Broadcrest Environmental Pty Ltd

55 Martin Road, Badgerys Creek NSW

On-Site Wastewater Report

May 2025

BLANK PAGE

DOCUMENT CONTROL

Approval and Authorisation

Title	55 Martin Road, Badgerys Creek NSW On-Site Wastewater Report
Authored on behalf of Broadcrest Environmental Pty Ltd by:	Kyle Ryan Engineer | Civil & Environmental
Signed:	
Dated:	21/05/2025

Document Status

Date	Internal Reference	Document Status	Prepared by	Reviewed by
27/07/2021	1294-WW-A-01	For Release	K. Ryan	L. Starkey
02/05/2025	1294-WW-A-02	Update to RFI & Arch Rev.	L. Starkey	K. Ryan
21/05/2025	1294-WW-A-03	Update to RFI	L. Starkey	K. Ryan

CONTENTS

1 INTRODUCTION

1.1 Foreword

An On-Site Wastewater Report is a technical document which specifies how the sewage produced on-site will be managed, treated, and then disposed. An On-Site Wastewater Report carefully considers the environment, health, cost, and long-term management options for the on-site management of sewage.

1.2 Background

Broadcrest Pty. Ltd. was engaged by AMJ Demolitions & Excavations to produce an On-Site Wastewater Management Report at 55 Martin Road, Badgerys Creek NSW (the site). The report will accompany plans for the construction of a 2-storey office and ancillary carparking. The report will also cover the wastewater loading from the amenities within the approved processing facility.

A site inspection was carried out by STS Geotechnics Pty Ltd which included a visual assessment of the site and soil sampling which are compiled in their report: Report No: 21/1206BProject No: 30955/5057D-G. This report will assume the site and soil properties identified in the STS report.

A Liverpool council RFI (02/04/25) Ref: DA-263/2018/C matter 5 and council RFI (04/04/25) ref: DA-263/2018/D matter 3 seek clarification as to the wastewater loading proposed by the 2-storey office and processing shed amenities respectively. The present onsite Wastewater Report is provided to quality the design loading of the modification proposals and to nominate suitable treatment and onsite dispersal measures to address the matters raised in the Liverpool RFIs.

1.3 Objectives

The performance objectives of the On-Site Wastewater Assessment are to:

- Protect human health
- Protect ground and surface water
- Maintain and enhance the quality of the land and vegetation
- Maintain and enhance community amenity
- Ensure maximum re-use of resources
- Promote an ecologically sustainable development.

1.4 Scope of Works

The scope of works included the following:

- Wastewater management assessment
- Drafting of the proposed system
- Reporting in accordance with the associated legislations and guidelines.

1.5 Compliance

This report has been produced in accordance with the following guiding documents:

- LGA DCP and wastewater policies
- DLG 1998, On-site Sewerage Management for Single Households
- SCA 2012, Designing and Installing On-Site Wastewater Systems
- Australian Standard AS 1289.3.8.1:2006 Methods for testing soils for engineering purposes
- Australian Standard AS 1546.1-3:2008 On-site domestic wastewater treatment units
- Australian Standard AS 1547:2012 On-site domestic wastewater management

2 SITE ASSESSMENT & INVESTIGATION

2.1 Site Information

Address / Locality	55 Martin Road, Badgerys Creek NSW
Lot Area:	~2.53 Ha
Council / LGA:	Liverpool City Council
Intended Water Supply:	Town Water

2.2 General

The lot occupies ~2.53 Ha of land zoned ENT Enterprise, within the Liverpool Council LGA. The development location is currently occupied by a single brick residence (Figure 2.2.1), with perennial pasture leading to a woodland in the far west. The site landform is a very gently inclined upper-slope on a local crest defined by Martin Road then, falling gently down to another lower lying flat area in the west, a Dam is located in the west and also centrally on the lot immediately to the south.

Figure 2.2.1: West facing photograph from Martin Road over proposed development area

2.3 Assessment Methodology

The assessment methodology of this report follows that prescribed in DLG (1998), whereby the restriction imposed by a site/soil features are categorised by severity, and their impact forms the basis for subsequent system selection, design, and recommendations (Table 2.3.1).

Table 2.3.1 - Site / soil limitation assigned per DLG (1998)

Limitation	Description
Minor	This feature has been assessed and deemed to pose no obstacle to OSSM, given the recommended system and measures are implemented.
Moderate	This feature requires consideration. It may typically be overcome by site modifications or by appropriate selection, design and sizing of treatment / application systems.
Major	This feature precludes the use of a given treatment, land application method, or Effluent Management Area (EMA). Particular Major Limitations may prevent OSSM entirely, require an off-site management approach, or re-evaluation of the development scope.

2.4 Site Assessment Summary

A summary of limitations pertinent to the suitability of the site for On-Site Sewerage Management (OSSM) is provided in Table 2.4.1 below.

Table 2.4.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Climate	Monthly evaporation exceeds rainfall for all months of the year.	Minor
Temperature	Annual mean daytime maximum > 15°C.	Minor
Flood Potential	The site lies above 52m AHD with Badgerys Creek 1% AEP Flooding extent identified as 46.76 (As per Table 5.2 of Wianamatta (South) Creek Catchment Flood Risk Assessment – Advisian).	Minor
Exposure	Good-excellent wind and solar exposure.	Minor
Slope	Approximately 2.6%.	Minor
Landform	Linear Planar upper slope	Minor
Run-on and Seepage	Limited potential interaction of stormwater and proposed EMA.	Minor
Site-drainage	No ponding of pronounce saturation identified with proposed EMA.	Minor
Erosion Potential	No erosion in proposed EMA identified.	Minor
Site and Soil Disturbances	Significant site and soil disturbance anticipated during site preparation & construction works, no ongoing disturbance of proposed EMA anticipated	Moderate
Groundwater Bores	No groundwater bores have been identified within 250 m of the proposed EMA.	Minor
Rock Outcropping	No outcropping identified.	Minor
Geology / Regolith	No geological discontinuities, fractures or highly porous regolith identified.	Minor
Buffer Distances & Available land area	All prescribed buffer distances can be achieved.	Minor

2.5 Climate

Badgerys Creek has a temperate climate, with mild to warm summers, cool winters, and rainfall distributed evenly throughout the year. Median annual rainfall is 639mm and evaporation 1460mm. Average monthly evaporation is greater than median rainfall for all months of the year. (Appendix B) (*Minor Limitation)*.

Average maximum and minimum temperatures range from 30.3°C to 4.1°C in January to July respectively. The mean annual daytime maximum of 24.0°C proves suitable for biological wastewater treatment systems (i.e. AWTS) (*Minor Limitation*).

2.6 Flood potential

The site lies above 52m AHD and the EMA above 58m, with Badgerys Creek 1% AEP Flooding extent identified as 46.76 (As per Table 5.2 of Wianamatta (South) Creek Catchment Flood Risk Assessment – Advisian). (*Minor Limitation*).

2.7 Exposure

The proposed effluent management area (EMA) is well exposed to sun and wind (*Minor Limitation*).

Landform Feature	Aspect	Solar Exposure	Wind Exposure	Limitation
A	Western	Excellent	Excellent	Minor

2.8 Slope

Slope has the potential to become a restrictive landform feature for OSSM with increased slope increasing the risk of run-off and/or erosion. Slope within the proposed effluent management was determined to be 8% (*Minor Limitation).*

Landform Feature	Approximate Slope Tangent (%)	Slope Classification	Limitation
A	2.6%	Very Gently Inclined	Minor

Table 2.8.1 - Percentage Slope and Land Application Limitations

Slope Range [%]	Slope Classification	Limitation				
		Surface Irrigation (Spray & Drip)	Absorption Systems	Mounds	Conventional Trenches & LPEDs	Sub-surface Irrigation
0 – 1	Level	Minor	Minor	Minor	Minor	Minor
1 – 3	**Very Gently Inclined**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**
3 – 10	Gently Inclined	Minor	Minor	Minor	Minor	Minor
10 – 15	Moderately Inclined	Major	Major	Moderate	Moderate	Minor
15 – 20		Major	Major	Major	Moderate [2]	Minor
> 20	Steeply Inclined	Major	Major	Major	Moderate [3]	Moderate [1]

[1] 30% maximum slope without specific design (AS 1547:2012, p.133)
[2] >15% slope increase difficulty in construction (AS 1547:2012, Table K1)
[3] >25% slope creates difficulty in trenching, risk of erosion during construction (AS 1547:2012, Table K1)

2.9 Landform

The landform describes the surface shape and topographic position at the proposed EMA. Typical landform descriptors per AS1547:2012 are detailed below.

Landform Feature	Slope Configuration	Limitation
A	Linear Planar	Minor

2.10 Surface Water and Seepage

Surface water and seepage flow is determined by the catchment preceding the EMA and the prevailing landform features. General assessment of the likely surface water interaction with the landform and EMA has been provided.

Landform Feature	Catchment		Surface Flow		Soil Moisture	Seepage Potential	Limitation
	Size	Surface Coverage	Run-on	Run-off			
A	Limited	Pastures	limited	Minor	Dry	Minor	Minor

2.11 Site drainage

The proposed effluent management area appeared to be free draining with no signs of soil saturation, surface ponding, or noted presence of macrophytes (i.e. sedges, ferns, juncus) *(Minor Limitation).*

2.12 Erosion potential

Erosion and surface soil movement results from the interaction of the existing landform, surface flows and surface coverage. The following existing erosion conditions were identified and assessed in proposing additional hydraulic loading in the form of effluent. Note that soils are potentially erodible where surface cover is broken and as such, site and soil disturbances should be minimised (*Minor Limitation*).

Landform Feature	Surface Flow Type	Erosion Hazard		Limitation
		Surface Flow	Wind	
A	Unconcentrated	low	Low	Minor

2.13 Site & Soil Disturbances

No site or soil disturbances were identified within the proposed EMA location *(Minor Limitation).* On commissioning, the EMA is to be excluded from the commercial activity within the area (see Site Modifications).

2.14 Domestic Bore

WaterNSW Realtime data indicated no domestic potable groundwater bores located within a 250m radius of the site *(Minor Limitation).*

2.15 Rock Outcropping

No rock outcrop or surface boulders were identified (*Minor Limitation)*.

2.16 Geology / Regolith

No geological discontinuities, fractures, or highly porous regolith are expected within and surrounding the EMA (*Minor Limitation*).

2.17 Buffer Distances & Available Land Area

Minimum offset distances are designated by local approval authorities within their guiding documents to ensure the ongoing protection of community health, sensitive ecosystems, and the maintenance of community amenity. Where LGA guidance on a constraint is not available, appropriate offsets have been nominated in accordance with AS1547:2012 and Table 5 DLG (1998).

The site-specific constraints for the proposed EMA and land application method have been assessed as per Table 2.17.1.

Table 2.17.1 – Minimum buffer distances from sensitive site features

Site Feature	Minimum Setback		Proposed Setback	Limitation
	If EMA is upslope of feature	If EMA is downslope / level with feature		
Dwellings/Offices	15m		15m	Minor
Property Boundaries	6m	3m	> 6/3m	Minor
Driveways	6m	3m	6/3m	Minor
Buildings	6m	3m	>6/3m	Minor
Pools	6m		NA	Minor
Watercourses	100m		>100m	Minor
Domestic Bore / Well	250m from high water level		>250m	Minor
Dam / Drainage Depression / Swale	40m from high water level		>40m	Minor

3 SOIL ASSESSMENT

3.1 Soil Assessment Summary

Investigation of the site for suitability for OSSM was accompanied by soil assessment within the proposed EMA. Soil sampling was conducted at the time of inspection with the soil characteristics assessed per AS 1547:2012, AS 1289.3.8.1:2006, and NSW DLWC (2001) methodologies. The summary of the soil investigation is presented in Table 3.1.1.

Table 3.1.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Depth to bedrock / hardpan	1500-5000 mm within EMA.	Minor
Depth to high watertable	NIL free water or waterlogging characteristics	Minor
Coarse Fragments	< 10% across all upper strata	Minor
pH	>5.5 across all samples	Minor
Electrical Conductivity (EC)	< 1 dS/m across all samples.	Minor
Sodicity (ESP)	N.A – Single lot	-
Cation exchange capacity (CEC)	N.A – Single lot	-
Phosphorous sorption	N.A – Single lot	-
Modified Emersion Aggregate Test – Dispersiveness (EAT_m)	3+. Non-critical with respect to OSSM	Minor

3.2 Soil Landscape Map

1:100,000 Soil Landscape Mapping indicates the site occurs on the Blacktown Residual Soil Landscape. The Landscape features Local relief to 30 m, slopes usually >5%. Broad rounded crests and ridges with gently inclined slopes. Cleared Eucalypt woodland.

Soils typically of Friable brownish black loam over Hardsetting brown clay loam over at depth Strongly pedal, mottled brown light clay. STS soil data survey indicates the site conforms to the above landscape mapping.

3.3 Depth to Bedrock / Hardpan

Soil depth was ascertained by STS via 19 auger drill holes, two of which are local to the proposed EMA; BH13 & BH17 achieved depths of 1500mm and 5000mm respectively prior to refusal prior to discontinuation (*Minor Limitation)*.

3.4 Depth to High Watertable

No visible free water, soil saturation, grey mottling or similar was encountered within the sampling depth *(Minor Limitation).*

3.5 Soil Permeability Category

Soil permeability has been assigned per Table 5.2 of AS1547:2012 for the excavation site(s) most representative of the EMA location. The hydraulically limiting strata for the application system is bolded within Table 3.7.1 below.

Table 3.5.1: Soil permeability and Design Irrigation Rate (As inferred via STS Report Appendix A Bore Log BH17)

Excavation #		BH17		
Lower Depth (mm)	Field Texture	Structure	Indicative Permeability K_{sat} (m/day)	Design Irrigation Rate (DIR) (mm/day)
400	Loam	Moderate	1.5 – 3.0	4.0
1000	**Light Clay**	**Strong**	**0.12 – 0.5**	**3.0**
>1000	Sandy Clay > Weathered Shale	Weak	<0.06	3.0

3.6 Soil Profiles

Table 3.6.1						
Excavation #	BH13	Sample size:	50	[mm]	Date Completed:	9/04/2021
Inspection Method:	Auger				Water-table Encountered:	NO

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	200	Dry	Dark Brown	Loam	High	<10%
2	400	Dry	Brown	Clay Loam	Moderate	<10%
2	1500	Dry	Light Brown /Orange	Light Clay	Strong	<10%
Refusal:	Inspection terminated at 1500mm, unknown cause					

See STS Report Appendix A for Borehole log

Table 3.6.2						
Excavation #	BH17	Sample size:	50	[mm]	Date Completed:	9/04/2021
Inspection Method:	Auger				Water-table Encountered:	NO

Layer Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Structure	Coarse Fragment
1	400	Dry	Dark Brown	Loam	Moderate	<5%
2	1000	Moist	Light Brown	Light Clay	Strong	<5%
3	3000	Moderately Moist	Grey / Orange / Brown	Sandy Clay	Weak	<5%
4	5000	Dry	Grey / Orange / Brown	Weathered Shale	Weak	<5%
Refusal:	Auger Refusal on Weathered Shale					

See STS Report Appendix A for Borehole log

3.7 Soil Chemistry

One sample from each horizon of the most descriptive excavation site was tested for acidity, Electrical Conductivity, Dispersiveness, and Phosphate Sorption Capacity by SMEC Laboratories. The results were as follows:

Table 3.7.1: Soil Chemistry results

Excavation #		BH14			
Sample Depth (mm)	Test	Result	Description	Limitation	Recommendations
400	pH[1]	6.9	Neutral	Minor	-
	EC_e (dS/m) [1]	0.09	Non-Saline	Minor	-
	EAT_m[2]	3	Non-critical	Minor	-
	Psorbed (mg/kg) [3]	928	-	-	-

[1]pH & EC_e obtained Table 7.3 of STS Report 21/1206B

[2]EAT_m of BH15 determined SMEC testing services, see STS Report 21/1206B Appendix B pg63,

[3]Psorp obtained via ALS Environmental Report: ES1731925, project 21649, pg. 9 & 12, STS Report 21/1206B Appendix B

Tested soil parameters indicated no restrictive properties for OSSM within the sample location.

4 NOMINATED WASTEWATER MANAGEMENT

4.1 Proposed OSSM Summary

Site and soil constraints were evaluated in selection of appropriate treatment and effluent management method. A summary of the recommended OSSM system and application sizing is presented below:

PROPOSED OSSM SYSTEM:

Treatment	→	Effluent Management
AWTS + disinfection or equivalent	(Pumped dosing)	378m^2 Subsurface Drip Irrigation

SITE WASTEWATER LOADING:

Wastewater loading for the site is identified to be from the following sources:

- Processing shed mezzanine offices, kitchen and toilet amenities. A total of four showers, 4 toilets and one kitchen facility.
- 2-storey office & lab building. A total of 3 showers, 4 toilets and two kitchen facilities.

