

Soil Water & Leachate Management Plan

For Woodlawn Mechanical Biological Treatment Facility

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Veolia Australia and New Zealand NSW Resource Recovery – Woodlawn MBT Facility 619 Collector Road Tarago NSW 2580 www.veolia.com.au

Tel: (02) 8588 1360



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DEFINITIONS/ABBREVIATIONS

ARI	Average Recurrence Interval
BRS	Biological Refining System
Bioreactor	Woodlawn Bioreactor
CEMP	Construction Environment Management Plan
DA	Development Application
DPE	Department of Planning and Environment
EA	Environment Assessment
EMP	Environment Management Plan
EP&A	Environmental Planning and Assessment (Act and Regulations)
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ERP	Emergency Response Plan
ha	Hectares
kL	Kilolitre
MBT	Mechanical Biological Treatment
ML	Mega litre
mAHD	metres Australian Height Datum
NIMS	National Integrated Management System
POEO	Protection of the Environment Operations (Act and Regulations)
RIVO	Incident and Compliance Management System
SMA	Sydney Metropolitan Area
TADPAI	Tarago and District Progress Association Incorporated
ТРА	Tonnes per annum
Veolia	Veolia Australia and New Zealand
WHS	Work Health and Safety (Act and Regulation)



Section 1 INTRODUCTION

1.1 Overview

Veolia Australia and New Zealand (Veolia) will operate the Mechanical Biological Treatment (MBT) Facility, which is located at 619 Collector Road, Tarago.

The MBT Facility has been approved to receive up to 240,000 tonnes per annum (TPA) of mixed waste and 40,000 TPA of garden waste from within the Sydney Metropolitan Region (SMA). The waste will be containerised and loaded onto rail wagons for transportation from Sydney to the Woodlawn Eco Project Site (also owned and operated by Veolia) in the Southern Tablelands (approximately 250 kilometres southwest of Sydney) for processing mixed waste organic outputs and production of compost.

The MBT Facility includes the following infrastructure:

- An access road for waste trucks (entering and exiting the facility from Collector Road);
- Car parking, weighbridge and amenities;
- Reception building and associated infrastructure;
- Biological Refining System (BRS) drums;
- Refining building;
- Organic buffer storage area;
- Fermentation building; and
- Compost storage area.

The NSW Department of Planning and Environment (DPE) assessed this State Significant development and granted Project Approval (MP 06-0239) for the 'State Significant' development on 6 November 2007, in accordance with section 75J of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

To incorporate current best available MBT technology and improve environmental controls in line with NSW Environmental Protection Authority (EPA) requirements, Veolia sought a modification to the development consent in December 2013. A Notice of Modification (MP 06-0239 MOD 1), issued under section 75W of the EP&A Act, on 17 June 2014, reflects the revised site layout and infrastructure, waste processing technologies and operating hours of the MBT Facility.

An Environment Protection Licence (EPL) 20476 has been issued by the EPA, under the *Protection of the Environment Operations Act 1997* (POEO Act).

This Soil, Water and Leachate Management Plan (SWLMP) has been prepared in accordance with regulatory requirements pertaining to the Woodlawn MBT Facility. This plan details potential soil, water and leachate impacts from MBT operations, as well as relevant control strategies and monitoring procedures to be undertaken to minimise the likelihood of these impacts occurring.



1.2 Scope and Objectives

The objective of this SWLMP is to ensure that there is minimal impact on soils and receiving waters from operations, as well as adequate management of leachate at the Woodlawn MBT Facility with regard to the following:

- Facilitating compliance with the relevant state legislations, regulations and/or approvals;
- Detailing how soil, water and leachate will be managed at the Woodlawn MBT facility;
- Providing a water balance for the Woodlawn MBT site;
- Providing mitigation measures to minimise the potential for erosion and sediment transport processes;
- Describing the control measures for stormwater management;
- Providing mitigation measures to minimise the potential for contamination of receiving waters;
- Detailing suitable monitoring programs used to detect changes in receiving waters; and
- Defining the response action plans for any water quality incidents.

1.3 Legal and Other Requirements

The following regulatory framework applies to this SWLMP:

- MP 06_0239 under Section 75J of the EP&A Act (issued by DPE);
- MP 06_239 MOD 1 under Section 75W of the EP&A Act (issued by DPE), and;
- EPL 20746 issued under the POEO Act, in particular Section 120.

1.3.1 <u>Development Consent</u>

The Consent Conditions provide the relevant requirements for this SWLMP and are provided in Table 1.1.

Relevant Condition	Requirement		
Schedule 3	3		
Leachate I	Management System		
7	The Proponent shall:		
	 (a) ensure the floor of the waste processing building is comprised of a concrete pad that is at least 10cm thick; 		
	 (b) install a leachate barrier system on any surface to be used for the direct impoundment of leachate such as the composting and other outdoor areas; 	Section 4.3	
	(c) ensure that this leachate barrier system:		
	 has a re-compacted clay or modified soil layer that is at least 60 centimetres thick and has an in-situ coefficient of permeability of less that 1*10-7 m/S, or some other suitable liner approved by EPA; and 		

Table 1.1 – Consent Conditions

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Relevant Condition	Requirement			
	 drains to the leachate dams at a minimum gradient of 0.5 % 			
	 (d) collect all the leachate in the leachate dams to prevent it from escaping from the site to surface water ,groundwater or subsoil; 			
	 (e) treat all water from waste storage or handling areas, including the organic waste storage area, or that has been contaminated by leachate, as leachate; 			
	(f) ensure that the leachate dams:			
	 are capable of accepting a 1 in 10 years, 24 hours duration storm event without overflowing; 			
	 have a re-compacted clay or modified soil layer that is at least 90 centimetres thick and an in situ coefficient of permeability of less that 1*10-9m/s, or some other suitable liner approved by EPA 			
	 have sides with a slope of less than 1 vertical to 3 horizontal; and have a 0.5 meter freeboard at all times. 			
Soil, Water	and Leachate Management Plan			
16	The Proponent shall prepare and implement a Soil, Water and Leachate Management Plan for the project to the satisfaction of the Secretary. This plan must:			
	 (a) be submitted to the Secretary for approval prior to carrying out any development on site; 			
	(b) be prepared by a suitably qualified and experienced expert;			
	(c) be prepared in consultation with EPA and SCA; and	Noted, in		
	(d) include:	this SWLMP		
	a site water balance;			
	 an erosion and sediment control plan; 			
	 a stormwater management scheme ; 			
	 a surface water, groundwater and leachate monitoring program; and 			
	 a surface water, groundwater and leachate response plan. 			
17	The site water balance must:			
	 (a) identify the source of all water collected or stored on the site, including rainfall, stormwater and groundwater; 			
	(b) include details of all water use on site and any discharges;			
	(c) describe the measures that would be implemented to minimise water use on site			



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Relevant Condition	Requirement			
18	The erosion and sediment control plan must:			
	 (a) be consistent with the requirements in the latest version of Managing Urban stormwater Soils and Construction (Landcom); 			
	(b) identify the activities on the site that could cause soil erosion and generate sediment; and	Covered in Construction		
	 describe what measures would be implemented to: minimise soil erosion and the transport of sediment to downstream waters, including the location, function and capacity of any erosion and sediment control structures; and 	CEMP		
	maintain these structures over time.			
19	The stormwater management scheme must:			
	 (a) be consistent with the guidance in the latest version of Managing Urban Stormwater Council Hand book (DEC) 			
	(b) be capable of capturing and storing all rainfall and stormwater runoff from areas where waste(including organic outputs)is handled up to and including a 1:100 year, 24 hour duration storm event; and	Section 4.2.2		
	(c) include the detailed plans for the proposed surface water management system			
20	The surface water, ground water and leachate monitoring program must:			
	(a) be generally consistent with the guidance in EPA's Environmental Guidelines for Composting & Related Organics Processing Facilities			
	(b) include:	Section 5.1		
	baseline data;	Section 5.1		
	 details of the proposed monitoring network; and 			
	 the parameters for testing and respective trigger levels for actions under the surface water, groundwater and leachate response plan 			
21	The surface water, groundwater and leachate response plan must:			
	 (a) include a protocol for the investigation, notification and mitigation of any exceedances of the respective trigger levels; and 	Section 6		
	(b) describe the array of measures that could be implemented to respond to any surface or groundwater contamination that may be caused by the development.			
1(d)	Schedule 4 Environmental Management, Reporting & Auditing Environmental Management Plan			
1(d)	A quality assurance program for the design and installation of the leachate management system has been developed in accordance with Australian Standard AS 3905.2	Appendix D1.3		



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1.3.2 <u>Statement of Commitments</u>

The commitments made by Veolia, and incorporated into the Consent, relevant to soil, water and leachate are detailed in Table 1.2 below.

Table 1.2 – Statement of Commitments

Mitigation Measure	SWLMP Reference
Soil and Water Management	
Prior to the commencement of construction, sediment and erosion controls as set out in Section 6.2.1.3 of the original EA (Unwelt, 2006) will be implemented.	Noted
Clean water diversion drains will be constructed to achieve the revised drainage requirements for the Development, as shown in Figure 2.1.2 of the modification EA (Veolia, 2013)	Noted
A stormwater dam will be constructed to accept runoff from the 1 in 100 Year 24 hour duration Average Recurrence Interval event, as shown in Figure 2.1.2 of the modification EA(Veolia, 2013)	Section 4.2.2
A single leachate aeration pond will be sized to store run off from a storm of magnitude 1 in 10 year Average Recurrence Interval (ARI) 24-hour duration rainfall event, located as shown in Figure 2.1.2 of the modification EA (Veolia, 2013).	Section 4.3

1.3.3 Environment Protection Licence

EPL 20476 stipulates the environmental obligations for Veolia under the POEO Act. The EPL conditions relevant to the SWLMP are provided in Table 1.3.

Relevant Condition	Requirement		
3. Limit Co	nditions		
L1 – Pollut	ion 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	Noted	
L2 – Conce	entration limits		
L2.1	For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.	Section 5.1.2	
L2.2	Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.	Noted	
L2.3	To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.	Noted	

Table 1.3 – EPL Condition



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Relevant Condition	Requirement					SWLMP Reference	
L2.4	Water and/o	Water and/or Land Concentration Limits					
	POINT 8 Pollutant Units of Measure 50 Percentile concentration Limit 90 Percentile concentration Limit 3DGM concentration limit 100 percentile concentration limit					Noted	
	pН	рН				6.5-8.5	
	Total Suspended Solids	milligrams per litre				50	
-	g Conditions						
05.1	The stormwater retention pond must be capable of containing all stormwater runoff generated at the premises during a 24-hour duration 1-in-100-year Average Recurrence Interval (ARI) rainfall event						
05.2	The leachate aeration pond must be capable of accepting the leachate generated at the premises by any 1-in-10-year, 24-hour-period rainfall event section 4.3 without overflowing.						
O5.3		A freeboard of at least 0.5 metres must be maintained in the leachate aeration pond at all times Section 4.3					

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 Eco Project Site to resolve issues that impact local environmental amenity as a result of operations on site.

1.4.1 Government Agencies

The following government agencies have been consulted with in association with the operations of the Woodlawn MBT Facility pertaining to soil, water and leachate management:

- DPE;
- NSW EPA;
- Water NSW

1.4.2 <u>Community Consultation</u>

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 local amenity from operations at the Eco Project Site. Information about the Woodlawn MBT Facility will be accordingly management.

The key objectives of the communication and consultation program shall include:



- Educating stakeholders regarding key aspects of the Woodlawn MBT Facility; and
- Informing community groups and neighbours to help Veolia understand concerns.

Community consultation activities include, but are not limited to:

- A dedicated Veolia webpage, offering general information on the Woodlawn MBT Facility;
- A community telephone line to provide a central point of contact for community enquiries;
- Proving regular updates in the local newspaper (Tarago Times) a non-profit community service, published monthly by the Tarago Sporting Association Inc. It is distributed throughout Tarago, Lake Bathurst, Mayfield, Boro, Taylors Creek and the surrounding district.
- Active participation in the Tarago and District Progress Association Incorporated (TADPAI), which is a community group aimed at promoting the district and assisting the community in the development and maintenance of a rural lifestyle.



Section 2 GOALS OF SWLMP

The goals of the SWLMP are to:

- Detail how soil, water and leachate is managed at the Woodlawn MBT Facility;
- Provide a water balance for inputs, usage and outputs of water at the Woodlawn MBT Facility;
- Detail measures to minimise the potential for erosion and mobilisation of sediment at the Woodlawn MBT Facility;
- Detail measures to control stormwater and separate stormwater and leachate management systems at the Woodlawn MBT Facility;
- Detail measures to protect receiving waters from activities associated with the Woodlawn MBT Facility;
- Detail the leachate barrier system installed at the Woodlawn MBT Facility to prevent soil and water contamination of the surrounding environment;
- Detail suitable monitoring schedules; and
- Identify triggers for response to incidents.

2.1 Roles and Responsibilities

Table 2.1 outlines the responsibilities of Veolia personnel with respect to soil, water and leachate management.

Action	Responsibility		
Overall implementation of the SWLMP	Woodlawn MBT Manager and operational personnel		
Implement management measures for soil and water including leachate	Woodlawn MBT Manager and operational personnel		
Maintenance of soil and water, including leachate management controls	Woodlawn MBT Manager and operational personnel		
Coordinate monitoring and compile reports	Woodlawn Environmental Officer or nominee		
Maintain internal records of monitoring	Woodlawn Environmental Officer or nominee		
Undertake inspection of soil and water, including leachate management controls	Woodlawn MBT Manager or Woodlawn Environmental Officer or nominee		
Facilitate training programs for soil and water, including leachate	Woodlawn MBT Manager or Woodlawn Environmental Officer or nominee		
Collate and maintain records of complaints, respond to complainants.	Woodlawn Environmental Officer or nominee		
Identify non-conformances and notify Facility Manager/ Safety Health Environment Quality (SHEQ) Representative	Woodlawn Environmental Officer or nominee		
Authorise and confirm the implementation of mitigation measures	Woodlawn MBT Manager or Woodlawn Environmental Officer or nominee		

Table 2.1 – SWLMP Responsibilities

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Section 3 EXISTING ENVIRONMENT AND OPERATIONAL IMPACTS

3.1 Existing Environment

3.1.1 Soil Landscape and Topography

The soil landscape mapping of the Eco Project Site area depicted in the Soil Landscapes of the Braidwood (Jenkins, 1996) indicates the MBT Facility footprint overlies the Duckfield Hut and Duckfield Hut variant soil landscapes, which are generally loam and clays. The Disturbed soil landscape, also occurring in the area, is due to past human activities such as clearing for pastoral land and mining that renders the land not suitable for cultivation and with moderate limitations for grazing (Umwelt, 2006).

Grazing at the 30 hectare (ha) site was undertaken historically, prior to the Woodlawn Mine operations in the 1970s and, anecdotal evidence suggests, converted as a clay borrow pit towards the north eastern part of the site.

The MBT Facility is located at an elevation of approximately 795 m AHD on the south of the site and sloping to an elevation of 788 m AHD at the north of the site. Topography of the surrounding terrain is generally flat, with some minor sloping to the north of approximately 5%.

While the MBT Facility site has been considered to be disturbed with poor drainage and fertility, given the site history, there was negligible existing soil contamination determined to be present (Umwelt, 2006).

3.1.2 Hydrogeology and Hydrology

The MBT Facility site lies in regional settings of volcanic rocks, which form part of the Lachlan Fold Belt of south-eastern NSW. The hydrology of the site is dominated by volcanic rocks which are of low permeability, and which exhibit low hydraulic conductivity.

Groundwater has been encountered at 783.9 metres (m) reduced level (RL), which is likely to increase in the south and may vary locally across the MBT Facility site (Golder, 2013). The regional groundwater table is a subdued reflection of surface water topography with gradient away from the Great Dividing Range and towards Crisps Creek and Lake Bathurst.

Located along the Great Dividing Range, the MBT Facility site is within the Allianoyonyiga Creek catchment, which forms part of the Lake George catchment area. Allianoyonyiga Creek has a catchment area of approximately 1300 ha and flows in a westerly direction towards its confluence with Willeroo Creek before flowing into Lake George, approximately 9 km from the MBT Facility.

The MBT Facility is sited within a closed water management system, which ensures no discharge to the downstream environment.



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3.2 Predicted Soil, Water and Leachate Impacts

The environmental assessment undertaken for the MBT Facility sought to identify potential soil, water and leachate impacts and risks associated during its operational phase.

Table 3.1 lists these impacts and risks. This risk assessment determined the level of mitigation required for those impacts.

Issue	Potential Impact	Source	Risk Ranking	Control required and reference, where applicable
Soil	Soil contamination	Negligible existing soil contamination; Contamination possible from leachate infiltration, without control measures.	Low	No, addressed in design of facility; Construction of concrete pads and the leachate barrier system in all areas where waste is to be handled restricts leachate migration pathways into underlying soil. Refer to Section 4.1
Soil Erosion	Run off the Sediment to receiving waters	Negligible because of the construction of the concrete pads in external areas	Low	. All areas around the MBT site will be top soiled using the saved topsoil from the original land clearing. Spray seeding of the local council recommended "con seed mix" will be used for batter stabilisation and regeneration with planting of some treed areas.
Water	Leachate generation	Uncontrolled rainfall and contact of water with waste in operational areas; Release of leachate from operational areas, causing pollution of receiving waters.	Low (net benefit)	No, addressed in design of facility; Diversion of clean rainwater/stormwater into tanks/ponds; Reduced leachate generation due to enclosed processing areas. Containment of leachate in leachate pond; Refer to Sections 4.2 and 4.3
Surface water	Contamination of surface waters	Contamination from transport of sediments and/or leachate migration possible without control measures.	Low - moderate	Yes, addressed in design of facility and ongoing operational control measures; Installation of bunds and water management measures; Capture of clean rainwater/stormwater into tanks/ponds; Diversion of contaminated surface water runoff into leachate pond; Containment of leachate in leachate pond; Management of compost stockpiles and site drainage; Refer to Section 4.2.2
Ground Water	Contamination of groundwater	Contamination possible from leachate infiltration, without control measures.	Low	No, addressed in design of facility; As no access to groundwater is anticipated for the

Table 3.1 – Soil and Water Risk Rating



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Issue	Potential Impact	Source	Risk Ranking	Control required and reference, where applicable
				MBT, contamination pathways are not likely;
				Installation of bunding and water management measures
				Construction of concrete pads and the leachate barrier system in all areas, where waste is to be handled, restricts leachate migration pathways into groundwater.
				Refer to Sections 4.1 and 4.2

Section 4 SOIL, WATER AND LEACHATE MANAGEMENT MEASURES

4.1 Soil Management

Potential soil impacts are minimised at the Woodlawn MBT through the construction of:

- Concrete pads in the processing buildings and hardstand on external surfaces;
- A leachate barrier system;
- Surface water management infrastructure to prevent:
 - \circ $\;$ the run-on of clean surface water to the site ,
 - runoff of leachate from the site;
 - o cross contamination; and
- An aeration pond to contain and treat leachate;

To manage sediment transport issues,

- Stockpiles on the Compost Storage area will be formed away from the areas of drainage flows.
- Batters around the site including diversions channels and cuts will be stabilized by the local council recommended, "con seed mix".
- Stockpiles will be maintained to avoid wind erosion through management of moisture levels;

Ongoing regular inspection and maintenance of the constructed hardstand areas will form part of the checks for the MBT Facility site. This will mitigate against both soil and groundwater contamination from potential leachate infiltration.

