VANZ Plan

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.

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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Quality Information

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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 Coffer Dam 1	Evaporation Dam 1 Coffer Dam No. 1
ED1 Coffer Dam 2	Evaporation Dam 1 Coffer 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

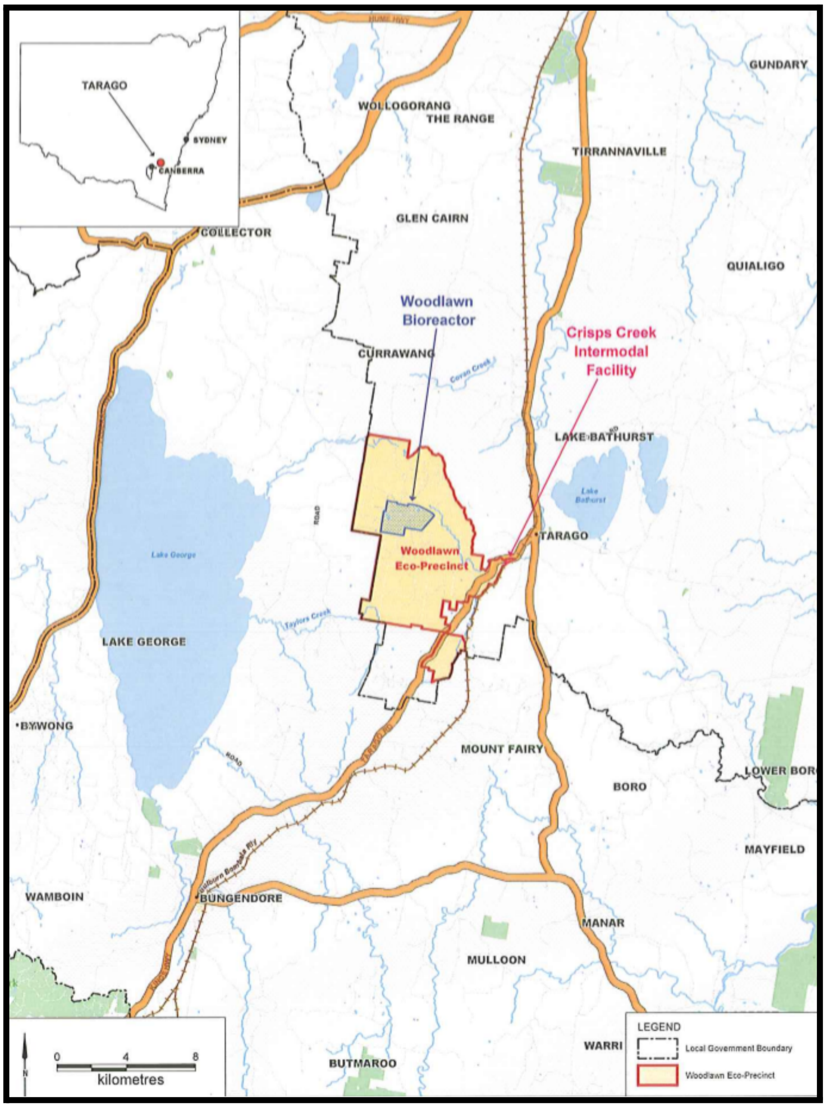
LGA	Local Government Area
LTP	Leachate Treatment Plan
MSW	Municipal Solid Waste
MBT	Woodlawn Mechanical Biological Facility
MWOO	Mixed Waste Organics Outputs
OEMP	Operational Environmental Management Plan (MBT)
PA	Project Approval
POEO	Protection of the Environment Operations Act 1997 (and Regulations)
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

Section 1 Introduction

1.1 Overview

Veolia Australia and New Zealand (Veolia) own and operate the Woodlawn Eco-Precinct (the Eco-Precinct), which is located approximately 40 km south of Goulburn and 50km north of Canberra and comprises of the Woodlawn Bioreactor (the Bioreactor), which also incorporates the Woodlawn Bio Energy Power Station (the Power Station) and Leachate Treatment Plant (LTP), the Crisps Creek Intermodal Facility (IMF) and the Woodlawn Mechanical Biological Treatment Facility (MBT) as depicted in **Figure 1.1**.

Figure 1.1 Eco-Precinct Location Plan



1.1.1 Eco-Precinct Context

The Eco-Precinct has been developed in stages by Veolia to encompass innovative practices, supplemented with renewable energy. Access to the Site is off Collector Road, which runs in an east-west direction from its 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 (formerlyTriAusMin 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 Coffer 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 Coffer 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 ED3is 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.	

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) pf 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;
- Proving 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 bv the Director-General.
- report of the complaints and the response/action taken to resolve the complaint as required bv 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 Coffer 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 1x10-9 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 1x10-9 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 m^3/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

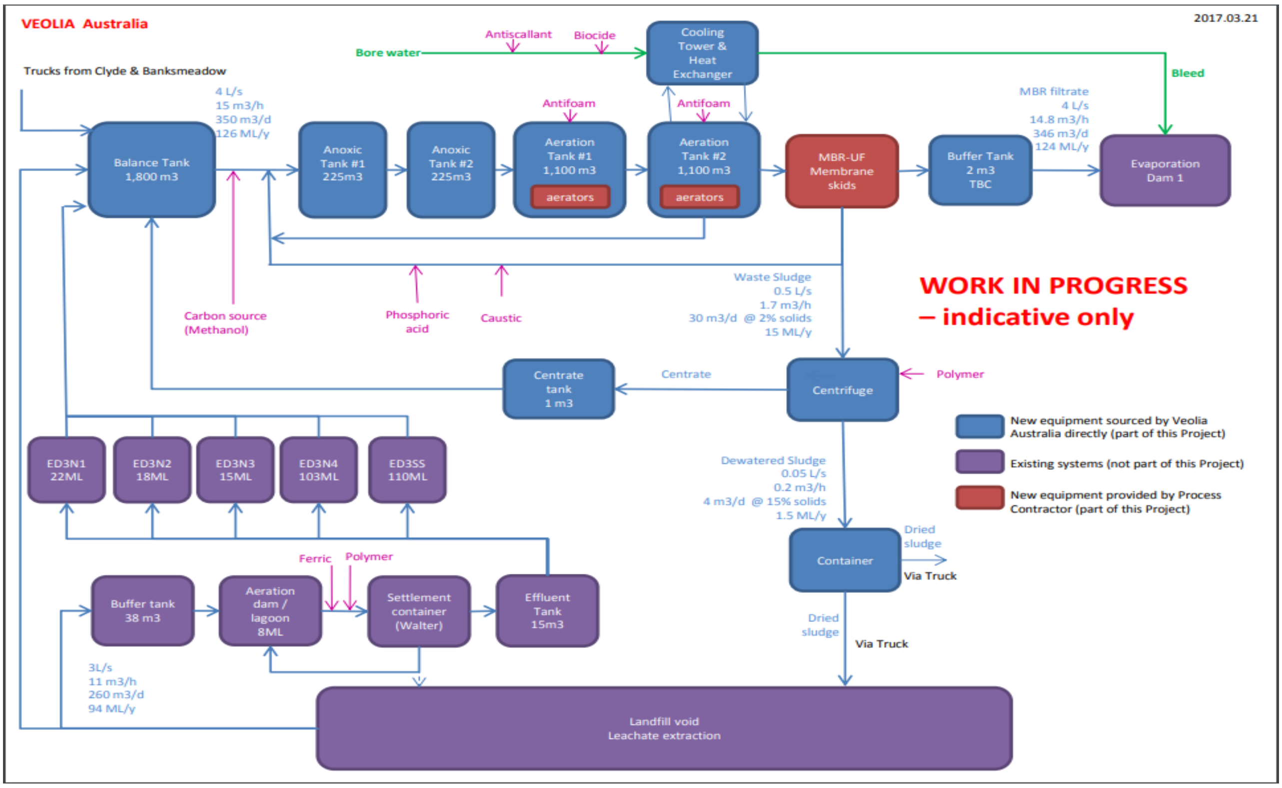


Table 4.2 LTP Process Description

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 dewaters 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 m^3 Transfer Tank and then pumped to a 1,800 m^3 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 m^3 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 m^3 aeration tanks for nitrification (biological transformation of ammonium (NH_4^+) to nitrate (NO_3^-) 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 m^3/h and will be stored in the 10 m^3 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 m^3/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 m^2.

	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 Coffer Dam(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 Coffer 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 receival 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 receival of treated leachate.

4.2.4 Evaporation Dam 1 Coffer Dam 1 (ED1 Coffer Dam 1)

ED1 Coffer Dam 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 Coffer Dam 1.

The design of the ED1 Coffer Dam 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 x10-9 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 Coffer Dam 2 (ED1 Coffer Dam 2)

ED1 Coffer Dam 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 Coffer Dam 2.

The design of the ED1 Coffer Dam 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 x10^{-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 m^3, 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 Coffer Dam(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 Coffer Dam 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 Coffer Dam 2 consists of a piping system installed from the current outlet at ED1 Coffer Dam 1 to the inlet at ED1 Coffer Dam 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 Coffer dam(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 (m^3), 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) Leachate Recirculation System (Point 24)	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	
		Quarterly	
ED1 ED1 Coffer Dam 1 ED1 Coffer Dam 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 Coffer Dam 1 ED1 Coffer Dam 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). *Design Report, Leachate Barrier for Northern Adit Portal*
Golder Associates (2013). *Design Report, Leachate Barrier for Southern Adit*
Golder Associates (2013). *Woodlawn Southern Adit Leachate Barrier – Completion Report*
Earth2Water (2016). *Hydrogeological Study at Woodlawn Bioreactor*
URS, (2010). *Leachate Management at Woodlawn Bioreactor*
URS, (2010). *Environmental Assessment Woodlawn Expansion Project*
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 System

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

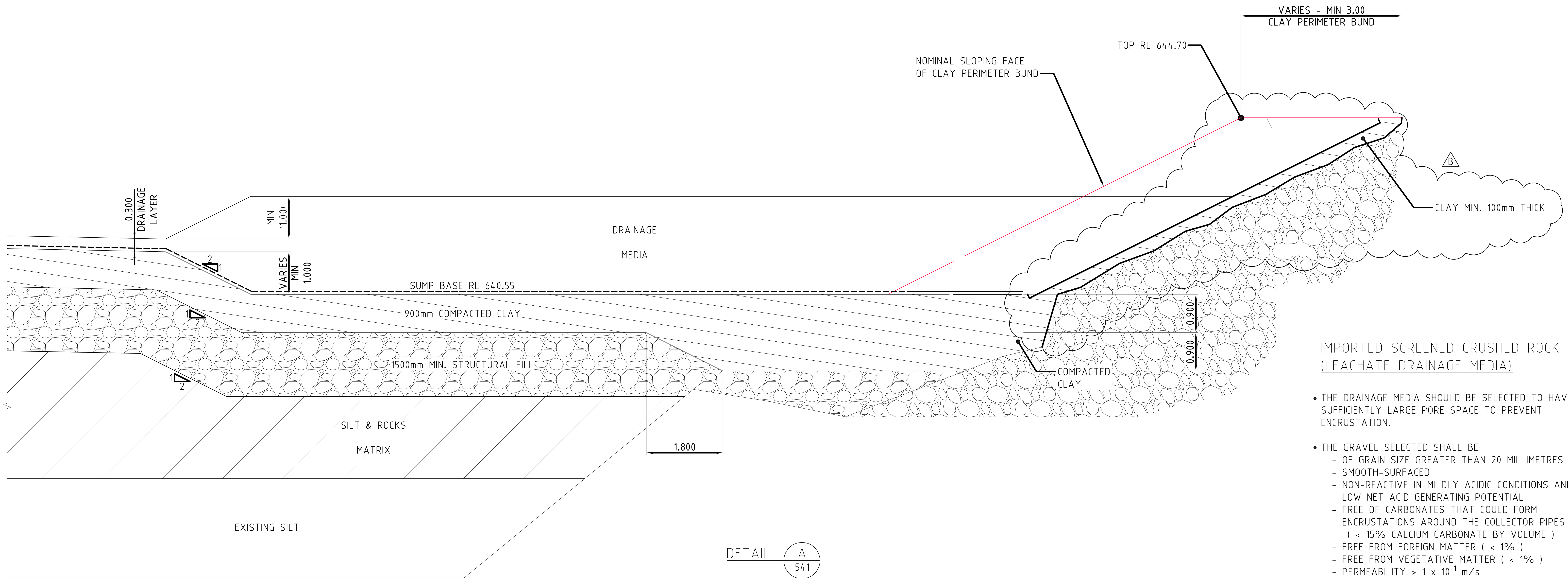
Appendix D Leachate Management System Layout Plan

Appendix E Mechanical Evaporator Operation Protocol

Appendix F Bioreactor Hydraulics Conceptual Model

Appendix G The Woodlawn Bioreactor Facility Odour Modelling Study

Appendix H Leachate Treatment Plant Layout Plans



IMPORTED SCREENED CRUSHED ROCK SPECIFICATION (LEACHATE DRAINAGE MEDIA)

- THE DRAINAGE MEDIA SHOULD BE SELECTED TO HAVE SUFFICIENTLY LARGE PORE SPACE TO PREVENT ENCRUSTATION.
- THE GRAVEL SELECTED SHALL BE:
  - OF GRAIN SIZE GREATER THAN 20 MILLIMETRES
  - SMOOTH-SURFACED
  - NON-REACTIVE IN MILDLY ACIDIC CONDITIONS AND LOW NET ACID GENERATING POTENTIAL
  - FREE OF CARBONATES THAT COULD FORM ENCRUSTATIONS AROUND THE COLLECTOR PIPES (< 15% CALCIUM CARBONATE BY VOLUME)
  - FREE FROM FOREIGN MATTER (< 1%)
  - FREE FROM VEGETATIVE MATTER (< 1%)
  - PERMEABILITY > 1 x 10^{-1} m/s

Cad ref.: J:\MMPL\10407001\Cad\Mine Site & Ints\dwgs\10407001-542.dwg

Last modified: 29 Oct 04 - 08:24

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
Z	LT	13.04.16	REDUNDANT DRAINAGE DETAILS REMOVED	
B	SGG	18.03.04	BENTONITE ADDED	
A	SGG	29.1.04	AS BUILT	RBY

Before commencing work, all controlling dimensions on the drawings must be verified on the site, particularly those relative to property alignments, other structures, and services.

Figured dimensions take preference over scaled. If in doubt, ask.

SCALES

0.5 0 1 2m

	PREPARED	CHECKED
DESIGN	SRH	RBY
DRAFTING	AJC	NG

PASSED Original signed by M.D BROWN

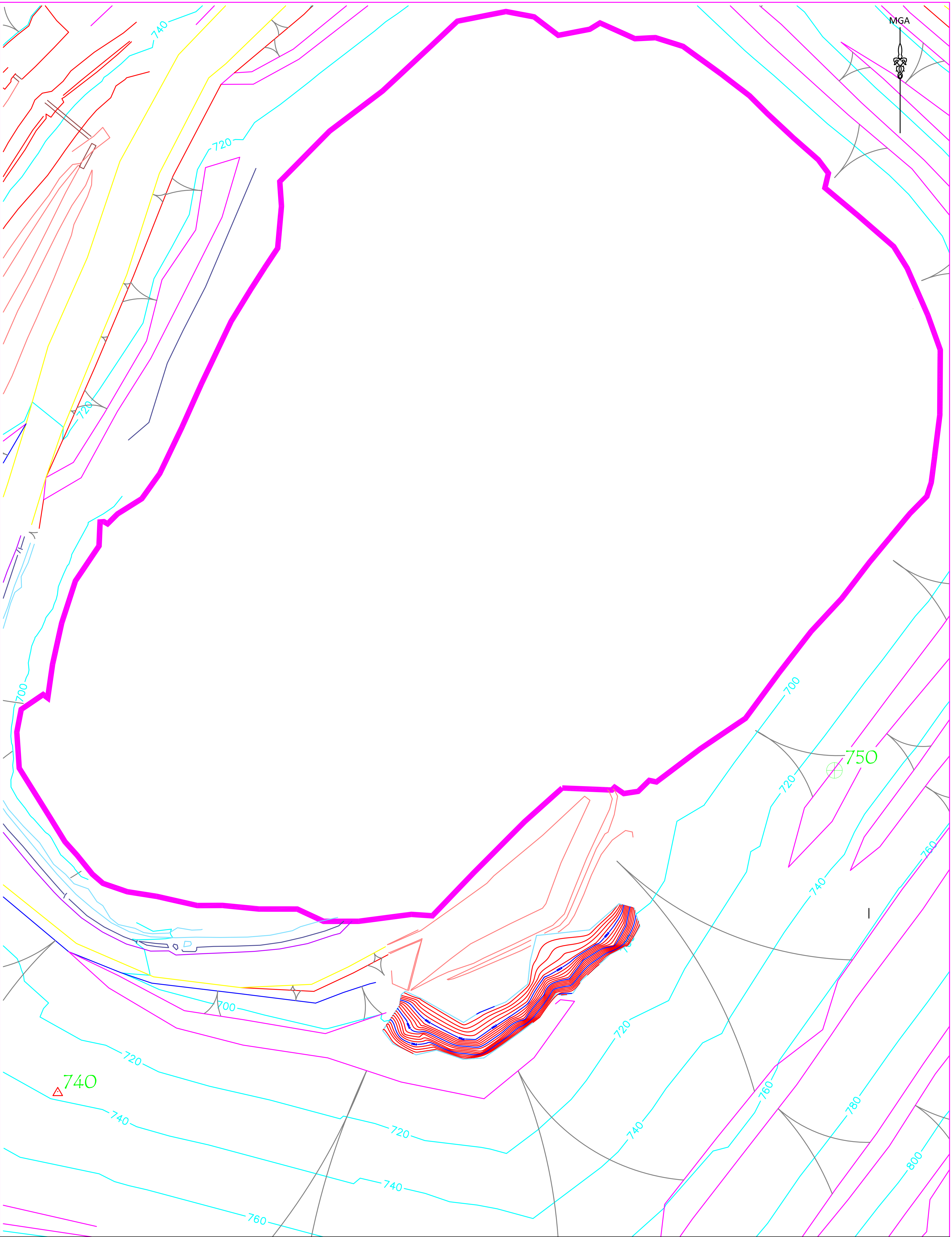
DATE 7.06.02

VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR ALLIANCE

WOODLAWN BIOREACTOR
BASAL LINER SYSTEM
COLLECTOR ROAD, TARAGO

10407001-542 Z



HEIGHT DATUM : AHD CONTOUR INTERVAL : 5m	PLAN	Sheet No. 1
0 15 30 45 60 METRES SCALE 1:1250	WOODLAWN BIOREACTOR CLAY LINING MARCH 2011	No. of Sheets: 1 Date: 22/11/2011 Ref. No: 16700 Drawing No. 35 — Issue A

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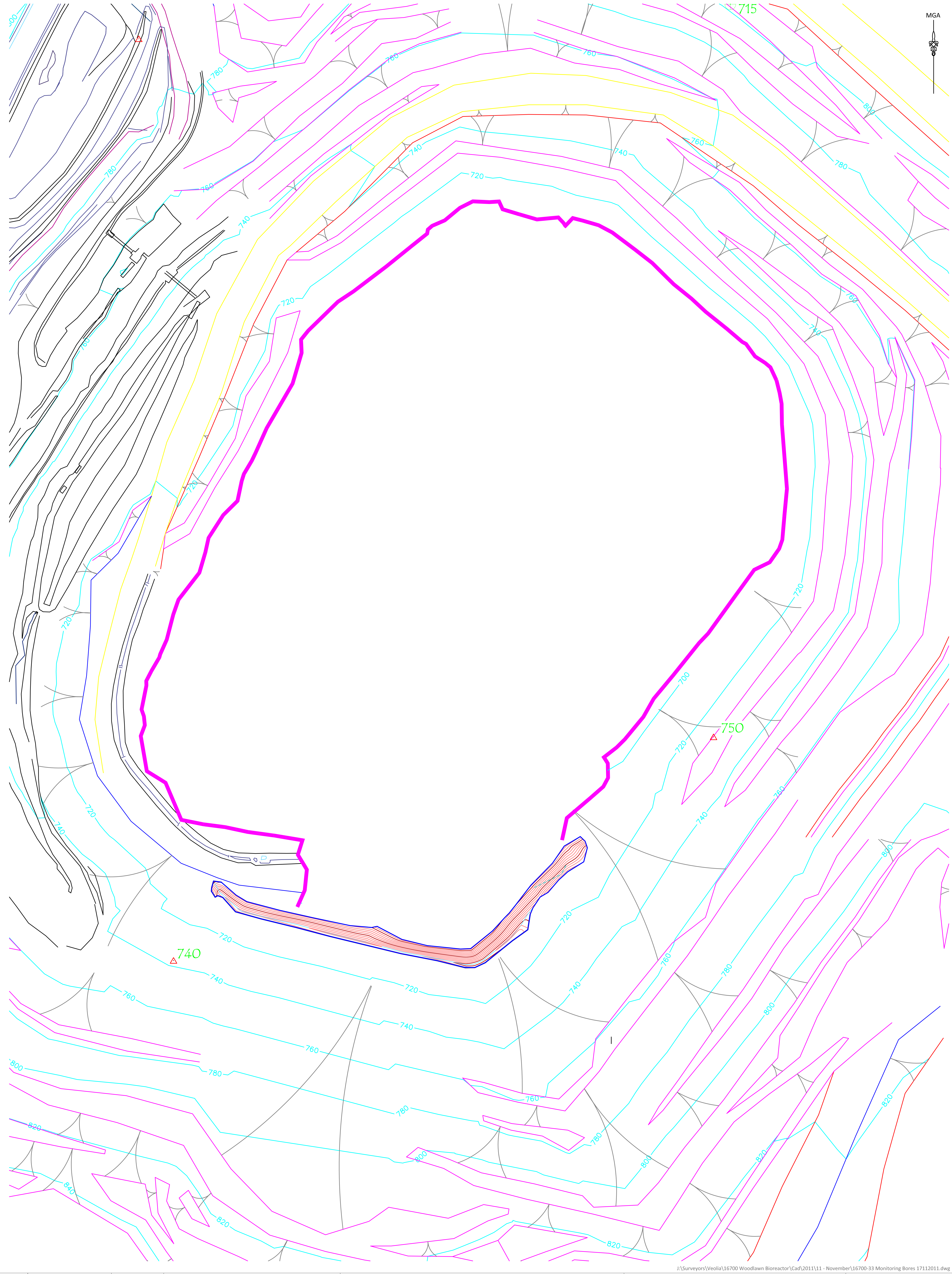

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A	INITIAL ISSUE	30/01/2012

SCALE 1:1250

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Metres

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A2 SHEET

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VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
CLAY LINING LOCATION
JANUARY 2012

DATUM: AHD | ORIGIN: PILLAR 713 | CONTOUR INTERVAL: 20m

DATE: 30/01/2012
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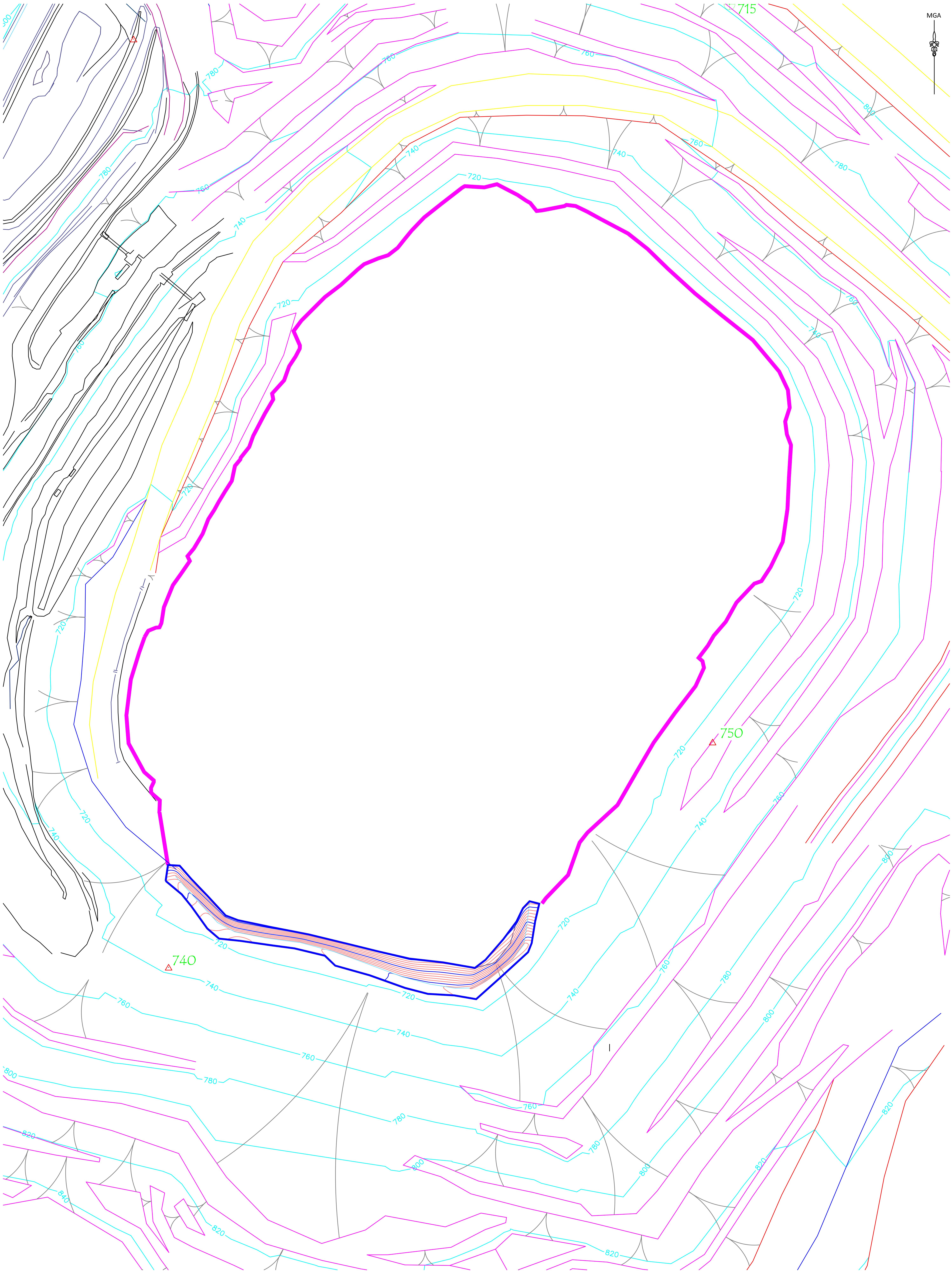
DRAWN: S McD
CHECKED: MK
ISSUE A
DRAWING No. 16700-41



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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	29/10/2012

SCALE 1:1250

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Metres

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A2
SHEET

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WOODLAWN BIOREACTOR
CLAY LINING LOCATION
OCTOBER 2012

DATUM: AHD | ORIGIN: PILLAR 713 | CONTOUR INTERVAL: 20m

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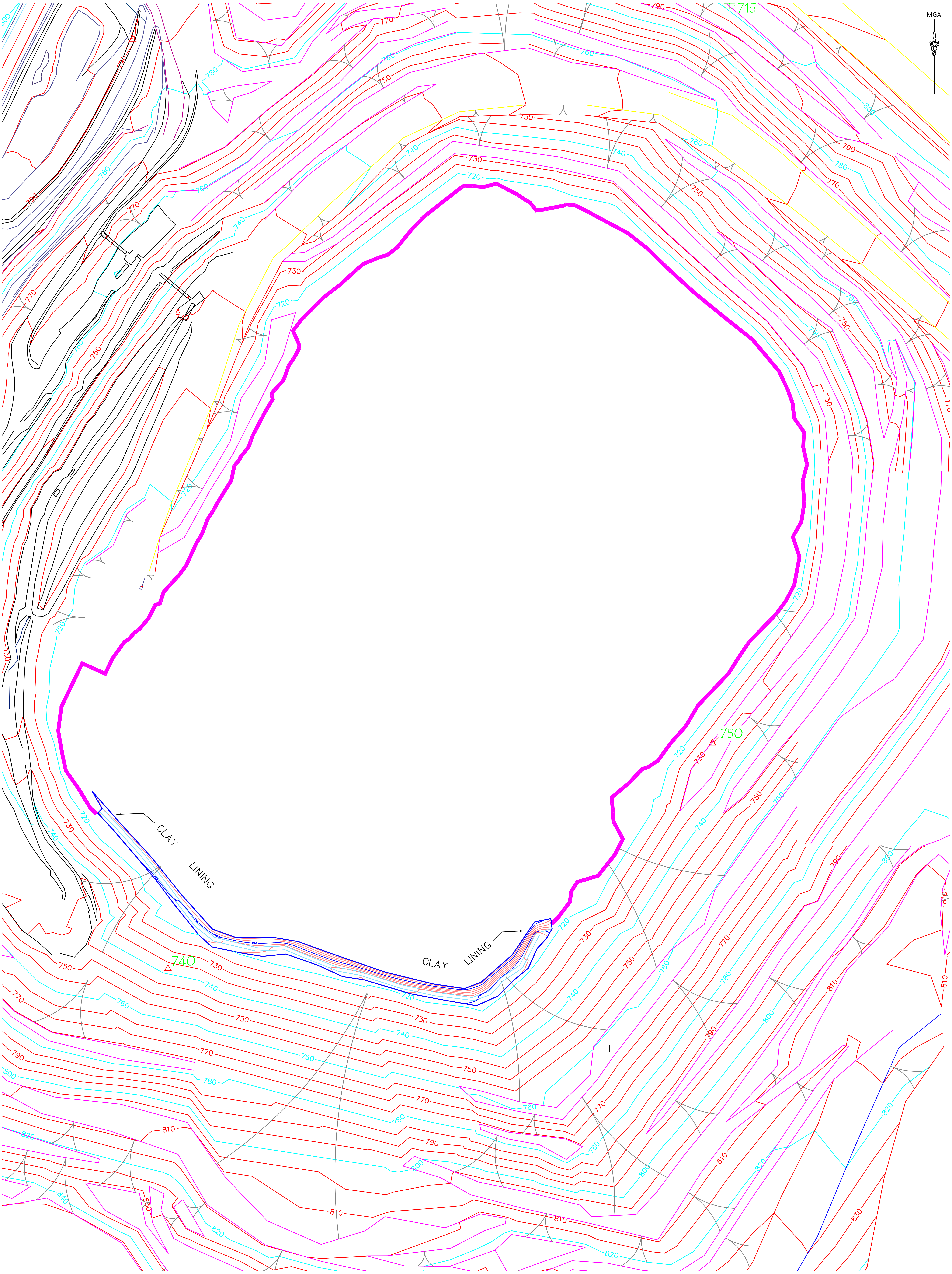

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ISSUE	AMENDMENT	DATE
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Metres

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A2 SHEET

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WOODLAWN BIOREACTOR
CLAY LINING LOCATION
OCTOBER 2013

DATUM: AHD | ORIGIN: PILLAR 713 | CONTOUR INTERVAL: 20m

DATE: 03/11/2013
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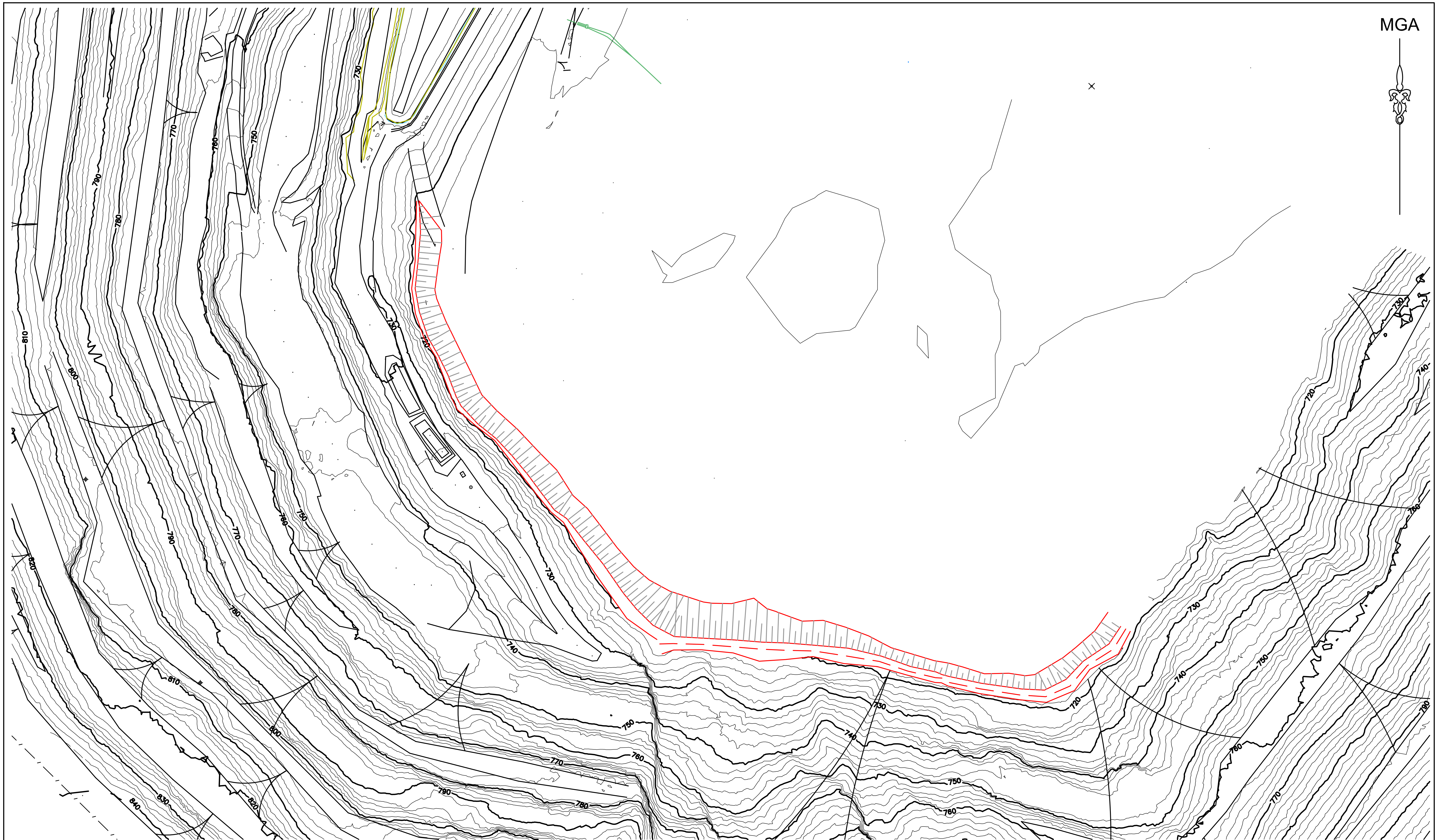

ISSUE	AMENDMENT	DATE
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SCALE 1:1250

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Metres

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VEOLIA ENVIRONMENTAL SERVICES

PLAN SHOWING
LOCATION OF NEW CLAY LINER
AT SOUTHERN SECTION OF VOID
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO

DATUM	N/A	CONTOUR INTERVAL	N/A

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SURVEYED: MK
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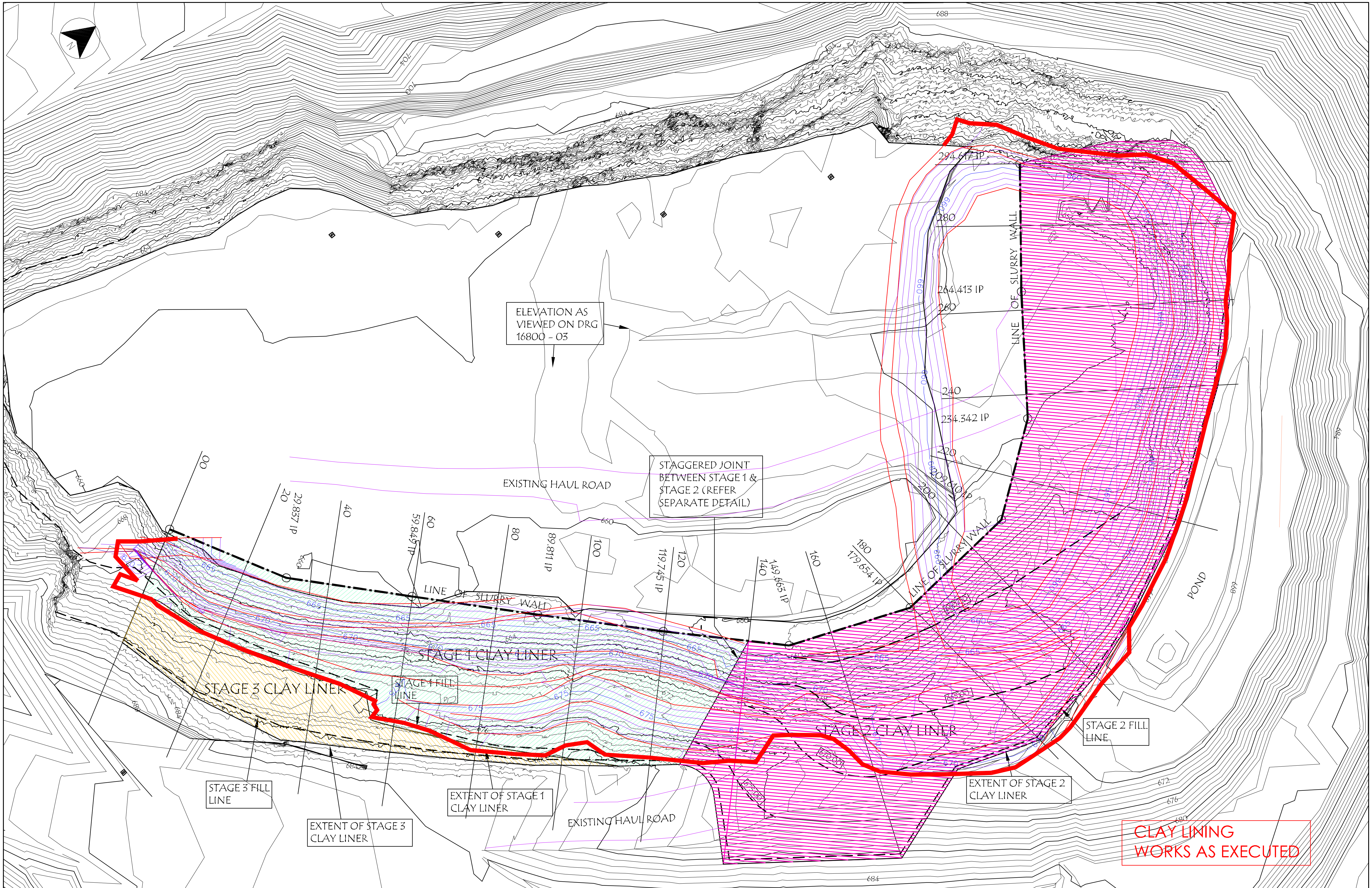
DRAWING No. 16700-117



Rev.	Description	By	Date
A	TENDER ISSUE	JR	07.10.05
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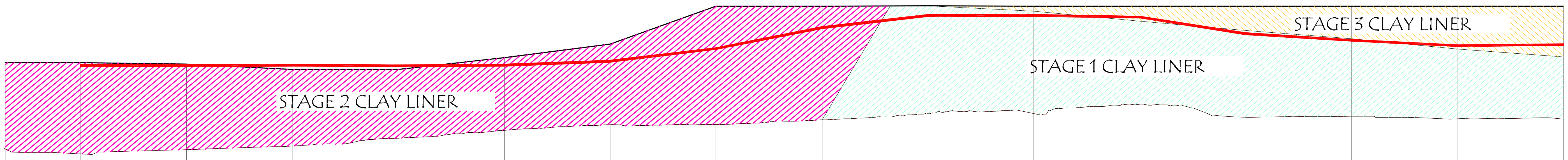
WOODLAWN BIOREACTOR
VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
CLAY LINER CONSTRUCTION PLAN

DATUM: AHD
ORIGIN OF LEVELS:
DRAWING No. 16800 - 01
REV. A



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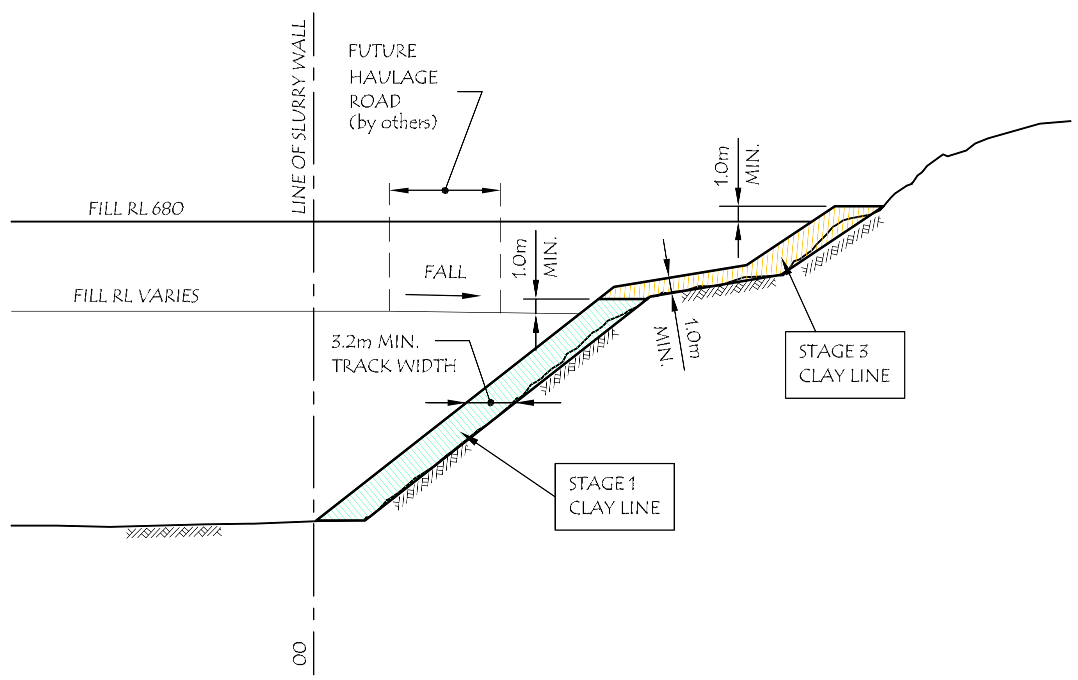
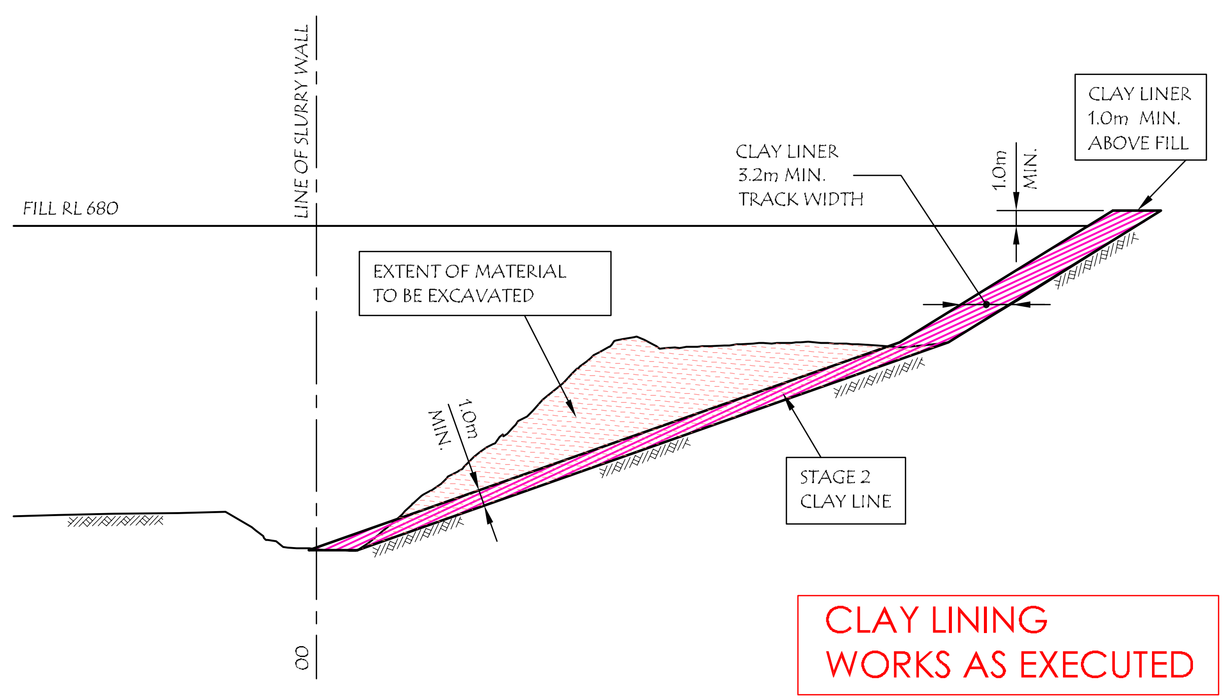
STAGE 2 & 3 CLAY LINER LEVEL		670.31	670.07	669.63	669.05	671.24	673.82	681.00	681.00	681.12	681.00	681.00	681.00	681.00	681.00	681.00
STAGE 1 CLAY LINER LEVEL										681.12	680.06	678.20	676.42	674.88	672.92	671.37
SLURRY WALL LEVEL	653.77	653.04	653.85	654.53	656.01	657.50	658.66	658.60	659.47	660.70	660.67	662.45	659.98	660.16	659.70	659.63
CHAINAGE	294.19	280.00	260.00	240.00	220.00	200.00	180.00	160.00	140.00	120.00	100.00	80.00	60.00	40.00	20.00	0.00