A total of 12 potential office spaces are present and 18 carparking spaces. The present DA applications seek to modify the layout of the site development with no additional occupancy above the prior allocated 20-staff and 5-visitor allowance. In response to RFI (02/04/25) Ref: DA-263/2018/C matter 5 and council RFI (04/04/25) ref: DA-263/2018/D matter 3 Table 4.1.1 below provides for a 25-staff and 15-visitor allowance as a conservative design flowrate estimate.

Table 4.1.1:- Maximum Anticipated Wastewater Loading

Source Type	Equivalent Population [Persons]	Water Supply	Wastewater Generation Rate per Capita [L/Person/Day]	Design Wastewater Loading [L/Day]
Employees: Factory & Offices (with bathroom, shower, + kitchen facilities)	25	Town Water	43 [1]	1,075
Visitors	15	Town Water	4.6 [2]	69
			Total	1,144 **(1,200 adopted)**

[1] To determine the per capita wastewater generation, the facility was assessed for amenities provided and the likely use case. The site is understood to provide facilities for office/lab staff. The staff amenities contain bathroom, shower, kitchen, and wash facilities, shower use is

infrequent. Based upon the above a 'factories and offices' with full facilities value has been adopted per the NSW Health (2001) *Septic Tank & collection accreditation guidelines pg17*.

[2] Visitor use rate has been calculated per NSW Dept. of Water & Energy (2008) *Guidelines for Greywater Reuse* toilet and handbasin values per the table below, allowing for 5 instances of visitor bathroom use per day.

Restroom Visitor Generation Rate

Generation stream	Type	Avg. usage [L]
Handbasin [1]	Greywater	1
Toilet [2]	Blackwater	3.6
	Total (L/p/day)	**4.6**

[1] Conservative single event use based on 4L/pp/day domestic use

[2] Dual flush (5.5L Full / 3L Half) with ratio of 4:1 half to full flush uses

4.2 Wastewater Treatment

It is proposed to treat all wastewater generated by the development to a secondary standard with disinfection via an aerated wastewater treatment system (AWTS) or equivalent. The nominated units must be capable of sustainably treating the calculated daily wastewater load of **1,200 L/Day** to the DLG 1998 parameters nominated in Table 4.2.1.

Justification of the proposed treatment method is as follows:

- Accidental or deliberate discharges are less detrimental to the environment and have less potential to adversely impact on health
- Higher quality effluent produced
- High commercial availability
- Allows for irrigation methods of effluent management

Table 4.2.1: - Secondary Treatment Targets (per DLG 1998)

Biochemical Oxygen Demand (BOD^5)	Suspended Solids (TSS)	Total Nitrogen (TN)	Total Phosphorus (TP)	Faecal coliforms		Dissolved Oxygen (DO)
				Non-disinfected effluent	Disinfected effluent	
< 20 mg/L	< 30 mg/L	25 - 50 mg/L	10 - 15 mg/L	Up to 10^4 cfu/100 mL	< 30 cfu/100 mL	> 2 mg/L

4.3 Effluent Management

Given the development proposed and site and soil conditions encountered, it is proposed to dispose of effluent from the treatment system servicing residence via **Subsurface Drip Irrigation**.

Sizing of the application method was undertaken via water and nutrient balance in accordance with DLG 1998 (see Appendix B) & via utilisation of lab tested Psorp values an average value of 928mg/kg being utilised in this case, with a minimum **Irrigation area of 378m^2 required.**

In this instance irrigation may be provided over one field. The irrigation field should be positioned within the effluent management area (EMA) nominated in Appendix A.

Justification of the proposed treatment method is as follows:

- Irrigation maximises the surface disposal area and evapo-transpiration.
- An irrigation area is available onsite meeting the minimum buffer distances.
- Irrigation is a suitable OSSM method for the site landform and soil properties

4.4 Recommended Site Modifications

To address present site constraints, the following modifications are recommended:

- Following the implementation of the irrigation field, the field is to be maintained with dense grass coverage and excluded from vehicle traffic.
- Signs are to be posted around the EMA indicating effluent dispersal in the area.
- The existing septic system is to be decommissioned. Refer to Appendix D.

4.5 Commercial Geotechnical Laboratory

LCC (20/05/2025) *Request for Additional Information* point 3 seeks clarification as to potential laboratory discharge into the OSSM system. Consultation was made with the site proprietor as to lab practices and potential for Geotech materials or associated processing liquids being discharged into the OSSM system. The proprietor has indicated that all waste liquids and material generated by the lab are collected for trade-waste or equivalent disposal and are not discharged into the OSSM system. The system as detailed in this report is therefore for servicing anthropogenic waste streams only with no proposal to direct lab waste discharge into the system.

5 ADDITIONAL INFORMATION

5.1 Pipework Detail

All associated plumbing / drainage work is to be in accordance with AS 3500.2:2015 *Sanitary Plumbing Drainage*. Positioning of the receiving treatment system is to ensure drainage from internal plumbing fixtures achieves the minimum grade and cover of the excerpts below.

Table 6.1 – Excerpts of AS3500.2:2015

Nominal Pipe Diameter (DN)	Minimum Grade	
(mm)	(%)	(Ratio)
65	2.50	1:40
80	1.65	1:60
100	1.65*****	1:60*****
125	1.25	1:80
150	1.00	1:100

*Drains from treatment plants may be 1.00% Min.

	Minimum depth of cover (mm)	
Location	Cast iron & Ductile iron	Other materials
Subject to vehicular loading	300	500
All other locations	NIL	300

5.2 Licensing

Operating a system of sewage management is a Prescribed Activity under the Local Government Act 1993 and clause 45 of the Local Government (Approvals) Regulation 1999. This means that an 'Approval to Operate' a system of sewage management must be obtained from Council.

5.3 Detailed Design

A detailed system design may still be requested at the 'Application to Install' stage. This design will include the size and location of all system components including tanks, distribution lines, valves, etc. These additional requirements will be furnished by the nominated treatment system suppliers / licensed installers. Additional information for the property owner is available in Appendix C.

6 CONCLUSION

- Development is proposed at 55 Martin Road, Badgerys Creek NSW for construction of a waste processing facility, with OSSM servicing the Office/Lab.
- The anticipated wastewater loading rates generated by the develop is calculated to be **1,200 L/day.**
- It is proposed to treat all wastewater generated by the Office/Lab to a secondary standard with disinfection. This is proposed to be via a new accredited aerate wastewater treatment system (AWTS).
- Application of the secondary treated effluent is proposed via **Subsurface Drip Irrigation** within the area(s) nominated in Appendix A. The **minimum irrigation area is to be 378m^2**.

APPENDIX A: SITE PLAN

REFER TO APPENDIX-D STS SOIL INVESTIGATION REPORT

MEZZANINE OFFICE & AMENITIES

PROCESSING SHED
[APPROVED DA-263/2018/A SUBJECT TO AMMNEDMENT AS PER PTI ARCHITECTURE PLANS REV-O]

PROPOSED 2-STOREY OFFICE BUILDING

BH15

BH14

BH16

BH13

BH17

10m ROAD WIDENING SETBACK LINE

10m ROAD WIDENING

PEDESTRIAN PATH

PROPOSED NSW-HEALTH ACCREDITED AWTS
TO SERVICE OFFICE BUILDING AND SHED AMENITIES
(APPROX LOCATION, FINAL LOCATION AS DETERMINED BY INSTALLER)
(PROVIDE SUITABLE LID / PAVEMENT TO ACHIEVE LOADING-CLASS OF ACCESSWAY)

BURIED DISTRUBTION LINE FROM AWTS UNIT TO EMA

1.5

8.792

3.000

3.0

22.400

17.912

16.900

21.197

31.156

92.393

TREE PROTECTION ZONE

2.6% GRADE

DAM

PROPOSED EMA
378m2 (MIN.) SUBSURFACE DRIP IRRIGATION
TO SERVICE OFFICE BUILDING AND SHED AMENITIES
(ESTABLISH DENSE LAWN COVERAGE OVER EMA PRIOR TO COMMISSIONING)

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE MADE INCOMPLETE IF COPIED

50mm A1 | 40 | 30 | 20 | 10 | 0 | A3 50mm | 45 | 40 | 35 | 30 | 25 | 20 | 15 | 10 | 5 | 0

ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-03	21/05/25	KR	KR	LS	UPDATE TO RFI
A-02	02/05/25	KR	KR	LS	ISSUE FOR REVIEW

BROADCREST
ENGINEERING AND ENVIRONMENTAL CONSULTANTS
broadcrest.com.au | contact@broadcrest.com.au | 1300 554 945
ENVIRONMENTAL FLOOD STORMWATER GEOTECHNICAL ACOUSTICS WASTEWATER
BROADCREST ENVIRONMENTAL PTY LTD |

PROJECT DESCRIPTION: PROPOSED PROCESSING SHED + OFFICES	SHEET: AWTS + IRRIGATION
PROJECT SITE: 55 MARTKIN RD, BADGERYS CREEK	PLAN: ONSITE WASTEWATER MANAGEMENT PLAN
LGA: LIVERPOOL COUNCIL	CLIENT: AMJ DEMOLITIONS & EXCAVATIONS

PROJECT ID	1294-WW
SCALE	1:600@ A3 1:300@ A1
SHEET NO.	1 OF 1

APPENDIX B: CLIMATE & NUTRIENT DATA

B1. - Climate Statistics

Table B1.1. Weather Stations

Statistic	Station No.	Station Name	Distance from site [km]
Temperature	67108	BADGERYS CREEK AWS	3.72
Precipitation	67108	BADGERYS CREEK AWS	3.72
Evaporation	67068	BADGERYS CREEK MCMASTERS F.STN	3.38

Figure B.1 - Monthly Cimate Statistics

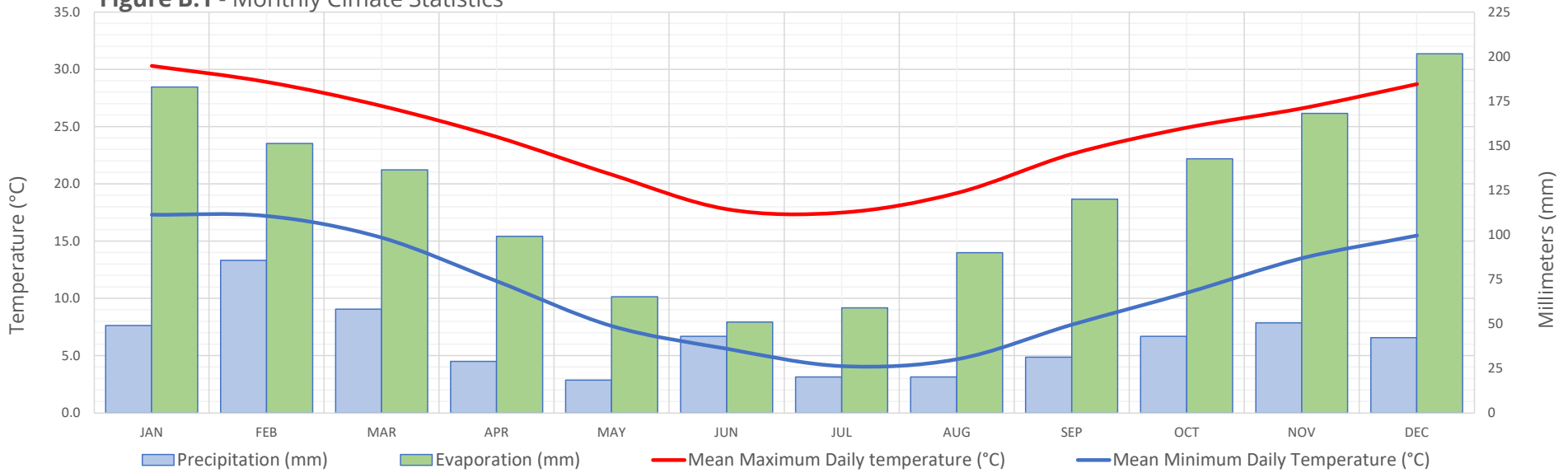


Table B1.2. Site Climate Statistics

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean Max. Temperature	[T]	[°C]	30.3	28.9	26.8	24.1	20.8	17.8	17.5	19.2	22.6	24.9	26.6	28.7	24.0
Mean Min. Temperature	[T]	[°C]	17.3	17.2	15.3	11.5	7.6	5.6	4.1	4.7	7.7	10.5	13.5	15.5	10.9
Days	[D]		31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation[1]	[P]	[mm/month]	49	85.6	58.2	28.9	18.4	43	20.2	20.1	31.3	42.9	50.5	42.2	639
Evaporation	[E]	[mm/day]	5.9	5.4	4.4	3.3	2.1	1.7	1.9	2.9	4	4.6	5.6	6.5	4
		[mm/month]	182.9	151.2	136.4	99	65.1	51	58.9	89.9	120	142.6	168	201.5	1460
Natural Site Balance[2]	[P-E]	[mm/month]	-133.9	-65.6	-78.2	-70.1	-46.7	-8	-38.7	-69.8	-88.7	-99.7	-117.5	-159.3	

[1] Median historic precipitation. Note: total is not equivalent to annual median.

[2] Negative value indicates monthly mean evaporation > precipitation

B2. - Water Balance

Table B2.1. Site & Soil Parameters

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	1,200	L/day
Soil Texture		Silty Clay	
Soil Structure		Moderate	
Indicative Permeability	K_{sat}	0.06 to 1.2	m/day
Design Irrigation Rate	DIR_{day}	4	mm/day

Table B2.2. Effluent water balance

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Days per Month	D	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Crop Factor	C		0.8	0.8	0.8	0.7	0.6	0.55	0.5	0.55	0.65	0.75	0.8	0.8	0.69167
Effluent Irrigation	(Q x D)	mm/month	37200	33600	37200	36000	37200	36000	37200	37200	36000	37200	36000	37200	438000
Evapotranspiration	(E xC)	mm/month	146.3	121.0	109.1	69.3	39.1	28.1	29.5	49.4	78.0	107.0	134.4	161.2	1009.8
Design Irrigation Rate	DIR_{Month}	mm/month	124	112	124	120	124	120	124	124	120	124	120	124	1460
Minmum Area Required	$A_{wb.min}$	m^2	168	228	213	224	257	**343**	279	243	216	198	177	153	239

Table B2.3. Water Balance Minimum Area Requirement

	Symbols	Area m^2
Minimum Area Required to Satisfy Water Balance:	A_{wb}	**343**

B3. - Nutrient Balance & Minimum irrigation area

Table B3.1. Nitrogen Balance

Parameter	**Symbols**	**Values**	**Units**
Design Wastewater Flowrate	Q	1,200	L/day
Surface Vegetation	Lawn - fully managed (clippings removed)		
Effluent Total Nitrogen (TN) Concentration[1]	TN	20	mg/L
Critical TN Loading Rate[2]	$L_{n.sfc}$	66	$mg/m^2/day$
Minimum Application Area	$A_{n.sfc}$	**365**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

Table B3.2. Phosphorus Balance

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	1200	L/day
Surface Vegetation	Lawn - fully managed (clippings removed)		
Effluent Total Phosphorus (TP) Concentration[1]	TP	10	mg/L
Phosphorus Generated 50_{YR}	P_{gen}	219	kg
Soil Phosphorus Sorption Capacity	P_{sorp}	12,899	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	0.430	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	8	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.150	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**378**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

B4. - Minimum Effluent Irrigation Areas

Table B4.1. Minimum Irrigation Area Requirement

Balance	Area Required (m^2)
Water	252
Nitrogen	365
Phosphorus	378
Minimum Irrigation Area	**378**

APPENDIX C: INFORMATION FOR THE PROPERTY OWNER

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank
Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS
Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets
Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

These are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTS (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTS desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with effluent.
- ✗ Don't extract untreated groundwater for cooking and drinking.
- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

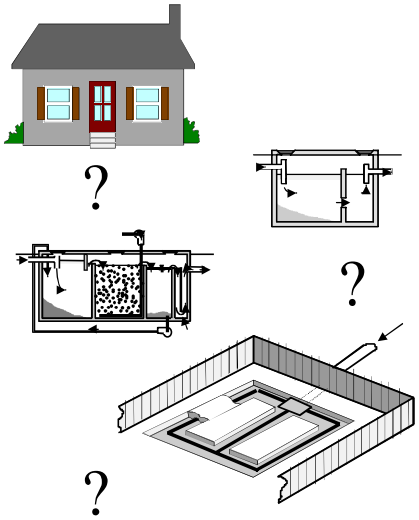
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:

Managing Wastewater In Your Backyard



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

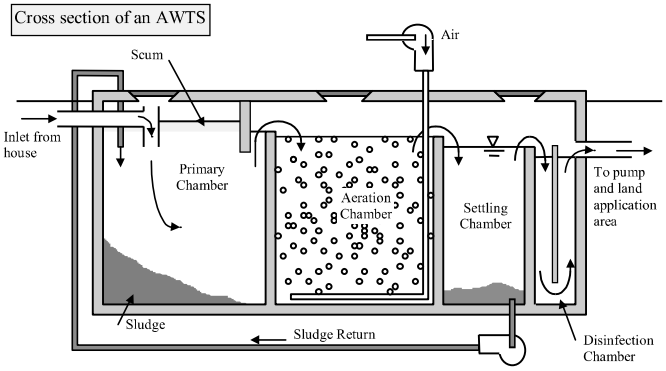
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

Cross section of an AWTS



Regulations and recommendations

Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:

DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✗ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't switch off power to the AWTS, even if you are going on holidays

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTS. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTS is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTS. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land application area.
- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTS can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

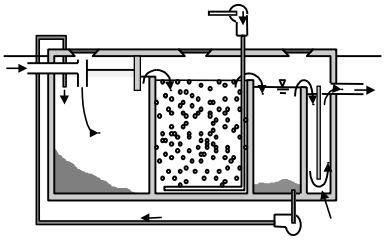
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTSs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

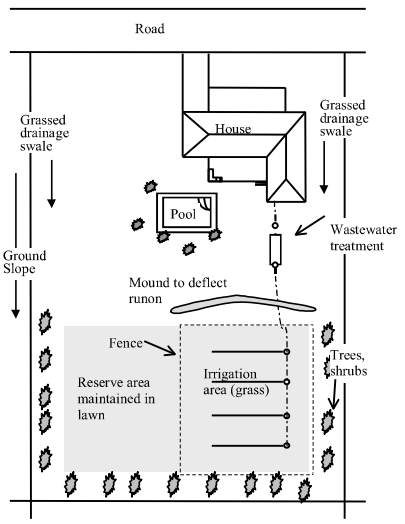
Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.