4.2 Water Management

The water management system has been designed to ensure that surface and ground water systems are not contaminated as result of the operations of the MBT Facility.



4.2.1 <u>Site Water Balance</u>

An assessment of the water demand during the operation phase of the MBT Facility has been undertaken to account for the enclosed composting process and the water infrastructure capacity requirements for leachate and stormwater. The predicted water demand for the MBT Facility indicates that enclosed MBT processing areas result in low leachate generation and storage requirements.

A water balance, based on the likely demand for potable water usage during the operational phase of the MBT Facility has been calculated however, non-potable water usage will also augment the water supply for the site.

Tanks have been installed to capture rainwater and storage of water extracted from the Willeroo Borefield, as described below, for use in the MBT processes. This negates potable water usage and the need to have significantly large storm water or leachate storage devices.

The operational water management infrastructure comprises;

- 1 x 30 kL rainwater tank;
- 2 x 475 kL process water tanks;
- 1 x 4.6 ML stormwater storage pond;
- 1 x 1.9 ML leachate aeration pond;
- 2 x 144 kL firewater tanks ;

The water balance shown in Figure 3.1 below describes the inputs and outputs of the flow of water at the MBT Facility and the water management infrastructure that:

- achieves sufficient storage capacity
- complies with regulatory requirements; and
- sustains onsite water usage while minimising the use of potable water.

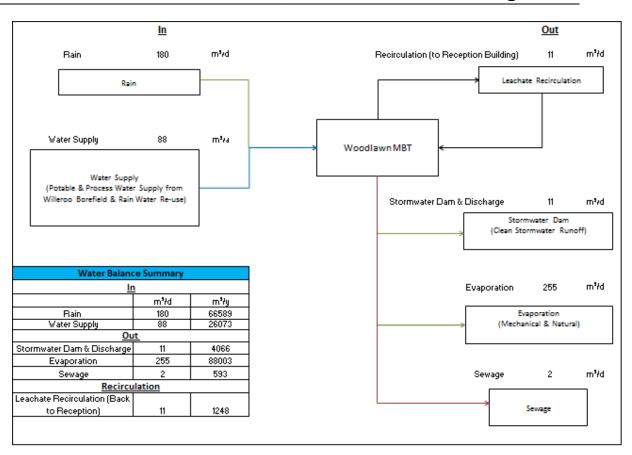
A detailed water balance is provided in **Appendix D1.1** of this plan.

Figure 3.1-Water Balance for MBT facility



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4.2.1.1 Water In

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The sources of water used to supply the MBT Facility during its operational stage are detailed below:

- i. Rain
 - Rain from the roof of the buffer building is captured in the rainwater tank for reuse on-site as required. This tank overflows to the stormwater pond, if full.
 - Stormwater runoff from the site that has not been contaminated by waste will be directed to the stormwater pond
 - Stormwater run-off from the compost storage area and around the tipping platform area, which may be potentially contaminated with organics, is directed towards the leachate aeration pond.

ii. Water Supply

Veolia has a licence to draw water from the Willeroo Borefield for operational purposes. Water supplied from this source is stored in two process water tanks and reticulated for:

- Potable water uses:
 - Sanitary and safety facilities for operational employees to utilise.
- Process water uses:
 - Washing down areas;
 - Addition of water in BRS drums;
 - Biofilter moisture maintenance for the odour control system; and
 - Spray irrigation for dust suppression in the Compost Storage Area;
- Firefighting uses

4.2.1.2 Water Usage

Based on the sanitary and safety requirements at the MBT Facility, an average total water demand and usage was calculated to be 2.1 m^3 /day.

Based on the process water demand described above, process water usage and losses are quantified in Table 4.2 below.



Process Inputs	Anticipated Demand	Usage/Process Loss	Output
Washdown	26.5	0	26.5
BRS process	38.5	38.5	0
Biofilters	11.3	7.6	3.7
Dust suppression	20.3	20.3	0
Total (m ³ /day)	96.6	66.4	30.2

Table 4.2- Daily averages for site water usage and process loss

4.2.1.3 Water Out

Water outputs generated from the MBT Facility and its processes during its operational stage will be as follows:

- Stormwater runoff from areas of the site that has not come into contact with waste (to stormwater pond);
- Stormwater run-off from areas of the site with potential contact with waste or compost stockpiles (to leachate aeration pond);
- Leachate from operational areas, including but not limited to, the processing buildings, fermentation building, tipping platform area, and any wash down waters (to leachate aeration pond);
- Evaporation (both via natural and mechanical processes, including from the above ponds and the biofilters)
- Sewage generated from the sanitary facilities;

4.2.1.4 Water Reuse

- Water in the leachate aeration pond will be used to supplement water supply from the process water tanks; and,
- Water from rainwater tanks will be re-used as required.

4.2.2 Stormwater Management Scheme

The MBT Facility shall be maintained as a zero discharge site during its operational stage. The Stormwater Plan (refer **Appendix D1.2**) for the MBT Facility describes the capture and storage of rainfall and storm water runoff on site utilising the surface water management system implemented on site. This system comprises infrastructure, consistent with the requirements of *Managing Urban Stormwater: Council Handbook*, has the following capacity.



- Rainwater Tank:
 - 0 To minimise water use on site, a 30 kL rainwater tank has been installed as part of the measures to supplement potable and non potable water demands at the MBT Facility.
 - The tank was sized based on the available catchment area of the buffer \cap building roof and its rainfall capture efficiency.
 - The tank height has been limited to 6m to remain below building roof 0 heights.
 - In any large storm events, excess rainfall runoff from the tank shall be directed to the stormwater pond
 - Stormwater Pond
 - 0 To ensure no uncontrolled stormwater captured from the MBT Facility site is discharged, the 4.6 ML onsite stormwater retention pond meets the capacity for a 1 in 100-year ARI 24-hour storm event.
 - As described in the water balance, stormwater runoff from the site that comes into contact with waste will be directed to the stormwater pond.
 - Stormwater run-off from operational areas, potentially contaminated 0 with organics will be directed towards the leachate aeration pond, as described in the previous section.

4.3 Leachate Management

The leachate management system for the Woodlawn MBT facility is managed separately to the stormwater system to ensure that separation between rainfall run-off and leachate is maintained. To reduce the generation of leachate, all processing areas are undercover. The leachate management system has been designed to ensure contaminated water and/or leachate drains to the leachate aeration dam, to prevent leachate escaping from the site to surface water, groundwater or subsoil. The system comprised as follows:



- Leachate Aeration Pond
 - Collects all leachate to prevent it from escaping from the site to surface water, groundwater or subsoil
 - The leachate aeration pond of capacity 1.9ML has been designed for a 1 in 10-year ARI 24-hour event;
 - The pond has a compacted clay or modified soil layer that is at least 90 centimetres thick and in situ coefficient of permeability of less than 1 × 10⁻9m/s, or some other suitable liner approved by EPA, with side slopes of less than 1 vertical to 3 horizontal and a freeboard of at least 0.5m.
 - As described in the previous section and the water balance for the MBT Facility, all water that comes into contact with waste or compost is treated as leachate and diverted to this pond.
 - Level sensor is installed on the leachate aeration pond to monitor the level of the leachate in the leachate aeration pond. Level sensor will communicate back to SCADA(supervisory control and data acquisition)
 - The pond will be aerated as required to maintain the aerobic conditions in the pond. Oxygen sensor to measure dissolved oxygen is installed on the leachate aeration dam to measure the effectiveness of the aeration system. Set point for dissolved oxygen for leachate aeration pond at MBT is set at 1.5 mg/L as low initially. Operational dissolved oxygen set point will be defined during the wet commissioning phase.
 - To reduce the water demand of the MBT Facility, water captured in the leachate aeration pond shall be reused within the MBT processes, where possible.
- Leachate Barrier System
 - The leachate barrier system has been installed on the compost storage area, to ensure the direct impoundment of leachate within this area.
 - The system consists of a re-compacted clay or modified soil layer that is at least 60 centimetres and has in situ coefficient of permeability of less than 1 × 10⁻⁷m/s, or some other suitable liner approved by the EPA and drains to the leachate dam at a minimum gradient of 0.5%;
- Waste Floor
 - The floor of the processing buildings that comes in contact with waste and any other operational areas likely to be in contact with leachate, have been constructed with concrete at least 10cm thick of concrete
- Existing Sewerage System

The aerated wastewater treatment including the effluent irrigation (Appendix D1.4) is installed in accordance with the recommendations in the Installing on-Site Wastewater Systems (Sydney Catchment Authority, 2012).All



sewerage is collected within a wastewater treatment system. All wastewater and solids enter the system via a sewer main into the primary treatment tank where digestion processes take place. Anaerobic microorganism's breakdown faecal solids to an inert waste.

Two chambers then provide aerobic treatment using a flow through media pack fixed below water level. Aerobic micro-organisms quickly form and form and attach to the media pack cleaning the water as it passes through.

Surge control allows water to rise and fall by up to 250 litres controlling flow to less than 10 litres per minute. The settling sludge in the sedimentation chamber is returned to the primary inlet of the septic tank. Treated effluent is disinfected and pumped to a small spray irrigation area adjacent to the system for evaporation. The aim of this is to maintain a moist surface without waterlogging the area, causing potential runoff.

Pump outs of the system are required on an infrequent basis which is managed as required. Quarterly servicing and maintenance of the system is carried out in accordance with the licence to ensure that the system is operating efficiently.

The sewage treatment system is regulated by Goulburn-Mulwaree Council with inspections undertaken following notification. Any follow up actions identified by the Council Officer are addressed as soon as practicable.



Soil, Water & Leachate Management

Section 5 SOIL, WATER AND LEACHATE MONITORING AND REPORTING

5.1 Monitoring Program

The soil, water and leachate monitoring program for the MBT Facility during its operational stage has been developed in accordance with the Consent and EPL requirements, as well as best practice industry guidelines. Guidance provided in the *Environmental Guidelines for Composting and Related Organics Processing Facilities* (DEC, 2004) and the *Australian Water Quality Guidelines for Fresh and Marine Waters* (ANZECC, 2000) has also been considered to ensure performance measures are met.

5.1.1 Baseline Data

5.1.1.1 Soil

Given that migration pathways to the underlying soil have been restricted with the construction of hardstand areas and the leachate barrier system, soil monitoring does not form part of the monitoring program for the MBT Facility.

Previous investigations have indicated that there is negligible existing soil contamination determined to be present at the site (Umwelt, 2006). It is anticipated that the operational stage of the MBT Facility is not likely to contribute to soil contamination.

5.1.1.2 Water

The mechanical, electrical, hydraulic, civil, etc. components of onsite water infrastructure will be monitored through the Veolia Asset Management System for maintenance as per the manufacture's specs. to ensure that each component is properly operated and maintained. This will form part of the inspection and testing register for the MBT Facility as described in Section 5.1.1 of the OEMP. The frequency of inspections may vary depending on site-specific attributes and rainfall patterns. In addition, the following water quality testing will be undertaken.

Surface Water:

Baseline data for surface water has been obtained from water quality monitoring undertaken for monitoring location Site 115 - Allianoyonyiga Creek (EPA Identification no. 1). The pollutant concentration trends are generally consistent and is outlined in Table 5.1

Pollutant	Value		
рН	6.1 - 8.6		
Electrical Conductivity	805 – 2970 uS/cm		
Ammonia	0.1 mg/L		
TOC	14mg/L		

Table-5.1- Baseline	Data-Surface Water	
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Groundwater:

Groundwater infiltration is minimised with the construction of hardstand areas and the leachate barrier system at the MBT Facility. There will be no ground water collected and stored on the site except for the bore water drawn from the Willeroo Borefield for operational purpose as explained in Section 4.2.1.1

There are groundwater wells in the vicinity of the MBT Facility that are monitored as part of the Woodlawn Bioreactor (EPL 114360). Information pertaining to groundwater quality, as required for the MBT Facility will be extracted from these locations (MB7&, MB11, MB12, MB13 and WM6) as shown in the Woodlawn Bioreactor Monitoring Locations (Appendix D1.5)

In addition, a new groundwater well will be installed near the leachate aeration dam prior to the transfer of leachate. This will enable the monitoring and detection of any leachate migration from the dam to the underlying groundwater. A baseline will be determined on installation of the well.

Leachate:

The level of the water in the leachate aeration pond will be visually monitored on a regular basis and after every rainfall event to make sure that the free board space is maintained at all the times. In the event of a heavy storm, water from the leachate aeration pond will be pumped to the Reception Building pit to maintain a 0.5 m free board space.

Leachate characterisation will be undertaken initially to establish baseline data and a leachate profile. Based on the leachate generation rates from the MBT Facility, sampling frequency will be assigned.

5.1.2 Monitoring Network and Parameters

The monitoring network and sampling parameters for the MBT Facility are outlined in Table 5.2 below

Location	Parameters	Frequency	Requirement	Performance Measure/ Trigger Levels	Monitoring Method
	Biological Oxygen Demand			Baseline	Approved Methods for the Sampling and Analysis of Water Pollutant in New South Wales Approved Methods for the Sampling and Analysis of
	Electrical Conductivity		Consent Condition 20(b) EPL Condition M2.3 POEO (General) Regulation 2009 cl.3(b)		
EDI	Ammonia				
EPL Identification No. 1 (Allianoyonyiga Creek)	Dissolved Oxygen				
	рH	Quarterly			
	Potassium				
	Redox Potential				
	Total Suspended Solids				
	Total Organic Carbon				
EPL Identification No. 8 (Discharge	рН	Daily during discharge	Consent Condition 20(b) EPL Condition	6.5-8.5	Water Pollutant in New South Wales
	EPL Identification No. 1 (Allianoyonyiga Creek) EPL Identification No. 8	EPL Identification No. 1 (Allianoyonyiga Creek) EPL Identification No. 2 (Allianoyonyiga Creek) EPL Identification No. 8 (Discharge Biological Oxygen Demand Electrical Conductivity Ammonia Dissolved Oxygen PH Potassium Redox Potential Total Suspended Solids Total Organic Carbon PH	EPL Identification No. 1 (Allianoyonyiga Creek)Biological Oxygen Demand Electrical ConductivityAmmonia Dissolved Oxygen PHQuarterlyPH Potassium Redox Potential Total Suspended Solids Total Organic CarbonQuarterlyEPL Identification No. 8 (DischargePHDaily during dischargeDaily during discharge	EPL Identification No. 1 (Allianoyonyiga Creek)Biological Oxygen Demand Electrical ConductivityConsent Condition 20(b)Ammonia Dissolved Oxygen pHDissolved Oxygen pHEPL Condition M2.3Potassium Redox Potential Total Suspended Solids Total Organic CarbonPOEO (General) Regulation 2009 cl.3(b)EPL Identification No. 8 (DischargepHPL Identification No. 8 (DischargepHPOED (General) Regulation 2009 cl.3(b)	LocationParametersFrequencyRequirementMeasure/ Trigger LevelsBiological Oxygen DemandElectrical ConductivityAmmoniaAmmoniaAmmoniaAmmoniaEPL Identification No. 1 (Allianoyonyiga Creek)Dissolved OxygenAumoniaEPL Condition M2.3BaselinePotassium (Allianoyonyiga Creek)Potassium Redox Potential Total Suspended SolidsPOEO (General) Regulation 2009 cl.3(b)BaselineEPL Identification No. 8 (DischargePHDaily during dischargeConsent Condition 20(b)EPL Condition BaselineEPL Identification No. 8 (DischargePHDaily during dischargeConsent Condition 20(b)6.5-8.5

Table 5.2 – Water quality monitoring requirements



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Soil, Water & Leachate Management

		Total Suspended Solids		POEO (General) Regulation 2009 cl.3(b)	50mg/L
Groundwater	New Groundwater monitoring well that will be installed close to the leachate aeration dam	pH Electrical conductivity Ammonia, Total organic carbon, Sulphate Zinc Lead	Quarterly		Baseline
Groundwater	New Groundwater monitoring well that will be installed close to the leachate aeration dam	Alkalinity (as calcium carbonate) Aluminium, Arsenic, Barium, Benzene, Cadmium, Calcium, Chloride, Chromium (hexavalent), Chromium (total) Cobalt, Copper, Ethyl Benzene, Fluoride, Lead, Magnesium, Manganese, Mercury, Nitrate, Nitrite, Nitrogen (ammonia), Organo chlorine Pesticides, Organophosphate Pesticides, Polycyclic Aromatic Hydrocarbons, Sodium, Standing Water level, Sulphate, Toluene, Total Organic Carbon, Total Petroleum Hydrocarbons, Total Phenolic, Xylene, Zinc	Once at the commissioni ng of the well		NA
Leachate	Leachate aeration pond	Alkalinity (as calcium carbonate), Aluminium, Arsenic, Barium, Benzene, Cadmium, Calcium, Chloride, Chromium (Hexavalent) Chromium (Total) Cobalt, Conductivity, Copper, Ethyl benzene, Fluoride, Iron, 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	6 monthly for leachate characterizat ion (to commence 6 months from the date of commissioni ng of the leachate aeration dam) Frequency will be reviewed after the sufficient data is captured	Characterization	NA
		Level inspections to maintain 0.5m freeboard	Weekly/After every rainfall event	Operational Performance	Not exceeding freeboard



5.2 **Performance Reporting and Review**

All compliance monitoring data including the comparison for actual and computed water balance key components-Rainfall data, process water usage and leachate generated on the site will be presented in the Annual Environmental Management Report (AEMR), which is submitted to the DPE & EPA. Where performance reporting is required, the EPL stipulates that all relevant data and information pertaining to environmental monitoring must be recorded and maintained onsite, 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. •

5.3 Exceedances and Corrective Actions

Details of exceedances and corrective action for any soil, water or leachate related incidents are provided as part of the response plan detailed in Section 6 of the SWLMP.

5.4 Publishing of Monitoring Data

Veolia publishes the results of any environmental monitoring undertaken for regulatory requirements on its website:

http://www.veolia.com.au/nsw-monitoring-reports

PLAN



Soil, Water & Leachate Management

Section 6 SURFACE WATER, GROUNDWATER AND LEACHATE RESPONSE PLAN

In line with regulatory requirements, a response plan has been prepared detailing the measures to be implemented in response to any water contamination that may arise due to the operation of the Woodlawn MBT. Protocols for the investigation, notification and mitigation of any exceedances to respective trigger levels are also detailed in this section. Table 6.1 describes the triggers and actions to be taken in the event that there is an exceedance of the trigger levels listed below.

Location	Pollutant	Performance Measure/ Trigger	Action	Responsibility	
	рН	6.5 to 8.5	General housekeeping inspections and clean up;	Facility Manager	
	Suspended solids	no greater than 50mg/L	Follow incident process for spills, pump out etc		
Surface water pond	Oils and grease	No visible films or odour	(refer Figures 6.1 and 6.2).	and/or SHEQ /	
	Litter	No visible litter washed (or blown) from the site	Where applicable, report exceedance to DPE, EPA, Goulburn Mulwaree Council and any other relevant government agencies	Environmental representative	
Groundwater wells	As per the Eco Project Site analytes testing regime	Existing groundwater network performance against baseline	Review Eco Project Site groundwater monitoring results; Identify exceedance, consider resampling and/or continue periodic monitoring to gauge any upward trends; Where applicable, report exceedance to DPE, EPA, Goulburn Mulwaree Council and any other relevant government agencies	Facility Manager and/or SHEQ / Environmental representative	
Leachate pond and/or waste processing/ operational areas	Leachate	0.5 m freeboard space in pond Visual inspections for spills, leaks, level exceedances	Pump leachate from pond to Reception Building pit; Follow incident process for spills, containment etc. (refer Figures 6.1 and 6.2). Where applicable, report exceedance to DPE, EPA, Goulburn Mulwaree Council and any other relevant government agencies	Facility Manager and/or operational personnel	

Table 6.1 Triggers and Actions



Handling of any soil, water and leachate related incidents will be managed in accordance with the process outlined in Section 4.4 of the OEMP. The Facility Manager, or their site nominee, will record and manage all incidents in accordance with Veolia's incident notification and reporting procedures.

