Table 4.1 LTP Design Values

Parameters	Units	LTP influent	LTP effluent design values
pH	--		6.5-8.5
Conductivity	µS/cm		--
COD	mg/L	6,000-7,000	2,500
BOD	mg/L	700-1,100	10
Total Phosphorus	mg/L		13
Ammonia	mg/L	3,000-4000	10
Nitrate	mg/L		<1,500
TSS	mg/L		5
TDS	mg/L		30,000
Chloride	mg/L		5,000

The LTP (**Figure 4.1**) includes the treatment process units as outlined in **Table 4.2** below.

Figure 4.1 LTP Process Flow Description

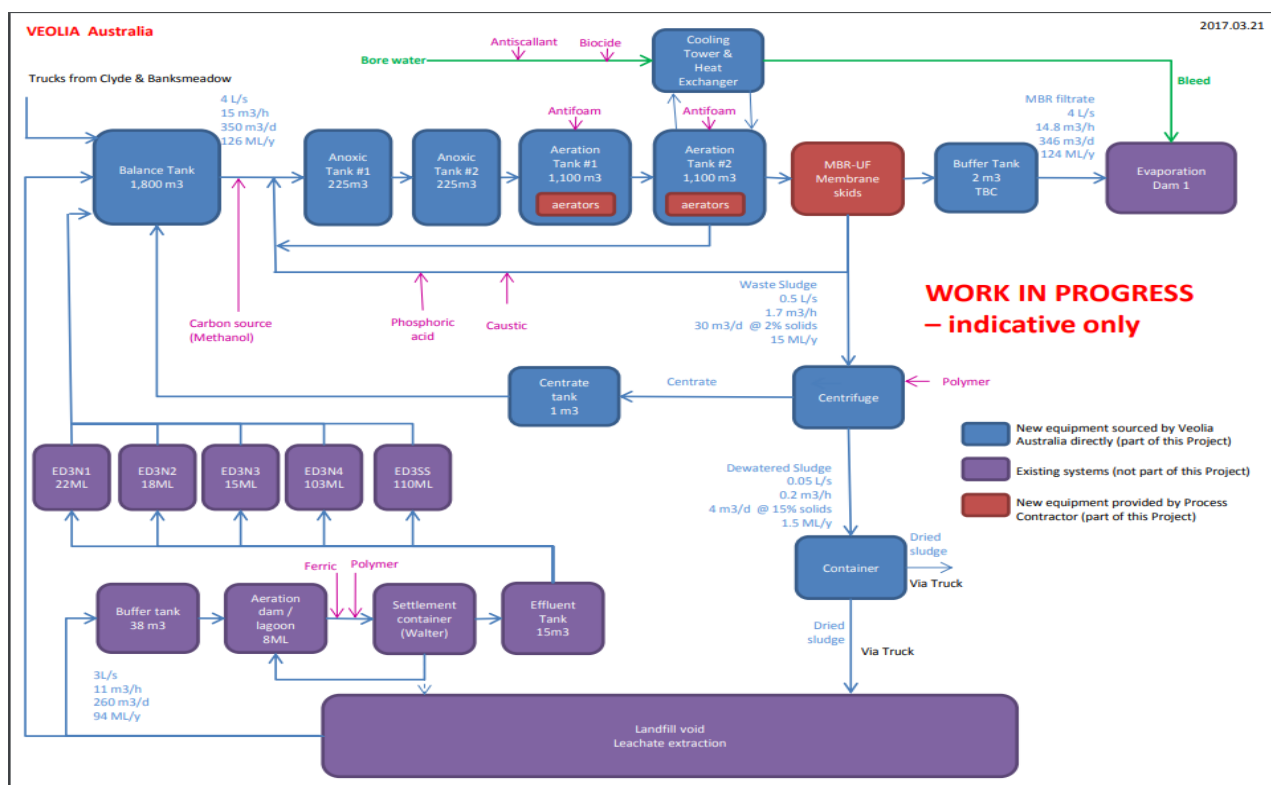


Table 4.2 LTP Process Description

MBR Process	Process description
Primary Treatment	All incoming raw leachate pumped from various site locations enters primary treatment via the screen to ensure removal of gross solids, large materials and other pollutants. The inlet screen protects the downstream treatment process and ultimately the membranes of the ultrafiltration system. The screening unit automatically dewateres and stores the rejects from the inlet screen in a collection skip bin. When the bin is full, it will be removed from the site by authorised Veolia personnel and taken to the bioreactor nearby for adequate final disposal.
Balance Tank	Primary treated leachate from the inlet screen is discharged into a 2 m³ Transfer Tank and then pumped to a 1,800 m³ Balance Tank. The balance tank provides buffer storage capacity to ensure the leachate flow into the downstream treatment process is controlled. If the influent flow rate exceeds the design flow rates of 4.05 L/s in the balance tank during peak periods, the leachate overflows back to the existing LTD nearby. In addition, the flow of leachate from the pressure pumping system will be reduced by the LTP's SCADA control system.
Anoxic Tanks	Leachate from the Balance Tank is pumped into 2 x 225 m³ anoxic tanks where it is mixed with nitrified leachate from the Aeration Tank to create conditions suitable for the denitrification process (biological transformation of nitrate to nitrogenous gases by reduction of NO_3^- to N_2). An emergency overflow is directed to the Balance Tank.