Typical Site Layout (not to scale)



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- × Don't erect any structures, construct paths, graze animals or drive over the land application area.
- × Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- × Don't plant trees or shrubs near or on house drains.
- × Don't alter stormwater lines to discharge into or near the land application area.
- × Don't flood the land application area through the use of hoses or sprinklers.
- × Don't let children or pets play on land application areas.
- × Don't water fruit and vegetables with the effluent.
- × Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- ∧ Overloading the treatment system with wastewater.
- ∧ The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- ∧ The application area has been poorly designed.
- ∧ Stormwater is running onto the area.

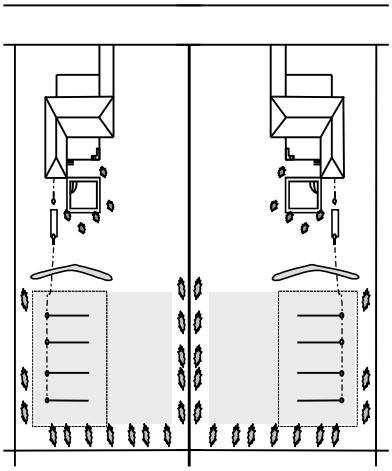
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



APPENDIX D: STS GEOENVIRONMENTAL REPORT

GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

GEOTECHNICAL INVESTIGATION, PRELIMINARY ACID SULFATE SOILS ASSESSMENT, SALINITY ASSESSMENT & WASTEWATER ASSESSMENT

FOR

AMJ DEMOLITION & EXCAVATION PTY LIMITED

55 Martin Road, Badgerys Creek, New South Wales

Report No: 21/1206B

Project No: 30955/5057D-G

July 2021

14/1 Cowpasture Place, Wetherill Park, NSW 2164, Australia
(PO Box 6989, Wetherill Park, NSW 2164, Australia)
T +61 2 9756 2166 | **F** +61 2 9756 1137
www.stsgeo.com.au | enquiries@stsgeo.com.au
ABN 61 162 976 543 | **ACN** 162 976 543

Table of Contents

1. INTRODUCTION

This report presents the results of a combined Geotechnical Investigation, Preliminary Acid Sulfate Soils Assessment, Salinity Assessment and Wastewater Assessment carried out by STS GeoEnvironmental Pty Limited (STS) for a proposed new commercial development to be constructed at 55 Martin Road, Badgerys Creek. We have been informed the works comprise the construction of a waste resource recovery centre which will include the following:

- Construction of a large (22m x 70m) shed with a concrete floor,
- Construction of an office building and staff/visitor car park,
- Construction of an unsealed stockpile and vehicle movement area,
- Construction of a wheel wash and weighbridge,
- Installation of an on-site wastewater disposal system, and
- Construction of sedimentation basins

We understand that the pavement design is required to satisfy heavy goods vehicle movements. The purpose of the salinity assessment was to determine if the site is affected by levels of soil salinity that would require specific management intervention in line with Councils DA requirements. The purpose of the Preliminary Acid Sulfate Soils Assessment was to determine if the site is affected by actual or potential Acid Sulfate Soils that would require specific management intervention in line with Councils DA requirements.

The purpose of the investigation was to:

- assess the subsurface conditions over the site,
- provide a site classification to AS2870,
- provide recommendations regarding the appropriate foundation system for the site including design parameters,
- provide retaining wall design parameters,
- comment on safe batter slopes,
- comment on soil aggressiveness to buried steel and concrete,
- provide a pavement design for rigid, flexible and un-sealed pavements,
- comment on site preparation and re-grading,

- undertake a salinity assessment,
- undertake a wastewater assessment, determining the area required for using both surface irrigation and trench systems,
- undertake a Preliminary Acid Sulfate Soils Assessment.

In regard to the salinity assessment, the procedures given in the publication below, have been adopted for this study:

Reference 1: DLWC (2002) publication, "Site Investigation for Urban Salinity."

The wastewater assessment has been undertaken in accordance with the following publications:

Reference 2: AS/NZS 1547:2012, "On-site domestic wastewater management" Standards Australia.

Reference 3: Department of Local Government (1998), "On-site Sewerage Management for Single Households," Environment and Health Protection Guidelines.

The investigation was undertaken at the request of Claron Consulting Pty Limited on behalf of AMJ Demolition & Excavation Pty Limited.

Our scope of included a Preliminary Site Investigation (PSI) contamination assessment. The results of the PSI have been reported separately.

2. NATURE OF THE INVESTIGATION

2.1. Fieldwork

The fieldwork consisted of drilling nineteen (19) boreholes numbered BH1 to BH19, inclusive, and undertaking ten (10) Dynamic Cone Penetrometer (DCP) tests at the locations shown on Drawing No. 17/3905. The boreholes were drilled using a combination of Christie and Edson RP70 utility mounted drilling rigs owned and operated by STS. Soils and weathered rock were drilled using rotary solid flight augers. In order to monitor groundwater levels and obtain water samples, PVC standpipe piezometers was installed in BH2, BH8 and BH15.

Drilling operations were undertaken by STS's technical officers and senior geologists who also logged the subsurface conditions encountered and collected samples for testing purposes.

The subsurface conditions observed are recorded on the borehole logs given in Appendix A. An explanation of the terms used on the logs is also given in Appendix A. Notes relating to geotechnical reports are also attached.

All soil samples were collected directly from the augers using hand tools and were transferred directly into new clean jars or bottles prepared by Australian Laboratory Services (ALS). Water samples were collected using a disposable polyurethane bailer. All jars and bottles were filled to the rim to minimize head space. The samples were then placed into ice-filled chests and transferred to ALS for testing purposes. Chain of Custody documentation was used to record and track the samples.

All sampling equipment was decontaminated prior to use and between sampling locations by washing with a mixture of water and DECON 90 and rinsing with potable water.

2.2. Laboratory Testing

In order to assess the soils for their aggressiveness, levels of salinity and to conduct the wastewater assessment, representative soil samples were tested to determine the following:

- Electrical Conductivity (EC),
- pH,
- Sulfate Content (SO_4),
- Chloride Content (Cl),
- Exchangeable Sodium Precent (ESP),
- Cation exchange capacity (CEC),
- Phosphorous Sorption Index,
- Emerson Class Number, and
- Particle Size Distribution.

In order to determine the pavement thickness, the California Bearing Ratio (CBR) of the pavement subgrade material was determined. The tests were carried out on samples compacted to a density ratio of 100% of the Standard maximum dry density.

Shrink swell testing was also undertaken to assist with determining the site classification.

The detailed test reports are given in Appendix B.

3. GEOLOGY AND SITE CONDITIONS

The Penrith geological series sheet at a scale of 1:100,000 shows Triassic Age Bringelly Shale of the Wianamatta Group underlies the site. Rocks within this formation comprise shale, claystone and laminite. Sandstone lenses are known to exist.

The site is rectangular in shape with an area of approximately 2.54ha. At the time of the fieldwork, the site comprised a rural residential parcel of land consisting of grassed paddocks with sparse trees and shrubs.

The north-east portion of the site comprises an enclosed area of about 2,900m^2 with 42m frontage to Martin Road. This part of the site is occupied by a single storey brick residence with gravel driveway, a metal shed and few mature trees. The remainder of the site is undeveloped.

There is a small dam with a footprint of about 40m^2 in the north-west corner of the site.

The ground surface falls to the west with a total fall of approximately 8 metres from RL 59.5m to RL 51.5m.

The land to the north is vacant and undeveloped, whilst the land to the south is rural residential. To the east and west are Martin Road and Lawson Road respectively.

4. SUBSURFACE CONDITIONS

When assessing the subsurface conditions across a site from a limited number of boreholes there is the possibility that variations may occur between test locations. The data derived from the site investigation programme are extrapolated across the site to form a geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour regarding the proposed development. The actual conditions at the site may differ from those inferred, since no subsurface exploration programme, no matter how comprehensive, can reveal all subsurface details and anomalies.

The subsurface conditions generally consist of topsoil overlying silty clays, sandy clays and weathered sandstone and shale. Topsoil materials were encountered across the site in all boreholes to depths of 0.3 to 0.5 metres. Natural silty clays and sandy clays were encountered below the topsoil to depths of 1.3 to 3.6 metres. The consistency of the clays varies from firm to stiff to very stiff. Weathered shale and sandstone underlie the site to the depth of auger refusal, 3.2 to greater than 6.0 metres.

Groundwater seepage was not observed during auger drilling of the boreholes. Six days later the water levels in the piezometers were recorded at 2.05m below the existing ground surface level in BH2 and 2.6 metres in BH8. BH15 remained dry.

5. GEOTECHNICAL RECOMMENDATIONS

5.1. Site Classification to AS2870

Table 5.1 below presents the results of the shrink swell testing undertaken.

Table 5.1 – Shrink Swell Index Summary Table

Location	Depth	Material Description	Shrink Swell Index (ISS)
BH6	0.7 – 1.0	SILTY CLAY: Light brown with light grey (Natural)	1.9
BH7	0.6 – 0.9	SILTY CLAY: Light brown with light grey (Natural)	1.8
BH15	0.5 – 0.9	SILTY CLAY: Orange brown with light grey (Natural)	1.7

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Because there are trees present, abnormal moisture conditions (AMC) prevail at the site (Refer to Section 1.3.3 of AS2870).

Because of the AMC, the site is classified *a problem site (P).* Provided that the recommendations given below are adopted and the footings are founded in natural underlying any topsoil, the site may be reclassified *moderately reactive (M).*

5.2. Foundation Design

Footings that bear in firm to stiff natural soils underlying any topsoil may be proportioned using an allowable bearing pressure of 100 kPa. This value may be increased to 150 kPa in stiff soils and 300kPa in very stiff soils. The minimum depth of founding must comply with the requirements of AS2870. In order to overcome the presence of trees, the foundations are to be designed in accordance with Appendices H and CH of AS2870.

Should a higher bearing pressure be required, then the loads should be transferred using piles to underlying stronger materials. Piles founded in the very stiff natural soils may be proportioned using an allowable bearing pressure of 450 kPa, provided that the pier depth to diameter ratio exceeds a value of 4. An allowable adhesion of 20 kPa applies to the portion of the shaft within the natural soils below a depth of 0.5 metres.

Piles founded in weathered shale/sandstone may be proportioned using an allowable bearing pressure of 700 kPa. An allowable adhesion of 70 kPa may be adopted for the portion of the shaft within the weathered shale/sandstone. These values may be increased to 1000 kPa and 100 kPa, respectively, when founding below the depth of auger refusal as shown on the borehole logs. When piles are founded in rock the adhesion in the overlying soils must be ignored.

In order to ensure the bearing values given can be achieved, care should be taken to ensure that the base of excavations are free of all loose material prior to concreting. It is recommended that all footing excavations be protected with a layer of blinding concrete as soon as possible, preferably immediately after excavating, cleaning, inspection and approval. The possible presence of groundwater needs to be considered when drilling piers and pouring concrete.

5.3. Pavement Design and Construction

5.3.1 Concrete Pavement for Heavy Vehicle Movements

The laboratory testing carried out indicated the existing subgrade has a CBR value of 1.5%. The design traffic volume is difficult to determine for this type of development. In the absence of design traffic loadings, we have adopted a design traffic loading of 1 x 10^6 Commercial Vehicle Axle Group (CVAGs). Using the above data, the suggested pavement thickness is as follows:

Table 5.2 – Concrete Pavement Thickness Design

28 Day Concrete Strength (MPa)	Concrete Base Thickness (mm)	Subbase Thickness (mm)
32	190	100
40	160	100

The above thickness assumes that the pavement extends a minimum of 600mm beyond the edge of the trafficked lane/area.

5.3.2 Concrete Pavement for Car Park Area

The laboratory testing carried out indicated the existing subgrade has a CBR value of 1.5%. The design traffic volume is difficult to determine for this type of development. In the absence of design traffic loadings, we have adopted a design traffic loading of 5 x 10^4 Commercial Vehicle Axle Group (CVAGs). This allows for infrequent use of the car park for commercial vehicles, such as weekly garage collection. Using the above data, the suggested pavement thickness is as follows:

Table 5.3 – Concrete Pavement Thickness Design

28 Day Concrete Strength (MPa)	Concrete Base Thickness (mm)	Subbase Thickness (mm)
32	170	100
40	140	100

The above thickness assumes that the pavement extends a minimum of 600mm beyond the edge of the trafficked lane/area.

5.3.3 Flexible Pavement for Heavy Vehicle Movements

The flexible pavement thicknesses have been determined using the procedures given in Australian Roads Research Board (ARRB) "Sealed Local Roads Manual." We have assumed a 95% confidence level that the pavement will perform satisfactorily during its design life. A design traffic loading of 1×10^6 ESAs is considered appropriate for the site. For a subgrade CBR value of 1.5%, the suggested pavement thickness is a recommended minimum of 610 mm, made up as follows:

Table 5.4 – Flexible Pavement Thickness Design

Material Type	Minimum Thickness (mm)
AC	50
Base Course	150
Subbase	410
TOTAL	**610**

Due to the low CBR value recorded, the above thickness assumes that the subgrade will be stabilised with 2% lime to a depth of 150mm.

The Asphaltic Concrete (AC) layer has been included as a wearing coarse and has not been considered as providing structural capacity to the pavement. If an unsealed pavement is required, then the AC layer may be omitted.

5.3.4 Flexible Pavement for Car Park Area

The flexible pavement thicknesses have been determined using the procedures given in Australian Roads Research Board (ARRB) "Sealed Local Roads Manual." We have assumed a 95% confidence level that the pavement will perform satisfactorily during its design life. A design traffic loading of 6×10^4 ESAs is considered appropriate for the site. This allows for infrequent use of the car park for commercial vehicles, such as weekly garage collection for a subgrade CBR value of 1.5%, the suggested pavement thickness is a recommended minimum of 530 mm, made up as follows:

Table 5.5 – Flexible Pavement Thickness Design

Material Type	Minimum Thickness (mm)
AC	50
Base Course	100
Subbase	380
TOTAL	**530**

Due to the low CBR value recorded, the above thickness assumes that the subgrade will be stabilised with 2% lime to a depth of 150mm.

5.3.5 Construction

The designs given above assume adequate provisions have been made for both surface and subsurface water.

The clayey site soils, which will make up the pavement subgrade are reactive. They will therefore be susceptible to shrinkage and swelling due to moisture content changes. If these subgrade soils are allowed to dry following compaction, it is probably that shrinkage will occur resulting in cracking. After placement of the pavement materials, the subgrade soils will moisten, resulting in swelling and partial loss of strength. It is therefore recommended that the subgrade be covered as soon as possible after completion of compaction in order to minimise the potential for evaporation and shrinkage to occur.

The subgrade materials should be compacted to a minimum density ratio of 100% of the Standard maximum dry density. Compaction should be verified by proof rolling and in-situ density tests. Base and subbase course materials should be compacted and tested to a minimum density ratio of 98% of the Modified maximum dry density. The level of compaction should be verified by in-situ density testing.