Incidents will be managed in accordance with Veolia's Non Conformance Procedure (PRO-COL-000-137). Investigations will be undertaken in accordance with the NSW Incident Investigation Procedure (PRO-NSW-000-130) or on a case by case basis depending on the severity of the incident as described in Section 5.1.1 of the OEMP.

At completion of any investigation, any corrective actions required will be recorded in the Vault and managed in accordance with the NSW Corrective Action and Non Conformance Procedure (PRO-NSW-000-132) in a timely manner.

An Emergency Response Plan (ERP) has been developed for the MBT Facility and is appended to the OEMP. The ERP identifies the procedures to be followed in the event of an emergency and is to be used as protocol in the event of an exceedance. The process for dealing with potential incidents and emergencies at the MBT Facility is summarised in Figure 6.1 below.



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This flowchart provides a basic guideline to emergency response. As such it cannot predict every emergency situation that could occur. Never place yourself or others at risk when following these procedures. Refer to your site Emergency Response Plan for further information.

Emergency and Environmental Incident Response Flow-Chart

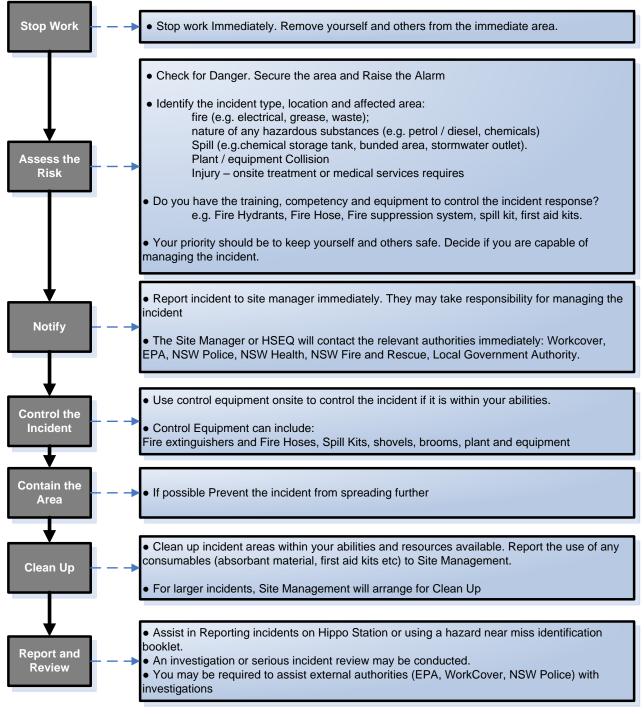


Figure 6.1 Emergency and Environmental Incident Response Flow Chart

PLAN



In addition to the emergency and environmental incident response process described previously, the following process provides additional guidance for the response to water quality contamination through incidents such as spills or overflows.

Containment may include the use of absorbent material to contain the spill/discharge. Spill kits are available onsite at all times and training in their use is to be provided to all personnel at the Woodlawn MBT.

Any fuel, lubricant, or hydraulic fluid spillages is contained through the design of site bunding, and any excess material may also be collected using absorbent material, with contaminated material disposed of to a licensed waste facility.

A typical spill response procedure to be followed by Veolia personnel is summarised in Figure 6.2 below.

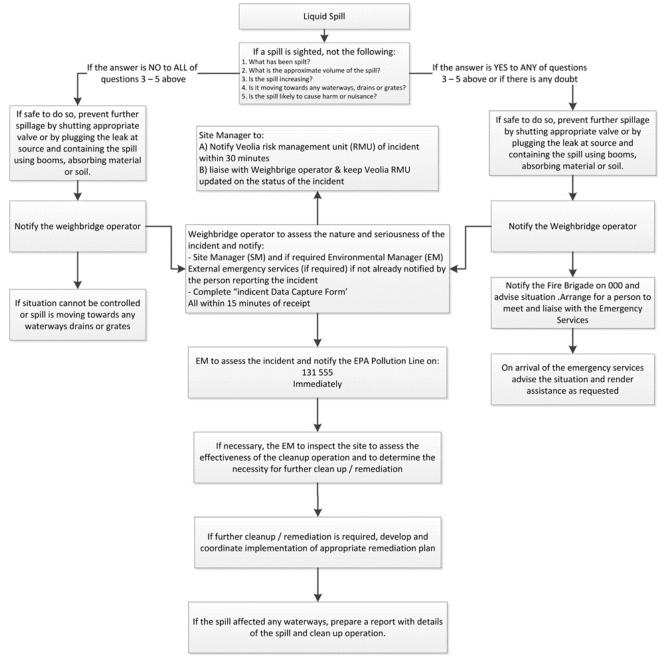


Figure 6.2 Typical Spill Response Flow Chart



References

- Australian and New Zealand Environment and Conservation Council. (2000). *Australian Water Quality Guidelines for Fresh and Marine Waters*.
- Department of Environment and Conservation, NSW. (2003). The Environmental Guidelines for Composting and Related Organics Processing Facilities. Unwelt Environment Consulting. (2006). Environmental Assessment: Woodlawn Expansion Project Volume 1 – Main Report.
- Environmental Protection Authority. (1997). *Managing Urban Stormwater:* Council Handbook
- Golder and Associates Pty Ltd. (2013). Geotechnical and Environmental Investigation Report (137622009-001-r-Rev0).
- Jenkins B.R. (1996). Soil Landscapes of the Braidwood 1:100,000 Sheet map and report. Department of Land and Water Conservation, Sydney
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- Sydney Catchment Authority (2012) Installing On-Site Wastewater Systems



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Appendices

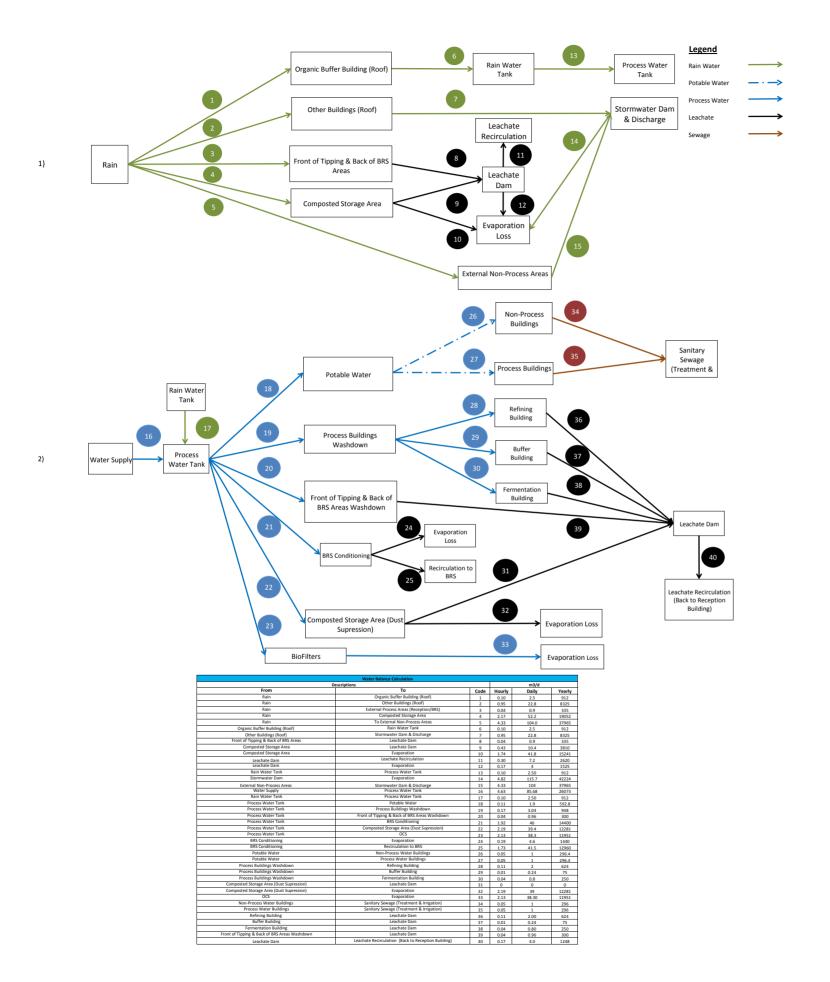


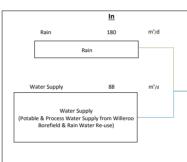
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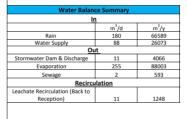
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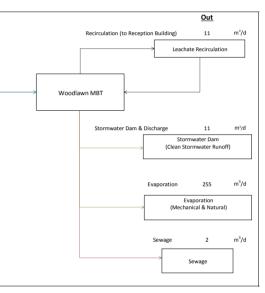
Soil, Water & Leachate Management

Appendix D1.1 Detailed Water Balance







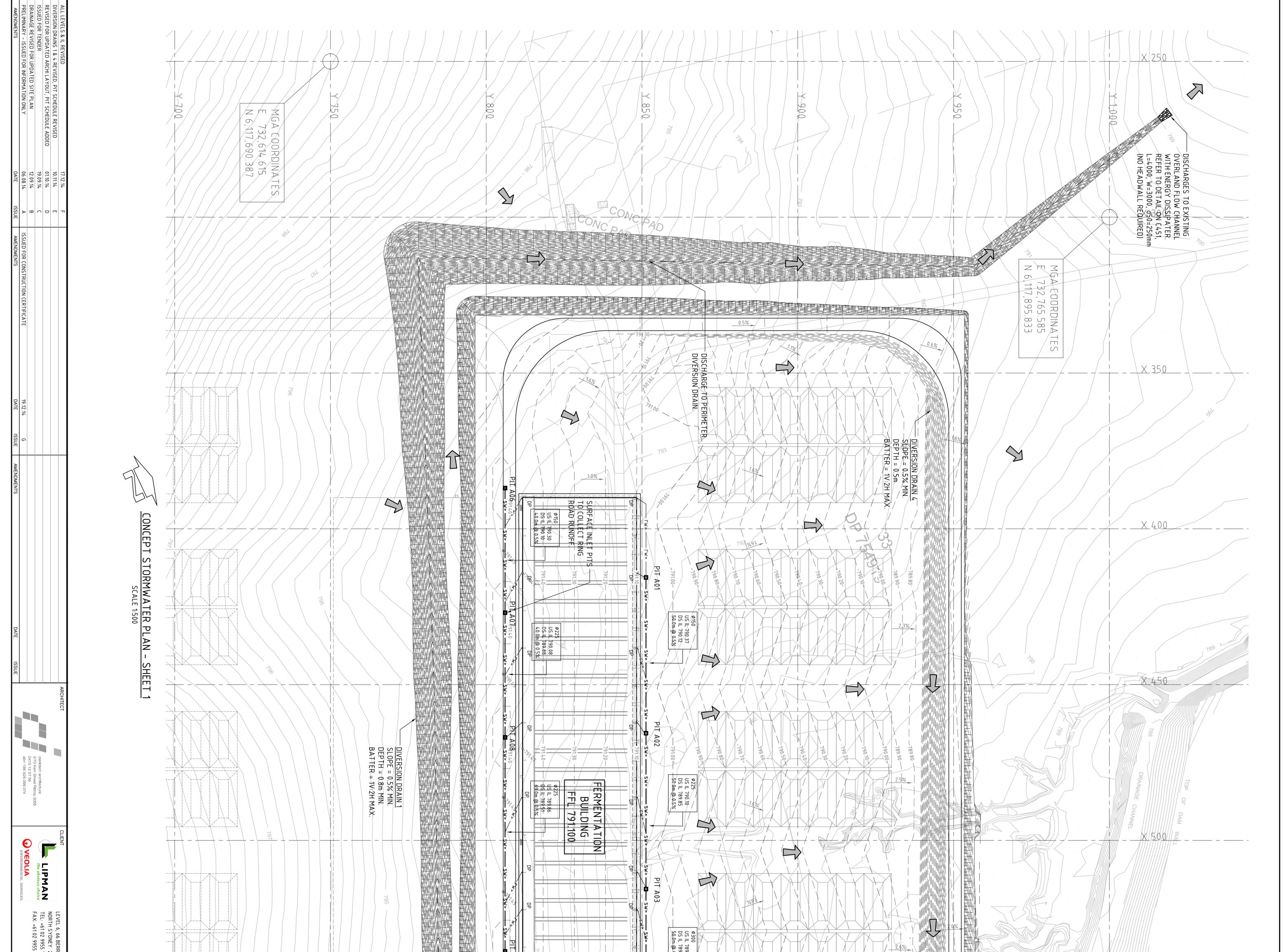




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PLAN

Appendix D1.2 Stormwater Plan



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	006×006	SGGP	1050	791.35	PIT A06
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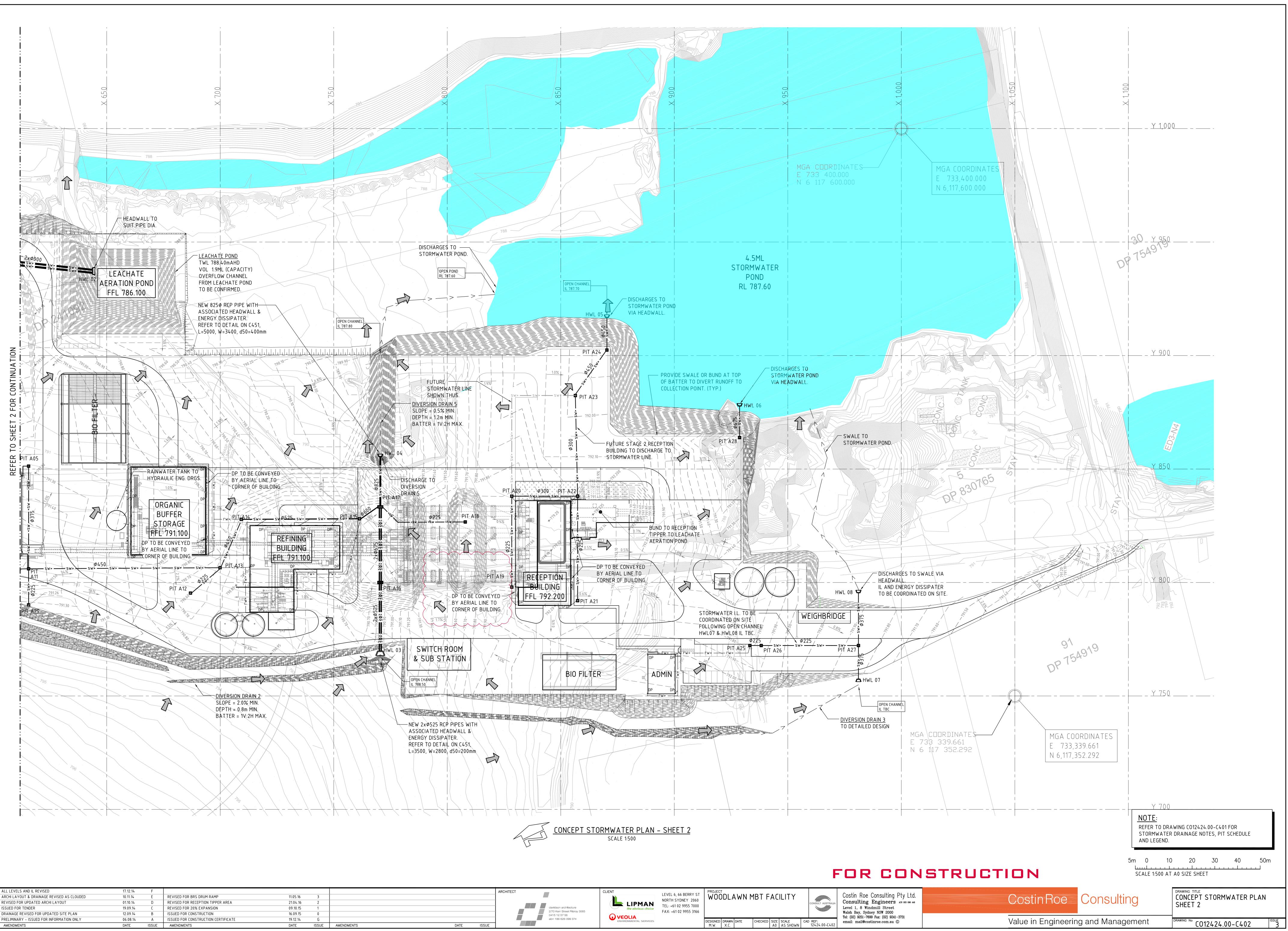
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Consulting



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Appendix D1.3 Verification of Compliance – Leachate Management



DATE

Subcontract Superintendent Lipman Pty Ltd NORTH SYDNEY NSW 2060 Level 6, 66 Berry Street

Attention: Mr Jason King, Senior Project Manager

Dear Jason,

RE: VEOLIA MBT WOODLAWN SUBCONTRACT NO: 1404-6300 SERVICES SUBCONTRACT NO: 1404-6300 DESIGN AND CONSTRUCT HYDRAULIC VERIFICATION OF COMPLIANCE – LEACHATE BARRIER SYSTEM

following: Composting Area and the Leachate 10-123-0001), Civil Drawings and EPA requirements, a leachate barrier system for both the Pursuant to the Hatch Technical Performance Specification – Civil Works (H345190-0000-Storage Pond have been constructed to meet the

7.1.1 – Leachate barrier

m/s. underlying layer." "Be a clay layer a minimum of 600mm thick with an in situ permeability (K) of less than 10⁻⁷ Clay shall be placed in successive layers not more than 300mm thick with each

7.2 – Leachate Storage Pond Liner

situ permeability (K) of less than 10-9 m/s. "The leachate storage pond liner shall be a clay layer a minimum of 900 mm thick, with an in layers not more than 300 mm thick with each underlying layer." Clay material shall be placed in successive

In addition to the 900mm clay layer, bentonite layer has been compacted into the top layer

The following evidence is provided to confirm these requirements

C7755 Proposed Veolia Development, Woodlawn Bioreactor – Permeability

- 15928 CONFORMANCE SG2 REV 01 JJ1
- 1
- 1 15928 CONFORMANCE SG1 REV 01 JJ1
- 1 15928-CONFORMANCE-SG1-REV 01 SHEET 1
- 15928-23-FERM-DRYING-REV 01 SHEET 2
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- 1 15928-23-FERM-DRYING-REV 01 SHEET 2

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Signature: 10m

Full name: Tom Paton

Qualification: Managing Director

Date: 24/11/16



74 Hunter Street Newcastle, NSW 2300, Australia (PO Box 1346, Newcastle, NSW 2300, Australia) Telephone +61 2 4925 9600 Facsimile +61 2 4925 3888 www.smec.com

28 April 2016

LIPMAN PTY LTD VEOLIA – WOMBAT PROJECT Level 6, 66 Berry Street North Sydney NSW 2060

ATTENTION: Mitchell Jeffries

RE: PERMEABILITY OF ON-SITE MATERIALS – Woodlawn MBT Facility

At the request by Lipman Pty Ltd, SMEC Australia have undertaken an investigation to review and test on-site materials at Woodlawn (Residual Clay) for use within the proposed hardstand/liner area for the Compost Storage Area for the new MBT facility at Woodlawn. The aim of the investigations was to evaluate the material properties of the existing onsite materials and assess whether this material could achieve the nominated permeability of 1×10^{-7} m/s as prescribed by the EPA.