	Methanol is supplied to the Anoxic Tank as an additional carbon source for denitrification.
Aeration Tanks	Leachate from the Anoxic Tank is pumped into 2 x 1,100 m³ aeration tanks for nitrification (biological transformation of ammonium (NH₄⁺) to nitrate (NO₃⁻) by oxidation). Excess liquid from the Aeration Tank is pumped to the anoxic tank using 2 centrifugal pumps. Dissolved Oxygen (DO) in the Aeration Tank is maintained to an adjustable set point of 2 mg/L via continuous online monitoring of DO and a variable speed drive blower that supplies air using a jet injector system installed at the base of the tank. The system operates with a high biomass concentration of around 8,000-10,000 mg/L Mixed Liquor Suspended Solids (MLSS). MLSS in the aeration tank can be maintained during low demand periods with supplementary carbon dosing into the Anoxic Tank. Waste Activated Sludge (WAS) is pumped from the Aeration Tank when MLSS increases above approximately 10,000 mg/L. Average WAS generation is estimated to be <2 m³/h and will be stored in the 10 m³ centrifuge feed tank for processing by the centrifuge.
Ultrafiltration Membrane System	Leachate from the aeration tank is pumped into the ultrafiltration membrane system installed in the plant room next to the LTP bunded area. Excess liquid from the ultrafiltration membrane system tank is pumped back to the Aeration Tank using 2 centrifugal pumps of capacity varying between 10 – 25 m³/h each, installed with variable speed drives (VSD). The proposed ultrafiltration system is a skid mounted system.  The skid is a complete factory tested package system and contains 4 membrane modules in each of the 2 loops. The membrane modules have an approximate membrane pore size and a membrane surface area of 28.5 m².

	The membranes are cleaned by backwash water supplied by the softening system installed nearby inside the plant room. Preliminary Critical Control Points (CCP) and Critical Limits (CL) will be continuously monitored with alarms and automatic shutdown using the LTP's SCADA controls system if critical limits are reached.
Sludge Treatment	The sludge is processed using a centrifuge. A polymer dosing system provides polymer to the centrifuge inlet stream to assist in the dewatering. The centrifuge has two outlet streams: a liquid stream (centrate) and a solid waste stream (dewatered sludge). The centrate is transferred to the 300 L Centrate Tank before it is reinjected back into the Anoxic Tank. The dewatered sludge is transferred to a skip bin where it will sit until it is removed from the site by authorised Veolia personnel and taken to the bioreactor nearby for adequate final disposal.
Final Effluent	The final treated effluent is then transferred to the ED1 Cofferdam(s) built within the ED1 footprint.

Chemical dosing: **Table 4.3** lists the key chemicals that are required in the LTP process and are part of chemical dosing systems.

Table 4.3 List of chemicals used in LTP process

Chemical name	Used for
Methanol 98%	As source of carbon
Sodium Hydroxide 46 %	To maintain the pH
Phosphoric acid 75%	To maintain the pH
Sodium hypochlorite & Citric acid	Membrane cleaning
Hydrex 2973	Anti-foam agent
Hydrex 2923	Anti-scalant for cooling tower
Hydrex 6664	Dewatering –liquid polymer

SCADA system: A Supervisory Control and Data Acquisition (SCADA) system is installed to control, monitor and optimise the processes and operation of LTP. The system includes control and communications equipment, cables, monitoring instruments and computers. This system allows monitoring and optimising processes to improve reliability, improve safety and working conditions, and reduce operating costs. Operational staff is able to remotely monitor and control the plant. Critical alarms are pushed to the operator on duty via Text.

Contingency Measures: An initial assessment of the operations of the LTP identified as the following critical items to prevent system failure.

- Supply of Power: Power supply is critical element to keep the activated sludge alive in the biological reactors, suitable generators will be used as a source of backup or standby power.
- Aeration Pumps: Aeration is also a critical element for the live activation sludge, a couple of spare aeration pumps will be stocked on site to be used in the event of any pump failure.
- Mixers in the Anoxic tanks: Consistent mixing is required in the anoxic tank for the completion of the reaction. Spare mixers will be stocked on site to be used in the event of any mixer failure.

