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

QUALITY INFORMATION

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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
TPA	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 Development Consent

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

Table 1.1 – Consent Conditions

Relevant Condition	Requirement	SWLMP Reference
Schedule 3		
Leachate 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; (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	Section 4.3

Relevant Condition	Requirement	SWLMP Reference
	• 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 (d) include: • 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.	Noted, in this SWLMP
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	Section 4.2.1

Relevant Condition	Requirement	SWLMP Reference
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 • 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 • maintain these structures over time.	Covered in Construction CEMP
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 (c) include the detailed plans for the proposed surface water management system	Section 4.2.2
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: • baseline data; • 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	Section 5.1
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 (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.	Section 6
1(d)	Schedule 4 Environmental Management, Reporting & Auditing Environmental Management Plan 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

1.3.2 Statement of Commitments

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.

Table 1.3 – EPL Condition

Relevant Condition	Requirement	SWLMP Reference
3. Limit Conditions		
L1 – Pollution of waters		
L1.1	Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997	Noted
L2 – Concentration 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>
<tr><th>Relevant Condition</th><th>Requirement</th><th>SWLMP Reference</th></tr>
<tr><td>L2.4</td><td>Water and/or Land Concentration Limits
POINT 8
<table>
<tr><th>Pollutant</th><th>Units of Measure</th><th>50 Percentile concentration Limit</th><th>90 Percentile concentration Limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>Total Suspended Solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>50</td></tr>
</table></td><td>Noted</td></tr>
<tr><td colspan="3">4. Operating Conditions</td></tr>
<tr><td colspan="3">O5 – Other operating conditions</td></tr>
<tr><td>O5.1</td><td>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</td><td>Section 4.2.2</td></tr>
<tr><td>O5.2</td><td>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 without overflowing.</td><td>Section 4.3</td></tr>
<tr><td>O5.3</td><td>A freeboard of at least 0.5 metres must be maintained in the leachate aeration pond at all times</td><td>Section 4.3</td></tr>
</table>

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 Community Consultation

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

Table 2.1 – SWLMP Responsibilities

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

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.

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.

Table 3.1 – Soil and Water Risk Rating

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

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:
  - the run-on of clean surface water to the site ,
  - runoff of leachate from the site;
  - 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 Site Water Balance

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;

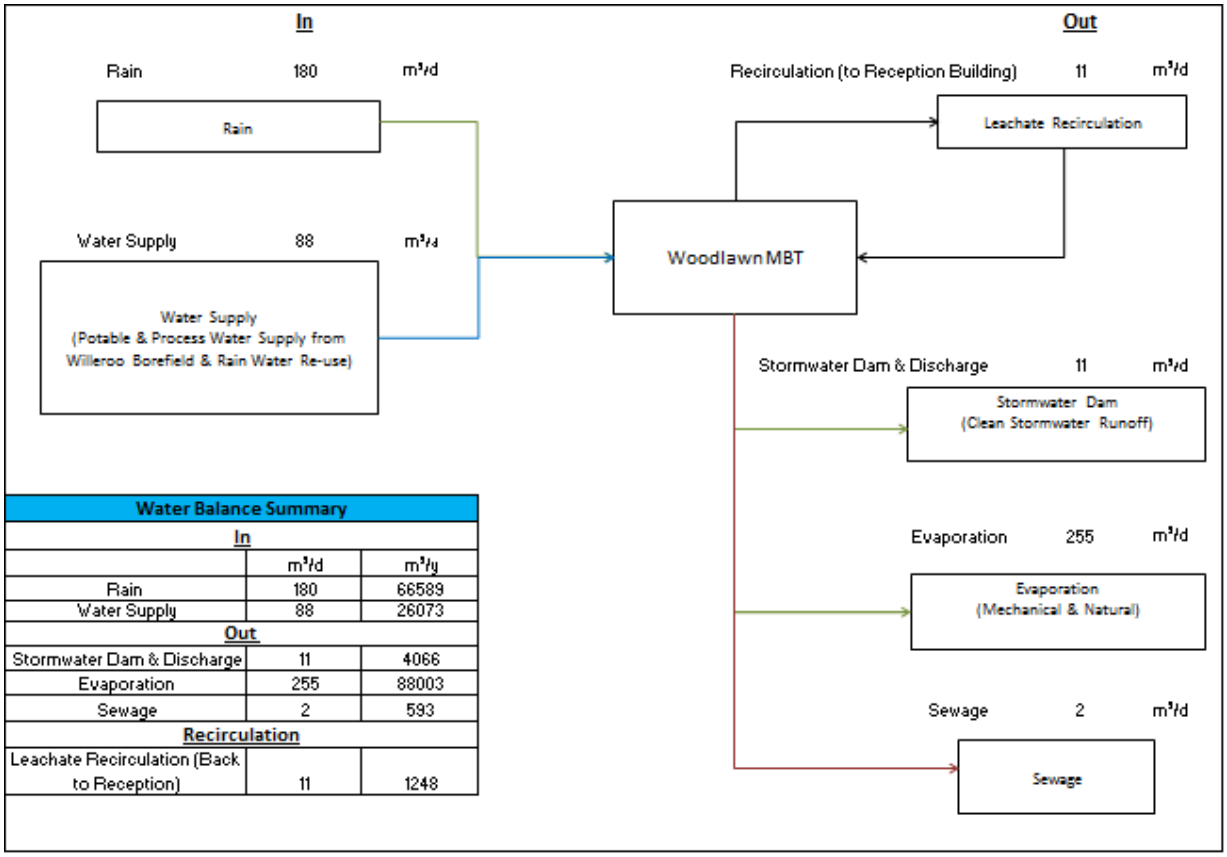
- 1 x 30 kL rainwater tank;
- 2 x 475 kL process water tanks;
- 1 x 4.6 ML stormwater storage pond;
- 1 x 1.9 ML leachate aeration pond;
- 2 x 144 kL firewater tanks ;

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



Water Balance Summary		
In		
	m³/d	m³/y
Rain	180	66589
Water Supply	88	26073
Out		
Stormwater Dam & Discharge	11	4066
Evaporation	255	88003
Sewage	2	593
Recirculation		
Leachate Recirculation (Back to Reception)	11	1248

4.2.1.1 Water In

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 re-use 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.

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

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**

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:
    - 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 building roof and its rainfall capture efficiency.
    - The tank height has been limited to 6m to remain below building roof heights.
    - In any large storm events, excess rainfall runoff from the tank shall be directed to the stormwater pond
- Stormwater Pond
    - 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 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^{-9}m/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^{-7}m/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.

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

Table-5.1- Baseline Data-Surface Water

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

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

Table 5.2 – Water quality monitoring requirements

Environmental Planner	Location	Parameters	Frequency	Requirement	Performance Measure/ Trigger Levels	Monitoring Method
Surface Water	EPL Identification No. 1 (Allianoyonyiga Creek)	Biological Oxygen Demand	Quarterly	Consent Condition 20(b) EPL Condition M2.3 POEO (General) Regulation 2009 cl.3(b)	Baseline	Approved Methods for the Sampling and Analysis of Water Pollutant in New South Wales Approved Methods for the Sampling and Analysis of Water Pollutant in New South Wales
		Electrical Conductivity				
		Ammonia				
		Dissolved Oxygen				
		pH				
		Potassium				
		Redox Potential				
		Total Suspended Solids				
		Total Organic Carbon				
Surface Water	EPL Identification No. 8 (Discharge point)	pH	Daily during discharge	Consent Condition 20(b) EPL Condition M2.3	6.5-8.5	

		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 commissioning 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 characterization (to commence 6 months from the date of commissioning 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

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.

Table 6.1 Triggers and Actions

Location	Pollutant	Performance Measure/ Trigger	Action	Responsibility
Surface water pond	pH	6.5 to 8.5	General housekeeping inspections and clean up; Follow incident process for spills, pump out 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 SHEQ / Environmental representative
	Suspended solids	no greater than 50mg/L		
	Oils and grease	No visible films or odour		
	Litter	No visible litter washed (or blown) from the site		
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

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.

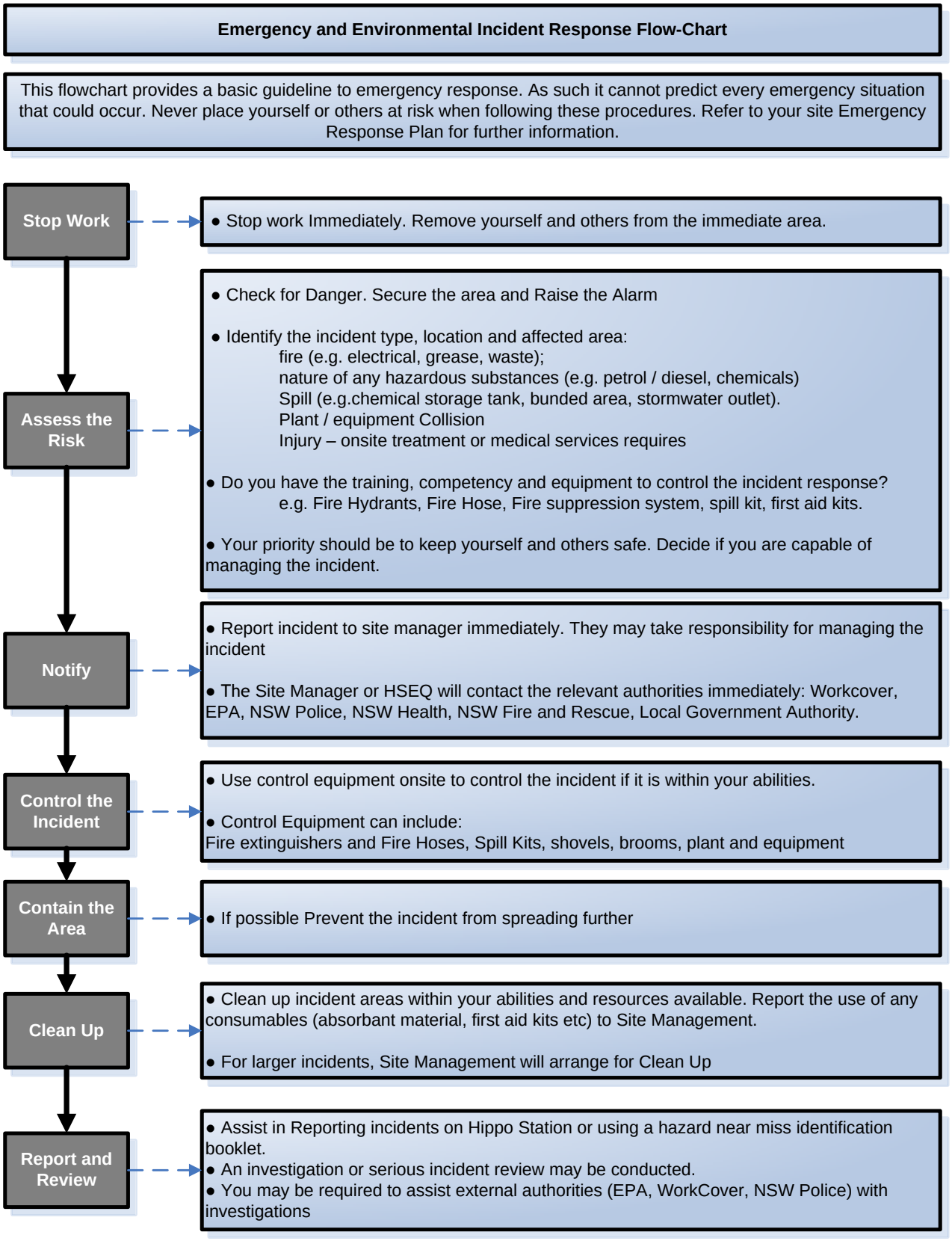


Figure 6.1 Emergency and Environmental Incident Response Flow Chart

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.

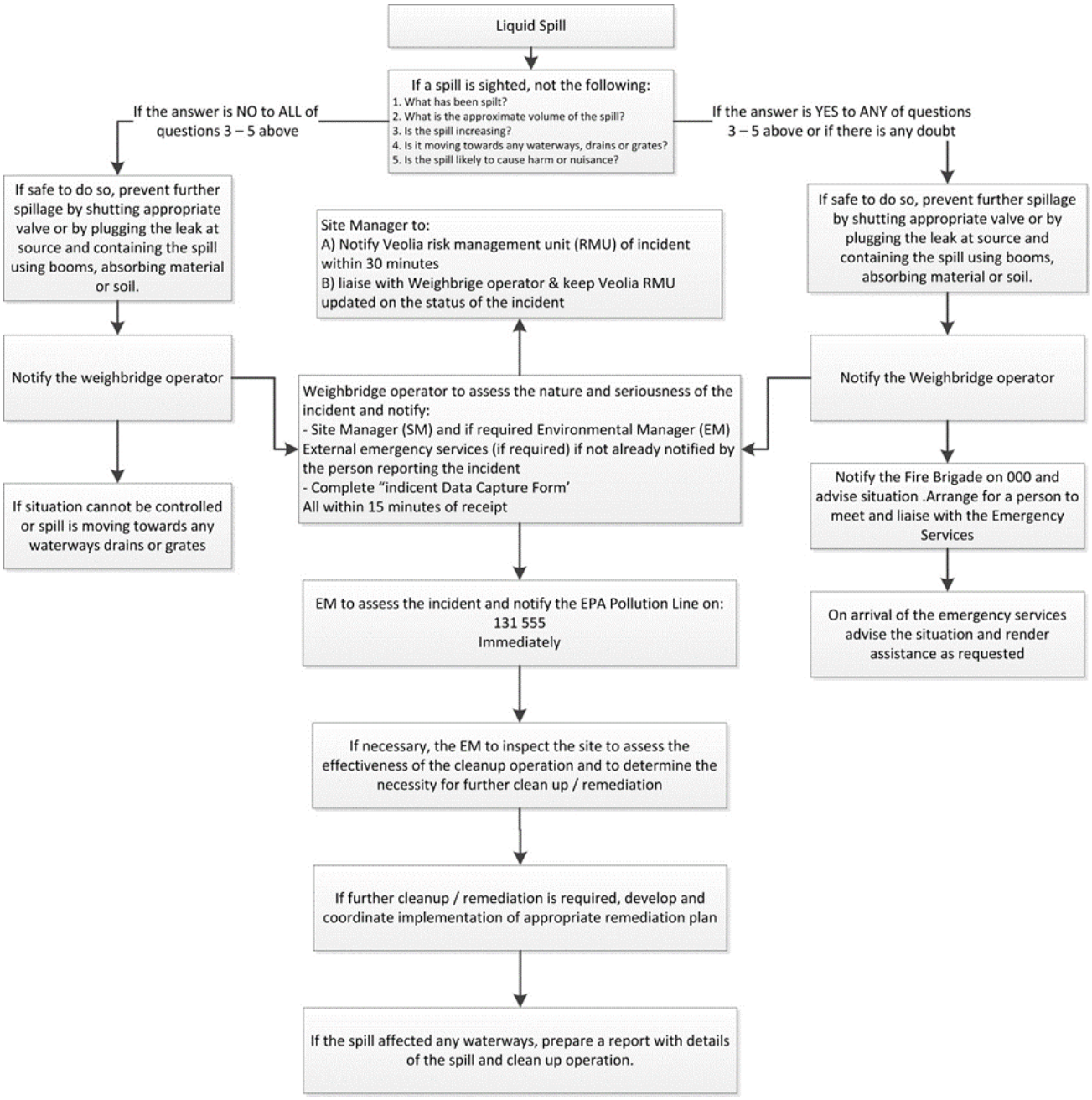


Figure 6.2 Typical Spill Response Flow Chart

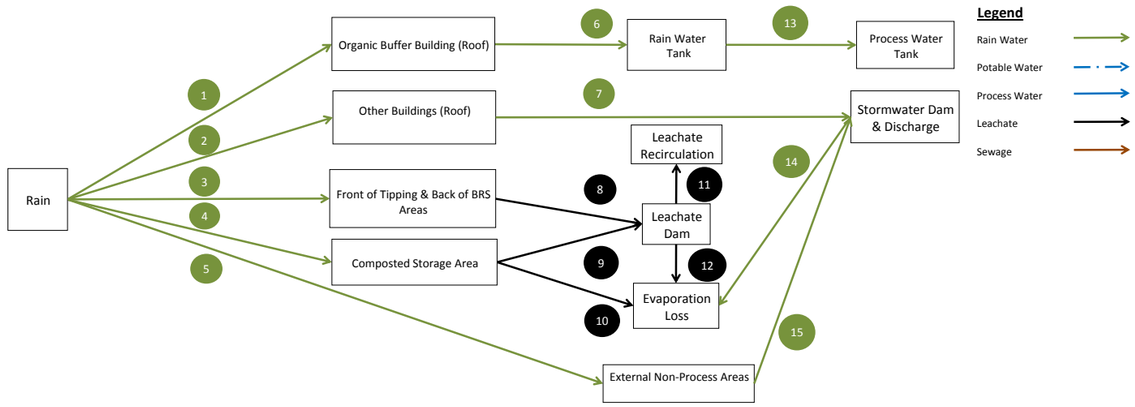
References

- 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
- Veolia Environmental Services. (2014). *Construction Environmental Management Plan*
- Sydney Catchment Authority (2012) Installing On-Site Wastewater Systems