EPA Requirements for Leachate Barrier System

The Compost Storage Area is required to comply with the NSW EPA's "Environmental Guidelines for Composting and Related Organics Processing Facilities", July 2004. Chapter 5 of this document specifies the minimum design requirements. The Compost Storage Area Hardstand is required to comply with the requirements of Sections 2 and 3 of Chapter 5 which relate to the Leachate Barrier System and Leachate Collection System. Essentially water runoff from the Compost Storage Area is required to be collected in a leachate collection system and then transferred to a storage system.

There is also a requirement for the hardstand to have a minimum permeability to reduce leachate entering the groundwater system. Section 2 of Chapter 5 states;

"Acceptable leachate barriers include;

- A clay or modified soil liner consisting of at least 600mm of recompacted clay with an insitu permeability (K) of less than 10⁻⁷ms⁻¹......"
- a natural geological barrier that is proven by competent geotechnical investigations to provide a secure barrier between the groundwater, soil and substrata and the composting organics, equivalent to the 600-mm recompacted clay above
- a concrete or asphalt cement pad of a thickness of at least 100 mm, designed to withstand the loads from all machines, vehicles and equipment that are required to operate the facility.

Proposed Leachate Barrier System for MBT

The leachate barrier is proposed to consist of insitu onsite clay. To form the subgrade level of the compost storage area the clay is required to be cut in some areas and filled (from clay won in the cut)



1

to form the subgrade levels. Therefore the barrier needs to comply with either dot point one or dot point two from the section above.

Leachate Collection system

The collection system is to be provided by both grading the surface and guiding runoff to the leachate pond as well as a subsurface drainage system that is to be incorporated within the hardstand design.

Dolerite Testing

The site contains significant amounts of Dolerite. Whilst extensive testing of this material was undertaken as part of the leachate barrier system design it was decided to not use this material for the purposes of a capping material. Therefore the Dolerite material is being used as a protective layer over the site insitu residual clay which shall form the leachate barrier system. The doerite layer is therefore to form part of the leachate collection system.

Site Won Residual Clay

Previous testing of on-site residual clays at the MBT facility has been undertaken and reported by Golder Associates (Report 137622009-001-r-Rev0, dated 7th May 2013). A summary of the findings is presented in Table 3 below.

Material Description	Sample Location	Depth (m)	Average Permeability m/s	Note
Orange Brown Clay	TP502	0.4 - 0.8	5.7 x 10 ⁻¹⁰	Material Investigation of Clay Borrow Area and Dolerite Stockpile at
Grey Brown Clay	TP506	1.0 - 1.2	3.0 x 10 ⁻⁹	Woodlawn Mine Site (Materials Investigation) (ref 01623025/051, dated July 2001)
Unit 2a – residual Silty Clay	TP1301	0.4 – 0.6	3.0 x 10 ⁻¹¹	
Unit 2b – residual Silty Clay	TP1301	0.5 – 0.7	4.0 x 10 ⁻¹¹	Golder Associates Report 137622009-
Unit 2a – residual Silty Clay	TP1313	0.7 – 0.8	3.0 x 10 ⁻¹¹	001-r-Rev0, dated 7th May 2013
Unit 2b – residual Silty Clay	TP1315	1.0 - 1.1	9.0 x 10 ⁻¹¹	

Table 3A – Summary of Permeability Tests results on residual clay from previous reports

Golder Associates (ref 01623025/051, dated July 2001) recommend adopting a permeability for the on-site residual clays of 1.0×10^{-9} m/s to 1.0×10^{-10} m/s based on the 2001 results. Adopting the permeability recommended would satisfy the EPA requirements for a leachate barrier.

To ensure that the onsite clay material in the vicinity of the compost storage areas was representative of the material tested by Golder SMEC arranged laboratory testing (Macquarie Geotech) of the clay unit for permeability. The results of these tests are provide below and appended to this letter. Photos of the samples were also prepared for future reference as required. Table 3B – Summary of Permeability Tests results on residual clay from Site Testing

Material Description	Sample Identifier	Average Permeability m/s
Clayey SILT trace sand	18616-FHP	1.5 x 10 ⁻¹⁰
Silty Clay with Sand	18617-FHP	8.5 x 10 ⁻¹¹
CLAY with sand trace gravel	18618-FHP	2.6 x 10 ⁻¹⁰
CLAY trace sand and gravel	18619-FHP	2.4 x 10 ⁻¹⁰
CLAY with sand trace gravel	18620-FHP	7.1 x 10 ⁻¹⁰

The results demonstrate the clay to have similar properties to the clay tested by Golder and therefore it can be comfortably stated that the onsite clay has a permeability of less than 1×10^{-9} . Therefore the on-site clay can be used for the leachate barrier required by the EPA for the Compost Storage Area when left in-situ.

Compost Storage Area Liner Composition

The Compost Storage Area is required to provide a leachate barrier (liner) that satisfies the NSW EPA's "Environmental Guidelines for Composting and Related Organics Processing Facilities" by complying with the following criteria;

"Acceptable leachate barriers include;

- A clay or modified soil liner consisting of at least 600mm of recompacted clay with an insitu permeability (K) of less than 10⁻⁷ms⁻¹......"
- a natural geological barrier that is proven by competent geotechnical investigations to provide a secure barrier between the groundwater, soil and substrata and the composting organics, equivalent to the 600-mm recompacted clay above "

The results of this investigation has shown a 600mm layer of insitu clay will satisfy this condition.

The following shall be provided as the handstand area and leachate barrier as part of the proposed organics facility;

- 1. Trafficable surface and drainage of hardstand (leachate collection system): A 400mm dolerite layer (without additives); constructed over
- 2. **leachate barrier (leachate barrier system):** 600mm layer of onsite clay (either placed and compacted, or left insitu to form the subgrade level of the compost area)

This combined handstand area and leachate barrier will comfortably exceed the EPA requirements for a leachate barrier as described above and has the following additional features;

- 1. The dolerite layer acts as a trafficable layer that will protect the leachate barrier layer
- 2. The dolerite layer is able to contain a leachate sub-soil drainage layer
- 3. The dolerite will protect the clay layer from drying out

Earthworks Procedure for Onsite Clay Material

In the proposed location of the Compost Storage Area on-site clay material already significantly exceeds the minimum 600mm depth requirement for a leachate barrier. The clay material is found to be located just below the topsoil profile across the entire compost storage area location. Therefore to form the levels required the following earthworks procedure was undertaken;

- 1. The site was cleared and grubbed and stripped of topsoil to expose the clay surface
- 2. In areas where additional clay is required to be placed as fill (to reach subgrade levels) the ground was proof rolled to ensure any unsuitable areas were exposed. Unsuitable areas were then excavated down to a suitable level. Clay material was then won from excavation areas (within the compost storage area) and placed and compacted and tested for density in accordance with the requirements of AS3798-2007 *Guidelines on earthworks for commercial and residential developments* to reach a minimum compaction of 95% standard.
- 3. In areas where the clay was required to be excavated to meet the design surface levels the excess clay was cut and moved to the fill areas and then proof rolled to ensure any unsuitable areas were exposed. Unsuitable areas were then excavated down to a suitable level. Fill was then placed back in these areas in accordance with the procedure above.
- 4. After earthworks are completed confirmation testing was undertaken to ensure a minimum 600mm thickness of clay was located over the compost storage area.

Confirmation of the Required Thickness of Onsite Clay Material

SMEC were instructed to undertake test pits over the compost storage area to confirm that the thickness of clay exceeded 600mm. The frequency of test-pits to visually confirm the in-situ clay thickness was based on Table 8.1 of AS3798-2007 which recommends that for Type 1 large scale earthworks testing (for density for filled material) is to be conducted at a frequency of 1 test per layer per 2500 sq.m. If the material were to be placed and compacted, the 600mm thick clay forming the leachate barrier (liner) would be required to be compacted in 2 layers of 300mm depth and therefore 1 test per 1250 sq.m for a 600mm clay layer. Whilst this frequency regime is based on density testing it is considered as an appropriate guide to use to assess the frequency of visual test pits to determine the thickness of clay onsite. The compost storage area is 3Ha in size and therefore 24 pits are required. SMEC prepared 27 test pits.

SMEC went to site on 19 January 2016 and prepared 12 test pits and also visited on the 31st March 2016 and prepared a further 15 test pits. Testing confirmed the presence of the clay to the required 600mm depth and photos were recorded of each test pit. The test pit log and photos are attached to this letter

It is important to note that there is a reliance on the cap being placed as a contiguous layer. Therefore penetration through the cap from services and the like needs to be minimised and constructed so as to not create a flow path for leachate to penetrate the cap. At the time of inspection there was no evidence of penetrations being constructed through the cap.

Conclusion/Recommendations

Based on the analysis undertaken for this report and site inspection confirming that onsite clay is present for a minimum depth of 600mm over the Compost Storage Area for the Woodlawn Waste Management Facility it can be concluded that a satisfactory leachate barrier has been provided for the storage area which satisfies the NSW EPA's "Environmental Guidelines for Composting and Related Organics Processing Facilities".

Yours sincerely

John Kniest Principal Civil Engineer

ATTACHMENTS Laboratory Test Results & photos

Laboratory Test results & Photos

		FALLING		RMEAB	ILITY	REPC	RT	
Client:	SMEC	- Australia & New Zealand Di	vision	Source:	Western Sto	ockpile Near	Void Samp	le 5
Address:		nter Street, Newcastle, NSW, 7 346, Newcastle, NSW, 2300, A		Sample Description:	CLAY with s	sand trace g	ravel	
Project:	Wood	lawn		Report No:	18620-FHP			
Job No:	B1545			Lab No:	18620			
Test Proc	edure:	AS1289 5.1.1 So	bil strength and consolidation tests - loil compaction and density tests - De bil compaction and density tests - De bil compaction and density tests - De	termination of the dry de	nsity/moisture conten	nt relationship of a so	il using standard co	
Sampling	:	Sampled by Macquarie Geo	technical Staff in accord	ance with AS12	89 1.1	Date Sa	mpled:	13/10/2015
Preparatio	on:	Prepared in accordance with	h the test method				•	
			RE	SULTS				
Standa	ard Max	kimum Dry Density (t/m ³)	1.67		Hydraulic G	Gradient		0.0
Ор	otimum I	Moisture Content (%)	20.0		Surcharge	e (kPa)		0.0
Plac		Moisture Content (%)	20.2		d Pressure A)	0.0
		sture Ratio (%)	101.2		Standard Co	-		Standard
PI		nt Dry Density (t/m ³)	1.67	Percentage N				0 % on 9.5
	Der	nsity Ratio (%)	99.8	Sample	e Height and			103.4 x 98.4
	PE	RMEABILITY	$k_{(20)} =$		7.111	E-10	(m/s	ec)
1. 8. 6. 4. 2.	.200E-08 .000E-09 .000E-09 .000E-09 .000E-09			eability				
NA	TA	The results of the tests, calibrations and in this document are traceable to Aus Accredited for compliance with ISO/IEC 1 not be reproduced, except in full.	stralian/national standards.		Authorised :	Signatory:		17/11/2015
		NATA Accredited Laboratory	Number: 14874		Bradley	Morris	-	Date:
MAC GEC	QUA	-					3	Macquarie Geotechnical 3 Watt Drive Bathurst NSW 2795

		FALLING		RMEAB		ORT	
Client:	SMEC	- Australia & New Zealand Div	vision	Source:	Western Stockpile Ne	ar Void Samp	ble 4
Address:		nter Street, Newcastle, NSW, 2 346, Newcastle, NSW, 2300, A		Sample Description:	CLAY trace sand & gr	avel	
Project:	Wood	lawn		Report No:	18619-FHP		
Job No:	B1545			Lab No:	18619		
Test Proc	edure:	AS1289 5.1.1 So	il compaction and density tests - De	termination of the dry de	Falling head method for a remoulded s nsity/moisture content relationship of a nsity/moisture content relationship of a	soil using standard co	
Sampling	:	Sampled by Macquarie Geo	technical Staff in accord	ance with AS12	89 1.1 Date S	ampled:	13/10/2015
Preparatio	on:	Prepared in accordance with	n the test method				
				SULTS			
		kimum Dry Density (t/m ³)	1.70		Hydraulic Gradient		0.0
		Moisture Content (%)	19.0		Surcharge (kPa)		0.0
Plac		Moisture Content (%)	19.0		d Pressure Applied (kF	Pa)	0.0
		sture Ratio (%)	<u>99.9</u> 1.70		Standard Compaction	Size (mm)	Standard 0 % on 9.5
P		nt Dry Density (t/m ³)		-			104 x 97.9
Density Ratio (%) 100.0 Sample Height and Diameter (mm)							
	PE	RMEABILITY	k ₍₂₀₎ =		2.42E-10	(m/s	ec)
2 () (U)(sec) 1. 1. 5.	.000E-09 .500E-09 .000E-09 .000E-09 .000E-09						
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		-			2.44.67 100113		Macquarie Geotechnical
GEC						:	3 Watt Drive Bathurst NSW 2795

		FALLING		RMEAB	ILITY I	REPO	RT	
Client:	SMEC	- Australia & New Zealand Div	vision	Source:	Western Sto	ckpile Near	Void Samp	le 3
Address:		nter Street, Newcastle, NSW, 2 146, Newcastle, NSW, 2300, A		Sample Description:	CLAY with sa	and trace g	ravel	
Project:	Woodl	awn		Report No:	18618-FHP			
Job No:	B1545			Lab No:	18618			
Test Proc	edure:	AS1289 5.1.1 So	bil strength and consolidation tests - loid compaction and density tests - De bil compacting and density tests - De bil compaction and density	termination of the dry de	nsity/moisture content	relationship of a so	il using standard cor	
Sampling	:	Sampled by Macquarie Geo	technical Staff in accord	lance with AS12	89 1.1	Date Sa	mpled:	13/10/2015
Preparatio	on:	Prepared in accordance with	n the test method					
				SULTS				
		imum Dry Density (t/m ³)	1.64		Hydraulic Gr			0.0
		Noisture Content (%)	19.0		Surcharge		,	0.0
Plac		Moisture Content (%)	18.9		d Pressure A)	0.0
		ture Ratio (%)	99.5 1.64	Percentage N	Standard Con	•	Sizo (mm)	Standard 0 % on 9.5
P		nt Dry Density (t/m ³) sity Ratio (%)	1.04	-	Height and I			103.3 x 98.3
			•			,		
	PEF	RMEABILITY	k ₍₂₀₎ =		2.57E	:-10	(m/se	ec)
3 2 2 () 20 (J) 1. 1. 5.	.000E-09 .500E-09 .500E-09 .500E-09 .500E-09 .000E-09 .000E-00			eability				
NA	TA	The results of the tests, calibrations and/ in this document are traceable to Aus Accredited for compliance with ISO/IEC 1 not be reproduced, except in full. NATA Accredited Laboratory N	stralian/national standards. 7025. This document shall		Authorised S By Bradley M			17/11/2015 Date:
MAC GEC	QUA DTEC						3	Aacquarie Geotechnical 8 Watt Drive 8athurst NSW 2795

	FAL	LING HE		RMEAB	ILITY REP	ORT	
Client:	SMEC - Australia & Nev	w Zealand Division		Source:	Site Stockpile Samp	le 2	
Address:	74 Hunter Street, Newc Box 1346, Newcastle, N			Sample Description:	Silty CLAY with sand	l	
Project:	Woodlawn			Report No:	18617-FHP		
Job No:	B15458			Lab No:	18617		
Test Proc		AS1289 5.1.1 Soil compac	ction and density tests - De	termination of the dry de	Falling head method for a remoulde nsity/moisture content relationship o nsity/moisture content relationship o	f a soil using standard c	
Sampling:	Sampled by N	Macquarie Geotechni	cal Staff in accord	lance with AS12	89 1.1 Date	Sampled:	13/10/2015
Preparatio	Dn: Prepared in a	accordance with the te					
				SULTS			
	ard Maximum Dry Density	,	1.51		Hydraulic Gradient		0.0
	timum Moisture Content	, ,	29.0		Surcharge (kPa)		0.0
Plac	cement Moisture Content	t (%)	28.9		d Pressure Applied (I	,	0.0
	Moisture Ratio (%)	- 3)	99.6		Standard Compaction		Standard
PI	acement Dry Density (t/n Density Ratio (%)	n:)	1.51 100.1	-	Aaterial Retained/Sie Height and Diamete		0 % on 9.5 103.5 x 98
			_	Sample	-		
	PERMEABI	LITY	$k_{(20)} =$		8.45E-11	l (m/s	sec)
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NA	in this document are Accredited for compliar not be reproduced, exco	s, calibrations and/or meas traceable to Australian/r nce with ISO/IEC 17025. T ept in full.	national standards. This document shall		Authorised Signatory	<i>:</i>	17/11/2015 Date:
					bradicy worris		Macquarie Geotechnical
	QUARIE						3 Watt Drive Bathurst NSW 2795