List for the critical item will be updated over the commissioning and process optimisation phase.

4.1.1 LTP commissioning and Process Optimisation Period

Commissioning of the facility will be managed by the original technology providers and Veolia, and is expected to be carried out over a period of 6 weeks following a pre-commissioning period of 4 weeks. Critical to commissioning of the plant is biological seeding (supply of biomass/microbial population) of the bioreactor. The seed shall be sourced from Earth Power (Camellia, NSW).

A period of biomass growth and adaptation is required during the early operation of activated sludge wastewater treatment plant. Stabilisation of a biological process is dependent upon suitability of imported seed sludge. Earth Power waste-activated sludge (excess biomass) has been identified as a suitable near match to the biomass required

During early plant operations, the LTP will be monitored closely to maintain and facilitate biomass growth conditions; less than optimal pH and other leachate characteristic variability that can create a slower than required processing capacity.

As with any biological treatment process, it will take time for the LTP to reach a consistent point of performance (referred to as a process optimisation period). A timeframe of approximately 6 months is expected to achieve reliable and conforming discharge specifications post commissioning

During the 6-month of process optimization period the LTP performance shall be verified against the Biowin process modelling outputs (BioWin wastewater process simulation software ties together biological, chemical, and physical process models to provide insight into the whole plant. BioWin simulations help engineers and operators make decisions that reduce capital and operating costs and ensure treatment objectives are met) which should demonstrate a consistent improvement in treatment performance toward final discharge acceptance criteria across all contaminants. The results of the Biowin process modelling outputs can be provided to relevant stakeholders upon request.

4.1.2 Discharge during the commissioning and process optimisation period

Due to storage capacity constraints at the Woodlawn site, treated effluent during the commissioning and process optimization period (when compliance discharge quality may yet to be achieved) will be required to be discharged to the ED1 Coffe Dam(s).

The Woodlawn Bioreactor Facility Odour Modelling Study (July 2016) (Appendix G) assessment identified Biological Oxygen Demand (BOD) and Ammonia as having the strongest influence on odour emission rates from the ED1 system. The modelling projection results demonstrate comfortable compliance with the relevant odour criterion of 6 ou at the nearest sensitive receptor and minimal sensitivity to possible fluctuations in leachate quality of 2, 5 and 10 times above the target design values (refer to Table 7).

On this basis, the storage of the treated effluent during the initial commissioning and process optimisation period is not expected to result in any significant increase to off-site odour impacts. The annual odour audit will coincide with this commissioning period and will provide the ability to verify the expected odour outcomes.

In the event that treated effluent does not meet the criteria specified above, treated effluent will be diverted back to the LTP or to the LTD for reprocessing.

4.2 Leachate Treatment Measures

The process that follows in 12 Megalitre (ML) Leachate Treatment Dam is a typical activated sludge treatment process, which focuses on minimising the organic loading within the leachate. The current target quality for treated leachate of LTD is:

- Biological Oxygen Demand – less than 300 mg/L
- pH – greater than 6.5
- Ammonia – less than 1500 mg/L

The treatment process reduces potential odour emissions to enable storage of treated leachate in engineered onsite dams for evaporation.

The leachate treatment process is as follows:

- Raw leachate pumped from the waste is discharged into the anoxic zone of the leachate treatment dam.
- In the anoxic zone of the leachate treatment dam, the raw leachate is treated via the denitrification process.
- Then the leachate from the anoxic zone flow into the aeration zone. Aerators are operating continuously within the dam to promote mixing and oxygen transfer.
- Coagulants and flocculants are added to promote sludge settlement.
- Partially treated leachate from the dam is passed through a settlement tank to remove suspended solids. The solids are flushed out of the settlement tank and returned back into the dam. Part of the treated leachate and the settled sludge are recirculated back into the anoxic zone of the leachate treatment dam. The rate of the recirculation is adjusted based on the monitoring of the treatment process.
- The residual liquid, termed treated leachate, is transferred to ED3N for storage.
- Sludge is removed from the dam, as required and transferred back into the Bioreactor.

4.2.1 Leachate Storage Systems

Evaporation Dam 3 (ED3) is split into a series of lagoons to manage and store either treated leachate or stormwater extracted from the void (refer to Appendix D for the Leachate Management Layout Plan).

Treated leachate from LTS is only discharged into either ED3N or ED3S-S. Diversion of treated leachate will be dependent on dam capacity, and will be achieved via pipelines and valves.