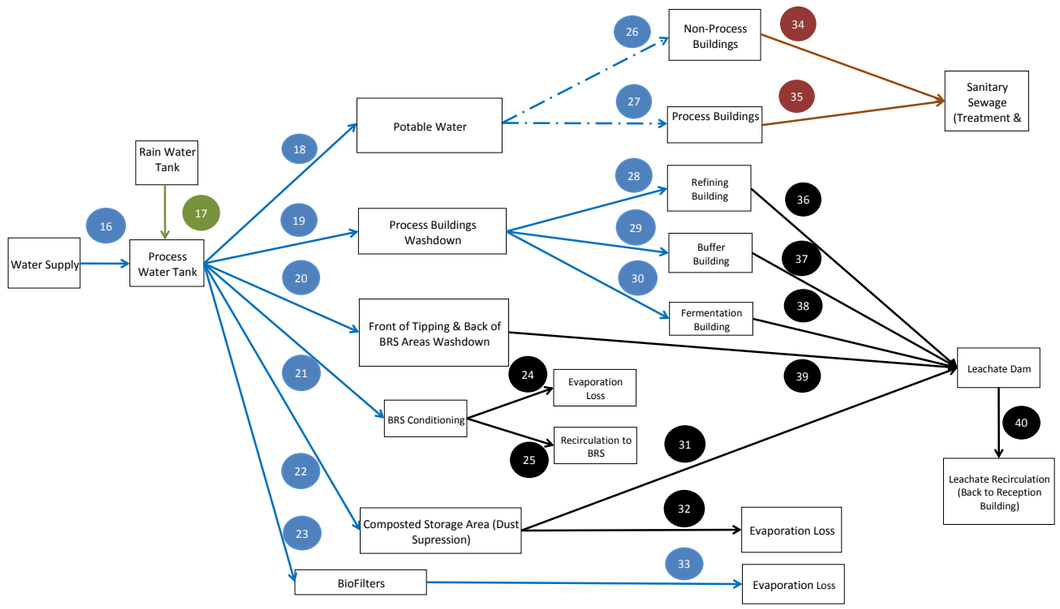
Appendices

Appendix D1.1 Detailed Water Balance

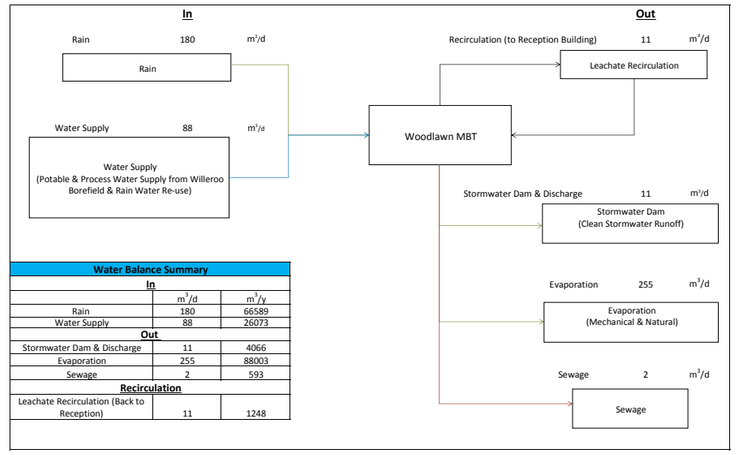
1)



2)

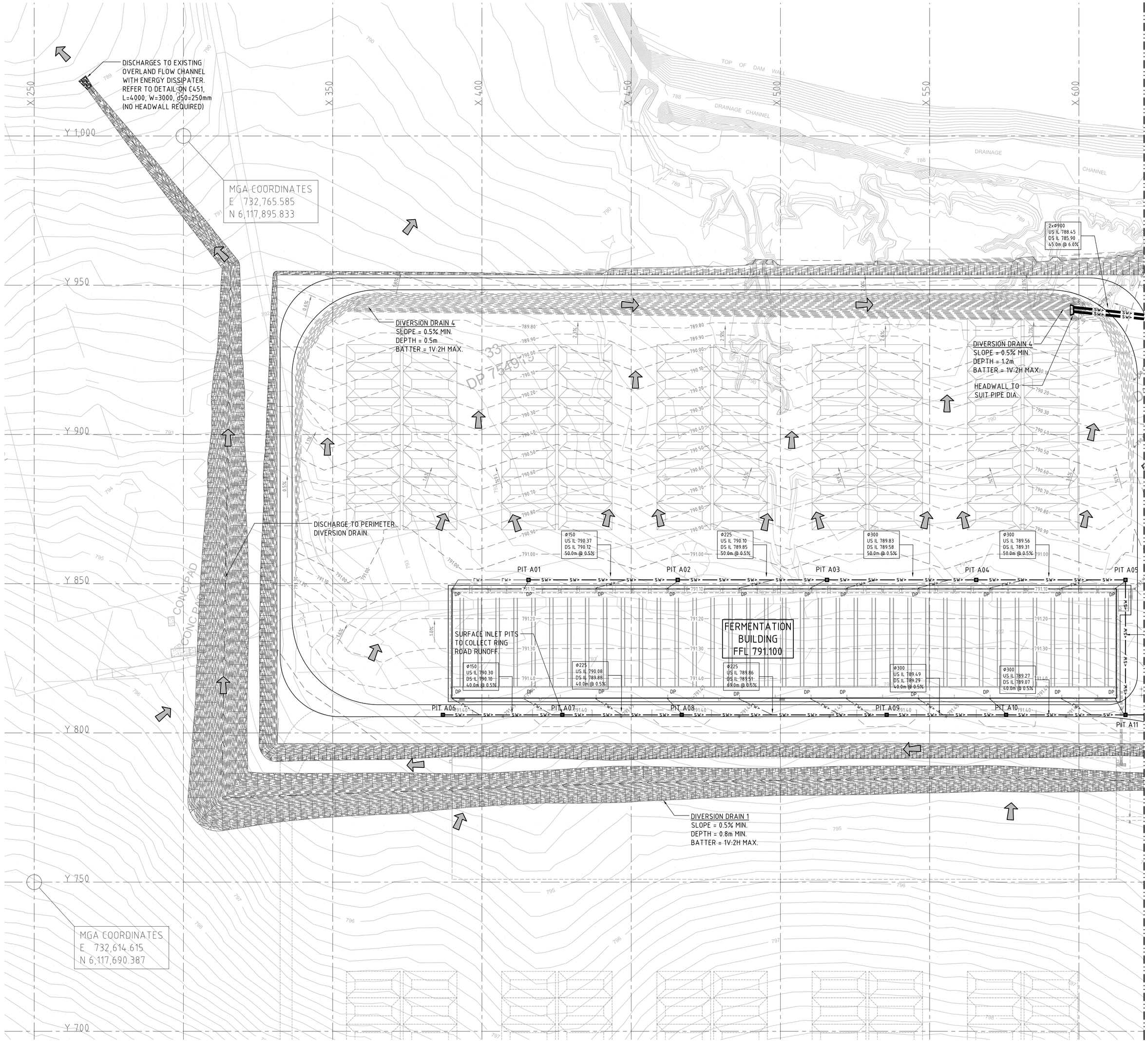


Water Balance Calculation					
Descriptions			m3/d		
From	To	Code	Hourly	Daily	Yearly
Rain	Organic Buffer Building (Roof)	1	0.10	2.5	912
Rain	Other Buildings (Roof)	2	0.95	22.8	8325
Rain	External Process Areas (Reception/BRS)	3	0.04	0.9	335
Rain	Composted Storage Area	4	2.17	52.2	19052
Rain	To External Non-Process Areas	5	4.33	104.0	37965
Organic Buffer Building (Roof)	Rain Water Tank	6	0.10	2.5	912
Other Buildings (Roof)	Stormwater Dam & Discharge	7	0.95	22.8	8325
Front of Tipping & Back of BRS Areas	Leachate Dam	8	0.04	0.9	335
Composted Storage Area	Leachate Dam	9	0.43	10.4	3810
Composted Storage Area	Evaporation	10	1.74	41.8	15241
Leachate Dam	Leachate Recirculation	11	0.30	7.2	2620
Leachate Dam	Evaporation	12	0.17	4	1525
Rain Water Tank	Process Water Tank	13	0.10	2.50	912
Stormwater Dam	Evaporation	14	4.82	115.7	42224
External Non-Process Areas	Stormwater Dam & Discharge	15	4.33	104	37965
Water Supply	Process Water Tank	16	4.63	85.68	26073
Rain Water Tank	Process Water Tank	17	0.10	2.50	912
Process Water Tank	Potable Water	18	0.11	1.9	592.8
Process Water Tank	Process Buildings Washdown	19	0.17	3.04	948
Process Water Tank	Front of Tipping & Back of BRS Areas Washdown	20	0.04	0.96	300
Process Water Tank	BRS Conditioning	21	1.92	46	14400
Process Water Tank	Composted Storage Area (Dust Supression)	22	2.19	39.4	12281
Process Water Tank	OCS	23	2.13	38.3	11951
BRS Conditioning	Evaporation	24	0.19	4.6	1440
BRS Conditioning	Recirculation to BRS	25	1.73	41.5	12960
Potable Water	Non-Process Water Buildings	26	0.05	1	296.4
Potable Water	Process Water Buildings	27	0.05	1	296.4
Process Buildings Washdown	Refining Building	28	0.11	2	624
Process Buildings Washdown	Buffer Building	29	0.01	0.24	75
Process Buildings Washdown	Fermentation Building	30	0.04	0.8	250
Composted Storage Area (Dust Supression)	Leachate Dam	31	0	0	0
Composted Storage Area (Dust Supression)	Evaporation	32	2.19	39	12281
OCS	Evaporation	33	2.13	38.30	11951
Non-Process Water Buildings	Sanitary Sewage (Treatment & Irrigation)	34	0.05	1	296
Process Water Buildings	Sanitary Sewage (Treatment & Irrigation)	35	0.05	1	296
Refining Building	Leachate Dam	36	0.11	2.00	624
Buffer Building	Leachate Dam	37	0.01	0.24	75
Fermentation Building	Leachate Dam	38	0.04	0.80	250
Front of Tipping & Back of BRS Areas Washdown	Leachate Dam	39	0.04	0.96	300
Leachate Dam	Leachate Recirculation (Back to Reception Building)	40	0.17	4.0	1248



Water Balance Summary		
In		
	m³/d	m³/y
Rain	180	66589
Water Supply	88	26073
Out		
Stormwater Dam & Discharge	11	4066
Evaporation	255	88003
Sewage	2	593
Recirculation		
Leachate Recirculation (Back to Reception)	11	1248

Appendix D1.2 Stormwater Plan



CONCEPT STORMWATER PLAN - SHEET 1
SCALE 1:500

LEGEND:

LEVELS DATUM IS AHD.
EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED.
PREPARED BY: LANDTEAM
DATED: 12.02.2014
REFERENCE: 204543-01

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- SW> DRAINAGE LINE
- RW> ROOFWATER LINE
- OVERLAND FLOW PATH DIRECTION
- 50.00 FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- 1.0% DIRECTION OF FALL AND % GRADE

STORMWATER DRAINAGE NOTES:

1. ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3:2003 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
2. THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
3. ALL FINISHED PAVEMENT LEVELS SHALL BE AS INDICATED ON FINISHED LEVELS PLANS.
4. PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN / LONGSECTIONS.
5. EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
6. ALL STORMWATER PIPES Φ375 OR GREATER SHALL BE CLASS 2 REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
7. ALL PIPES UP TO AND INCLUDING Φ300 TO BE uPVC GRADE SN8 UNO.
8. PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
9. ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE F'c 25 MPA. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
10. IN ADDITION TO ITEM 6 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
11. PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMMERS OR OTHER SUITABLE TAMPING DETAILS.
12. WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Φ100 uPVC TO EACH SIDE OF PIPE.
13. ALL SUBSOIL DRAINAGE LINES SHALL BE Φ100 SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT/ LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
14. ALL PIPE GRADES 1 IN 100 MINIMUM UNO.
15. PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
16. MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
17. PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY'.
18. PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
19. DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE U.N.O. ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
20. PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.

PIT SCHEDULE

PIT No.	GRATE RL	DEPTH	TYPE	SIZE	COMMENT
PIT A01	791.09	720	SJP	600x600	
PIT A02	791.09	990	SJP	600x600	
PIT A03	791.09	1260	SJP	900x900	
PIT A04	791.09	1530	SJP	900x900	
PIT A05	791.09	1800	SJP	900x900	
PIT A06	791.35	1050	SGGP	900x900	
PIT A07	791.35	1270	SGGP	900x900	
PIT A08	791.35	1490	SGGP	900x900	
PIT A09	791.35	1860	SGGP	900x900	
PIT A10	791.35	2080	SGGP	900x900	
PIT A11	791.35	2300	SGGP	900x900	
PIT A12	790.80	1000	SGGP	900x900	
PIT A13	791.05	2440	SJP	900x900	
PIT A14	791.05	2570	SJP	900x900	
PIT A15	789.50	1300	SJP	900x900	
PIT A16	789.40	1150	SGGP	2100x1200	
PIT A17	789.40	1300	SGGP	2100x1200	
PIT A18	790.03	830	SGGP	900x900	
PIT A19	791.65	950	SJP	900x900	
PIT A20	791.65	1380	SJP	900x900	
PIT A21	792.15	950	SJP	900x900	
PIT A22	792.15	2190	SJP	900x900	
PIT A23	791.95	2470	SJP	900x900	
PIT A24	791.80	3800	SGGP	900x900	
PIT A25	791.80	1000	SGGP	900x900	
PIT A26	791.85	1130	SGGP	900x900	
PIT A27	791.86	TBC	SGGP	900x900	

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ALL LEVELS & IL REVISED	17.12.14	F
DIVERSION DRAINS 1 & 4 REVISED, PIT SCHEDULE REVISED	10.11.14	E
REVISED FOR UPDATED ARCHI LAYOUT, PIT SCHEDULE ADDED	01.10.14	D
ISSUED FOR TENDER	19.09.14	C
DRAINAGE REVISED FOR UPDATED SITE PLAN	12.09.14	B
PRELIMINARY - ISSUED FOR INFORMATION ONLY	06.08.14	A
ISSUED FOR CONSTRUCTION CERTIFICATE	19.12.14	G

ARCHITECT
clarkson architecture
2/73 Kent Street Fitzroy 3065
0415 12 67 56
abn 186 826 099 374

CLIENT
LIPMAN the obvious choice
VEOLIA ENVIRONMENTAL SERVICES
LEVEL 6, 66 BERRY ST
NORTH SYDNEY 2060
TEL: +61 02 9955 7000
FAX: +61 02 9955 3166

PROJECT
WOODLAWN MBT FACILITY

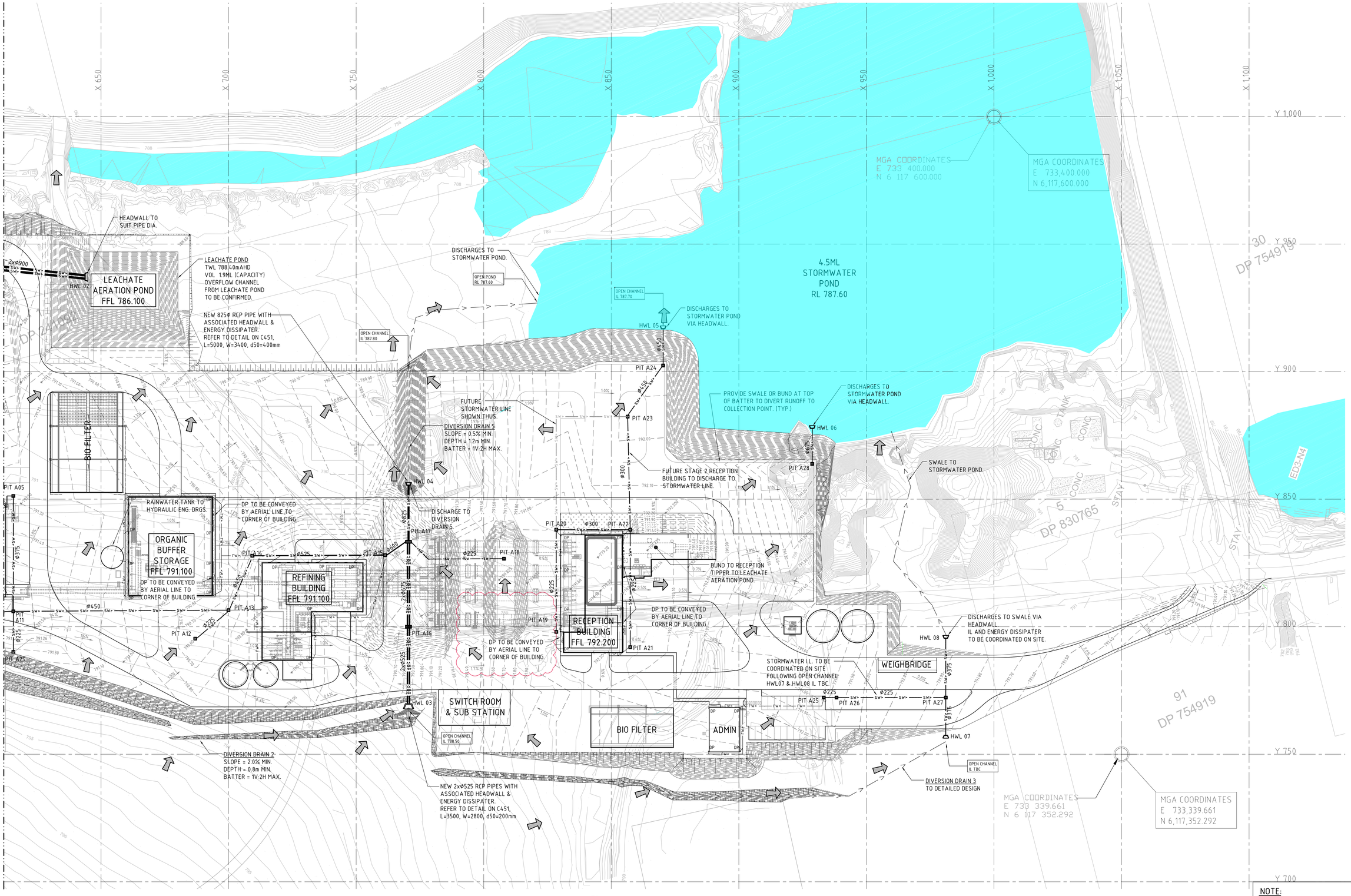
DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
M.W.	X.C.			A0	AS SHOWN	12424.00-C401

CONSULT AUSTRALIA
Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 696 448
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7699 Fax: (02) 9241-3731
email: mail@costinroe.com.au

Costin Roe Consulting
Value in Engineering and Management

DRAWING TITLE
CONCEPT STORMWATER PLAN SHEET 1

DRAWING No. C012424.00-C401 ISSUE G



CONCEPT STORMWATER PLAN – SHEET 2

SCALE 1:500

NOTE:
REFER TO DRAWING C012424.00-C401 FOR STORMWATER DRAINAGE NOTES, PIT SCHEDULE AND LEGEND.