		FALLING	HEAD PEF	RMEAB	ILITY R	EPO	RT	
Client:	SMEC - Aust	ralia & New Zealand Di	vision	Source:	Site Stockpile	Sample 1		
Address:		reet, Newcastle, NSW, ewcastle, NSW, 2300, A		Sample Description:	Clayey SILT tr	ace sand		
Project:	Woodlawn			Report No:	18616-FHP			
Job No:	B15458	_		Lab No:	18616			
Test Proce	edure:	AS1289 5.1.1 S	oil strength and consolidation tests - I oil compaction and density tests - De oil compaction and density tests - De	termination of the dry de	nsity/moisture content rela	ationship of a so	il using standard cor	
Sampling:	S	ampled by Macquarie Geo	otechnical Staff in accord	lance with AS12	89 1.1	Date Sar	npled:	13/10/2015
Preparatio	on: P	repared in accordance wit	h the test method					
			RE	SULTS			•	
		Dry Density (t/m ³)	1.51		Hydraulic Gra			0.0
-		re Content (%)	27.0		Surcharge (k	;		0.0
Plac		re Content (%)	27.2		d Pressure App)	0.0
	Moisture R		100.8		Standard Comp			Standard
Pla	acement Dry I		1.50	•	Aaterial Retaine		, ,	0 % on 9.5
	Density Ra	atio (%)	99.8	Sample	e Height and Di	ameter (n	nm)	103.8 x 98.1
	PERM	EABILITY	k ₍₂₀₎ =		1.51E	-10	(m/s	ec)
1.1 1.0 K²⁰ (m/sec) 5.0	000E-09							
NAT	in this Accredit	ults of the tests, calibrations and document are traceable to Au ed for compliance with ISO/IEC aproduced, except in full.	stralian/national standards.		Authorised Sig	inatory:		17/11/2015
	NATA	Accredited Laboratory	Number: 14874		Bradley M	orris		Date:
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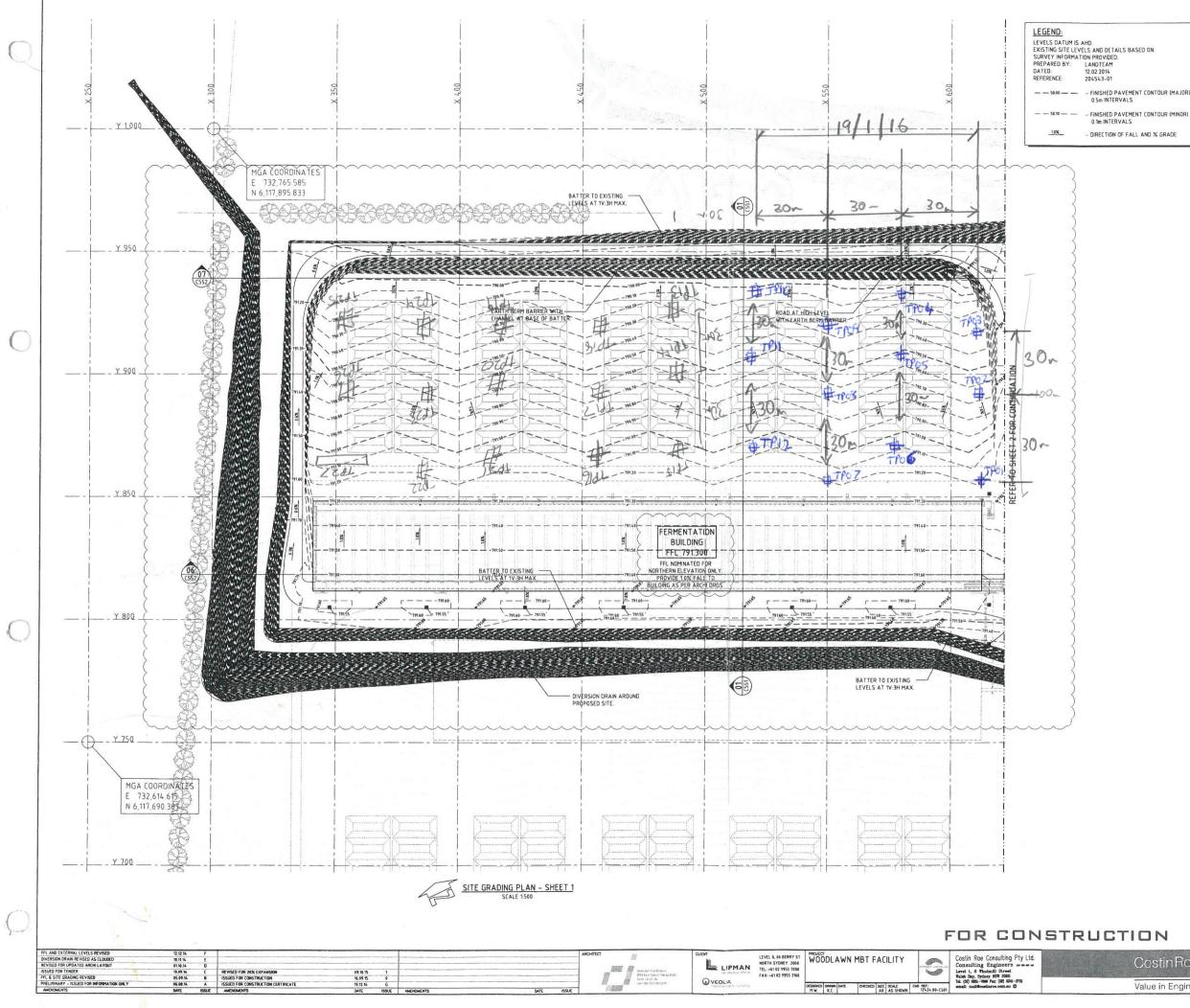
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Site Inspection Test Pits and Photos



FINISHED LEVELS PLAN NOTES:

- LEVELS DATUM IS A.H.D. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVENNT LEVELS UN D. ON PLAN. THE MAJOR CONTOUR INTERVAL IS 0.5m THE MINOR CONTOUR INTERVAL IS 0.5m MAXIMUM PAVEMENT GRADE IS TO BE 1100 (1%) UNO. MAXIMUM PAVEMENT GRADE IS TO BE 1100 (1%) UNO. MAXIMUM PAVEMENT GRADE IS TO BE 122 (4.5%) UNO. MAXIMUM RAMP GRADES ARE TO BE 112 (8.3%) UNO. ON PLAN
- 8
- 10.
- MAXIMUM RAMP GRADES ARE TO BE 112 (8.3%) U.N.O. ON PLAN PROVIDE HININUM 3.0m LONG TRANSITION WHERE CHANGES GRADE EXCEED 120 (5%). PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE DF 1V.2H. ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING TV/6H ARE TO BE TUPFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOVINAL. GRADE. 2. ALL PAVEMENTS ARE TO BE SET AT SOMM BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS UND. 12.

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Field Log - Excavation	SMEC	Test Pit No.	TP <i>O</i>)
		Sheet	1 of /
Client Lipman Constructions		Job No.	3002464
Principal		Date	19 11/16
Project Woodlawn		Logged by	RB
Test Pit Location Clay Liner	and a	Checked by	
equipment type & model: Hitachi 5,57	pit dimensions:	🖌 m long 📿	うっこ m wide
R.L surface:	Datum: AHD		
E 1 2 3 tests, etc (m) USC seconda	material olasticity or particle characteristics, colour ary components & minor components	sture sist.	PP kPa structure and ଝ୍ଲିଚ୍ଚିଣ୍ଡି additional observations
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1.5			
2.0			
215			
3.0			
groundwater not observed groundwater inflow a	it: m istanding water level	m time:	date:
Sketch 1. On 0. 6n Fill XW MATE Row 1 - Column 1	Lim D. 2. N 61176	633	
method support notes samples, test N natural exposure T timbering N N X existing excavation T motes samples, test U50 undisturbed sa BH backhoe bucket penetration D disturbed sa R ripper 1 2 no resistance E excavator Imaging to refusal Bs bulk sample HA hand auger refusal refusal R	sample LP low plasticity R red Gr ter MP medium plasticity B brown Bu mple HP high plasticity G grey P kPa) LL liquid limit BI black D F fine O orange	green D dry blue M moist y pale W wet I dark Wp plastic y limit	consistency/density index VS very soft VL very loose S soft L loose F firm MD med. dense St stiff D dense VSt very stiff VD very dense H hard Fb friable Fb Issue: 29/10/2015 State



Field	Log -	Exc	ava	ation	SMEC		Test F	Pit No.		TP 02
	-						Sheet			1 of Į
Client	Lip	man Co	nstru	ctions			Job N	0.		3002464
Principal							Date		19	/1/16
Project	Wo	odlawn					Logge	d by		RB
Test Pit Loc		y Liner					Check	ed by		
equipment	type & model	: 4;4	ach.	57	pit dimensions:	1.0	m long		0.6	m wide
R.L surface					Datum: $A \vdash D$					
method 7 2 1 7 2 3	notes samples, tests, etc	depth (m)	usc		material soil name, plasticity or particle characteristics, colour secondary components & minor components		moisture	consist.	and the second s	structure and additional observation
EM		0		CLAY:	Hp, PALE BROWN		>Up	N57/4	XUS	FILL/Liver
		015		(CLAY	>0.6m)				K30	0
		110		TPOZ OGBTH		TARGET				
		1.5								
		2-0								
		-								

method	support	notes	samples, tests	plast	ticity/grainsize	colo	our			mois	sture	cons	sistency/den	sity in	dex
N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper excavator HA hand auger	T timbering N nil penetration 1 2 3 no resistance ranging to refusal	U50 D V Bs E R	undisturbed sample 50mm diameter disturbed sample vane shear (kPa) bulk sample environmental sample refusal	LP MP HP LL F C	low plasticity medium plasticity high plasticity liquid limit fine medium coarse	R B G B O Y W	red brown grey black orange yellow white	Gr Bu P D	green blue pale dark	D M W Wp	dry moist wet plastic limit	VS S St VSt H Fb	very soft soft firm stiff very stiff hard friable Issue: 29/	VL L MD D VD	very loose loose med. den dense very dens

m

standing water level

E 0733000 N 6117658

m time:

date:

groundwater not observed

ST/VST

Sketch

groundwater inflow at:

0.7



Field	Log -	Exc	ava	ition				SMEC	-			Test	Pit No.		TP 03
						AH.	Ņ					Shee	et		1 of /
Client	Lipr	man Con	nstruc	tions								Job N	No.		3002464
Principal									2			Date		10	9 /1/16
Project	Woo	odlawn										Logg	ed by		RB
est Pit Locati	tion Clay	y Liner										Chec	ked by		
equipment typ	rpe & model:	Hit	lach	(; s	57			pit dimensio	ons:		0.6	ς m long	3	0.6	m wide
R.L surface:								Datum: 🙏	4D						
tenet 1 2 3	notes samples, tests, etc	depth (m)	USC					erial ticle characteris s & minor comp		our		moisture	consist.	PP kPa 00€	structure and ङ्घे additional observations
Empire		0		CLAY!	Hp,	PALE	s B	row				>Wf	Vsi/		
		0.5												×30 ×30	0
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		E													
groundv Sketch	lwater not ob h	served			ndwater inflo	ow at:	m	n 🗌 standi	ng water	r level		m time:			date:
	La Lor	and a		5.6-	ž 	0.6.				EN	07	330	50	8	
	er blade tor	support T timberin penetratio		nil U5 D V esistance Bs ing to F	50mm d disturbe vane sh s bulk san environr	urbed sample diameter ed sample hear (kPa) imple imental sample	LP MP HP LL F	ticity/grainsize low plasticity medium plastici high plasticity liquid limit fine medium coarse	R	lour red brown grey black orange yellow white	Bu I P I D (green D blue M pale W dark W		t S F ic St	sistency/density index very soft VL very loose soft L loose firm MD med. dense stiff D dense very stiff VD very dense hard friable Issue: 29/10/2015



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F	ield	L	-og -	Exc	ava	ation				SME	EC			1	Test P	it No.		Т	P 04	
								Carlo	,					Ş	Sheet			(1)	of	
Clie	nt		Lip	man Co	nstruc	tions								J	Job No).		30024	464	
Prin	ncipal													۵	Date		19	7 /1/16		
Proj	ect		Wo	odlawn										L	Logge	d by		RB		
Test	t Pit Loc	atior	n Cla	y Liner										(Checke	ed by				
equi	ipment	type	3 & model:	Hit	ech.	· 57				pit dime	nsions:	0.6		m	long	l	0.6	m wide		
	surface									Datum:										
method	benet 123	support	notes samples, tests, etc	depth (m)	USC					erial ticle charact s & minor co					moisture	consist.	PP kPa 00€		ructure and nal observa	d ations
£				0		LLAY	: Hp,	PAL	it k	BROWN	V				тшр		250	Ferr	Y Ltu	KK)
				0.5													200			
				40		TP04 @ 7	TE	ERMS	NA: DEO	TED (OTH	0	0.6	Sn							
				1.5																
				2.0																
																				-
	groun	dwa	ater not obs	served		groundv	water inflow a	at:	m	🗌 sta	inding wat	ter level		m ti	ime:			date:		
	Sketc		CLA: Line			0.6m)		0.6			E N	06	732	298	8					
meth N X BH R E HA	natural	ig exi oe bu zer bl ator	oosure xcavation ucket blade	support T timberin penetratio	on 3	nil U50 D V sistance Bs ng to E	s samples, te undisturbed 50mm diam disturbed sa vane shear bulk sample environmen refusal	d sample neter ample r (kPa) e	LP MP HP LL F	icity/grainsize low plasticity medium plas high plasticit liquid limit fine medium coarse	sticity B	B brow G grey B black O oran Y yello	v P k D nge ow	green blue pale dark	moist D M W Wp	dry moist wet plastic limit	VS S F	sistency/den very soft soft firm stiff very stiff hard friable Issue: 29/	VL very L loos MD med D den VD very	d. dense



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Fi	eld	Log -	Exc	avatio	on			SMEC				Test P	it No.		TP 05	
						AA(~					Sheet			1 of /	
Clien	t	Lipi	man Cor	nstruction	s	-						Job No	D.		3002464	_
Princ	ipal											Date		19	/1/16	
Proje	ect	Wo	odlawn									Logge	d by		RB	
Test	Pit Loc	ation Cla	y Liner									Check	ed by			
equi	oment	type & model	1+:	tarhi	5	57		pit dimensions:			0.6	m long		0.6	m wide	
R.L s	surface	:						Datum:								
method	tenet-	tion notes samples, notests, etc	depth (m)	USC	S			erial ticle characteristics s & minor compone		ır		moisture	consist.	PP kPa 000000000000000000000000000000000	structure and additional observations	5
E			0	CI	AY :	Hp, Prit	Be-	لہ تیر و				<up></up>	Vst	400	FILL (LIKY LIVER)	
			0.5											300		
			1.0	TA	POSALE	TERM DEPT	INA 17	160 0	0.7	~ (c))					
Ø	groun	idwater not ob	served		groundwa	ater inflow at:	m	standing v	water le	evel	m	time:			date:	
	Sketo	lay lenear			0	- Fr				EZ	61	73	29	74 Ə		
meth	nod		support		notes	samples, tests	plast	icity/grainsize	colou	Jr.		moi	sture	consi	stency/density index	
N BH B R E HA	natura existir backh bulldo ripper excav		T timberi penetratio	on	U50 D V	undisturbed sample 50mm diameter disturbed sample vane shear (kPa) bulk sample environmental samp refusal	LP MP HP LL F	low plasticity medium plasticity high plasticity liquid limit fine medium coarse	R B G B O Y W	red brown grey black orange yellow white	Gr gre Bu blu P pale D dar	en D e M e W	dry mois wet plast limit	VS F ic St t VSt H	very soft VL very loos soft L loose firm MD med. den stiff D dense very stiff VD very dens hard frjable Issue: 29/10/2015	se



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F	ielc	1 L	.og -	Exc	ava	ation				5MEC				Tes	t Pit No.		Tŀ	06	
_			- Proven						•					She	et		1 0	f /	
Clie			Lip	man Co	onstru	ctions								Job	No.		30024	64	
Prir	icipal													Date	9	1	9/1/16		_
Pro	ject		Wo	odlawn										Log	ged by		RB		
Tes	t Pit Lo	catio	n Cla	y Liner				Management						Che	cked by				
equ	ipment	type	e & model	: [4	, ta	1: 5	T			pit dimensi	ons:		0.	6 m lon	9	0.0	f m wide		
R.L	surface	-		1						Datum:									_
method	benet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC					ial le characteris & minor com		our		moisture	consist.	PP kPa		cture and al observations	5
E				0	CM	LLAY: F-C	ltp. f quatz	ale G	Br	sun,	TRAC	e o	if	<w </w 	OVST/H			Y LING)
				0.5												800			
				1.0		TPOG	TEA	06 06	NAT(SPT)	50 6) 1	0.0	Su							
				1.5															
				-															
				-															11111111
				-															11111
	groun	idwa	ter not ob	served		ground	water inflow a	ıt:	m	standi	ng water	level		m time:	:		date:		7
	Sketo	ch				0.6.			0.6m			EN	61	732	955	-6			
metl N X BH R E HA	natura	oe bu zer b	cavation ucket lade	support T timberi penetratio	on	nil U50 D V esistance Bs ing to E	s samples, ter undisturbed s 50mm diame disturbed sar vane shear (i bulk sample environment refusal	sample eter mple kPa)	LP Io MP m HP hi LL lic F fir	y/grainsize w plasticity iedium plasticity igh plasticity quid limit ne iedium parse	y B G Bi O Y W	red brown grey black orange yellow white	Bu P	green D blue M pale W dark Wp	dry dry moist wet plasti limit	VS S F c St	istency/dens very soft soft firm stiff very stiff hard friable Issue: 29/10	VL very loose L loose MD med. dens D dense VD very dense	e



Client Lipman Constructions Principal Project Woodlawn Test Pit Location Clay Liner equipment type & model: $H_1 f_{acl}$: S_7 R.L surface: Datum:	Sheet Job No. Date Logged by Checked by	1 of 1 3002464 19 /1/16 RB
Principal Project Woodlawn Test Pit Location Clay Liner equipment type & model: H, fac. L. 57 pit dimensions: R.L surface: Datum:	Date Logged by Checked by	19 11/16
Project Woodlawn Test Pit Location Clay Liner equipment type & model: H, Jack 57 pit dimensions: R.L surface: Datum:	Logged by Checked by	· · · · · · · · · · · · · · · · · · ·
Test Pit Location Clay Liner equipment type & model: #.jfacL: 57 pit dimensions: R.L surface: Datum:	Checked by	RB
equipment type & model: H. J. C. 57 pit dimensions: R.L. surface: Datum:		
R.L surface: Datum:	O.6 m long (
		0.6m wide
	· · · · · · · · · · · · · · · · · · ·	
begin totes notes material samples, depth soil name, plasticity or particle characteristics, colour secondary components & minor components	k sist.	PP (Pa structure and ଷ୍ଟ୍ରିଚ୍ଚିଣ୍ଣ additional observations
E 0.0 CLAY: Hp. Pale Brown, TRACE OF GRANELS, TRACE OF CORBLES	F-C SWP VSF > =Wp/H	600 FILL (CLAY LINER)
0.5		600
TROZ TOMATCO O O		
110 TARGET DEPTH	1/2	
groundwater not observed groundwater inflow at: m standing water level	el m time:	date:
Sketch		uale.
$\frac{1}{1} \frac{1}{1} \frac{1}$	3 293 <i>8</i> 7657	
Land and		
BH backhoe bucket penetration D disturbed sample HP high plasticity G gre B bulldozer blade 1 2 3 no resistance Bs bulk sample HP high plasticity G gre R ripper 1 2 3 no resistance Bs bulk sample F fine O oral	d Gr green D dry V own Bu blue M moist S sy P pale W wet F ack D dark Wp plastic S ange limit V llow F	firm MD med. dense St stiff D dense /St very stiff VD very dense



Fi	eld Log	g - Excav	vation	SMEC	1	Test Pit No.	TP 08
			and the second se	~	a sur a s	Sheet	1 of <i>(</i>
Clien		Lipman Constr	uctions			Job No.	3002464
Princ						Date	19/1/16
Proje		Woodlawn				Logged by	RB
		Clay Liner	4			Checked by	841
	pment type & mo	del: Hid	tachi 5+	pit dimension	is: 0	6 m long	0.6 m wide
R.L s	surface:	-	I	Datum:			PP
method	1 2 3	eles, depth	c secondary con	material ty or particle characteristi nponents & minor compo	onents	moisture consist.	ନନ kPa structure and ହିଛିଛିନ୍ଦି
E		0	CCAY, Hp, PAL	E BROWN		- 1/4	350 FILL 350 CCLAY LINGE
	P					>Wp	200
		0.5					
-							200
		1,0	TPOS TERM TARGET &	UNATED 6	20.7n		
		1 1	TRAGET \$	2-PTH			
		1.5					
		2.0					
		2.5					
			-				
		2 0					
R	groundwater not	t observed	groundwater inflow at:	m 🗌 standing	g water level	m time:	date:
	Sketch		0.6		,		
). Th	EN	073293	39 3
meth N X BH B R	natural exposure existing excavatio backhoe bucket bulldozer blade	on penetration	N nil notes samples, tests U50 undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa)	MP medium plasticity HP high plasticity LL liquid limit	G grey P Bi black D	u blue M moist pale W wet dark Wp plastic	consistency/density index VS very soft VL very loose S soft L loose F firm MD med. dense St stiff D dense
R E HA	ripper excavator hand auger	no ra	o resistance anging to afusal R refusal R refusal	F fine M medium C coarse	O orange Y yellow W white	limit	VSt very stiff VD very dense H hard Fb frijable Issue: 29/10/2015