CLAY LINER ELEVATION



TYPICAL SECTION THROUGH STAGE 1 & 3 LINER



CLAY LINING
WORKS AS EXECUTED

TYPICAL SECTION THROUGH STAGE 2 LINER

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A	TENDER ISSUE	JR	07.10.05
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VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
CLAY LINER ELEVATION
AND TYPICAL CROSS SECTIONS

DATUM: AHD
ORIGIN OF LEVELS:
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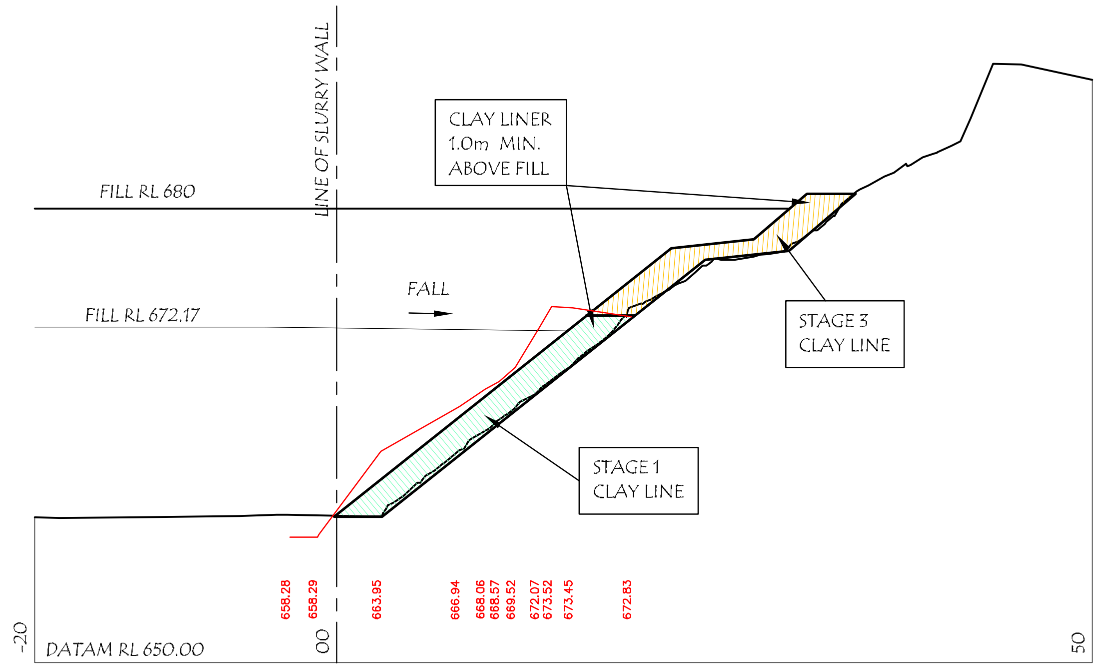

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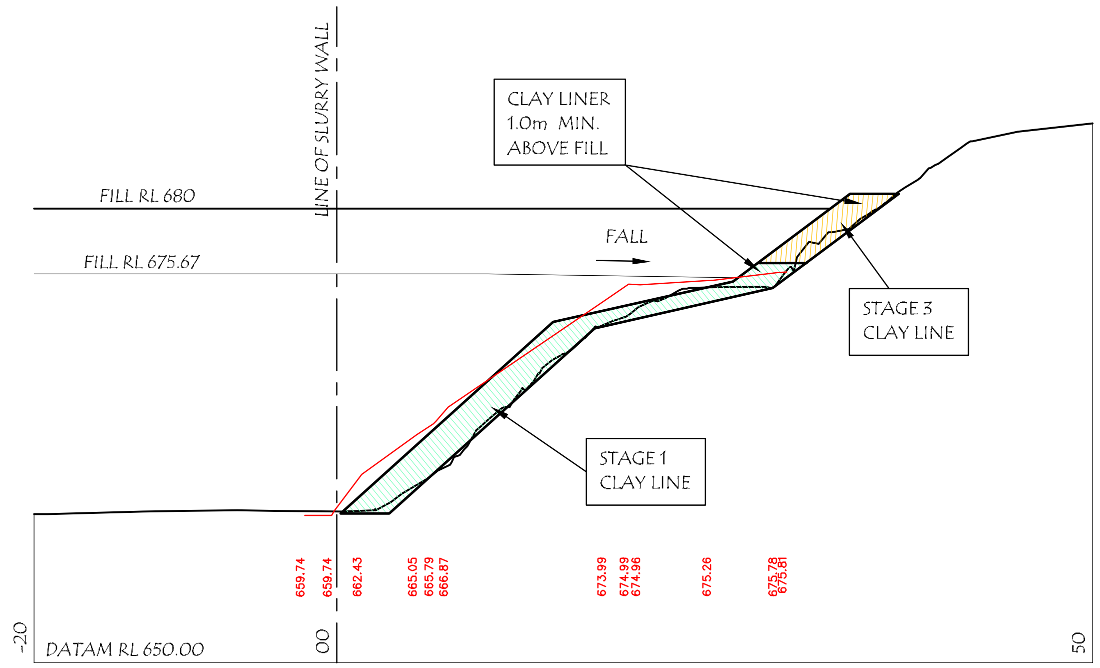

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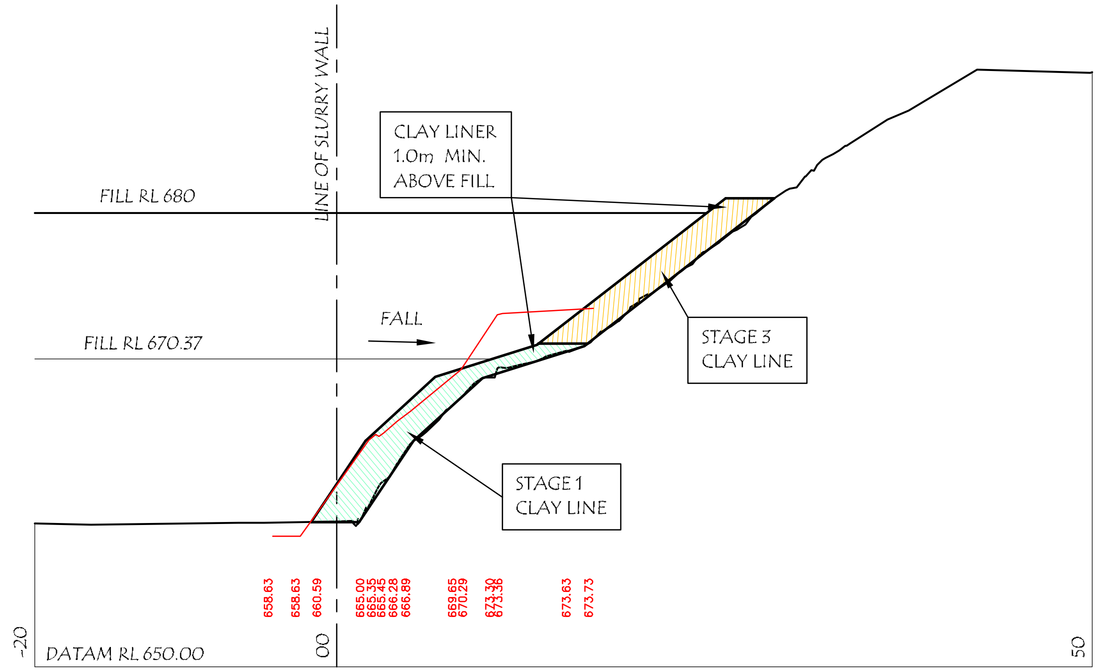

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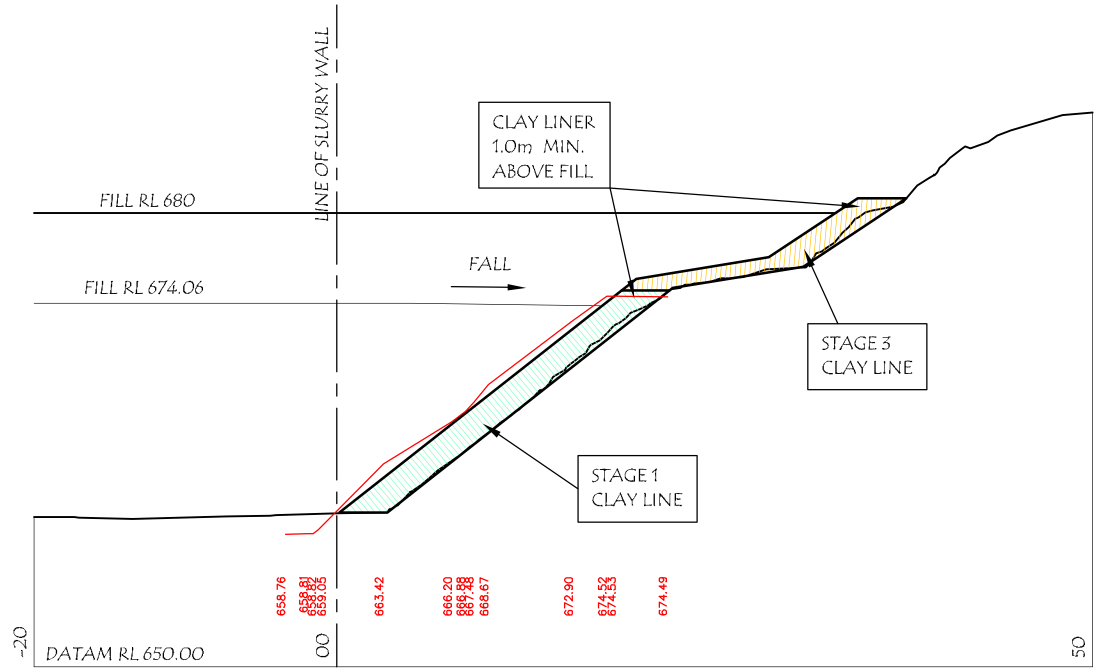

CH 40

CLAY LINING
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WOODLAWN BIOREACTOR
CLAY LINER CROSS SECTIONS
SHEET 1 OF 4

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ORIGIN OF LEVELS:
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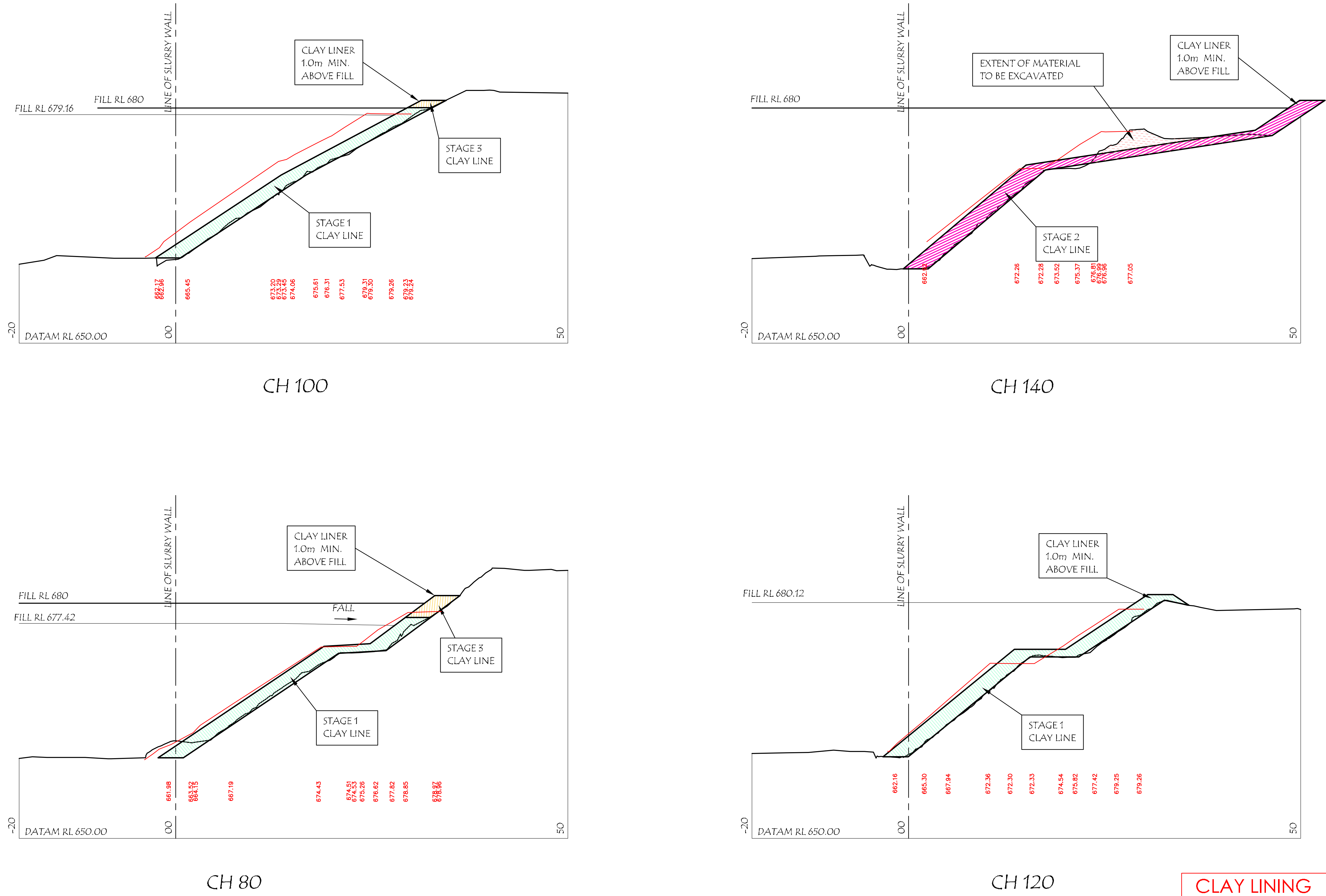

CLAY LINING
WORKS AS EXECUTED

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A	TENDER ISSUE	JR	07.10.05
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VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
CLAY LINER CROSS SECTIONS
SHEET 2 OF 4

DATUM: AHD
ORIGIN OF LEVELS:
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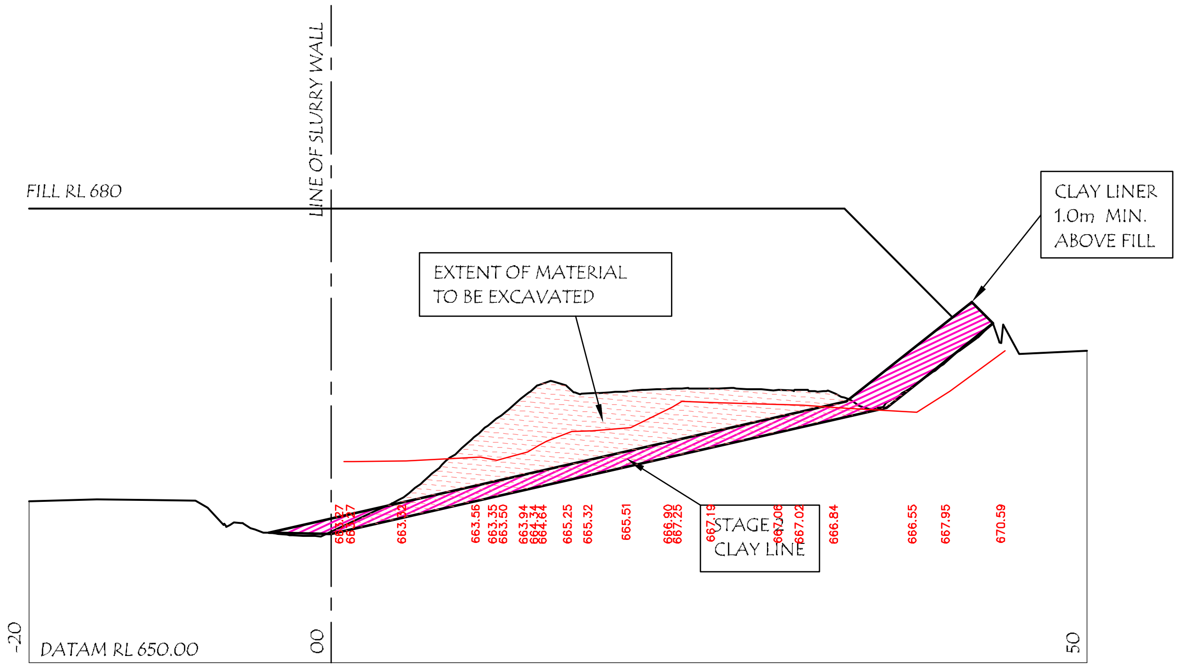

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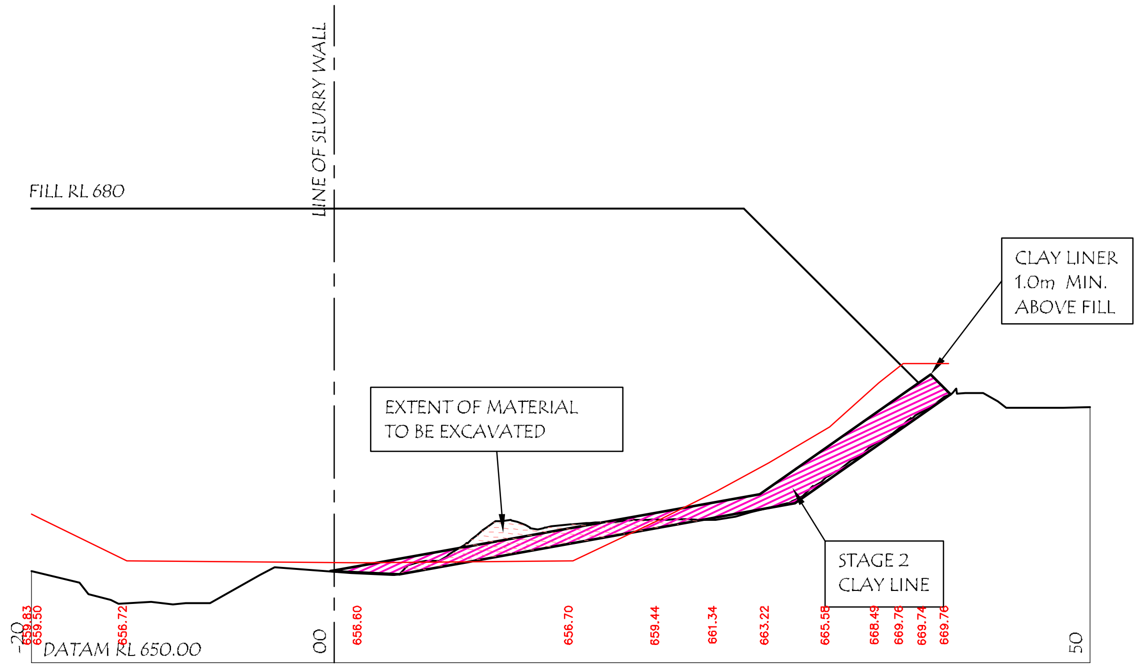

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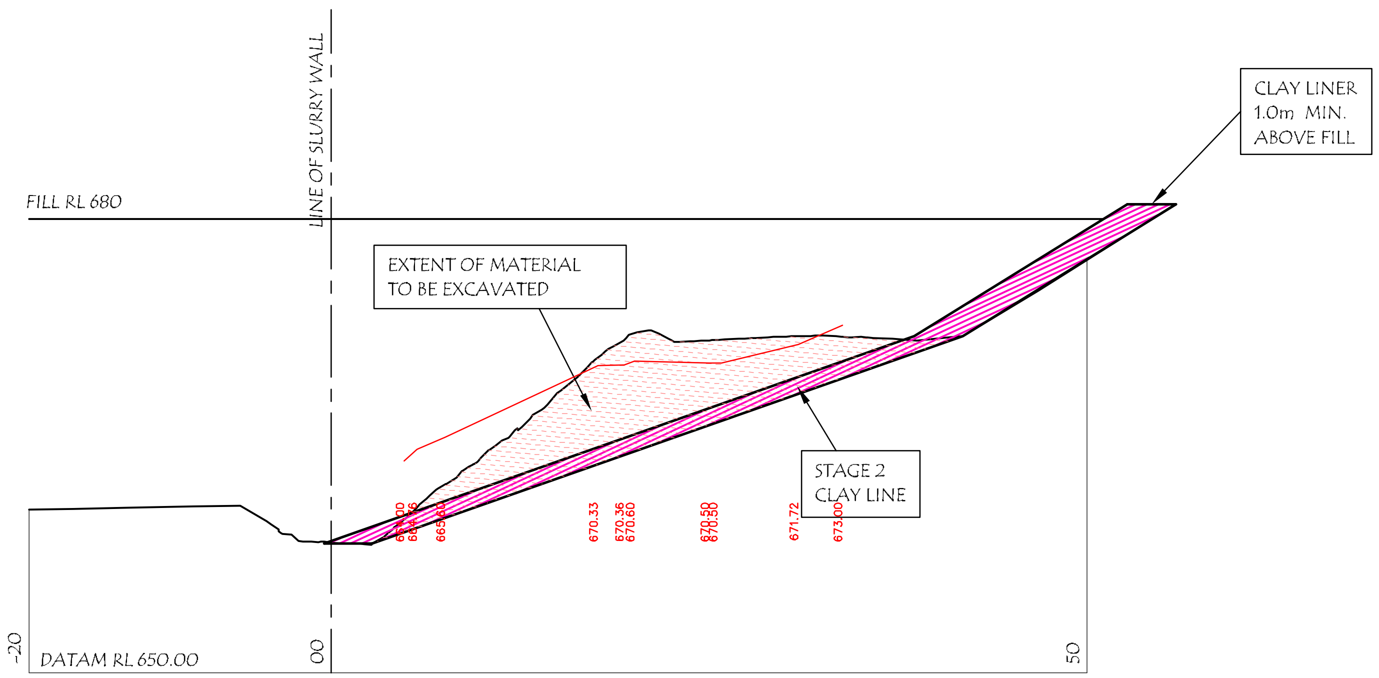

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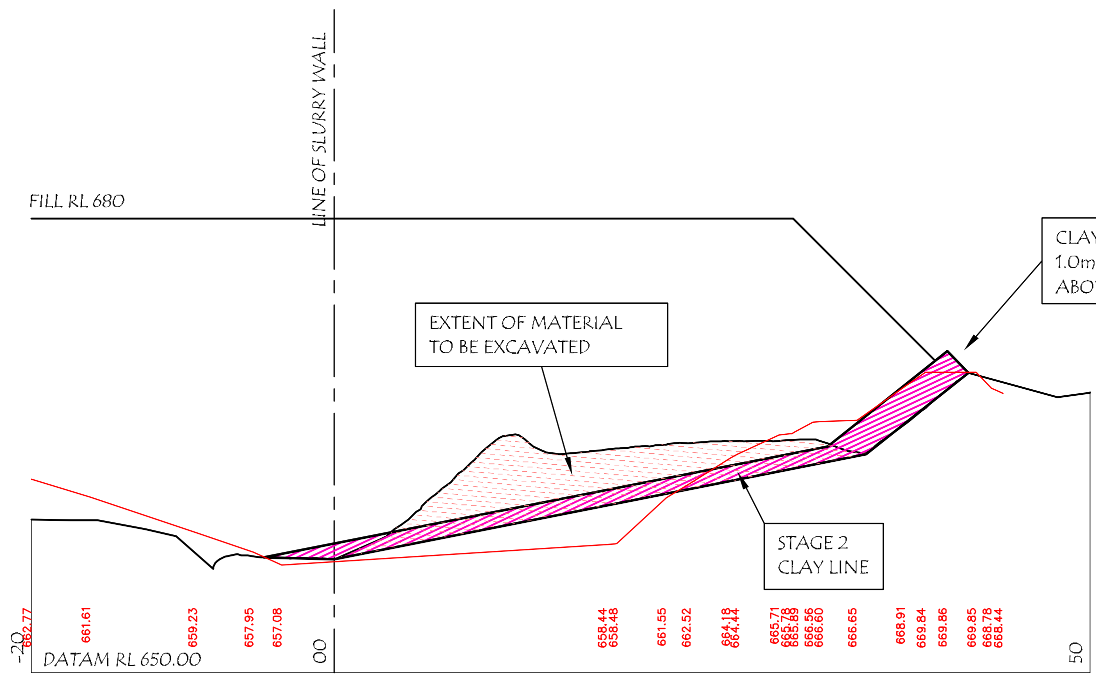

CH 200

CLAY LINING
WORKS AS EXECUTED

Rev.	Description	By	Date
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VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
CLAY LINER CROSS SECTIONS
SHEET 3 OF 4

DATUM: AHD
ORIGIN OF LEVELS:
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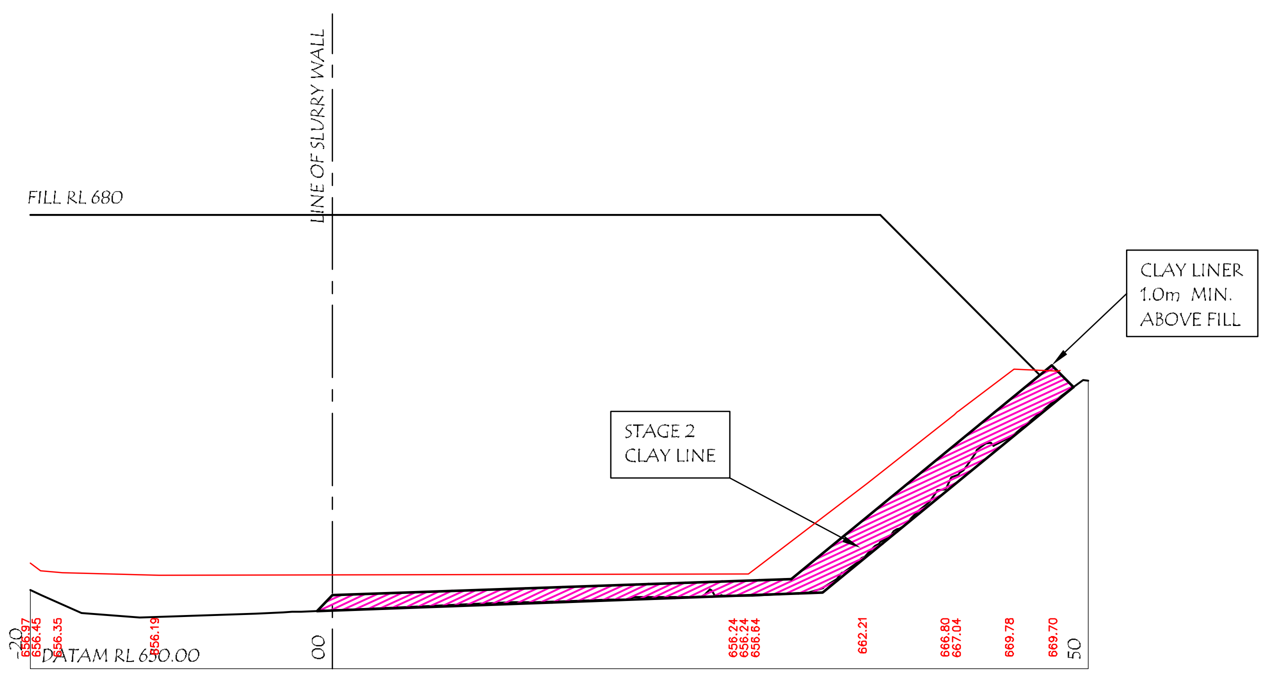

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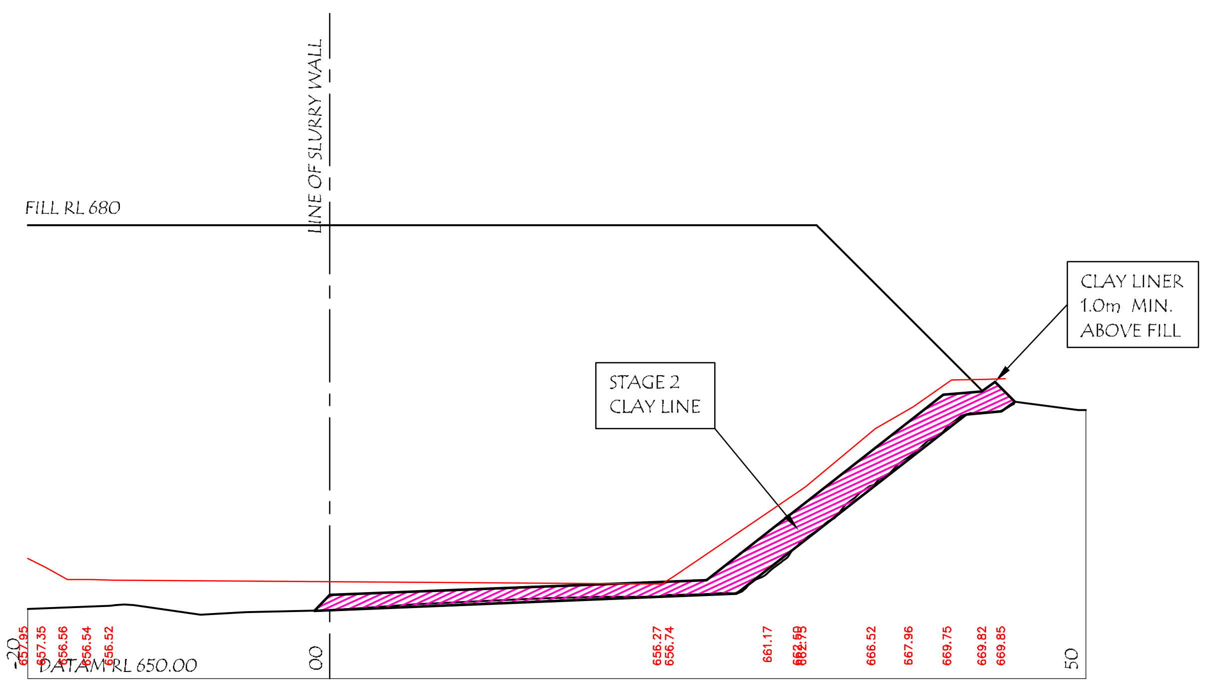

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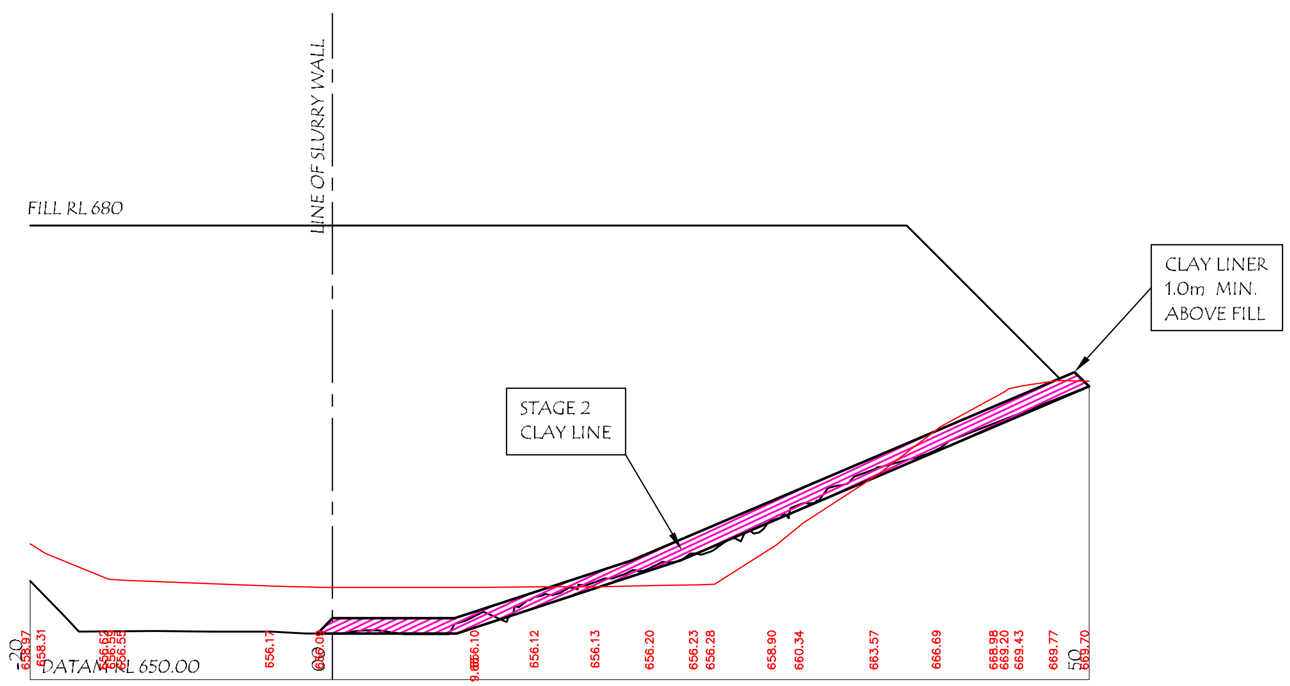

CH 280

CLAY LINING
WORKS AS EXECUTED

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WOODLAWN BIOREACTOR
CLAY LINER CROSS SECTIONS
SHEET 4 OF 4

DATUM: AHD
ORIGIN OF LEVELS:
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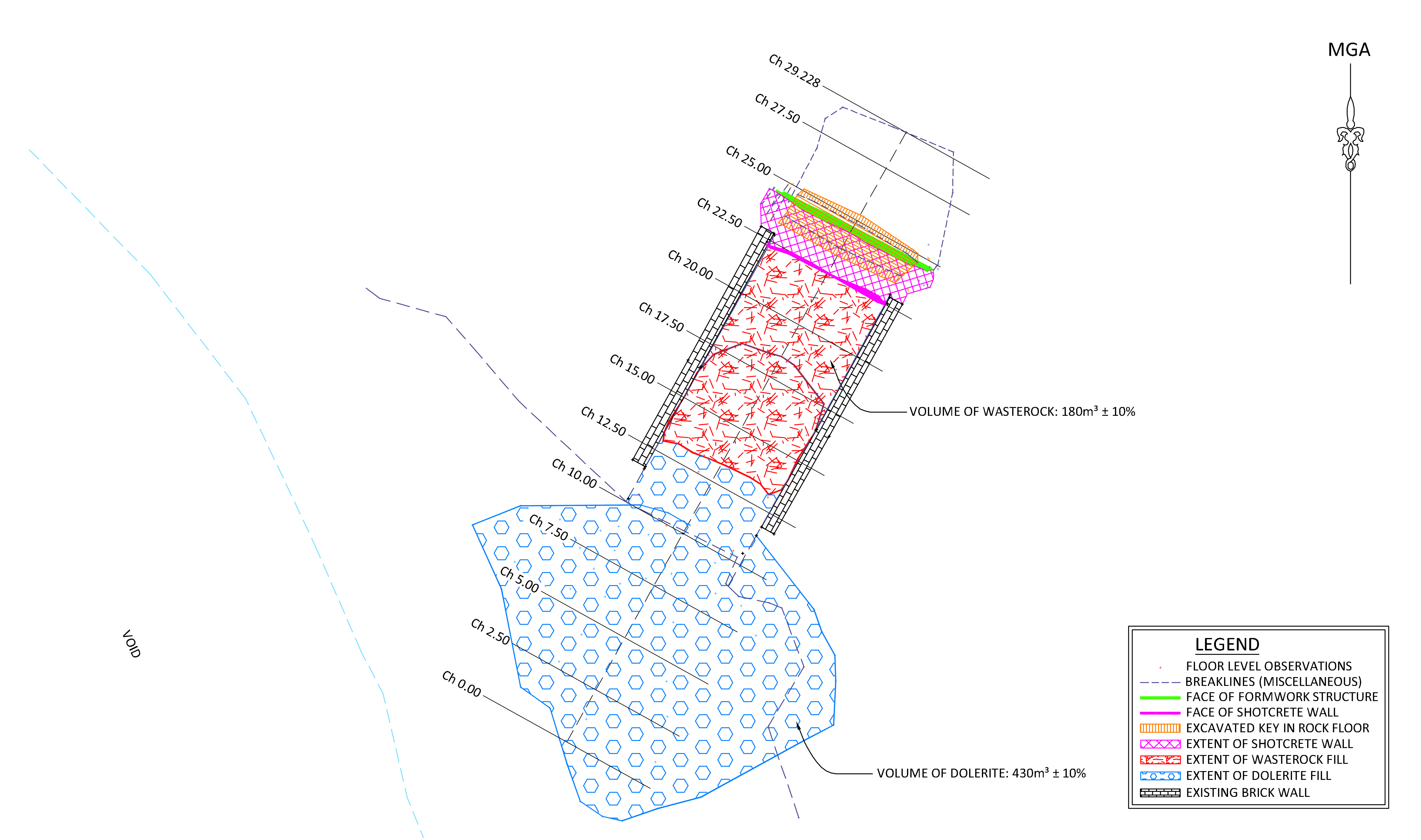

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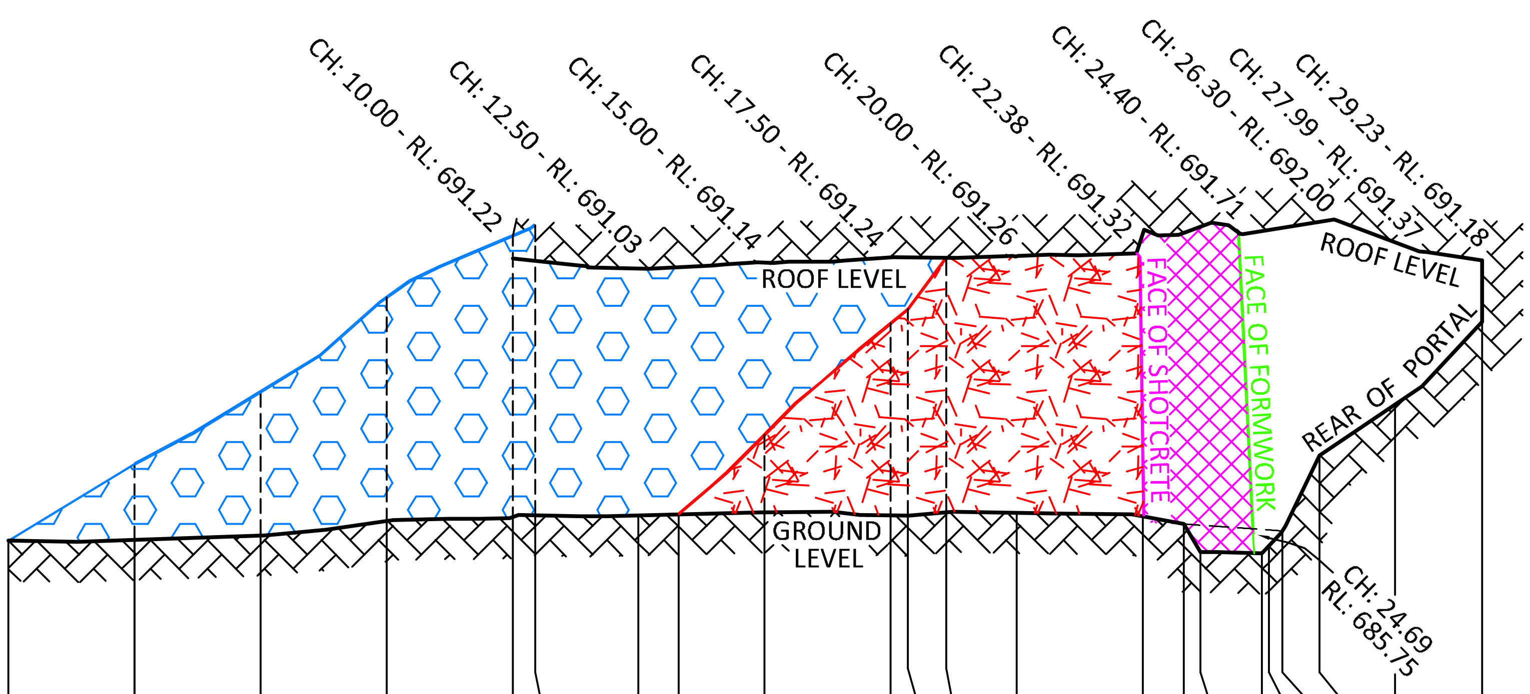
SCALE 1:150	DRAWN BY: M KADZIELA	NORTHERN PORTAL PROJECT	Sheet No. 1
0 2 4 6 8 10 Metres	DATUM: MGA & AHD ORIGIN OF LEVELS: PILLAR 740 CONTOUR INTERVAL: N/A	PLAN VIEW OF NORTHERN PORTAL FILLING COMPONENTS WOODLAWN BIOREACTOR COLLECTOR ROAD, TARAGO PARISH OF WERRIWA COUNTY OF MURRAY	No. of Sheets: 4 Date: 3/06/2009 Ref. No: 16700
	NOTE : DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY		Dwg No. NP01 Rev. A