All pavement materials used should comply with the local council requirements.

5.4. Safe Batter Slopes

In the short term, dry cut slopes should remain stable at an angle of 1 to 1. In the long-term dry cut slopes formed at an angle of 2(H) to 1(V) should remain stable. Slopes cut at this angle would be subject to erosion unless protected by topsoil and diversion drains at the crest of the slopes. In order to use mowers to maintain cut slopes, an angle of 4(H) to 1(V) or flatter should be used.

5.5. Retaining Wall Design

The parameters used to proportion the retaining walls depend on whether the walls can be permitted to deflect. For walls, which cannot be permitted to deflect, the "at rest" (K_o) conditions should be adopted. A value of 0.6 should be adopted. For walls that can be allowed to deflect, an active earth pressure coefficient (K_a) of 0.4 should be adopted. A passive earth pressure coefficient (K_p) of 2.5 may be used for the clays. A bulk density of 20 kN/m^3 may be used.

As with all retaining walls, the above coefficient must be adjusted for ground surface slope, groundwater and external loads, such as buildings and vehicles.

5.6. Site Preparation and Re-Grading

The performance of the slabs and pavements cannot be guaranteed unless the following procedures are adopted during the site earthworks:

- Remove any vegetation, topsoil and fill present. The exposed subgrade should be inspected by a geotechnical engineer who may wish to proof roll the exposed subgrade with a heavy, non-vibrating roller to detect soft or wet areas. These areas should be excavated to competent material and then filled as detailed below.

- Fill the site to the underside of slab or pavement level, in layers not exceeding 200 mm loose thickness, compacted to achieve a density ratio in the range of 98% to 102% of the Standard maximum dry density, at a moisture content within the range of -2% to +2% of the optimum for the material adopted.

The onsite silty clays can become non-trafficable during periods of wet weather.

5.7. Soil Aggressiveness

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation and Tables 5.1 and 5.2 of AS2870-2011. Regarding the electrical conductivity, the laboratory test results have been multiplied by the appropriate factor to convert the results to EC_e. The test results are summarised in Table 5.6.

Table 5.6 – Soil Aggressiveness Summary Table

Sample No.	Location	Depth (m)	pH	Sulfate (mg/kg)	Electrical Conductivity (dS/m)	
					$EC_{1:5}$	EC_e
S2-3	BH2	1.0	5.2	180	0.640	4.480
S2-5	BH2	2.0	5.1	80	0.741	5.187
S2-6	BH2	2.5	5.4	160	0.790	5.530
S2-8	BH2	4.0	7.2	100	0.693	6.237
S8-2	BH8	0.5	6.2	10	0.155	1.085
S8-4	BH8	1.5	8.7	140	1.120	7.840
S8-5	BH8	2.0	8.7	120	0.944	6.608
S8-7	BH8	3.0	9.1	110	0.736	6.624
S15-2	BH15	0.5	6.4	90	0.112	0.784
S15-3	BH15	1.0	8.8	120	0.446	3.122
S15-5	BH15	2.0	8.7	10	0.192	1.728
S15-6	BH15	2.5	8.6	20	0.224	2.016

The report results range between:

- pH - 5.1 to 9.1
- soluble SO_4 - 10 to 180 mg/kg (ppm)
- EC_e - 0.784 to 7.840 dS/m

The soils on the site consist of low permeability silty clays. Therefore, the soil conditions B are considered appropriate.

A review of the durability aspects indicates that:

- pH : minimum value of 5.1
- SO_4 : maximum value of 180 mg/kg (ppm) < 5000 ppm
- EC_e : maximum value of 7.8 dS/m

The exposure classification for the onsite soils is non-aggressive for steel and mildly aggressive to concrete in accordance with AS2159-2009. The soils are classified as A2 in accordance with AS2870-2011.

6. SALINITY ASSESSMENT

6.1. Soil Test Results

The results of the soil sample analyses are provided in Tables 6.1 to Table 6.3. Table 6.1 also includes the appropriate multiplier factors used to convert results to EC_e (µS/cm) and the salinity class with which the soil sample falls according to Table 6.2: EC_e Values of Soil Salinity Classes in the publication entitled "Site Investigation for Urban Salinity (DLWC, 2002)".

Table 6.1 – Salinity Results

Sample ID	Sample Depth (m)	$EC_{1:5}$ (µS/cm)	Soil Type	Multiplier Factor	EC_e (µS/cm)	Salinity Class
S1-1	0.2	724	Silty Clay	7	5068	Moderately Saline
S2-2	0.5	437	Silty Clay	7	3059	Slightly Saline
S2-3	1.0	640	Silty Clay	7	4480	Moderately Saline
S2-4	1.5	780	Silty Clay	7	5460	Moderately Saline
S2-5	2.0	741	Silty Clay	7	5187	Moderately Saline
S2-6	2.5	790	Silty Clay	7	5530	Moderately Saline
S2-7	3.0	723	Silty Clay	7	5061	Moderately Saline
S2-8	4.0	693	Shale	9	6237	Moderately Saline
S4-1	0.2	226	Silty Clay	7	1582	Non-Saline
S6-1	0.2	52	Silty Clay	7	364	Non-Saline
S7-1	0.2	84	Silty Clay	7	588	Non-Saline
S8-1	0.2	76	Silty Clay	7	532	Non-Saline
S8-2	0.5	155	Silty Clay	7	1085	Non-Saline
S8-3	1.0	997	Silty Clay	7	6979	Moderately Saline
S8-4	1.5	1120	Silty Clay	7	7840	Moderately Saline
S8-5	2.0	944	Silty Clay	7	6608	Moderately Saline
S8-6	2.5	666	Shale	9	5994	Moderately Saline
S8-7	3.0	736	Shale	9	6624	Moderately Saline
S8-8	4.0	570	Shale	9	5130	Moderately Saline
S9-1	0.2	430	Silty Clay	7	3010	Slightly Saline
S11-1	0.2	155	Silty Clay	7	1085	Non-Saline
S12-1	0.2	87	Silty Clay	7	609	Non-Saline
S13-1	0.2	58	Silty Clay	7	406	Non-Saline
S14-1	0.2	100	Silty Clay	7	700	Non-Saline
S15-1	0.2	87	Silty Clay	7	609	Non-Saline

S15-2	0.5	112	Silty Clay	7	784	Non-Saline
S15-3	1.0	446	Silty Clay	7	3122	Slightly Saline
S15-4	1.5	350	Sandstone	9	3150	Slightly Saline
S15-5	2.0	192	Sandstone	9	1728	Non-Saline
S15-6	2.5	224	Sandstone	9	2016	Slightly Saline
S15-7	3.0	240	Sandstone	9	2160	Slightly Saline
S15-8	4.0	337	Sandstone	9	3033	Slightly Saline
S17-1	0.2	37	Silty Clay	7	259	Non-Saline
S19-1	0.2	46	Silty Clay	7	322	Non-Saline

Table 6.2 –Summary of ESP Results

Sample No.	Location	Depth (m)	ESP (%)	Sodicity
S2-3	BH2	1.0	21.5	Highly Sodic
S2-5	BH2	2.0	30.4	Highly Sodic
S2-6	BH2	2.5	29.9	Highly Sodic
S2-8	BH2	4.0	24.6	Highly Sodic
S8-2	BH8	0.5	10.3	Sodic
S8-4	BH8	1.5	6.6	Sodic
S8-5	BH8	2.0	13.4	Sodic
S8-7	BH8	3.0	9.0	Sodic
S13-1	BH13	0.2	1.4	Non-Sodic
S15-2	BH15	0.5	12.9	Sodic
S15-3	BH15	1.0	8.2	Sodic
S15-5	BH15	2.0	<0.2	Non-Sodic
S15-6	BH15	2.5	<0.2	Non-Sodic

Table 6.3 –Summary of Emerson Class Number Results

Sample No.	Location	Depth (m)	Emerson Class No.	Classification
8653/C1	BH2	0.5 – 1.1	6	Slaking, no dispersion
8653/C2	BH4	1.0 – 1.4	5	Slaking, no dispersion
8653/C3	BH8	0.3 – 0.8	3	Slaking, dispersion after remoulding
8653/C4	BH17	0.4 – 1.0	3	Slaking, dispersion after remoulding

EC_e is representative of the actual salinity level that the plant roots are exposed to and as such provides an indication of the toxicity of the soils to various plant species. Reported EC_e for the samples ranged from 259 µS/cm to 7840 µS/cm and may be classified as non-saline to moderately saline.

Sodicity is expressed as the amount of exchangeable sodium as a percentage of the Cation Exchange Capacity or ESP %. Soil with an ESP of less than 5% is considered non-sodic. Those with an ESP between 5 and 15% are considered sodic whereas those with an ESP greater than 15% are considered highly sodic. The ESP results indicate that the on-site soils which overly shale bedrock are sodic to highly sodic, whereas the soils which overly sandstone bedrock are non-sodic to sodic.

The results of the Emerson Class Number testing indicate that the on-site soils are Class 3 to Class 6. Soils of Class 3 are slaking and no dispersion before remoulding, dispersion after remoulding. Soils of Class 5 are slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present and dispersion after slaking in a 1:5 soil/water suspension. Soils of Class 6 are as per Class 5, however experience flocculation after slaking in a 1:5 soil/water suspension. These results indicate that the soils are mostly non-dispersive.

6.2. Groundwater Salinity

As noted above, standpipe piezometers were installed in borehole BH2, BH8 and BH15. After installation, the piezometer was dewatered prior to sampling. Water samples were obtained six days later to ensure the sample was representative of the in-situ conditions. A description of salinity in water has been developed by Australia Water Resources Council and is given in Table 6.3.

Table 6.3 – Class of Groundwater Salinity

Class	Electrical Conductivity (µS/cm)
Fresh	0 – 800
Marginal	800 – 1600
Brackish	1600 – 4800
Saline	>4800

The electrical conductivity measured in SAL1 (BH8) is 35500 µS/cm, the electrical conductivity measured in SAL2 (BH2) is 33000 µS/cm. BH15 remained dry. This indicates the groundwater can be classified as saline.

6.3. Potential Impacts on Development

The general impacts that have the potential to occur may be summarised as:

- Damage to and subsequent reduction of the lifespan of buildings and associated infrastructure such as roads and underground services as a result of construction close to aggressive soil and groundwater. This may include:
    - Degradation of bricks, concrete, road base and curbing materials leading to expansion, cracking, strength and mass loss;
    - Corrosion of reinforcement and loss of structural integrity;
    - Rising/falling damp; and
    - Non-structural impacts, such as efflorescence on bricks.
- Degradation of drainage infrastructure by a rise in the groundwater level. Damage to pipes has the potential to exacerbate the problem by further recharging the shallow groundwater; and

- Damage to or prevention of the cultivation of salt-sensitive vegetation in landscaped areas and gardens may arise across the site due to the salinity levels in surface soils.

The risks considered to be potentially posed to individual assets and activities and appropriate management options are detailed below.

The construction and maintenance stages of the proposed development have the potential to adversely affect salinity conditions on the site and in the surrounding area, mostly by altering the current hydrological cycle. Potential impacts include:

- A rise in the groundwater level due to increased water inputs associated with urban development. e.g. irrigation and leaking pipes. Reduced infiltration due to the construction of hardstand across the site may offset this to some extent;

- Altered flow and drainage patterns which may result in increased water accumulation and associated salinity issues in areas of impeded flow, as a consequence of e.g. the construction of drainage lines, footings and roads;

- Interception of groundwater should local groundwater levels be raised by prolonged periods of precipitation, creation of a perched water table, or increased recharge of the regional or localized aquifer may result from cutting or compaction within the perched or permanent aquifer;

- Excavation and redistribution of saline soil during excavation and filling operations around the site.

These impacts have the potential to lead to an increase in the surface expression of soil salinity and adversely affect downstream water quality.

6.4. Salinity Model

The testing results (provided in Table 6.1 to 6.3) indicates that the soils tested are classed as being mostly non saline to moderately saline. Most of the near surface soils were non saline. Therefore, the soils are unlikely to present a risk of producing adverse salinity-based impacts. The groundwater below the site is saline and occurs at depths of approximately 2.0 to 2.5 metres below the existing ground surface. Further, the results suggest that the soils on site are classed as sodic to highly sodic and non-dispersive. Sodic soils have the potential to lose structure and become dispersive when saturated, and therefore can be both poorly draining and susceptible to erosion. However, many Australian soils are sodic and sodicity is not necessarily a function of land salinity.

Therefore, the main mechanisms by which salts could potentially be mobilised, thereby amplifying salinity issues, include;

- raising of the groundwater table;
- impedance of groundwater flow or surface water drainage;

These mechanisms would result in an increased surface expression of salinity.

6.5. Salinity Risk Assessment and Conclusions

Based on the results of the salinity assessment, the following conclusions are made:

- Soil salinity is not expected to impact on the proposed site development; therefore, a salinity management plan will not be required.
- The groundwater beneath the site should not be extracted for use as an irrigation source;
- Standard landscaping procedures for urban development sites would be sufficient to prevent any surface expression of salinity or impacts due to sodic soils. Such procedures would include the design and installation of appropriate drainage, covering landscaping zones in topsoil and revegetating.
- Selection of appropriate building designs and materials would also be necessary to ensure that the integrity of building foundations and floor slabs is not compromised due to the natural acidity, electrical conductivity and concentrations of key anions in the soils. Reference should be made to Section 5.7 of this report for advice regarding the aggressiveness of soils to buried steel and concrete.

7. WASTEWATER ASSESSMENT

7.1. Introduction

Climate data used to prepare the wastewater management plan for the site is that recorded by the Australian Government Bureau of Meteorology at Prospect Water Reservoir, Prospect, about 12.0km north east of the site. Details are given in Appendix C.

Table 7.1 – Monthly Rainfall and Evaporation Data

Month	Rainfall (Median) (mm)	Average Evaporation (mm)
January	73.2	170.5
February	73.1	131.6
March	78.3	120.9
April	57.2	87
May	38.4	62
June	50.0	48
July	32.9	52.7
August	30.9	77.5
September	40.2	108
October	43.1	136.4
November	60.1	150
December	58.0	173.6

Note: Data was obtained from the Prospect Water Reservoir (Prospect) weather station via the Bureau of Meteorology.

7.2. Laboratory Test Results

The physical soil parameters are summarised in Table 7.2 and the chemical parameters in Table 7.3.

Table 7.2 – Physical Soil Properties

Location	Depth (m)	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Material Description[1]
BH13	0.0 – 0.4	17	16	44	23	Loam
BH14	0.0 – 0.4	14	20	48	18	Loam

[1] = As given in AS/NZS 1547:2012

Table 7.3 – Soil Chemical Properties

Location	Depth (m)	pH	Electrical Conductivity (µS/cm)	CEC (meq/100g)	ESP (%)	Phosphorous Sorption Capacity (mgP)
BH13	0.2	6.7	58	17.1	1.4	766
BH14	0.9	6.9	100	17.7	11.5	1090

Based on the results in Table 7.2, the Design Irrigation Rate (DIR) has been determined using Table M1 in AS/NZ1547:2012. A DIR value of 21 mm/week (28 divided by a factor of safety of 1.3) has been adopted for a spray irrigation system. The site tactile assessment was that the site soils are clayey in nature, however, the laboratory results indicate the soils to be sandier. The rate chosen reflects are more clayey conservative nature.

7.3. Wastewater Assessment

Individual soil features are discussed below, and a limitation rating is provided for each feature.

- Depth of soil – greater than the 0.4 m minimum required.
- Depth to water table – 2.0m.
- Soil permeability – A DIR value of 21 mm/week for surface irrigation is consistent with a soil of moderate permeability. This poses a minor limitation.
- If trenches are used a Design Loading Rate (DLR) of 10 mm/day can be used for the onsite soil when there is primary treatment of the effluent. If the effluent receives secondary treatment, the DLR can be increased to 30 mm/day.
- Emerson Crumb – The soils are primarily Class 3, Class 5 and Class 6. These soils pose no limitation due to the soils potential to disperse.
- pH – The values of 6.7 and 6.9 pose no limitation.
- Electrical conductivity – this is a measure of soil salinity. Values below 4 dS/m (4000µS/cm) pose no limitations. The measured values are significantly less than this value.
- Sodicity – Exchangeable sodium percentage (ESP) is a measure of sodicity. Values less than 5 are considered non-sodic, whilst values greater than 15 are considered highly sodic. Values of 1.4 and 11.5 indicate non sodic to sodic soils are present. This poses a minor limitation.
- Cation Exchange Capacity (CEC) – A measure of the soil's ability to retain nutrients. Values in excess of 15 meq/100g pose no constraints. The measures values of 17.1 and 17.7 are in excess of 15 and therefore pose no limitation.
- Phosphorus Sorption – A measure of the soil's ability to immobilise excess phosphorus. Values in excess of 6000 kg/ha pose no constraints. Values of less than 2000 kg/ha pose a major limitation. The measured values are less than 2000kg/ha, and therefore pose a major limitation.