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Field Log - Excavation SMEC	Test Pit No.	TP 09
	Sheet	1 of /
Client Lipman Constructions	Job No.	3002464
Principal	Date	19 11/16
Project Woodlawn	Logged by	RB
Test Pit Location Clay Liner	Checked by	
equipment type & model: Actach: Stonge pit dimensions:	06 m long C	⊃C m wide
R.L surface: Datum:		DD
begin b	sist. unoloc	PP <pa structure and ଷ୍ଟ୍ରିଷ୍ଟ୍ରିୟ additional observations</pa
E O CLAY: Hp, PALE BROWN, BE F-C GRAVEL	TRACE Lup H	600 FILL (CLAY (EWER)
0.5		5.06
	and an and a second	60
TPOQ TERMINATED	@0.7n	
1.0 TARGET DEPTH		
1.5		
2		
2.5		
groundwater inflow at: m standing water	ater level m time:	date:
Sketch		
0.6 N D D D D D	0732954	
method support notes samples, tests plasticity/grainsize N natural exposure T timbering N nil X existing excavation T timbering N nil BH backhoe bucket penetration D disturbed sample LP low plasticity B bulldozer blade 1 2 3 no resistance D disturbed sample R ripper 1 2 3 no resistance Bs bulk sample HA hand auger Imaging to refusal R refusal M medium	colour moisture R red Gr green B brown Bu blue M G grey P pale BI black D dark O orange ilimit Y yellow W white	consistency/density index VS very soft VL very loose S soft L loose F firm MD med. dense St stiff D dense VSt very stiff VD very dense H hard Fb friable ISSUE: 29/10/2015



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Fi	eld	Log	- Exc	ava	tion		D.	SMEC				Test F	Pit No.		TP / 0
		the state state state				1991	~					Sheet			1 of /
Clier	nt	Li	pman Co	onstruc	tions							Job N	0.		3002464
Princ	cipal											Date		19	/1/16
Proje	ect	W	oodlawn									Logge	d by		RB
Test	Pit Loc	ation Cl	ay Liner									Check	ed by		
equi	pment	type & mod	el:]./	ita	ch.	5+		pit dimensions	:	6	0.6	m long		0.6	m wide
R.L	surface):						Datum:							
method	teuet-	notes sample	s, depth tc (m)	USC			y or par	ts & minor compon	nents			moisture	consist.	PP kPa 000000000000000000000000000000000	structure and additional observations
E			0.5		CLAY. f-c	Hp, Pala gravele	e le	breawn, A	Tar	e q	+	Kwp >Vp	H	7600	FILL (CCAY LINGH)
									and the second	ner (Antonio Antonio anto	na na fathanai a bhana brian a			7600	
			1.0		TAR	TER.	MI	NATED	E) 0	. 7.				
			1.5												
			2.0												
			2.5												
			3.0												
\square	groun	dwater not	observed		ground	water inflow at:	m	n 🗌 standing	water le	vel	m	time:			date:
	Sketc	c la					0,7~			E S	61	732	a' 740	31	
meti N X BH B R E HA	natura existin backh	ator	support T timber penetrat	ion 3	nil U50 D V sistance Bs ng to E	s samples, tests undisturbed sample 50mm diameter disturbed sample vane shear (kPa) bulk sample environmental samp refusal	LP MP HP LL F	ticity/grainsize low plasticity medium plasticity high plasticity liquid limit fine medium coarse	B Bl O Y	r red brown grey black orange yellow white	Gr gree Bu blue P pale D dark	n D M W	sture dry moisi wet plast limit	VS S F St VSt H	stency/density index very soft VL very loose soft L loose firm MD med. dense stiff D dense very stiff VD very dense hard frjable Issue: 29/10/2015



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Field Log - Excavation SMEC	Test Pit No.	TP / /
	Sheet	1 of /
Client Lipman Constructions	Job No.	3002464
Principal	Date	19 /1/16
Project Woodlawn	Logged by	RB
Test Pit Location Clay Liner	Checked by	
equipment type & model: 1-1 i fachi Stome pit dimensions: 0-6	m long	0 Gm wide
R.L surface: Datum:		
begin b	moisture consist.	PP kPa structure and ≨SSS additional observations
	Kup H	
E O CLAY! Mp, trave of f-c gravel	TWO US	
	1 day	450 (CLAY Liner)
0.5		450
TPIL TERMENATED Q 0.6-		
10 TANGET DEPTH		
CAMPER NOP 113		
1.5		
2.0		
2.5		
3.0 -		
groundwater not observed groundwater inflow at: m standing water level	m time:	date:
Sketch		
-10.6m E 27.		
E UI	32419	
cluy D.G. N GILT	714	
liver		
method support notes samples, tests plasticity/grainsize colour N natural exposure T timbering N nil U50 undisturbed sample LP low plasticity R red Gr	green D dry	consistency/density index VS very soft VL very loose
X existing excavation 50mm diameter MP medium plasticity B brown Bu BH backhoe bucket penetration D disturbed sample HP high plasticity G grey P BH backhoe bucket V varbed sample HP high plasticity G grey P	blue M mois pale W wet dark Wp plas	F firm MD med. dense
R ripper E excavator	lim	hit VSt very stiff VD very dense H hard
HA hand auger R refusal C coarse W white		Fb friable Issue: 29/10/2015



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Fi	eld	Log	- Ex	cava	tion SMEC	Test P	it No.		TP	12
						Sheet			1 of	/
Clie	nt	L	.ipman C	onstru	tions	Job No	D .		3002464	
Prin	cipal					Date		19	/1/16	
Proj	ect	I	Voodlawi	n		Logge	d by	,	RB	
Test	Pit Loc	ation (Clay Line	r		Check	ed by			
equ	pment	type & mo	del: /	lita	chi' 52 pit dimensions: 0.	.6 m long		0.6	m wide	
R.L	surface	:			Datum:					
method	benet-	tiod samp tests,	es les, depth etc (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 000€	structu additional o	
E			6	Сн	UNY: Hp, Pale BROWN	>wþ	ST	200	FILL (CLAY	LINER)
			0.5					200		
				-				200	weighten and a state of the second	-
			1.0		0.6.					
				1	TP 12 - TERMINATED @ 0.6- Below ground head					
			1.5							
			2							
			5 5							
			2.9							
			3							
Ľ			ot observed		groundwater inflow at: m standing water level	m time:			date:	
	CL Lio	ch H H U	te		E 07 N 611	768	96			
me N BH B R E HA	existi backl bulld rippe exca		tion penet	bering I ration 2 3 rar	notes samples, tests plasticity/grainsize colour N nil U50 undisturbed sample LP low plasticity R red Gr D disturbed sample HP high plasticity B brown Bu V vane shear (kPa) LL liquid limit B black D ging to usal R refusal C coarse W white	green D	dry mois wet plas	st S F stic St	soft L firm M stiff [/L very loose loose MD med. dense dense /D very dense



Test Pit No.	
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TP /3	
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Field Log - Excavation SMEC	Test Pit No.	TP /3
	Sheet	1 of /
Client Lipman Constructions	Job No.	3002464
Principal	Date	15 17/16
Project Woodlawn	Logged by	RB
Test Pit Location Clay Liner	Checked by	
equipment type & model: HITACHI 3 TONK pit dimensions: 1.5	m long	O.3 m wide
R.L surface: Datum:		
bit t notes material 0 samples, depth soil name, plasticity or particle characteristics, colour 1 2 3 tests, etc (m) USC	moisture consist.	PP kPa Structure and ହିଛିଛିଙ୍କି additional observations
OF COBBLES OFTO 2001	lup 155	FILL (CLAY LINER)
0.5	= 13 14	
TPIS TERMINATED @ 0.65m 1.0 CN Liner ON steerly progress		
- Sitely progress		
groundwater not observed groundwater inflow at: m standing water level m	time:	date:
Sketch $5 35' 3' 22.60$ E 149' $33' 14,43$		
CLAY Liner 0.65.		
HW/XW NATERIAL		
thod natural exposure existing excavation backhoe bucket hand auger support T timbering N nil penetration notes N nil penetration notes Somples, tests US0 disturbed sample disturbed sample V vane shear (kPa) Bs bulk sample R plasticity/grainsize LP disturbed sample HP high plasticity R colour R red G greer B brown Bu blue G grey P pale 1 2 no resistance ranging to refusal no resistance refusal bulk sample R the staturbed sample F plasticity/grainsize LP colour MP medium plasticity LL R red G grey P greer Pale 1 2 no resistance ranging to refusal bulk sample R refusal N MP medium R no resistance F N MP no resistance F N	M moist W wet Wp plastic limit	Consistency/density index VS very soft VL very loose S soft L loose F firm MD med. dense St stiff D dense VSt very stiff VD very dense H hard Fb friable ISSUE: 29/10/2015



Field Log Execution

F	ielo	1 L	.og -	Exc	;ava	ation			5MEC				Test P	Pit No.		TF	14	
-													Sheet			1 of	/	
Clie			Lip	man Co	nstru	ctions							Job No	0.		30024	54	
	ncipal												Date		15	15 11/16		
	oject			odlawn									Logge			RB		
-	st Pit Lo			y Liner									Check	ed by				
			& model:	H	itar	chi 3	TOAM		pit dimension:	S:		r	m long		0.3	m wide		
R.L	surfac			1		T			Datum:					1	00			
method	teuet- 123	support	notes samples, tests, etc	depth (m)	USC		oil name, plastici secondary cor				ır		moisture	consist.	PP kPa ₽		cture and Il observations	
to the second second				0	CH	LIAY: seinel + UR40 1	Hp, Pahe + gravels	e ba , tre	own, Fr	cok	of	f-c	KWp	Н		(CLAY FILL	LINCR)	
			An and the of the late of a second	0.5				nder verlagen her son eine her sinder er bestenen.		ile etar da Agameti con c								
analagus ** 1444				1.0		TPIS	t ter	nir cete,	16	>								
			and desires and and				an ann an t-statement ar george a san an		ning management and an annual statement of the		eren and an an an an an	antar al ann an an ann a				e many from a constant of set second		
*********								Man Aut (19, 199) - a shekara ya										
							lande house - on, chi ala an a con a c											
				Ę			an an an a gana an	an der an einer seinen eine seinen einer										
	grour	Idwati	er not obs	served		groundwat	er inflow at:	m	standing	water le	vel	m	time:		1	date:		
	Sketc	;h	SE	35' 149'	33	3' 22.7: 3' 13.7'	7 9											
	-	(C 22	AT NER	MAT	Car	HC 7	10	.65 ?										
meth N BH B R E HA	natura existin backho	oe buc zer bla ator	avation cket	support T timberin penetratio 1 2 3	on	nil U50 ur 50 D di: V va sistance Bs bu ing to E er	amples, tests ndisturbed sample Omm diameter isturbed sample ane shear (kPa) ulk sample nvironmental sampl efusal	LP Iov MP me HP hig LL liq F fin	y/grainsize w plasticity edium plasticity gh plasticity juid limit ne edium parse	B b G g BI b O o Y y	red G			dry moist wet plastic limit	VS V S S F fi St S VSt V H h	oft rm tiff	VL very loose L loose MD med. dense D dense VD very dense	



F	ielo	d Log	- Ex	cava	tion SMEC	Test I	Pit No.	8	TP 15
_						Sheet	t		1 of /
Clie		L	ipman C	onstruc	tions	Job N	lo.		3002464
-	cipal					Date		15	11/16
Pro			Voodlawi			Logge	ed by		RB
-	t Pit Lo	Contraction of the local division of the loc	lay Linei			Check	ked by		
-	-	type & moo	del:	lita	hi 3 Toore pit dimensions: /	m long		0,3	m wide
R.L	surface				Datum:				
method	teuet 123	Bample	s es, depth etc (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa	structure and additional observations
E			0	cr1	CLAY: Hp. Pale brown to brown, TRACE OF F-C SAND, F-C GRAVEL,	Kwp	4		(CLAY LIWER) FILL
ation (1999)			0.5				9 8 1 1 1		
					TP15 terminated @ 0,62k in CLAY LINER				
			6	1	CA CLAY I TNER				
					<i>c</i> -				
				1					
hanner (1997) / 10									
		a statement and particular to any second state	-						
1	+++-					na na marana ara ara ara ara	19.7 6 , 6 , 66, 97, 97, 9		
			-						-
									-
				1					anali al'anna any ana amin' any amin' a
			=						
			=						
			-						
	-	dwater not o	bserved	[groundwater inflow at: m standing water level m	time:			date:
	Sketc	n	S	35	3 23.47				
			F	140	7 33 12.60				
			-						
					CLAY 0.62				
					LENER 31				
					CLAY LENER XW/HW MATERIAL				
neth SH SH	natural existing backho		support T timberi penetratio	on	notes samples, tests plasticity/grainsize colour II U50 undisturbed sample LP low plasticity R red Gr greet 50mm diameter D disturbed sample HP high plasticity B brown Bu blue V vane shear (kPa) LL liquid limit BI black D dark tance Bs bulk sample F fine O or anne	e M W	dry moist wet plastic limit	VS ve S so F fir St st VSt ve H ha	ency/density index ency/density index oft L loose rm MD med. dense iff D dense ery stiff VD very dense ard iable ssue: 29/10/2015



Image: Should, File Should, File Granding, Control of State Image: Should, File Granding, Control of State Image: Control of State Image: Should, File Sho	F	ield		og -	Exc	;ava	ation SMEC	Test F	Pit No.		TP 16
Principal Defe /S / Prior Principal Defe /S / Prior Text PLocation Clay Liner Choosed by RB Text PLocation Clay Liner Choosed by RB RL surface: Default / S more Choosed by RB RL surface: Defaul											1 of /
Project Woodlawn Loget ly AP Tee PE Loation Cley Liner Onecked by Russinger files & model H.HL.L.I 3 - conce all dimension: /, 5 m long .3 m wide RL surface: Bit Samples, diegen diegen files onecked by associated files	_			Lip	man Co	nstru	ctions .	Job N	0.		2
Test Pill Lossito Clay Liner Oracidad yr explainent type & model H, H = L, L 3 + annet pil dimensions: /, f mixing 0, 3 m wide RL surface: Datum: Datum: Datum: Bill Status etc. Bill S							l	Date		15	14,116
equipment type & model: H, H, e, L, i 3 , H, en L, H,							I	Logge	ed by		RB
RL surce: Dawn: all source source get sour											
Bit 123 Bit stores desting Use material solution oparticle characteristics, colour secondary components Bit 123	_			k model:	: H	itac	hi 3 tonne pit dimensions: /15 m	long		0,3	m wide
Image: register into a components Image:	R.L		н 				Datum:				
Image: register into a components Image:	р	penet-	ti	notes				nre	St.		
Image: Standard Standa	meth		ddns te	amples, ests, etc	depth (m)	usc	coopdan, companyota & minor companyota	moist	consis	00000000000000000000000000000000000000	structure and additional observations
Image: Sketch Sk	£		ĪT	_					1	- tati c	FILL
Image: Sketch Imag						 	L'E GRAVELY - DUNLES TOOL				(CLAY LINERY
Image: Sketch Imag]	1 1					
Image: Sketch Signature Image: Sketch Signature Image: Sketch Image: Sketch Signature Sig					0.5						
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Clie	nt		Lip	oman Co	onstru	ctions	Job N	0.		3002464
Prin	ncipal						Date		15	14/16
Proj	ect		Wo	odlawn	1		Logge	ed by		RB
Test	t Pit Loca	ation	n Cla	ay Liner			Check	ked by		
equi	ipment	type	e & model:	: 14	-181	chi 3 forme pit dimensions: 1,0	m long		0.3	m wide
R.L	surface	and the second second				Datum:		_		
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	og - Ex	uval	SMEC		Pit No.	TP) さ 1 of		
Client	Lipman C	onstructi	ons	Shee				
Principal				Job N		3002464		
Project	Woodlawn	1		Date		15 11/16		
Fest Pit Location	Clay Liner			Logge		RB		
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groundwater no	ot observed		roundwater inflow at: m 🗌 standing water level m	time:		date:		
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ripper excavator	1111 m	no resistance ranging to refusal	vane snear (kPa) LL liquid limit BI black D dari Bs bulk sample F fine O orange E environmental sampla M medium V mellar		stic St nit VSt	stiff D dense very stiff VD very dense		
hand auger	willing .	oruoal	R refusal C coarse W white		н	hard friable Issue: 29/10/2015		



Fi	eld	Log	J - Ex	C	ava	tior	1			4	J		5N	1E	C					Test	Pit No	D .			TP	19	
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Clier	it		Lipman	Con	struc	ctions														Job N	No.			30	00246	64	
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Test Pit No.	
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Field Log - Excavation	Test Pit	t No. TP 20	
		Sheet	1 of /
Client Lipman Constructions		Job No.	3002464
Principal		Date	15 11/16
Project Woodlawn		Logged	by RB
Test Pit Location Clay Liner		Checked	d by
equipment type & model: fl.tachi	3 tonne pit dimensions: 1,5	m long	Ø, ⊰ m wide
R.L surface:	Datum:		
ting tests, etc (m) USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	PP kPa structure and ତ୍ରୁ କ୍ରିଷ୍ଟ୍ରଷ୍ଟ୍ର additional observations
E CH CLa - c - c - c - c - c - c - c - c	y: Hp. pale brown, Trave of sand + grand, trave of cold. 200-1	ly Kup I	lt (Clay Liver)
1.0 On	20 terminated @ 0.7m day hour		
	undwater inflow at: m Standing water level	m time:	date:
Sketch 5 35' 3' 2' E 149' 33'	2.24		
-	Clay hour 0.72 Xw/HW Natoriul		
natural exposure T timbering N nil L existing excavation H backhoe bucket penetration [bulldozer blade 1 2 3	50mm diameter MP medium plasticity B brown Bu b disturbed sample HP high plasticity G grey P p vane shear (kPa) LL liquid limit BI black D d s bulk sample F fine O orange environmental sample M medium Y vellow	ale W we lark Wp pla	y VS very soft VL very loose oist S soft L loose



Field Log Execution

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-				_								S	heet			1 of		
Clie			Lipman	Constr	uctions							J	ob No	D.		300246	4	
	ncipal											D	ate		15	1/16		
Pro	ject		Woodla									L	ogge	d by		RB		
Tes	t Pit Loo	cation	Clay Lir	ner								С	heck	ed by				
equ	ipment	type & m	iodel:		He	tachi 30	tom	pit dimension	s:		1, 2	ml	long		0.3	m wide		
R.L	surface	e:						Datum:									the second second	
method	-teued 1 2 3	disam	tes ples, der s, etc (n				y or par nponent	s & minor compoi	nents				moisture	consist.	PP kPa ₽	struc additional	ture and observation	IS
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meth N BH B R E HA	natural existing backho		on penet	bering 1 ration 2 3 no	nil resistance ging to isal	notes samples, tests U50 undisturbed sample 50mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample E environmental sample R refusal	plasti LP MP HP LL F M C	city/grainsize low plasticity medium plasticity high plasticity liquid limit fine medium coarse	B G BI O Y	red brown grey black orange yellow white	Bu I P I	blue pale	mois D M W Wp	ture dry moist wet plastic limit	VS VS S F f St s VSt V H f	oft i irm i tiff i	/L very loos loose MD med. den D dense /D very dens	ise