5m 0 10 20 30 40 50m

SCALE 1:500 AT A0 SIZE SHEET

FOR CONSTRUCTION

AMENDMENTS	DATE	ISSUE
ALL LEVELS AND IL REVISED	17.12.14	F
ARCHI LAYOUT & DRAINAGE REVISED AS CLOUDED	10.11.14	E
REVISED FOR UPDATED ARCHI LAYOUT	01.10.14	D
ISSUED FOR TENDER	19.09.14	C
DRAINAGE REVISED FOR UPDATED SITE PLAN	12.09.14	B
PRELIMINARY - ISSUED FOR INFORMATION ONLY	06.08.14	A

AMENDMENTS	DATE	ISSUE
REVISED FOR BRS DRUM RAMP	11.05.16	3
REVISED FOR RECEPTION TIPPER AREA	21.04.16	2
REVISED FOR 20% EXPANSION	09.10.15	1
ISSUED FOR CONSTRUCTION	16.09.15	0
ISSUED FOR CONSTRUCTION CERTIFICATE	19.12.14	G

AMENDMENTS	DATE	ISSUE

ARCHITECT
davidson architecture
2/70 Kent Street Fairoy 3065
0415 12 57 56
abn 166 026 099 374

CLIENT
LIPMAN the obvious choice
VEOLIA ENVIRONMENTAL SERVICES
LEVEL 6, 66 BERRY ST
NORTH SYDNEY 2060
TEL: +61 02 9955 7000
FAX: +61 02 9955 3166

PROJECT
WOODLAWN MBT FACILITY

DESIGNED M.W. | DRAWN X.C. | DATE | CHECKED | SIZE A0 | SCALE AS SHOWN | CAD REF: 12424.00-C402

Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 696 448
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7699 Fax: (02) 9241-3721
email: mail@costinroe.com.au

Costin Roe Consulting
Value in Engineering and Management

DRAWING TITLE: CONCEPT STORMWATER PLAN SHEET 2

DRAWING NO: C012424.00-C402 | ISSUE: 3

Appendix D1.3 Verification of Compliance – Leachate Management

DATE 24/11/16

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

Attention: Mr Jason King, Senior Project Manager

Dear Jason,

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

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

7.1.1 – Leachate barrier

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

7.2 – Leachate Storage Pond Liner

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

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

Signature: Tom Paton

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 $1x10^{-7}$ 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 in-situ permeability (K) of less than $10^{-7}ms^{-1}$……."*
- *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)

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.

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

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

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	1.5×10^{-10}
Silty Clay with Sand	18617-FHP	8.5×10^{-11}
CLAY with sand trace gravel	18618-FHP	2.6×10^{-10}
CLAY trace sand and gravel	18619-FHP	2.4×10^{-10}
CLAY with sand trace gravel	18620-FHP	7.1×10^{-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 in-situ permeability (K) of less than $10^{-7}ms^{-1}$……"*
- *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 HEAD PERMEABILITY REPORT

Client:	SMEC - Australia & New Zealand Division	**Source:**	Western Stockpile Near Void Sample 5
Address:	74 Hunter Street, Newcastle, NSW, 2300, Australia (PO Box 1346, Newcastle, NSW, 2300, Australia)	**Sample Description:**	CLAY with sand trace gravel
Project:	Woodlawn	**Report No:**	18620-FHP
Job No:	B15458	**Lab No:**	18620

Test Procedure:

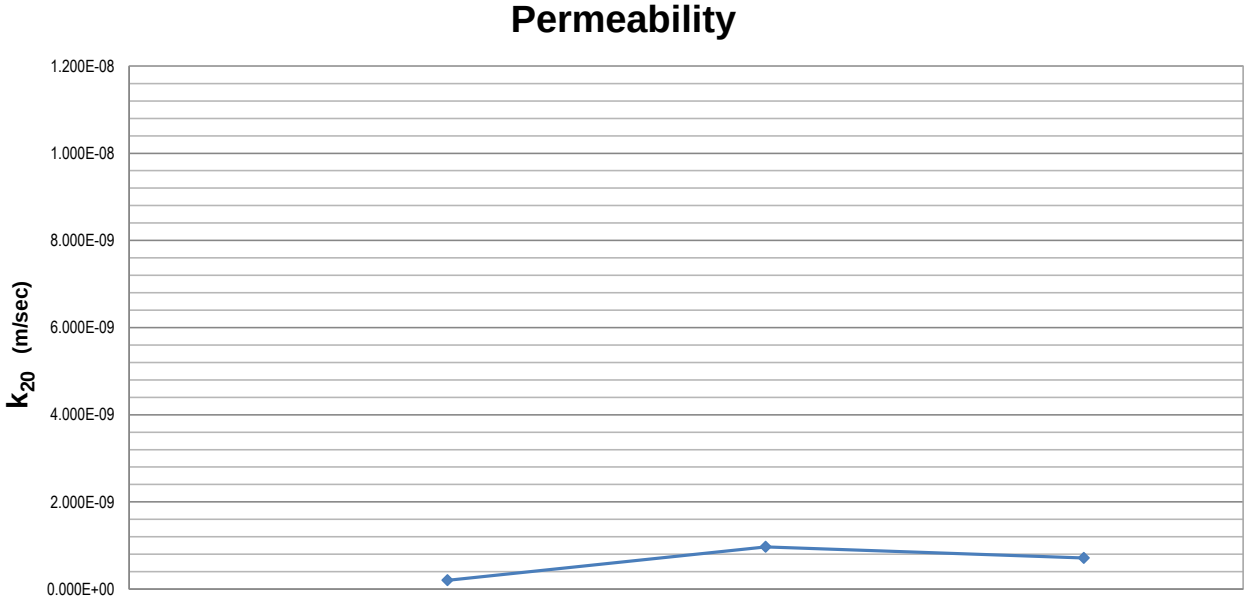
- ☑ AS1289 6.7.2 Soil strength and consolidation tests - Determination of a soil - Falling head method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	13/10/2015
Preparation:	Prepared in accordance with the test method		

RESULTS

Standard Maximum Dry Density (t/m³)	**1.67**	Hydraulic Gradient	**0.0**
Optimum Moisture Content (%)	**20.0**	Surcharge (kPa)	**0.0**
Placement Moisture Content (%)	**20.2**	Head Pressure Applied (kPa)	**0.0**
Moisture Ratio (%)	**101.2**	Standard Compaction	**Standard**
Placement Dry Density (t/m^3)	**1.67**	Percentage Material Retained/Sieve Size (mm)	**0 % on 9.5**
Density Ratio (%)	**99.8**	Sample Height and Diameter (mm)	**103.4 x 98.4**

PERMEABILITY $k_{(20)}$ = 7.11E-10 (m/sec)



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. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Bradley Morris

17/11/2015

Date:

MACQUARIE GEOTECH

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

FALLING HEAD PERMEABILITY REPORT

Client:	SMEC - Australia & New Zealand Division	**Source:**	Western Stockpile Near Void Sample 4
Address:	74 Hunter Street, Newcastle, NSW, 2300, Australia (PO Box 1346, Newcastle, NSW, 2300, Australia)	**Sample Description:**	CLAY trace sand & gravel
Project:	Woodlawn	**Report No:**	18619-FHP
Job No:	B15458	**Lab No:**	18619

Test Procedure:

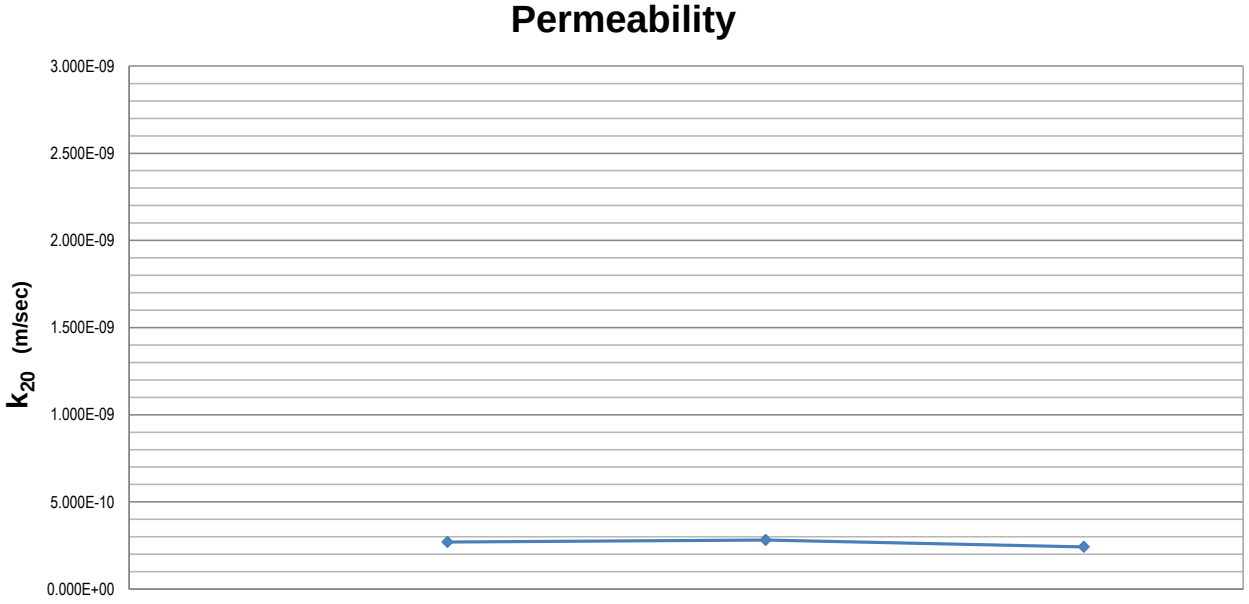
- ☑ AS1289 6.7.2 Soil strength and consolidation tests - Determination of a soil - Falling head method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	13/10/2015
Preparation:	Prepared in accordance with the test method		

RESULTS

Standard Maximum Dry Density (t/m³)	**1.70**	Hydraulic Gradient	**0.0**
Optimum Moisture Content (%)	**19.0**	Surcharge (kPa)	**0.0**
Placement Moisture Content (%)	**19.0**	Head Pressure Applied (kPa)	**0.0**
Moisture Ratio (%)	**99.9**	Standard Compaction	**Standard**
Placement Dry Density (t/m^3)	**1.70**	Percentage Material Retained/Sieve Size (mm)	**0 % on 9.5**
Density Ratio (%)	**100.0**	Sample Height and Diameter (mm)	**104 x 97.9**

PERMEABILITY $k_{(20)}$ = 2.42E-10 (m/sec)



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Authorised Signatory:

Bradley Morris

17/11/2015

Date:

MACQUARIE GEOTECH

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

FALLING HEAD PERMEABILITY REPORT

Client:	SMEC - Australia & New Zealand Division	**Source:**	Western Stockpile Near Void Sample 3
Address:	74 Hunter Street, Newcastle, NSW, 2300, Australia (PO Box 1346, Newcastle, NSW, 2300, Australia)	**Sample Description:**	CLAY with sand trace gravel
Project:	Woodlawn	**Report No:**	18618-FHP
Job No:	B15458	**Lab No:**	18618

Test Procedure:

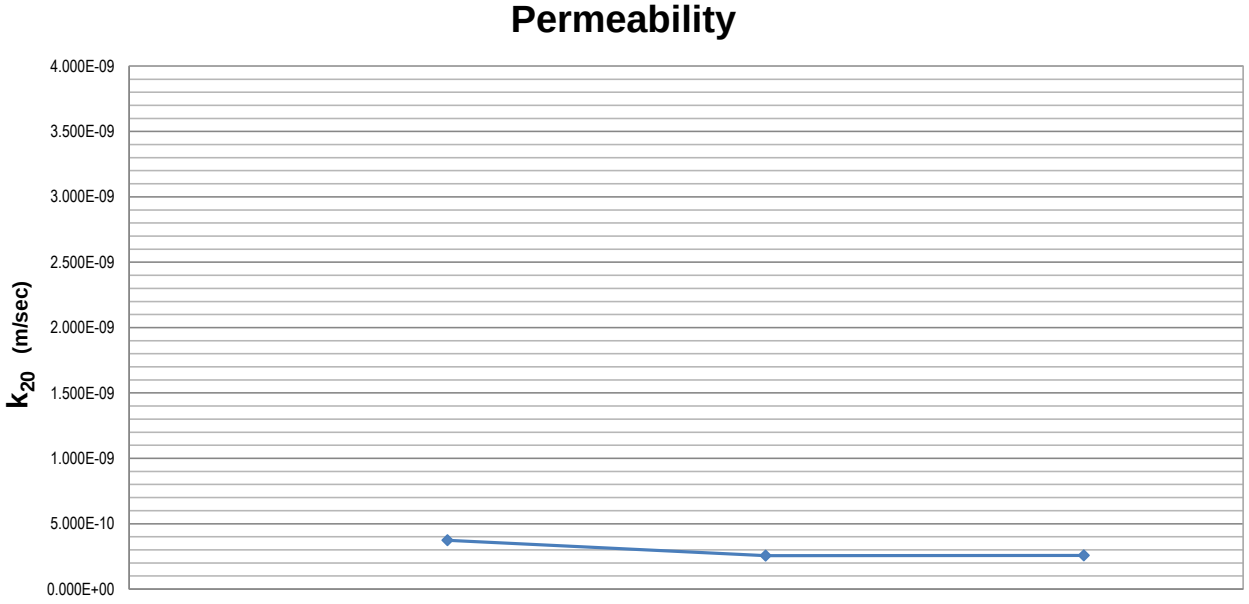
- ☑ AS1289 6.7.2 Soil strength and consolidation tests - Determination of a soil - Falling head method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	13/10/2015
Preparation:	Prepared in accordance with the test method		

RESULTS

Standard Maximum Dry Density (t/m³)	**1.64**	Hydraulic Gradient	**0.0**
Optimum Moisture Content (%)	**19.0**	Surcharge (kPa)	**0.0**
Placement Moisture Content (%)	**18.9**	Head Pressure Applied (kPa)	**0.0**
Moisture Ratio (%)	**99.5**	Standard Compaction	**Standard**
Placement Dry Density (t/m^3)	**1.64**	Percentage Material Retained/Sieve Size (mm)	**0 % on 9.5**
Density Ratio (%)	**100.1**	Sample Height and Diameter (mm)	**103.3 x 98.3**

PERMEABILITY $k_{(20)}$ = 2.57E-10 (m/sec)



NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Bradley Morris

17/11/2015

Date:

MACQUARIE GEOTECH

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

FALLING HEAD PERMEABILITY REPORT

Client:	SMEC - Australia & New Zealand Division	**Source:**	Site Stockpile Sample 2
Address:	74 Hunter Street, Newcastle, NSW, 2300, Australia (PO Box 1346, Newcastle, NSW, 2300, Australia)	**Sample Description:**	Silty CLAY with sand
Project:	Woodlawn	**Report No:**	18617-FHP
Job No:	B15458	**Lab No:**	18617

Test Procedure:

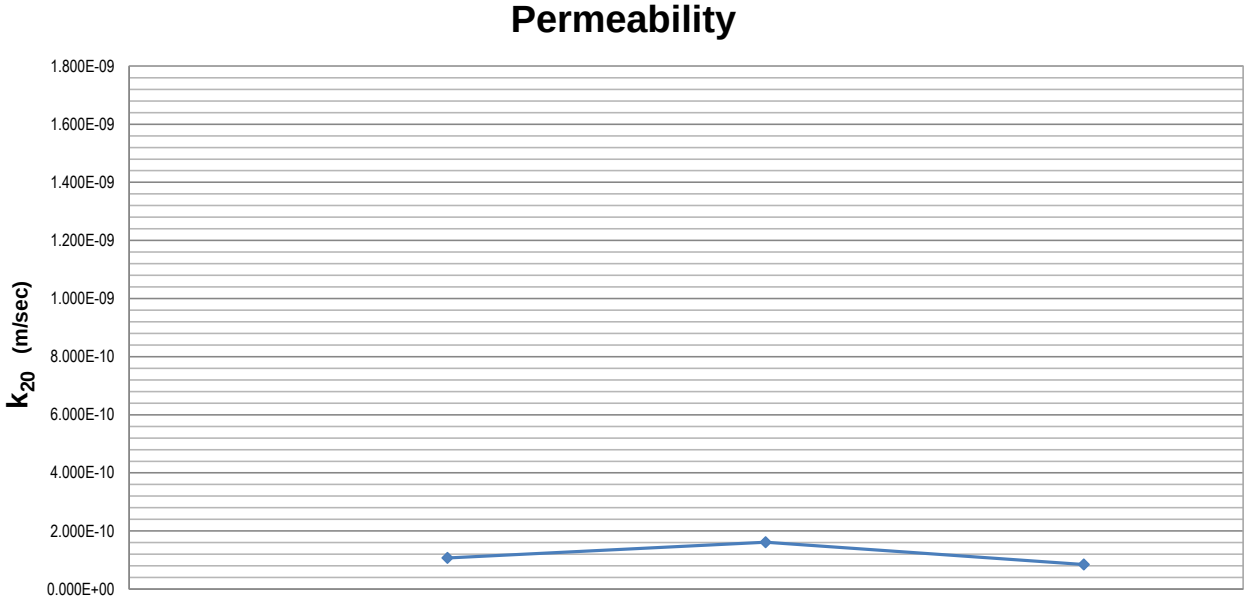
- ☑ AS1289 6.7.2 Soil strength and consolidation tests - Determination of a soil - Falling head method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	13/10/2015
Preparation:	Prepared in accordance with the test method		

RESULTS

Standard Maximum Dry Density (t/m³)	**1.51**	Hydraulic Gradient	**0.0**
Optimum Moisture Content (%)	**29.0**	Surcharge (kPa)	**0.0**
Placement Moisture Content (%)	**28.9**	Head Pressure Applied (kPa)	**0.0**
Moisture Ratio (%)	**99.6**	Standard Compaction	**Standard**
Placement Dry Density (t/m^3)	**1.51**	Percentage Material Retained/Sieve Size (mm)	**0 % on 9.5**
Density Ratio (%)	**100.1**	Sample Height and Diameter (mm)	**103.5 x 98**

PERMEABILITY $k_{(20)}$ = 8.45E-11 (m/sec)



NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Bradley Morris

17/11/2015

Date:

MACQUARIE GEOTECH

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

FALLING HEAD PERMEABILITY REPORT

Client:	SMEC - Australia & New Zealand Division	**Source:**	Site Stockpile Sample 1
Address:	74 Hunter Street, Newcastle, NSW, 2300, Australia (PO Box 1346, Newcastle, NSW, 2300, Australia)	**Sample Description:**	Clayey SILT trace sand
Project:	Woodlawn	**Report No:**	18616-FHP
Job No:	B15458	**Lab No:**	18616

Test Procedure:

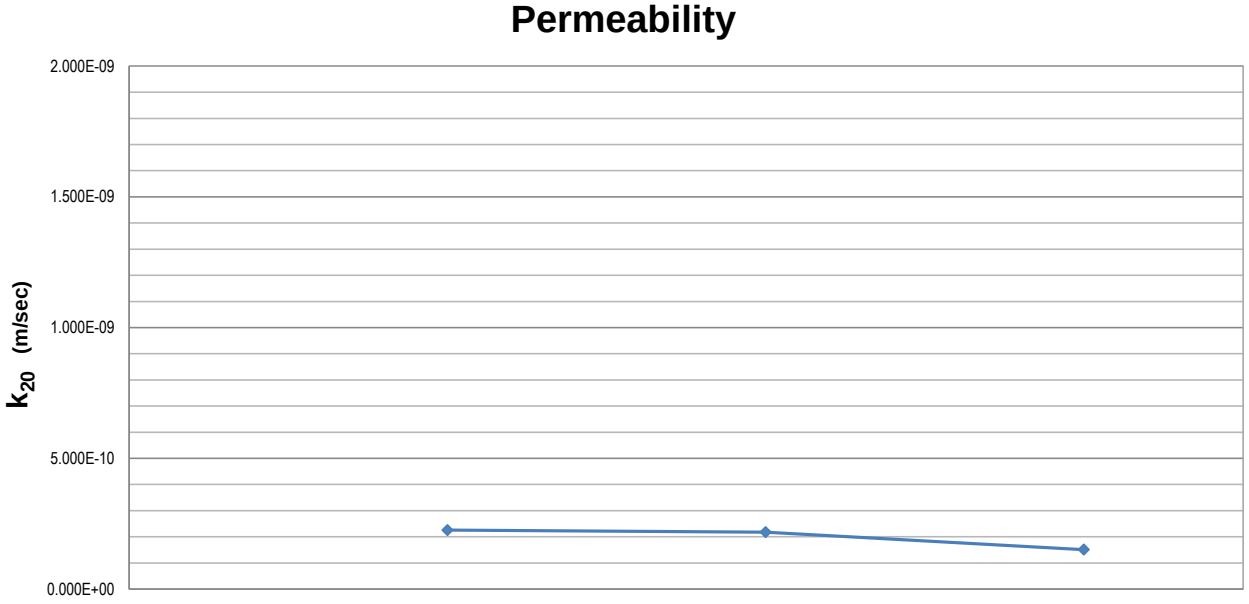
- ☑ AS1289 6.7.2 Soil strength and consolidation tests - Determination of a soil - Falling head method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	13/10/2015
Preparation:	Prepared in accordance with the test method		

RESULTS

Standard Maximum Dry Density (t/m³)	**1.51**	Hydraulic Gradient	**0.0**
Optimum Moisture Content (%)	**27.0**	Surcharge (kPa)	**0.0**
Placement Moisture Content (%)	**27.2**	Head Pressure Applied (kPa)	**0.0**
Moisture Ratio (%)	**100.8**	Standard Compaction	**Standard**
Placement Dry Density (t/m^3)	**1.50**	Percentage Material Retained/Sieve Size (mm)	**0 % on 9.5**
Density Ratio (%)	**99.8**	Sample Height and Diameter (mm)	**103.8 x 98.1**

PERMEABILITY $k_{(20)}$ = 1.51E-10 (m/sec)



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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Bradley Morris

17/11/2015

Date:

MACQUARIE GEOTECH

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795


18620
Job No: B15458
Client: C - Australia & New Zealand Divi
18620
Client: C - Australia & New Zealand Divi

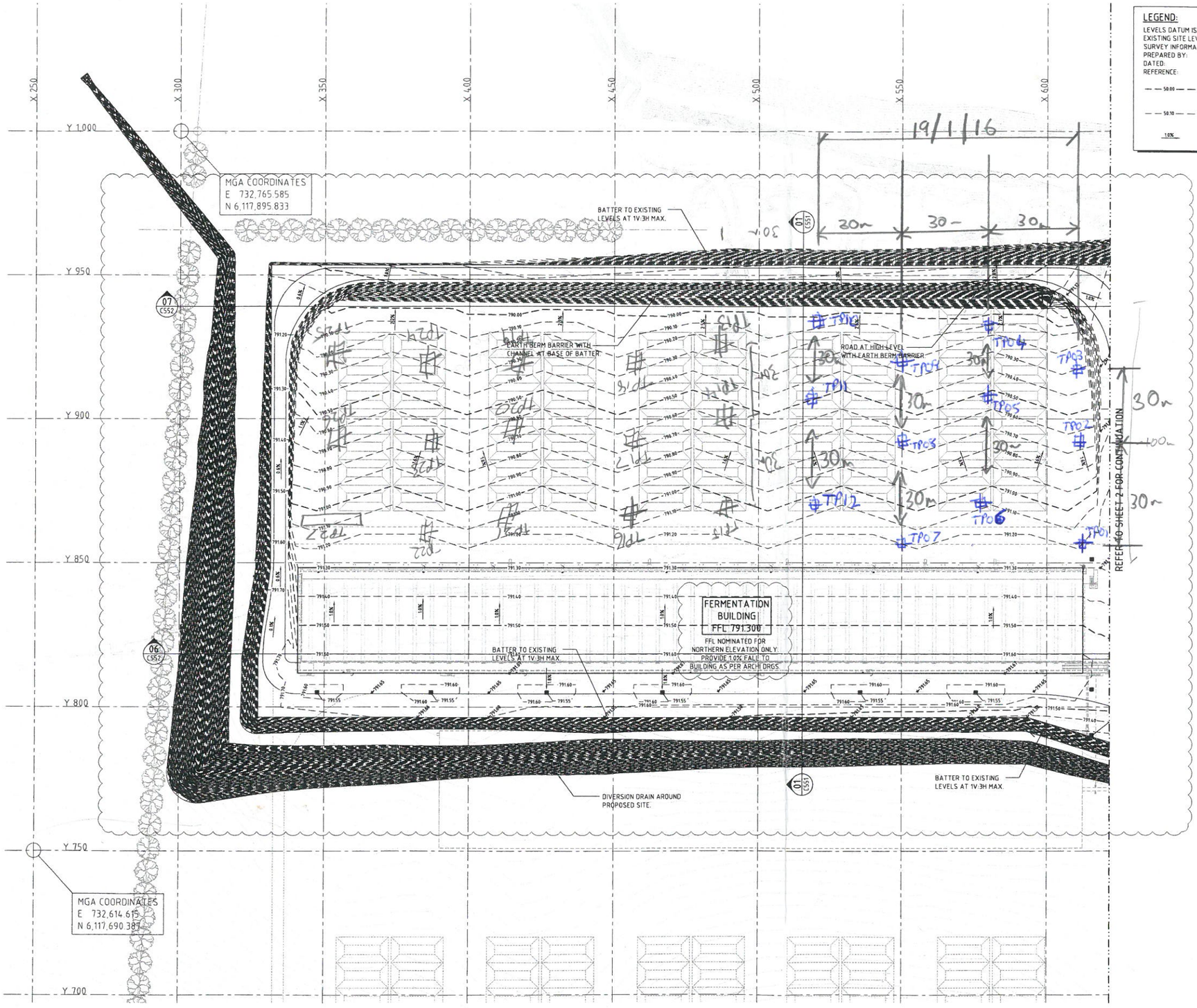

18619
Job No: B15458
Client: C - Australia & New Zealand Divi
Source: stern Stockpile Near Void Samp
Testing: AS1289 2.1.1 Moisture
18619


18618
Job No: B15458
Client: C - Australia & New Zealand Divi
Source: stern Stockpile Near Void Samp
Testing: AS1289 2.1.1 Moisture
Client: C - Australia & New Zealand Divi
AS1289 3.6.1 PSD


18617
Job No: B15458
Client: C - Australia & New Zealand Divi
Source: Site Stockpile Sample 2
Testing: AS1289 2.1.1 Moisture
18617
New Zealand Divi
Source: Site Stockpile Sample 2
Testing: AS1289 3.6.1 PSD


18616
Job No: B15458
Client: C - Australia & New Zealand Divi
Source: Site Stockpile Sample 1
Testing: AS1289 2.1.1 Moisture

Site Inspection Test Pits and Photos



SITE GRADING PLAN - SHEET 1
SCALE 1:500

LEGEND:

LEVELS DATUM IS AHD.
EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED.
PREPARED BY: LANDTEAM
DATED: 12.02.2014
REFERENCE: 204543-01

- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- 1.0% - DIRECTION OF FALL AND % GRADE

FINISHED LEVELS PLAN NOTES:

1. LEVELS DATUM IS A.H.D.
2. ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
3. THE MAJOR CONTOUR INTERVAL IS 0.5m
4. THE MINOR CONTOUR INTERVAL IS 0.1m.
5. MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%) UNO.
6. MAXIMUM PAVEMENT GRADE IS TO BE 1:22.2 (4.5%) IN HARDSTAND AREAS AND 1:20 (5%) ELSEWHERE.
7. MAXIMUM RAMP GRADES ARE TO BE 1:12 (8.3%) U.N.O. ON PLAN
8. PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGES GRADE EXCEED 1:20 (5%).
9. PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:2H.
10. ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
11. ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 2.5% NOMINAL GRADE.
12. ALL PAVEMENTS ARE TO BE SET AT 50mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS UNO.

FOR CONSTRUCTION

5m 0 10 20 30 40 50m
SCALE 1:500 AT A0 SIZE SHEET

AMENDMENTS	DATE	ISSUE
PFL AND EXTERNAL LEVELS REVISED	12.12.14	F
DIVERSION DRAIN REVISED AS CLOUDED	10.11.14	E
REVISED FOR UPDATED ARCH LAYOUT	01.10.14	D
ISSUED FOR TENDER	19.09.14	C
FFL & SITE GRADING REVISED	05.09.14	B
PRELIMINARY - ISSUED FOR INFORMATION ONLY	06.08.14	A

AMENDMENTS	DATE	ISSUE
REVISED FOR 20% EXPANSION	09.10.15	1
ISSUED FOR CONSTRUCTION	16.09.15	0
ISSUED FOR CONSTRUCTION CERTIFICATE	19.12.14	G

AMENDMENTS	DATE	ISSUE

ARCHITECT

CLIENT
LIPMAN
VEOLIA
LEVEL 6, 66 BERRY ST
NORTH SYDNEY 2060
TEL: +61 02 9955 7000
FAX: +61 02 9955 3166

PROJECT
WOODLAWN MBT FACILITY

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
M.W.	X.C.			A0	AS SHOWN	12424.00-C501

Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7888 Fax: (02) 9241-2726
email: mail@costinroe.com.au

CostinRoe Consulting
Value in Engineering and Management

DRAWING TITLE
SITE GRADING PLAN
SHEET 1

DRAWING No C012424.00-C501 ISSUE 1

Field Log - Excavation

SMEC

Test Pit No. TP 01

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	19/1/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

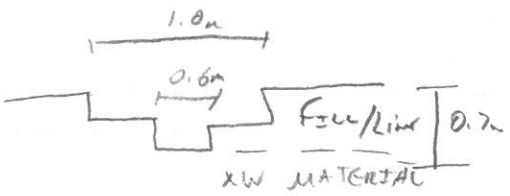
equipment type & model: Hitachi 5.5T pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum: AHD

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		SILTY CLAY: Mp to Hp, BROWN, TRACE OF F-C SAND, TRACE OF F-C GRAVELS	D	H		FILL (CLAY LINER)
									>600	
				0.5		COLOUR TO PALE GREEN				
				0.7m		XW MATERIAL				Residual
				0.8						
				1.0		TP01 TERMINATED @ 0.8m TARGET DEPTH				
				1.5						
				2.0						
				2.5						
				3.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732984
N 6117633

Row 1 - Column 1

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 02**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	19/1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

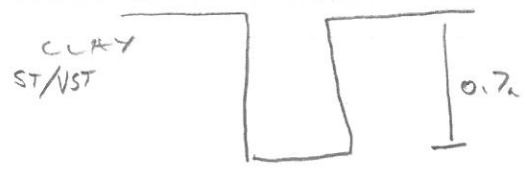
equipment type & model: Hitachi 5T pit dimensions: 1.0 m long 0.6 m wide

R.L surface: Datum: AHD

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY: HP, PALE BROWN	>Wp	St/H	x430	FILL/LINER
				0.5		(CLAY >0.6m)			x300	
						TP02 TERMINATED @ 0.7m @ TARGET DEPTH				
				1.0						
				1.5						
				2.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0733000
N 6117658

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

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 03**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	19/1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

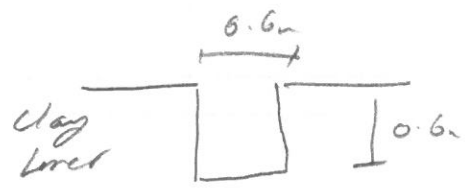
equipment type & model: Hitachi 5T pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum: AHD

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY: Hp, Pale Brown	>Wp	VSt/H	x500 x500 x400 x300 x300	FILL/Liner
				0.5						
				1.0		TP03 TERMINATED @ 0.6m ON TARGET DEPTH				Liner Below

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0733008
N 6117684

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

Field Log - Excavation

SMEC

Test Pit No. TP 04

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	

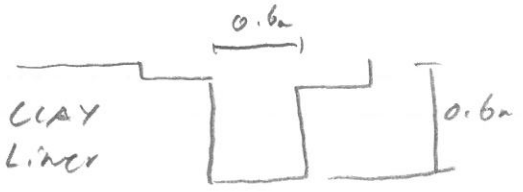
equipment type & model: Hitachi 5T pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material: soil name, plasticity or particle characteristics, colour, secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY: lp, PALE BROWN	>Wp		250	(CLAY LINER) FILL
				0.5					200	
									200	
									250	
				1.0		TP04 TERMINATED @ 0.65m @ TARGET DEPTH				
				1.5						
				2.0						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732986
N 6117708