The above assessment indicates there are minor and major limitations on the soils.

7.4. Site Constraints

Individual site features are discussed below, and a limitation rating provided for each:

- Flood potential – It is unknown whether the site is above the 1 in 100-year flood contour.
- Exposure – The proposed disposal area has good wind and sun exposure.
- Slope – The slopes on the site are less than 5 degrees. Ensuring a good grass cover is maintained in the spray areas should ensure minimal if any erosion.
- Run on and up slope drainage – Where this is excessive, wastewater can be transported off site. The site has a gentle slope so run on drainage should not pose a limitation.
- Erosion potential - None visible on the site.
- Site drainage – No sign of surface dampness.
- Rock outcrops – None present on the site.
- Fill – No fill is present.
- Geology – There are no geological discontinuities in the area.
- Buffer distances – The buffer distances given in Table 7.4 should be adopted.

Table 7.4 – Recommended Buffer Distances

System	Recommended Buffer Distances
All land application systems	100 metres to permanent surface waters (e.g. river, streams, lakes, etc) 250 metres to domestic groundwater well 40 metres to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc)
Surface spray irrigation	6 metres if area up-gradient and 3 metres if area down-gradient of driveways and property boundaries 15 metres to dwellings 3 metres to paths and walkways
Subsurface irrigation	6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, property boundaries, driveways and buildings.

7.5 Spray Irrigation

7.5.1 Required Irrigation Area

The design criteria for sizing the required wastewater irrigation area are detailed in AS 1547. The required area for spray irrigation is calculated as follows:

$A_i = Q/DIR$

Where

A_i = irrigation area required (m^2)

Q = total quantity of effluent generated per week (L-litres)

DIR = design irrigation rate (litres/m^2/week)

AS/NZ 1547:2012 does not provide design effluent flows for commercial premises in Australia. Commercial premises generate less effluent than domestic premises. Table H2 provides some guidance to load. A WC+ hand basin generates 60 litres/person/day. Typically, modern showers use a maximum of 10 litres per minute which equates to say 50 litres/person/day. This equates to 120 litres/person/day. For 20 staff, this equates to 16, 800 litres per week.

In regard to visitors, a review of the tables in AS/NZ 1547:2012 suggest a figure of about 20 litres/person/day is appropriate. 5 visits, this equates to 700 litres per week.

The weekly effluent load is 16,800 + 700 = 17,500 litres per week.

For a DIR value of 21 litres/week, the minimum surface irrigation area required is:

$A_i = 17,500/21 = 833\ m^2$

7.5.2 Hydraulic Loading

The hydraulic loading provides an indication of the potential periods when wet weather storage may be required. The hydraulic loading is given by the following relationships:

Hydraulic Loading = Precipitation - (Evapo transpiration + Percolation)

The monthly hydraulic loadings for the sites are determined from the water balance given in Appendix D. Hydraulic loads in excess of zero indicate wastewater storage is required. A minimum subsurface spray irrigation disposal area of 1,090 m^2 will be required if no storage is provided for 20 staff and 5 visitors.

7.5.3 Nutrient Balance

The amount of nutrient available can be determined by multiplying the effluent application note by the amount of nutrient in the effluent. The available nutrients are given below in Table 7.5.

Table 7.5 – Available Nutrients

Effluent Rate (litres per day)	Nitrogen[1] (kg/yr)	Phosphorous[2] (kg/yr)
2,500	9.9	10.9

[1] = Assume a nominal rate of 30 mg/litre

[2] = Assume nominal rate of 12 mg/litre

Regarding the nitrogen, a nominal rate of 50 mg/m^2 /day has been assumed for the uptake of nitrogen into the soil. We have assumed that 50% of the nitrogen will be either lost to the atmosphere or taken up by the vegetation.

The area required is calculated as follows:

$$A = \frac{(0.5 \times 30) \times Q}{50} \qquad Q = \text{flow rate (L/d)}$$

$$= 750 m^2$$

The phosphorous sorption capacity of the onsite soils range between 766 and 1,090 mg/kg, with an average value of 928 mg/kg. Based on a bulk unit weight of 17kN/m^3 and an effective thickness of 0.4m, this equates to an uptake of 0.63 kg/m^2.

The area required for a 50-year life can be determined by multiplying the life required by the available phosphorous. This equates to

$$\text{Area} = \frac{P_{\text{generated}}}{P_{\text{uptake}}}$$

$$= \frac{50 \times 10.9}{0.63}$$

$$= 865 m^2$$

7.5.4 Conclusion

Based on the above assessment the required area for the different criteria are given below in Table 7.6. These are based on a design daily local of 2500 litres/day.

Table 7.6 – Summary Table

Criteria	Hydraulic	Nitrogen	Phosphorous
Area required (m^2)	1,090	750	865

The hydraulic requirements dictate the minimum disposal area required; i.e. 1,090 m^2.

In order to comply with the required buffer distances the maximum disposal area available is 402 m^2 as shown on Drawing No. 21/1206/1. The water balance for this area is attached. Effluent storage and disposal in periods when there is a negative balance shown can be adopted. The water balances, given in Appendix D, for the 402 m^2 disposal area shows that the storage increases each month. This means this area is too small.

Drawing no. 21/1206/2 shows an area of 998 m^2 which is slightly less than required. With this area the set back from the drainage channel is 20 m, half of that required. The water balances given in Appendix D shows that with storage of 6, 400 litres, this area can accept the effluent generated. This option will require the stored effluent to be disposed of in a managed way so as not to overload the disposal area.

A discussion on recommended setbacks (buffer distances) is given in AS/NZS1547:2012, Table R1. The setback distance is based on the evaluation of site features with respect to site features and how these interact to provide a pathway or barrier to the movement of wastewater to the site features.

Table R1 in the standard notes that the setback distance for surface water ranges between 15-100 metres. The table notes that surface water includes man-made drains. The setback distances at the lower end of this range are for lower risk sites and these at the higher end are for high risk sites. Table R2 in the standard nominates those Category 1 to 3 soils are considered to be low risk. Table 7.2 indicated that the onsite soils are a loam which AS/NZS1547:2012 classifies as a Category 3 soil. The DIR adopted to determine the water balance is at the lower range for a Category 3 soil.

Based on the low-risk nature of the site, it is our view that a reduced buffer distance can be justified, and the area shown on Drawing No. 21/1206/2 be adopted for the effluent disposal. We recommend Council be requested to consider this proposal.

7.6 Bed/Trench Land Application

The traditional means of effluent disposal from wastewater treatment units is by land application using trenches. Trenches can be used whether the effluent is subject to either primary or secondary treatment.

As noted above, the DLR values for primary and secondary treated effluent are 10 mm/day and 30 mm/day, respectively. Also, as noted above (section 7.5.1), the design daily flow (Q) is 2500 litres/day.

Trenches dimensions can be determined as follows:

$$L = Q/(DLR \times W)$$

Where

L = trench length in metres

Q = daily flow in litres/day (2500)

DLR = 10 or 30 mm/day

W = trench width in metres.

Using trench width of 0.6 metres (maximum allowed)

$$L = 2500/(DLR \times 0.6) = 4166.7$$

For a DLR = 10, L = 416.7 m → 420 m

For a DLR = 30, L = 138.9 m → 140 m

AS/NZS 1547 provides that the minimum distance between the trenches is 1m. Reference to Drawing Nos. 21/1206/1 and 321/1206/2, both disposal areas are about 30 metres in the north-south direction. Assuming all trenches are 30 meters in length, a total number of trenches required is as follows:

Primary treated effluent = 14

Secondary treated effluent = 5

This leads to total disposal areas required of;

Primary treated effluent = $30 \times 14 \times 1.6 = 672\ m^2$

Secondary treated effluent = $30 \times 5 \times 1.6 = 240\ m^2$

When considering buffer distances, the primary treated effluent aera required does not meet the requirements of a 40-metre buffer from the drainage channel. The secondary treated effluent area required is less than the area shown on Drawing No. 21/1206/2 and satisfies this buffer distance requirement. Therefore, to comply with buffer distance requirements, it will be necessary to use a unit capable of applying secondary treatment.

The following restrictions apply to construction of the trenches:

Trench Width	= 600 mm
Aggregate depth	= 400 mm
Topsoil depth	= 100 to 150 mm

Minimum trench spacing (sidewall to sidewall) = 1000 mm

8. PRELIMINARY ACID SULFATE SOILS ASSESSMENT

8.1. Introduction

ASS is the common name given to sediments and soils containing iron sulfides which, when exposed to oxygen generate sulfuric acid. Natural processes formed most acid sulfate sediments when certain conditions existed in the Holocene geological period (the last 10,000 years).

Formation conditions require the presence of iron-rich sediments, sulfate (usually from seawater), removal of reaction products such as bicarbonate, the presence of sulfate reducing bacteria and a plentiful supply of organic matter. It should be noted that these conditions exist in mangroves, salt marsh vegetation or tidal areas, and at the bottom of coastal rivers and lakes.

The relatively specific conditions under which acid sulfate soils are formed usually limit their occurrence to low lying parts of coastal floodplains, rivers and creeks. This includes areas with saline or brackish water such as deltas, coastal flats, backswamps and seasonal or permanent freshwater swamps that were formerly brackish. Due to flooding and stormwater erosion, these sulfidic sediments may continue to be re-distributed through the sands and sediments of the estuarine floodplain region. Sulfidic sediment may be found at any depth in suitable coastal sediments – usually beneath the water table.

Any lowering in the water table that covers and protects potential ASS will result in their aeration and the exposure of iron sulfide sediments to oxygen. The lowering in the water table can occur naturally due to seasonal fluctuations and drought or any human intervention, when carrying out any excavations during site development. Potential ASS can also be the exposed to air during physical disturbance with the material at the disturbance face, as well as the extracted material, both potentially being oxidised. The oxidation of iron sulfide sediments in potential ASS results in ASS soils.

Successful management of areas with ASS is possible but must take into account the specific nature of the site and the environmental consequences of development. While it is preferable that sites exhibiting acid sulfate characteristics are not disturbed, management techniques have been devised to minimise and manage impacts in certain circumstances.

When works involving the disturbance of soil or the change of groundwater levels are proposed in coastal areas, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

8.2. Presence of ASS

Reference to the Liverpool ASS Risk Map indicates the property is within an area where there are no known occurrences of ASS. It should be noted that maps are a guide only.

The following geomorphic or site criteria are normally used to determine if acid sulfate soils are likely to be present:

- sediments of recent geological age (Holocene)
- soil horizons less than 5 in AHD
- marine or estuarine sediments and tidal lakes
- in coastal wetlands or back swamp areas

8.3. Assessment

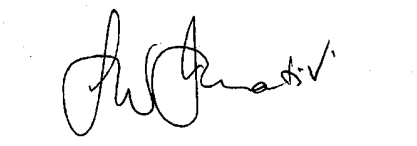
The property is at an elevation of about RL50 m AHD and is underlain by Bringelly Shale. This is not consistent with the geomorphic criteria necessary for the presence of ASS. Based on our onsite observations and the subsurface conditions exposed in the boreholes, it is our opinion that the proposed construction will not intercept any ASS. Based on the observations undertaken in the piezometers, it appears that any seepage into any excavations would be minor and therefore, construction will not result in the lowering of any groundwater that may be present in the area.

Our assessment is the proposed construction will not require the preparation of an Acid Sulfate Soil Management Plan.

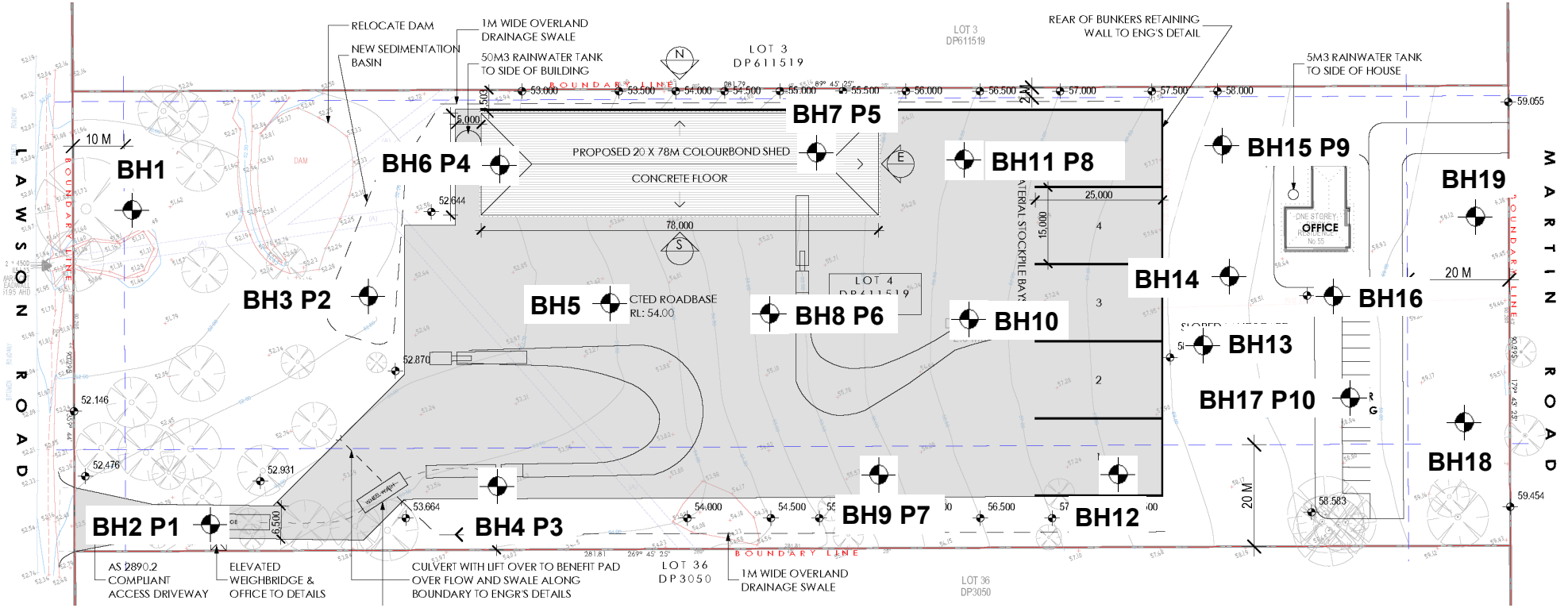
9. FINAL COMMENTS

During construction, should the subsurface conditions vary from those inferred above, we would be contacted to determine if any changes should be made to our recommendations.

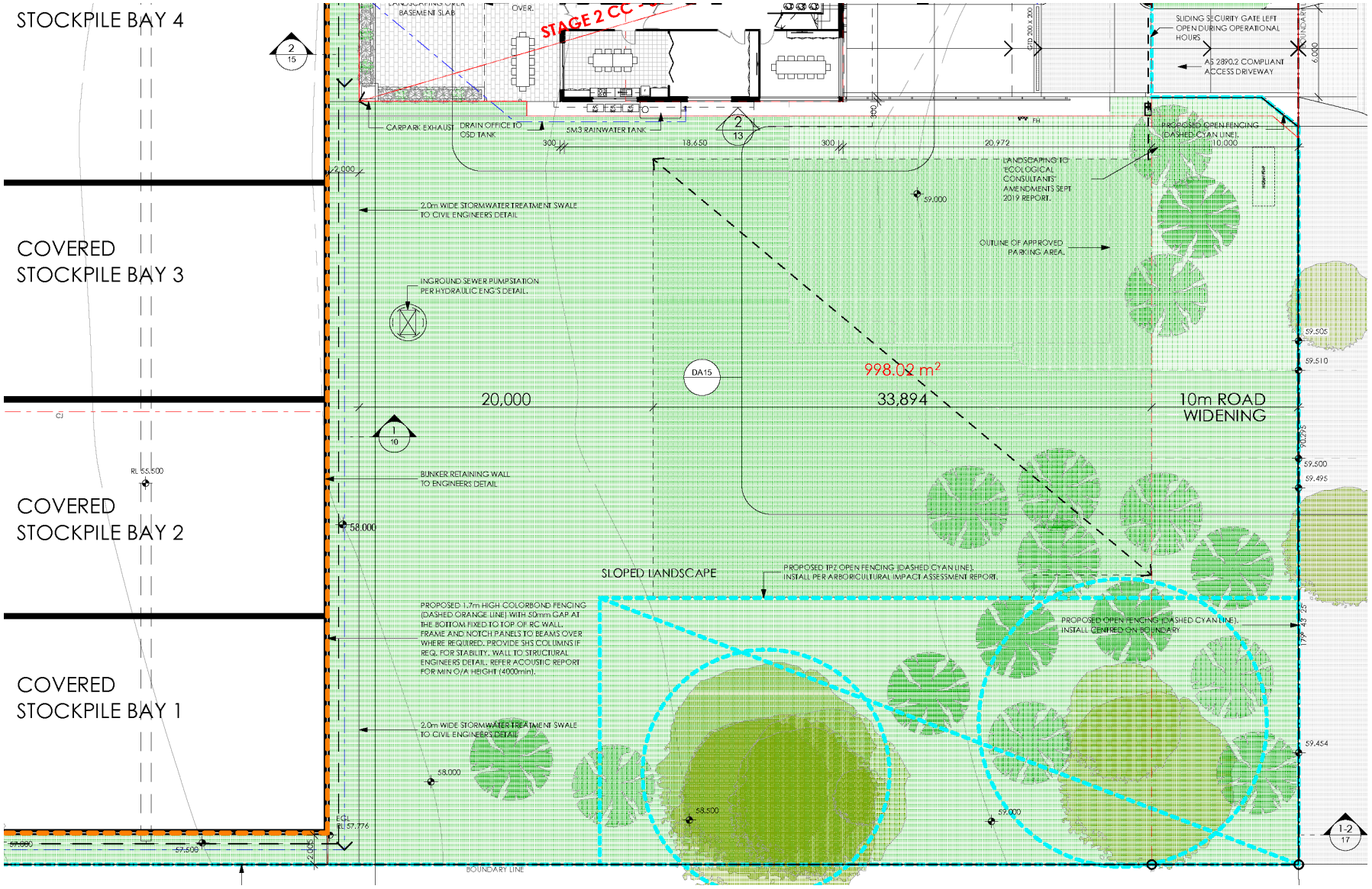
The exposed bearing surfaces for footings should be inspected by a geotechnical engineer to ensure the allowable pressure given has been achieved.