F	ield	IL	og -	Exc	ava	ation SMEC	Tes	st Pit No.		TP 22
							She	eet		1 of /
Clie	ent		Lipı	nan Co	nstru	tions	Job	No.		3002464
Prir	ncipal						Dat	е	15	11/16
Pro	ject		Woo	odlawn			Log	ged by		RB
Tes	t Pit Loo	ation	Clay	/ Liner			Che	ecked by	5	
equ	ipment	type	& model:	Þ.	Fac	hi 3 former pit dimensions: 1.5	m lor	ng	0.3	m wide
R.L	surface	e:			•	Datum:				
method	-teuet 123	support	notes samples, ests, etc	depth (m)	usc	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 00€	structure and ≩ additional observations
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				1111						
P	groun	dwate	er not ob:	served		groundwater inflow at: m standing water level m	time	e:		date:
	Sketo	ch	54	35	3	3' 22.84 3' 9.54 Clay liner 0.6 XW/HW Madrial				?
met N BH B R E HA	hod natura existin backh bulldo ripper excava hand a	ig exc oe bud zer bla ator	sure avation cket	support T timberi penetratio	on	nil U50 undisturbed sample 50mm diameter D disturbed sample sistance af af B b b b b b b b b b b b b b	een D Je M Ie W	l mois	t S F tic St	istency/density index very soft VL very loose soft L loose firm MD med. dense stiff D dense very stiff VD very dense hard friable Issue: 29/10/2015

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Evenuette

Field Log	- Excav	ation SMEC	Test Pit No.	TP 23
			Sheet	1 of
	pman Constru	ictions	Job No.	3002464
Principal	10 1823		Date	15 14716
	loodlawn		Logged by	RB
Test Pit Location Cla	lay Liner		Checked by	
equipment type & mode	el: H.A	achi 37 pit dimensions: 1,5	m long	6.3 m wide
R.L surface:		Datum:		-
pout and 1 2 3 1 2 3 tests, etc	s, depth tc (m) USC		moisture consist.	PP kPa structure and ତ୍ରିଛ୍ଡିଛି additional observations
E	0 CH	Clay: Hp, Brown, Frace of fre Scend, trave of fre grands, France of Lobbles.	Кыр Н	Ester (ccay how)
17 <i>0</i> 7		TP23 Terminoded & O. Tr M Clay lines		
	1.0	in clay lines		
			Har, schuler and Harris Vieler's start and the physical dis- tribution of the second start and the second start	
			·	
groundwater not ob Sketch	- 35	1 3' 21,97	m time:	date:
method	5 49	1 notes samples, tests plasticity/grainsize colour	0.7m/	
N natural exposure X existing excavation BH backhoe bucket B bulldozer blade R ripper E excavator HA hand auger	T timbering N penetration 1 2 3	nil U50 undisturbed sample LP low plasticity R red Gr g 50mm diameter MP medium plasticity B brown Bu b D disturbed sample HP high plasticity G grey P p V vane shear (kPa) LL liquid limit BI black D d sistance Bs bulk sample F fine O orange ing to F convironmental campt	green D dry blue M moist pale W wet dark Wp plastic limit	F firm MD med. dense c St stiff D dense



Et al al 1 -..

Fie	ld L	.og -	Exc	ava	tion SMEC	Test P	Pit No.		TP 24
						Sheet			1 of /
Client		Lip	man Co	nstruc	tions	Job N	0.		3002464
Principa	l					Date		15	11/16
Project		Wo	odlawn			Logge	d by		RB
Test Pit	Locatio	n Cla	y Liner			Check	ed by		
equipm	ent type	e & model	:	Hite	uchi 3 tonne pit dimensions: 1,5 r	m long		0.3	m wide
R.L sur	face:				Datum:				
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					Note: XW/HW Material encountered @ 0.65m				
-					encountered @ 0.65m				
		1		alat (19-active)					
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	oundwa acetch	ater not ob	served	1 -	groundwater inflow at: m standing water level m	time:			date:
		£	149'	3	groundwater inflow at: m standing water level m 3' 21:07 3' 10:55 Clay Uner 0.65r 2 2 Xw/HW Madarial	\sum_{i}			
X ex BH ba B bu R rip E ex	atural exp isting ex ackhoe b illdozer b oper icavator and auge	xcavation ucket blade	support T timberi penetrati	on 3	nil U50 undisturbed sample LP low plasticity R red Gr greet S0mm diameter MP medium plasticity B brown Bu blue D disturbed sample HP high plasticity G grey P pale V vane shear (kPa) LL liquid limit BI black D dark Statemeter Bs bulk sample F fine O orange V velow	n D M W	sture dry moist wet plast limit	VS F ic St VSt H	tency/density index very soft VL very loose soft L loose irm MD med. dense stiff D dense very stiff VD very dense nard riable Issue: 29/10/2015



Field Log Execution

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	st Pit Loc	cation		y Liner									Logge			RB		
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	surface			114	ach.	U	Jonne		Datum:	<u>.</u>	/,	. >	In iee		U)	C	
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Field

F	ield	Log -	Exc	ava	tion GALL SMEC	Test F	Pit No.		TP 27
		Ŭ				Sheet			1 of /
Clie	nt	Lipi	man Co	nstru	ctions	Job N	0.		3002464
Prin	cipal					Date		15	/3/16
Proj	ect	Woo	odlawn			Logge	ed by		RB
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equ	ipment	type & model:	On	~	pype fourch pit dimensions: 20m	m long		Im	m wide
R.L	surface	:	P		Datum:				
method	tenet 1 2 3	tion samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 000000000000000000000000000000000	structure and additional observations
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	16R 2 0			CH 1.0 1.5	Gravelly clay: Hp, pack brown, grants of grante with rock structure, estimated low strength	wp o	H		XW/HW Material
P		idwater not ob	oserved		groundwater inflow at: m standing water level m	time:			date:
		35' 149'	<u> </u>			ate.	a		115
					-20m				/

m N X B B R	bulldozer blade ripper	penetration	notes U50 D V Bs	undisturbed sample 50mm diameter disturbed sample vane shear (kPa) bulk sample	LP MP HP LL F	ticity/grainsize low plasticity medium plasticity high plasticity liquid limit fine	cold R B G B O	red brown grey black orange	Gr Bu P D	green blue pale dark	mois D M W Wp	dry moist wet	cons VS S F St VSt	sistency/dens very soft soft firm stiff very stiff bard	VL L MD D VD	lex very loose loose med. dense dense very dense
R E H	excavator	no resistance ranging to refusal	Bs E R	bulk sample environmental sample refusal	F M C	fine medium coarse	O Y W	orange yellow white				limit	VSt H Fb	hard friable Issue: 29/1		





GENERAL

Information obtained from excavation and drilling investigations is recorded on log sheets. The "Geotechnical Log of Non-core Drillhole" presents data from drilling operations where a core barrel has not been used to recover material and information is based on a combination of regular sampling and insitu testing. The "Geotechnical Log of Excavation" presents data obtained on the subsurface profile from observations of excavations, either natural or man-made.

The heading of the log sheets contains information on client and project identification, hole or pit identification, location and elevation. Details of the drilling contractor, equipment, drilling or excavation dates, and of the personnel responsible for the preparation of log, are given at the bottom of the sheet. The main section of the log contains information on drilling or excavation methods and conditions, material substance description, details of insitu tests and additional observations, presented as a series of columns plotted with reference to length in metres below the ground surface. The "Geotechnical Log of Excavation" contains a squared section for a scaled, graphical presentation of the typical excavation profile

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the assessment of conditions between samples and of the origin of the materials. Material description and classification is generally based on Geotechnical Site Investigation Code AS1726-1993.

DRILLING

Drilling & Casing

HA	Hand auger
AS	Auger screwing
ADV	Auger drilling with V bit
ADT	Auger drilling with TC bit
WB	Wash-bore drilling
RR	Rock Roller
NQ	NQ core barrel (42mm diameter)
NMLC	NMLC core barrel (52mm diameter)
HQ	HQ Core Barrel (62mm diameter)

Sampling

Sections sampled bounded by lines across column.

- Disturbed sample D
- в Bulk disturbed sample
- Е Environmental sample
- Water Sample W
- SPT Standard penetration test sample
- U50 Undisturbed tube sample (50 mm diameter)

Rate of Drilling / Excavation Penetration

VE	Very Easy
E	Easy
F	Firm
Н	Hard
VH	Very Hard
R	Refusal

Water

- ▾ Groundwater level with date observed
- Groundwater inflow at the level marked
- Loss of drilling fluid at the level marked 4

Field Tests

- Standard Penetration Test result Ν
- VS Vane Shear (kPa)
- PP Pocket Penetrometer (kPa)
- Ρ Pressuremeter W/
- Permeability
- MC Field moisture content

Elevation / Depth

Depth is length in metres below the ground surface. Elevation is vertical height in metres above datum.

MATERIAL

Graphic Log

Material types are indicated by standard symbols based on visual examination, field tests and available laboratory tests.

Classification Symbol

Standard classification symbols are based on the Unified Soil Classification System (USCS), AS1726-1993, Appendix A, Table A1.

Material Description

Materials are described in accordance with AS1726- 1993: Soil Type, Plasticity (cohesive soils) or Particle Characteristics (cohesionless soils), Colour, Secondary and Minor Components. Soils types are described according to their predominate particle/grain size:

Cohesiv Silt Clay		Boulder Cobble Gravel	nless Soils >200 mm 63 – 200 mm 2.36 – 63 mm 0.075 – 2.36 mm
Plasticit Descript Low Medium High	y – Cohesive Soils tion	LL (%) < 35 % 35 – 50 % > 50 %	6
	Characteristics – Co nd gravels can be sub Grading	divided by	

Sanus an	u yraveis carr be	Subulvided by their gra
Name	Grading	Particle Size (mm
Gravel	Fine	2.36 - 6.0
	Madium	6.0 20

	Medium	6.0 – 20
	Coarse	20 – 63
Sand	Fine	0.075 – 0.20
	Medium	0.20 - 0.6
	Coarse	0.63 – 2.36
Malatura		

Moisture

Dry D

- Μ Moist - no free water on remoulding W
 - Wet free water on remoulding

Consistency / Relative Density

Consistency – Cohesive Soils

Symbol	Term	Unconfined Compressive Strength, q _u (kPa)
VS	Very Soft	< 25
S	Soft	25 – 50
F	Firm	50 – 100
St	Stiff	100 – 200
VSt	Very Stuff	200 - 400
Н	Hard	> 400
Fr	Friable	

Relative Density – Cohesionless Soils

Symbol	Term	SPT N- Value (Blows/0.3m)	Density
VL	Very Loose	0 – 3	< 15 %
L	Loose	3 – 8	15 – 35 %
MD	Medium Dense	8 – 25	25 – 65 %
D	Dense	25 – 52	65 – 85 %
VD	Very Dense	> 42	> 85 %

Structure

Fissuring and other structural defects are described in accordance with AS1726-1993, Appensix 2.6, using the terminology for rock defects.

<u>Origin</u>

Where practicable, an assessment is provided of probable origin of the soil, e.g. fill, topsoil, alluvium, colluvium, or residual soil.



ACT Geotechnical Engineers Pty Ltd ACN 063 673 530

5/9 Beaconsfield Street, Fyshwick, ACT, 2609 PO Box 9225, Deakin, ACT, 2600 Ph: (02) 6285 1547

Our ref: SM/C7755 1 December 2015

A Plus Plumbing 1/1 Pelle Street Mitchell BC ACT 2911

Attention: Mr Tom Paton

PROPOSED VEOLIA DEVELOPMENT - WOODLAWN BIOREACTOR, WOODLAWN (TARAGO), NSW GEOTECHNICAL ASSESSMENT & PERMEABILITY TESTING OF EXCAVATED MATERIAL

1 Introduction

At the request of A Plus Plumbing, ACT Geotechnical Engineers Pty Ltd conducted a geotechnical assessment and laboratory permeability testing of material that will be excavated as part of the construction of the proposed Veolia Development at Woodlawn, NSW. It is understood that the development will require excavations into virgin natural material, and the spoil from the excavations is proposed to be used on site as a controlled fill in building pads, roads, and the high plasticity (CH) clay soils as a capping/sealing layers in certain areas.

The purpose of the inspection was to assess the material as being suitable as a capping material. Laboratory falling head permeability testing was conducted to confirm that the material meets the EPA requirements of an in-situ co-efficient of permeability of less than 1×10^{-9} m/s.

2 Subsurface Conditions

Two stockpiles were sampled on the site on 16 November 2015, to inspect the soil composition/type and to obtain samples for laboratory testing. The stockpiles found the soils to comprise high plasticity silty clay/clay, with some sand and trace gravels.

3 Material Assessment

Two samples comprising a mix of the residual soils from the on site stockpiles were sampled and tested in a NATA lab for falling head permeability, particle size distribution, and Atterberg limits. The testing showed that the material classifies as being a well-graded CH (cohesive slightly silty clay soil of high plasticity) in accordance with the Unified Soil Classification System (USCS). The testing also obtained coefficients of permeability of $2x10^{-10}$ m/s and $3x10^{-10}$ m/s, when compacted to 98%StdMDD, which exceeds the specified co-efficient of permeability of less than $1 \times 10^{.9}$ m/s. Hydrometer (0.002mm) results of 50% and 70%, and Cation Exchange Capacity results of 23 and 27, for samples 1D and 2D, both exceed the compliance criteria. Therefore, the residual clayey soils are suitable for use as a capping material. The laboratory test certificates are attached.

Any topsoil in the upper 0.1m/0.2m of the general on site profile is silty and should not be used as capping material, while any excavated bedrock would probably be too granular for use as clay capping material.

Should you require any further information regarding this inspection report, please contact our office.

Yours faithfully ACT Geotechnical Engineers Pty Ltd

Jeremy Murray Director Senior Geotechnical Engineer





Douglas Partners Pty Ltd ABN 75 053 980 117 www.douglaspartners.com.au 231 Normanby Road PO Box 5051 South Melbourne VIC 3205 Phone (03) 9673 3500 Fax (03) 9673 3599

Results of Moisture 2 ontent Plasticity and Linear Shrink 3 QP Tests

Remarks:	Sampling Methods: Sampled by Client	Test Methods:Moisture Content:AS 1289 2.1.1Liquid Limit:AS 1289 3.1.2Plastic Limit:AS 1289 3.2.1Plasticity Index:AS 1289 3.3.1Linear Shrinkage:AS 1289 3.4.1	Legend: W _F Field Moisture Content W _L Liquid limit W _P Plastic limit Pl Plasticity index LS Linear shrinkage from liquid limit condition (Mould length254mm)	2D Stockpile Slightly silty CLAY, trace gravel, some sand	1D Stockpile Slightly sandy silty CLAY, gravel	TestDepthLocation(m)	Location: Tarago Collector Road, Tarago	Client: ACT Geotechnical Engineers Pty Ltd Project: Woodlawn Bioreactor - C7755	Results of Moisture Content, Pla
			igth254mm)	trace gravel,	CLAY, some		Tarago, NSW	Pty Ltd	Plasticity and L
		*Sp	Code: Sample 1. Ai 2. Lo 3. O 4. U	2,5	2,5	Code			Linear Shrinkage
		hod of prepa Dry sieved Wet sieved Natural vecify if sample	de: nple history Air dried Low temp Oven (10: Unknown	17.0	16.6	% _₽	Date Sample Date of Test: Page:	Project No: Report No: Report Date:	Shrii
		Method of preparation for plasticity tests 5. Dry sieved 6. Wet sieved 7. Natural *Specify if sample crumbled CR or curled CU	Code: Sample history for plasticity tests 1. Air dried 2. Low temperature (<50°C) oven dried 3. Oven (105°C) dried 4. Unknown	88	85	%r	Date Sampled: Date of Test: Page:	t No: No: Date:	nkage
		n for plas	asticity te (<50°C) ied	22	22	%₽		ω Ζ Φ	e Tests
und		or curled	e sts oven drie	66	63	% PI	- 24-Nov-2015 1 of 1	68950.00 M15177001 30-Nov-2015	ts
Counder		CU ts	٩	22.0 CU	21.0 CR	*LS	2015	0 001 2015	

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Peter Chan Associate her

lested Checked AD

NATA Accredited Laboratory Number: 828 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Loss in pretreatment: Type of Hydrometer:

> 0% g/I

Soil Particle Density Passing 2.36 mm Sieve = 2.62 t/m³

Sampling Method(s): Sampled by Client

AS 1289.3.6.1, AS1289.3.6.3

Slightly sandy silty CLAY, some gravel

Description:

Test Method(s):

Remarks:

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Results Project : Location : Client : Depth / Layer: **Test Location:** 9 Geotechnics of Doug Particle 10 Woodlawn Bioreactor Stockpile ACT Geotechnical Engineers Pty Ltd Tarago Collector Road, Tarago, NSW I Environment I as Size 10 Distribution (Hydrometer) artners 1 C7755 Groundwater AUSTRALIAN STANDARD SIEVE APERTURES Page: **Report Date :** Date of Test: Date Sampled: Report No. : Project No. : 10/11/2015 30.11.2015 M15177002 68950.00 www.douglaspartners.com.au 231.Normanby Road South Melbourne VIC 3205 Phone (03) 9673 3599 Fax (03) 9673 3599 -Douglas Partners Pty Ltd ABN 75 053 980 117 of -

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Percent Passing

50

60

70

80

90

100

40

Associate	Peter Char	Allon
ate	an	6

Checked:	Tested:
AG	AD

NATA Accredited Laboratory Number: 828 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Loss in pretreatment: Type of Hydrometer:

> 0% g/I

Soil Particle Density Passing 2.36 mm Sieve = 2.62 t/m³

Sampled by Client

Remarks:

Sampling Method(s):

AS 1289.3.6.1, AS1289.3.6. ŵ

Slightly silty CLAY, trace gravel, some sand

Description: Test Method(s):

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Results of Particle Size Distribution (Hydrometer)

Project :

Woodlawn Bioreactor -

- C7755

ACT Geotechnical Engineers Pty Ltd

Client :

Test Location:

Location :

Tarago Collector Road, Tarago, NSW

Depth / Layer:

Stockpile 2D

0.075

0.150

0.300

0.425

0.600 1.18 2.36 4.75

6.70 9.5 13.2 19.0

26.5

37.5

200

AUSTRALIAN STANDARD SIEVE APERTURES

Page:

Date Sampled:

Date of Test:

10/11/2015

-

of, -

Report Date : Report No. : Project No. :

30.11.2015 M15177003 68950.00

WWW vvw.douglaspartners.com.au 231 Normanby Road PO Box 5051 South Melbourne VIC 3205 Phone (03) 9673 3509 Fax (03) 9673 3599 Douglas Partners Pty Ltd ABN 75 053 980 117

Geotechnics Doug I Environment I as 10 artners Groundwater

FORM R004D REV 5 JULY 2010

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Environment I	las Pai
Groundwater	rtners

Douglas Partners Pty Itd ABN 75 053 980 117 www.douglaspartners.com.au 231 Normanby Road PO Box 5051 South Melbourne VIC 3205 Phone (03) 9673 3500 Fax (03) 9673 3599

Results of Compaction Test

Client :

ACT Geotechnical Engineers Pty Ltd

Report No. : Project No. :