ED3N and ED3S-S dams are generally maintained in an alkaline state to manage potential odour emissions from the reduction of hydrogen sulphide. The quality of water in these lagoons is usually neutral to alkaline in state and therefore do not require further addition of chemicals. The pH level of the dams is monitored as required and should acidic conditions be identified, measures will be undertaken to correct the pH. This may include the addition of lime.

Current Monitoring and Inspection Program for dams is used to evaluate the integrity of the existing barrier and to assess if leakage from the dam is occurring.

The volume of the leachate transferred to the leachate storage dams is recorded on a daily basis using the flow meter installed on the discharge side of the leachate treatment system.

All dams/lagoons used for the storage of treated leachate are maintained with a minimum freeboard of 0.5 m. Untreated leachate is not stored in the evaporation dams, unless prior approval is obtained from the EPA.

4.2.2 Evaporation Dam 3 (North)

In September 2016, Veolia received modifications (MOD 1 and MOD 2) to the project approval and development consent to store treated leachate within Evaporation Dam 3 South-South (ED3S-S). This dam has a capacity to hold 111.44 ML and was lined with a 1.5 m thick dual clay liner system that was

independently verified by report (Construction Quality Control Assurance for Lining Evaporation Dam (ED3SS), November 2015 to July 2016) prior to initial receipt of treated leachate.

4.2.3 Evaporation Dam 3 (South-South)

In September 2016, Veolia received modifications (MOD 1 and MOD 2) to the project approval and development consent to store treated leachate within Evaporation Dam 3 South-South (ED3S-S). This dam has a capacity to hold 111.44 ML and was lined with a 1.5 m thick dual clay liner system that was independently verified by report (Construction Quality Control Assurance for Lining Evaporation Dam (ED3SS), November 2015 to July 2016) prior to initial receipt of treated leachate.

4.2.4 Evaporation Dam 1 Cofferdam 1 (ED1 Cofferdam 1)

ED1 Cofferdam 1 is constructed in accordance with the requirements of DA and PA within existing ED1 footprint, (**Figure 1**) and is approximately of capacity of 150ML. Only treated effluent from LTP is stored in ED1 Cofferdam 1.

The design of the ED1 Cofferdam 1 includes:

- A minimum thickness of 0.3 m of re-compacted clay from the floor of ED1 with an in situ coefficient of permeability of 1×10^{-9} m/s.
- High Density Polyethylene (HDPE) liner with 1.5 mm thickness.
- Bund walls with slopes not exceeding a gradient of one vertical to three horizontal.

4.2.5 Evaporation Dam 1 Cofferdam 2 (ED1 Cofferdam 2)

ED1 Cofferdam 2 is constructed in accordance with the requirements of DA and PA within the existing ED1 footprint, (**Figure 1**) and is approximately of capacity of 50ML. Treated effluent from LTP is stored in ED1 Cofferdam 2.

The design of the ED1 Cofferdam 2 includes:

- A minimum thickness of 0.3 m of compacted clay from the floor of ED1 with an in situ coefficient of permeability of 1×10^{-9} m/s.
- High Density Polyethylene (HDPE) liner with 1.5 mm thickness.
- Bund walls with slopes not exceeding a gradient of one vertical to three horizontal.

4.2.6 Evaporation of Treated Leachate and Effluent

Treated Leachate from the LTD and effluent from LTP is stored in onsite dams and is managed through evaporation and mechanical evaporation (**Appendix E**). Natural evaporation at the site is approximately twice the magnitude of rainfall based on historical records. Therefore, liquid loss from large surface area dams is a suitable volume management measure for the site.

4.2.7 Mechanical Evaporation Techniques

ED3N4: Four of the mechanical evaporator units are operated to increase the evaporation potential of liquid within the lagoon. They are automatically operated based on ambient weather conditions including wind speed and wind direction to ensure that spray is contained back over the source dam. When all the four units are operating, the flow rate is about 14.5 L/s. Three new floating evaporators with flow rate of 2 L/s were installed in Feb 2017 to assist with mechanical evaporation.

ED3N1-3: To assist with evaporation, three new (one in each lagoon) floating evaporators with flow rate of 2 L/s are installed and are operated based on ambient weather conditions including wind speed and wind direction to ensure that spray is contained back over the source dam.

The outflow from the current leachate treatment dam to the ED3N system is discharged via 8 of spray nozzles to increase the evaporation. The flowrate will vary based on the operation of the current OASTS.

ED3SS: 3 floating evaporators are in operation. The flowrate is about 86 L/min for each evaporator. The treated effluent already in ED3SS is also recirculating within ED3SS via a pump and a spray system for evaporation.

Investigations about other evaporation technologies are ongoing. Veolia is investigating the possibility of using residual heat from the station exhaust to assist evaporation and other technologies using electricity or fuel.