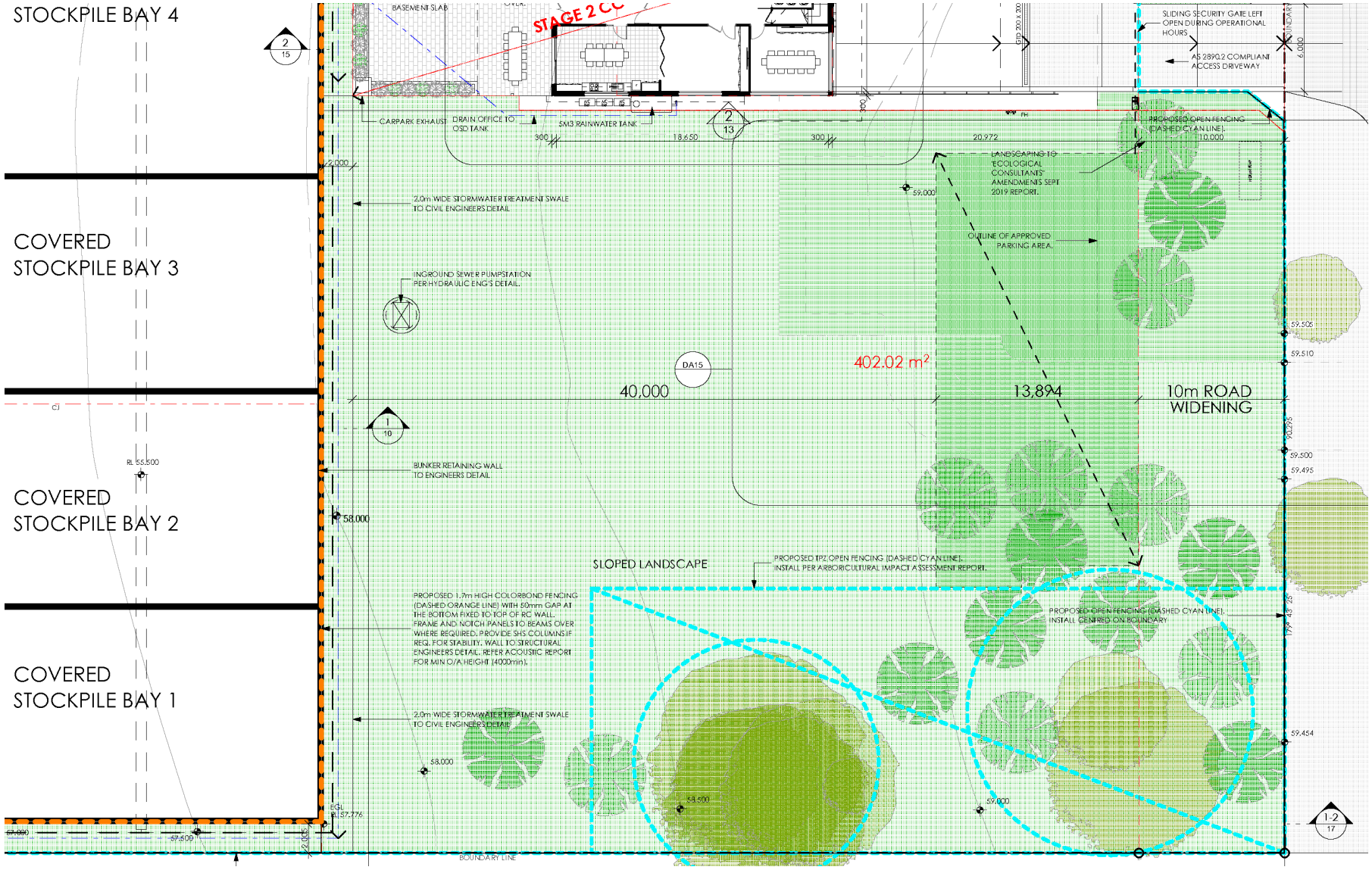
Laurie Ihnativ
Senior Geotechnical Engineer
STS Geotechnics Pty Limited



STS GEOENVIRONMENTAL Pty. Ltd.	Scale: Unknown	Date: December 2017
Client: AMJ DEMOLITION AND EXCAVATION		
GEOTECHNICAL INVESTIGATION **55 MARTIN ROAD, BADGERYS CREEK** **BOREHOLE AND PENETROMETER LOCATIONS**	Project No. 21649/8653C	
	Drawing No: 17/3905	



STS Geotechnics Pty. Ltd.	Scale: Unknown	Date: June 2021
Client: AMJ DEMOLITION & EXCVATION PTY LIMITED		
GEOTECHNICAL INVESTIGATION & WASTEWATER ASSESSMENT **55 MARTIN ROAD, BADGERYS CREEK** **PROPOSED DISPOSAL AREA—20 METRE SET BACK**		Project No. 30955/5057D-G Drawing No: 21/1206/1



STS Geotechnics Pty. Ltd.	Scale: Unknown	Date: June 2021
Client: AMJ DEMOLITION & EXCVATION PTY LIMITED		
GEOTECHNICAL INVESTIGATION & WASTEWATER ASSESSMENT **55 MARTIN ROAD, BADGERYS CREEK** **PROPOSED DISPOSAL AREA—40 METRE SET BACK**		Project No. 30955/5057D-G Drawing No: 21/1206/2

GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

APPENDIX A – BOREHOLE LOGS AND EXPLANATION SHEETS

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 1**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S1/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D-M
			BOREHOLE DISCONTINUED AT 0.3 M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 2**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S2-1/DUP/TRI @ 0.2 m S2-2 @ 0.5 m		SILTY CLAY: dark brown, medium plasticity TOPSOIL	CL	FIRM TO STIFF	D
	U50 0.5-0.8 m S2-3 @ 1.0 m B @ 0.5- 1.1 m	1.0	SILTY CLAY: red brown with orange brown and light grey, medium to high plasticity	CL/CH	STIFF	D-M M
WT 18/12/17	S2-4 @ 1.5 m S2-5 @ 2.0 m S2-6 @ 2.5 m S2-7 @ 3.0 m	2.0 3.0	SILTY CLAY: light grey with yellow brown/orange brown, medium to high plasticity	CL/CH	VERY STIFF	M M-D
	S2-8 @ 4.0 m	4.0 5.0	WEATHERED SHALE: dark grey with light grey, clay seams, trace of fine grained sand STANDPIPE PIEZOMETER INSTALLED BOREHOLE DISCONTINUED AT 6.0 M ON WEATHERED SHALE		EXTREMELY LOW STRENGTH	D D-M

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Edson RP70

Hole Diameter (mm): 100

Angle from Vertical (^{o}):

Drill Bit: Spiral

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 3**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S3/1 @ 0.2 m		SILTY CLAY: brown with light brown, low to medium plasticity, trace of gravel	CL	FIRM TO STIFF	D-M
			TOPSOIL			
	S3/2 @ 0.8 m		SILTY CLAY: light brown with light grey and some light orange, medium to high plasticity, trace of grave	CL/CH	STIFF	M
		1.0				
	S3/3 @ 1.6 m		SILTY CLAY: grey with light grey and some light brown, low to medium plasticity, trace of gravel	CL	VERY STIFF	D-M
		2.0				
		3.0				
			WEATHERED SHALE: grey with light grey		EXTREMELY LOW STRENGTH	
			AUGER REFUSAL AT 3.2 M ON WEATHERED SHALE			
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 4**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S4/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel	CL	STIFF	D-M
			TOPSOIL			
	S4/2 @ 0.7 m		SILTY CLAY: light brown with orange brown, low to medium plasticity, trace of gravel, trace of fine grained sand	CL	STIFF	M
	S4/3 @ 0.9 m					
	B 1.0-1.4 m	1.0	SILTY CLAY: orange brown with light grey and some light brown, medium to high plasticity, trace of gravel	CL/CH	VERY STIFF	M
	S4/4 @ 1.4 m		SILTY CLAY: light grey with light brown, medium to high plasticity, trace of gravel	CL/CH	VERY STIFF	M
	S4/5 @ 2.1 m	2.0	SILTY CLAY: light brown with grey and some light grey, low to medium plasticity, trace of shale	CL	VERY STIFF	M
	S4/6 @ 3.0 m	3.0	SILTY CLAY: grey with light grey, low to medium plasticity, trace of shale	CL	VERY STIFF	M
			WEATHERED SHALE: grey with dark grey		EXTREMELY LOW STRENGTH	
		4.0	AUGER REFUSAL AT 3.8 M ON WEATHERED SHALE			
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 5**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S5/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D
			BOREHOLE DISCONTINUED AT 0.3 M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 6**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S6/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel	CL	STIFF	D
	S6/2 @ 0.6 m		TOPSOIL SILTY CLAY: light brown with light grey, low to medium plasticity, trace of gravel	CL	VERY STIFF	D-M
	U50	1.0				
	S6/3 @ 1.6 m		SILTY CLAY: light grey with grey, medium to high plasticity, trace of gravel	CL/CH	VERY STIFF	M
	S6/4 @ 2.4 m	2.0	SILTY CLAY: light brown with light grey, low to medium plasticity, trace of gravel	CL	VERY STIFF	D-M
		3.0	WEATHERED SHALE: light brown with brown		EXTREMELY LOW STRENGTH	
			AUGER REFUSAL AT 3.3 M ON WEATHERED SHALE			
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 7**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S7/1 @ 0.2 m		SILTY CLAY: brown with light brown, low to medium plasticity, trace of gravel	CL	STIFF	D-M
	S7/2 @ 0.7 m		TOPSOIL SILTY CLAY: light brown with light grey, low to medium plasticity, trace of gravel	CL	VERY STIFF	D-M
	U50	1.0				
	S7/3 @ 1.6 m	2.0	SILTY CLAY: light grey with light brown, medium to high plasticity, trace of gravel	CL/CH	VERY STIFF	M
	S7/4 @ 2.8 m	3.0	SILTY CLAY: grey with light grey and some orange brown, low to medium plasticity, trace of shale	CL	VERY STIFF	M
			WEATHERED SHALE: grey with dark grey		EXTREMELY LOW STRENGTH	
		4.0	AUGER REFUSAL AT 3.6 M ON WEATHERED SHALE			
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 8**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S1/DUP/TRI @ 0.2 m		SILTY CLAY: dark brown, low plasticity	CL	FIRM TO STIFF	D
	S8/2 @ 0.5 m		TOPSOIL			
	B @0.3-0.9m		SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	STIFF	M
	S8/3 @ 1.0m	1.0	SILTY CLAY: light grey with yellow brown/orange brown, medium to high plasticity	CL/CH	STIFF	M
	S8/4 @ 1.5 m					
	S8/5 @ 2.0 m	2.0			VERY STIFF	
	S8/6 @ 2.5 m					
WT 18/12/17			WEATHERED SHALE: dark grey with occasional light grey, trace of fine grained sand		EXTREMELY LOW STRENGTH	D
	S8/7 @ 3.0 m	3.0				
	S8/8 @ 4.0 m	4.0				
		5.0				
			STANDPIPE PIEZOMETER INSTALLED			
			BOREHOLE DISCONTINUED AT 6.0 M			

D - disturbed sample U - undisturbed tube sample B - bulk sample
WT - level of water table or free water N - Standard Penetration Test (SPT)
S - jar sample

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

Contractor: STS
Equipment: Edson RP70
Hole Diameter (mm): 100
Angle from Vertical (^{o}):
Drill Bit: Spiral

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 9**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S9/1 @ 0.2 m		SILTY CLAY: dark brown, low plasticity TOPSOIL	CL	FIRM TO STIFF	D
		1.0	SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	STIFF	M-D
			SILTY CLAY: light grey with orange brown, medium to high plasticity	CL/CH	VERY STIFF	M
		2.0	WEATHERED SHALE: light grey with dark grey, fine grained, clay seams		EXTREMELY LOW STRENGTH	D
		3.0				
		4.0	AUGER REFUSAL AT 4.0 M ON WEATHERED SHALE			
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Edson RP70

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 10**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S10/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D
			BOREHOLE DISCONTINUED AT 0.3 M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 11**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S1/DUP/TRI @ 0.2 m		SILTY CLAY: dark brown/orange brown, medium plasticity TOPSOIL	CL	FIRM TO STIFF	D-M
		1.0	SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	STIFF	M
		2.0	SILTY CLAY: light grey with orange brown and yellow brown, medium plasticity, trace of fine grained sand	CL	VERY STIFF	M-D
		3.0				
		4.0	WEATHERED SHALE: light brown with orange brown and dark grey, fine grained, clay seams		EXTREMELY LOW STRENGTH	D
		5.0	AUGER REFUSAL AT 4.5 M ON WEATHERED SHALE			

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Edson RP70

Hole Diameter (mm): 100

Angle from Vertical (^{o}):

Drill Bit: Spiral

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 12**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S12/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D
			BOREHOLE DISCONTINUED AT 0.3 M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 13**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S12/1 @ 0.2 m B1 @ 0.4 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D
		1.0	SILTY CLAY: light brown with orange brown, low to medium plasticity, trace of gravel	CL		D
		2.0	BOREHOLE DISCONTINUED AT 1.5 M			
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 14**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S14/1 @ 0.2 m B2 @ 0.4 m		SILTY CLAY: dark brown with brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D
	S14/2 @ 0.9 m	1.0	SILTY CLAY: light brown with orange brown, low to medium plasticity, trace of gravel	CL		D
		2.0	BOREHOLE DISCONTINUED AT 1.5 M			
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 15**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	B4/S15-1 @ 0.2 m		SILTY CLAY: dark brown, low plasticity TOPSOIL	CL	FIRM	D
	S15/2 @ 0.5 m		SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	FIRM TO STIFF	D-M
	U50				STIFF	
	S15/3 @ 1.0 m	1.0			VERY STIFF	
	S15/4 @ 1.5 m		WEATHERED SANDSTONE: dark grey with light grey and orange brown, fine grained, clay seams			D
	S15/5 @ 2.0 m	2.0				
	S15/6 @ 2.5 m					
	S15/7 @ 3.0 m	3.0				D-M
	S15/8 @ 4.0 m	4.0				D
			AUGER REFUSAL AT 4.3 M ON WEATHERD SANDSTONE STANDPIPE PIEZOMETER INSTALLED			
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Edson RP70

Hole Diameter (mm): 100

Angle from Vertical (^{o}):

Drill Bit: Spiral

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 16**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S16/1 @ 0.2 m		SILTY CLAY: dark brown, low plasticity TOPSOIL			
			BOREHOLE DISCONTINUED AT 0.2 M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Edson RP70

Hole Diameter (mm): 100

Angle from Vertical (^{o}):