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

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP05

Sheet 1 of 1

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: Hitachi 5T pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY: HP, PALE BROWN	<Wp ≈Wp	VST	400 200 250 300	FILL (CLAY LINER)
				0.5						
						TP05 TERMINATED @ 0.7m @ TARGET DEPTH				
				1.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

E 0732974
N 6117680

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

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 06**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	19/1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

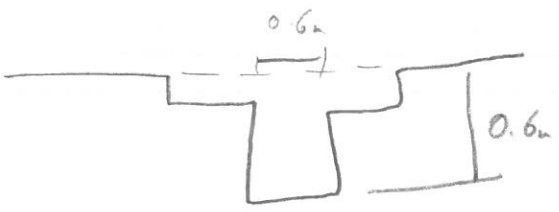
equipment type & model: Hitachi 5T pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	CLAY: Hp, Pale Brown, TRACE of f-c quartz gravels	<Wp / ≈Wp	VSt/H	x 600 x 416 800	FILL (CLAY LINER)
				0.5						
						TP06 TERMINATED @ 0.6m TARGET DEPTH				
				1.0						
				1.5						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732956
N 6117655

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP 07

Sheet 1 of 1

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: Hitachi 57 pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0.0		CLAY: Hp, Pale Brown, TRACE OF F-C GRAVELS, TRACE OF COBBLES	<Wp =Wp	VSt/H	>600	FILL (CLAY LINER)
				0.5					>600	
									>600	
				1.0		TP07 TERMINATED @ 0.7m TARGET DEPTH				

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

E 0732938
N 6117657

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

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 08**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	19/1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

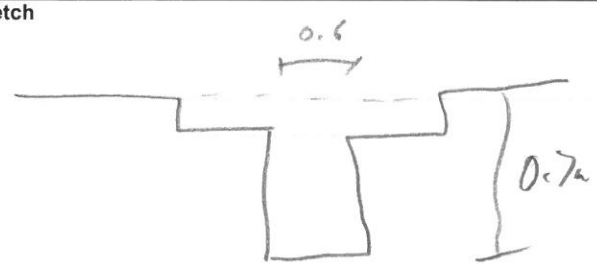
equipment type & model: Hitachi 5t pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY, HP, PALE BROWN	<Wp	VST/H	>600	FILL CLAY LINER
							>Wp		350	
				0.5					200	
									200	
				1.0		TP08 TERMINATED @ 0.7m TARGET DEPTH				
				1.5						
				2.0						
				2.5						
				3.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732939
N 6117688

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP 09

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	19/1/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

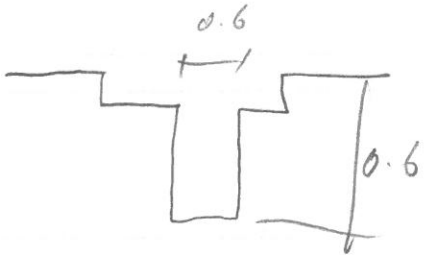
equipment type & model: Hitachi 5 Tonne pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY: Hp, PALE BROWN, TRACE OF F-C GRAVEL	Wp	H	>600	FILL (CLAY LINER)
				0.5			Wp	VSt	600	
									300	
				1.0		TPO9 TERMINATED @ 0.7m TARGET DEPTH				
				1.5						
				2						
				2.5						
				3						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732954
N 6117712

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 10**

Sheet 1 of 1

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: Hitachi 5+ pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0		CLAY: Hp, Pale Brown, trace of f-c gravels	<Wp	H	>600	FILL (CLAY LINER)
				0.5			>Wp		>600	
									>600	
				1.0		TP10 TERMINATED @ 0.7m TARGET DEPTH				
				1.5						
				2.0						
				2.5						
				3.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

E 0732931
N 6117740

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 11**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	19/1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

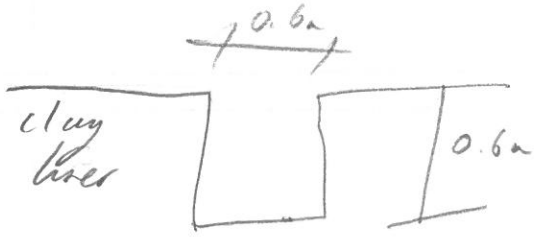
equipment type & model: Hitachi 5 Tonne | pit dimensions: 0.6 m long | 0.6 m wide

R.L surface: | Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material: soil name, plasticity or particle characteristics, colour, secondary components & minor components	moisture	consist.	PP kPa (100 200 300 400)	structure and additional observations
E				0		CLAY: Hp, trace of f-c gravel	<Wp	H	>600	FILL (CLAY Liner)
				0.5			>Wp	VSt	450	
									450	
				1.0		TP11 TERMINATED @ 0.6m TARGET DEPTH				
				1.5						
				2.0						
				2.5						
				3.0						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732919
N 6117714

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

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Field Log - Excavation

SMEC

Test Pit No. **TP 12**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	19 /1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

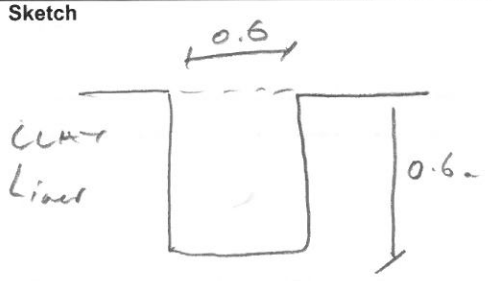
equipment type & model: Hitachi 5t pit dimensions: 0.6 m long 0.6 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	CLAY: Hp, Pale Brown	>Wp	ST	200	FILL (CLAY LINER)
				0.5					200	
									200	
						0.6m				
				1.0		TP12 - TERMINATED @ 0.6m Below ground level				
				1.5						
				2						
				2.5						
				3						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



E 0732906
N 6117686

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

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Field Log - Excavation

SMEC

Test Pit No.	TP13
Sheet	1 of 1
Client	Lipman Constructions
Job No.	3002464
Principal	
Date	15/3/16
Project	Woodlawn
Logged by	RB
Test Pit Location	Clay Liner
Checked by	

equipment type & model: HITACHI 3 TONNE pit dimensions: 1.5 m long 0.3 m wide

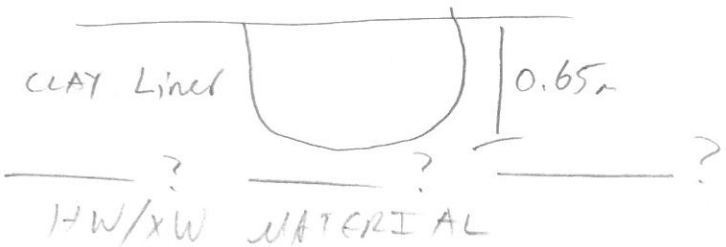
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material: soil name, plasticity or particle characteristics, colour, secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
				0	CH	CLAY: Hp, Pale Brown, TRACE OF F-C SAND, TRACE OF F-C GRAVELS, TRACE OF COBBLES UPTO 200mm	D/Wp / Wp	VSt / H		FILL (CLAY LINER)
				0.5						
						TP13 TERMINATED @ 0.65m on Liner on steady progress				
				1.0						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35° 3' 22.60"
E 149° 33' 14.43"



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

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Field Log - Excavation

SMEC

Test Pit No. TP 14

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/11/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1 m long 0.3 m wide

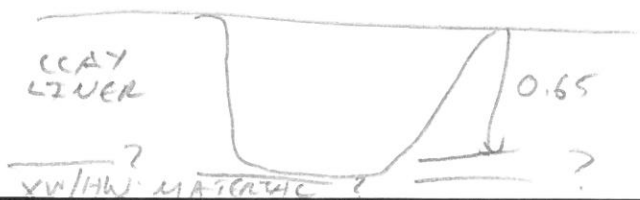
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
				0	CH	CLAY: Hp, Pale brown, TRACE of f-c sand + gravels, trace of cobbles UP to 100mm	Wp	H		(CLAY LINER) FILL
				0.5						
						TP14 terminated @				
				1.0						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 22.77
E 149' 33' 13.79



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

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Field Log - Excavation

SMEC

Test Pit No. TP 15

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/11/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3 Tonne | pit dimensions: 1 m long 0.3 m wide

R.L surface: | Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	CLAY; Hp, Pale brown to brown, TRACE OF F-C SAND, F-C GRAVEL.	Wp	H		(CLAY LINER) FILL
				0.5						
						TP15 terminated @ 0.62m in CLAY LINER				
				1.0						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 23.47
E 149' 33' 12.60

method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP 16

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/3/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.5 m long 0.3 m wide

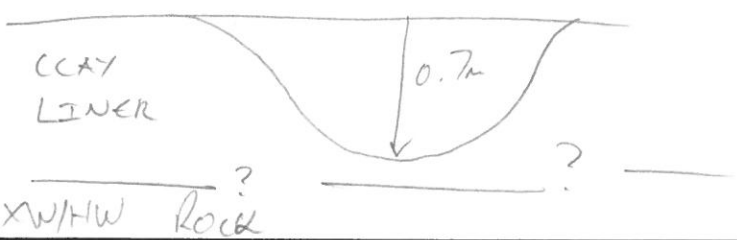
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	CLAY: HP, BROWN, WITH TRACE OF F-C SAND, F-C GRAVEL, COBBLES <200mm	<WP	H		FILL (CLAY LINER)
				0.5						
						TP16 TERMINATED @ 0.7m IN CLAY LINER				
				1.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 24.76
E 149' 33' 11.97



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP17

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/11/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.0 m long 0.3 m wide

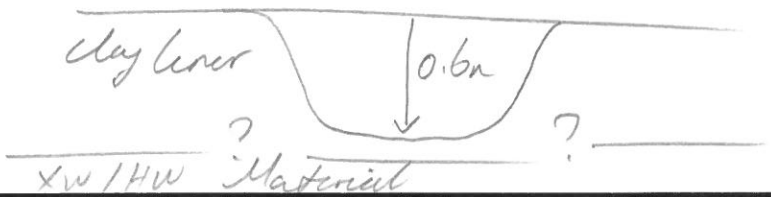
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: Hp, pale brown to brown, trace of f-c sandy, trace of f-c gravel, trace cobbles <150mm	Wp	H		FILL (Clay Liner)
				0.5						
				1.0		TP17 Terminated @ 0.6m In clay liner				

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 24.57
E 149' 33' 16.41



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

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 18**

Sheet 1 of

Client	**Lipman Constructions**
Principal	
Project	**Woodlawn**
Test Pit Location	**Clay Liner**
Job No.	**3002464**
Date	15/11/16
Logged by	**RB**
Checked by	

equipment type & model: Hitachi 3 Tonne pit dimensions: 1.0 m long 0.3 m wide

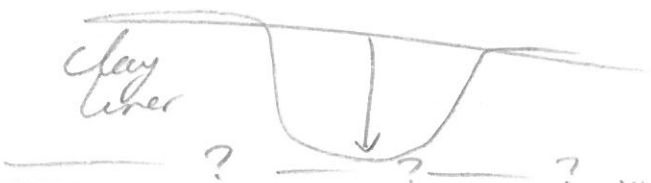
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: Hp, pale brown to brown, Trace of f-c sand, trace of f-c gravel. Trace of cobbles <200m.	<Wp / =Wp	+I		(Clay liner) FILL
				0.5						
						TP18 terminated @ 0.6m on clay liner				
				1.0						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35° 3' 21.85
E 149° 33' 12.90



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 19**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	15/11/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

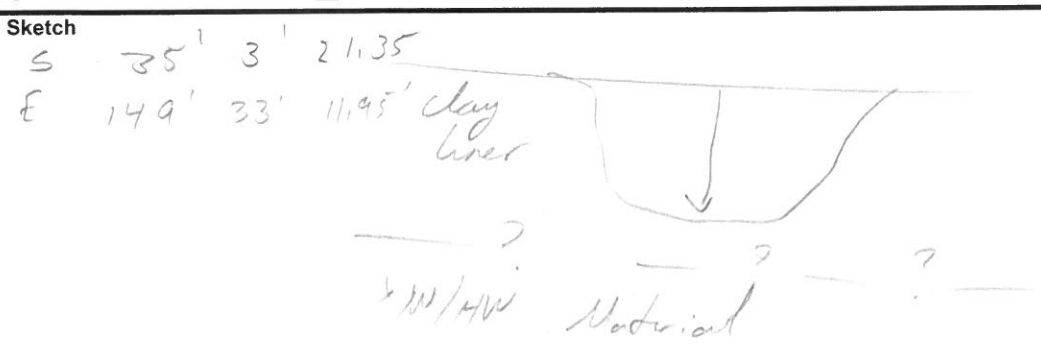
equipment type & model: Hitachi 3 tonne pit dimensions: 4.0 m long 0.3 m wide

R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay. Wp, Brown, Trace of f-c Sand, trace of f-c gravel	<Wp / >Wp	H		FILL (Clay liner)
				0.15						
						TP 19 Terminated @ 1.10 in clay liner				
				1.10						

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 20**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	15/1/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.5 m long 0.3 m wide

R.L surface: Datum:

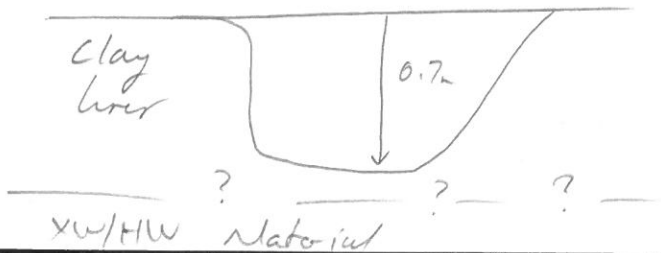
method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: HP, pale brown, Trace of f-c sand + gravel, trace of cobbles <200mm	Dry	H		FILL (Clay Liner)
				0.5						
				1.0		TP20 terminated @ 0.7m on clay liner				

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35° 3' 22.24"

E 149° 33' 11.23"



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, Gr green, B brown, Bu blue, G grey, P pale, Bl black, D dark, O orange, Y yellow, W white

moisture
D dry
M moist
W wet
Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 21**

Sheet 1 of

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	15/3/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.2 m long 0.3 m wide

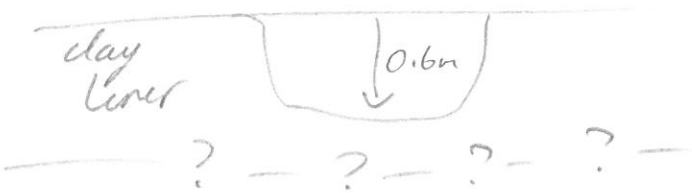
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: Hp, brown, Trace of f-c sand + gravel, trace of cobbles < 200mm	<Wp	H		FILL (Clay liner)
				0.5						
						TP21 terminated @ 0.6m on steady progress in clay liner				
				1.0		Note: xw/HW rock noted @ 0.61m, just correct thickness.				