LEVELS OF EXISTING ROOF STRUCTURE



DATUM: 682.00

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5.00	685.73	685.73	---	688.58
7.50	686.01	686.01	---	690.45
10.00	686.09	686.09	---	691.67
10.45	686.12	686.12	---	691.89
12.50	686.12	686.12	---	---
13.29	686.14	686.14	686.14	---
15.00	686.18	686.18	687.72	---
17.50	686.12	686.12	689.94	---
17.85	686.12	686.12	690.22	---
18.60	686.19	686.19	691.24	---
20.00	686.17	686.17	---	---
22.50	686.10	686.10	---	---
23.31	685.95	685.95	---	---
23.64	685.40	685.93	---	---
24.86	685.36	685.84	---	---
25.00	685.51	685.84	---	---
25.27	685.78	685.78	---	---
26.01	687.29	687.29	---	---
27.50	688.32	688.32	---	---
29.23	689.96	689.96	---	---

LEGEND
SHOTCRETE WALL
WASTEROCK FILL
DOLERITE FILL

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SCALE 1:150

0 2 4 6 8 10
Metres

DRAWN BY: M KADZIELA

DATUM: AHD
ORIGIN OF LEVELS: PILLAR 740
CONTOUR INTERVAL: N/A

NOTE : DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY

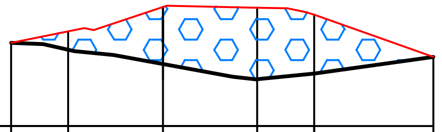
NORTHERN PORTAL PROJECT

LONGITUDINAL SECTION
OF NORTHERN PORTAL FILLING COMPONENTS
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO
PARISH OF WERRIWA
COUNTY OF MURRAY

Sheet No. 2
No. of Sheets: 4
Date: 3/06/2009
Ref. No: 16700
Dwg No. NP02
Rev. A

LEGEND

- SHOTCRETE WALL
- WASTEROCK FILL
- DOLERITE FILL



DATUM LEVEL 684.00

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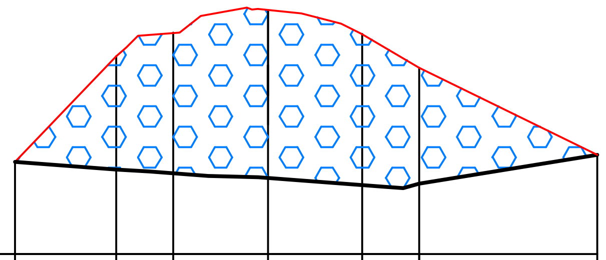
FLOOR LEVEL SURFACE	686.20	686.02	685.64	685.23	685.37	685.19
OFFSET	-4.01	-2.50	0.00	2.50	4.00	7.15

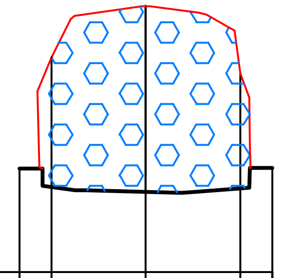
Ch 2.500



DATUM LEVEL 684.00

FILL MATERIAL SURFACE	689.44	689.22	689.84	690.45	689.82	688.92	686.625
FLOOR LEVEL SURFACE	686.44	686.23	686.13	686.01	685.81	685.85	686.63
OFFSET	-6.68	-4.00	-2.50	0.00	2.50	4.00	8.71

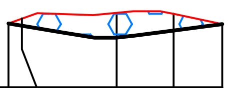
Ch 7.500



DATUM LEVEL 684.00

FILL MATERIAL SURFACE		689.68	691.04	689.25	
FLOOR LEVEL SURFACE	686.73	686.25	686.12	686.21	686.75
OFFSET	-3.34	-2.50	0.00	2.50	3.35

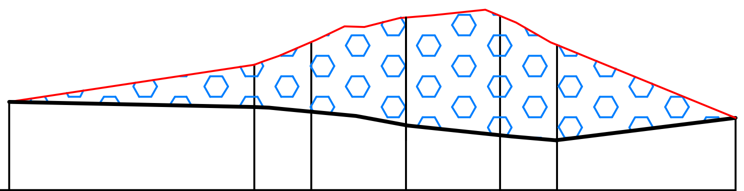
Ch 12.500



DATUM LEVEL 684.00

FILL MATERIAL SURFACE	685.68	685.81	685.95	685.93	685.66
FLOOR LEVEL SURFACE	685.68	685.62	685.31	685.50	685.66
OFFSET	-0.37	0.00	2.50	4.00	5.66

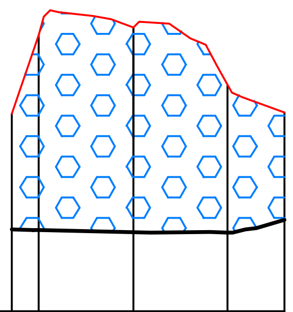
Ch 0.000



DATUM LEVEL 684.00

FILL MATERIAL SURFACE	686.34	687.32	687.92	688.58	688.61	687.85	685.92
FLOOR LEVEL SURFACE	686.34	686.21	686.08	685.73	685.45	685.32	685.92
OFFSET	-6.49	-4.00	-2.50	0.00	2.50	4.00	8.72

Ch 5.000



DATUM LEVEL 684.00

FILL MATERIAL SURFACE	689.24	691.32	691.52	689.99	689.26
FLOOR LEVEL SURFACE	689.17	686.16	686.09	686.09	686.42
OFFSET	-3.22	-2.50	0.00	2.50	4.00

Ch 10.000

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VEOLIA ENVIRONMENTAL SERVICES

SCALE 1:200

0 3 6 9 12
Metres

DRAWN BY: M KADZIELA

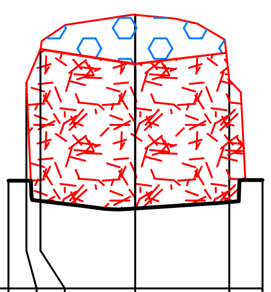
DATUM: AHD
ORIGIN OF LEVELS: PILLAR 740
CONTOUR INTERVAL: N/A

NOTE : DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY

NORTHERN PORTAL PROJECT

CROSS SECTIONS: CH 0.00 TO CH 12.50
OF NORTHERN PORTAL FILLING COMPONENTS
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO
PARISH OF WERRIWA
COUNTY OF MURRAY

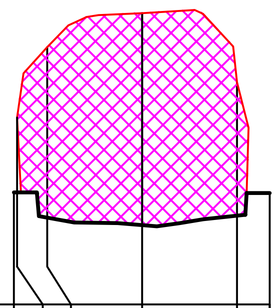
Sheet No. 3
No. of Sheets: 4
Date: 3/06/2009
Ref. No: 16700
Dwg No. NP03
Rev. A



DATUM LEVEL 684.00

FILL MATERIAL SURFACE		689.45	690.33	691.24	689.51	
FLOOR LEVEL SURFACE	686.86	686.86	686.31	686.12	686.28	686.87
OFFSET	-3.35	-2.87	-2.50	0.00	2.50	3.38

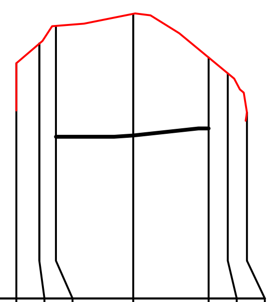
Ch 17.500



DATUM LEVEL 684.00

FILL MATERIAL SURFACE		688.96	690.81	691.72	689.88	
FLOOR LEVEL SURFACE	686.97	686.97	686.30	686.10	686.35	686.95
OFFSET	-3.38	-3.30	-2.50	0.00	2.50	3.36

Ch 22.500



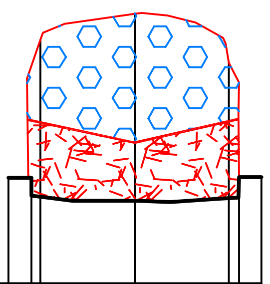
DATUM LEVEL 684.00

FILL MATERIAL SURFACE	690.24	690.76	691.22	691.54	690.39	689.97	688.94
FLOOR LEVEL SURFACE			688.30	688.32	688.51		
OFFSET	-3.11	-2.50	-2.06	0.00	1.99	2.50	3.02

Ch 27.500

LEGEND

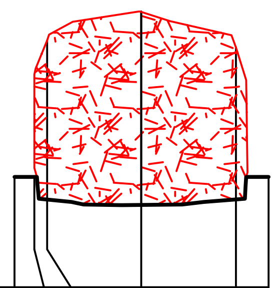
- SHOTCRETE WALL
- WASTEROCK FILL
- DOLERITE FILL



DATUM LEVEL 684.00

FILL MATERIAL SURFACE		690.46	691.14	689.84	
FLOOR LEVEL SURFACE	686.80	686.28	686.18	686.25	686.81
OFFSET	-3.34	-2.50	0.00	2.50	3.37

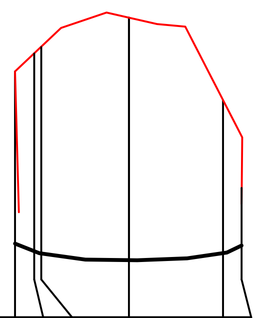
Ch 15.000



DATUM LEVEL 684.00

FILL MATERIAL SURFACE		689.62	690.52	691.27	690.33	
FLOOR LEVEL SURFACE	686.91	686.91	686.31	686.17	686.32	686.91
OFFSET	-3.36	-2.83	-2.50	0.00	2.50	3.37

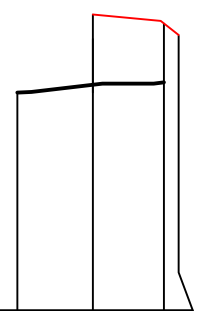
Ch 20.000



DATUM LEVEL 684.00

FILL MATERIAL SURFACE	690.50	687.66	687.98	691.93	688.63	687.84
FLOOR LEVEL SURFACE	685.95	685.74	685.68	685.51	685.69	685.90
OFFSET	-3.00	-2.50	-2.32	0.00	2.50	2.99

Ch 25.000



DATUM LEVEL 684.00

FILL MATERIAL SURFACE		691.82	691.59	691.28
FLOOR LEVEL SURFACE	689.76	689.96	690.03	
OFFSET	-2.00	0.00	1.88	2.26

Ch 29.228

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VEOLIA ENVIRONMENTAL SERVICES

SCALE 1:200

0 3 6 9 12
Metres

DRAWN BY: M KADZIELA

DATUM: AHD
ORIGIN OF LEVELS: PILLAR 740
CONTOUR INTERVAL: N/A

NOTE : DIMENSIONS AND AREAS ARE SUBJECT TO SURVEY

NORTHERN PORTAL PROJECT

CROSS SECTIONS: CH 15.00 TO CH 29.228
OF NORTHERN PORTAL FILLING COMPONENTS
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO
PARISH OF WERRIWA
COUNTY OF MURRAY

Sheet No. 4
No. of Sheets: 4
Date: 3/06/2009
Ref. No: 16700
Dwg No. NP04
Rev. A

LANDTEAM
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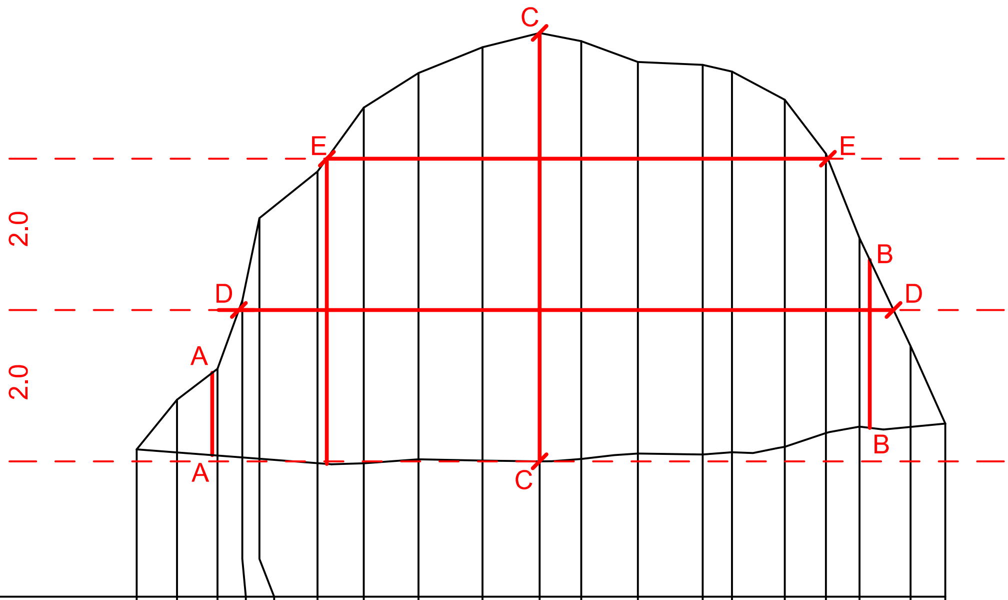

Datum 706.210m

Cut/Fill							4.702	5.105	5.462	5.663	5.522	5.174	5.151	5.033	4.588	3.691	2.489		
ROCK_KEY_PROPOSED	708.16	708.81	709.22	710.12	711.21	711.83	712.67	713.13	713.47	713.66	713.55	713.28	713.24	713.15	712.78	712.06	710.95	709.52	708.50
PORTAL_FLOOR							707.97	708.03	708.01	708.00	708.03	708.10	708.09	708.12	708.19	708.37	708.46		
Chainage	0.00	0.53	1.07	1.40	1.62	2.39	3.00	3.73	4.57	5.33	5.88	6.63	7.49	7.87	8.57	9.12	9.56	10.24	10.70

SECTION DIMENSIONS:

A - A: 1·09
B - B: 2·22
C - C: 5·66
D - D: 8·66
E - E: 6·63

Scale 1:100
Ref. No: 16700
Date: 31 May 2013

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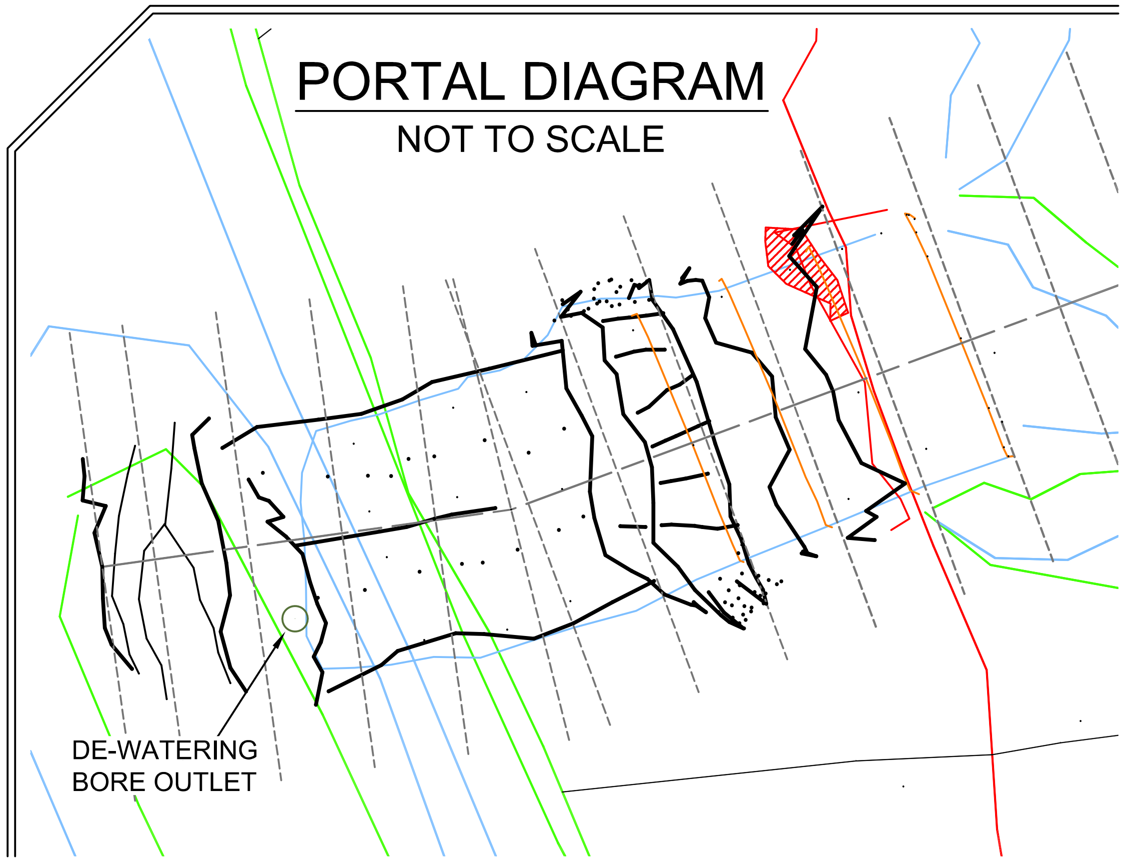
MGA



LEGEND

- TOP OF BANK
- TOE OF BANK
- FACE OF ROCK
- UNDERSIDE OF ROCK
- PORTAL IRON FRAMES

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:400

0 5 10 15 20 25

Metres

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A3 SHEET

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BSI FS550318

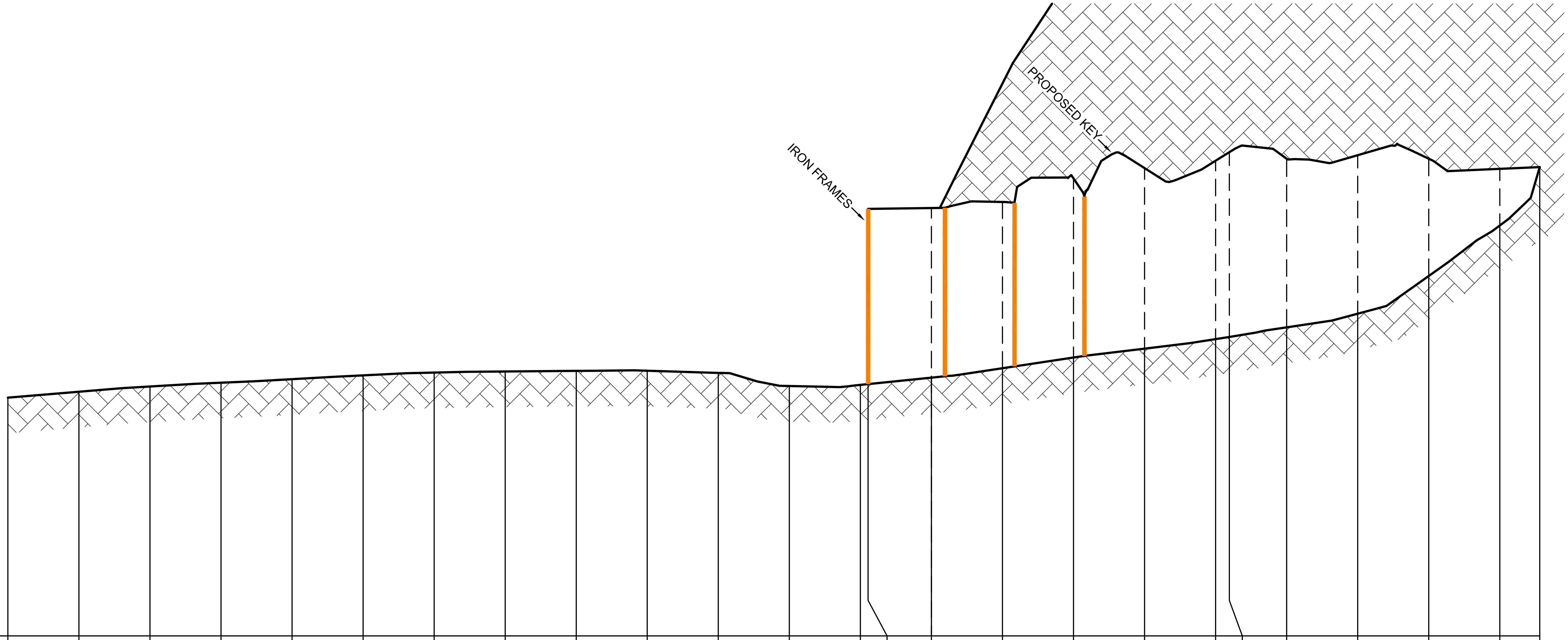
SOUTHERN PORTAL SEALING PROJECT

PLAN VIEW
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No.
16700-SP01



DATUM 700.000

CHAINAGE	PORTAL FLOOR	UNDERSIDE OF ROCK	CUT/FILL
0.000	706.71		
2.000	706.88		
4.000	707.02		
6.000	707.13		
8.000	707.23		
10.000	707.34		
12.000	707.42		
14.000	707.45		
16.000	707.47		
18.000	707.47		
20.000	707.41		
22.000	707.04		
24.000	707.07		
24.217	707.09	712.03	4.94
26.000	707.27	712.05	4.78
28.000	707.54	712.22	4.68
30.000	707.84	712.89	5.04
32.000	708.09	713.18	5.09
34.000	708.36	713.39	5.02
34.386	708.42	713.63	5.21
36.000	708.69	713.44	4.75
38.000	709.08	713.54	4.46
40.000	710.14	713.44	3.30
42.000	711.56	713.16	1.60
43.125	713.21	713.21	0.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:400

0 5 10 15 20 25

Metres

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FS550318

SOUTHERN PORTAL SEALING PROJECT

LONGITUDINAL SECTION
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP02

CH4.000

DATUM 705.41

PORTAL FLOOR	706.67	706.74	706.80	706.87	706.95	707.02	707.10	707.17	707.25	707.33	707.41
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH10.000

DATUM 705.81

PORTAL FLOOR	707.05	707.10	707.16	707.21	707.28	707.34	707.40	707.46	707.52	707.58	707.64
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH2.000

DATUM 705.26

PORTAL FLOOR	706.49	706.56	706.64	706.73	706.80	706.88	706.95	707.03	707.11	707.20	707.29
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH8.000

DATUM 705.68

PORTAL FLOOR	706.92	706.98	707.04	707.10	707.17	707.23	707.30	707.36	707.42	707.48	707.54
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH0.000

DATUM 705.80

PORTAL FLOOR	706.80	706.86	706.95	707.04	707.13	707.21	707.30	707.39	707.47	707.55
OFFSET	1.19	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00

CH6.000

DATUM 705.55

PORTAL FLOOR	706.79	706.86	706.92	706.99	707.07	707.13	707.20	707.26	707.33	707.41	707.48
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:200

0 3 6 9 12

Metres

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FS550318

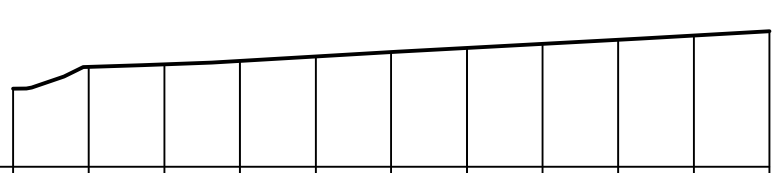
SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH0.000 - CH10.000
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No. 16700-SP03



DATUM 705.95

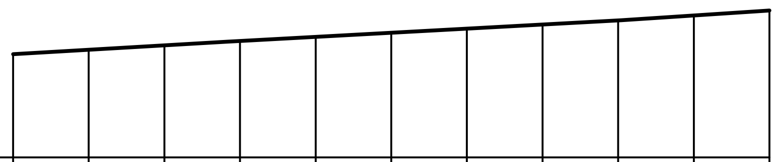
PORTAL FLOOR	706.98	707.27	707.30	707.35	707.41	707.47	707.52	707.58	707.63	707.69	707.74
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH16.000

DATUM 706.01

PORTAL FLOOR	708.10	707.80	707.25	707.09	707.04	707.04	707.18	707.33	707.66	708.05	708.52	708.77
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	5.53

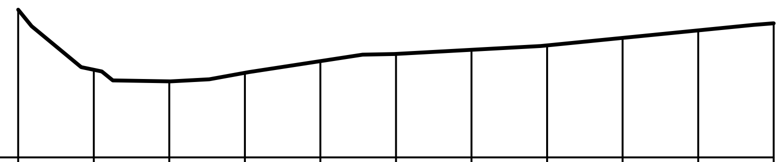
CH22.000



DATUM 705.80

PORTAL FLOOR	707.17	707.22	707.28	707.34	707.39	707.45	707.50	707.56	707.61	707.68	707.74
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

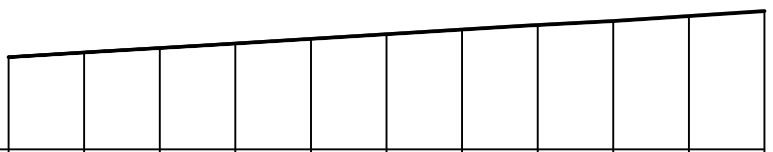
CH14.000



DATUM 706.04

PORTAL FLOOR	707.99	707.20	707.04	707.16	707.31	707.41	707.46	707.52	707.62	707.72	707.81
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

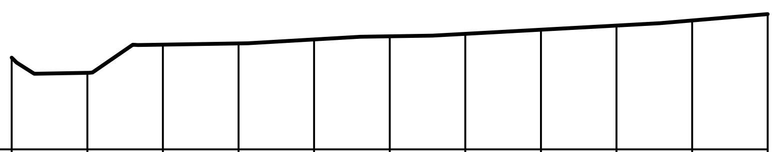
CH20.000



DATUM 705.89

PORTAL FLOOR	707.11	707.18	707.23	707.29	707.36	707.42	707.48	707.54	707.59	707.66	707.72
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH12.000



DATUM 705.97

PORTAL FLOOR	707.19	706.99	707.36	707.38	707.43	707.47	707.50	707.56	707.61	707.69	707.76
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH18.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:200

0 3 6 9 12

Metres

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A3 SHEET

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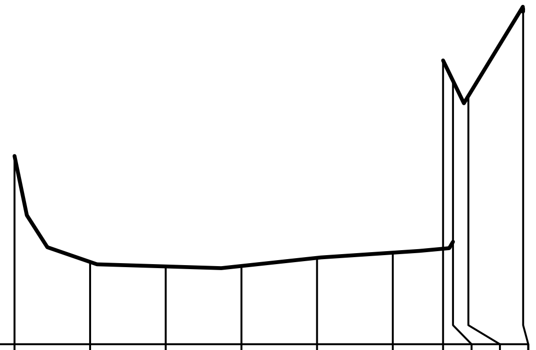
FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH12.000 - CH22.000
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

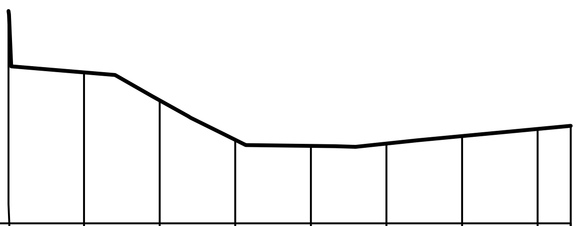
DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP04



DATUM 706.24

PORTAL FLOOR	708.73	707.33	707.27	707.27	707.38	707.45	707.50	707.60		
UNDERSIDE OF ROCK							710.00	709.73	709.53	710.68
OFFSET	-3.00	-2.00	-1.00	0.00	1.00	2.00	2.67	2.80	3.00	3.72

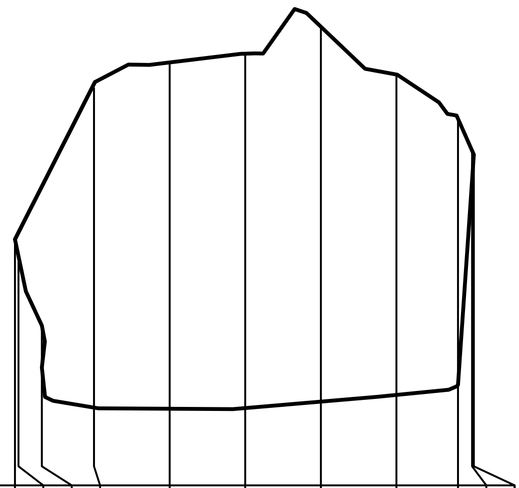
CH26.000



DATUM 706.02

PORTAL FLOOR	708.82	708.01	707.64	707.12	707.04	707.07	707.17	707.26	707.31
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	2.44

CH24.000



DATUM 706.52

PORTAL FLOOR			708.08	707.55	707.53	707.54	707.63	707.72	707.85		
UNDERSIDE OF ROCK	709.77	709.55	708.62	711.77	712.11	712.22	712.58	711.95	711.36	710.94	710.89
OFFSET	-3.05	-3.00	-2.69	-2.00	-1.00	0.00	1.00	2.00	2.81	3.00	3.02

CH28.000

J:\Surveyors\Jobs\Veolia\16700 Woodlawn Bioreactor\Veolia Southern Portal\Cad\16700-SP2 Plans.dwg

ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:200

0 3 6 9 12

Metres

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A3 SHEET

VEOLIA ENVIRONMENTAL SERVICES

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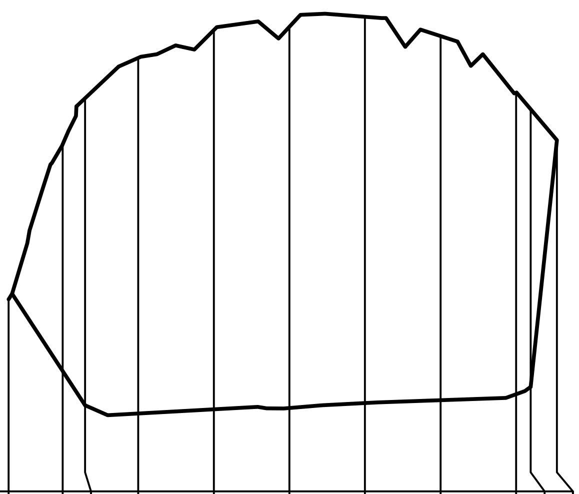
FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH24.000 - CH28.000
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

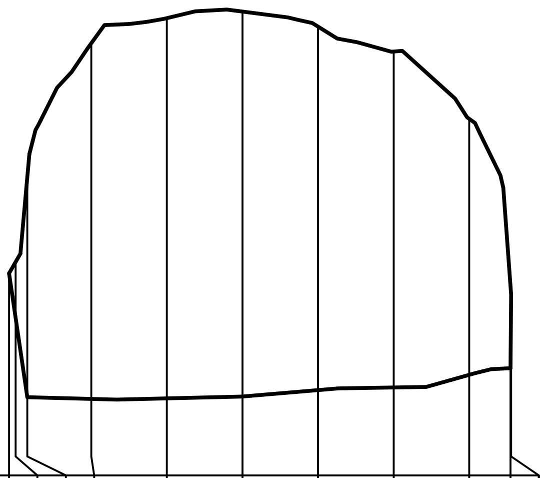
DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP05



DATUM 706.74

PORTAL FLOOR			707.88	707.77	707.82	707.84	707.91	707.94	708.02	708.12	
UNDERSIDE OF ROCK	709.28	711.33	711.94	712.47	712.84	712.89	713.02	712.76	712.01	711.79	711.38
OFFSET	-3.71	-3.00	-2.70	-2.00	-1.00	0.00	1.00	2.00	3.00	3.19	3.54

CH30.000



DATUM 707.05

PORTAL FLOOR			708.08	708.06	708.07	708.09	708.18	708.21	708.38	708.47	
UNDERSIDE OF ROCK	709.72	709.87	710.99	712.76	713.09	713.18	712.98	712.65	711.76	708.47	709.44
OFFSET	-3.09	-3.00	-2.85	-2.00	-1.00	0.00	1.00	2.00	3.00	3.55	3.55

CH32.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:200

0 3 6 9 12

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BSI FS550318

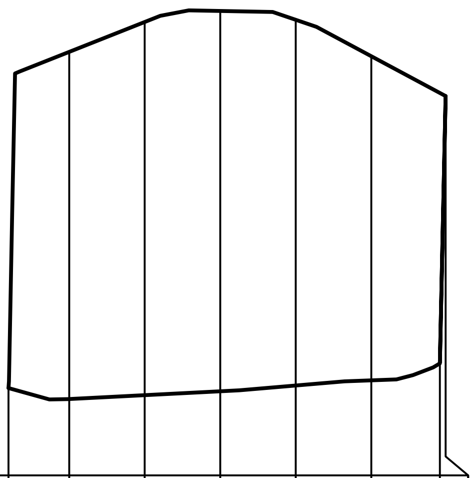
SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH30.000 - CH32.000
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A

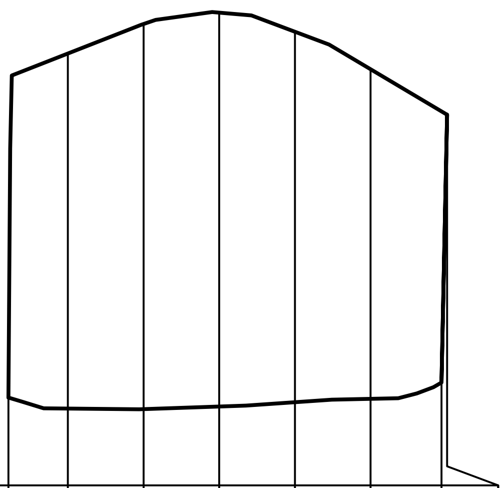
DRAWING No.
16700-SP06



DATUM 707.25

PORTAL FLOOR	708.40	708.26	708.31	708.36	708.44	708.51	708.73	
UNDERSIDE OF ROCK	708.40	712.85	713.24	713.39	713.27	712.79	708.73	712.26
OFFSET	-2.80	-2.00	-1.00	0.00	1.00	2.00	2.91	2.99

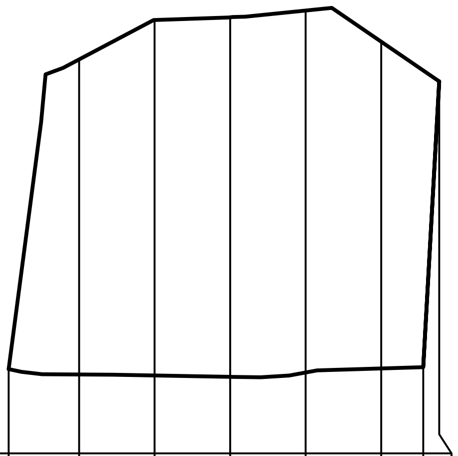
CH34.000



DATUM 707.38

PORTAL FLOOR	708.54	708.40	708.39	708.42	708.48	708.52	708.74	
UNDERSIDE OF ROCK	708.54	713.09	713.48	713.63	713.37	712.88	708.74	712.28
OFFSET	-2.79	-2.00	-1.00	0.00	1.00	2.00	2.94	3.01

CH34.386



DATUM 707.68

PORTAL FLOOR	708.79	708.72	708.71	708.69	708.75	708.80	708.82	
UNDERSIDE OF ROCK	708.79	712.88	713.41	713.44	713.53	711.01	708.82	712.59
OFFSET	-2.93	-2.00	-1.00	0.00	1.00	2.00	2.56	2.77

CH36.000

J:\Surveyors\Jobs\Veolia\16700 Woodlawn Bioreactor\Veolia Southern Portal\Cad\16700-SP2 Plans.dwg

ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:200

0 3 6 9 12

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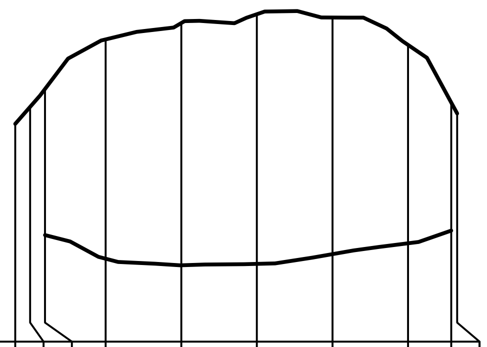
SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH34.000 - CH36.000
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

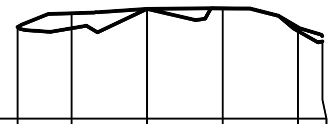
DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP07



DATUM 709.11

PORTAL FLOOR			710.52	710.21	710.12	710.14	710.27	710.41	710.58	
UNDERSIDE OF ROCK	711.99	712.22	712.45	713.11	713.32	713.44	713.40	713.03	712.27	712.13
OFFSET	-3.20	-3.00	-2.80	-2.00	-1.00	0.00	1.00	2.00	2.57	2.65

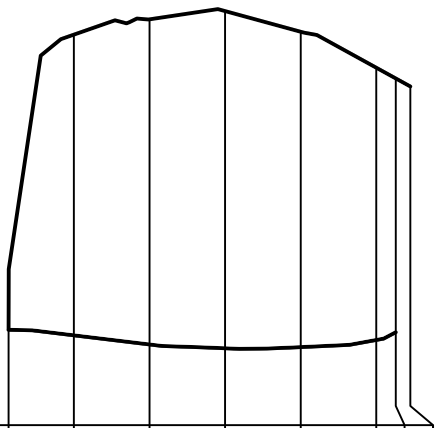
CH40.000



DATUM 711.76

PORTAL FLOOR	712.97	712.95	713.21	713.21	712.91	712.78
UNDERSIDE OF ROCK	712.97	713.15	713.21	713.21	712.96	
OFFSET	-1.72	-1.00	0.00	1.00	2.00	2.32

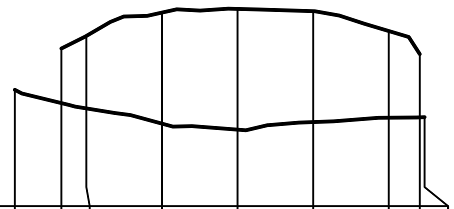
CH43.125



DATUM 708.06

PORTAL FLOOR	709.32	709.25	709.13	709.08	709.09	709.19	709.29	
UNDERSIDE OF ROCK	709.32	713.23	713.43	713.54	713.27	712.79	712.65	712.54
OFFSET	-2.87	-2.00	-1.00	0.00	1.00	2.00	2.26	2.45

CH38.000



DATUM 710.55

PORTAL FLOOR	712.09	711.91	711.84	711.64	711.56	711.66	711.72	711.72	711.73
UNDERSIDE OF ROCK		712.63	712.80	713.11	713.16	713.13	712.86	712.56	
OFFSET	-2.95	-2.33	-2.00	-1.00	0.00	1.00	2.00	2.41	2.47

CH42.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	3/06/2013

SCALE 1:200

0 3 6 9 12

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FS550318

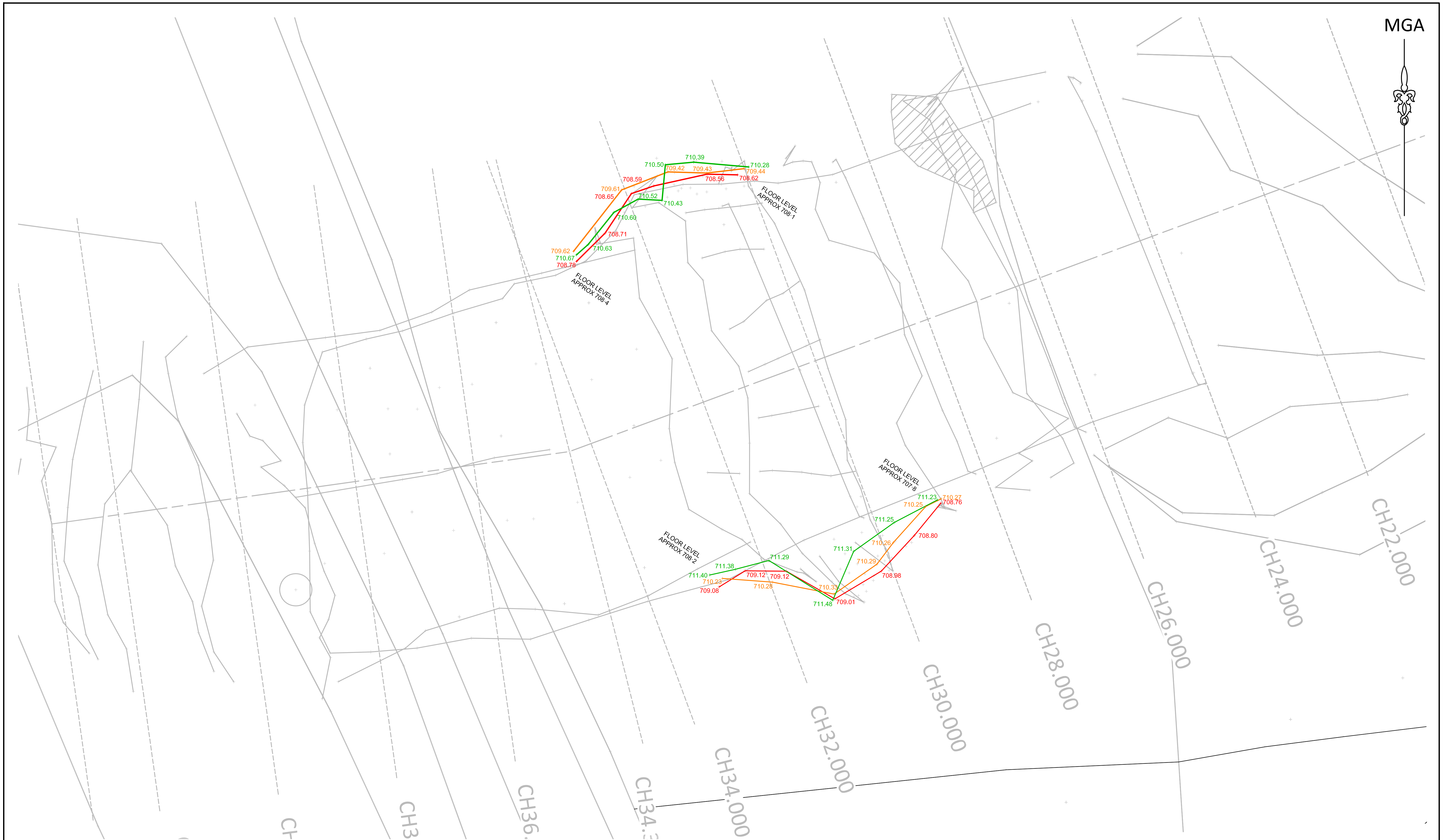
SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH38.000 - CH43.125
SURVEY OF EXISTING SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 3/06/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No.
16700-SP08



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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	2/08/2013