Veolia is confident that ongoing monitoring and assisted evaporation readiness will ensure the Eco-Precinct remains a nil discharge site.

4.3 Void Water Balance

The EA for the Woodlawn Expansion Project included a water balance model calibrated with more than 5 years of data obtained from Veolia's continual monitoring of the Bioreactor's performance. Based on anticipated waste loads, climatic conditions and management arrangements, this model was used to predict the future level of leachate saturation under the changing disposal rate within the void.

The water balance model was based on:

Liquid out = Liquid in +/- Liquid contributing to change in storage

4.3.1 Inflows

Total inflow to the pit calculated from September 2004 – January 2010 data was 665,561 m³. The components of the inflow are summarised in **Table 4.4**.

Table 4.4 Components of Inflow

Inflows	% of Total Inflow
Groundwater Inflow	21
Rainfall (direct onto waste)	13
Indirect Rainfall (sides of the pit)	63
Added Water	<1
Recirculated Leachate	2

4.3.2 Outflow

Total outflow from the pit calculated for the same period was 465,641 m³, or 70% of inflow. The components of outflow are summarised in **Table 4.5**.

Table 4.5 Components of Outflow

Outflows	% of Total Outflow
Dewatering below liner	31
Intercepted stormwater	45
Leachate extracted	13
Loss to unsaturated storage	11

4.4 Predicted Leachate Impacts

The existing potential leachate impacts associated with operations of the Bioreactor and LTP are:

- Contamination of the groundwater
- Contamination of the surface water
- Accumulation of the leachate can impact the ability to capture landfill gas
- Odour generation
- Accumulation of the treated effluent stored on the site.

The potential risks are shown in **Table 4.6**.

Table 4.6 Leachate Risk Rating

Potential Impact	Source	Risk Ranking	Mitigation Measures	Key Issue? (Yes/No)
Contamination of the groundwater	Leachate within the Bioreactor Storage of treated leachate and effluent	High	Yes	Yes Refer to Section 4
Contamination of the surface water	Leachate within the Bioreactor Storage of treated leachate and effluent	Moderate	Yes	Yes Refer to Section 4 and 4.1.4
Accumulation of the leachate can impact the ability to capture landfill gas	Inflows of groundwater and surface water into the Bioreactor Inability to extract leachate from the waste mass at a sustainable rate	Moderate	Yes	Yes Refer to Section 4
Odour generation	Odour generation from the untreated leachate can contribute to the odour impacts on sensitive receptors end Too much leachate generated might limit the effectiveness of the Bioreactor landfill gas capture system and could contribute to potential odour impacts at sensitive receptors	High	Yes	Yes Refer to Section 3.1.2 and Section 4
Accumulation of the treated effluent stored on the site	Accumulation of large volumes of treated effluent in storage dams over time from the treatment process	Moderate	Yes	Yes Refer to section 4.5
Impact of pipe burst	Leachate within the Leachate Treatment Plant, or transfer system to ED1 Cofferdam(s)	Moderate	Yes	Yes Refer to Section 4.2

Section 5 Leachate Management Measures

Mitigation measures that have been incorporated into the operations of the Bioreactor and the LTP to minimise the risk and consequences associated with the leachate management issues and are summarised below:

- Leachate control measures within Bioreactor Void
- Control of the leachate within the LTP
- Control measures for Treated leachate and Effluent within the Dams
- Leachate Treatment
- Leachate Contingency Measures

5.1 Leachate Control Measures within Bioreactor Void

5.1.1 Leachate Barrier Systems

Barrier systems shall continue to be implemented, including:

- Clay lining of areas where the rock wall is discontinuous are completed progressively as detailed in section 3.2.
- Clay lining of the entire perimeter of the top 20 m of the void will minimise the risk of an outward hydraulic gradient being generated should the leachate level rise above the natural water table.
- Sealing of seep and drill holes as detailed in section 3.2.
- Construction of any new storage dams with an engineered liner system will be completed in accordance with EPA minimum requirements that are documented and current at the time of construction.
- All barrier systems shall be completed in accordance with the Barrier System and Quality Assurance Plan. Construction works for barrier systems not identified in this plan will be independently verified. This will ensure that containment systems are suitably constructed.

5.1.2 Leachate Recirculation

Leachate recirculation is undertaken to promote even distribution of moisture within the Bioreactor. Leachate is pumped from within the mass at leachate extraction wells and is then reinjected back into waste just below the surface. As the leachate filters through the upper layers of waste, a proportion of the liquid is retained in the upper layers of waste. Covered reinjection trenches are used to facilitate the infiltration of leachate back through the waste. This process is continuous as part of the operation of the Bioreactor.