Drill Bit: Spiral

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 17**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: JK Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S17/1 @ 0.2 m B 0.4-1.0		SILTY CLAY: dark brown, low plasticity TOPSOIL	CL	FIRM TO STIFF	D
			SILTY CLAY: orange brown with light grey, medium to high plasticity	CL/CH	STIFF	M
		1.0	SANDY CLAY: light grey with orange brown, fine grained sand, medium plasticity	CL	STIFF	M-D
					VERY STIFF	
		2.0				M
		3.0				
			WEATHERED SHALE: light grey with orange brown and yellow brown, trace of fined grained sand		EXTREMELY LOW STRENGTH	D
		4.0				
		5.0	AUGER REFUSAL AT 5.0 M ON WEATHERED SHALE			

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Edson RP70

Hole Diameter (mm): 100

Angle from Vertical (^{o}):

Drill Bit: Spiral

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 18**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S18/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL			
			BOREHOLE DISCONTINUED AT 0.3 M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

STS GeoEnvironmental Pty Ltd

GEOTECHNICAL LOG - NON CORE BOREHOLE

Client: AMJ Demolition and Excavation P/L	Project / STS No.: 21649/8653C	**BOREHOLE NO.: BH 19**
Project: 55 Martin Road, Badgerys Creek	Date: December 12, 2017	
Location: Refer to Drawing No. 17/3905	Logged: DL Checked By: MG	Sheet 1 of 1

WATER TABLE	SAMPLES	DEPTH (m)	DESCRIPTION OF DRILLED PRODUCT (Soil type, colour, grain size, plasticity, minor components, observations)	SYMBOL	CONSISTENCY (cohesive soils) or RELATIVE DENSITY (sands and gravels)	MOISTURE
	S19/1 @ 0.2 m		SILTY CLAY: brown with dark brown, low to medium plasticity, trace of gravel TOPSOIL	CL		D
			BOREHOLE DISCONTINUED AT 0.3M			
		1.0				
		2.0				
		3.0				
		4.0				
		5.0				

D - disturbed sample U - undisturbed tube sample B - bulk sample

WT - level of water table or free water N - Standard Penetration Test (SPT)

S - jar sample

Contractor: STS

Equipment: Christie

Hole Diameter (mm): 100/200/300

Angle from Vertical (^{o}):

Drill Bit: V/Spiral/Two Prong

NOTES: See explanation sheets for meaning of all descriptive terms and symbols

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dynamic Cone Penetrometer Test Report

Project: No.55 Martin Road, Badgerys Creek
Client: AMJ Demolition and Excavation P/L
Address: No.44 Pearson Street, South Wentworthville 2145
Test Method: AS 1289.6.3.2

Project No.: 21649/8653C
Report No.: 17/3905
Report Date: 15/12/2017

Site No.	P1	P2	P3	P4		P1	P2	P3	P4
Location	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905					
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level					
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	3	3	5	5	3.00 - 3.15			*	
0.15 - 0.30	5	5	8	10	3.15 - 3.30			*	
0.30 - 0.45	6	7	9	14	3.30 - 3.45			*	
0.45 - 0.60	6	6	10	16	3.45 - 3.60			*	
0.60 - 0.75	7	6	11	13	3.60 - 3.75			22	
0.75 - 0.90	5	9	12	11	3.75 - 3.90			Refusal	
0.90 - 1.05	5	16	12	15	3.90 - 4.05				
1.05 - 1.20	6	16	13	14	4.05 - 4.20				
1.20 - 1.35	8	20	22	22	4.20 - 4.35				
1.35 - 1.50	11	22	*	*	4.35 - 4.50				
1.50 - 1.65	11	*	*	*	4.50 - 4.65				
1.65 - 1.80	15	*	*	*	4.65 - 4.80				
1.80 - 1.95	19	*	*	*	4.80 - 4.95				
1.95 - 2.10	22	*	22	*	4.95 - 5.10				
2.10 - 2.25	Refusal	*	*	22	5.10 - 5.25				
2.25 - 2.40		22	*	Refusal	5.25 - 5.40				
2.40 - 2.55		Refusal	*		5.40 - 5.55				
2.55 - 2.70			*		5.55 - 5.70				
2.70 - 2.85			*		5.70 - 5.85				
2.85 - 3.00			22		5.85 - 6.00				

Remarks: * = Pre-drilled hole prior to testing

Technician: DL/JK

Approved Signatory.....
Laurie Ihnativ - Manager

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dynamic Cone Penetrometer Test Report

Project: No.55 Martin Road, Badgerys Creek
Client: AMJ Demolition and Excavation P/L
Address: No.44 Pearson Street, South Wentworthville 2145
Test Method: AS 1289.6.3.2

Project No.: 21649/8653C
Report No.: 17/3905
Report Date: 15/12/2017

Site No.	P5	P6	P7	P8		P5	P6	P7	P8
Location	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905					
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level					
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	6	2	2	2	3.00 - 3.15				
0.15 - 0.30	9	3	4	3	3.15 - 3.30				
0.30 - 0.45	13	3	4	5	3.30 - 3.45				
0.45 - 0.60	13	5	5	5	3.45 - 3.60				
0.60 - 0.75	13	7	6	6	3.60 - 3.75				
0.75 - 0.90	16	8	6	7	3.75 - 3.90				
0.90 - 1.05	15	8	10	5	3.90 - 4.05				
1.05 - 1.20	14	9	8	8	4.05 - 4.20				
1.20 - 1.35	12	11	17	12	4.20 - 4.35				
1.35 - 1.50	18	13	22	9	4.35 - 4.50				
1.50 - 1.65	16	9	Refusal	10	4.50 - 4.65				
1.65 - 1.80	22	9		13	4.65 - 4.80				
1.80 - 1.95	*	12		13	4.80 - 4.95				
1.95 - 2.10	*	22		10	4.95 - 5.10				
2.10 - 2.25	*	Refusal		17	5.10 - 5.25				
2.25 - 2.40	*			22	5.25 - 5.40				
2.40 - 2.55	18			Refusal	5.40 - 5.55				
2.55 - 2.70	19				5.55 - 5.70				
2.70 - 2.85	22				5.70 - 5.85				
2.85 - 3.00	Refusal				5.85 - 6.00				

Remarks: * = Pre-drilled hole prior to testing

Approved Signatory. ....
Laurie Ihnativ - Manager

Technician: DL/JK

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Dynamic Cone Penetrometer Test Report

Project: No.55 Martin Road, Badgerys Creek
Client: AMJ Demolition and Excavation P/L
Address: No.44 Pearson Street, South Wentworthville 2145
Test Method: AS 1289.6.3.2

Project No.: 21649/8653C
Report No.: 17/3905
Report Date: 15/12/2017

Site No.	P9	P10							
Location	Refer to Drawing No. 17/3905	Refer to Drawing No. 17/3905							
Starting Level	Surface Level	Surface Level							
Depth (m)	Penetration Resistance (blows / 150mm)				Depth (m)	Penetration Resistance (blows / 150mm)			
0.00 - 0.15	2	3			3.00 - 3.15				
0.15 - 0.30	1	4			3.15 - 3.30				
0.30 - 0.45	3	5			3.30 - 3.45				
0.45 - 0.60	4	5			3.45 - 3.60				
0.60 - 0.75	6	8			3.60 - 3.75				
0.75 - 0.90	10	10			3.75 - 3.90				
0.90 - 1.05	12	9			3.90 - 4.05				
1.05 - 1.20	15	9			4.05 - 4.20				
1.20 - 1.35	22	12			4.20 - 4.35				
1.35 - 1.50	Refusal	19			4.35 - 4.50				
1.50 - 1.65		22			4.50 - 4.65				
1.65 - 1.80		Refusal			4.65 - 4.80				
1.80 - 1.95					4.80 - 4.95				
1.95 - 2.10					4.95 - 5.10				
2.10 - 2.25					5.10 - 5.25				
2.25 - 2.40					5.25 - 5.40				
2.40 - 2.55					5.40 - 5.55				
2.55 - 2.70					5.55 - 5.70				
2.70 - 2.85					5.70 - 5.85				
2.85 - 3.00					5.85 - 6.00				

Remarks: * = Pre-drilled hole prior to testing

Technician: DL/JK

Approved Signatory..... .....
Laurie Ihnativ - Manager

E1. CLASSIFICATION OF SOILS

E1.1 Soil Classification and the Unified System

An assessment of the site conditions usually includes an appraisal of the data available by combining values of engineering properties obtained by the site investigation with descriptions, from visual observation of the materials present on site.

The system used by STS Geotechnics Pty Ltd (STS) in the identification of soil is the Unified Soil Classification system (USC) which was developed by the US Army Corps of Engineers during World War II and has since gained international acceptance and has been adopted in its metricated form by the Standards Association of Australia.

The Australian Site Investigation Code (AS1726-1981, Appendix D) recommends that the description of a soil includes the USC group symbols which are an integral component of the system.

The soil description should contain the following information in order:

Soil composition

- SOIL NAME and USC classification symbol (IN BLOCK LETTERS)
- plasticity or particle characteristics
- colour
- secondary and minor constituents (name estimated proportion, plasticity or particle characteristics, colour

Soil condition

- moisture condition
- consistency or density index

Soil structure

- structure (zoning, defects, cementing)

Soil origin

interpretation based on observation eg FILL, TOPSOIL, RESIDUAL, ALLUVIUM.

E1.2 Soil Composition

(a) Soil Name and Classification Symbol

The USC system is summarised in Figure E1.2.1. The primary division separates soil types on the basis of particle size into:

- Coarse grained soils - more than 50% of the material less than 60 mm is larger than 0.06 mm (60 µm).

- Fine grained soils - more than 50% of the material less than 60 mm is smaller than 0.06 mm (60 µm).

Initial classification is by particle size as shown in Table E1.2.1. Further classification of fine grained soils is based on plasticity.

TABLE E1.2.1 - CLASSIFICATION BY PARTICLE SIZE

NAME	SUB-DIVISION	SIZE
Clay (1)		< 2 µm
Silt (2)		2 µm to 60 µm
Sand	Fine Medium Coarse	60 µm to 200 µm 200 µm to 600 µm 600 µm to 2 mm
Gravel (3)	Fine Medium Coarse	2 mm to 6 mm 6 mm to 20 mm 20 mm to 60 mm
Cobbles (3)		60 mm to 200 mm
Boulders (3)		> 200 mm

Where a soil contains an appropriate amount of secondary material, the name includes each of the secondary components (greater than 12%) in increasing order of significance, eg sandy silty clay.

Minor components of a soil are included in the description by means of the terms “some” and “trace” as defined in Table E1.2.2.

TABLE E1.2.2 - MINOR SOIL COMPONENTS

TERM	DESCRIPTION	APPROXIMATE PROPORTION (%)
Trace	presence just detectable, little or no influence on soil properties	0-5
Some	presence easily detectable, little influence on soil properties	5-12

The USC group symbols should be included with each soil description as shown in Table E1.2.3

TABLE E1.2.3 - SOIL GROUP SYMBOLS

SOIL TYPE	PREFIX
Gravel	G
Sand	S
Silt	M
Clay	C
Organic	O
Peat	Pt

The group symbols are combined with qualifiers which indicate grading, plasticity or secondary components as shown on Table E1.2.4

TABLE E1.2.4 - SOIL GROUP QUALIFIERS

SUBGROUP	SUFFIX
Well graded	W
Poorly Graded	P
Silty	M
Clayey	C
Liquid Limit <50% - low to medium plasticity	L
Liquid Limit >50% - medium to high plasticity	H

(b) Grading

"Well graded" Good representation of all particle sizes from the largest to the smallest.

"Poorly graded" One or more intermediate sizes poorly represented

"Gap graded" One or more intermediate sizes absent

"Uniformly graded" Essentially single size material.

(c) Particle shape and texture

The shape and surface texture of the coarse grained particles should be described.

Angularity may be expressed as "rounded", "sub-rounded", "sub-angular" or "angular".

Particle **form** can be "equidimensional", "flat" or elongate".

Surface texture can be "glassy", "smooth", "rough", pitted" or striated".

(d) Colour

The colour of the soil should be described in the moist condition using simple terms such as:

Black White Grey Red
Brown Orange Yellow Green
Blue

These may be modified as necessary by "light" or "dark". Borderline colours may be described as a combination of two colours, eg red-brown.

For soils that contain more than one colour terms such as:

- Speckled Very small (<10 mm dia) patches
- Mottled Irregular
- Blotched Large irregular (>75 mm dia)
- Streaked Randomly oriented streaks

(e) Minor Components

Secondary and minor components should be individually described in a similar manner to the dominant component.

*E1.3 **S**oil Condition*

(a) Moisture

Soil moisture condition is described as "dry", "moist" or "wet".

The moisture categories are defined as:
Dry (D) - Little or no moisture evident. Soils are running.
Moist (M) - Darkened in colour with cool feel. Granular soil particles tend to adhere. No free water evident upon remoulding of cohesive soils.

In addition the moisture content of cohesive soils can be estimated in relation to their liquid or plastic limit.

(b) Consistency

Estimates of the consistency of a clay or silt soil may be made from manual examination, hand penetrometer test, SPT results or from laboratory tests to determine undrained shear or unconfined compressive strengths. The classification of consistency is defined in Table E1.3.1.

TABLE E1.3.1 - CONSISTENCY OF FINE-GRAINED SOILS

TERM	UNCONFINED STRENGTH (kPa)	FIELD IDENTIFICATION
Very Soft	<25	Easily penetrated by fist. Sample exudes between fingers when squeezed in the fist.
Soft	25 - 50	Easily moulded in fingers. Easily penetrated 50 mm by thumb.
Firm	50 - 100	Can be moulded by strong pressure in the fingers. Penetrated only with great effort.
Stiff	100 - 200	Cannot be moulded in fingers. Indented by thumb but penetrated only with great effort.
Very Stiff	200 - 400	Very tough. Difficult to cut with knife. Readily indented with thumb nail.
Hard	>400	Brittle, can just be scratched with thumb nail. Tends to break into fragments.

Unconfined compressive strength as derived by a hand penetrometer can be taken as approximately double the undrained shear strength ($q_u = 2\ c_u$).

(c) Density Index

The insitu density index of granular soils can be assessed from the results of SPT or cone penetrometer tests. Density index should not be estimated visually.

TABLE E1.3.2 - DENSITY OF GRANULAR SOILS

TERM	SPT N VALUE	STATIC CONE VALUE q_c (MPa)	DENSITY INDEX (%)
Very Loose	0 - 3	0 - 2	0 - 15
Loose	3 - 8	2 - 5	15 - 35
Medium Dense	8 - 25	5 - 15	35 - 65
Dense	25 - 42	15 - 20	65 - 85
Very Dense	>42	>20	>85

E1.4 Soil Structure

(a) Zoning

A sample may consist of several zones differing in colour, grain size or other properties. Terms to classify these zones are:

Layer - continuous across exposure or sample
Lens - discontinuous with lenticular shape
Pocket - irregular inclusion
Each zone should be described, their distinguishing features, and the nature of the interzone boundaries.

(b) Defects

Defects which are present in the sample can include:

- fissures
- roots (containing organic matter)
- tubes (hollow)
- casts (infilled)

Defects should be described giving details of dimensions and frequency. Fissure orientation, planarity, surface condition and infilling should be noted. If there is a tendency to break into blocks, block dimensions should be recorded

E1.5 Soil Origin

Information which may be interpretative but which may contribute to the usefulness of the material description should be included. The most common interpreted feature is the origin of the soil. The assessment of the probable origin is based on the soil material description, soil structure and its relationship to other soil and rock materials.

Common terms used are:

“Residual Soil” - Material which appears to have been derived by weathering from the underlying rock. There is no evidence of transport.

“Colluvium” - Material which appears to have been transported from its original location. The method of movement is usually the combination of gravity and erosion.

“Landslide Debris” - An extreme form of colluvium where the soil has been transported by mass movement. The material is obviously distributed and contains distinct defects related to the slope failure.

“Alluvium” - Material which has been transported essentially by water. usually associated with former stream activity.

“Fill” - Material which has been transported and placed by man. This can range from natural soils which have been placed in a controlled manner in engineering construction to dumped waste material. A description of the constituents should include an assessment of the method of placement.

E1.6 Fine Grained Soils

The physical properties of fine grained soils are dominated by silts and clays.

The definition of clay and silt soils is governed by their Atterberg Limits. Clay soils are characterised by the properties of cohesion and plasticity with cohesion defines as the ability to deform without rupture. Silts exhibit cohesion but have low plasticity or are non-plastic.

The field characteristics of clay soils include:

- dry lumps have appreciable dry strength and cannot be powdered
- volume changes occur with moisture content variation
- feels smooth when moist with a greasy appearance when cut.

The field characteristics of silt soils include:

- dry lumps have negligible dry strength and can be powdered easily
- dilatancy - an increase in volume due to shearing - is indicted by the presence of a shiny film of water after a hand sample is shaken. The water disappears upon remoulding. Very fine grained sands may also exhibit dilatancy.
- low plasticity index
- feels gritty to the teeth

E1.7 Organic Soils

Organic soils are distinguished from other soils by their appreciable content of vegetable matter, usually derived from plant remains.