SCALE 1:60

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FS550318

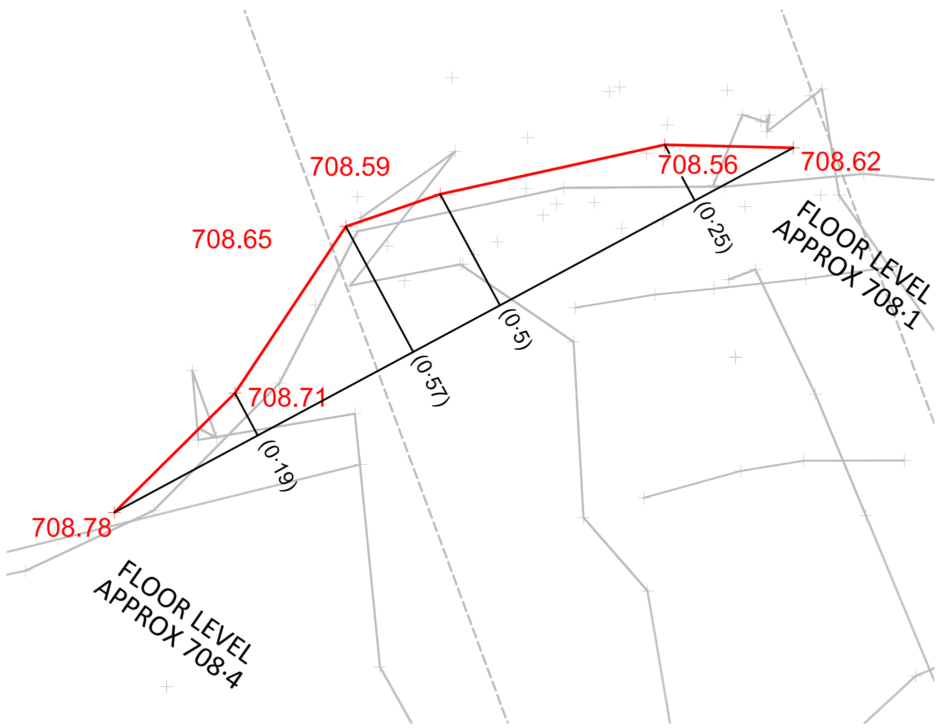
SOUTHERN PORTAL SEALING PROJECT

PLAN VIEW
SHOWING SOUTHERN PORTAL SIDE WALL KEYS
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

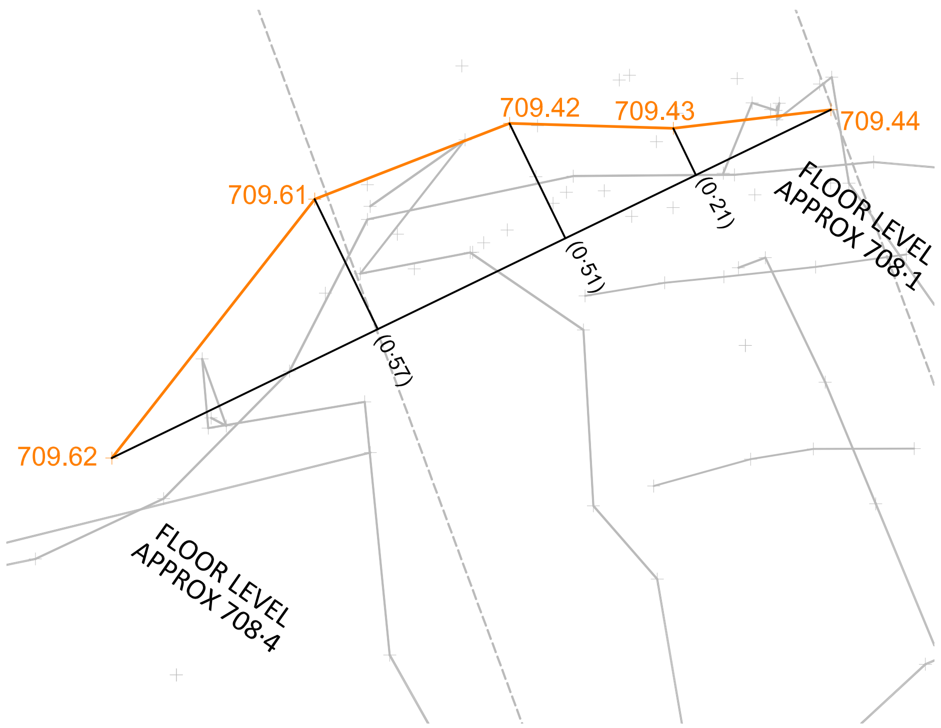
DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 2/08/2013
SURVEYED: SM
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP3-1

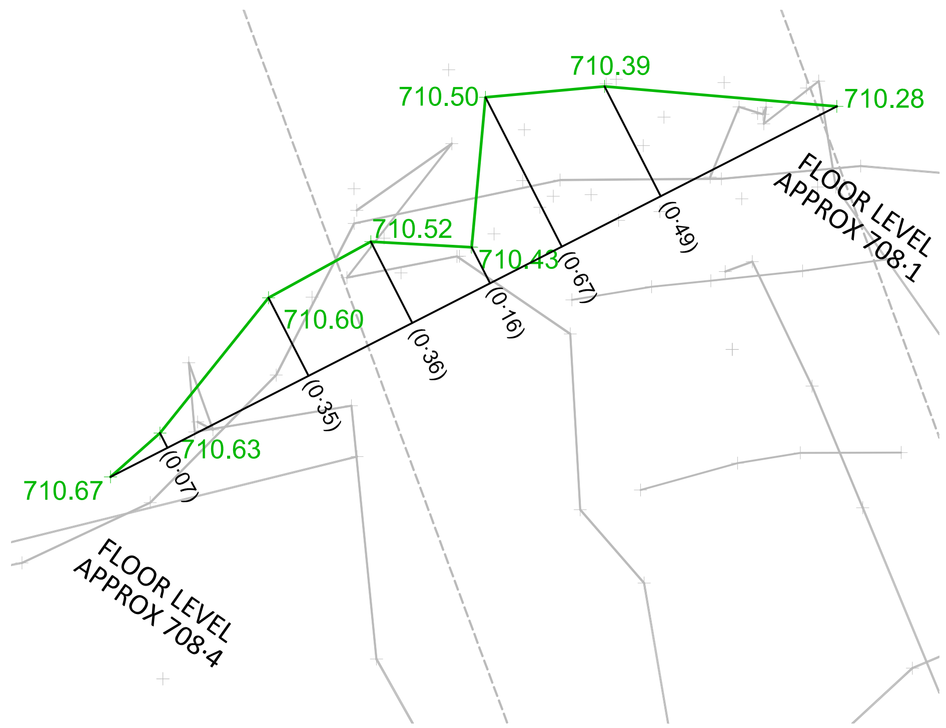
MGA



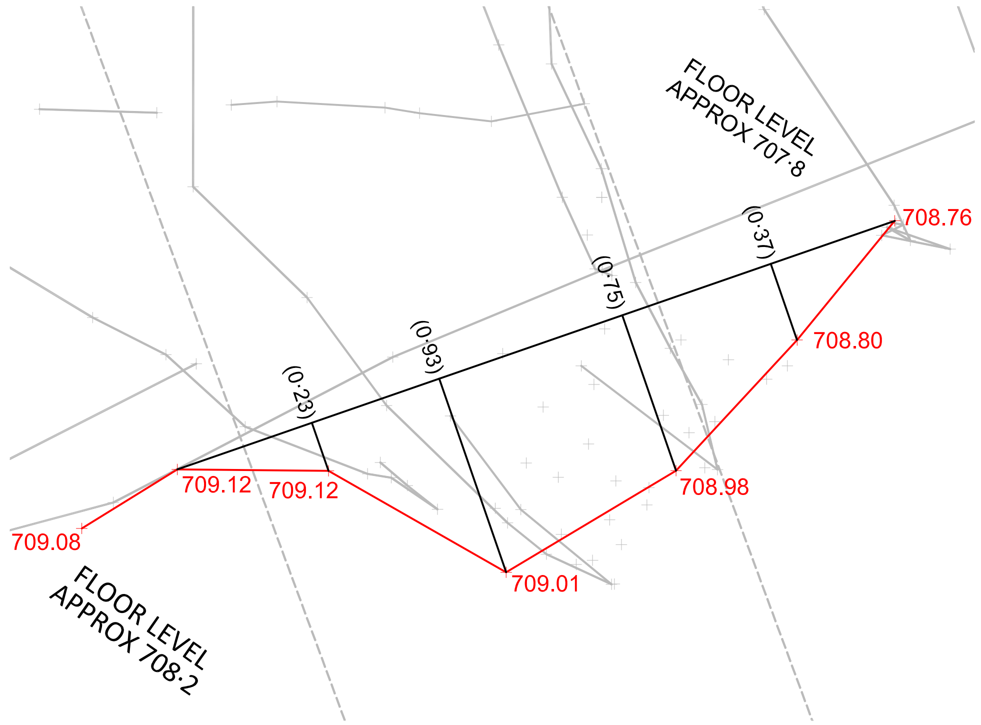
NORTHERN SIDE - LOWER SECTION



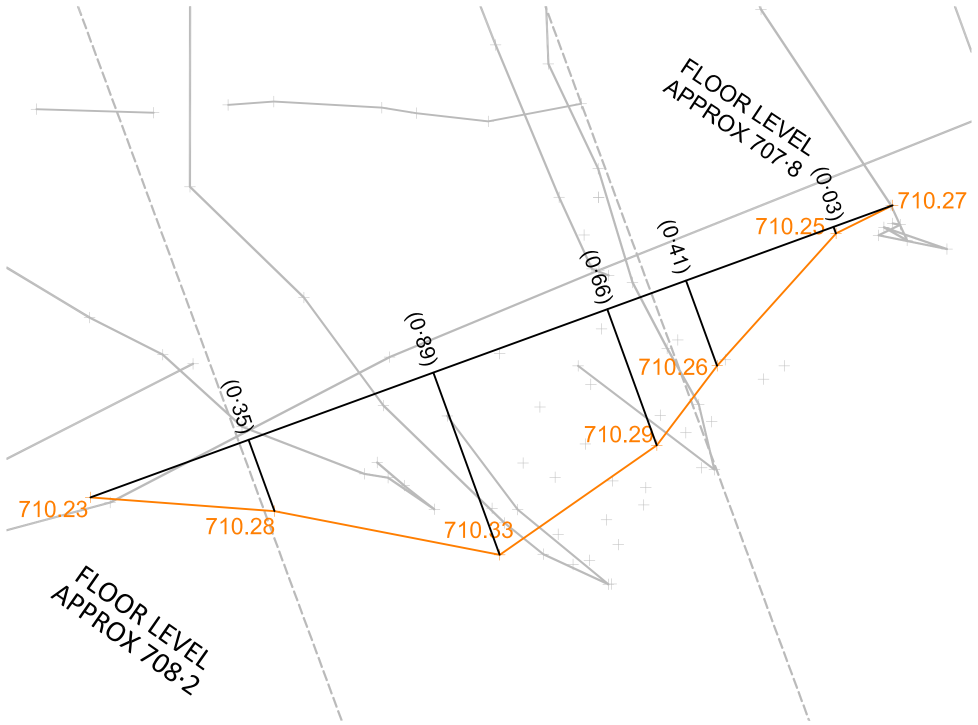
NORTHERN SIDE - MID SECTION



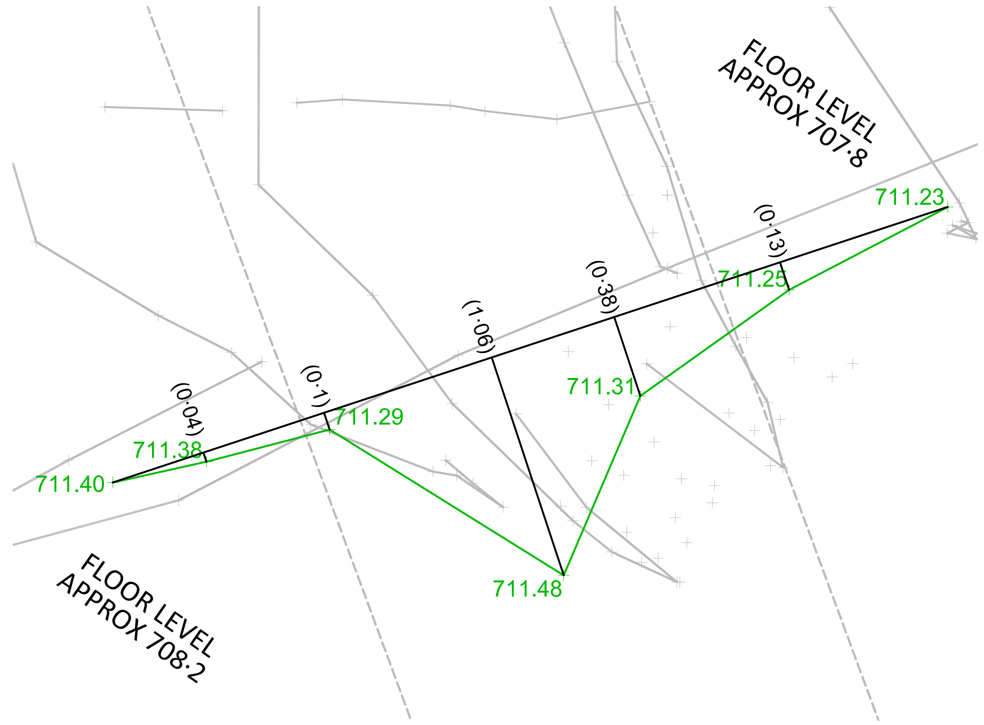
NORTHERN SIDE - HIGHER SECTION



SOUTHERN SIDE - LOWER SECTION



SOUTHERN SIDE - MID SECTION



SOUTHERN SIDE - HIGHER SECTION

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	2/08/2013

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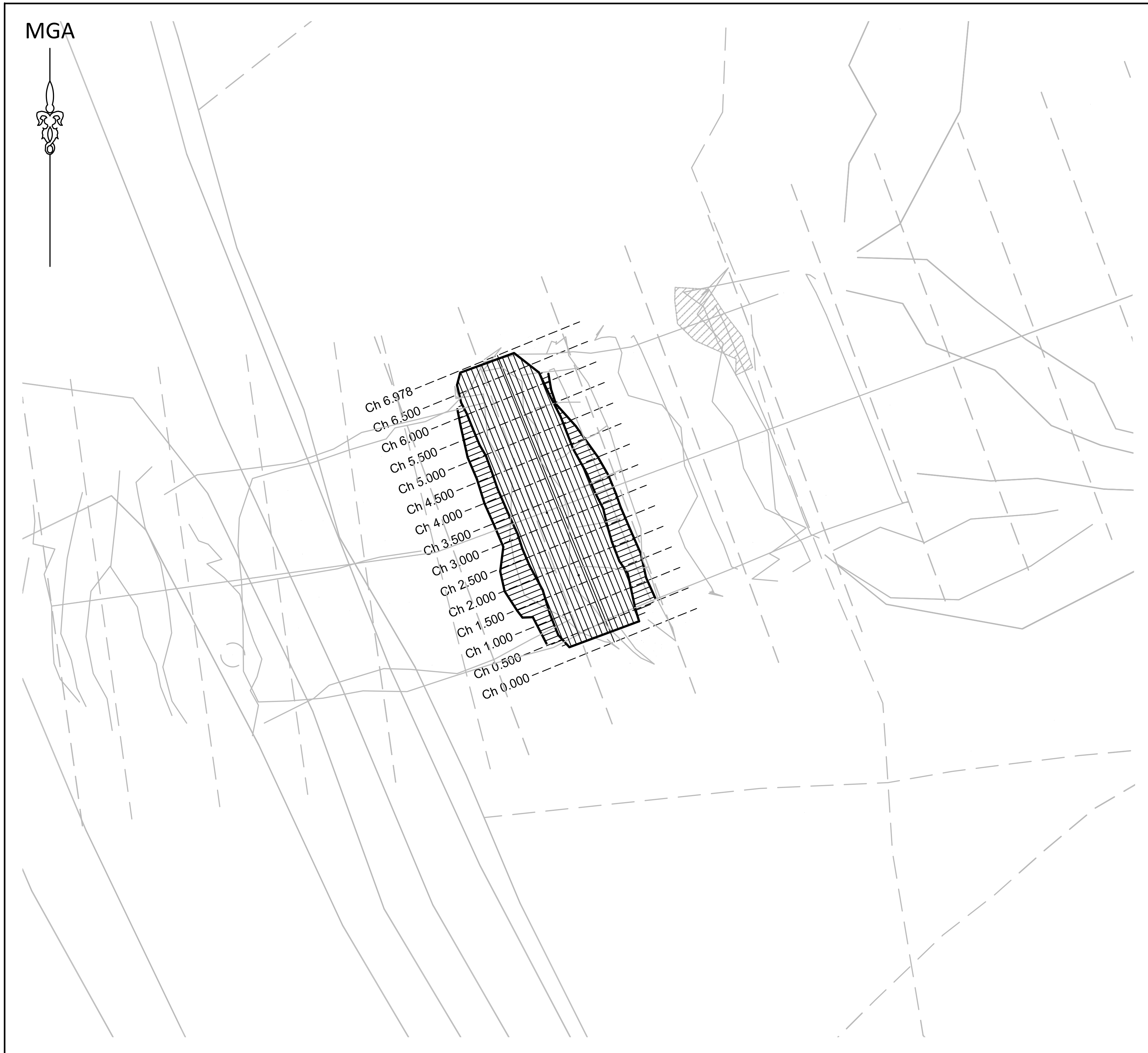
BSI FS550318

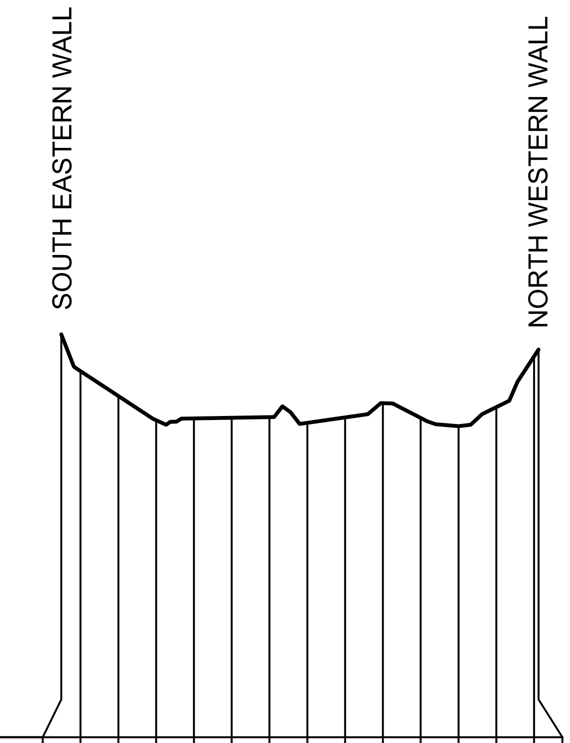
SOUTHERN PORTAL SEALING PROJECT

PLAN VIEW
SHOWING SOUTHERN PORTAL SIDE WALL KEYS
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 2/08/2013
SURVEYED: SM
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP3-2





DATUM 706.500

KEY IN FLOOR	706.984	706.984	706.951	706.919	706.922	706.923	706.923	706.916	706.923	706.942	706.922	706.911	706.937	707.004	707.013
CHAINAGE	0.245	0.500	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.000	5.500	6.000	6.500	6.558

LONGITUDINAL SECTION OF FLOOR KEY

SCALE 1:100 HORIZONTAL
SCALE 1:10 VERTICAL

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	15/08/2013

SCALE 1:100

0 1.2 2.4 3.6 4.8 6

Metres

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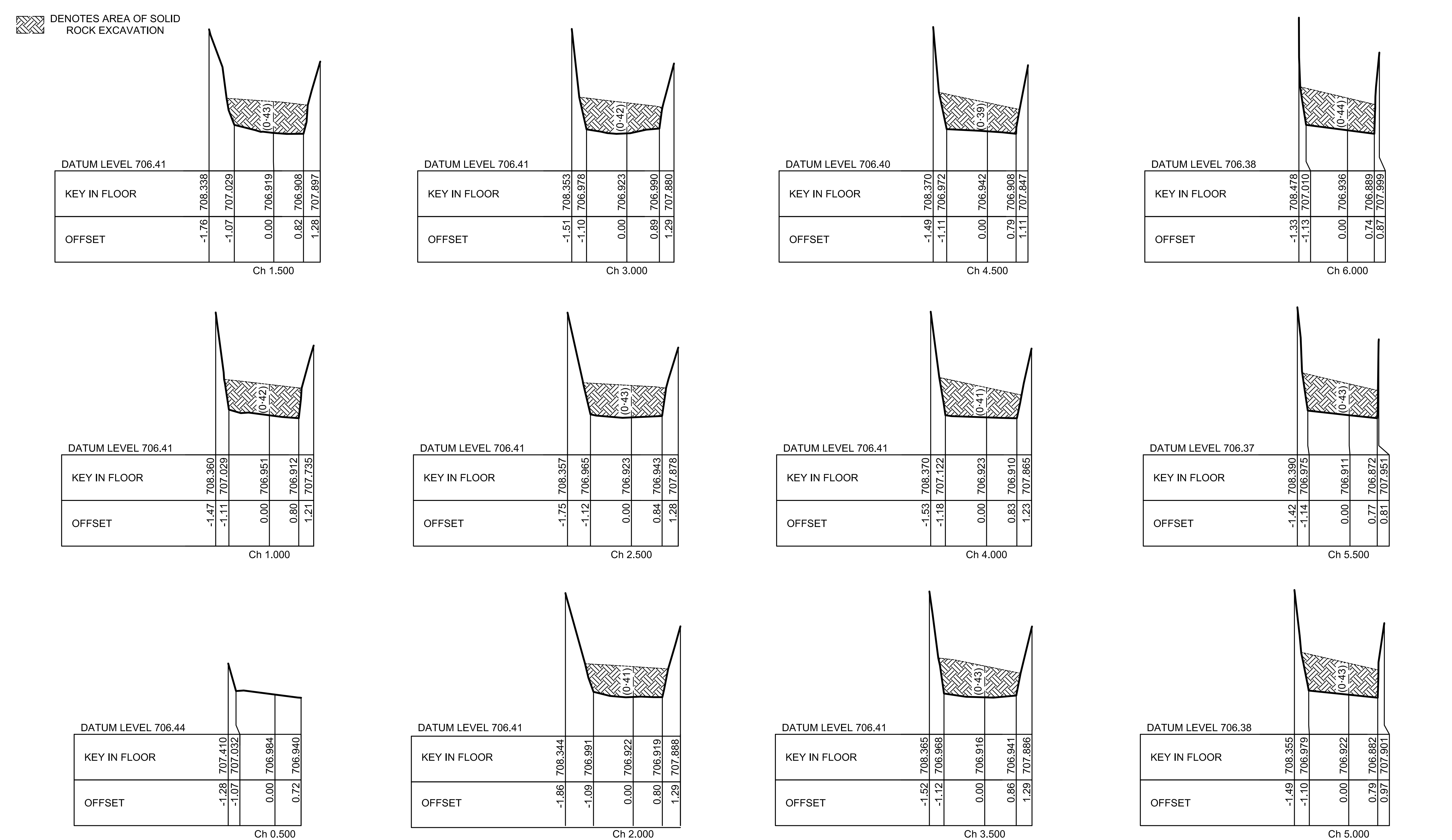
SOUTHERN PORTAL SEALING PROJECT

PLAN SHOWING
CONSTRUCTED KEY IN FLOOR
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 15/08/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP4-1



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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	15/08/2013

SCALE 1:100

1:100 HORIZ 0 1.2 2.4 3.6 4.8

1:50 VERT 0 0.6 1.2 1.8 2.4

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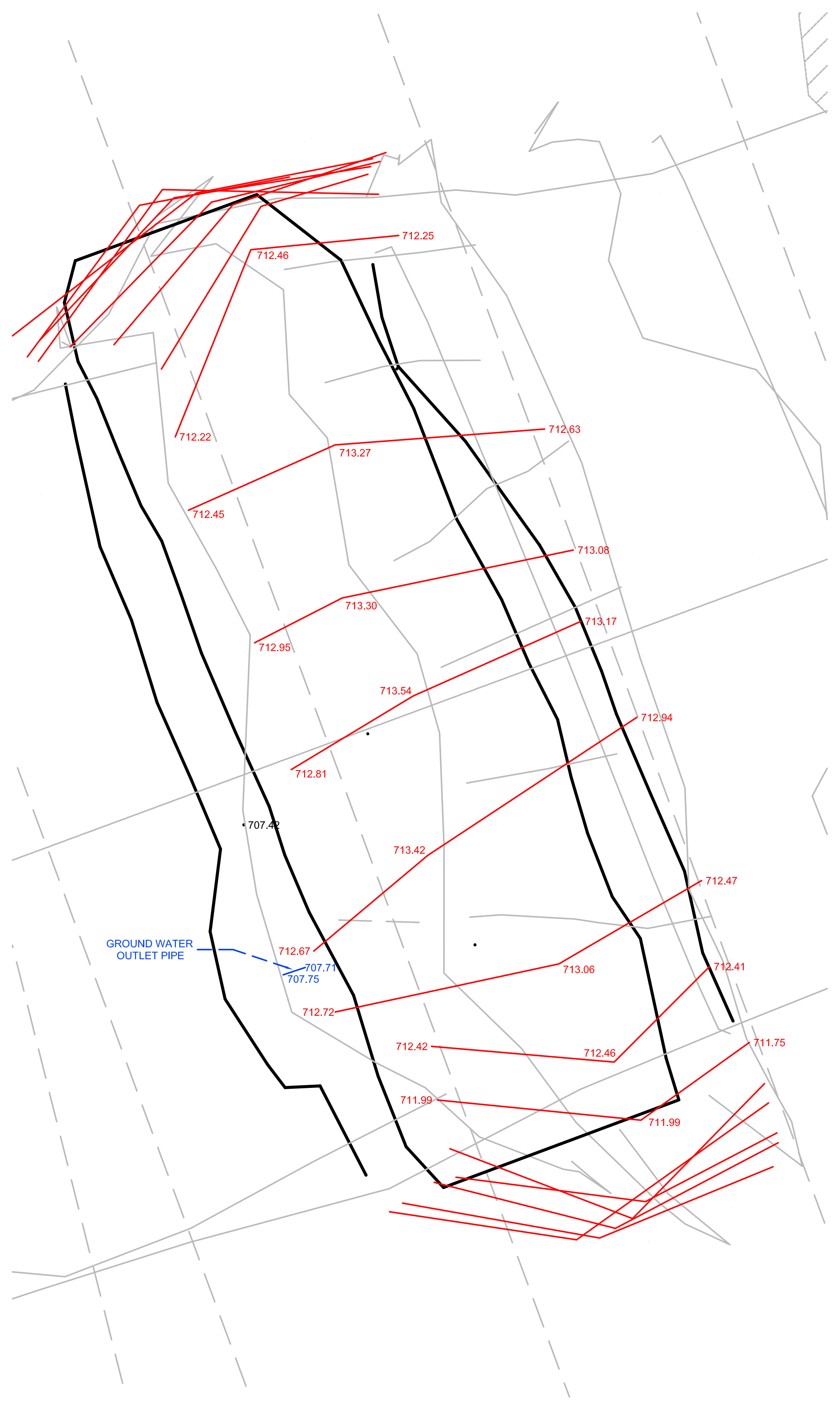
SOUTHERN PORTAL SEALING PROJECT

PLAN SHOWING
CROSS SECTIONS OF CONSTRUCTED KEY IN FLOOR
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO

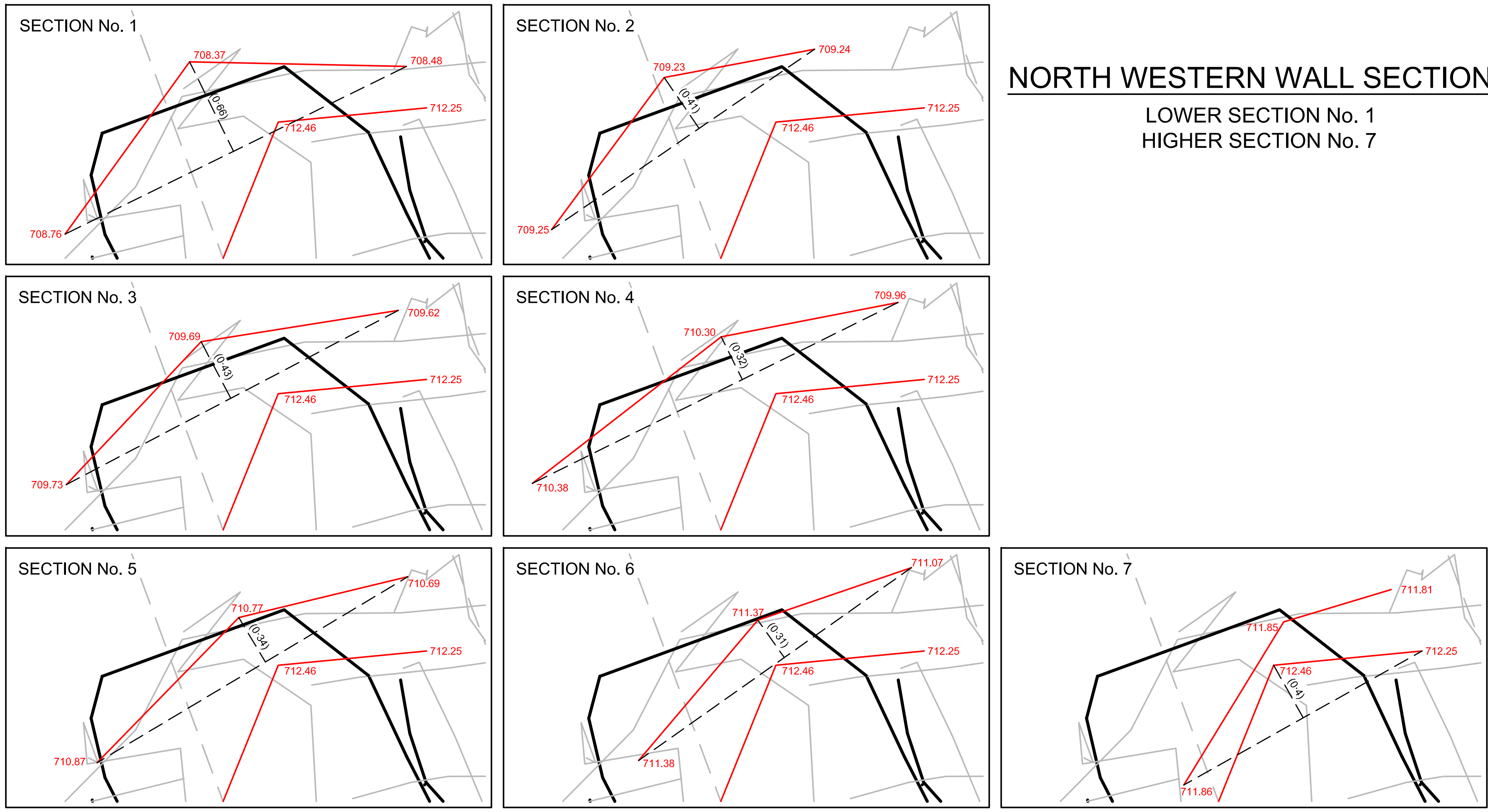
DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 15/08/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP4-2



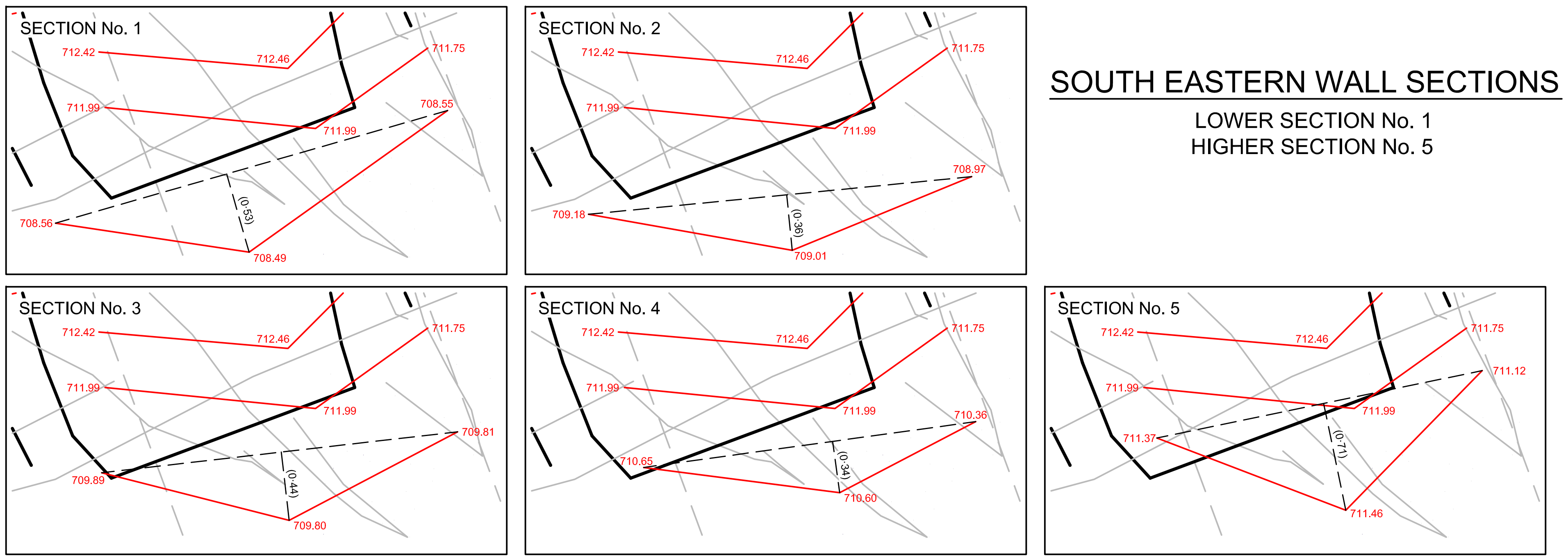
NORTH WESTERN WALL SECTIONS

LOWER SECTION No. 1
HIGHER SECTION No. 7



SOUTH EASTERN WALL SECTIONS

LOWER SECTION No. 1
HIGHER SECTION No. 5



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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	15/08/2013

SCALE 1:40

0 0.5 1.0 1.5 2.0 2.5
Metres

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FS550318

SOUTHERN PORTAL SEALING PROJECT

PLAN SHOWING
DETAILS OF KEY IN WALLS & CEILING
WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 15/08/2013
SURVEYED: MK
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP4-3

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:125

0 2 4 6 8

Metres

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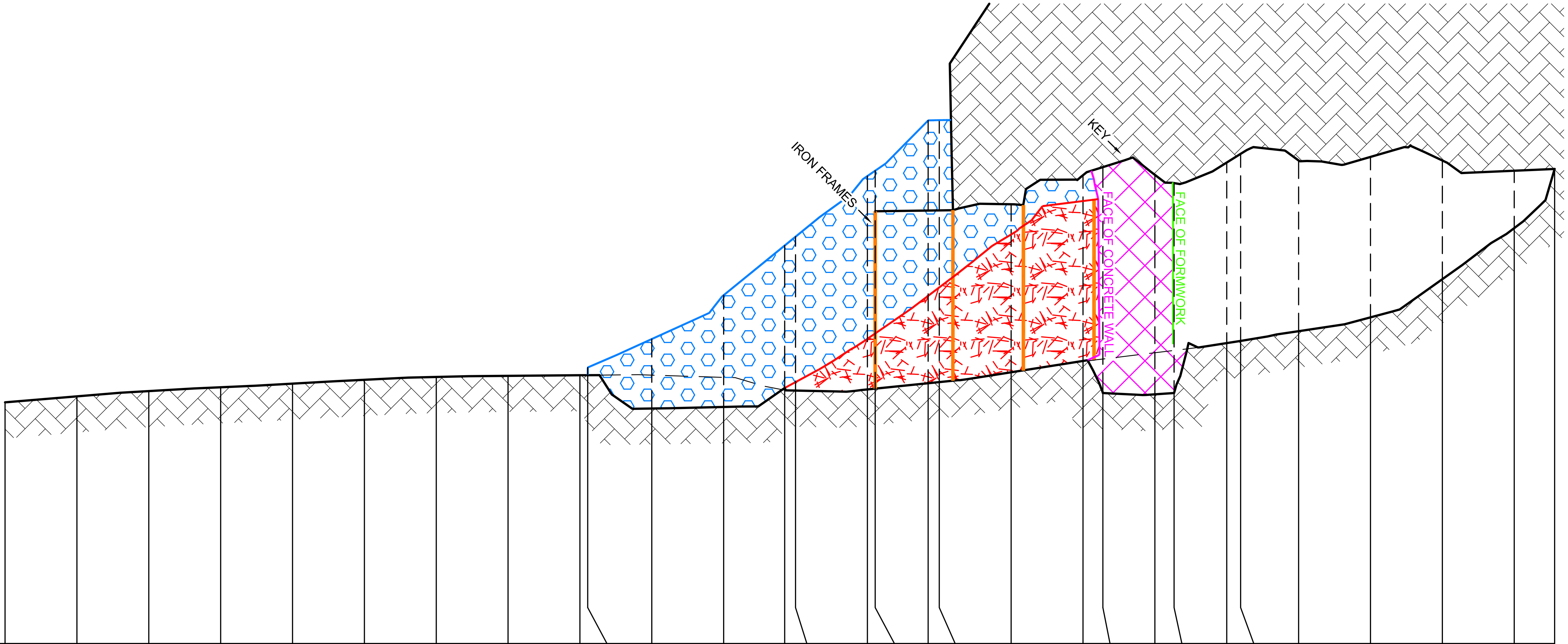
BSI FS550318

SOUTHERN PORTAL SEALING PROJECT

PLAN VIEW
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP5-1



DATUM 700.000

CHAINAGE	0.000	2.000	4.000	6.000	8.000	10.000	12.000	14.000	16.000	16.217	18.000	20.000	21.669	22.000	24.000
FACE OF DOLERITE	-	-	-	-	-	-	-	-	-	707.47	707.68 708.47	709.69	711.08	711.32	713.01
FACE OF GRAVEL	-	-	-	-	-	-	-	-	-	-	-	-	707.11	707.28	708.48
FINAL GROUND LEVELS	-	-	-	-	-	-	-	-	-	-	706.54	706.58	707.11	-	-
UNDERSIDE OF ROCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PORTAL FLOOR	706.71	706.88	707.02	707.13	707.23	707.34	707.42	707.45	707.47	707.47	707.47	707.41	707.05	707.04	707.07

CHAINAGE	24.217	25.691	26.000	28.000	30.000	30.553	32.000	32.533	34.000	34.386	36.000	38.000	40.000	42.000	43.125
FACE OF DOLERITE	713.16	714.56	714.57	712.22	713.04	-	-	-	-	-	-	-	-	-	-
FACE OF GRAVEL	708.63	709.68	709.91	711.39	712.31	-	-	-	-	-	-	-	-	-	-
FINAL GROUND LEVELS	-	-	-	-	-	706.97	706.93	706.97	-	-	-	-	-	-	-
UNDERSIDE OF ROCK	712.03	712.05	712.05	712.22	712.89	713.26	713.18	712.81	713.39	713.63	713.44	713.54	713.44	713.16	713.21
PORTAL FLOOR	707.09	707.24	707.27	707.54	707.84	707.92	708.09	708.16	708.36	708.42	708.69	709.08	710.14	711.56	713.21

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:125

0 2 4 6 8

Metres

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A3 SHEET

VEOLIA ENVIRONMENTAL SERVICES

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FS550318

SOUTHERN PORTAL SEALING PROJECT

LONGITUDINAL SECTION
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP5-2

CH4.000

DATUM 705.41

PORTAL FLOOR	706.67	706.74	706.80	706.87	706.95	707.02	707.10	707.17	707.25	707.33	707.41
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH10.000

DATUM 705.81

PORTAL FLOOR	707.05	707.10	707.16	707.21	707.28	707.34	707.40	707.46	707.52	707.58	707.64
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH2.000

DATUM 705.26

PORTAL FLOOR	706.49	706.56	706.64	706.73	706.80	706.88	706.95	707.03	707.11	707.20	707.29
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH8.000

DATUM 705.68

PORTAL FLOOR	706.92	706.98	707.04	707.10	707.17	707.23	707.30	707.36	707.42	707.48	707.54
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH0.000

DATUM 705.80

PORTAL FLOOR	706.80	706.86	706.95	707.04	707.13	707.21	707.30	707.39	707.47	707.55
OFFSET	1.19	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00

CH6.000

DATUM 705.55

PORTAL FLOOR	706.79	706.86	706.92	706.99	707.07	707.13	707.20	707.26	707.33	707.41	707.48
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:200

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A3 SHEET

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FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH0.000 - CH10.000
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

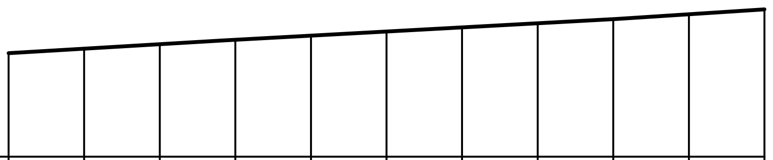
DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No. 16700-SP5-3

FILL MATERIAL LEGEND

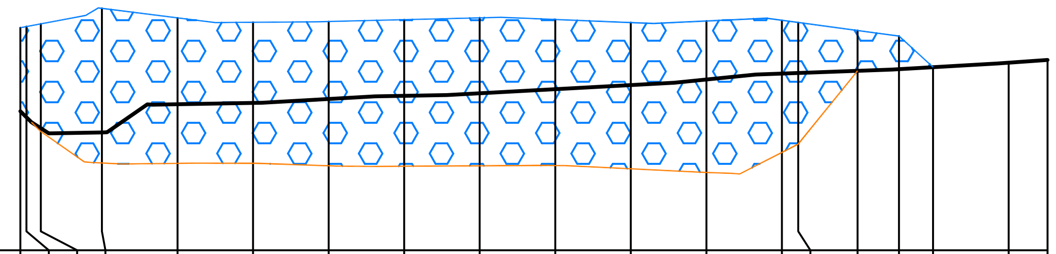
- DOLERITE
- GRAVEL
- CONCRETE



DATUM 705.80

PORTAL FLOOR	707.17	707.22	707.28	707.34	707.39	707.45	707.50	707.56	707.61	707.68	707.74
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