5.1.3 Control of Leachate within the Bioreactor

Leachate and gas well erupting leachate onto the surface of the waste within the Bioreactor can be a potential source of odour. Management measures to minimise the leachate spills and eruptions include the following:

- If an area is identified as having high leachate level, leachate extraction pumps will be installed into the LFG wells within that area to control the leachate level. The leachate extraction pumps will be controlled automatically based on the leachate level and target to maintaining leachate below the level that will significantly affect LFG capture.

- Surveillance cameras have been installed on site and can be used for assuring any leachate spills are identified and cleaned as soon as possible as per the Leachate Spill Cleaning Procedure
- Old infrastructure, including some of the old wells in the void with potential to cause leachate spills/eruptions are also being considered for the installation of leachate extraction pumps or decommissioning.
- Installation and commissioning of a new leachate level monitoring system is anticipated to be completed by December 2018. The system is based on the installation of level loggers and pressure sensors into LFG extraction wells and monitoring of the readings via site SCADA, which will assist operation to gain better understanding of the leachate levels within the waste to perform proactively for leachate control.

5.1.4 Diversion of Stormwater into Surface Water Capture systems

Stormwater diversion structures are installed in accordance with those outlined in the SWMP. Any rainfall or surface water that comes in contact with waste or leachate is managed as leachate. These measures will ensure that leachate generation is minimised and required to be managed.

Detailed monitoring of leachate levels, leachate quality, surface water and groundwater quality enables identification of any breaches of environmental integrity or interaction between surface water and leachate systems and facilitates the early adoption of remedial measures.

5.2 Leachate Control within the LTP

Following measures are in place to control the leachate within the leachate within the LTP:

- LTP is fully bunded (to contain 110% of the facilities largest sized tank) to control the leachate within the bund in the event of any spills from the tank.
- Levels and pressure sensors are installed on all the critical tanks in the LTP. Monitoring and control of all the sensors accessible from the plant SCADA with critical alarms are pushed to the operator on duty via Text.
- Assessment of drainage and bund wall of LTP as part of the weekly checklist.
- The leak detection system for ED1 Cofferdam 1 consists of a double-containment piping system with built-in leak detection system that will monitor the transport of treated effluent from the LTP to Dam. The space between the inner pipe carrying the substance and the protective outer pipe serves as a pressure-resistant containment chamber for any leaks that might occur. The outer pipe will drain to a sump monitored with a level sensor so that, if a leak occurs, the sensors immediately register the problem. Sump will also be monitored as part of the daily checklist.
- The leak detection system for ED1 Cofferdam 2 consists of a piping system installed from the current outlet at ED1 Cofferdam 1 to the inlet at ED1 Cofferdam 2, with flow meters installed at either end. Any inconsistencies between the two flow meters will be investigated for potential leaks. The pipeline is installed above the surface to facilitate inspections and repairs as required.
- Sludge skip bin is covered and in the bunded area to prevent generation of any excess leachate.

5.3 Control measures for managing the treated leachate and effluent within the dams

5.3.1 Maintaining sufficient freeboard in storage dams

Maintaining a freeboard of at least 0.5 m in storage dams provides safeguard against overflow from significant rainfall events and waves generated by wind. In the event that the dams exceed the freeboard

amount, such as after a significant rainfall event, then excess volume shall be transferred to another dam with sufficient capacity. If no capacity is available, the Bioreactor can be used as a storage point as a last resort.

Before any ED1 Cofferdam(s) exceed 80% capacity, sufficient space will be made available in new or existing HDPE lined dams in accordance with conditions of DA and PA for the discharge of effluent from LTP.

5.3.2 Evaporation of Treated Leachate

Veolia is committed to minimise the volume of treated stored onsite and is using mechanical evaporators in addition to natural evaporators on ED3N and ED3S dams volume reductions

As detailed in section 3.1.4 a number of mechanical evaporators are used across the different storage dams. The use of mechanical evaporators assist in reducing the level of treated effluent stored in these dams.

5.3.3 Use of treated effluent from LTP

Heron Resources will have access to the treated effluent from the LTP for using it in their mineral processing.

Use of uncovered or open spray systems can contribute to the release of odour emissions and are currently not implemented at the Bioreactor. These systems may be viable in the future with the use of treated leachate or effluent from the LTP.

The above listed measures enable zero discharge leachate from the Bioreactor operational areas. Refer to the SWMP for measures to manage surface water discharge.

5.4 Leachate Treatment

The two-leachate treatment systems as detailed in Section 3.1.2 provides the ability to treat excess leachate volumes from the Bioreactor to higher quality effluent to reduce the odour potential from the site.