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35° 3' 23.40
E 149° 33' 10.35



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

Field Log - Excavation

SMEC

Test Pit No. **TP 22**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	15/11/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.5 m long 0.3 m wide

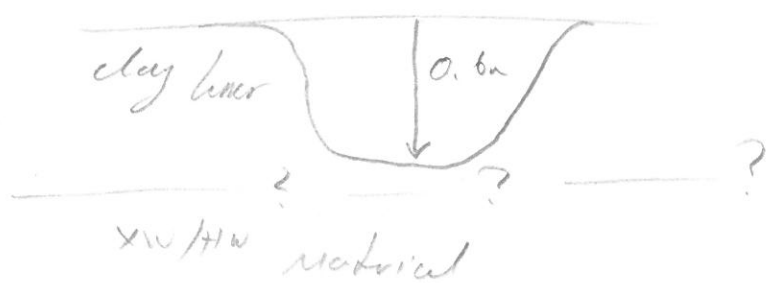
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: Hp: Brown, Trace of f-c gravels, trace of f-c sand trace of cobbles <200mm	<Wp / ≈Wp	H		FILL (Clay liner)
				0.5						
						TP22 terminated @ 0.6m in clay liner				
				1.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 22.84
E 149' 33' 9.54



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP 23

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/3/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3t pit dimensions: 1.5 m long 0.3 m wide

R.L surface: Datum:

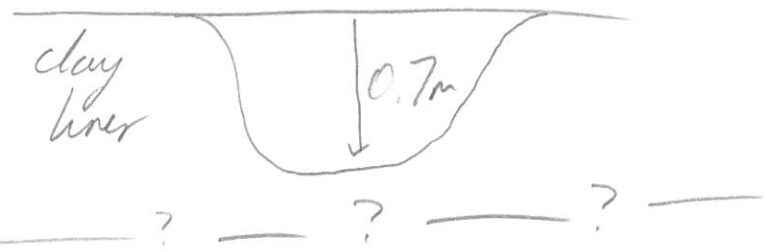
method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: Hp, Brown, Trace of f-c sand, trace of f-c gravels, trace of cobbles.	MP	H		FILL (Clay liner)
				0.5						
						TP23 Terminated @ 0.7m in clay liner				
				1.0						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 21.97

E 149' 33' 10.38



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, Gr green
B brown, Bu blue
G grey, P pale
Bl black, D dark
O orange
Y yellow
W white

moisture
D dry
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 - Excavation

SMEC

Test Pit No. **TP 24**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	15/11/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.5 m long 0.3 m wide

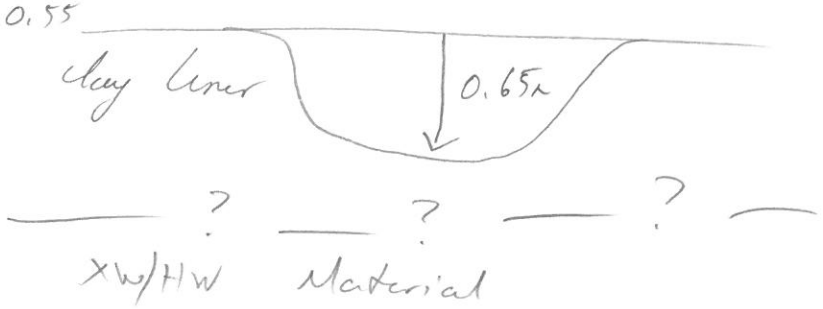
R.L surface: Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	clay: Hp, Brown, trace of f-c gravel + sand. trace of cobbles <200mm	<Wp	H		FILL (CLAY LINER)
				0.5						
				1.0		TP24 terminated @ 0.65m in clay liner Note: XW/HW Material encountered @ 0.65m				

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 21.07
E 149' 33' 10.55



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP 25

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/11/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3 tonne | pit dimensions: 1.5 m long 0.3 m wide

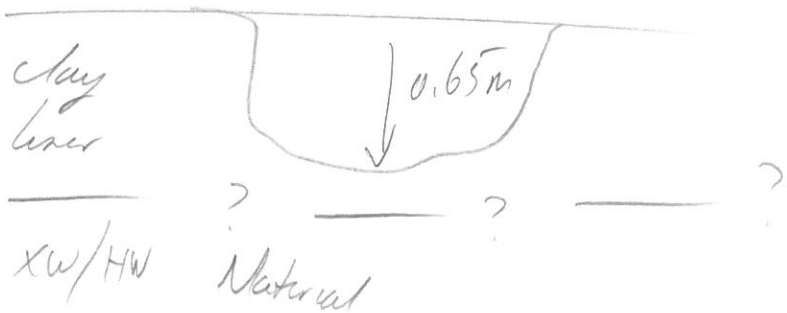
R.L surface: | Datum:

method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: Hp, brown, trace of f-c sand + gravel, trace of cobbles <200mm	Wp	H		FILL (Clay Liner)
				0.5			>Wp			
				1.0		TP25 terminated @ 0.65m in clay liner				

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 5' 20.89
E 149' 33' 9.52



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, B brown, G grey, Bl black, O orange, Y yellow, W white, Gr green, Bu blue, P pale, D dark

moisture
D dry, M moist, W wet, Wp plastic limit

consistency/density index
VS very soft, S soft, F firm, St stiff, VSt very stiff, H hard, Fb friable
VL very loose, L loose, MD med. dense, D dense, VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. TP26

Sheet 1 of 1

Client	Lipman Constructions	Job No.	3002464
Principal		Date	15/3/16
Project	Woodlawn	Logged by	RB
Test Pit Location	Clay Liner	Checked by	

equipment type & model: Hitachi 3 tonne pit dimensions: 1.5 m long 0.3 m wide

R.L surface: Datum:

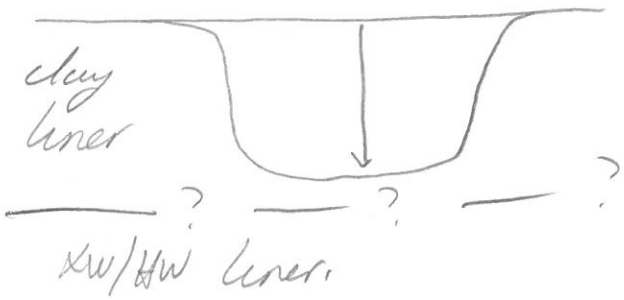
method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E				0	CH	Clay: hp, brown, trace of f-c sand + Gravel, trace of cobbles <200mm	Wp	H		FILL (clay liner)
				0.5						
						TP26 terminated @				
				1.0		in clay liner				

☐ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 21.12

E 149' 33' 9.28



method
N natural exposure; X existing excavation; BH backhoe bucket; B bulldozer blade; R ripper; E excavator; HA hand auger

support
T timbering; N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter; D disturbed sample; V vane shear (kPa); Bs bulk sample; E environmental sample; R refusal

plasticity/grainsize
LP low plasticity; MP medium plasticity; HP high plasticity; LL liquid limit; F fine; M medium; C coarse

colour
R red; B brown; G grey; Bl black; O orange; Y yellow; W white; Gr green; Bu blue; P pale; D dark

moisture
D dry; M moist; W wet; Wp plastic limit

consistency/density index
VS very soft; S soft; F firm; St stiff; VSt very stiff; H hard; Fb friable; VL very loose; L loose; MD med. dense; D dense; VD very dense

Issue: 29/10/2015

Field Log - Excavation

SMEC

Test Pit No. **TP 27**

Sheet 1 of 1

Client	**Lipman Constructions**	Job No.	**3002464**
Principal		Date	15/3/16
Project	**Woodlawn**	Logged by	**RB**
Test Pit Location	**Clay Liner**	Checked by	

equipment type & model: Open pipe trench pit dimensions: 20m m long 1m m wide

R.L surface: Datum:

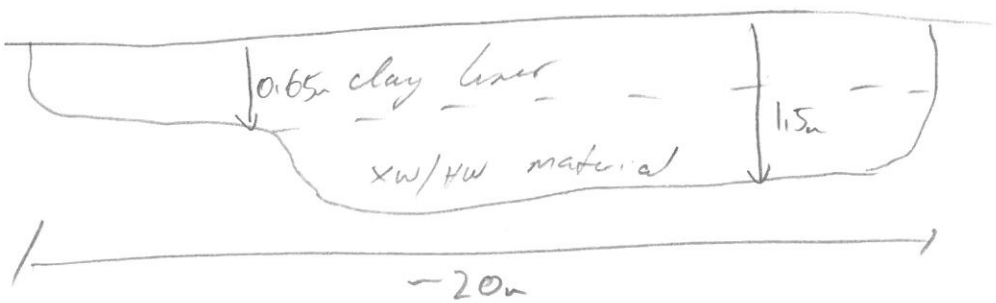
method	penet- 1 2 3	support	notes samples, tests, etc	depth (m)	USC	material soil name, plasticity or particle characteristics, colour secondary components & minor components	moisture	consist.	PP kPa 100 200 300 400	structure and additional observations
E	NOT OBSERVED			0	CH	clay: Hp, brown, trace of f-c sand + gravel, trace of cobbles <200mm	<Wp	H		FILL (clay liner)
				0.5						
					CH	Gravelly clay: Hp, pale brown, gravels of granite with rock structure, estimated low strength	<Wp	H		XW/HW
				1.0			D	D		Material
				1.5						

☑ groundwater not observed ☐ groundwater inflow at: m ☐ standing water level m time: date:

Sketch

S 35' 3' 21.97

E 149' 33' 8.62



method
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator
HA hand auger

support
T timbering N nil

penetration
1 2 3 — no resistance ranging to refusal

notes samples, tests
U50 undisturbed sample 50mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

plasticity/grainsize
LP low plasticity
MP medium plasticity
HP high plasticity
LL liquid limit
F fine
M medium
C coarse

colour
R red, Gr green
B brown, Bu blue
G grey, P pale
Bl black, D dark
O orange
Y yellow
W white

moisture
D dry
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

EXPLANATORY NOTES
NON-CORE DRILLHOLE and EXCAVATION

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.

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

Rate of Drilling / Excavation Penetration

VE	Very Easy
E	Easy
F	Firm
H	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

Field Tests

N	Standard Penetration Test result
VS	Vane Shear (kPa)
PP	Pocket Penetrometer (kPa)
P	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:

Cohesive Soils		**Cohesionless Soils**	
Silt	0.002 – 0.075 mm	**Boulder**	>200 mm
Clay	< 0.002 mm	**Cobble**	63 – 200 mm
		Gravel	2.36 – 63 mm
		Sand	0.075 – 2.36 mm

Plasticity – Cohesive Soils

Description	**LL (%)**
Low	< 35 %
Medium	35 – 50 %
High	> 50 %

Particle Characteristics – Cohesionless Soils

Sands and gravels can be subdivided by their grain size:

Name	**Grading**	**Particle Size (mm)**
Gravel	Fine	2.36 – 6.0
	Medium	6.0 – 20
	Coarse	20 – 63
Sand	Fine	0.075 – 0.20
	Medium	0.20 – 0.6
	Coarse	0.63 – 2.36

Moisture

D	Dry
M	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
H	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.

Origin

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

Geotechnical Engineers

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 x 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 x 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
Geotechnics / Environment / Groundwater

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 Content, Plasticity and Linear Shrinkage Tests

Client: ACT Geotechnical Engineers Pty Ltd

Project: Woodlawn Bioreactor - C7755

Location: Tarago Collector Road, Tarago, NSW

Project No: 68950.00
Report No: M15177001
Report Date: 30-Nov-2015
Date Sampled: -
Date of Test: 24-Nov-2015
Page: 1 of 1

Test Location	Depth (m)	Description	Code	W_F %	W_L %	W_P %	PI %	*LS %
1D	Stockpile	Slightly sandy silty CLAY, some gravel	2,5	16.6	85	22	63	21.0 CR
2D	Stockpile	Slightly silty CLAY, trace gravel, some sand	2,5	17.0	88	22	66	22.0 CU

Legend:

W_F	Field Moisture Content
W_L	Liquid limit
W_P	Plastic limit
PI	Plasticity index
LS	Linear shrinkage from liquid limit condition (Mould length254mm)

Test Methods:

Moisture Content:	AS 1289 2.1.1
Liquid Limit:	AS 1289 3.1.2
Plastic Limit:	AS 1289 3.2.1
Plasticity Index:	AS 1289 3.3.1
Linear Shrinkage:	AS 1289 3.4.1

Code:

Sample history for plasticity tests
1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

Method of preparation for plasticity tests
5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

Sampling Methods: Sampled by Client

Remarks:

Tested: SR
Checked: AG

Arveendra Gounder
Laboratory Manager

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

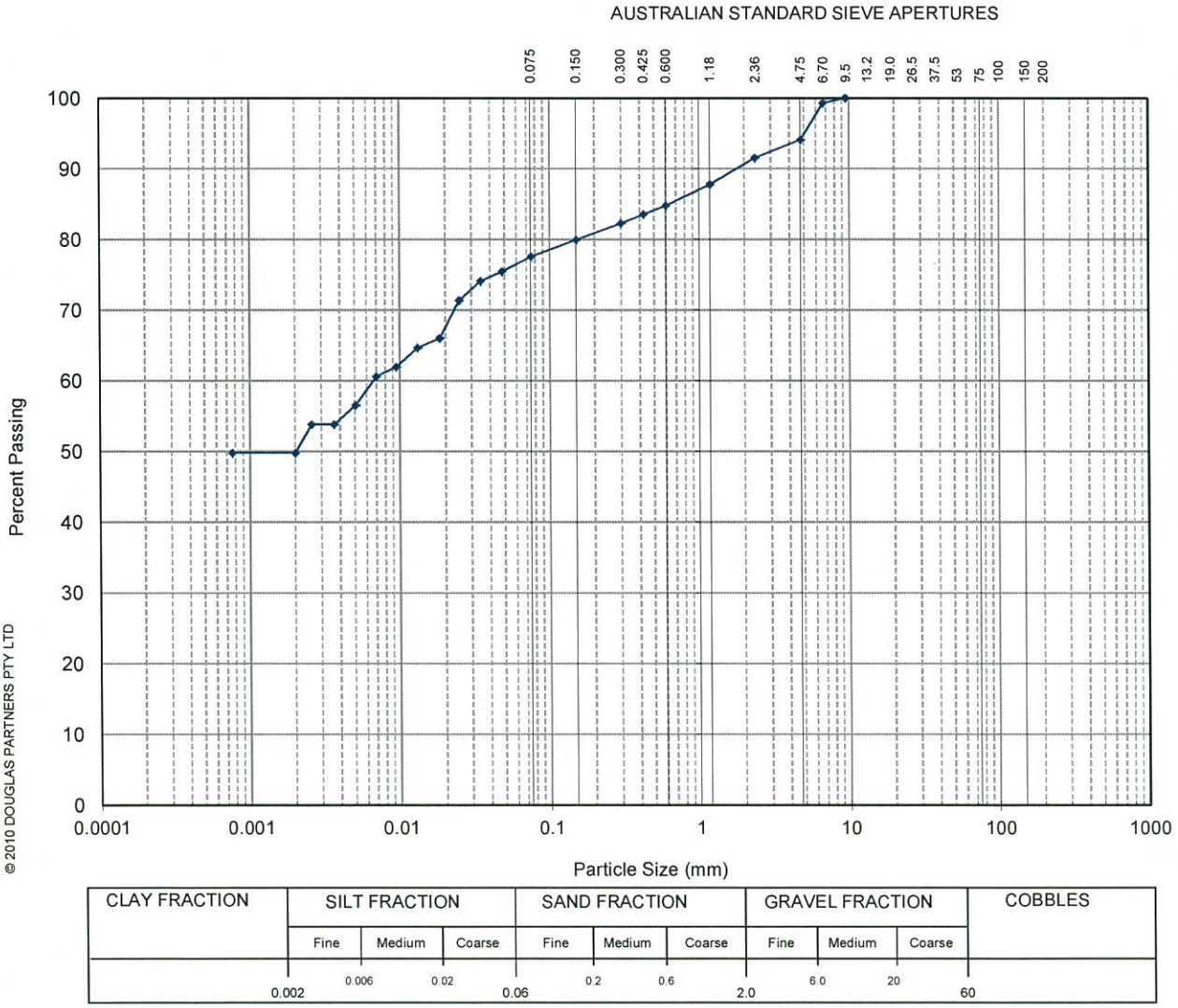
ACCREDITED FOR TECHNICAL COMPETENCE

Douglas Partners
Geotechnics / Environment / Groundwater

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 Particle Size Distribution (Hydrometer)

Client :	ACT Geotechnical Engineers Pty Ltd	**Project No. :**	68950.00
		Report No. :	M15177002
Project :	Woodlawn Bioreactor - C7755	**Report Date :**	30.11.2015
Location :	Tarago Collector Road, Tarago, NSW	**Date Sampled:**	-
Test Location:	1D	**Date of Test:**	10/11/2015
Depth / Layer:	Stockpile	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	~
13.2	~
9.5	100%
6.7	99%
4.75	94%
2.36	92%
1.18	88%
0.600	85%
0.425	84%
0.300	82%
0.150	80%
0.075	78%
0.034	74%
0.025	71%
0.018	66%
0.013	65%
0.009	62%
0.007	61%
0.005	57%
0.004	54%
0.003	54%
0.002	50%
0.001	50%

Description: Slightly sandy silty CLAY, some gravel

Test Method(s): AS 1289.3.6.1, AS1289.3.6.3

Sampling Method(s): Sampled by Client

Loss in pretreatment: 0%

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

Type of Hydrometer: g/l

NATA ACCREDITED FOR TECHNICAL 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