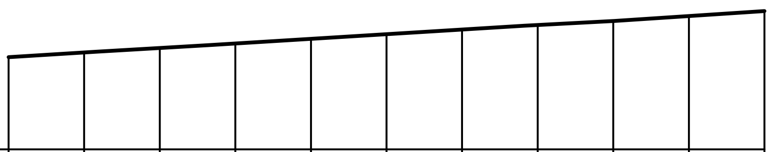
CH14.000



DATUM 705.43

PORTAL FLOOR	707.27	707.19	707.04	706.99	707.36	707.38	707.43	707.47	707.50	707.56	707.61	707.69	707.76	707.77	707.80	707.82	707.85	707.91	707.94
DOLERITE	708.37	708.38	708.42	708.62	708.50	708.44	708.45	708.47	708.50	708.48	708.44	708.46	708.47	708.44	708.33	708.26			
FINISHED FLOOR			707.00	706.58	706.58	706.58	706.55	706.54	706.55	706.55	706.51	706.46	706.72	706.83					
OFFSET	-5.08	-5.00	-4.81	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	5.21	6.00	6.55	7.00	8.00	8.51

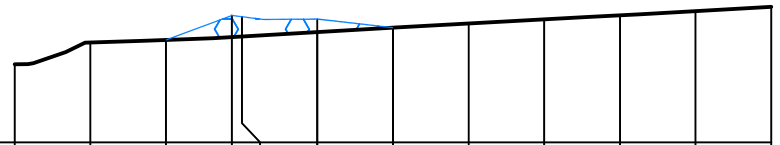
CH18.000



DATUM 705.89

PORTAL FLOOR	707.11	707.18	707.23	707.29	707.36	707.42	707.48	707.54	707.59	707.66	707.72
OFFSET	-5.00	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00

CH12.000



DATUM 705.95

PORTAL FLOOR	706.98	707.27	707.30	707.34	707.35	707.41	707.47	707.52	707.58	707.63	707.69	707.74
DOLERITE				707.63	707.61	707.58						
OFFSET	-5.00	-4.00	-3.00	-2.14	-2.00	-1.01	0.00	1.00	2.00	3.00	4.00	5.00

CH16.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:200

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Metres

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BSI FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH12.000 - CH18.000
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

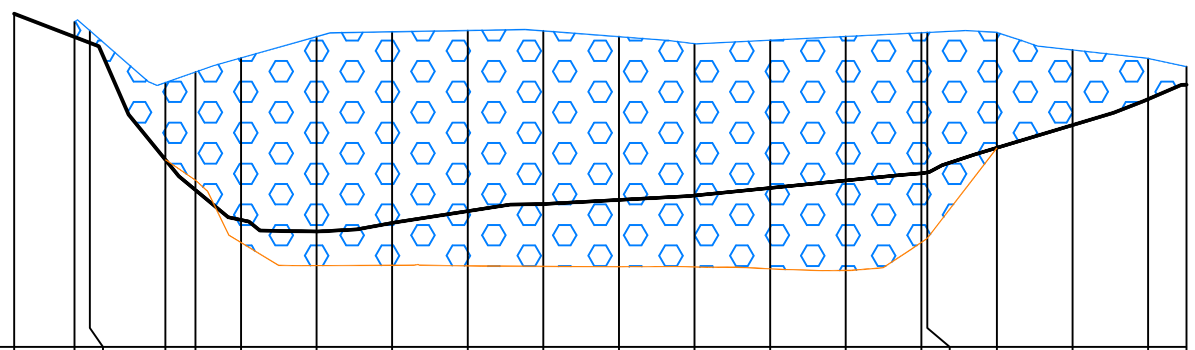
DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No.
16700-SP5-4

FILL MATERIAL LEGEND

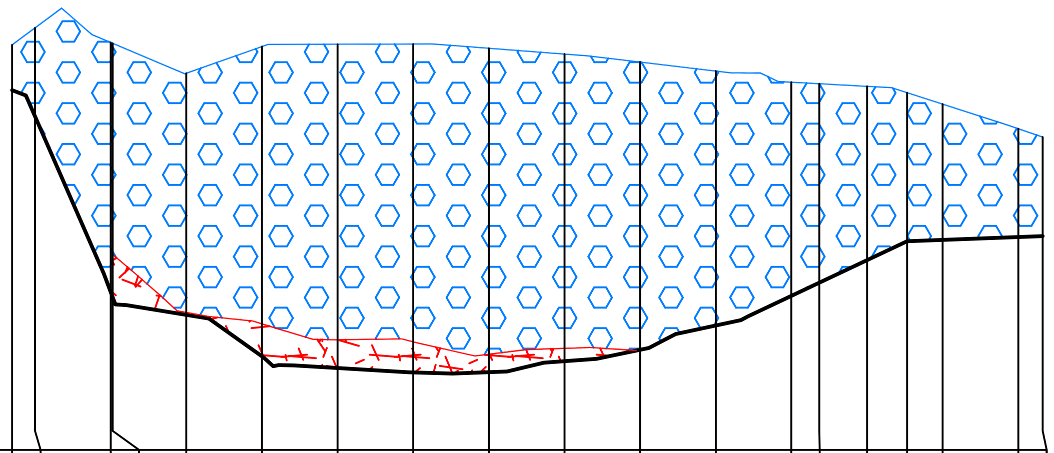
- DOLERITE
- GRAVEL
- CONCRETE



DATUM 705.52

PORTAL FLOOR	709.92	709.62	709.54	707.99	707.59	707.20	707.04	707.16	707.31	707.41	707.46	707.52	707.62	707.72	707.81	707.83	708.15	708.45	708.79	708.98
DOLERITE		709.81	709.70	709.01	709.15	709.34	709.62	709.68	709.70	709.69	709.62	709.53	709.57	709.62	709.67	709.67	709.67	709.44	709.33	709.22
FINISHED FLOOR					707.72	706.90	706.59	706.60	706.59	706.58	706.58	706.58	706.55	706.53	706.90	706.95				
OFFSET	-7.00	-6.20	-6.00	-5.00	-4.60	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	5.00	5.08	6.00	7.00	8.00	8.51

CH20.000



DATUM 706.01

PORTAL FLOOR	710.77	710.42	708.10	708.03	707.80	707.25	707.09	707.04	707.04	707.18	707.33	707.66	708.05	708.22	708.52	708.77			
DOLERITE	711.37	711.59	711.40	711.39	710.99	711.35	711.38	711.38	711.32	711.25	711.14	711.02	710.87	710.85	710.82	710.74	710.58	710.26	710.15
GRAVEL				708.59	707.83	707.68	707.47	707.44	707.28	707.35	707.32	707.27	707.37	707.41					
OFFSET	-6.30	-6.00	-5.00	-4.97	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	3.00	4.00	4.37	5.00	5.53	6.00	7.00	7.32

CH22.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:200

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BSI FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH20.000 - CH22.000
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

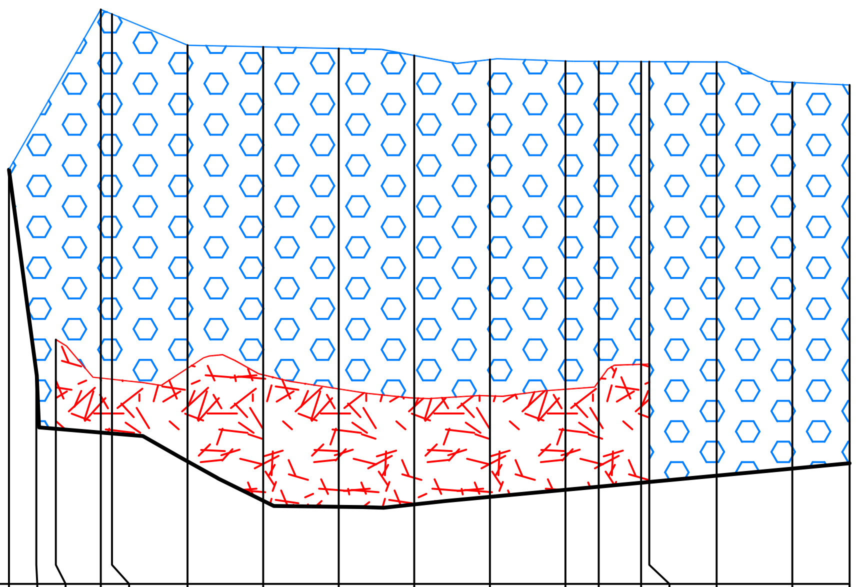
DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No.
16700-SP5-5

FILL MATERIAL LEGEND

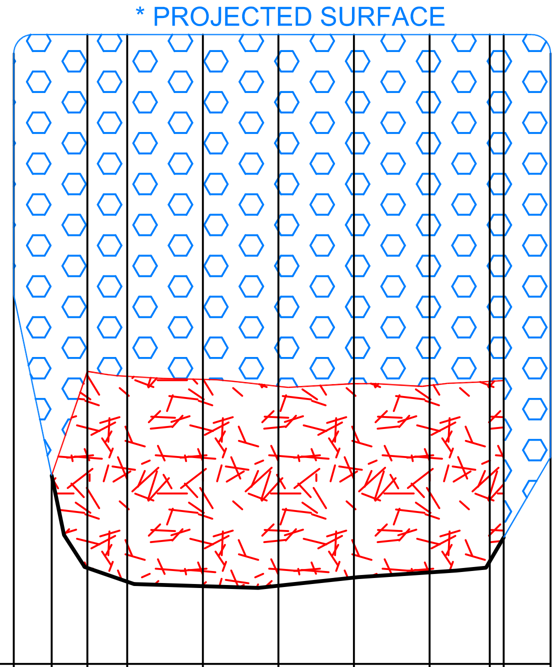
- DOLERITE
- GRAVEL
- CONCRETE



DATUM 706.02

PORTAL FLOOR	711.50	708.82	708.07	708.02	708.01	707.64	707.12	707.04	707.07	707.17	707.26	707.31					
DOLERITE				713.62	713.56	713.15	713.12	713.10	713.01	712.96	712.94	712.93	712.93	712.93	712.92	712.65	712.62
GRAVEL	708.82		709.25	708.74	708.73	708.87	708.79	708.60	708.48	708.51	708.60	708.70	708.92	708.93			
OFFSET	-5.36	-5.00	-4.74	-4.15	-4.00	-3.00	-2.00	-1.00	0.00	1.00	2.00	2.44	3.00	3.11	4.00	5.00	5.76

CH24.000



DATUM 706.24

PORTAL FLOOR		708.73	707.51	707.33	707.27	707.27	707.38	707.45	707.60		
DOLERITE	714.57	714.57	714.57	714.57	714.57	714.57	714.57	714.57	714.57	714.57	714.57
GRAVEL		708.73	710.11	710.04	710.00	709.91	709.95	709.92	709.98	709.99	
OFFSET	-3.50	-3.00	-2.53	-2.00	-1.00	0.00	1.00	2.00	2.80	2.98	3.60

CH26.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

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FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH24.000 - CH26.000
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

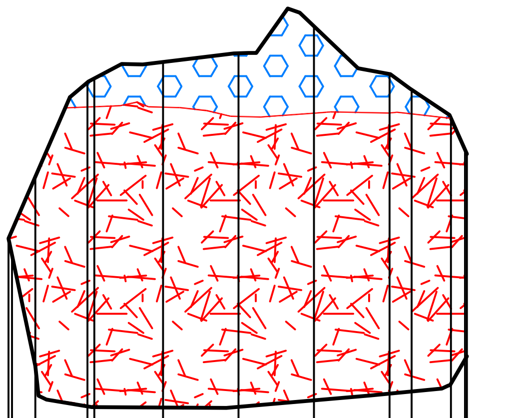
DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE: A

DRAWING No. 16700-SP5-6

FILL MATERIAL LEGEND

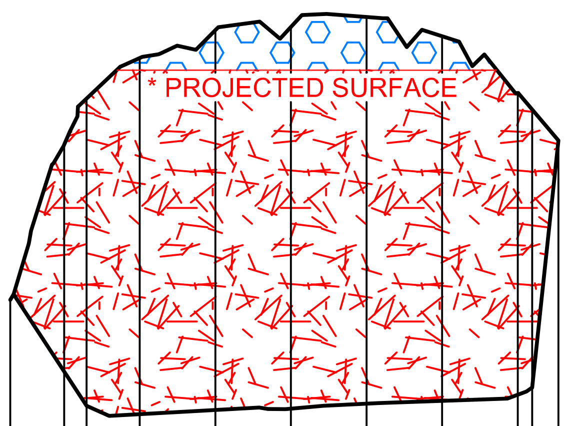
- DOLERITE
- GRAVEL
- CONCRETE



DATUM 706.52

OFFSET	PORTAL FLOOR	UNDERSIDE OF ROCK	GRAVEL
-3.05		709.77	
-3.00		709.55	
-2.69	708.08	710.59	
-2.00	707.55	711.84	
-1.91	707.54	711.89	711.51
-1.00	707.53	712.11	711.51
0.00	707.54	712.22	711.39
1.00	707.63	712.58	711.43
2.00	707.72	711.95	711.43
2.29	707.74	711.74	711.42
2.81	707.85	711.36	
3.00		710.94	
3.02		710.89	

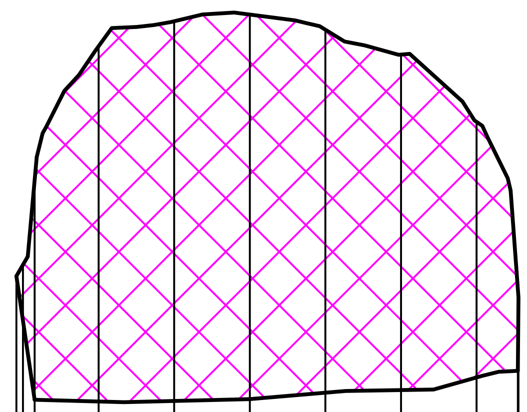
CH28.000



DATUM 706.74

OFFSET	PORTAL FLOOR	UNDERSIDE OF ROCK	GRAVEL
-3.71		709.28	
-3.00		711.33	
-2.70	707.88	711.94	
-2.00	707.77	712.47	712.31
-1.00	707.82	712.84	712.31
0.00	707.84	712.89	712.31
1.00	707.91	713.02	713.31
2.00	707.94	712.76	712.31
3.00	708.02	712.01	
3.19	708.12	711.79	
3.54		711.38	

CH30.000



DATUM 707.05

OFFSET	PORTAL FLOOR	UNDERSIDE OF ROCK
-3.09		709.72
-3.00		709.87
-2.85	708.08	710.99
-2.00	708.06	712.76
-1.00	708.07	713.09
0.00	708.09	713.18
1.00	708.18	712.98
2.00	708.21	712.65
3.00	708.38	711.76
3.55	708.47	708.47
3.55		709.44

CH32.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

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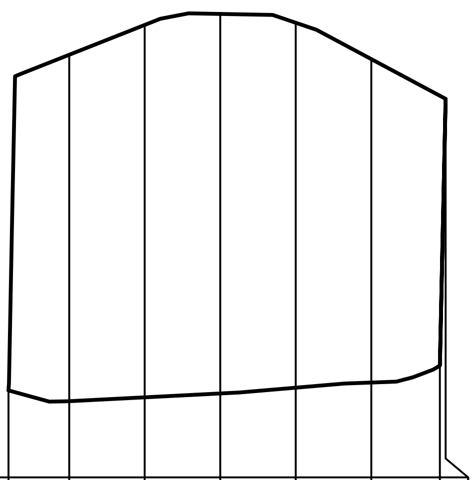
SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH28.000 - CH32.000
COMPLETED SEALIG WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A

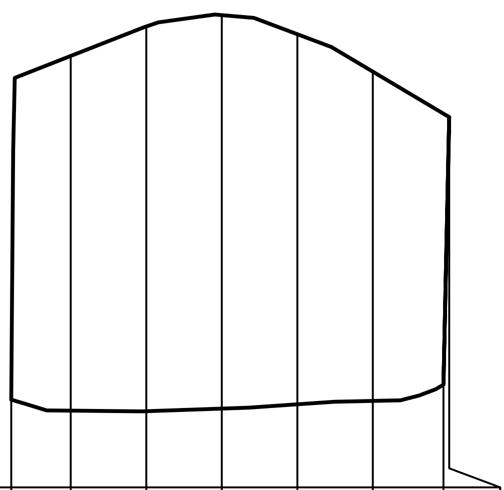
DRAWING No. 16700-SP5-7



DATUM 707.25

PORTAL FLOOR	708.40	708.26	708.31	708.36	708.44	708.51	708.73	
UNDERSIDE OF ROCK	708.40	712.85	713.24	713.39	713.27	712.79	708.73	712.26
OFFSET	-2.80	-2.00	-1.00	0.00	1.00	2.00	2.91	2.99

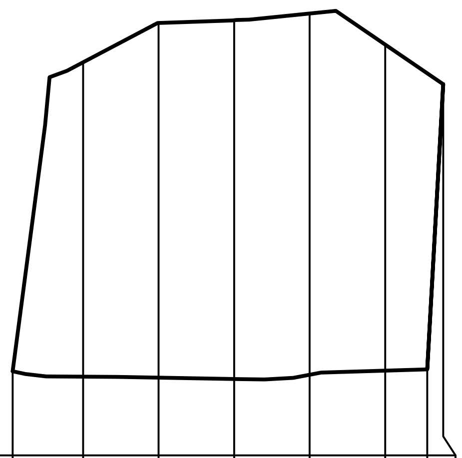
CH34.000



DATUM 707.38

PORTAL FLOOR	708.54	708.40	708.39	708.42	708.48	708.52	708.74	
UNDERSIDE OF ROCK	708.54	713.09	713.48	713.63	713.37	712.88	708.74	712.28
OFFSET	-2.79	-2.00	-1.00	0.00	1.00	2.00	2.94	3.01

CH34.386



DATUM 707.68

PORTAL FLOOR	708.79	708.72	708.71	708.69	708.75	708.80	708.82	
UNDERSIDE OF ROCK	708.79	712.88	713.41	713.44	713.53	711.01	708.82	712.59
OFFSET	-2.93	-2.00	-1.00	0.00	1.00	2.00	2.56	2.77

CH36.000

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ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:200

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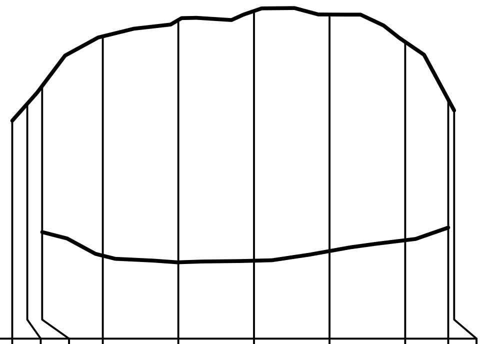
FS550318

SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH34.000 - CH36.000
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD	ORIGIN: PILLAR 715	CONTOUR INTERVAL: N/A

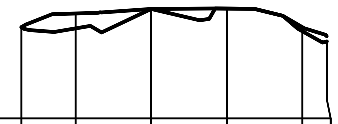
DATE:	18/09/2013	
SURVEYED:	MK/SH	ISSUE
DRAWN:	MK	A
CHECKED:	JK	
DRAWING No.	16700-SP5-8	



DATUM 709.11

PORTAL FLOOR			710.52	710.21	710.12	710.14	710.27	710.41	710.58	
UNDERSIDE OF ROCK	711.99	712.22	712.45	713.11	713.32	713.44	713.40	713.03	712.27	712.13
OFFSET	-3.20	-3.00	-2.80	-2.00	-1.00	0.00	1.00	2.00	2.57	2.65

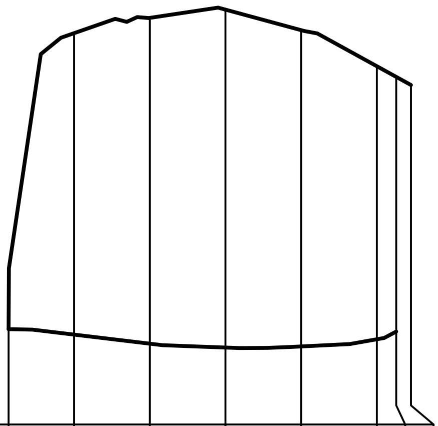
CH40.000



DATUM 711.76

PORTAL FLOOR	712.97	712.95	713.21	713.21	712.91	712.78
UNDERSIDE OF ROCK	712.97	713.15	713.21	713.21	712.96	
OFFSET	-1.72	-1.00	0.00	1.00	2.00	2.32

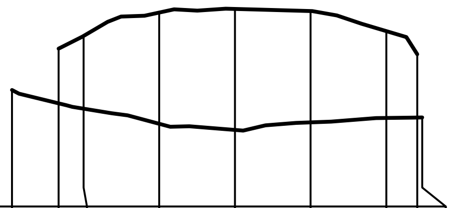
CH43.125



DATUM 708.06

PORTAL FLOOR	709.32	709.25	709.13	709.08	709.09	709.19	709.29	
UNDERSIDE OF ROCK	709.32	713.23	713.43	713.54	713.27	712.79	712.65	712.54
OFFSET	-2.87	-2.00	-1.00	0.00	1.00	2.00	2.26	2.45

CH38.000



DATUM 710.55

PORTAL FLOOR	712.09	711.91	711.84	711.64	711.56	711.66	711.72	711.72	711.73
UNDERSIDE OF ROCK		712.63	712.80	713.11	713.16	713.13	712.86	712.56	
OFFSET	-2.95	-2.33	-2.00	-1.00	0.00	1.00	2.00	2.41	2.47

CH42.000

J:\Surveyors\Jobs\Veolia\16700 Woodlawn Bioreactor\Veolia Southern Portal\Cad\16700-SP5 Final Plans.dwg

ISSUE	AMENDMENT	DATE
A	INITIAL ISSUE	18/09/2013

SCALE 1:200

0 3 6 9 12

Metres

Liability limited by a scheme approved under Professional Standards Legislation.

A3 SHEET

VEOLIA ENVIRONMENTAL SERVICES

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SOUTHERN PORTAL SEALING PROJECT

CROSS SECTIONS: CH38.000 - CH43.125
COMPLETED SEALING WORKS OF SOUTHERN PORTAL
WOODLAWN BIOREACTOR
COLLECTOR ROAD
TARAGO

DATUM: AHD | ORIGIN: PILLAR 715 | CONTOUR INTERVAL: N/A

DATE: 18/09/2013
SURVEYED: MK/SH
DRAWN: MK
CHECKED: JK
ISSUE A
DRAWING No. 16700-SP5-9

VEOLIA ENVIRONMENTAL SERVICES

SCALE 1:2500

0 50 100 150 200 250
Metres

ISSUE	AMENDMENT	DRAWN	DATE
B	EVAPORATION DAMS ED3 ADDED	JA	6/2006
C	CEA CONSTRUCTION AREA UPDATED	JA	1/2007
D	GENERAL REVISION & REMOVAL OF REDUNDANT DETAIL	MK	14/04/2016
E	NOTE REGARDING LEACHATE EXTRACTION ADDED	MK	14/04/2016
F	MINOR ADDITIONS AND AMENDMENTS	MK	21/07/2016
G	GENERAL AMENDMENTS AND RE-ISSUE	MK	24/07/2018
H	ED1CD2 ADDED & VARIOUS AMENDMENTS	MK	18/01/2023

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LandTeam

A1 SHEET

VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO

LEACHATE TRANSFER SYSTEM
WOODLAWN BIOREACTOR

SURVEYED: N/A
DRAWN: MK
CHECKED: JK

ISSUE H

DATUM AHD | CONTOUR INTERVAL 1m | DATE 18/01/2023

DRAWING No. 16800-180

Mechanical Evaporator Operation Protocol
Woodlawn Bioreactor

Protocol Objective

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

Background

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

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

Figure 1: Evaporator units in action

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Veolia Operating Protocol

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

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

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

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

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

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

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

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

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

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

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

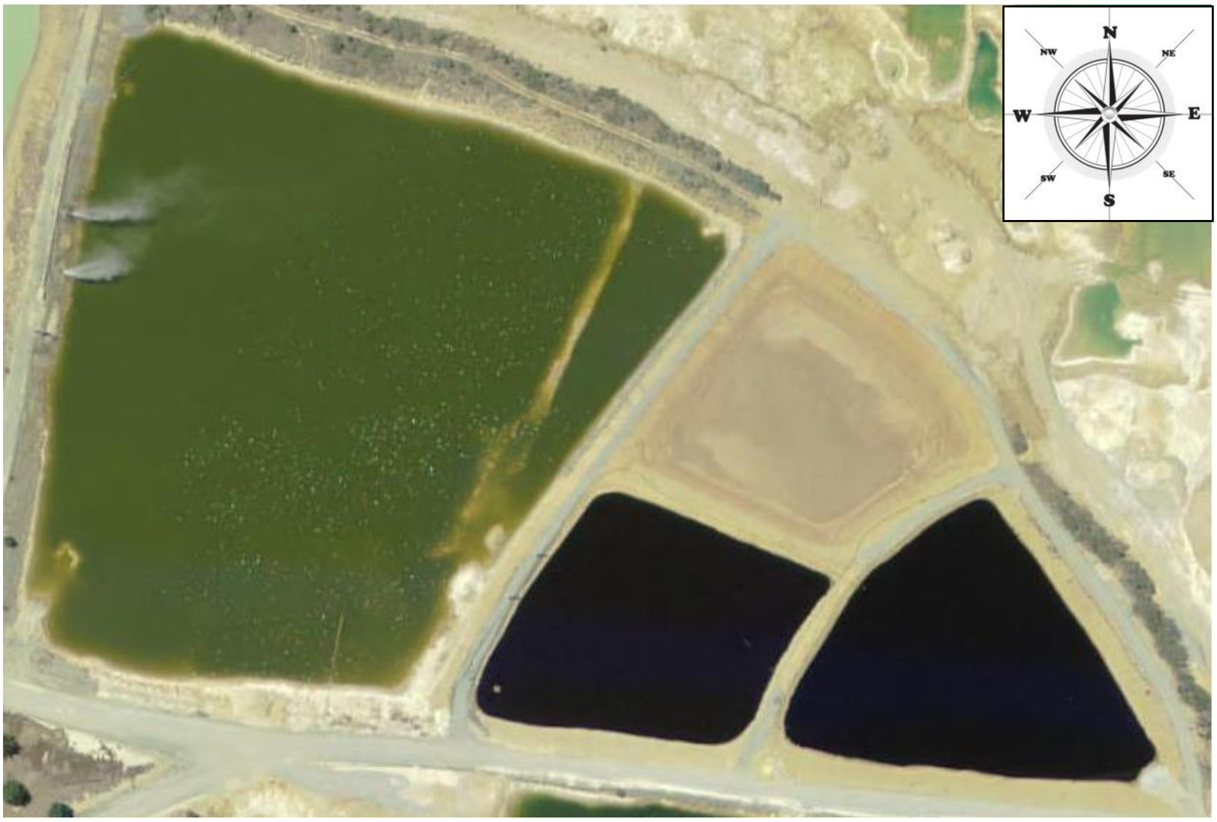
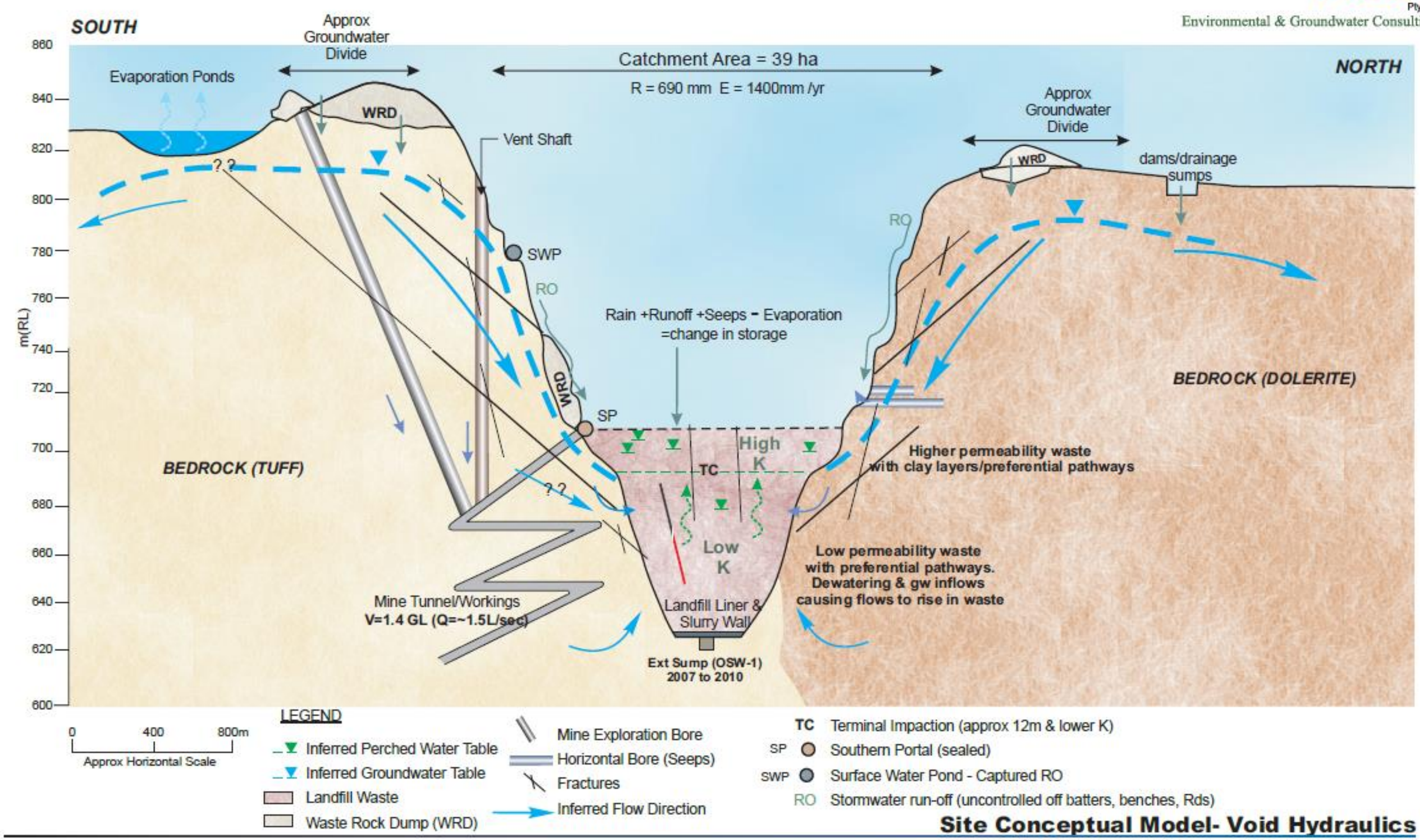


Figure 2 – Woodlawn ED3 North system



Site Conceptual Model- Void Hydraulics

Veolia Australia & New Zealand

Woodlawn Bioreactor Facility Odour Modelling Study

Long-term Treated Leachate Solution

July 2016

Final Report

THE ODOUR UNIT PTY LTD

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Project Number: N1806L.06

Report Revision		
Revision Number	**Date**	**Description**
Draft report	21.07.2016	Internal review
Final report (unsigned)	22.07.2016	Issued to client for review
Final Report (signed)	22.07.2016	Final report issued
Report Preparation		
Report Prepared By: M. Assal & S. Hayes	**Approved By:** M. Assal	
Report Title: Veolia Australia & New Zealand Woodlawn Bioreactor Facility Odour Modelling Study – Long-term Treated Leachate Solution		

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APPENDICES

1 INTRODUCTION

In June 2016, Veolia Australia & New Zealand (Veolia) engaged The Odour Unit Pty Ltd (TOU) to carry out an odour dispersion model study to evaluate the odour profile contribution and assess compliance against the New South Wales Environment Protection Authority (NSW EPA) odour performance criteria of the addition of the proposed Evaporation Dam 1 (ED1) System to the Leachate Management System (LMS) at the Woodlawn Bioreactor Facility located at Collector Road, Tarago, NSW (the Site).

The basis for this additional pond system is to create the necessary reserve capacity for the storage of treated leachate from the future Membrane Bioreactor (MBR) Treatment Plant. This is part of Veolia's long term strategy for managing leachate at the Site. The MBR Treatment Plant will see the decommissioning of the existing Leachate Aeration Dam (LAD) and storage in Evaporation Dam 3 South (ED3S), once it fully operation. The expected date of this decommissioning is end of 2017. Overall, this is considered to represent a significant upgrade in the Leachate Management System (LMS) and aims to improve the stored treated leachate quality at the Woodlawn Bioreactor Facility.

1.1 SCOPE OF WORKS

The scope of works for the odour dispersion model study consisted of:

- Sourcing and setting up the original odour dispersion model used in the *Environmental Assessment Woodlawn Expansion Report* dated August 2010 (EA). Some meteorology-based revisions to this model were necessary given the year that the model was completed (see **Section 3** for details);
- Inclusion of the proposed ED1 System into the EA odour dispersion model;
- Undertaking of a regression analysis for the purposes of developing a mathematical function that can project the expected specific odour emission rate (SOER) based on the final treated leachate quality generated by the proposed MBR Treatment Plant. This analysis was based on an extensive dataset pertaining to leachate quality and odour emissions from the LMS obtained during the previous four odour audits, conducted annually, at the Woodlawn Bioreactor Facility since 2012; and
- Odour dispersion modelling projection of the individual off-site odour impact from the inclusion of the proposed ED1 System. In addition, the cumulative off-site odour impact with the other modelled emission sources in the EA were

undertaken to assess site-wide compliance with the relevant NSW EPA odour performance criterion.

The following report details the methodology and findings from the odour dispersion model in the context of the quality of treated leachate from the MBR Treatment Plant and storage in ED1 system.

2 STUDY METHODOLOGY

The odour dispersion modelling study methodology required the need to setup and carry out new modelling runs of the original EA odour dispersion model, developed by the former Heggies Pty Ltd, now operating as SLR Consulting, to evaluate the contribution and assess compliance of the proposed addition of ED1 system to the LMS and other modelled emissions. The original dispersion modelling configuration and the adopted odour emission rates used in the EA odour dispersion model can be found in *Section 5* of the EA's *Odour and Dust Impact Assessment (Rev 7)* report dated February 2011. Moreover, the modelling study from TOU reports titled *Proposed Addition of ED3S to Leachate Management System* dated May 2016 should be read in conjunction with this report.

2.1 PROJECTED ED3S SYSTEM ODOUR EMISSION RATES

The projected ED3S System odour emission rates adopted from the May 2016 study were used as part of this modelling study. For convenience, the derived odour emission rates have been presented in **Table 2.1**.

Table 2.1 - Projected Odour Emission Rates for ED3S

ED3N System 2015			
Source ID	**Dam Surface Area (m^2)**	**SOER ($ou.m^3/m^2/s$)**	**OER ($ou.m^3/s$)**
ED3N-1	6,000	0.132	794
ED3N-2	5,500	0.145	797
ED3N-3	5,500	0.091	500
ED3N-4	25,000	0.269	6,720
ED3N Total	**42,000**	**0.159 (mean)**	**8,810**
Projected ED3S System			
ED3S	89,435	0.159	14,200
ED3S-S	28,330		4,510
ED3S Total	**118,000**		**18,700**

The modelling was carried out on the basis of ED3S-S at total water level (TWL). This is considered to be a conservative approach as ED3S-S is planned to receive treated leachate until the end of 2017, after which it will be decommissioned and replacement with the MBR Treatment Plant and ED1 System.

2.2 ED1 TREATED LEACAHE QUALITY TARGET VALUES

The treated leachate quality target values were supplied by Veolia on 5 July 2016, understood to be from the designer and installer of the MBR Treatment Plant. These are summarised in **Table 2.2**.

Table 2.2 – Final treated leachate quality target values by the MBR Treatment Plant

Parameter	Units	Minimum	Average	Maximum
pH	--	--	--	7 - 7.5
Conductivity	µS/cm	--	36,000	--
COD	mg/L	--	--	2,500
BOD	mg/L	--	--	10
Total Phosphorus	mg/L	--	--	13
Ammonia	mg/L	--	--	10
Nitrate	mg/L	--	--	500
TSS	mg/L	--	--	5
TDS	mg/L	--	--	30,000
Chloride	mg/L	--	--	5,000

2.3 REGRESSION ANALYSIS

As previously mentioned in **Section 1**, a regression analysis for the purposes of developing a mathematical function that can project the expected SOER based on the final treated leachate quality generated by the proposed MBR Treatment Plant. This analysis is considered to be important for the purposes of inputting reliable odour emissions data in the dispersion model and undertaking of a sensitivity analysis, where the effect of fluctuations in the final effluent quality can be examined and the resultant odour impact assessed.

The regression analysis involved three key steps:

1. Evaluation of key leachate parameters that are likely to have the most significant impact to odour emission from stored leachate, based on an extensive dataset pertaining to leachate quality and odour emissions from the LMS obtained during the previous four odour audits, conducted annually, at the Woodlawn Bioreactor Facility since 2012. A summary of the processed data is provided in **Appendix A.** The raw dataset can be provided upon request. The parameters examined included: pH, Biological Oxygen Demand (BOD), Total phosphorus, Ammonia, Nitrate, Total Suspended Solids, Total Dissolved Solids, Chloride and Volatile Fatty Acids (VFAs);

2. Once a positive and confident correlation was developed between odour and the leachate quality parameter, a regression function was developed; and

3. Undertaking of a sensitivity analysis with leachate quality parameters at:

   - The final effluent target design values (see **Table 2.2**); and
   - Leachate quality values above the final target design values (see **Table 2.4**).

Upon completion of the regression analysis, the mean of the projected SOERs between leachate quality parameter was undertaken. For example, if the BOD regression model produced a SOER of 1 ou.m^3/m^2/s and Ammonia of 2 ou.m^3/m^2/s, the arithmetic mean was computed (i.e. 1.5 ou.m^3/m^2/s in this hypothetical example). A nominal multiplicity factor was then applied to the mean value at 2, 5, and 10 times above the final target design values.

2.3.1 Leachate quality parameters selected

From the list of leachate quality parameters listed in **Section 2.3**, the following parameters were selected for a covariance and correlation analysis: pH, BOD, Ammonia, Sulphide, and VFAs. These parameters are well known to be a contributing factor for the generation of adverse levels of odour from wastewater, if they are not adequately managed.

The covariance analysis conducted (see **Appendix A**) indicated a positive covariance suggesting that a relationship existed between SOER and BOD, Ammonia, Sulphide and VFAs. pH was found to have a negative covariance, suggesting that a relationship between SOER and pH is not likely. From there, a correlation analysis was undertaken, the result of which are summarised in **Table 2.3** below. The result shows the coefficient of determination (R^2). Put simply, the closer the R^2 value is to 1 the stronger the statistical relationship between the two variables, in this case the SOER and leachate quality parameter.

Table 2.3 – Coefficient of determination for leachate quality parameters

Leachate quality parameter	R^2
BOD	0.89
Sulphide	0.35
Ammonia	0.94
VFAs	0.86

The detailed analysis worksheet is appended as **Appendix A.** On the basis of the results in **Table 2.3**, BOD and Ammonia were selected as the parameters for further analysis.

2.3.2 Leachate quality parameter regression results

The regression results between SOER and the leachate quality parameters including BOD and Ammonia are illustrated in **Figure 2.1 & Figure 2.2**, respectively. As can be seen, for both regression results for BOD and Ammonia, there exists a strong exponential correlation with SOER.