5.4.1 Sustainable Extraction estimate

An estimate of the sustainable leachate extraction rate shall be determined for the leachate treatment process. The sustainable extraction rate shall be calculated based on the desirable average extraction rate from the Bioreactor and will consider the following variables:

- Average extraction rate from the Bioreactor (L/s)
- Output rate of the leachate treatment process (L/s)
- Storage volume (m³), usage/application/evaporation/discharge rate (L/s) of the treated leachate.

5.5 Leachate Contingency Measures

Leachate contingency measures relate to the extraction and treatment of leachate from the Bioreactor. These measures shall be adopted should storage space in ED3 become limited using the current leachate treatment process or if the leachate levels exceed the height on the natural groundwater table.

- Construction of New ED1 coffer dams - New effluent dams will be constructed within ED1 footprint in accordance with the requirements of the DA and PA .

- Additional treatment technology - If circumstances require a different approach, Veolia will look at modifying the MBR plant with RO and evaporator technology to ensure that long-term leachate management solution to manage the odour and leachate on the site remains viable and sustainable.
- Leachate Recirculation - In the event of a leachate transfer system failure, for example pump failure or transfer pipe failure, the re-circulated leachate will be injected into waste directly via a re-injection pipe. As a result, leachate will not be exposed to air directly during the recirculation, which minimises the possibility of odour.

Section 6 Leachate Quality Monitoring and Reporting

6.1 Monitoring Program

Veolia undertakes the monitoring program in accordance with the requirements in EPL 11436. Environmental monitoring is undertaken in accordance with Veolia's environmental monitoring procedures, which specify the relevant standards and methodologies.

6.1.1 Environmental Monitoring

Monitoring of groundwater and surface water systems provides early indications of failure of leachate management systems. This enables the required corrective measures to be undertaken in a timely manner. Groundwater and surface water monitoring schedules are detailed in the SWMP.

Quarterly updates of the volume of leachate and remaining storage within ED3S-S will be provided to the EPA in accordance with the conditions set out by the modifications of the PA and DA.

The chemical composition and quantity of leachate relating to ED3S-S and ED3N as well as within the effluent discharge line will be addressed within the surface water-monitoring program as per the consent conditions. The quantity of the leachate from each source to ED3S-S and ED3N is compared in graphical format with rainfall data.

The chemical composition of the effluent from the LTP will be monitored. In addition, the leachate level will also be monitored at different locations in the Bioreactor to establish the standing level of leachate. These results are compared against groundwater levels to determine potential interaction between leachate and groundwater.

6.1.2 Quality Assurance Plan (QAP) for LTP

The QAP will be developed and implemented during commissioning works and Process Optimisation Period will include the following:

- Details on the number of samples, type of sample containers, preservation of samples, holding times, analytical methods, analytical detection and quantitation limits for each target compound
- LTP map(s) indicating the location of each sampling point
- Veolia will amend the QAP whenever there is a modification in sample collection, sample analysis, or other change in operational or monitoring procedures addressed by the QAP.
- Copies of the QAP will be retained on site and will be made available to EPA upon request.

The influent and treated effluent monitoring will consist of side-stream taken samples from the balance tank outlet and other locations of the plant to test the critical parameters and prove performance improvement until the LTP achieves final effluent requirements.

Operational monitoring plan will be implemented as part of Veolia's QAP during commissioning works and process optimisation Period. The parameters (pH, TSS and Turbidity) will be monitored in real time to allow critical data for the purposes of operator intervention and Plant performance improvement.

On-Line Monitoring

Monitoring equipment will be installed at critical points within the Leachate Treatment Plant process and will be linked to the SCADA to control chemical dosing rates in addition to providing a warning system for out of range results. The tests listed in **Table 6.1** below will be carried out by on-line analysers and recorded on SCADA.

Table 6.1 Online Monitoring Schedule

Sample Location	Parameter
Inlet point for Influent to the Balance Tank	Ammonia, Total Suspended Solids
Discharge point from LTP	Ammonia, TSS, Turbidity and pH
Balance Tank	Level, pH, suspended solids
Anoxic Tanks	pH
Aerobic Tanks	pH, Dissolved Oxygen
Membrane filtration	pH
Methanol Tank	Level, Pressure
Caustic Tank	Level, Pressure

The Plant results obtained from the monitoring plan will be benchmarked against Biowin™ simulator outputs during the Performance Proving Period, which is estimated as 6 months after commissioning works finish. This proposed QA/QC methodology will be part of Veolia QAP and should demonstrate a consistent improvement in the Plant performance towards a complying discharge quality across all contaminants.

6.1.3 EPL Monitoring Requirements

Monitoring required under EPL 11436 is detailed in **Table 6.2**.