Tested: AD
Checked: AG

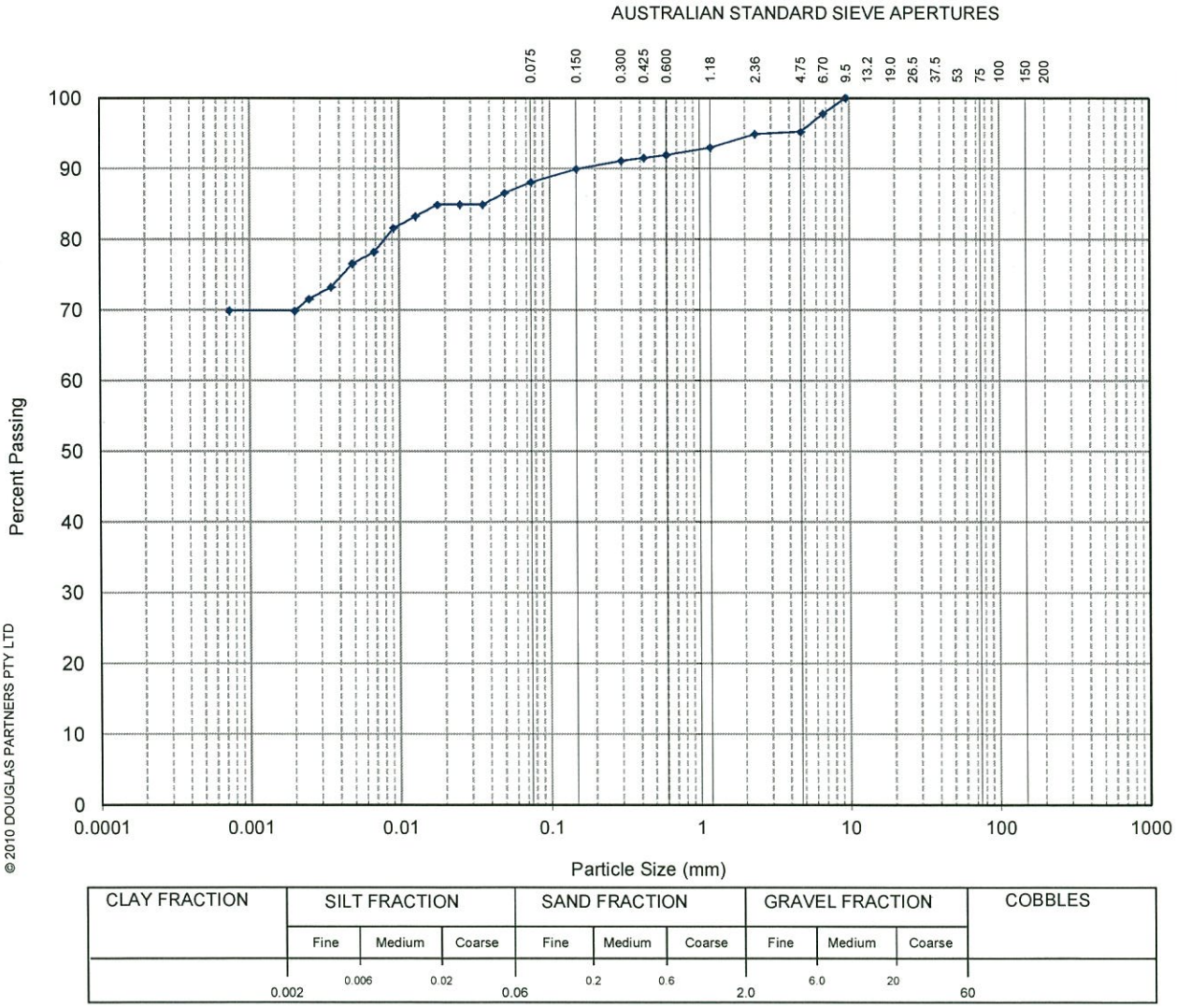
Peter Chan
Associate

Douglas Partners
Geotechnics / Environment / Groundwater

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 Particle Size Distribution (Hydrometer)

Client :	ACT Geotechnical Engineers Pty Ltd	**Project No. :**	68950.00
		Report No. :	M15177003
Project :	Woodlawn Bioreactor - C7755	**Report Date :**	30.11.2015
Location :	Tarago Collector Road, Tarago, NSW	**Date Sampled:**	-
Test Location:	2D	**Date of Test:**	10/11/2015
Depth / Layer:	Stockpile	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	~
13.2	~
9.5	100%
6.7	98%
4.75	95%
2.36	95%
1.18	93%
0.600	92%
0.425	92%
0.300	91%
0.150	90%
0.075	88%
0.036	85%
0.025	85%
0.018	85%
0.013	83%
0.009	82%
0.007	78%
0.005	77%
0.003	73%
0.002	72%
0.002	70%
0.001	70%

Description: Slightly silty CLAY, trace gravel, some sand

Test Method(s): AS 1289.3.6.1, AS1289.3.6.3

Sampling Method(s): Sampled by Client

Loss in pretreatment: 0%

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

Type of Hydrometer: g/l

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

Tested: AD
Checked: AG

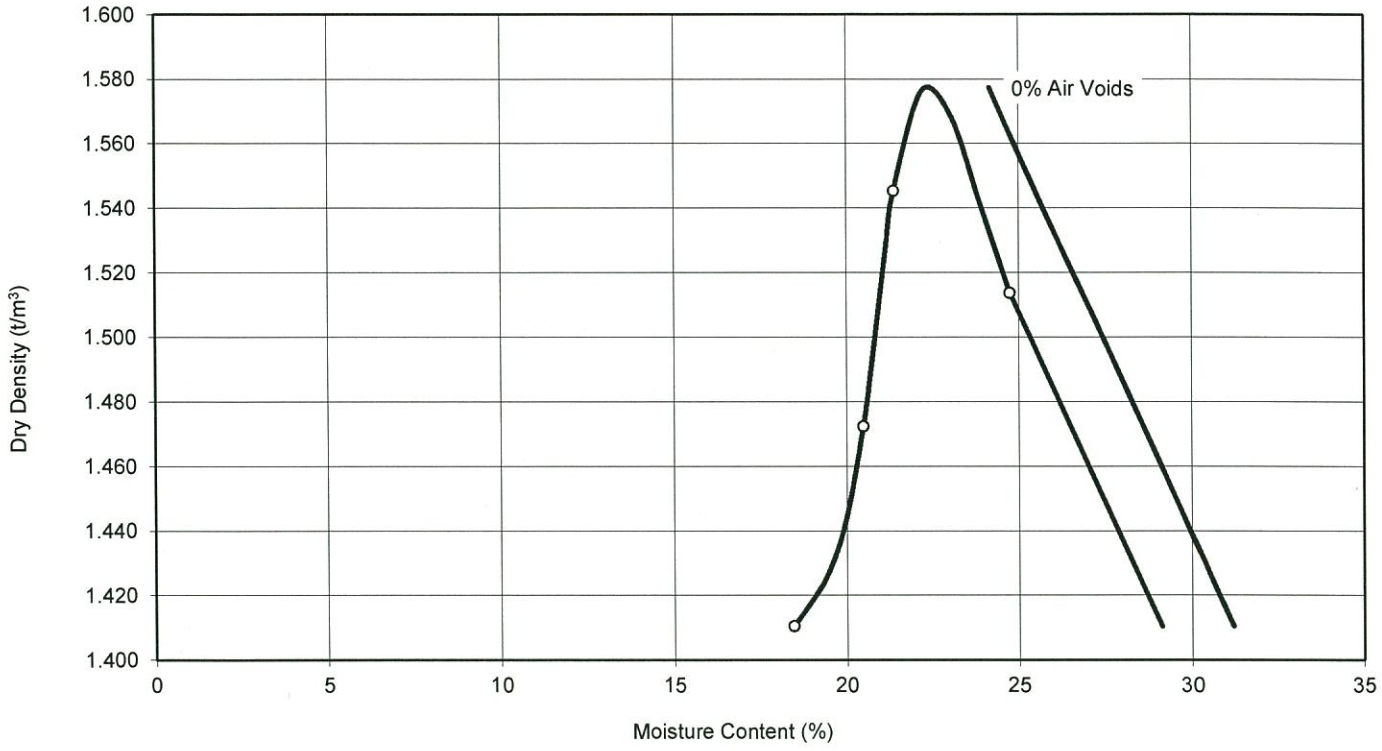
Peter Chan
Associate

Douglas Partners
Geotechnics / Environment / Groundwater

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 Compaction Test

Client :	ACT Geotechnical Engineers Pty Ltd	**Project No. :**	68950.00
		Report No. :	M15177004
Project :	Woodlawn Bioreactor - C7755	**Report Date :**	11/11/2015
Location :	Tarago Collector Road, Tarago, NSW	**Date of Test:**	10/11/2015
		Page:	1 of 1



Sample Details: **Location:** 1D
Depth: Stockpile

Particles > 19mm: 0%

Description: Slightly sandy silty CLAY, some gravel

Maximum Dry Density:	**1.58 t/m³**
Optimum Moisture Content:	**22.5 %**

Remarks:

Test Methods: AS 1289.2.1.1, AS 1289. 5.1.1

Sampling Methods: Sampled by Client

NATA ACCREDITED FOR TECHNICAL 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

Tested:	AM
Checked:	AG

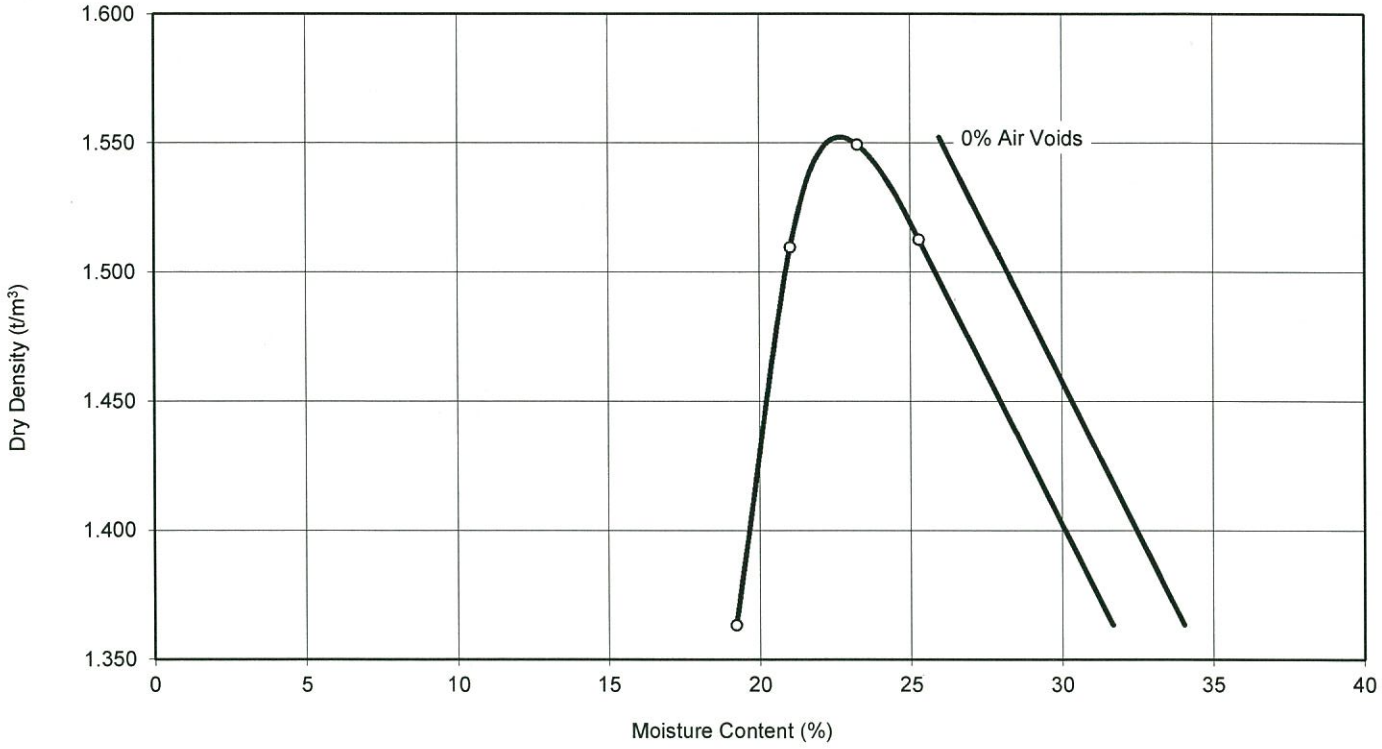
Arveendra Gounder
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

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 Compaction Test

Client :	ACT Geotechnical Engineers Pty Ltd	**Project No. :**	68950.00
		Report No. :	M15177005
Project :	Woodlawn Bioreactor - C7755	**Report Date :**	11/11/2015
Location :	Tarago Collector Road, Tarago, NSW	**Date of Test:**	10/11/2015
		Page:	1 of 1



Sample Details: **Location:** 2D
Depth: Stockpile

Particles > 19mm: 0%

Description: Slightly silty CLAY, trace gravel, some sand

Maximum Dry Density:	**1.55 t/m^3**
Optimum Moisture Content:	**22.5 %**

Remarks:

Test Methods: AS 1289.2.1.1, AS 1289. 5.1.1

Sampling Methods: Sampled by Client

NATA
ACCREDITED FOR TECHNICAL 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

Tested:	AM
Checked:	AG

Arveendra Gounder
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

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

Client: ACT Geotechnical Engineers Pty Ltd
Project: Woodlawn Bioreactor - C7755
Location: Tarago Collector Road, Tarago, NSW

Project No: 68950.00
Report No: M15177006
Report Date: 30-Nov-2015
Date Sampled: -
Date of Test: 23-Nov-2015
Page: 1 of 1

Sample Location	Depth (m)	Sample Description	Dry Density Before Test	Density Ratio (Standard) (%)	Moisture Content Before Test (%)	Moisture Content After test (%)	Hydraulic Gradient	Surcharge Applied (kg)	Percentage Oversize (%)	Coefficient of Permeability (m/sec)
1D	Stockpile	Slightly sandy silty CLAY	1.55	98	22.4	25.5	Variable	NIL	NIL	$3x10^{-10}$
2D	Stockpile	Slightly silty CLAY	1.49	98	22.5	24.8	Variable	NIL	NIL	$2x10^{-10}$

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

ACCREDITED FOR TECHNICAL COMPETENCE

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

Tested: TT
Checked: AG

Arveendra Gounder
Laboratory Manager

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

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		

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Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Jacinta Hurst
Laboratory Manager

CEC Our Reference: Your Reference Type of sample	UNITS ---------- ----------	137226-1 1D Soil	137226-2 2D 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
Exchangeable K	meq/100g	0.3	0.4
Exchangeable Mg	meq/100g	15	17
Exchangeable Na	meq/100g	3.0	3.7
Cation Exchange Capacity	meq/100g	23	27

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

QUALITY CONTROL CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			13/11/2015	[NT]	[NT]	LCS-1	13/11/2015
Date analysed	-			13/11/2015	[NT]	[NT]	LCS-1	13/11/2015
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	107%
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	107%
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	104%
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	91%
Cation Exchange Capacity	meq/100g	1	Metals-009	[NT]	[NT]	[NT]	[NR]	[NR]

Report Comments:

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

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

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.

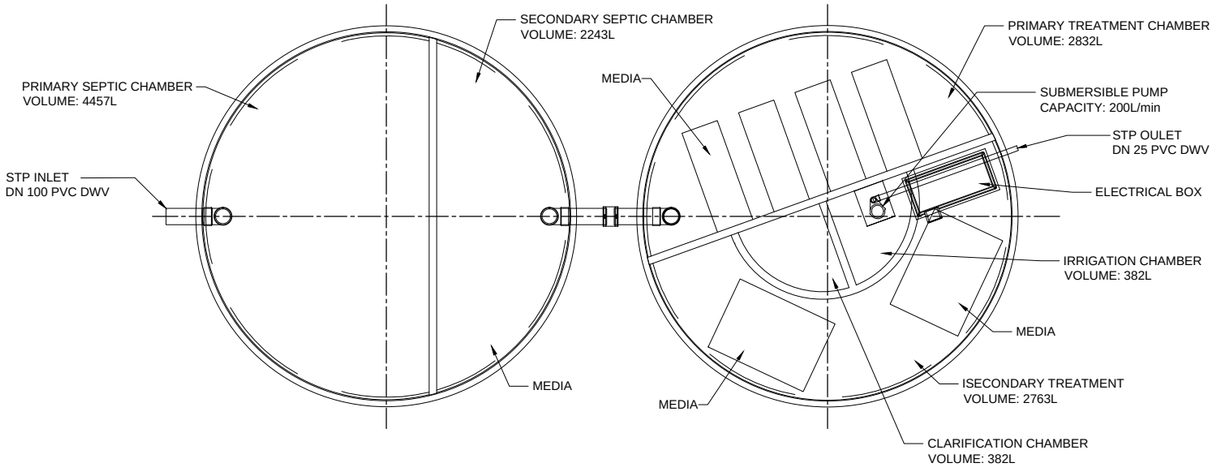
Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols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

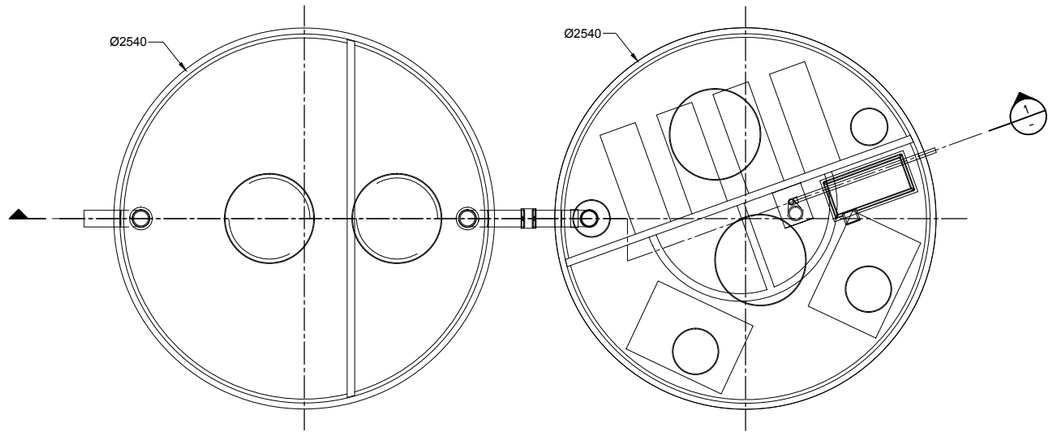
In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

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.