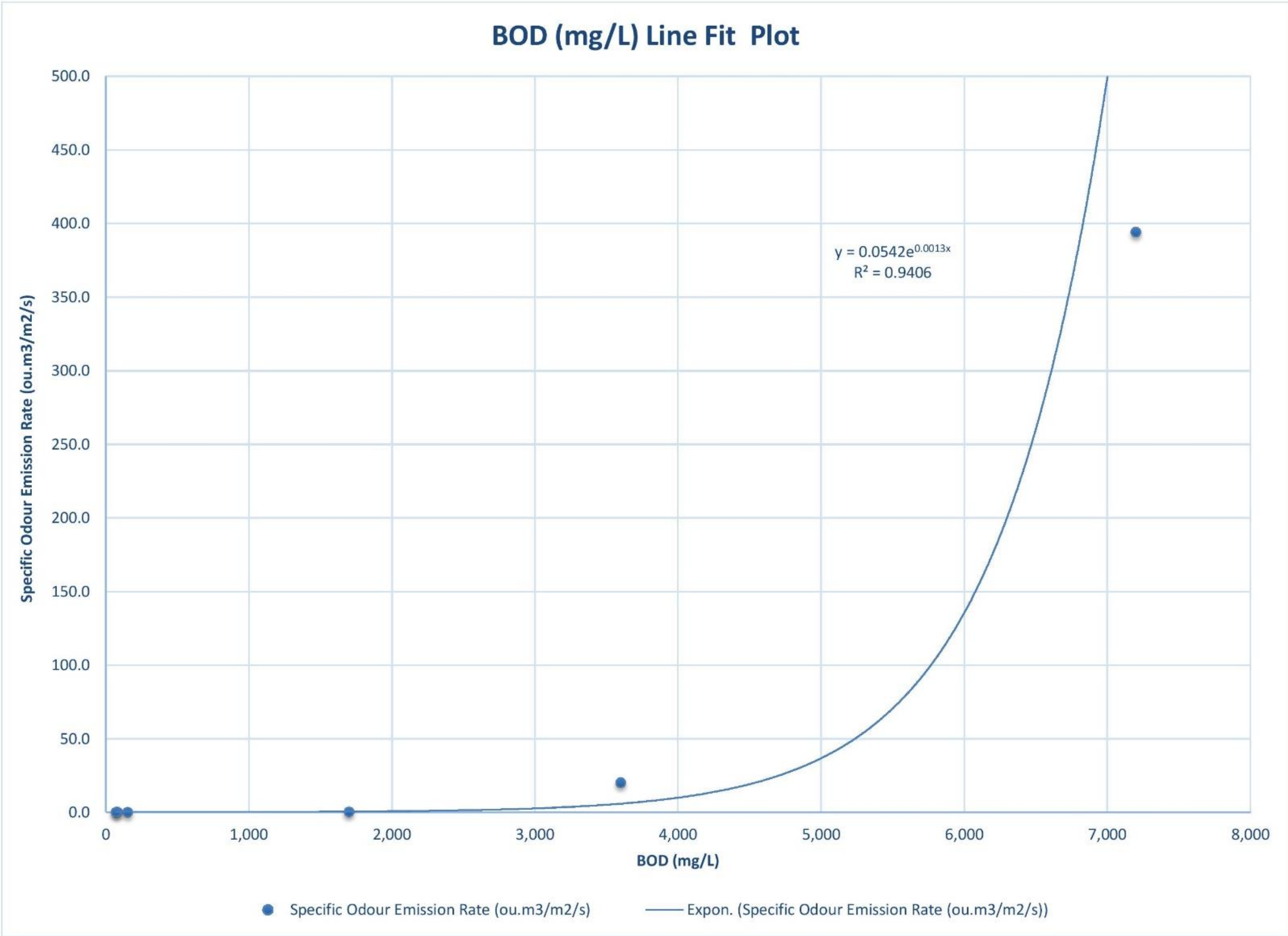


Figure 2.1 - SOER and BOD SOER regression projection results

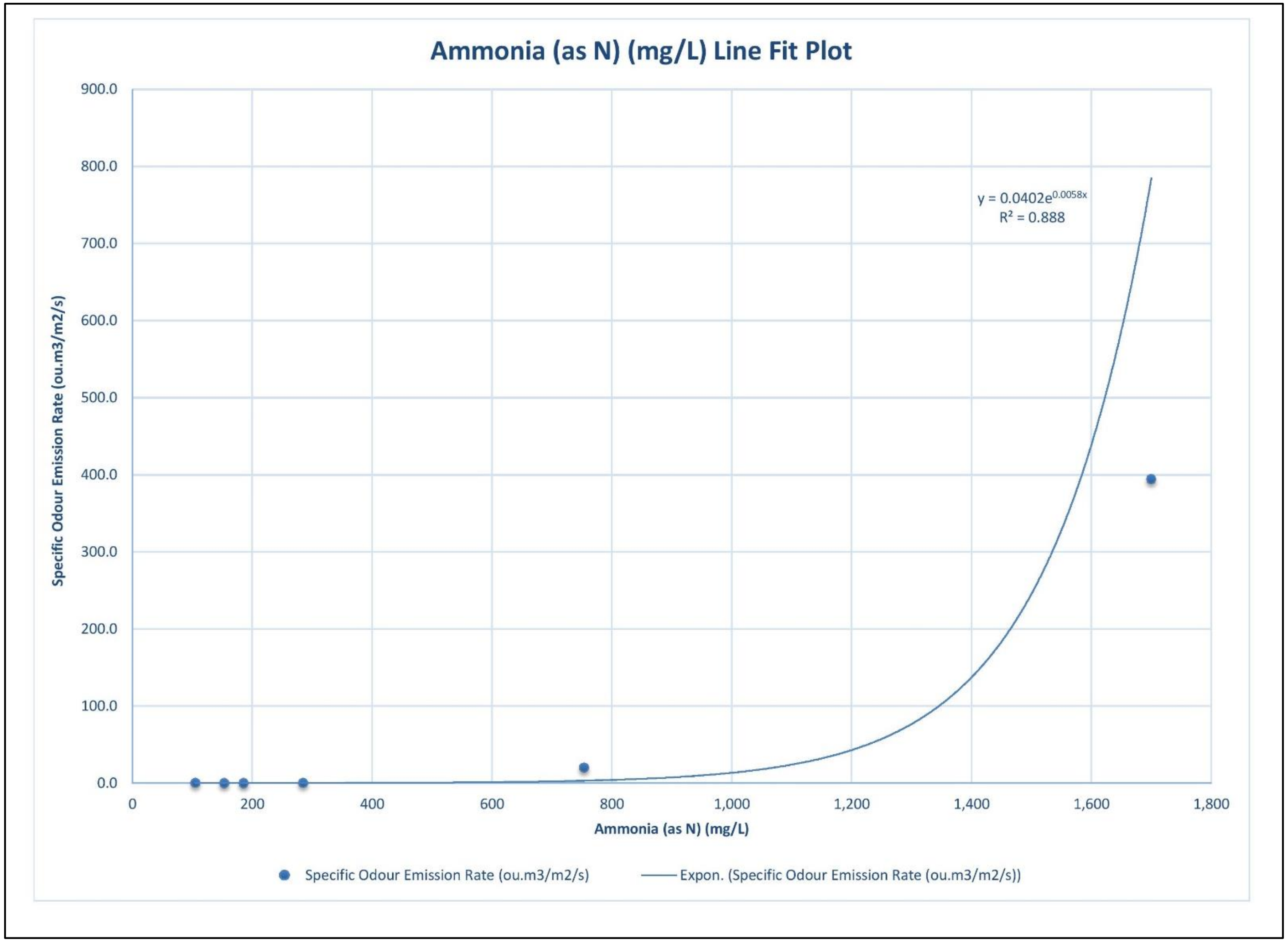


Figure 2.2 - SOER and Ammonia regression projection results

2.3.3 Projected SOERs values

Based on the regression analysis results presented in **Section 2.3.2**, the selected leachate quality parameters for further analysis (i.e. BOD and Ammonia) were entered into the regression function and resultant SOERs calculated. The results from this computation are summarised in **Table 2.4.**

Table 2.4 – Projected SOER results for ED1 under varying target values

Scenario No.	BOD (mg/L)	Ammonia (mg/L)	Scenario Description (Factor)	Mean SOER (ou.m^3/m^2/s)	Comments
1	10	10	Design	0.0488	Design target, as indicated
2	20	20	2 x	0.0504	Treated leachate 2 x above design target
3	50	50	5 x	0.0558	Treated leachate 5 x above design target
4	100	100	10 x	0.0668	Treated leachate 10 x above design target

When compared to the results from **Table 2.1** where a derived SOER for treated leachate of 0.159 ou.m^3/m^2/s is used, the values in **Table 2.4** suggest that the quality of treated leachate from the proposed MBR Treatment Plant will be superior and of a higher quality than that possible under the existing LMS. This is consistent with the stringent final effluent targets shown in **Table 2.2**. From an odour performance viewpoint, this is considered to be a good outcome for the long-term and sustainable management of leachate at the Site.

2.3.4 Regression Results Discussion

The regression results are based on observable and real leachate quality and odour emissions data. It is considered that the data used is a reasonable basis for the projected SOERs values generated in this study, for the following reasons:

- The odour emissions data used was collected from different leachate quality including untreated, partially leachate and fully treated leachate over four audits i.e. equivalent to four years' worth of data. This provided a span of different operationally scenarios from best case to worst case; and

- It was possible to obtain data from Veolia on leachate quality that was close to the time of the odour sampling. This meant the odour emissions could be closely related to leachate quality.

The correlation made in this study are considered to be unique to the Site. Therefore, any correlations presented in this study are not necessarily transposable to other facilities, particularly other waste management facilities.

3 ODOUR DISPERSION MODELLING METHODOLOGY

3.1 NSW ODOUR CRITERIA AND DISPERSION MODEL GUIDELINES

Regulatory authority guidelines for odorous impacts of gaseous process emissions are not designed to satisfy a 'zero odour impact criteria', but rather to minimise the nuisance effect to acceptable levels of these emissions to a large range of odour sensitive receptors within the local community.

The odour impact assessment for this project has been carried out in accordance with the methods outlined by the documents:

- Environment Protection Authority, 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*;
- Environment Protection Authority, 2006, *Technical Framework (and Notes): Assessment and Management of Odour from Stationary Sources in NSW;* and
- Barclay & Scire, 2011. *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'.*

The documents specify that the odour modelling for Level 3 impact assessments, upon which this study has been conducted, be based on the use of:

- The 99.0th percentile dispersion model predictions;
- 1-hour averaging times with built–in peak-to-mean ratios to adjust the averaging time to a 1-second nose-response-time;
- Odour emission rates multiplied by the peak-to-mean ratios as outlined in **Table 3.1**;
- The near field distance, defined typically as 10 times the largest source dimension, either height or width; and
- The appropriate odour unit performance criterion, based on the population of the affected community in the vicinity of the development.

Table 3.1 - EPA peak-to-mean factors			
Source type	**Pasquill-Gifford stability class**	**Near-field P/M60***	**Far-field P/M60***
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A-F	6	6
Surface wake-free point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A-F	2.3	2.3
Volume	A-F	2.3	2.3

* Ratio of peak 1-second average concentrations to mean 1-hour average concentrations
Source: Environment Protection Authority, 2005 – Table 6.1

The impact assessment criteria (IAC) for complex mixtures of odours are designed to include receptors with a range of sensitivities. Therefore a statistical approach is used to determine the acceptable ground level concentration of odour at the nearest sensitive receptor. This criterion is determined by the following equation (Environment Protection Authority, 2005, p. 37):

$$IAC = \frac{\log_{10}(p) - 4.5}{-0.6}$$

Equation 3.1

where,

IAC = Impact Assessment Criteria (ou)

***p* =** population

Based on **Equation 3.1**, **Table 3.2** outlines the odour performance criteria for six different affected population density categories. It states that higher odour concentrations are permitted in lower population density applications.

Table 3.2 - Odour Performance Criteria under Various Population Densities	
Population of affected community	**Odour performance criterion (ou)**
Urban Area (≥ ~2000)	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤ ~2)	7.0

Source: Environment Protection Authority, 2005 – Table 7.5

The original odour impact assessment (Heggies, 2010) had adopted the IAC of **6 ou** "*given the low number of sensitive receptor locations in the vicinity of the Woodlawn site*" (PAE Holmes, 2010). TOU has maintained consistency with this approach as conditions have not significantly changed.

3.2 ODOUR DISPERSION MODEL SELECTION

The odour dispersion modelling assessment was carried out using the CALPUFF System (Version 6.42). CALPUFF is a puff dispersion model that is able to simulate the effects of time- and three dimensional space-varying meteorological conditions on pollutant transport (Environment Protection Authority, 2005). CALMET is a meteorological model that produces three dimensional gridded wind and temperature fields to be fed into CALPUFF (Atmospheric Studies Group, 2011). The primary output from CALPUFF is hourly pollutant concentrations evaluated at gridded and/or discrete receptor locations. CALPOST processes the hourly pollutant concentration output to produce tables at each receptor and contour plots across the modelling domain. For further technical information about the CALPUFF modelling system refer to the document *CALPUFF Modeling System Version 6 User Instructions* (Atmospheric Studies Group, 2011).

The CALPUFF system can account for a variety of effects such as non-steady-state meteorological conditions, complex terrain, varying land uses, plume fumigation and low wind speed dispersion (Environment Protection Authority, 2005). CALPUFF is considered an appropriate dispersion model for impact assessment by EPA in their document - *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales* in one or more of the following applications:

- complex terrain, non-steady-state conditions,
- buoyant line plumes,
- coastal effects such as fumigation,

- high frequency of stable calm night-time conditions,
- high frequency of calm conditions, and
- inversion break-up fumigation conditions.

In the case of the this odour impact assessment, CALPUFF was required in order to handle the complexity of surrounding terrain features. Under calm and very light winds, non-steady-state conditions such as accumulation of odour and/or downslope movement with drainage air flow would almost certainly occur.

For this study, the air contaminant was odour and ground level concentrations in odour units (ou) have been projected.

3.3 GEOPHYSICAL AND METEOROLOGICAL CONFIGURATION

A CALMET hybrid three-dimensional meteorological data file for Tarago, NSW was produced that incorporated of gridded numerical meteorological data supplemented by surface observation data, topography and land use over the domain area.

3.3.1 Terrain configuration

Terrain elevations were sourced from 1 Second Shuttle Radar Topography Mission (SRTM) Derived Smoothed Digital Elevation Model (DEM-S). The SRTM data was treated with several processes including but not limited to removal of stripes, void filling, tree offset removal and adaptive smoothing (Gallant, et al., 2011). The DEM-S was used as input into TERREL processor to produce a 400 km^2 grid at 0.15 km resolution. A map of the terrain is illustrated in **Figure 3.1.**

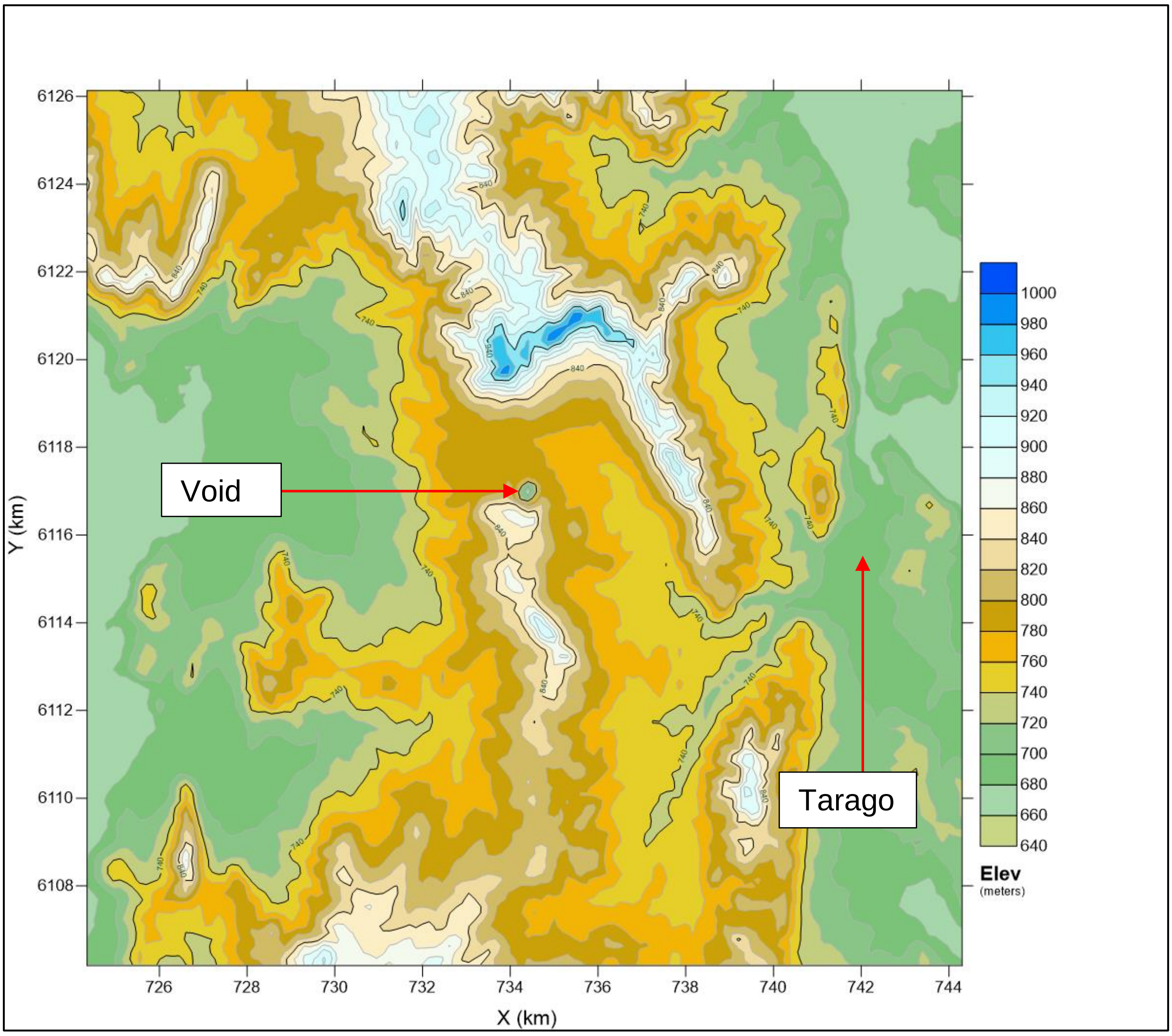


Figure 3.1 - Terrain map of Woodlawn and surrounds

3.3.2 Land use configuration

Land use was sourced from the United States Geological Survey (USGS) Global Land Cover Characteristics Data Base for the Australia-Pacific Region (USGS, 1997). The data was used as input into CTGPROC processor to produce a 400 km^2 grid at 0.15 km resolution. A map of the land use is illustrated in **Figure 3.2**.

3.3.3 Geophysical configuration

The geophysical data file was created using the MAKEGEO processor. Land use data from CTGPROC and terrain data from TERREL was used as input to produce a 400 km^2 geophysical grid at 0.15 km resolution.

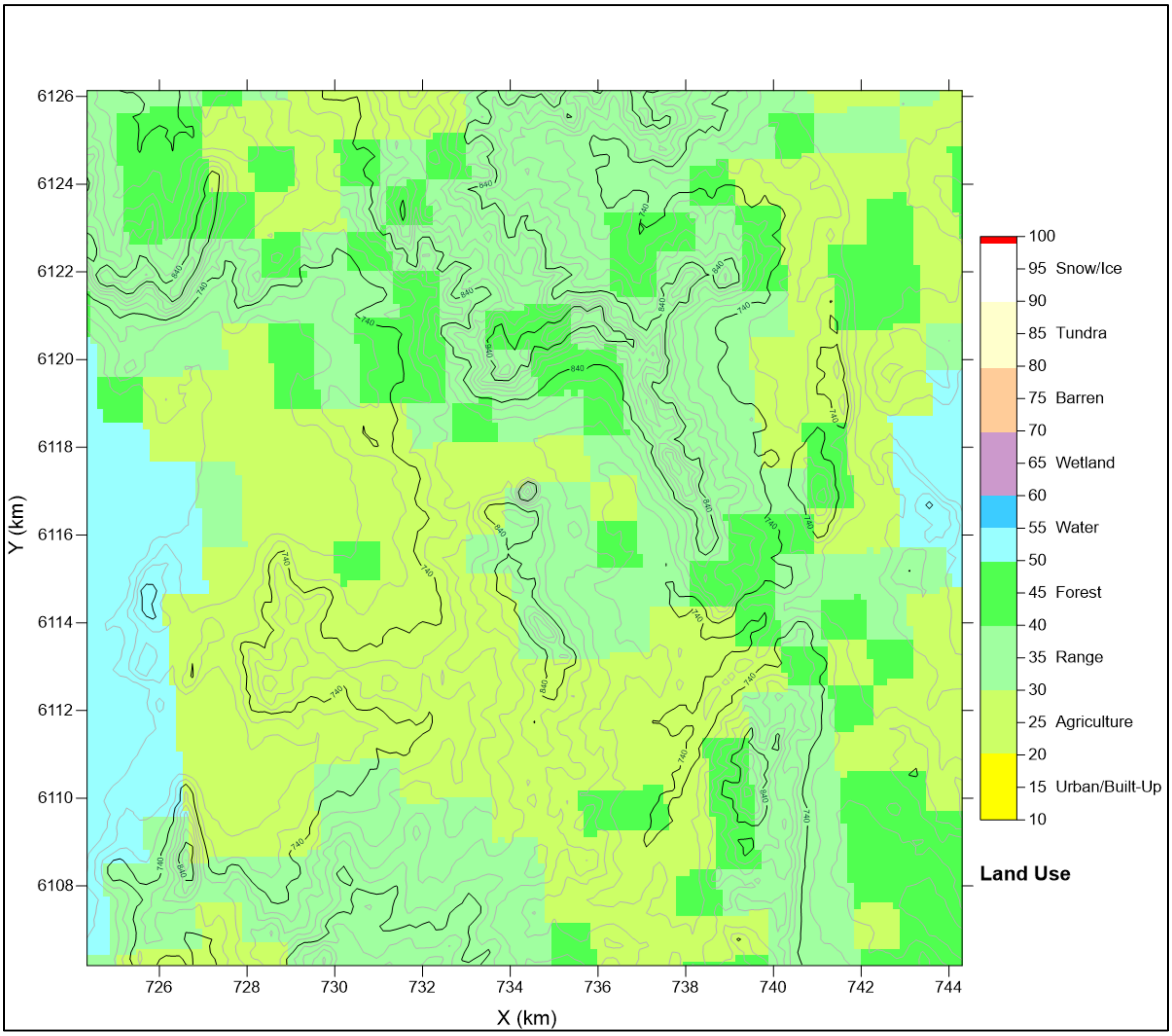


Figure 3.2 - Land use map of Woodlawn and surrounds

3.3.4 Meteorological configuration

3.3.4.1 Input data

One-hour average observed meteorological surface data for the latest representative year (2015) was sourced from Goulburn Airport maintained by Bureau of Meteorology (BOM). The location of Goulburn Airport surface station and other metadata are available in **Appendix B**. The BOM data was formatted into generic format and was processed with SMERGE to produce a surface meteorological data file.

Numerical meteorological data was produced as a 3D data tile from The Air Pollution Model (v4.0.5) and processed it with CALTAPM (v7.0.0) into a suitable format. TAPM was run using multiple nested grids, at least three nests and 35 vertical levels centred over the Woodlawn site. TAPM innermost nest was 33 km by 33 km at 1 km resolution. The nested grid resolutions were close to a ratio of three as possible.

3.3.4.2 CALMET meteorological model configuration

CALMET was run using the hybrid option that uses geophysical data, surface station data from Bundaberg Airport and upper air data from the TAPM 3D data tile. The data was used to initialise the diagnostic functions of the CALMET module to produce a full 3D meteorology data for input into CALPUFF. **Table 3.3** shows key variable fields selected.

3.3.4.3 Meteorological data analysis

Observed 2015 BOM surface data was compared with longer term climate (2011 – 2015) from Goulburn Airport to gauge how representative and suitable the year is for the purpose of air quality dispersion modelling. For reference, meteorological data was also extracted from the CALMET model for the location directly nearby the Woodlawn site office. The annual windroses for Goulburn Airport show very good agreement with west to northwest winds dominating (**Figure 3.3**). The Woodlawn windroses (**Figure 3.4**) show bias to lighter winds and greater frequency of east to south-easterly winds, perhaps due influences from the nearby valley and ridgelines. A more conservative bias is expected relative to the observations at Goulburn Airport.

Both monthly average (**Figure 3.5**) and diurnal temperature (**Figure 3.6**) profiles for the long term and 2015 are in very good agreement. Diurnal mixing heights and stability class frequencies over the Woodlawn site are shown in **Figure 3.7** and **Figure 3.8** respectively.

Table 3.3 - CALMET key variable fields												
Grid Configuration (WGS-84 UTM Zone 55S)												
134						**NX Cells**						
134						**NY Cells**						
0.15						**Cell Size (km)**						
724.277		6106.107				**SW Corner (km)**						
11						**Vertical Layers**						
ZFACE (m)	0	20	40	80	160	320	640	1000	1500	2000	2500	3000
LAYER	1	2	3	4	5	6	7	8	9	10	11	
MID-PT (m)	10	30	60	120	240	480	820	1250	1750	2250	2750	
Critical Wind Field Settings												
Value			**Found**		**Typical**		**Values**					
TERRAD			4		None		Terrain scale (km) for terrain effects					
IEXTRP			-4		4,-4		Similarity extrap. of wind (-4 ignore upper stn sfc)					
ICALM			0		0		Do Not extrapolate calm winds					
RMAX1			6		None		MAX radius of influence over land in layer 1 (km)					
RMAX2			8		None		MAX radius of influence over land aloft (km)					
R1			3		None		Distance (km) where OBS wt = IGF wt in layer 1					
R2			4		None		Distance (km) where OBS wt = IGF wt aloft					

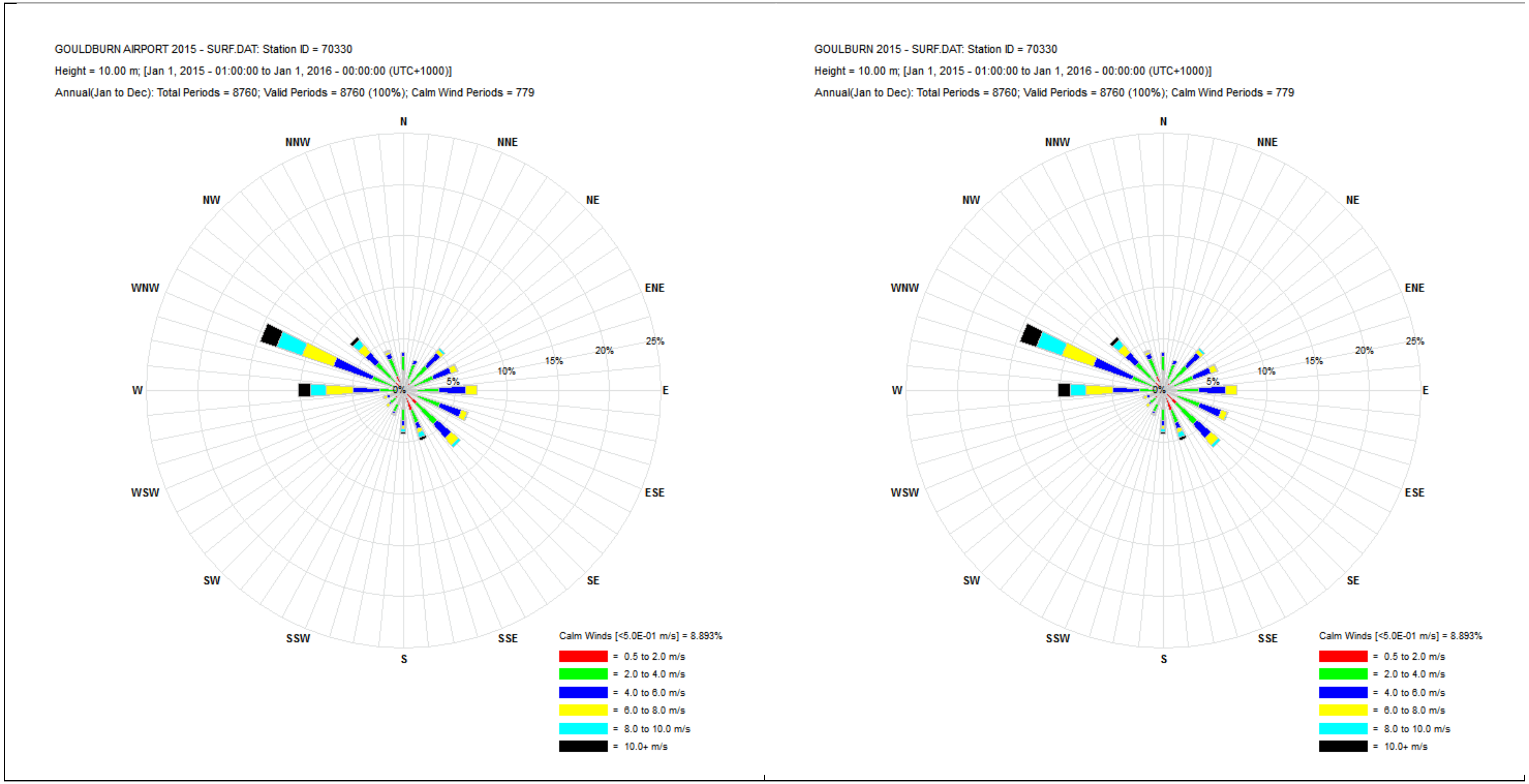


Figure 3.3 - Annual windroses for Goulburn Airport 5 years and 2015 only

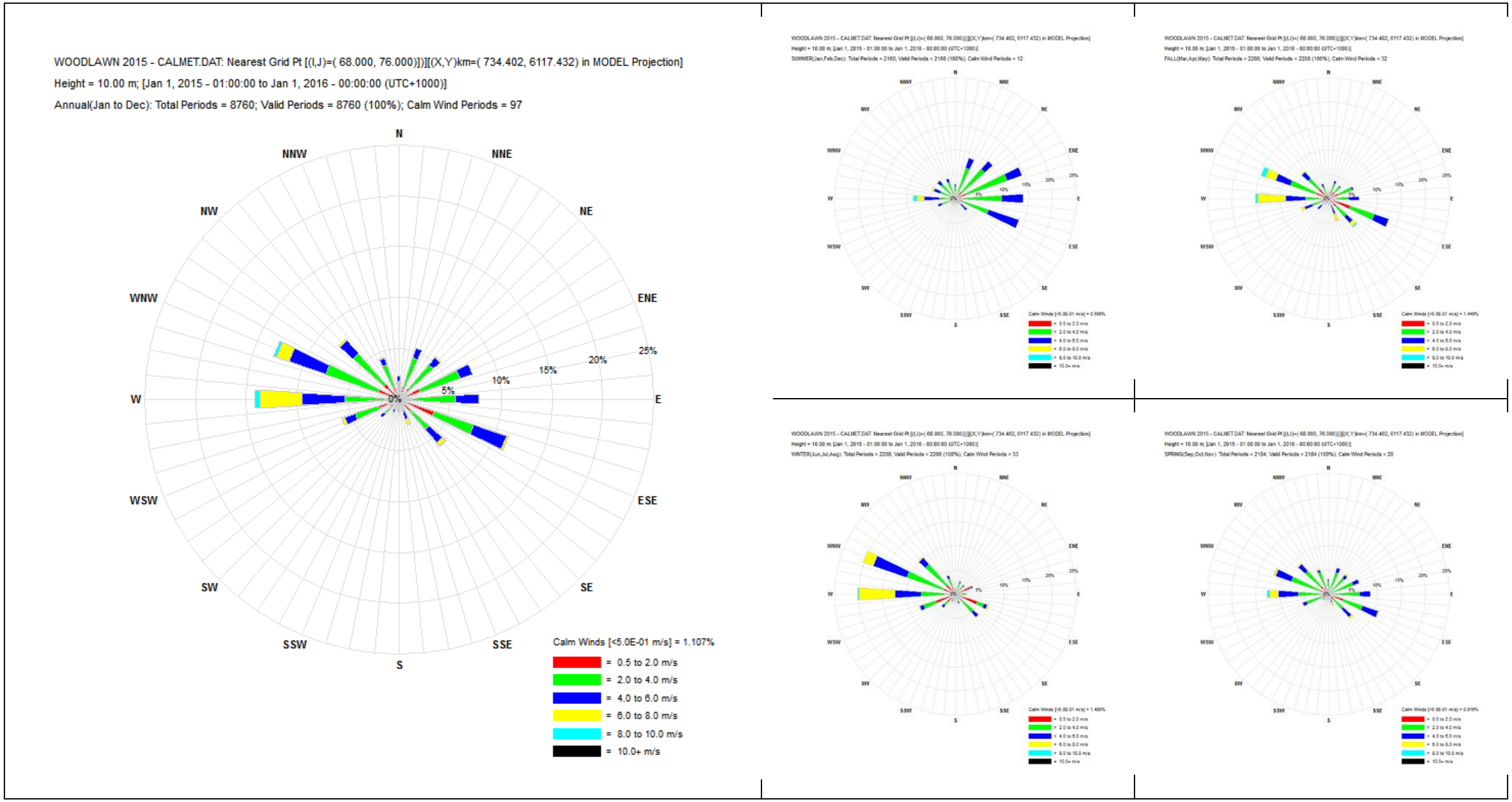


Figure 3.4 - Annual and seasonal windroses for Woodlawn 2015 (modelled)

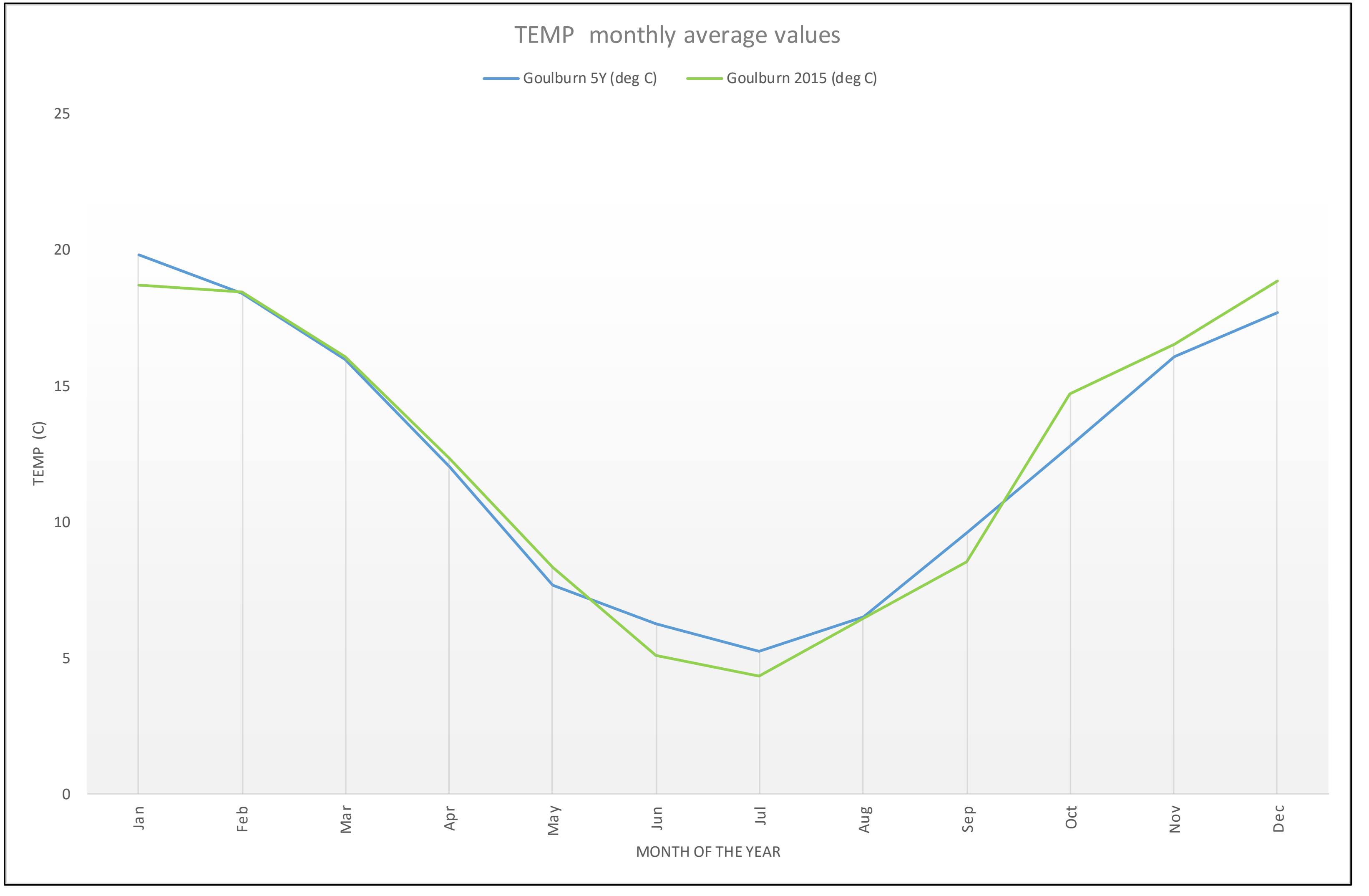


Figure 3.5 - Monthly average temperatures for Goulburn Airport 5 years and 2015 only

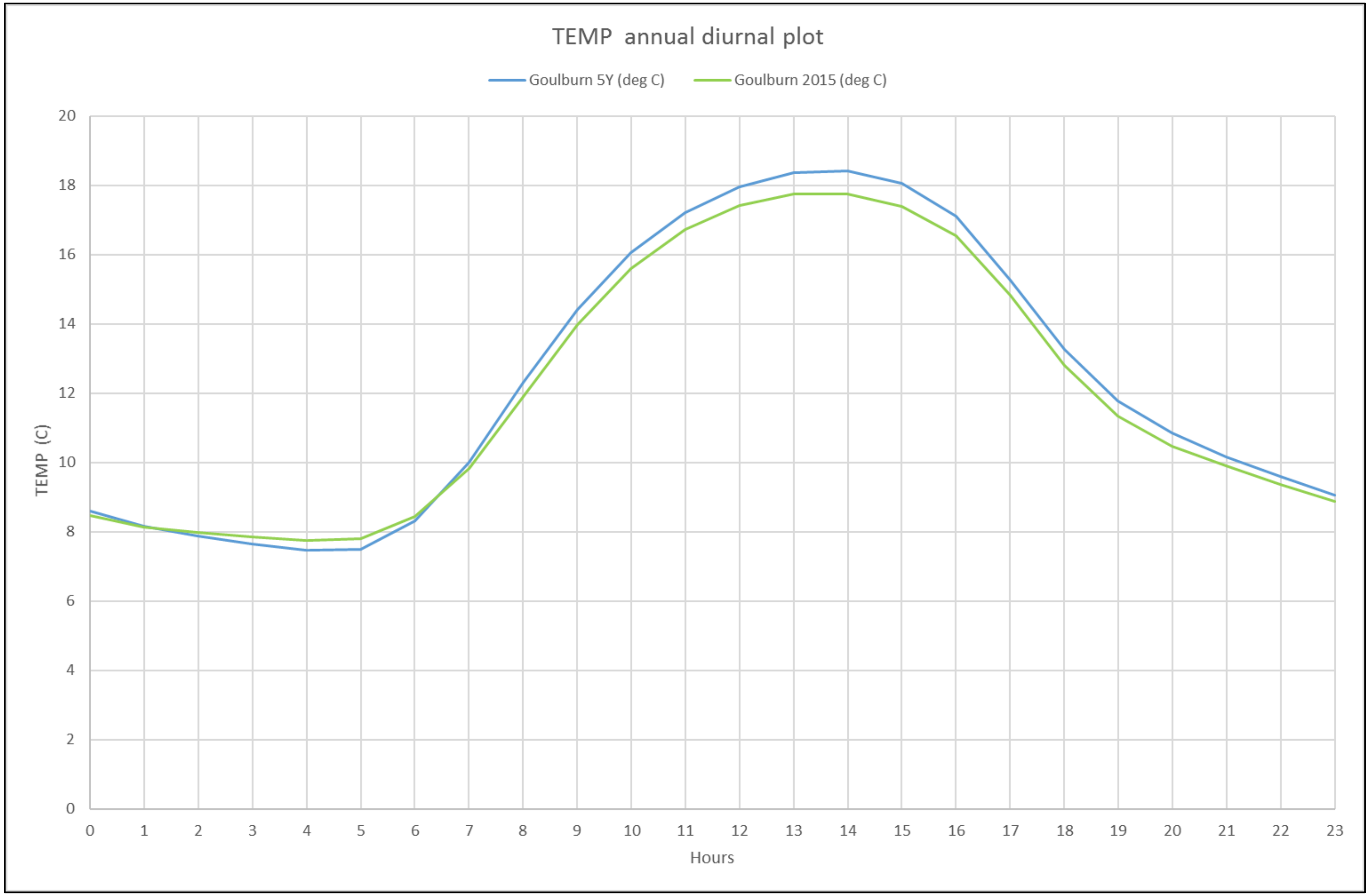


Figure 3.6 - Annual diurnal temperature for Goulburn Airport 5 years and 2015 only

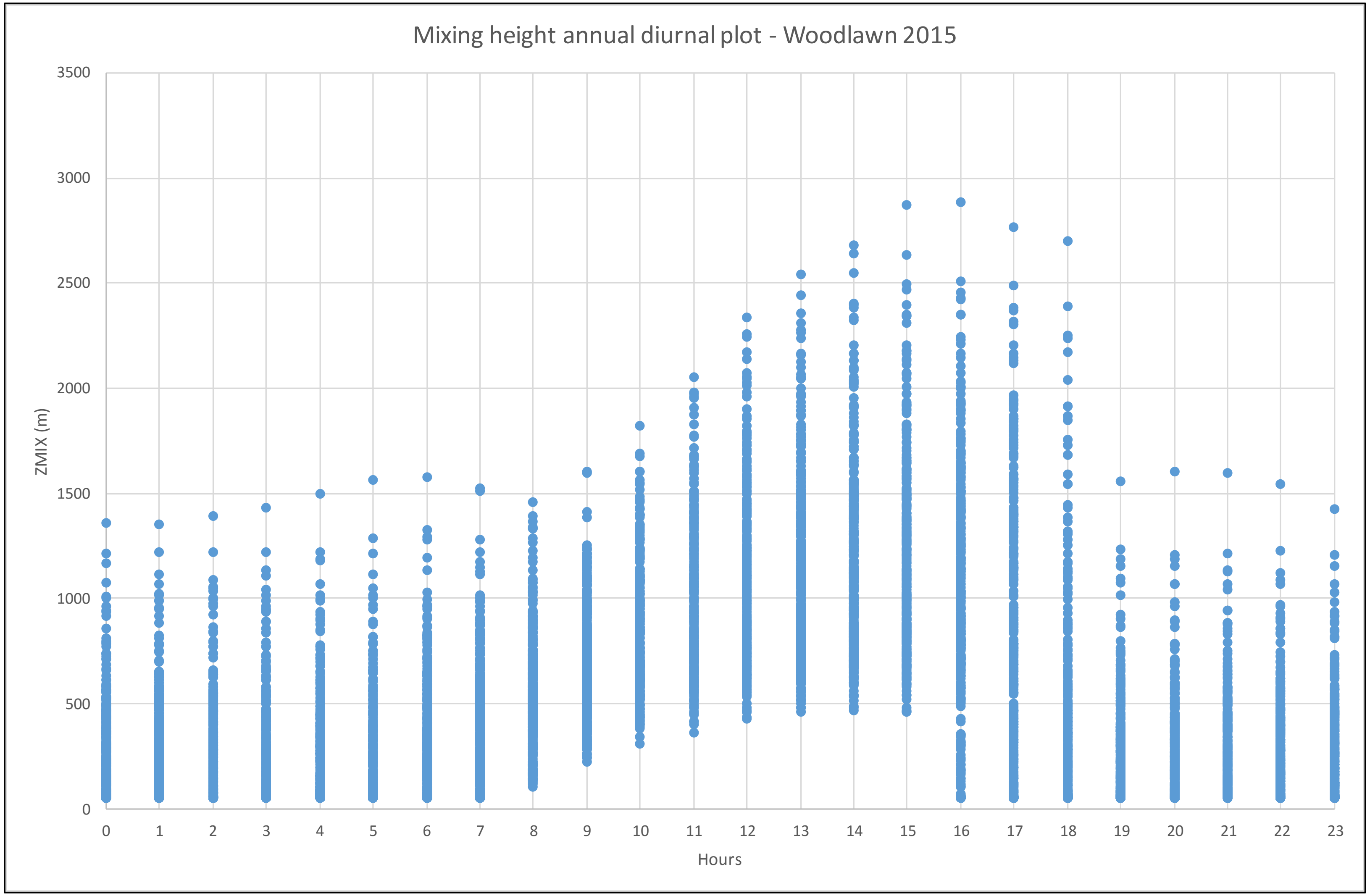


Figure 3.7 - Annual X-Y scatter plot diurnal mixing height for Woodlawn 2015 (modelled)

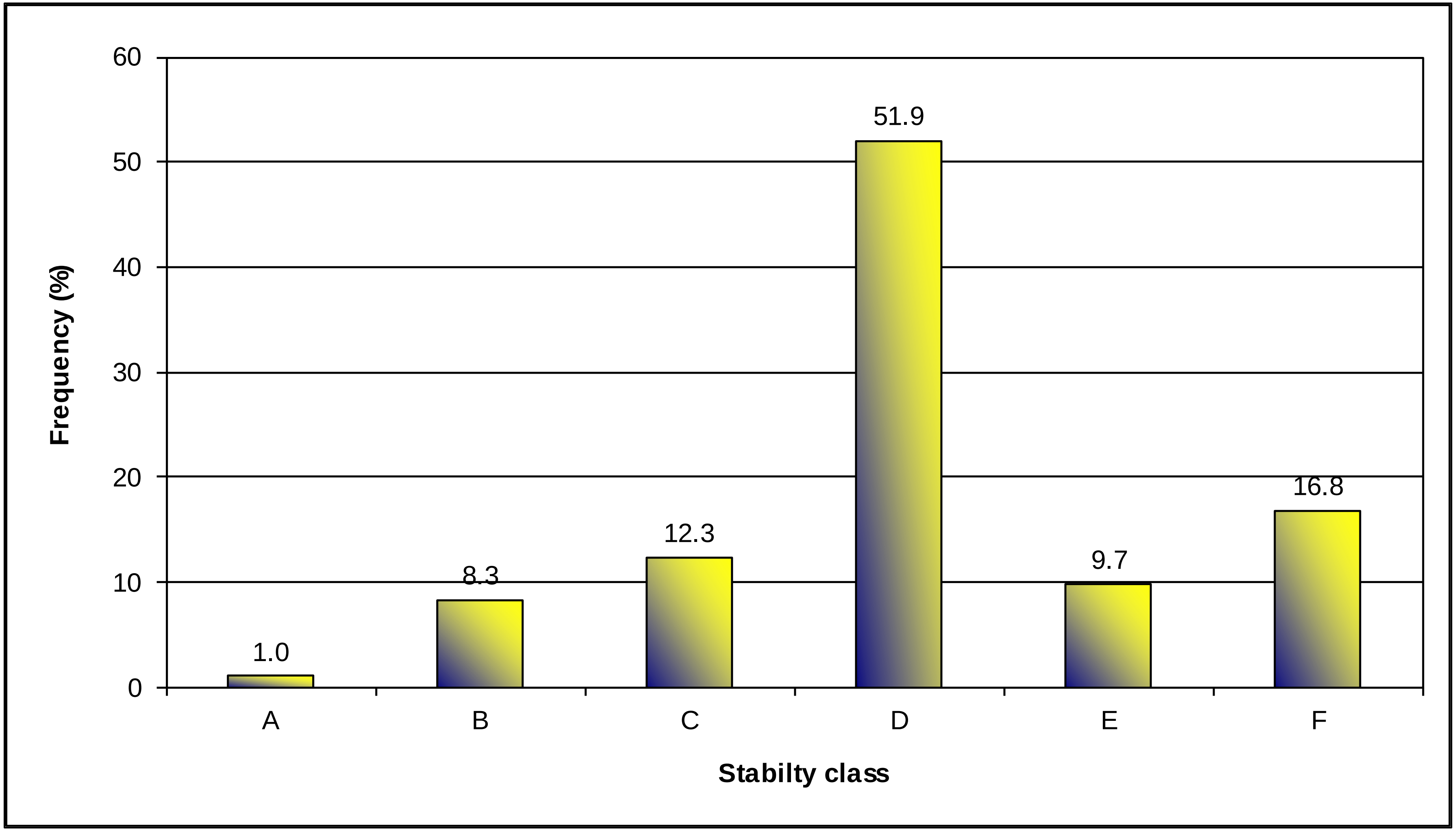


Figure 3.8 - Annual stability class frequency for Woodlawn 2015 (modelled)

3.4 CALPUFF DISPERSION MODEL CONFIGURATION

3.4.1 Computational domain

The computational domain was set to the same parameters as the meteorological domain.