The leachate level is also monitored at different locations in the Bioreactor to establish the standing level of leachate. These results are compared against groundwater levels.

Table 6.2 - EPL Monitoring Schedule

Monitoring Location(s)	Parameter	Frequency	Percentile
Leachate Pond (Point 23)	Alkalinity (as calcium carbonate), Aluminium, Arsenic, Barium, Benzene, Cadmium, Calcium, Chloride, Chromium (Hexavalent) Chromium (Total) Cobalt, Conductivity, Copper, Ethyl benzene, Fluoride, Lead, Magnesium, Manganese, Mercury, Nitrate, Nitrite, Nitrogen (ammonia), Organochlorine pesticides, Organophosphate pesticides, pH, Phosphorus (total), Polycyclic aromatic hydrocarbons, Potassium, Sodium, Sulphate, Toluene, Total dissolved solids, Total organic carbon, Total petroleum hydrocarbons, Total Phenolics, Total Suspended solids, Xylene, Zinc	Annual	
Leachate Recirculation System (Point 24)		Quarterly	
ED1 ED1 Cofferdam 1 ED1 Cofferdam 2 (Proposed) ED3N-1(Point 19) ED3N-2(Point 19) ED3N-3(Point 19) ED3N-4(Point 19) ED3SS-Lagoon 5(Point 18)	Volume (ML)	Monthly	
Effluent from LTP	Conductivity, Ammonia, COD, BOD Total Phosphorus, Nitrate, TSS, TDS, Chloride, pH	Weekly	100%ile
ED1 Cofferdam 1 ED1 Cofferdam 2 (Proposed)	Conductivity, Ammonia, COD, BOD Total Phosphorus, Nitrate, TSS, TDS, Chloride, pH	Monthly	

6.2 Performance Reporting and Review

All monitoring data collected is presented in Annual Environmental Management Reports (AEMR) to DPE and EPA. AEMR is also submitted to other relevant stakeholders. Where performance reporting is

required, the EPL stipulates that all relevant data and information pertaining to environmental monitoring must be recorded and maintained on site, including but not limited to:

- Sampling dates, times and name of sampler;
- Chain of Custody, analysis and results;
- Complaints received and corrective actions taken; and
- Copy of the EPL, development consent and other relevant approvals.

Within six months of commissioning the LTP and annually thereafter, Veolia will commission and pay the full cost of an independent assessment of the leachate and water management system. The audit will be performed in accordance with requirements of the DA and PA

The monitoring data is used to review and identify any exceedances against the adapted goals with the appropriate corrective actions applied as discussed below.

6.3 Exceedances and Corrective Actions

All incidents are investigated, and corrective actions assigned to prevent future occurrences.

An incident may involve any action or activity deemed to be in non-compliance with this LMP, other management plans as well as actual or potential Material or Serious Environmental Harm, or Pollution of Waters pursuant to section 120 of the Protection of the Environment Operations Act 1997.

All incident reporting will be recorded in RIVO, which forms part of Veolia's National Integrated Management System (NIMS).

6.4 Publishing of Monitoring Data

Where required, Veolia publishes the results of any environmental monitoring required under the EPL on the following website: <https://www.veolia.com/anz/media/media/reports>

Reference and Related Documents

Document Name
Golder Associates (2009). <i>Design Report, Leachate Barrier for Northern Adit Portal</i>
Golder Associates (2013). <i>Design Report, Leachate Barrier for Southern Adit</i>
Golder Associates (2013). <i>Woodlawn Southern Adit Leachate Barrier – Completion Report</i>
Earth2Water (2016). <i>Hydrogeological Study at Woodlawn Bioreactor</i>
URS, (2010). <i>Leachate Management at Woodlawn Bioreactor</i>
URS, (2010). <i>Environmental Assessment Woodlawn Expansion Project</i>
Veolia (2004). Barrier System and Quality Assurance Plan.
Veolia (2009). Northern Portal Sealing Construction Quality Assurance / Quality Control Report
Veolia (2016). Woodlawn Bioreactor Soil and Water Management Plan
Veolia (2016) Long Term Leachate Management Submission Report.

Appendices

Appendix A Bioreactor Basal Liner

Appendix B Clay Lining on Void Walls

Appendix C.1 Northern Adit Barrier Work As Executed Drawings

Appendix C.2 Southern Adit Barrier Work As Executed Drawings

Appendix D Leachate Management System Layout Plan

Appendix E Mechanical Evaporator Operation Protocol

Appendix F Bioreactor Hydraulics Conceptual Model

Appendix G The Woodlawn Bioreactor Facility Odour Modelling Study

Appendix H LTP Plans