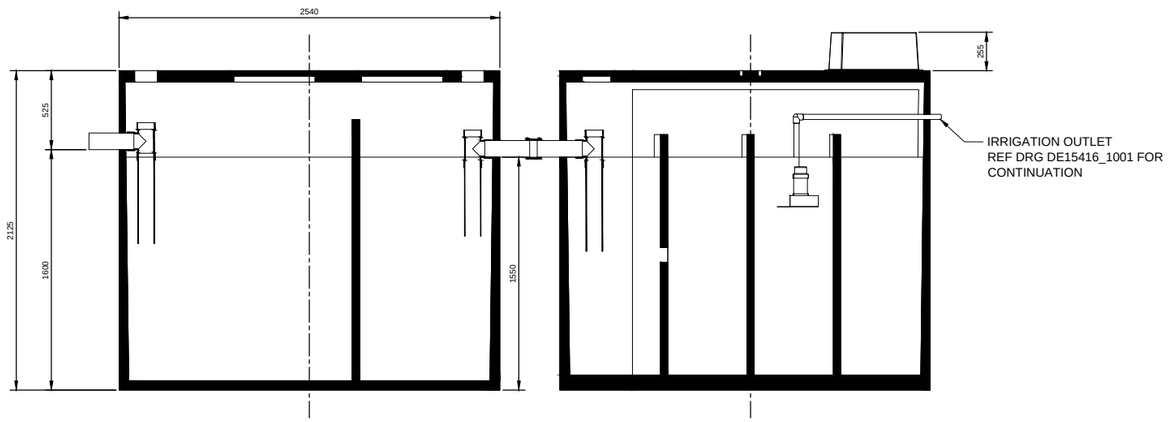
Appendix D1.4 Effluent Disposal Package Sewage Irrigation System



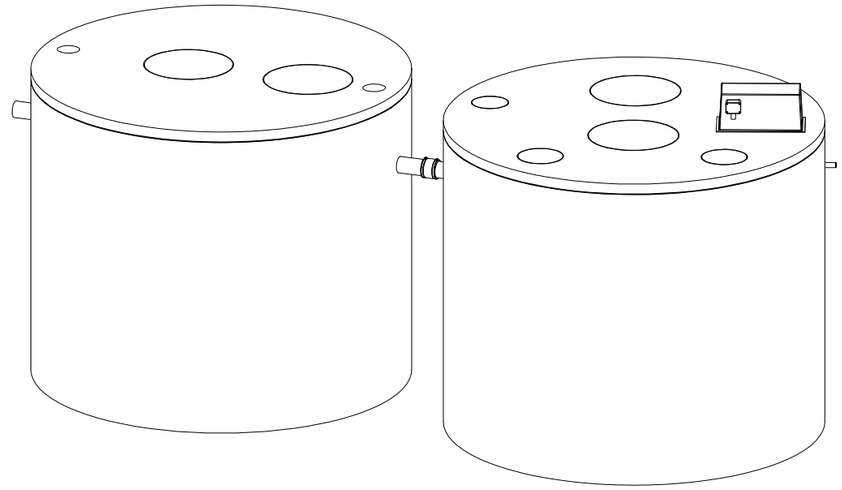


SEPTIC TANK - PLAN VIEW
SCALE 1:20

TREATMENT TANK - PLAN VIEW
SCALE 1:20



SECTION VIEW 1
SCALE 1:20



TYPICAL MAXI 20 STP - ISOMETRIC VIEW
NOTE: STP SHOWN WITHOUT 1200 RISER
NTS

NOTES:
1. SEPTIC TANKS MANUFACTURED & TESTED IN ACCORDANCE WITH AS/NZ 1546.1:2008
2. DISCHARGE PUMP CAPACITY: 200L/min
3. GROWTH MEDIA TOTAL SURFACE AREA: 160m2
4. 1200mm HIGH CONCRETE RISER SHAFT ADDED PENDING CONFIRMATION OF FINAL SEWER LINE DEPTH

ISSUED FOR CONSTRUCTION CERTIFICATE

REV	DESCRIPTION	BY/DATE	CHECKED	VERIFIED
3	FOR CONSTRUCTION CERTIFICATE	06/01/15	D. MURPHY	V. NAIK
2	70% DESIGN ISSUE	05/12/14	D. MURPHY	V. NAIK
1	MINOR REVISION	24/11/14	D. MURPHY	V. NAIK
0	25% DESIGN ISSUE	08/09/14	D. MURPHY	V. NAIK

VEOLIA LIPMAN the obvious choice

Downer
10 Orangegrove Avenue, Unanderra. NSW. 2526.
Phone: (02) 4271 0500 Fax: (02) 4271 2579

VEOLIA/LIPMAN

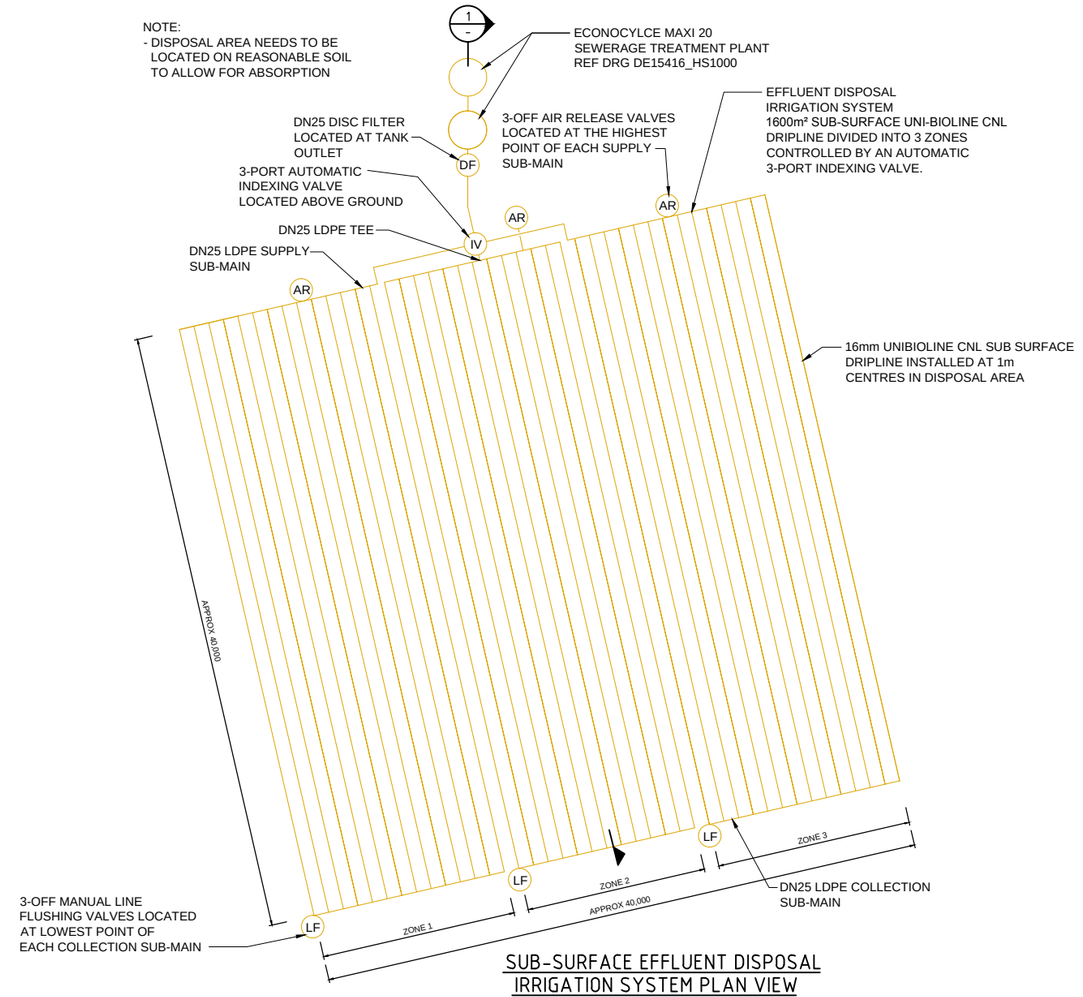
WOODLAWN MBT FACILITY
EFFLUENT DISPOSAL
PACKAGE SEWAGE
TREATMENT PLANT
PLAN, SECTION & DETAILS

DATE	DRAWN	DRAWING PRODUCED BY:- Downer Phone (02) 4271 0500 FILE NAMEDE15416_HS1000.dwg	SHEET No.
08/09/14	D. MURPHY		1 OF 1
CHECKED	RESP. ENGINEER		REV No.
D. MURPHY	V. NAIK		3

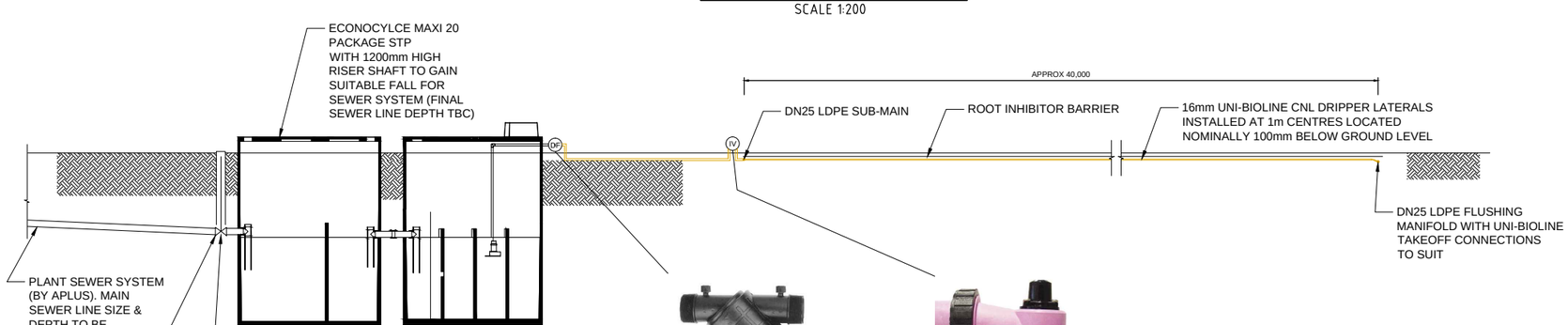
DE15416_HS1000

Plotted By: Damien.Murphy Plot Date: 06/01/15 - 17:07 Cad File: G:\DEP\SYDNEY\SYDNEY\JOBS\SWC NFRP\Projects\Mechanical Design Projects\Woodlawn MBT\Drawings\DE15416_HS1000.dwg

NOTE:
- DISPOSAL AREA NEEDS TO BE LOCATED ON REASONABLE SOIL TO ALLOW FOR ABSORPTION



SUB-SURFACE EFFLUENT DISPOSAL
IRRIGATION SYSTEM PLAN VIEW
SCALE 1:200



SECTION VIEW 1
NTS

FILTER

INDEXING VALVE

ISSUED FOR CONSTRUCTION CERTIFICATE

REV	DESCRIPTION	BY/DATE	CHECKED	VERIFIED
3	FOR CONSTRUCTION CERTIFICATE	06/01/15	D. MURPHY	V. NAIK
2	70% DESIGN ISSUE	05/12/14	D. MURPHY	V. NAIK
1	DISPOSAL REVISED TO SUB-SURFACE	24/11/14	D. MURPHY	V. NAIK
0	25% DESIGN ISSUE	08/09/14	D. MURPHY	V. NAIK

VEOLIA LIPMAN the obvious choice

Downer
10 Orangegrove Avenue, Unanderra. NSW. 2526.
Phone: (02) 4271 0500 Fax: (02) 4271 2579

VEOLIA/LIPMAN

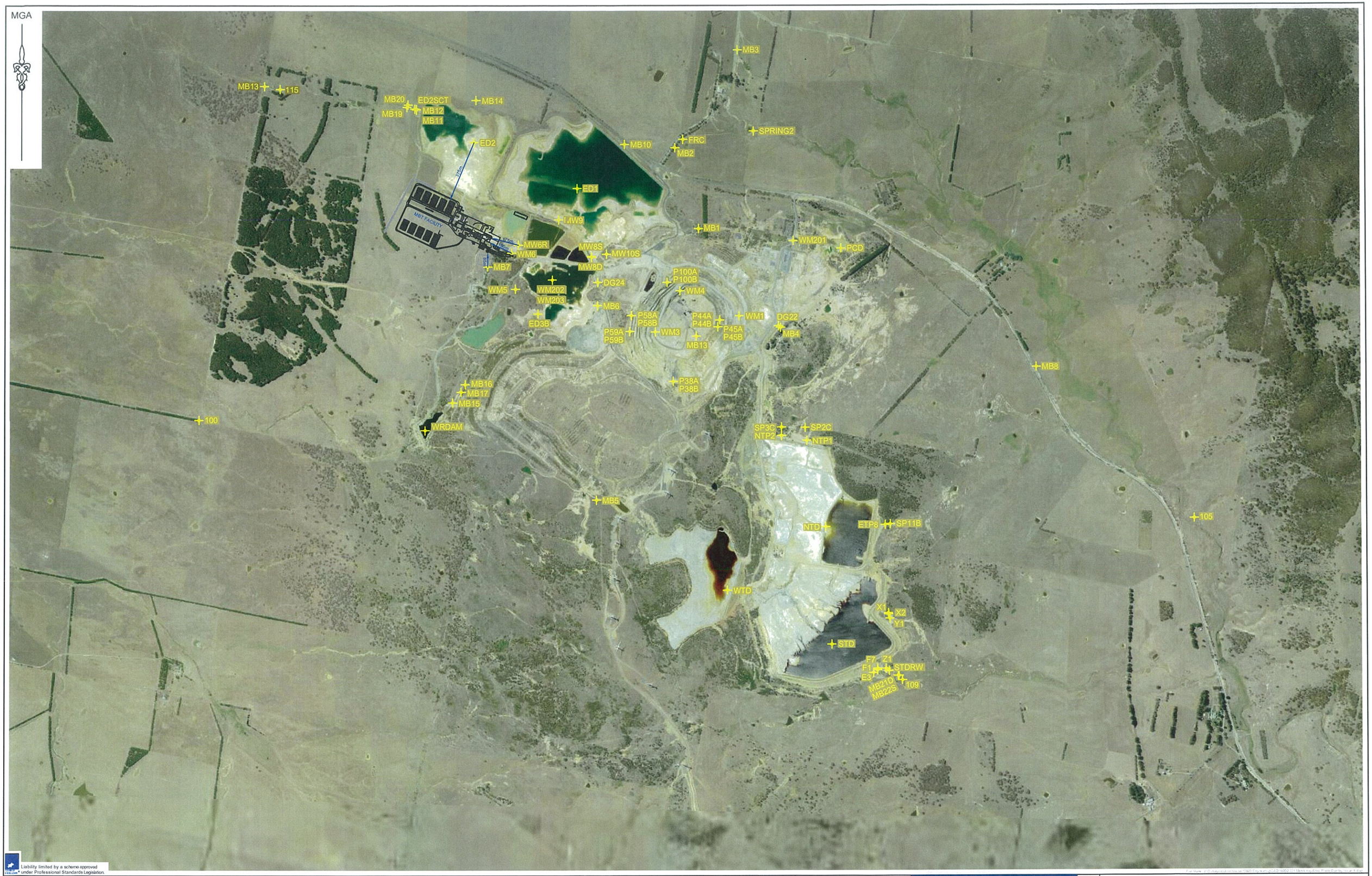
WOODLAWN MBT FACILITY
EFFLUENT DISPOSAL
IRRIGATION SYSTEM
PLAN, SECTION & DETAILS

DATE	DRAWN	DRAWING PRODUCED BY:- Downer Phone (02) 4271 0500 FILE NAMEDE15416_HS1001.dwg	SHEET No.
08/09/14	D. MURPHY		1 OF 1
CHECKED	RESP. ENGINEER		REV No.
D. MURPHY	V. NAIK		3

DE15416_HS1001

Plotted By: Damien.Murphy Plot Date: 06/01/15 - 14:47 Cad File: G:\DEP\SYDNEY\SYDNEY\JOBS\SWC NFRP\Projects\Mechanical Design Projects\Woodlawn MBT\Drawings\DE15416_HS1001.dwg

Appendix D1.5 Woodlawn Bioreactor Monitoring Locations



Liability limited by a scheme approved under Professional Standards Legislation.

VEOLIA ENVIRONMENTAL SERVICES

SCALE 1:10,000

0 200 400 600 800 1000

Metres

ISSUE	AMENDMENT	DRAWN	DATE
A	DRWG 16800-220 ISSUE E WITH MBT SITE SHOWN	MK	12/01/2017

LandTeam Australia Pty Ltd
ABN 26 300 280 682
Goulburn Office
36 Montague Street
Postal: PO Box 1040
GOULBURN NSW 2580
p: (02) 4821 1033
f: (02) 4821 7238
e: goulburn@landteam.com.au
www.landteam.com.au

LandTeam

A1 SHEET

VEOLIA ENVIRONMENTAL SERVICES

WOODLAWN BIOREACTOR
COLLECTOR ROAD, TARAGO

WOODLAWN BIOREACTOR
SITE MONITORING LOCATIONS
WITH PROXIMITY TO MBT FACILITY

DESIGNED: N/A
DRAWN: MK
CHECKED: JK
ISSUE A

DRAWING No. 16800-221

DATUM N/A | CONTOUR INTERVAL N/A | DATE 12/01/2017