M15177004

68950.00

REV 8 APRIL 2013			© 2013 DO	UGLAS P	ARTNERS PTY LTD														
Sampling Methods:	Test Methods:	Remarks:		Description:	Sample Details:	c	1.400	1.420	1.440	Dr 1.460	1.480	1.500	2) 1.520 	1.540	1.560	1.580	1.600	Location :	Project :
hods: Sampled by Client	AS 1289.2.1.1, AS 1289. 5.1.1		Optimum	Slightly sandy silty CLAY, some gravel Maxi	s: Location: 1D Depth: Stockpile		5											Tarago Collector Road, Tarago, NSW	Woodlawn Bioreactor - C7755
(how ,			Optimum Moisture Content: 2	Maximum Dry Density: 1	Particles > 19mm: 0%		25									> 0% Air Voids		Date of Test: 10/11/2015 Page: 1 of 1	Report Date : 11/11/2015
we			22.5 %	1.58 t/m ³	~	ŝ												15	15

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ORM R016 REV 8 APRIL 2013

COMPETENCE

NATA Accredited Laboratory Number: 828 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Checked: Tested:

Laboratory Manager Arveendra Gounder

AM AG

ORM R016 REV 8 APRIL 2013			© 2013 DOUGLAS	PARTNERS PTY L	TD									
NAT TECHNICAL COMPETENCE	Test Methods:	Remarks:	Description:	Sample Details:	c	1.350	Density (t/m³) 1.450	1.500	1.550	1.600	Location :	Project :	Client :	
Inods: Sampled by Client NATA Accredited Laboratory Number: 828 The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025	AS 1289.2.1.1, AS 1289.		Slightly silty CLAY, trace gravel, some sand	s: Location: 2D Depth: Stockpile	2	л 					Tarago Collector Road, Tarago, NSW		ACT Geotechnical Engineers Ptv Ltd	ouglas Par technics Environment
Tested: AM Checked: AG	5.1.1		Maximum Dry Density: Optimum Moisture Content:	Particles >	nt (%)	25 30			0% Air Voids		W Date of Test: Page:		Project No. :	tners Groundwater
Arveendra Gounder Laboratory Manager			1.55 t/m ³ 22.5 %	19mm: 0%						-	10/11/2015 1 of 1	M15177005 11/11/2015	68950.00	Douglas Partners Pty Ltd ABN 75 053 980 117 www.douglaspartners.com.au 231 Normanby Road 231 Normanby Road PO Box 5051 South Melbourne VIC 3205 Phone (03) 9673 3500 Fax (03) 9673 3599



Douglas Partners Pty Ltd ABN 75 053 980 117 www.douglaspartners.com.au 231 Normanby Road PO Box 5051 South Melbourne VIC 3205 Phone (03) 9673 3500 Fax (03) 9673 3599

Results of Falling Head Permeability

2D	1D	Sample Location	Location:	Project:	Client:
Stockp ile	Stockp ile	Depth (m)			Þ
Slightly silty CLAY	Slightly sandy silty CLAY	Sample Description	Tarago Collector Road, Tarago, NSW	Woodlawn Bioreactor - C7755	ACT Geotechnical Engineers Pty Ltd
1.49	1.55	Dry Density Before Test	or Road, T	actor - C7	cal Engin
86	86	Density Ratio (Standard) (%)	arago, N	755	ieers Pty
22.5	22.4	Moisture Content Before Test (%)	SW		Ltd
24.8	25.5	Moisture Content After test (%)		71.	נד ת
Variable	Variable	Hydraulic Gradient	Date Sampled: Date of Test: Page:	Report Date:	Project No: Report No:
NIL	NIL	Surcharge Applied (kg)	ä	<u>e</u> :	
NIL	NIL	Percentage Oversize (%)	- 23-No 1 of 1	30-No	68950.00 M151770
2x10 ⁻¹⁰	3x10 ⁻¹⁰	Coefficient of Permeability (m/sec)	- 23-Nov-2015 1 of 1	30-Nov-2015	68950.00 M15177006

Test Method(s): DP In-House Method

Sampling Method(s): Sampled by Client

Remarks: Intended Compaction Conditions were 98% STD at OMC Coefficient of permeability corrected to equivalent water temperature 20°c Saturation achieved in closed system within the test mould



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

COMPETENCE

Checked: Tested: AG T

> Laboratory Manager Arveendra Gounder



email: sydney@envirolab.com.au envirolab.com.au

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

CERTIFICATE OF ANALYSIS

137226

Client: Douglas Partners Pty Ltd (Melbourne) 68 Brighton St Richmond VIC 3121

Attention: Alex Patterson

Sample log in details:

Your Reference:	68950.00, Woodlawn Bioreactor - C7755
No. of samples:	2 Soils
Date samples received / completed instructions received	11/11/15 / 11/11/15

Analysis Details:

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

Report Details:			
Date results requested by: / Issue Date:	17/11/15	/	16/11/15
Date of Preliminary Report:	Not issued		
NATA accreditation number 2901. This document sha	all not be reproduced e	except i	n full.
Accredited for compliance with ISO/IEC 17025.	Tests not covered b	y NAT	A are denoted with *.

Results Approved By:

Jacinta/Hurst

Laboratory Manager



CEC			
Our Reference:	UNITS	137226-1	137226-2
Your Reference		1D	2D
Type of sample		Soil	Soil
Date prepared	-	13/11/2015	13/11/2015
Date analysed	-	13/11/2015	13/11/2015
Exchangeable Ca	meq/100g	4.3	6.0
ExchangeableK	meq/100g	0.3	0.4
Exchangeable Mg	meq/100g	15	17
ExchangeableNa	meq/100g	3.0	3.7
Cation Exchange Capacity	meq/100g	23	27

MethodID	Methodology Summary
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.

	Client Reference: 68950.00, Woodlawn Bioreactor - C7755													
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery						
CEC						Base II Duplicate II % RPD								
Date prepared	-			13/11/2 015	[NT]	[NT]	LCS-1	13/11/2015						
Date analysed	-			13/11/2 015	[NT]	[NT]	LCS-1	13/11/2015						
Exchangeable Ca	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	107%						
Exchangeable K	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	107%						
ExchangeableMg	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	104%						
ExchangeableNa	meq/100 g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	91%						
Cation Exchange Capacity	meq/100 g	1	Metals-009	[NT]	[NT]	[TN]	[NR]	[NR]						

Report Comments:

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

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

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples. **Duplicate**: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

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

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

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

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

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

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

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

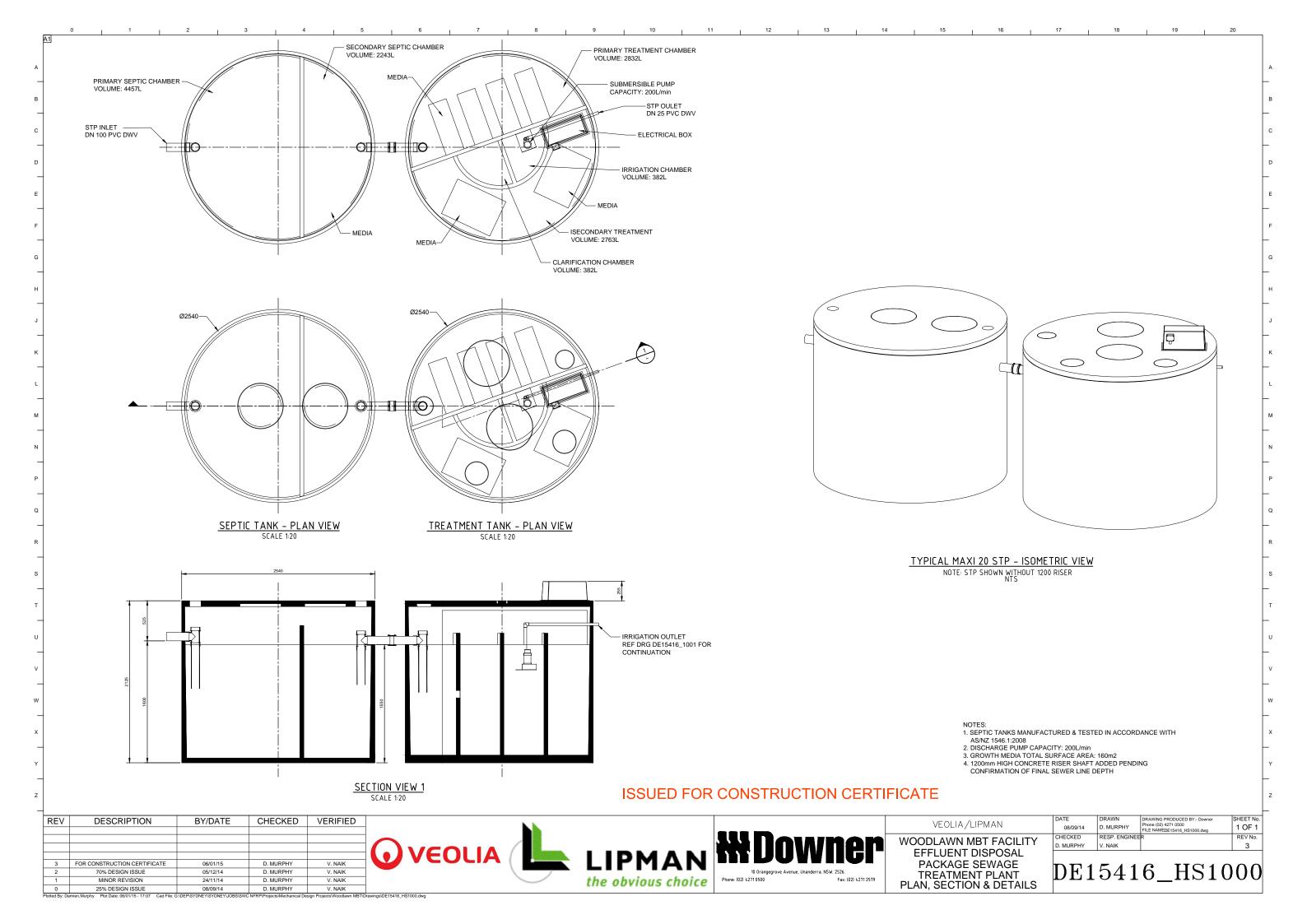
Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

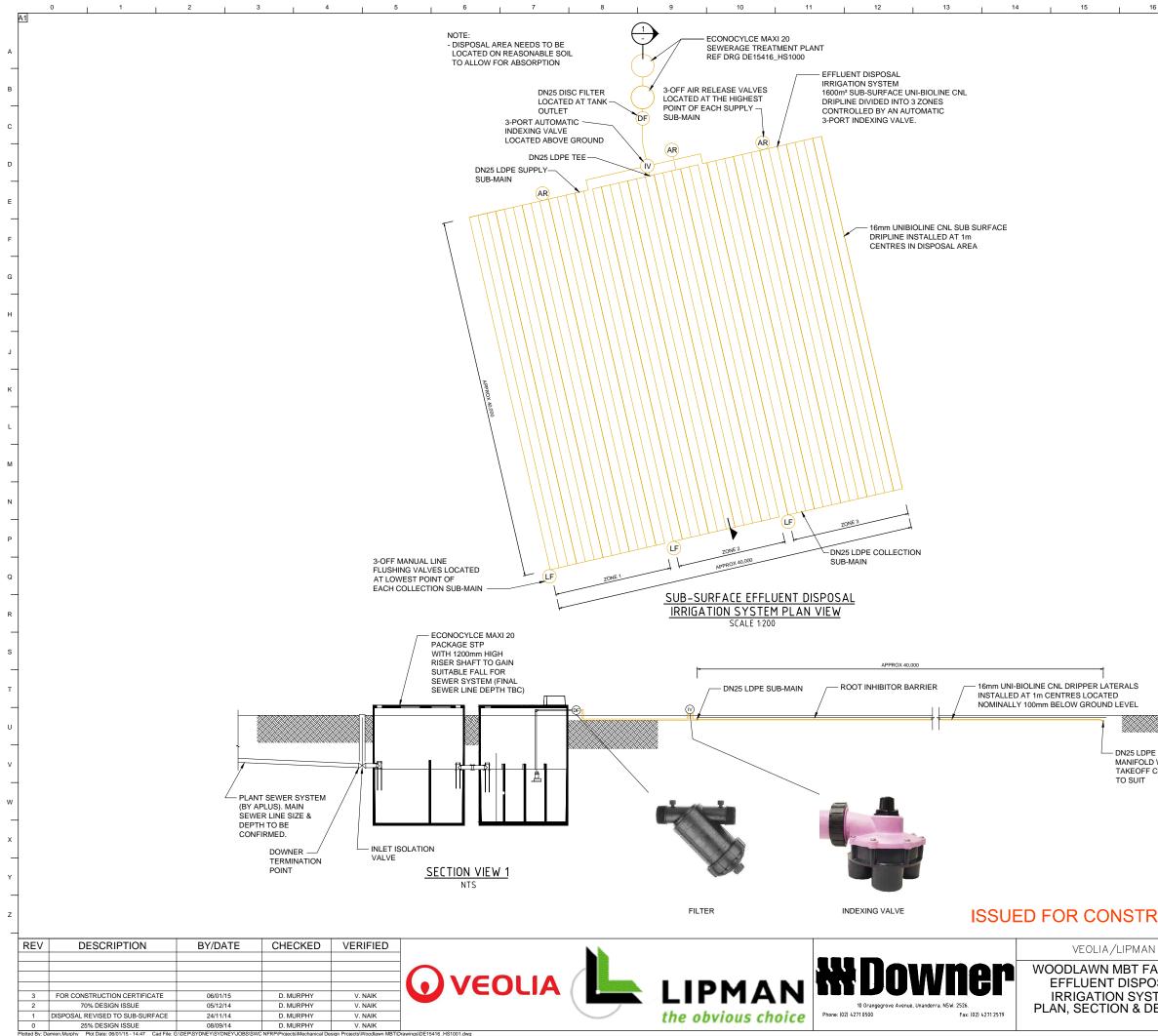


PLAN

Page: Page 37 of 38 Document: PLA-NSW-XXX-XXX-1 Date: 19.01.2017 Soil, Water & Leachate Management

Appendix D1.4 Effluent Disposal Package Sewage Irrigation System





	08/09/14	D. MURPHY	FILE NAMEDE15416_HS1001.dwg	1 OF 1
FACILITY	CHECKED	RESP. ENGINEE	R	REV No.
	D. MURPHY	V. NAIK		3
POSAL STEM DETAILS	DE1	541	6_HS1	001

ISSUED FOR CONSTRUCTION CERTIFICATE DATE DRAWN DRAWING PRODUCED BY:- Downer SHEET No.

18

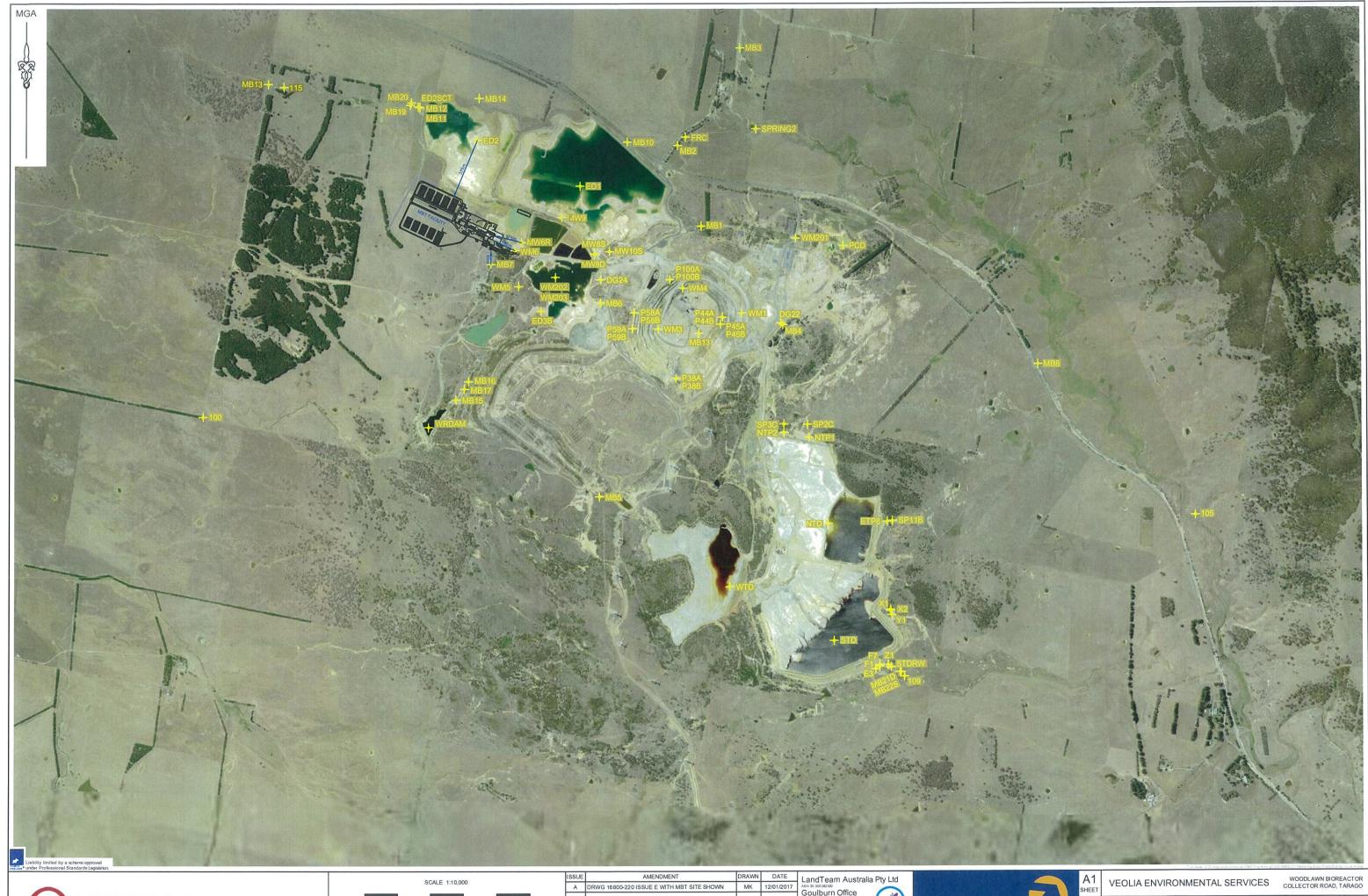
- DN25 LDPE FLUSHING MANIFOLD WITH UNI-BIOLINE TAKEOFF CONNECTIONS



PLAN

Page: Page 38 of 38 Document: PLA-NSW-XXX-XX-1 Date: 19.01.2017 Soil, Water & Leachate Management

Appendix D1.5 Woodlawn Bioreactor Monitoring Locations





	ISSUE	AMENDMENT	DRAWN	DATE	LandTeam Australia Pt
	A	DRWG 16800-220 ISSUE E WITH MBT SITE SHOWN	МК	12/01/2017	ABN 35 300 283 582 Goulburn Office
1000					36 Montague Street Postal: PO Box 1040 GOULBURN NSW 2580
I documents are the sole of the					p: (02) 4821 1033 f: (02) 4821 7238 e: goulburn@landteam.com. www.landteam.com.au

Metre:

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	OTILLI							
	1						DESIGNED: N/A	ISSUE
V	WOODLAWN BIOREACTOR						DRAWN: MK	
	SITE MONITORING LOCATIONS							
-							DRAWING No.	
\cap							16800-221	
	DATUM	NI/A	CONTOUR INTERVAL	NI/A	DATE	12/01/2017	10000	-221