3.4.2 Receptor configuration

Three groups of arbitrary discrete receptors were configured over the modelling domain. Four sensitive discrete receptors were placed at ground level at the same locations identified by the previous EA modelling (Heggies, 2010). A receptor grid was created with a fine resolution inner nest of 9.6 km by 9.6 km by 0.15 km spacing; and an outer nest of 19.35 km by 19.35 km by 0.45 km spacing.

3.4.3 Source Configuration and Emission Rates

See **Appendix C** for full odour source and emission rate configurations. The CALPUFF model text output files can be produced upon request.

3.4.4 CALPUFF Model Options

CALPUFF default model options were set except for the following as recommended in *Table A*-4 contained and explained within *Barclay and Scire (2011)*:

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

3.5 MODELLING SENSITIVITY TEST SCENARIOS

The following sensitivity test scenarios were simulated with CALPUFF:

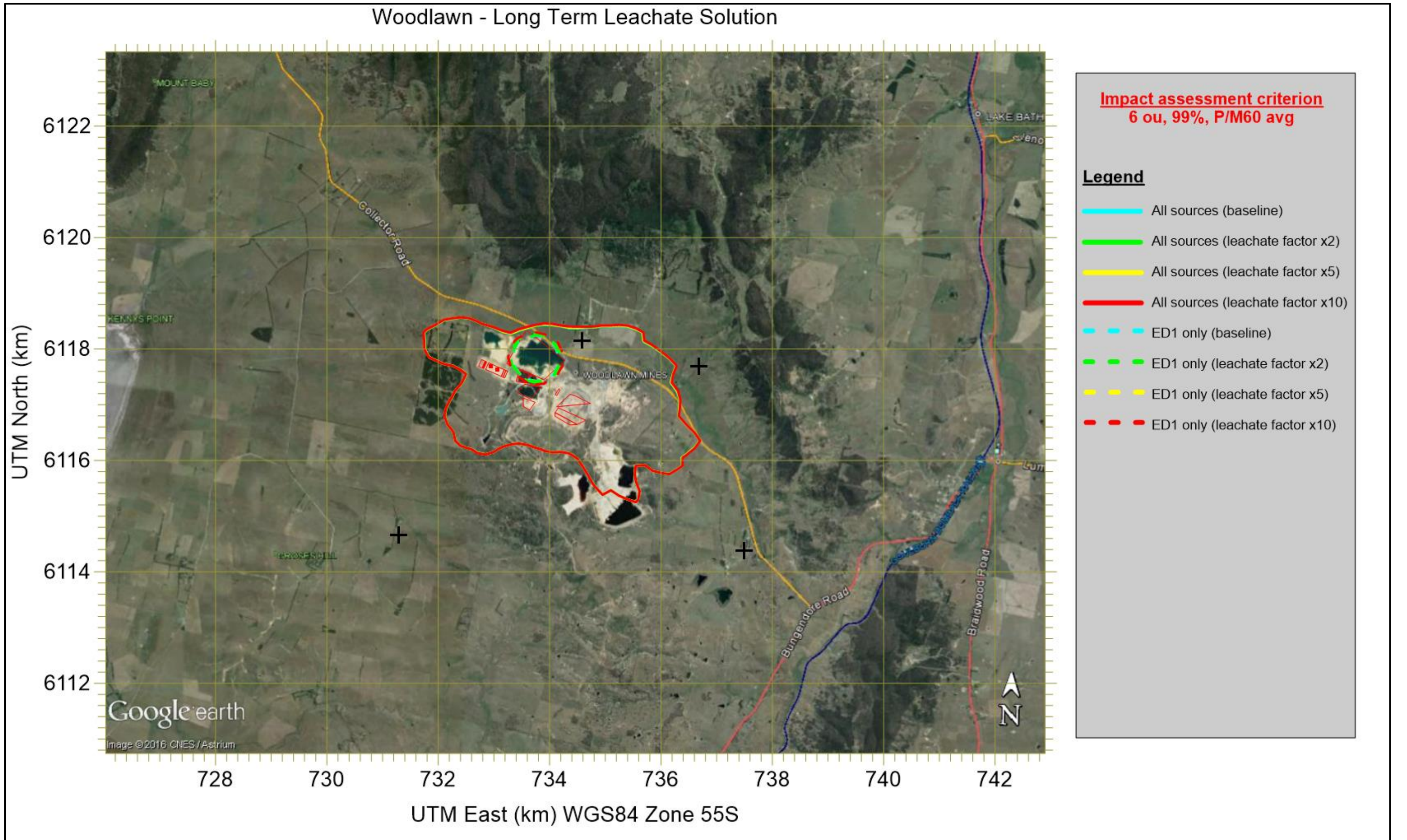
- **Scenario #1:** design target values;
- **Scenario #2:** if leachate quality is exceeded by a factor of 2 times from the design target value;
- **Scenario #3:** if leachate quality is exceeded by a factor of 5 times from the design target value; and
- **Scenario #4:** if leachate quality is exceeded by a factor of 10 times from the design target value.

A total surface area of 47.6 hectares (ha) was used for the ED1 system in the modelling. This represents the top water level (TWL) of ED1, when the maximum exposed surface area will occur. This is considered to represent a conservative approach and necessary as to assess the long term feasibility of treated leachate stored in the ED1 System from an odour performance viewpoint.

4 ODOUR DISPERSION MODELLING RESULTS

The odour dispersion modelling results are visually shown in **Figure 4.1**. These plots illustrate the isopleth of the projected ground level odour concentration against the 6 ou odour performance criterion concentration based on 1-hour averaging at the 99.0th percentile frequency at the nearest sensitive receptor.

The sensitivity analysis conducted for the long-term treated leachate solution under each modelled scenario show a negligible change in the extent of odour impact, even if the leachate quality target is exceeded by an order of magnitude. The results are considered conservative and were modelled on the basis of TWL i.e. when ED3S and ED1 Systems are full and are at their maximum exposed surface area.



	CALPUFF modelling for Veolia **Odour Impact Assessment, Woodlawn** **Modelled by: S. Hayes 20/07/16** **Checked by:** **The Odour Unit Group**	**Projection of odour impact from Woodlawn operations.** **Long Term Leachate Solution. Updated meteorology (2015).** **Contours depict 6 ou ground level odour concentrations (ou),** **99.0th percentile frequency, P/M60 average.**

Figure 4.1 – Long-term treated leachate solution (Scenarios #1 to #4)

5 MODELLING STUDY FINDINGS & CONCLUSION

The aim of the odour dispersion modelling study was to evaluate the odour profile contribution and assess compliance against the NSW EPA odour performance criteria of the addition of the proposed ED1 System to the LMS at the Site. This also includes the proposed ED3S System, as discussed in **Section 2.1**. The modelling was conducted with the 6 ou odour performance criterion ground level concentration based on 1-hour averaging at the 99.0th percentile frequency at the nearest sensitive receptor. The modelling projection results demonstrate compliance with this criterion at the nearest sensitive receptor and minimal sensitivity to possible fluctuations in leachate quality of 2, 5 and 10 times above the target design value at TWL. On this basis, it can be safely concluded that the proposed MBR Treatment Plant and subsequent storage of the treated leachate flow in ED1 system will not result in any significant increase to off-site odour impacts, have negligible change on the existing surrounding off-site amenity, and is in compliance with the relevant NSW EPA odour performance criterion. This is attributable to the high leachate treatment quality criteria proposed (see **Table 2.2**).

Overall, the modelling study finds that the proposed MBR Treatment Plant and subsequent storage of the final treated effluent will not result in any adverse levels of odour impact, and represents a sustainable, long term solution for the management and storage of leachate at the Site.

6 BIBLIOGRAPHY

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REPORT SIGNATURE PAGE

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Veolia Australia & New Zealand

Woodlawn Bioreactor Facility Odour Modelling Study

Long-term Treated Leachate Solution

July 2016

Appendices

Veolia Australia & New Zealand

APPENDIX A:

LEACHATE AND ODOUR QUALITY CORRELATION ANALYSIS WORKSHEET

Long-term Treated Leachate Solution

July 2016

THE ODOUR UNIT

Job No. N1806L.06
Document Title Appendix A - Veolia Woodlawn Odour Treatment Long Term Solution: Leachate and odour quality correlation analysis worksheet

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	H_2S (ppm)	pH	BOD (mg/L)	Sulphide (mg/L)	Ammonia (as N) (mg/L)	VFA (mg/L)	Odour character
Untreated	394.2	180	7.8	7,200	0.4	1,700	6,100	rotten egg
Partially Treated	20.1	8.0	8.0	3,600	0.3	754	3,690	rotten egg, onion, cabbage
LAD -1	0.323	0.000	8.9	1,700	0.1	285	285	sweet, garbage, ammonia
LAD -2	0.0259	0.000	8.6	154	0.02	186	980	stale water
Treated & Stored - 1	0.187	0.000	8.7	81	0.5	105	338	stagnant water, dirty water, fatty, greast, sweet onion, grain wheat
Treated & Stored - 2	0.0364	0.003	8.3	73	0.3	153	646	musty, soil, rubber, stale water, burnt, nutty, sewage, cooking oil, fat, rubbery, dusty, stale air

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	H_2S (ppm)
Untreated	394.2	180
Partially Treated	20.1	8.0
LAD -1	0.323	0.000
LAD -2	0.0259	0.000
Treated & Stored - 1	0.187	0.000
Treated & Stored - 2	0.0364	0.003

Covariance statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	H2S (ppm)
Specific Odour Emission Rate (ou.m3/m2/s)	21187.47519	
H2S (ppm)	9686.93475	4429.056443

Correlation Statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	H2S (ppm)
Specific Odour Emission Rate (ou.m3/m2/s)	1	
H2S (ppm)	0.999979653	1

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	pH
Untreated	394.2	7.8
Partially Treated	20.1	8.0
LAD -1	0.323	8.9
LAD -2	0.0259	8.6
Treated & Stored - 1	0.187	8.7
Treated & Stored - 2	0.0364	8.3

Covariance statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	pH
Specific Odour Emission Rate (ou.m3/m2/s)	21187.47519	
pH	-38.79843801	0.150242284

Correlation Statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	pH
Specific Odour Emission Rate (ou.m3/m2/s)	1	
pH	-0.687667579	1

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	BOD (mg/L)
Untreated	394.2	7,200
Partially Treated	20.1	3,600
LAD -1	0.323	1,700
LAD -2	0.0259	154
Treated & Stored - 1	0.187	81
Treated & Stored - 2	0.0364	73

Covariance statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	BOD (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	21187.47519	
BOD (mg/L)	337620.1624	6731165.225

Correlation Statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	BOD (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	1	
BOD (mg/L)	0.894012612	1

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	Sulphide (mg/L)
Untreated	394.2	0.4
Partially Treated	20.1	0.3
LAD -1	0.323	0.1
LAD -2	0.0259	0.02
Treated & Stored - 1	0.187	0.5
Treated & Stored - 2	0.0364	0.3

Covariance statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	Sulphide (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	21187.47519	
Sulphide (mg/L)	8.582545027	0.028070139

Correlation Statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	Sulphide (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	1	
Sulphide (mg/L)	0.351928312	1

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	Ammonia (as N) (mg/L)
Untreated	394.2	1,700
Partially Treated	20.1	754
LAD -1	0.323	285
LAD -2	0.0259	186
Treated & Stored - 1	0.187	105
Treated & Stored - 2	0.0364	153

Covariance statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	Ammonia (as N) (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	21187.47519	
Ammonia (as N) (mg/L)	77561.36675	319982.4849

Correlation Statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	Ammonia (as N) (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	1	
Ammonia (as N) (mg/L)	0.941982309	1

Sample Location	Specific Odour Emission Rate (ou.m^3/m^2/s)	VFA (mg/L)
Untreated	394.2	6,100
Partially Treated	20.1	3,690
LAD -1	0.323	285
LAD -2	0.0259	980
Treated & Stored - 1	0.187	338
Treated & Stored - 2	0.0364	646

Covariance statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	VFA (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	21187.47519	
VFA (mg/L)	274444.7055	4707211.875

Correlation Statistics

	Specific Odour Emission Rate (ou.m3/m2/s)	VFA (mg/L)
Specific Odour Emission Rate (ou.m3/m2/s)	1	
VFA (mg/L)	0.869027221	1

Veolia Australia & New Zealand

APPENDIX B:

BUREAU OF METEOROLOGY BASIC CLIMATOLOGICAL STATION METADATA – GOULBURN AIRPORT (COMPLIED 26 NOVEMBER 2015)

Long-term Treated Leachate Solution

July 2016

Basic Climatological Station Metadata

Current status

Metadata compiled: 26 NOV 2015

Station: GOULBURN AIRPORT AWS

Bureau of Meteorology station number: 070330
Bureau of Meteorology district name: Sthn Tablelands Gburn-Monaro
State: NSW

World Meteorological Organization number: 95716
Identification: YGLB

Network Classification: National Benchmark Network for Agrometeorology
Station purpose: Synoptic, Aeronautical
Automatic Weather Station: Almos

Current Station Location				
Latitude	**Decimal**	-34.8085	**Hour Min Sec**	34°48'31"S
Longitude	**Decimal**	149.7312	**Hour Min Sec**	149°43'52"E
Station Height	640 m	**Barometer Height**	640.8 m	
Method of station geographic positioning			GPS	

Year opened: 1988
Status: Open

Station summary

No summary for this site has been written as yet.

Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Australian Government
Bureau of Meteorology

Basic Climatological Station Metadata

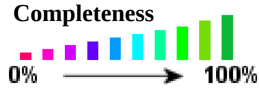
Current status

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS	**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:** Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:** 26 NOV 2015

Observation summary

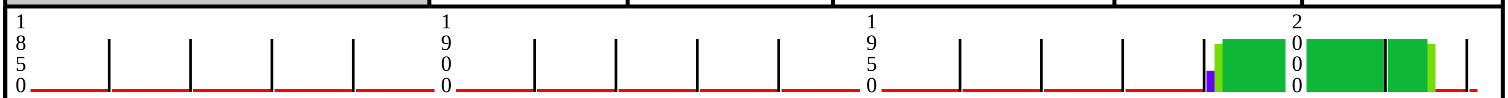
The table below indicates the approximate completeness of the record for individual element types within the Australian Data Archive for Meteorology. For elements not listed see the note below.

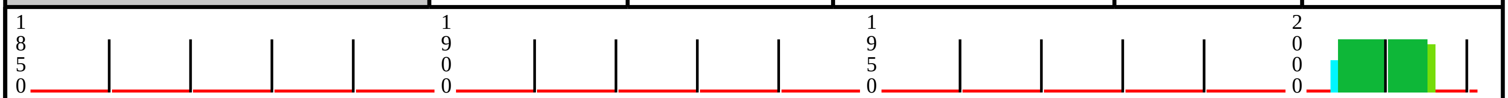
Completeness

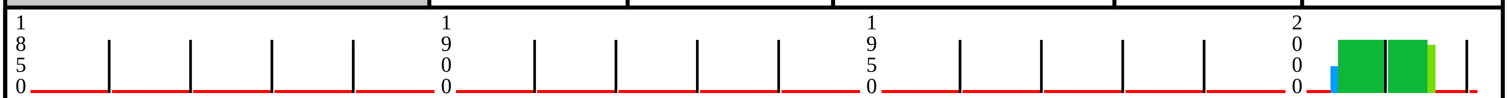


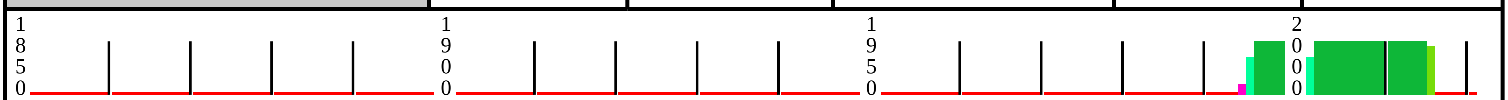
DAILY DATA HOLDINGS

OBSERVATION TYPE	FIRST MONTH	LAST MONTH	COMPLETENESS (% estimate)	SINGLE DAYS MISSED	FULL MONTHS MISSED
MAXIMUM AIR TEMPERATURE	JUL 1990	OCT 2015	95.9	372	0
MAXIMUM WIND GUST SPEED	JUN 2003	OCT 2015	98.8	53	0
WIND RUN ABOVE 10 FEET	JUN 2003	OCT 2015	98.7	57	0
RAINFALL	JUN 1994	NOV 2015	94	N/A	N/A



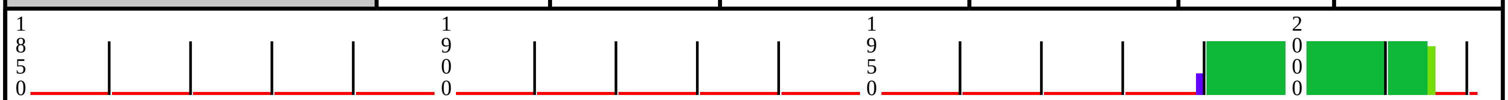


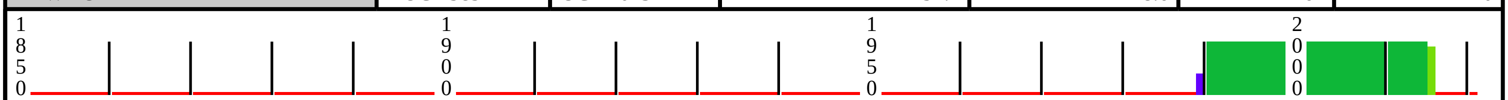


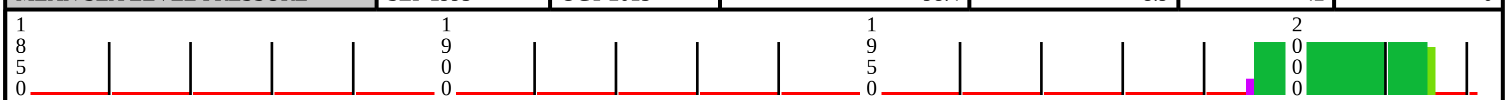


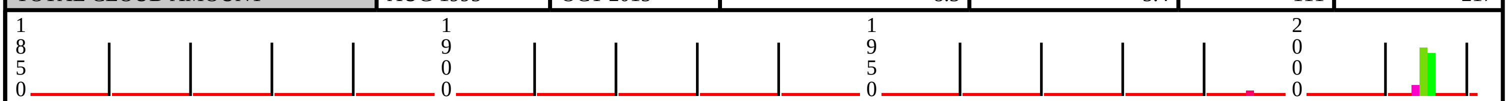
HOURLY DATA HOLDINGS - from 1 to 24 observations per day

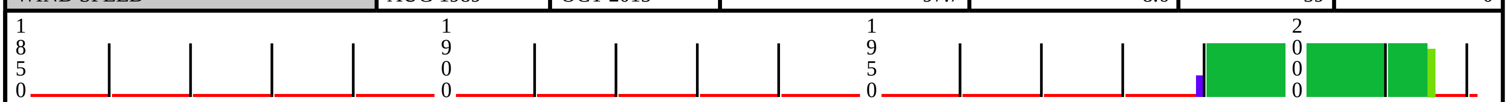
OBSERVATION TYPE	FIRST MONTH	LAST MONTH	COMPLETENESS (% estimate)	FREQUENCY average daily	SINGLE DAYS MISSED	FULL MONTHS MISSED
AIR TEMPERATURE	AUG 1989	OCT 2015	97.7	8.6	61	0
DEW POINT	AUG 1989	OCT 2015	97.4	8.6	64	0
MEAN SEA LEVEL PRESSURE	SEP 1995	OCT 2015	98.4	8.9	42	0
TOTAL CLOUD AMOUNT	AUG 1995	OCT 2015	8.3	5.4	111	217
WIND SPEED	AUG 1989	OCT 2015	97.7	8.6	59	0











Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Prepared by the Bureau of Meteorology.
Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by email on climatedata@bom.gov.au

Basic Climatological Station Metadata
Current status

Station:	GOULBURN AIRPORT AWS			Location:	GOULBURN AIRPORT AWS			State:	NSW
Bureau No.:	070330	WMO No.:	95716	Aviation ID:	YGLB	Opened:	07 Nov 1988	Current Status:	Still open
Latitude:	-34.8085	Longitude:	149.7312	Elevation:	640 m	Barometer Elev:	640.8 m	Metadata compiled:	26 NOV 2015

THERE ARE NO RAINFALL INTENSITY DATA HOLDINGS

ONE-MINUTE DATA HOLDINGS

OBSERVATION TYPE	FIRST MONTH	LAST MONTH	COMPLETENESS (% estimate)	FREQUENCY average daily	SINGLE DAYS MISSED	FULL MONTHS MISSED
ALL ELEMENTS	SEP 2010	NOV 2015	99.1	1427.4	N/A	0

HALF-HOURLY DATA HOLDINGS

OBSERVATION TYPE	FIRST MONTH	LAST MONTH	COMPLETENESS (% estimate)	FREQUENCY average daily	SINGLE DAYS MISSED	FULL MONTHS MISSED
ALL ELEMENTS	JAN 1989	NOV 2015	72.1	34.6	N/A	2

THERE ARE NO UPPER-AIR EDT DATA HOLDINGS

Holdings calculated up to 01 Nov 2015

The % complete figure is the completeness of observations averaged over all months of record, for the given station and observation type, taking gaps into account. For hourly holdings, the completeness is relative to the maximum number of daily observations for the site each month, and is therefore an estimate. For daily holdings, the completeness figure shown is exact.

The single days missed figure is the total number of days for which no observation was received, not including full missed months. The full months missed figure is the total of full month gaps over the period of record. Where an element is not included assumptions can generally be made about availability, and the list to use has been suggested below.

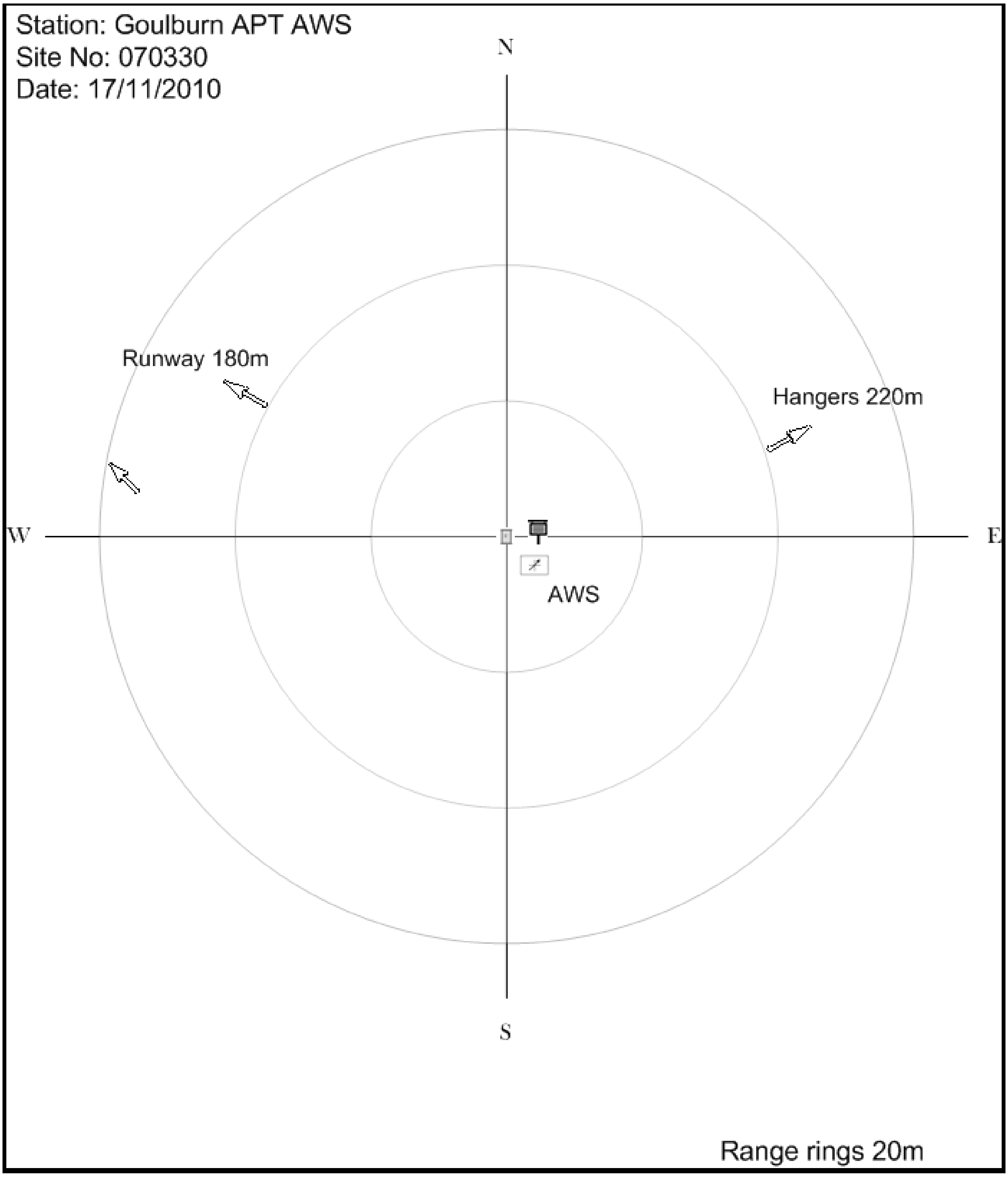
Unlisted element	Listed element to use
Minimum air temperature	Maximum air temperature
Wet bulb temperature	Dew point
Soil temperature at 20, 50 & 100cm	10cm soil temperature
Relative humidity	Dew point
Minimum temp. of water in evaporimeter	Evaporimeter - max water temp
Visual observations eg. weather, visibility	Total cloud amount
Sea related observations	Sea state

Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS			**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:**	07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:**	640.8 m	**Metadata compiled:**	26 NOV 2015

Instrument Location and Surrounding Features
17/11/2010(most recent)

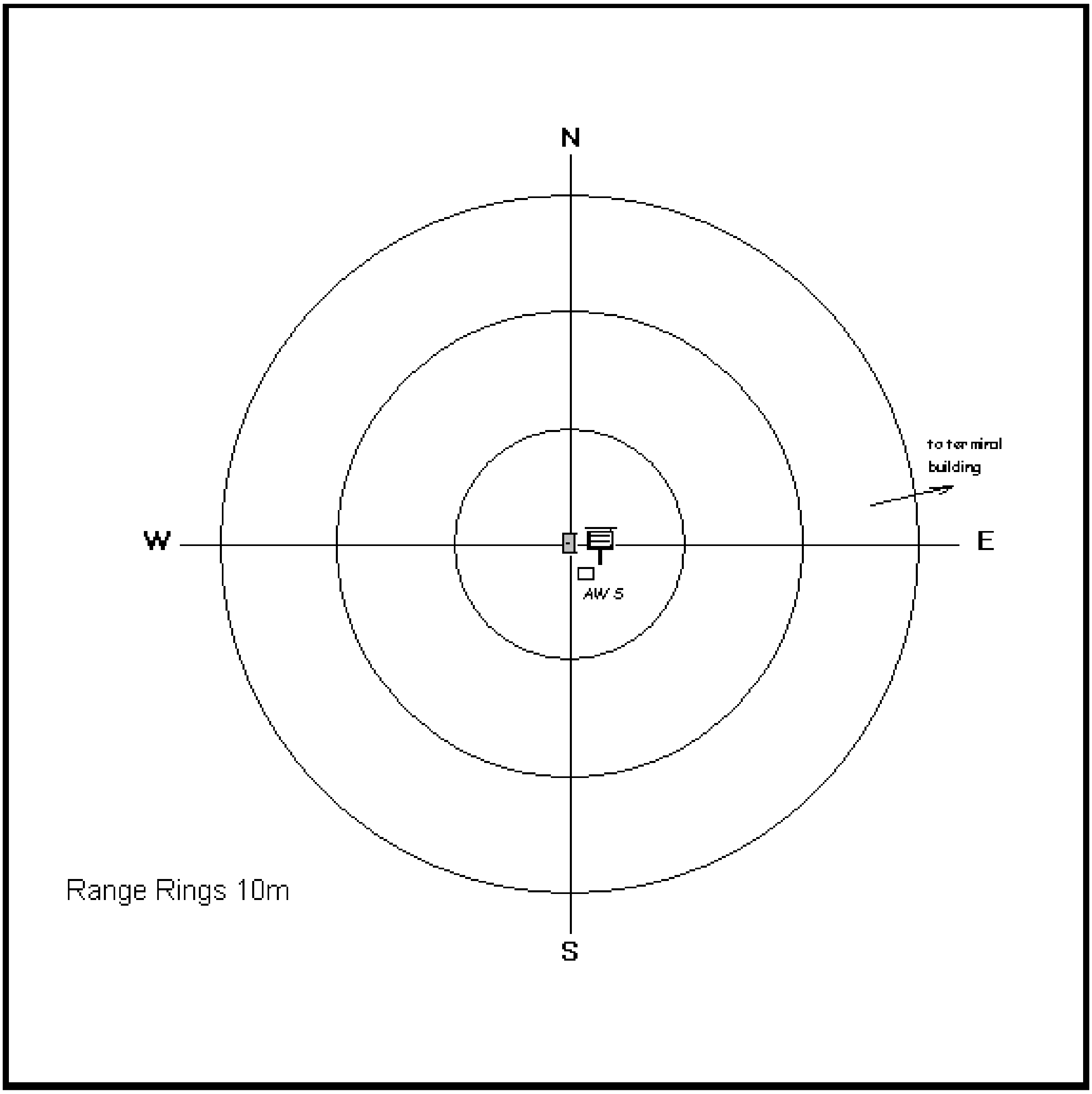


Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS			**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:**	07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:**	640.8 m	**Metadata compiled:**	26 NOV 2015

Instrument Location and Surrounding Features
26/03/2007

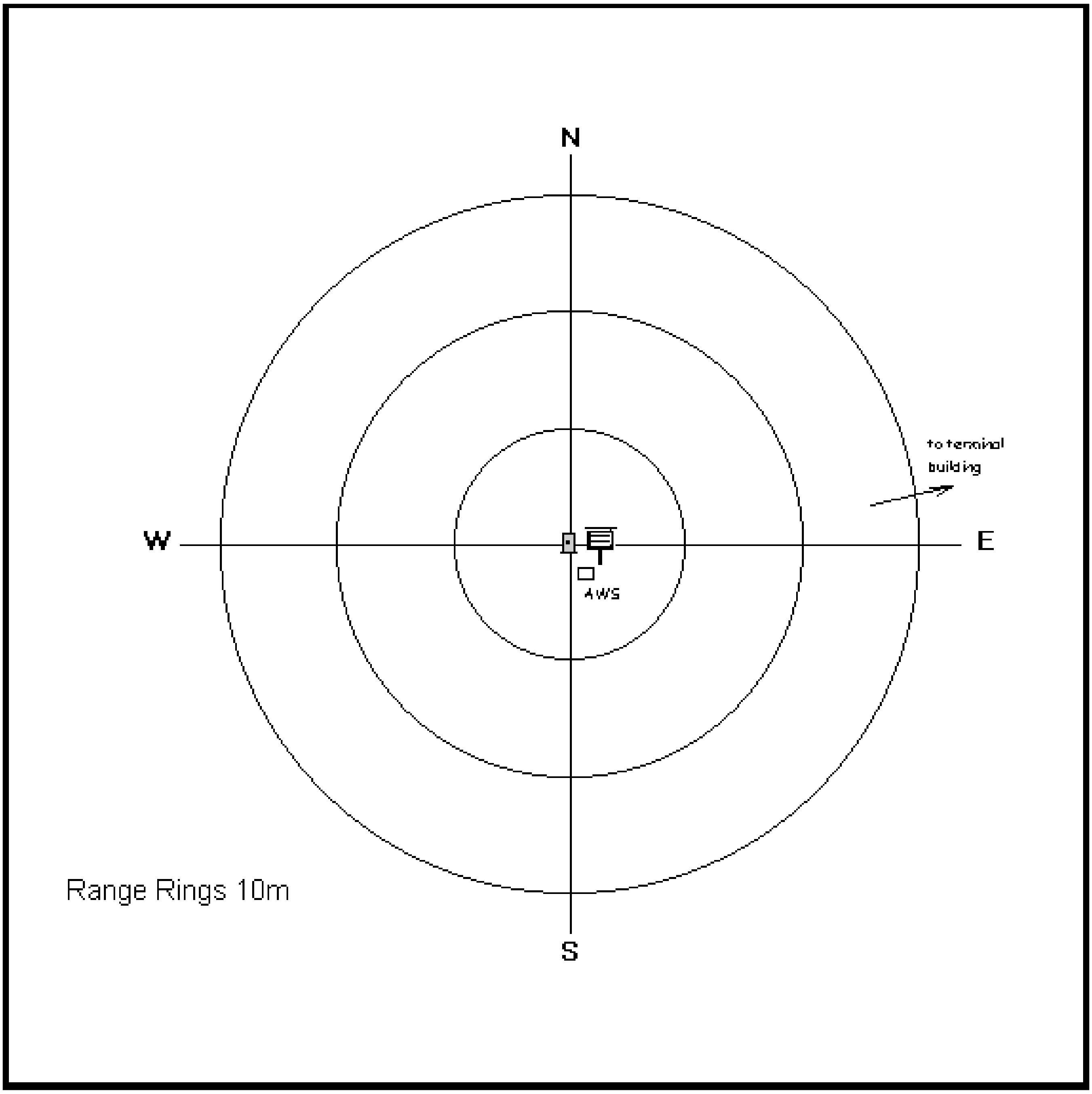


Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS	**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:**	07 Nov 1988
						Current Status:	Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:**	640.8 m
						Metadata compiled:	26 NOV 2015

Instrument Location and Surrounding Features
13/11/2002

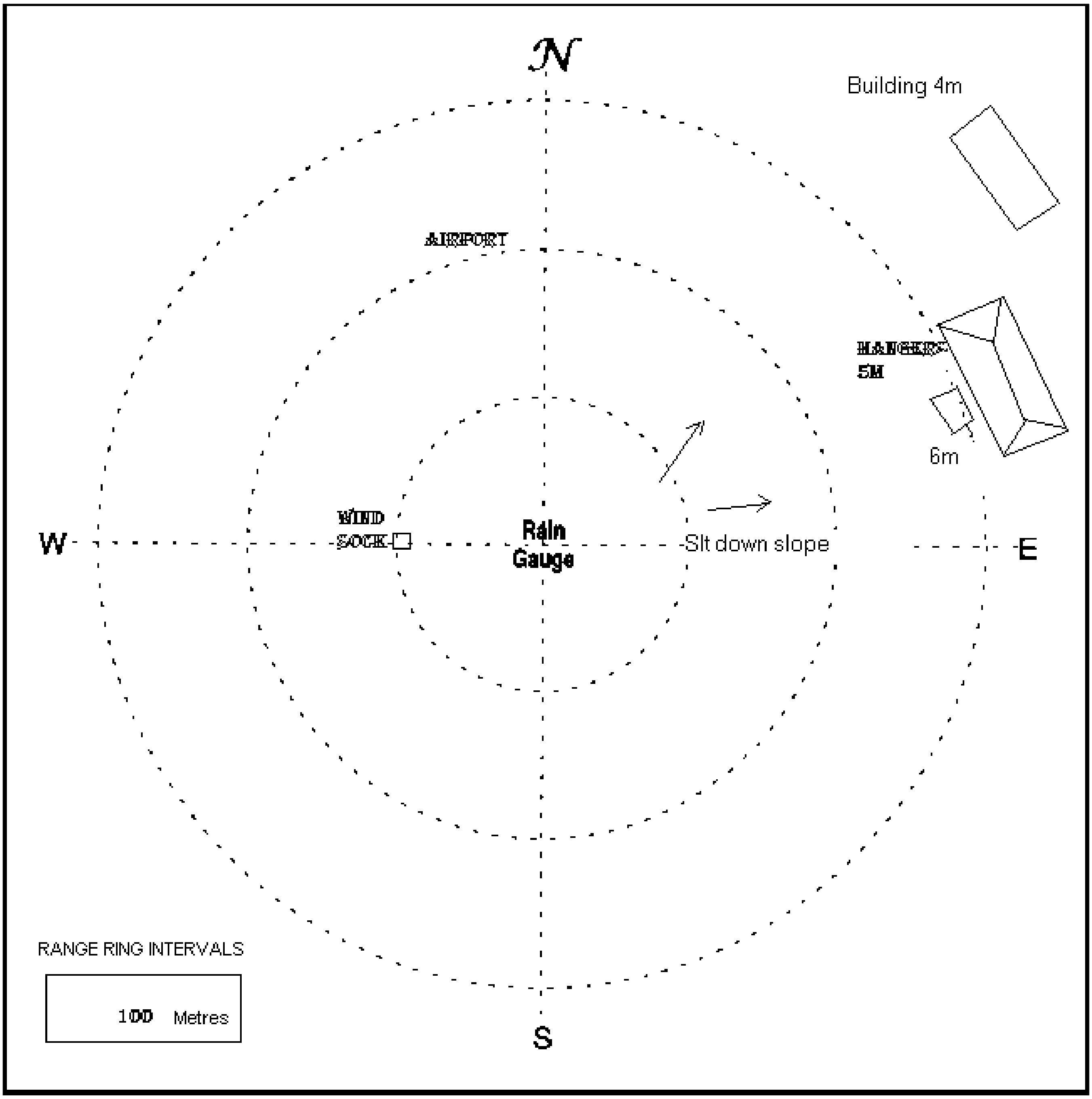


Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS			**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:**	07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:**	640.8 m	**Metadata compiled:**	26 NOV 2015

Instrument Location and Surrounding Features
27/03/2001

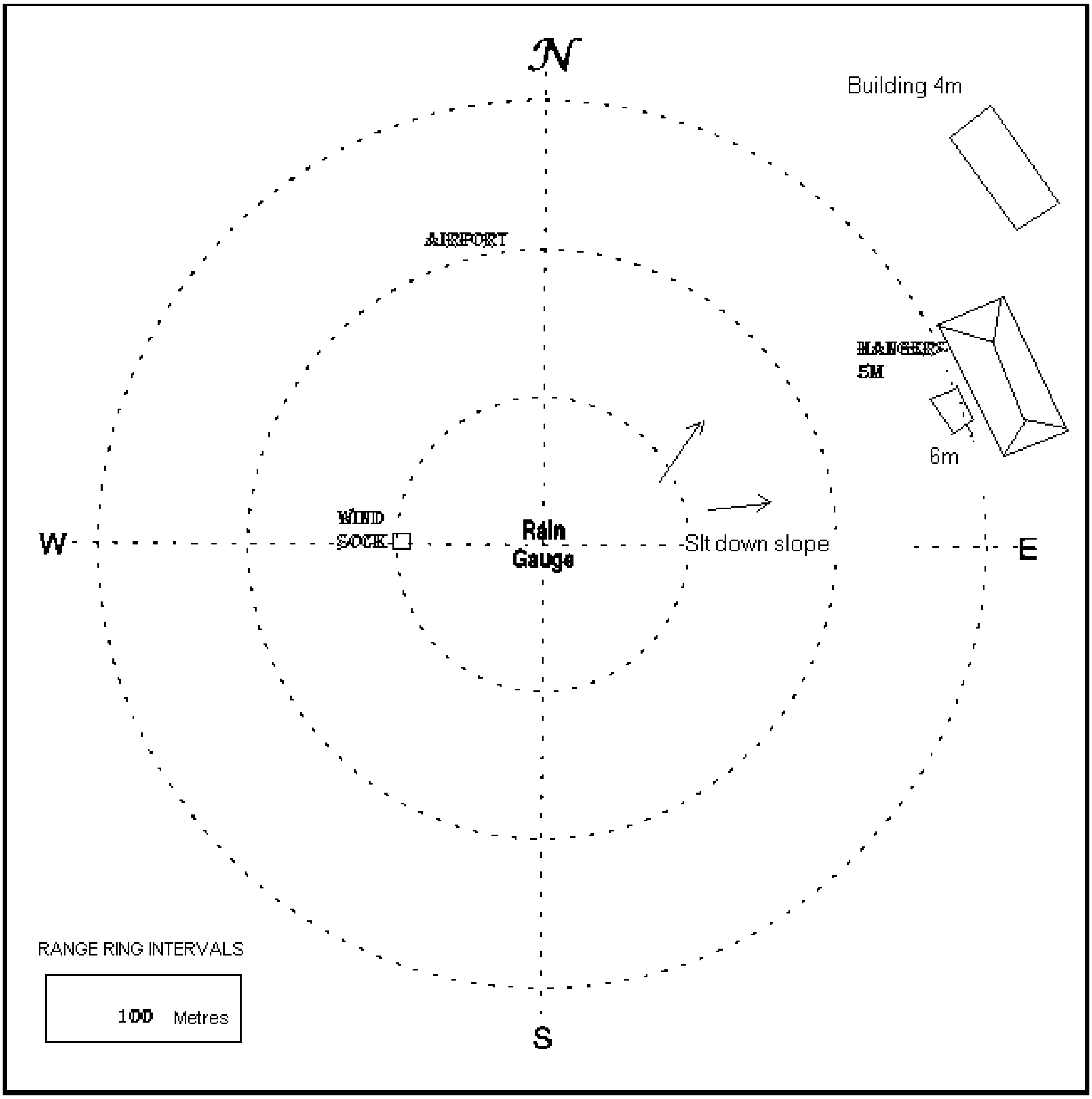


Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS		**Location:**	GOULBURN AIRPORT AWS		**State:**	NSW
Bureau No.:	070330	**WMO No.:** 95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:** 149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:**	26 NOV 2015

Instrument Location and Surrounding Features
09/03/1998

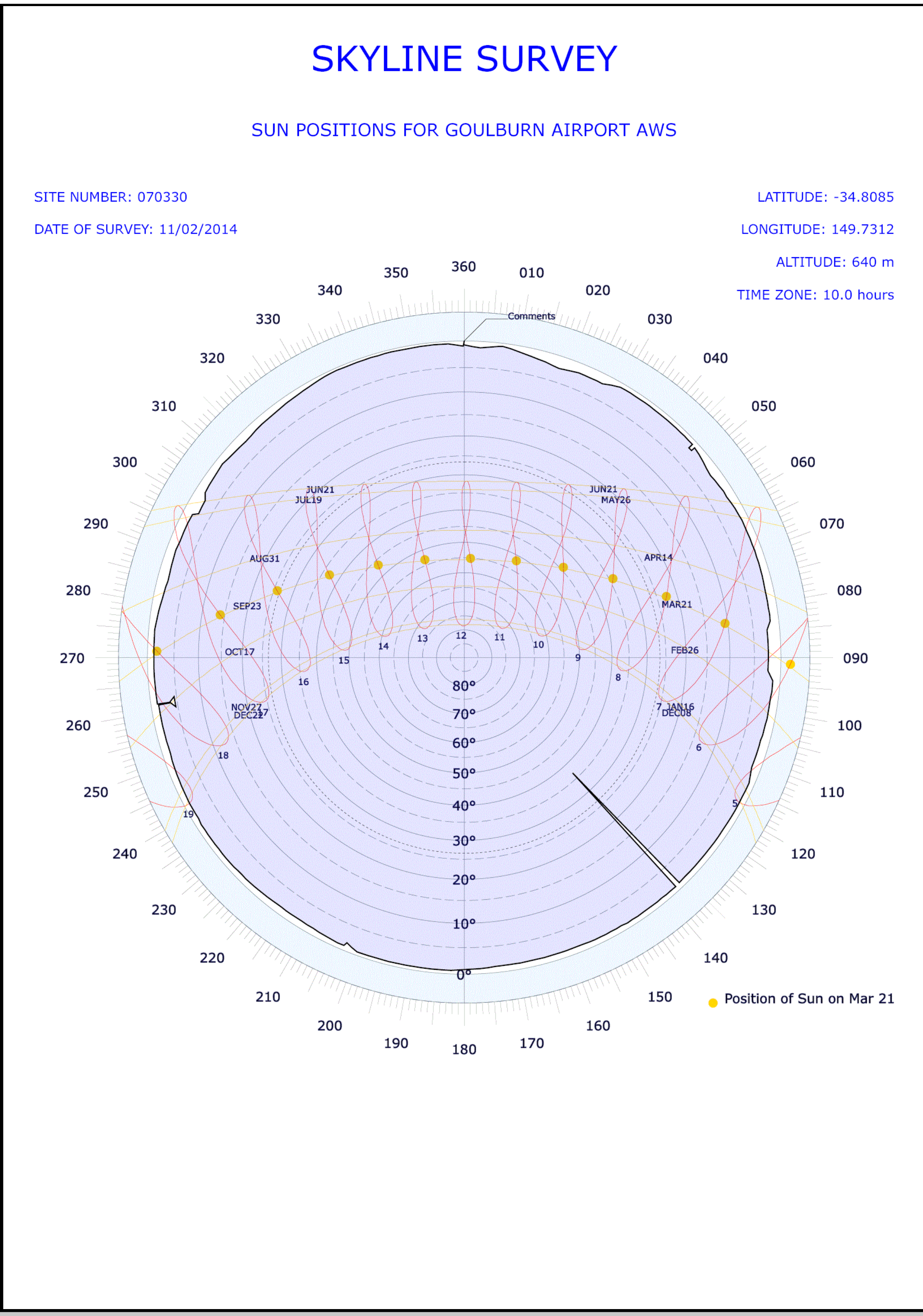


Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS	**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:** Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:** 26 NOV 2015

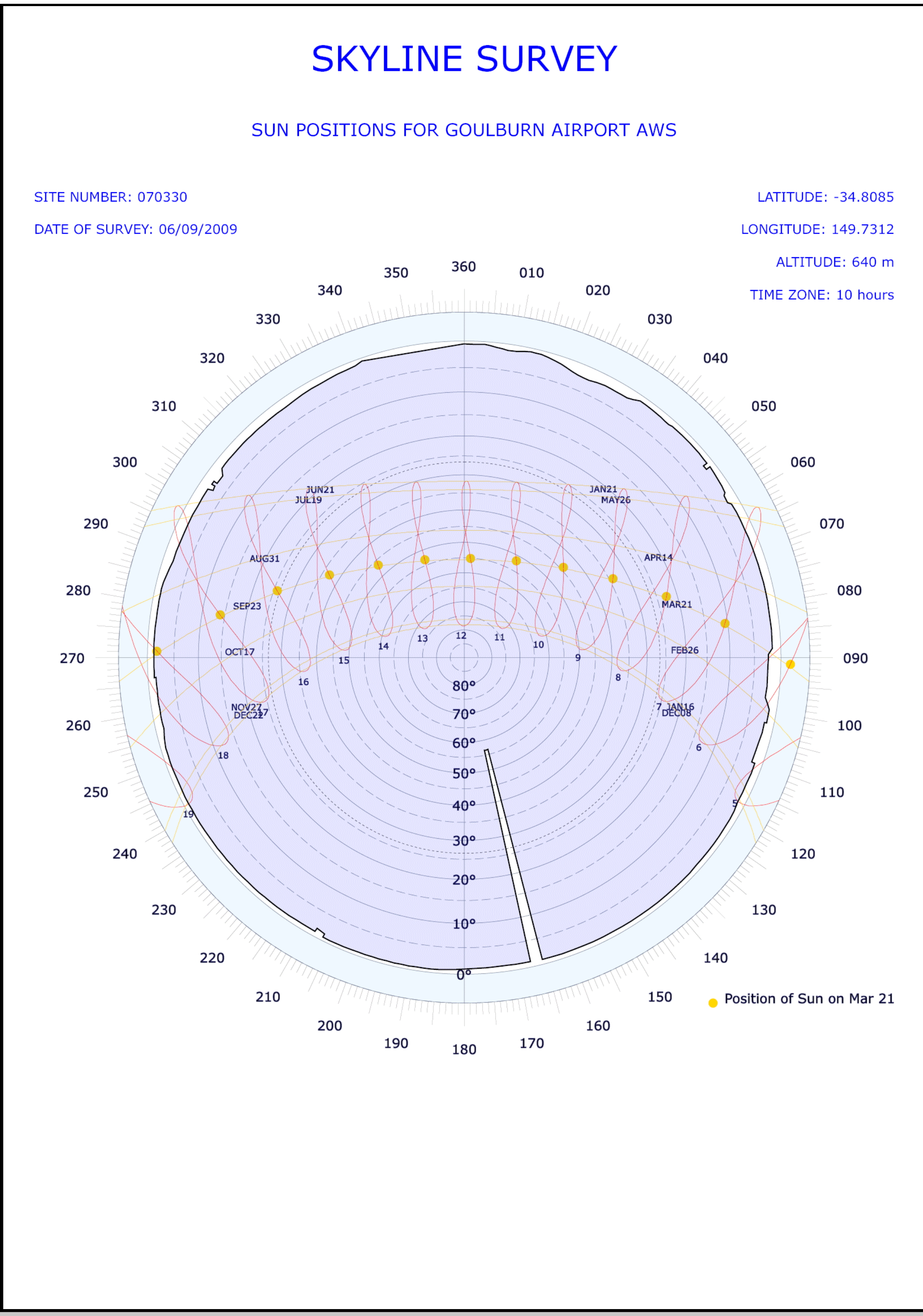
Skyline Diagram
11/02/2014(most recent)



Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS		**Location:**	GOULBURN AIRPORT AWS		**State:**	NSW
Bureau No.:	070330	**WMO No.:** 95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:** 149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:**	26 NOV 2015

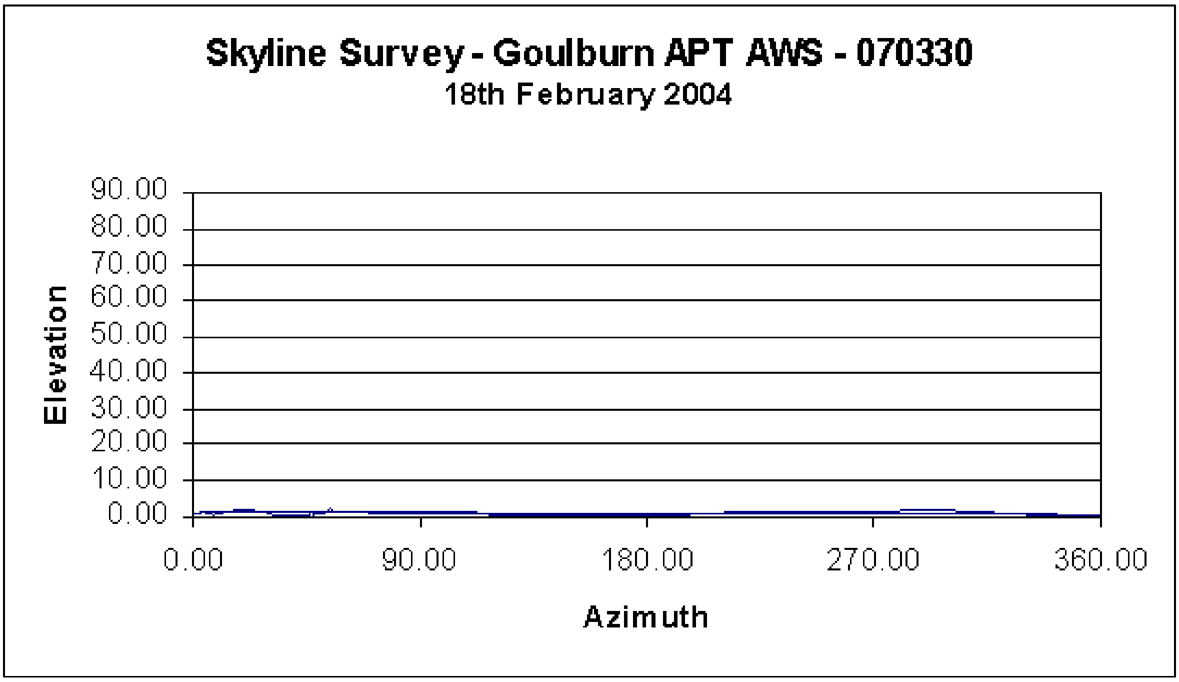
Skyline Diagram
06/09/2009



Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS	**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:** Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:** 26 NOV 2015

Skyline Diagram
24/02/2004



Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS		**Location:**	GOULBURN AIRPORT AWS		**State:**	NSW
Bureau No.:	070330	**WMO No.:** 95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:** 149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:**	26 NOV 2015

Station Observation Program Summary (Surface Observations) from 01/11/1988 to 13/09/2010

Current Observation	**Continuous**	**Half Hourly**	**Hourly**
Surface Observations	-	Y	Y

Current Observation	Program Type	12 AM	3 AM	6 AM	9 AM	12 PM	3 PM	6 AM	9 AM
Surface Observation	PERFORMED	Y	Y	Y	Y	Y	Y	Y	Y
Surface Observation	REPORTED	Y	Y	Y	Y	Y	Y	Y	Y
Surface Observation	SEASONAL	-	-	-	-	-	-	-	-

Station Observation Program Summary (Surface Observations) 26 NOV 2015 (most recent)

Current Observation	**Continuous**	**Half Hourly**	**Hourly**
Surface Observations	Y	Y	Y

Current Observation	Program Type	12 AM	3 AM	6 AM	9 AM	12 PM	3 PM	6 AM	9 AM
Surface Observation	PERFORMED	Y	Y	Y	Y	Y	Y	Y	Y
Surface Observation	REPORTED	Y	Y	Y	Y	Y	Y	Y	Y
Surface Observation	SEASONAL	-	-	-	-	-	-	-	-

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS			**Location:**	GOULBURN AIRPORT AWS			**State:**	NSW
Bureau No.:	070330	**WMO No.:**	95716	**Aviation ID:**	YGLB	**Opened:**	07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:**	149.7312	**Elevation:**	640 m	**Barometer Elev:**	640.8 m	**Metadata compiled:**	26 NOV 2015

Station Equipment History

Equipment Install/Remove

Cloud Height

31/OCT/2013 INSTALL Ceilometer (Type Vaisala CL31 S/N - J3510003) Surface Observations

River Height (No Electronic History)

Wind Run (No Electronic History)

Spectral Radiation (No Electronic History)

Sea Surface Temperature (No Electronic History)

Sea Water Temperature (No Electronic History)

Evaporation (No Electronic History)

Minimum Temperature (No Electronic History)

Soil Temperature 50cm (No Electronic History)

Sub Surface Temperature (No Electronic History)

Electrical Conductivity (No Electronic History)

Maximum Temperature (No Electronic History)

Soil Temperature 20cm (No Electronic History)

Solar Radiation (No Electronic History)

Soil Temperature 5cm (No Electronic History)

Oxygen Content (No Electronic History)

Sea Water Level (No Electronic History)

Surface Inclination (No Electronic History)

Terrestial Minimum Temperature (No Electronic History)

Visibility (No Electronic History)

Solar Radiation (Direct) (No Electronic History)

Magnetic Bearing (No Electronic History)

Wind Direction

10/SEP/2004 INSTALL Anemometer (Type Synchrotac Cups - Type 732 S/N - 80261) Surface Observations
01/NOV/1988 INSTALL Anemometer (Type Synchrotac Vane - Type 706 S/N - WS - 74105 WD - 74066) Surface Observations
01/NOV/1988 INSTALL Mast Anemometer (Type Pivot, Standard 8m S/N - NONE) Infrastructure
15/FEB/2005 REPLACE Anemometer (Now Synchrotac Cups - Type 732 S/N - D100) Surface Observations
10/SEP/2004 REPLACE Anemometer (Now Synchrotac Vane - Type 706 S/N - 80309) Surface Observations
15/FEB/2005 REPLACE Anemometer (Now Synchrotac Vane - Type 706 S/N - D100) Surface Observations

Air Temperature

01/NOV/1988 INSTALL Humidity Probe (Type Rotronics S/N - 713201/9) Surface Observations
23/FEB/2012 REPLACE Humidity Probe (Now Rotronics MP101A-T4-W4W S/N - 11666-005) Surface Observations
19/FEB/2010 REPLACE Humidity Probe (Now Rotronics MP101A-T4-W4W S/N - 39220-007) Surface Observations
03/APR/2012 REPLACE Humidity Probe (Now Rotronics MP101A-T4-W4W S/N - 49513-003) Surface Observations
25/NOV/2002 REPLACE Humidity Probe (Now Vaisala HMP45D S/N - X4150011) Surface Observations
01/NOV/1988 INSTALL Temperature Probe - Dry Bulb (Type Rosemount S/N - NONE) Surface Observations
23/FEB/2012 REPLACE Temperature Probe - Dry Bulb (Now WIKA TR40 S/N - 107822-1) Surface Observations
01/NOV/1988 INSTALL Thermometer, Mercury, Dry Bulb (Type Dobbie S/N - M1803) Surface Observations

Wet Bulb Temperature (No Electronic History)

Lightning (No Electronic History)

Turbidity (No Electronic History)

Total Column Ozone Amount (No Electronic History)

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS		**Location:**	GOULBURN AIRPORT AWS		**State:**	NSW
Bureau No.:	070330	**WMO No.:** 95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:** 149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:**	26 NOV 2015

Station Equipment History (continued)

Equipment Install/Remove(Continued)

Pressure

01/MAY/1995 INSTALL Barometer (Type Vaisala PA11A S/N - 601091) Surface Observations
23/SEP/2002 REPLACE Barometer (Now Vaisala PA11A S/N - 458199) Surface Observations
31/MAR/2011 REPLACE Barometer (Now Vaisala PTB220B S/N - D3540108) Surface Observations

Humidity

01/NOV/1988 INSTALL Humidity Probe (Type Rotronics S/N - 713201/9) Surface Observations
23/FEB/2012 REPLACE Humidity Probe (Now Rotronics MP101A-T4-W4W S/N - 11666-005) Surface Observations
19/FEB/2010 REPLACE Humidity Probe (Now Rotronics MP101A-T4-W4W S/N - 39220-007) Surface Observations
03/APR/2012 REPLACE Humidity Probe (Now Rotronics MP101A-T4-W4W S/N - 49513-003) Surface Observations
25/NOV/2002 REPLACE Humidity Probe (Now Vaisala HMP45D S/N - X4150011) Surface Observations

Sunshine Hours (No Electronic History)

Pressure Trend (No Electronic History)

Snow Height (No Electronic History)

Wind Speed

10/SEP/2004 INSTALL Anemometer (Type Synchrotac Cups - Type 732 S/N - 80261) Surface Observations
01/NOV/1988 INSTALL Anemometer (Type Synchrotac Vane - Type 706 S/N - WS - 74105 WD - 74066) Surface Observations
01/NOV/1988 INSTALL Mast Anemometer (Type Pivot, Standard 8m S/N - NONE) Infrastructure
15/FEB/2005 REPLACE Anemometer (Now Synchrotac Cups - Type 732 S/N - D100) Surface Observations
10/SEP/2004 REPLACE Anemometer (Now Synchrotac Vane - Type 706 S/N - 80309) Surface Observations
15/FEB/2005 REPLACE Anemometer (Now Synchrotac Vane - Type 706 S/N - D100) Surface Observations

Rainfall

01/NOV/1988 INSTALL Raingauge (Type Rimco 7499 TBRG S/N - 66837) Surface Observations
31/JUL/2006 REPLACE Raingauge (Now Rimco 7499 TBRG S/N - 84619) Surface Observations
01/AUG/2006 REPLACE Raingauge (Now Rimco 7499 TBRG S/N - 84625) Surface Observations

Soil Temperature 100cm (No Electronic History)

Soil Temperature 10cm (No Electronic History)

Solar Radiation (Long Wave) (No Electronic History)

RF Reflectivity (No Electronic History)

The following table summarises information on field performance checks available electronically over the period indicated. The number of instances an instrument was found to fail field performance checks should only be used as a guide. A system of data quality flags is implemented by the Bureau of Meteorology to indicate the data quality of an observation as determined by a mutli-stage quality control process.

Available Date Range	Element	Fail Field Performance Check
14/NOV/2013 - 10/MAR/2015	Cloud Height	0
09/MAR/1998 - 18/NOV/2015	Wind Direction	6
09/MAR/1998 - 18/NOV/2015	Air Temperature	3
09/MAR/1998 - 10/MAR/2015	Pressure	0
09/MAR/1998 - 18/NOV/2015	Humidity	2
09/MAR/1998 - 18/NOV/2015	Wind Speed	6
09/MAR/1998 - 18/NOV/2015	Rainfall	4

Station Detail Changes

09/MAY/2006 CLASSIFICATION Category D (TAF D)

Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Extended Climatological Station Metadata
All History

Station:	GOULBURN AIRPORT AWS		**Location:**	GOULBURN AIRPORT AWS		**State:**	NSW
Bureau No.:	070330	**WMO No.:** 95716	**Aviation ID:**	YGLB	**Opened:** 07 Nov 1988	**Current Status:**	Still open
Latitude:	-34.8085	**Longitude:** 149.7312	**Elevation:**	640 m	**Barometer Elev:** 640.8 m	**Metadata compiled:**	26 NOV 2015

Station Equipment History (continued)

Station Detail Changes(Continued)

01/NOV/1988 CLASSIFICATION Mesonet (FME)
05/OCT/2001 CLASSIFICATION National Benchmark Network for Agrometeorology (NBNA)
10/JAN/2011 CLASSIFICATION Standard (ASOSSTD)
10/JUN/2014 CLASSIFICATION Standard Aviation or Defence (AVSTD)
28/JUN/2011 OBJECT Document/AWS SITE AUDIT
14/NOV/2013 OBJECT Document/CEILOMETER STATUS
24/FEB/2004 OBJECT Document/Goulburn APT AWS Skyline points
06/SEP/2009 OBJECT Document/SKYLINE DATA
11/FEB/2014 OBJECT Document/SKYLINE DATA
07/NOV/1988 STATION - (nondb seeding) Opened
07/NOV/1988 STATION - (nondb seeding) aero_ht Changed to 652.6
07/NOV/1988 STATION - (nondb seeding) bar_ht Changed to 640.8
07/NOV/1988 STATION - (nondb seeding) bar_ht_deriv Changed to MAP 1:25 000
07/NOV/1988 STATION - (nondb seeding) stn_ht Changed to 640
07/NOV/1988 STATION - (nondb seeding) stn_ht_deriv Changed to MAP 1:25 000
07/NOV/1988 STATION - (nondb seeding) wmo_num Changed to 95716
07/NOV/1988 STATION aviation_id Changed to YGLB
07/NOV/1988 STATION latitude Changed to -34.80854
07/NOV/1988 STATION latlon_deriv Changed to GPS
07/NOV/1988 STATION latlon_error Changed to 4
07/NOV/1988 STATION longitude Changed to 149.73118
09/MAR/1998 STATION lu_0_100m Changed to Airport
09/MAR/1998 STATION lu_100m_1km Changed to Airport
09/MAR/1998 STATION lu_1km_10km Changed to Open farmland, grassland or tundra
07/NOV/1988 STATION name Changed to GOULBURN AIRPORT AWS
09/MAR/1998 STATION soil_type Changed to red soil
09/MAR/1998 STATION surface_type Changed to fully covered by grass

System Changes

01/NOV/1988 SYSTEM Infrastructure Commenced
01/NOV/1988 SYSTEM Surface Observations Commenced

Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Notes on these metadata

The following notes have been compiled to assist with interpreting the metadata provided in this document. These notes are subject to change as the network evolves. Changes in station-specific metadata occur more frequently, both as recent changes are recorded and historical information is transferred from paper file to electronic database.

Reliability of the metadata

The Commonwealth Bureau of Meteorology maintains information on more than 20,000 stations which have operated since observations began in the mid 1800s. The amount of information available for each of these sites and its associated uncertainty are influenced by a number of factors including the type and purpose of the station and the time over which it operated.

Early information about stations was held only on paper file. In 1998 a corporate electronic database was established to help maintain information about the network and its components. The number of parameters recorded about a station is now much greater than before this database was established. The national database has also helped improve consistency in the metadata through the implementation of predefined fields. As a result, and through the refinement of operating procedures, station metadata recorded since 1998 are of a higher overall standard than previously, although occasional omissions and errors are still possible.

The Bureau is part way through a task of entering historical information held on paper file into the corporate database. **Until this process is completed there will remain large gaps in the information contained in these metadata documents and considerable caution should be used when deriving conclusions from the metadata.** As an example, two consecutive entries about a rain gauge dated 50 years apart may appear in the equipment metadata. This may either mean that nothing happened to that instrument over the 50 years, or that information for the intervening period has yet to be entered into the database. Similarly, if no information was available about instruments at a site when it was first established, fields which were required to have a value present may have used the earliest information available as a best-guess estimate. Sometimes this was the metadata current when the database was established in 1998. In some instances there may be gaps in metadata relevant to the post 1998 period.

For the above reasons it is recommended that all metadata prior to 1998 be considered as indicative only, and used with caution, unless it has been quality controlled. The Bureau of Meteorology should be contacted if further information or confirmation of the data is required. Depending on the nature of the inquiry there may be a fee associated with this request. Contact details are provided in the telephone book for each capital city or the Bureau's web site at:
http://www.bom.gov.au

The following pages contain explanatory notes for selected terms found in this document.

Station Number

The Bureau of Meteorology station number uniquely specifies a station and is not intended to change over time time, although on very rare occasions a station number may change or be deleted from the record (usually to correct an error). Generally a new station number is established if an existing station changes in a way that would affect the climate data record for that site (measured in terms of air temperature and precipitation). Significant station moves are an example of this.

Some stations also possess a World Meteorological Organization (WMO) station number. The WMO number is different to the Bureau of Meteorology number. It also uniquely specifies a station at any given time but can be reassigned to another station if the new station takes priority in the global reporting network. Only selected stations will have a WMO number. Significant stations may maintain their WMO number for many decades.

Notes on these metadata

Network Classification

SUPPORTING the BASIC CLIMATE SERVICE
Global Climate Observing System (GCOS)
GCOS Upper Air Network (GUAN)
GCOS Surface Network (GSN)
National Climate Network {not yet assigned}
Reference Climate Stations (RCS)
Regional Basic Climatological Network (RBCN)
CLIMAT Stations (CLC)
CLIMAT TEMP Stations (CLT)
SUPPORTING the NATIONAL WEATHER WATCH SYSTEM
WMO Global Observing System (GOS)
GOS Upper Air Network
GOS Satellite Network
Global Atmospheric Watch
Background Atmospheric Pollution Monitoring Network (BAPMON)
Basic Ozone Network
Basic Solar and Terrestrial Radiation Network
Regional Basic Synoptic Network (RBSN)
WMO Global Oceanic Observing System (GOOS)
SUPPORTING the BASIC WEATHER SERVICE (BWS)
BWS Land Network
Significant Land Locations
Capital City Mesonets
National Benchmark Network for Agrometeorology (NBNA)
BWS Marine Network
Significant Coastal Loactions
Open Ocean Network
BWS Upper Air Network
Major Significant Locations
BWS Remote Sensing Network
Weather Watch Radar Network
Fire Weather Wind Mesonets
High Resolution Satellite
SUPPORTING the BASIC HYDROLOGICAL SERVICE
Regional Flood Warning Network
Water Resources Assessment Network
Global Hydrological Network
Global Terrestrial Observing System (GTOS)
World Hydrological Cycle Observing System (WHYCOS)
National Hydrological Network

Networks of stations are defined for a variety of purposes (as defined in above table).

Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by email on climatedata@bom.gov.au

Notes on these metadata

Network Classification Continued....

Stations may be included in several different networks, which may change over time. The table on the previous page lists current network classifications related to the scientific purpose of the network. Some of these networks - the GCOS network for instance - are components of a global network. Entries in the database for some networks may not be complete, thus not properly representing the status of the network. The composition of the network will usually change over time. While several of the networks have international significance, other network classifications have been developed to aid operational management.

Station Purpose

The station purpose can be classified according to the observation program listed below. Parameters in brackets list some of the various different configurations which occur.

- Synoptic [Seasonal, River Height, Climatological, Telegraphic Rain, Aeronautical, Upper Air]
- Climatological [Seasonal, Telegraphic Rain]
- Aeronautical
- Rainfall [River Height]
- River Height
- Telegraphic Rain [Non-Telegraphic River Height, Telegraphic River Height]
- Non-Telegraphic Rain [Telegraphic River Height]
- Evaporation [Rainfall, River Height, Telegraphic River Height, Non-Telegraphic River Height, Telegraphic Rain, Non-Telegraphic Rain]
- Pluviograph [Rainfall, Telegraphic Rain, Non-Telegraphic Rain, River Height, Telegraphic River Height, Non-Telegraphic River Height]
- Radiation
- Lightning Flash Counter
- Public Information
- Local Conditions
- Radar Site
- Unclassified
- No Routine Observations

Note: Telegraphic observations are those which are sent by some electronic means be it a phone or telegram to the responsible Bureau office. It is a term which is historically linked to analogue non automatic data transmission.

Station Observation Program Summary

Surface Observations

The following terms are used to describe the frequency of surface observations at a site. Historical observation programs will typically be missing for many sites until the database is backfilled with information.

Set a)
- Continuous Program
  - More than half hourly observations sent (eg an automatic weather station {AWS} which continuously transmits 10 minute observations). This will automatically include half hourly and hourly observations programs.
- Half hourly observations
  - Half hourly observations sent. This will automatically include hourly observations.
- Hourly observations
  - Hourly observations sent only. Stations report on non-synoptic hours (ie. 0100, 0200, 0400, 0500, etc)

Historical metadata for this site has not been quality controlled for accuracy and completeness. Data other than current station information, particularly earlier than 1998, should be considered accordingly. Information may not be complete, as backfilling of historical data is incomplete.

Surface observations continued....

Set b)
- Performed
  - Observations performed, instruments read and observations recorded
- Reported
  - Observations performed, instruments read and reported real time
- Seasonal
  - The program may only be performed during a defined season (such as Fire Weather observations) or the routine program may increase in reporting frequency and/or parameters. The program dates are currently modified at the start and end of each season for stations performing seasonal observations. Historically this was not always the case.

Current Station Equipment Summary

Equipment listed in this metadata product is catalogued under one of systems listed below, appropriate to its application. The "Infrastructure" category has been included since it contains information about the mast height of an anemometer (if present).

- Flood Warning
- Infrastructure
- Radiation
- Rainfall Intensity
- Surface Observations
- Upper Air
- Weather Watch {RADAR}

Station Equipment History

Equipment Install/Remove

One of four types of actions can be performed on an instrument in this listing:

Install - A new instrument is installed at the site. This can be either a completely new addition (eg the first barometer at the site), or the replacement of an existing instrument with a different type (eg replacing mercury barometer with electronic barometer)

Remove - An instrument can be removed either when it is no longer necessary to measure a particular element, or when the element is to be measured by an instrument of a different type (see under "Install" above)

Replace - This occurs when one instrument is replaced with another of the same type (eg Kew pattern mercury barometer replacing another Kew pattern mercury barometer)

Share - The same instrument is used for observations under two (or more) systems (eg a rain gauge may be used within both Surface Observations and Rainfall Intensity systems)

Unshare - The instrument is no longer shared between systems

Notes on these metadata

Calibration

During a site inspection an instrument will be calibrated as either being within or not within the specified tolerance in accuracy.

Where a quantative calibration result can be achieved by comparison to a transfer standard (eg barometer comparisons and tipping bucket rain gauge calibrations), the instrument will be recorded as being within or outside the required tolerance. Instruments (such as 203mm rain gauges, screens and evaporation pans) where quantitative calibrations cannot be derived should be regarded as meeting specifications when the instrument is in 'good working order'.

This product provides a summary table of the number of times an instrument was found to be out of calibration

Station Detail Changes

This set of metadata indicates when some aspect of the general information about a station has changed.

- STATION

Metadata which are categorised as pertaining to STATION are items of (textual) information describing a specific attribute of the station. A reference to (nondB seeding) indicates initial information of this field has been sourced from a previous database.

Station position

- Latitude and longitude

Derivation of station latitude and longitude, defined by the location of the rain gauge when it is present, has changed over time. Current practice is to locate or verify open and operational station latitude and longitude based on Global Positioning System equipment. Methods used to locate a station as described in this product (latlon_deriv) are as follows: GPS, MAP 1:10000, MAP 1:12500, MAP 1:25000, MAP 1:50000, MAP 1:100000, MAP 1:250000, SURVEY, and Unknown (which is more commonly represented by a null value). The field latlon_error should be used with caution as the method of determining this value has been interpreted in different ways over time.

- Height

Determination of heights for observing sites is by survey where possible. Otherwise height may be determined using a Digital Aneroid Barometer and a known surveyed point, or derived from map contours. The source of height is provided in the corresponding parameter with a suffix of "_deriv".

Heights which may appear in these metadata are:

- aero_ht
  - The official elevation of the aerodrome which normally corresponds to the altitude of the highest threshold of the runways at that airport;
- bar_ht
  - this represents the height of the mercury barometer cistern or the digital aneroid barometer above mean sea level (MSL);
- stn_ht
  - this normally represents the height of the rain gauge above MSL

Contact us by phone on (03) 9669 4082, by fax on (03) 9669 4515, or by email on climatedata@bom.gov.au

Notes on these metadata

- Land Use

To assist the long term understanding of climate change it is important to be able to determine the differences over time which are attributed to variations in the climate. Since land use has an effect on the micro climate around the site, and changes in land use will therefore affect the climate record, it is important that the characteristics of the site are monitored. Soil types are recorded as they affect the land use and also add to the knowledge of the site details.

Defined Land use Types.

- Non-vegetated (barren, desert)
- Coastal or Island
- Forest
- Open farmland, grassland or tundra
- Small town, less than 1000 population
- Town 1000 to 10,000 population
- City area with buildings less than 10 metres (3 stories)
- City area with buildings greater than 10 metres (3 stories)
- Airport

The land use code is entered on the station inspection form in the ranges 0 to 100 m, 100 to 1 km and 1km to 10 km; ie:

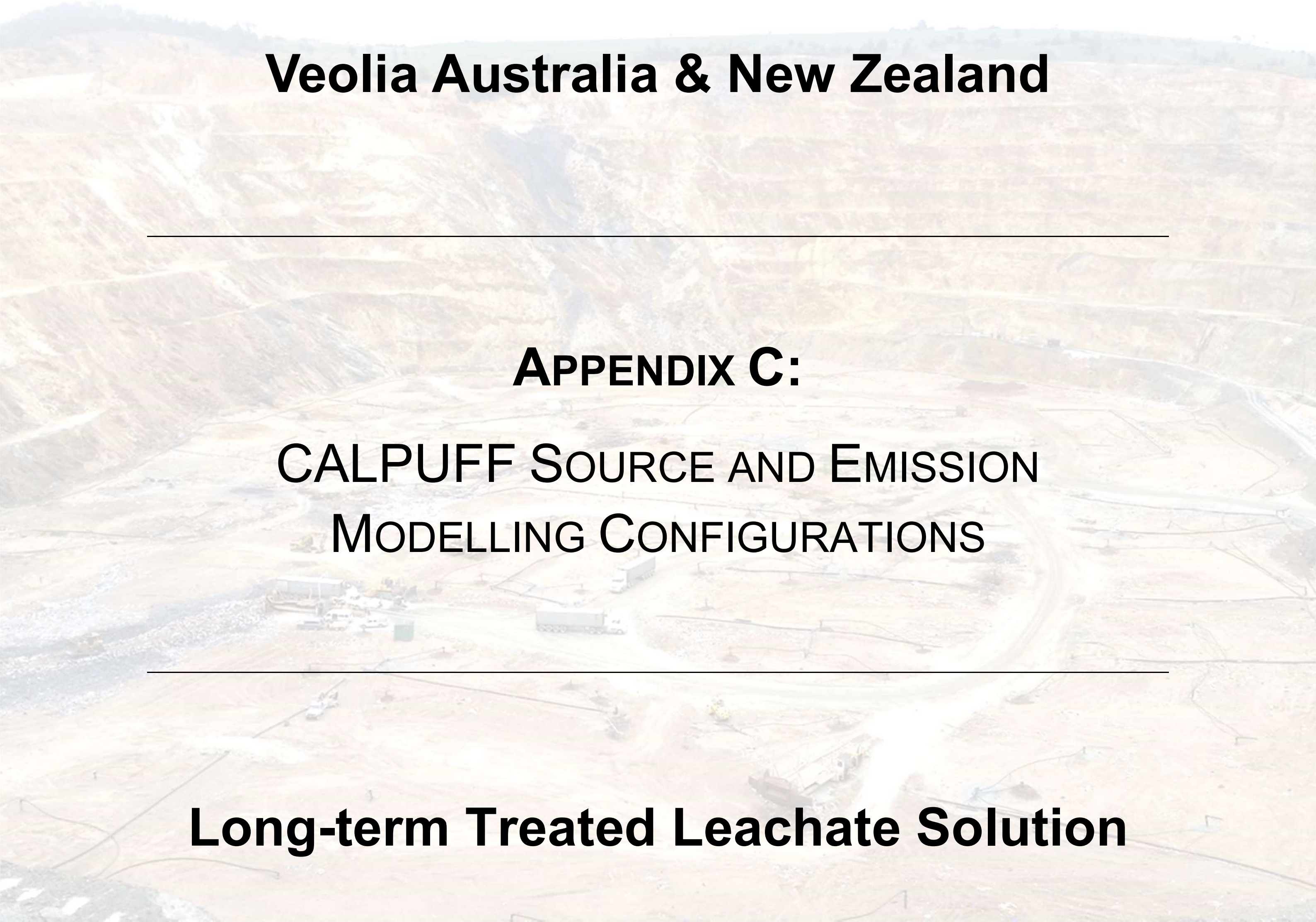
- lu_0_100m: Land Use 0 to 100 metres from the enclosure
- lu_100m_1km: Land Use 100 metres to 1 kilometre
- lu_1km_10km: Land Use 1 kilometre to 10 kilometres

Defined Soil Type (At Enclosure).

- unable to determine
- sand
- black soil
- clay
- rock
- red soil
- other

Surface Type (At Enclosure).

- unable to determine
- fully covered by grass
- mostly covered by grass
- partly covered by grass
- bare ground
- sand
- concrete
- asphalt
- rock
- other



Veolia Australia & New Zealand

APPENDIX C:

CALPUFF SOURCE AND EMISSION MODELLING CONFIGURATIONS

Long-term Treated Leachate Solution

July 2016

AREA SOURCE

Source	Lower	Lower	Upper	Upper	Upper	Upper	Lower	Lower	Effect.	Base	Init.	ODOR
(12 chars.)	(km)	(km)	(km)	(km)	(km)	(km)	(km)	(km)	(m)	(m)	(m)	(g/m**2/s)
LDAM	734.1	6117.183	734.166	6117.287	734.184	6117.268	734.129	6117.163	0	797.19	0.1	3.6
GW	733.455	6117.624	733.399	6117.421	733.552	6117.39	733.652	6117.541	0	791.39	0.1	0.3
TL1	733.559	6117.387	733.658	6117.54	733.707	6117.508	733.725	6117.46	0	791.56	0.1	3.6
UTL	733.661	6117.366	733.788	6117.346	733.73	6117.455	733.662	6117.37	0	791.55	0.1	5
SW	733.55	6117.367	733.84	6117.319	733.661	6117.1	733.424	6117.219	0	792.37	0.1	0.1
COVW	734.128	6116.962	734.37	6117.189	734.463	6117.157	734.735	6117.023	0	731.67	0.1	0.3
AGEDW	734.156	6116.944	734.649	6116.721	734.498	6116.646	734.099	6116.859	0	687.56	0.1	3.6
FW	734.099	6116.858	734.098	6116.793	734.359	6116.638	734.493	6116.644	0	753.02	0.1	0.7
WR3	733.132	6117.509	733.185	6117.628	732.905	6117.753	732.852	6117.634	0	793.74	2	0.253
WR2	733.163	6117.495	733.216	6117.614	733.185	6117.628	733.132	6117.509	0	792.15	2	13
WR4	733.193	6117.482	733.246	6117.6	733.216	6117.614	733.163	6117.495	0	791.81	2	11.3
WR4_2	732.816	6117.65	732.869	6117.769	732.857	6117.775	732.803	6117.656	0	796.36	2	11.3
WR5	732.803	6117.656	732.857	6117.775	732.843	6117.781	732.79	6117.662	0	796.38	2	5.45
WR5_2	732.79	6117.662	732.843	6117.781	732.778	6117.81	732.725	6117.691	0	796.74	2	0.253
ED3S-S	733.529	6116.967	733.523	6117.122	733.739	6117.044	733.641	6116.904	0	794	0.1	0.159
ED1	733.233	6117.742	733.577	6118.346	734.273	6117.793	733.898	6117.446		785	0.1	0.0488

VOLUME SOURCE

Source	X	Y	Effect.	Base	Init.	Init.	ODOR
(12 chars.)	(km)	(km)	(m)	(m)	(m)	(m)	(g/s)
SRC_1	732.95	6117.695	0	0	20	2	5.65
SRC_2	733.066	6117.623	0	0	10	2	2.37

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
B_01	ISSUED FOR TENDER	JM	MS	MS	31/05/2017
B_00	ISSUED FOR CONCEPT DESIGN	JM		_	24/04/2017

DO NOT SCALE THIS DRAWING
IF IN DOUBT ASK
THIRD ANGLE PROJECTION

Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia.
Phone: +61 (2) 85710000
Web: www.veolia.com/anz
Email: reception.PYR@veolia.com

DRAWN	DATE 24/04/2017	PROJECT	WOODLAWN LEACHATE TREATMENT PLANT
CHECKED MS	DATE 24/04/2017	TITLE	LTP PLANT LAYOUT PLAN
APPROVED -	DATE -		

SCALE	SHEET	OF	SIZE
1:200	01	01	A1

DRAWING No.	REVISION
00004-Z-00-D02-00-01	B_01

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
B_01	ISSUED FOR TENDER	JM	MS	MS	31/05/2017
B_00	ISSUED FOR CONCEPT DESIGN	JM		_	24/04/2017

DO NOT SCALE THIS DRAWING
IF IN DOUBT ASK
THIRD ANGLE PROJECTION

0 2 4 6 8 M

Level 4, Bay Centre,
65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia.
Phone: +61 (2) 85710000
Web: www.veolia.com/anz
Email: reception.PYR@veolia.com

DRAWN — DATE 24/04/2017
CHECKED MS — DATE 24/04/2017
APPROVED - — DATE -

PROJECT: WOODLAWN LEACHATE TREATMENT PLANT
TITLE: LTP SHED LAYOUT PLAN
SCALE: 1:100
SHEET 01 OF 01
SIZE: A1
DRAWING No.: 00004-Z-00-D03-00-01
REVISION: B_01

REV	REVISION	DRAWN	CHECKED	APPROVED	REVISION DATE
B_01	ISSUED FOR TENDER	JM	MS	MS	31/05/2017
B_00	ISSUED FOR CONCEPT DESIGN	JM		_	24/04/2017

DO NOT SCALE THIS DRAWING
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THIRD ANGLE PROJECTION

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65 Pirrama Road
Pyrmont, NSW, 2009
Sydney, Australia.
Phone: +61 (2) 85710000
Web: www.veolia.com/anz
Email: reception.PYR@veolia.com

DRAWN	DATE 24/04/2017	PROJECT	WOODLAWN LEACHATE TREATMENT PLANT
CHECKED MS	DATE 24/04/2017	TITLE	LTP SHED ROOF PLAN
APPROVED -	DATE -		

SCALE	SHEET	OF	SIZE
1:50	01	01	A1

DRAWING No.	REVISION
00004-Z-00-D04-00-01	B_01