The soil usually has a distinctive smell and low bulk density.

The USC system uses the symbol Pt for partly decomposed organic material. The O symbol is combined with suffixes “O” or “H” depending on plasticity.

Where roots or root fibres are present their frequency and the depth to which they are encountered should be recorded. The presence of roots or root fibres does not necessarily mean the material is an “organic material” by classification.

Coal and lignite should be described as such and not simply as organic matter.

GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

APPENDIX B – LABORATORY TEST RESULTS

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Shrink Swell Index Report

Project: No.55 Martin Road, Badgerys Creek — Project No.: 21649
Client: AMJ Demolition and Excavation P/L — Report No.: 17/3920
Address: No.44 Pearson Street, South Wentworthville 2145 — Report Date: 18/12/2017
Test Method: AS 1289.7.1.1 — Page: 1 of 1

Sampling Procedure: AS 1289.1.3.1 Clause 3.1.3.2 - Thin Walled Sampler

STS / Sample No.		8653C/1	8653C/2	8653C/3			
Sample Location		Borehole 6 Refer to Drawing	Borehole 7 Refer to Drawing	Borehole 15 Refer to Drawing			
Material Description		SILTY CLAY: light brown with light grey, trace of gravel	SILTY CLAY: light brown with light grey, trace of gravel	SILTY CLAY: orange brown with light grey			
Depth (m)		0.7 - 1.0	0.6 - 0.9	0.5 - 0.8			
Sample Date		12/12/2017	12/12/2017	12/12/2017			
Shrink	Moisture Content (%)	16.3	10.6	15.2			
	Soil Crumbling	Nil	Nil	Nil			
	Extent of Cracking	Fine Cracks	Open Cracks	Open Cracks			
	Strain (%)	2.5	1.8	3.1			
Swell	Moisture Content Initial (%)	14.0	10.0	16.2			
	Moisture Content Final (%)	34.7	20.0	35.3			
	Strain (%)	1.7	3.1	0.0			
Inert Inclusions (%)		<5	<10	<5			
Shrink Swell Index (%)		**1.9**	**1.8**	**1.7**			

Remarks:

Approved Signatory.....

Technician: NP

Orlando Mendoza - Laboratory Manager

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

California Bearing Ratio Determination Report

Project: 55 MARTIN ROAD, BADGERYS CREEK — Project No.: 21649
Client: AMJ Demolition and Excavation P/L — Report No.: 17/3960
Address: No.44 Pearson Street, South Wentworthville 2145 — Report Date: 20/12/2017
Test Method: AS 1289.6.1.1, 2.1.1 — Page: 1 of 1
No. of Days Soaked: 4 — Compactive Effort: Standard
Target Compaction (%): 100
Surcharge (Kg): 4.5
Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

STS / Sample No.		8653C/1	8653C/2	8653C/3	8653C/4		
Sample Location		Borehole 2 Refer to Drawing No. 17/3905	Borehole 4 Refer to Drawing No. 17/3905	Borehole 8 Refer to Drawing No. 17/3905	Borehole 17 Refer to Drawing No. 17/3905		
Material Description		Silty Gravelly Clay, red brown	Silty Clay, orange brown/light grey/light brown, trace of gravel	Slity Clay: light grey with yellow brown/orange brown	Silty Gravelly Clay, red brown		
Depth of Sample (m)		0.5-1.1	1.0-1.4	0.3-0.9	0.4-1.0		
Sample Date		13/12/2017	13/12/2017	13/12/2017	13/12/2017		
Oversize on Wet Basis +19mm (%)		0.0	0.0	0.0	0.0		
Field Moisture Content (%)		19	12.4	13.1	13		
Optimum Moisture Content (%)		22.9	20.5	17.3	17		
Maximum Dry Density (t/m³)		1.648	1.581	1.691	1.74		
Dry Density (t/m³)	Before Soaking	1.65	1.582	1.679	1.743		
	After Soaking	1.641	1.515	1.606	1.672		
Relative Compaction (%)	Before Soaking	100.1	100.1	99.3	100.2		
	After Soaking	99.6	95.9	94.9	96.1		
Moisture Content (%)	Before Soaking	22.7	20.0	17.6	16.9		
	After Soaking	25.6	26.1	23	21.5		
Moisture Ratio Before Soaking (%)		99	98	101.8	99.3		
Moisture Content after test (%)	Top 30mm	27.0	30.2	27.9	27.9		
	Entire Depth	24.5	24.2	25.2	25.2		
Swell after Soaking (%)		0.6	4.4	4.6	4.3		
CBR Value (%)		**1.5**	**2.5**	**1.5**	**1.5**		
Penetration (mm)		**2.0**	**2.5**	**2.5**	**2.5**		

Remarks: +19mm material excluded from test

NATA Accredited Laboratory Number 2750
Accredited for compliance with ISO/IEC 17025
The results of tests, calibrations and / or measurements included in this document are traceable to Australian / national standards

Approved Signatory.....
Orlando Mendoza - Laboratory Manager

Technician: NP

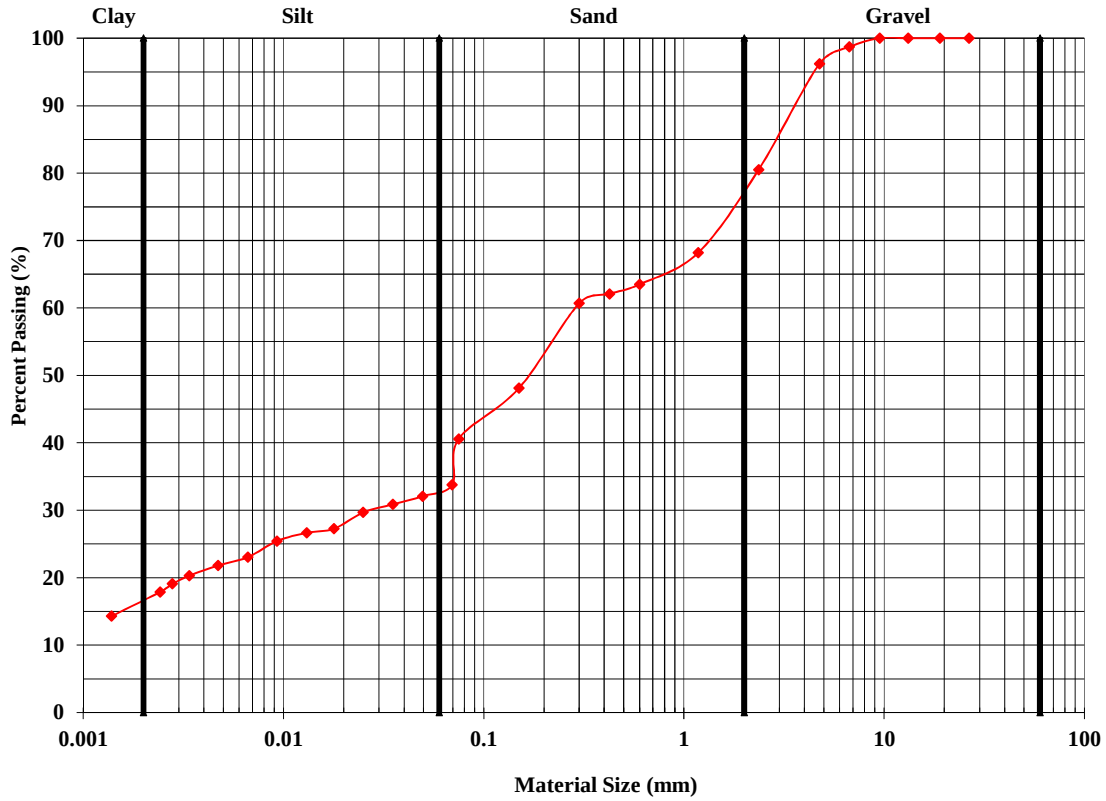
SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Project: 55 MARTIN ROAD, BADGERYS CREEK
Client: AMJ Demolition and Excavation P/L
Address: No.44 Pearson Street, South Wentworthville 2145
Test Method: AS 1289.3.6.3
Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)
Material Description: Sand, brown, with clay/gravel, trace of silt

STS / Sample No.: 8653C/1
Sample Location: Borehole 13
Depth (m): 0.0 - 0.4
Method of Despersion: Mechanical Stirrer

Project No.: 21649
Report No.: 17/3969
Report Date: 21/12/2017
Page: 1 of 2
Client Project No: N/A



Sieve Size (mm)	Percent Passing (%)
26.5	100
19.0	100
13.2	100
9.5	100
6.7	98.7
4.75	96.2
2.36	80.5
1.18	68.2
0.60	63.5
0.425	62.1
0.30	60.7
0.15	48.1
0.075	40.6
*Particle Size (mm)	Percent Passing (%)
0.0696	33.8
0.0496	32.1
0.0352	30.9
0.0250	29.7
0.0179	27.3
0.0131	26.7
0.0093	25.5
0.0066	23.0
0.0047	21.8
0.0034	20.3
0.0028	19.1
0.0024	17.9
0.0014	14.3

*Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks:

Technician: BV

NATA Accredited Laboratory Number 2750
Accredited for compliance with ISO/IEC 17025
The results of tests, calibrations and / or measurements included in this document are traceable to Australian / national standards.

Approved Signatory.....
Orlando Mendoza - Laboratory Manager

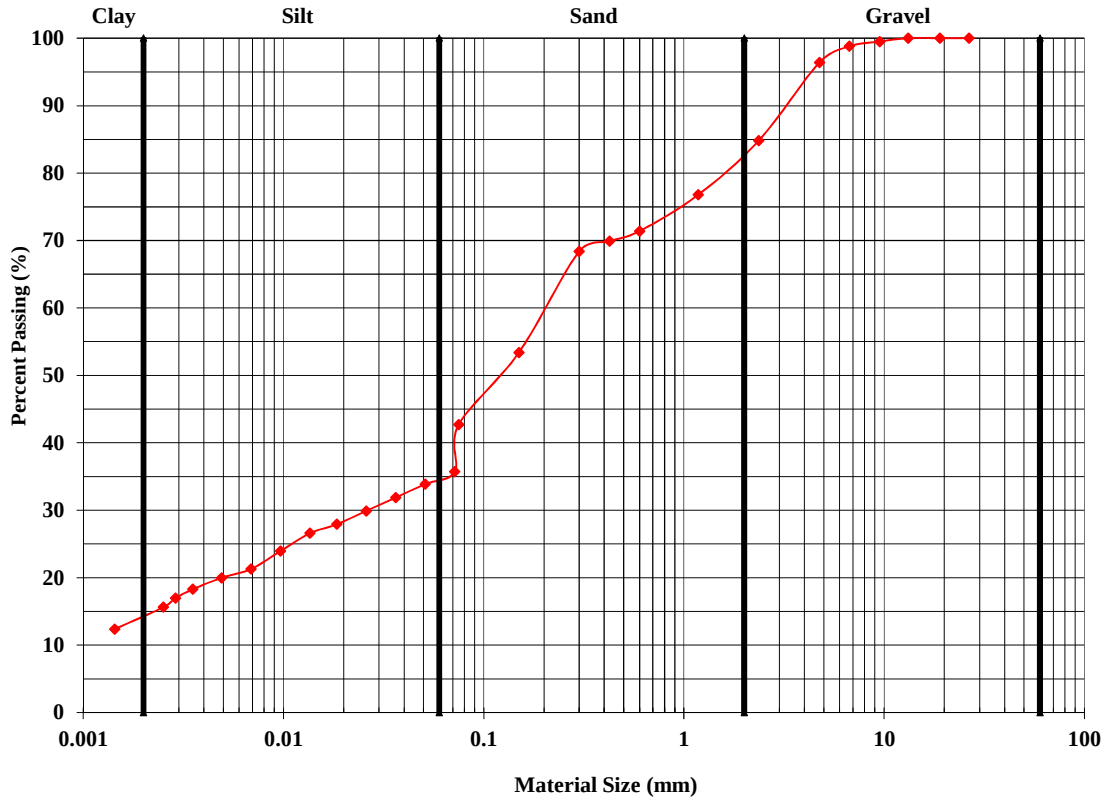
SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Particle Size Distribution

Project: 55 MARTIN ROAD, BADGERYS CREEK
Client: AMJ Demolition and Excavation P/L
Address: No.44 Pearson Street, South Wentworthville 2145
Test Method: AS 1289.3.6.3
Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)
Material Description: Sand, brown, with silt/gravel, trace of clay

STS / Sample No.: 8653C/2
Sample Location: Borehole 14
Depth (m): 0.0 - 0.4
Method of Despersion: Mechanical Stirrer

Project No.: 21649
Report No.: 17/3969
Report Date: 21/12/2017
Page: 2 OF 2
Client Project No: N/A



Sieve Size (mm)	Percent Passing (%)
26.5	100
19.0	100
13.2	100
9.5	99.5
6.7	98.8
4.75	96.4
2.36	84.8
1.18	76.8
0.60	71.4
0.425	69.9
0.30	68.4
0.15	53.4
0.075	42.7
*Particle Size (mm)	Percent Passing (%)
0.0717	35.7
0.0510	33.9
0.0364	31.9
0.0259	29.9
0.0185	27.9
0.0135	26.6
0.0097	24.0
0.0069	21.3
0.0049	20.0
0.0035	18.3
0.0029	17.0
0.0025	15.7
0.0014	12.4

*Particle Size obtained by Hydrometer Analysis.
Hydrometer Type: g/L

Remarks:

Technician: BV

NATA Accredited Laboratory Number 2750
Accredited for compliance with ISO/IEC 17025
The results of tests, calibrations and / or measurements included in this document are traceable to Australian / national standards.

Approved Signatory.....
Orlando Mendoza - Laboratory Manager

SMEC Testing Services Pty Ltd
14/1 Cowpasture Place, Wetherill Park NSW 2164
Phone: (02)9756 2166 Fax: (02)9756 1137 Email: enquiries@smectesting.com.au

Emerson Class No.

Project: NO.6 EDWARD STREET, NELSON — Project No.: 21825
Client: THE SALVATION ARMY PROPERTY TRUST — Report No.: 18/0101
Address: 265 CHALMERS STREET, REDFERN NSW 2016 — Report Date: 16/01/2018
Test Method: AS 1289.3.8.1 — Page: 1 OF 1

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

STS / Sample No.	8653C/1	8653C/2	8653C/3	8653C/4		
Sample Location	Borehole 2	Borehole 4	Borehole 8	Borehole 17		
Material Description	SILTY CLAY: red brown with orange brown and light grey	SILTY CLAY: orange brown with light grey and some light brown, trace of fine grained sand	SILTY CLAY: orange brown with light grey	SILTY CLAY: orange brown with light grey		
Depth (mm)	0.5 - 1.1	1.0 - 1.4	0.3 - 0.9	0.4 - 1.0		
Sample Date	12/12/2017	12/12/2017	12/12/2017	12/12/2017		
Date Tested	11/01/2018	11/01/2018	11/01/2018	11/01/2018		
Source of Material	Disturbed	Disturbed	Disturbed	Disturbed		
Water Temperature (°)	20	20	20	20		
Emerson Class No.	**6**	**5**	**3**	**3**		

Emerson Classification

Class 1: Slaking and complete dispersion before remoulding

Class 2: Slaking and some dispersion before remoulding

Class 3: Slaking and no dispersion before remoulding, dispersion after remoulding

Class 4: Slaking and no despersion before remoulding, no dispersion after remoulding, calcite or gypsum present

Class 5: Slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present, dispersion after slaking in a 1:5 soil / water suspension

Class 6: Slaking and no dispersion before remoulding, no dispersion after remoulding, no calcite or gypsum present, flocculation after shaking in a 1:5 soil / water suspension

Class 7: No slaking, swelling occurs

Class 8: No slaking, swelling does not occur

Remarks:

Approved Signatory..... .....

Technician: FV — Orlando Mendoza - Laboratory Manager

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1731937**	Page	: 1 of 15
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Customer Services ES
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 21649	Date Samples Received	: 14-Dec-2017 16:02
Order number	: E-2017-713	Date Analysis Commenced	: 19-Dec-2017
C-O-C number	: ----	Issue Date	: 27-Dec-2017 13:42
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 24		
No. of samples analysed	: 18		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW
Shaun Spooner	Asbestos Identifier	Newcastle - Asbestos, Mayfield West, NSW

General Comments

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

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

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

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

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

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

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

- EA200N: Asbestos weights and percentages are not covered under the Scope of NATA Accreditation.
  Weights of Asbestos are based on extracted bulk asbestos, fibre bundles, and/or ACM and do not include respirable fibres (if present)
  The Asbestos (Fines and Fibrous) weight is calculated from the extracted Fibrous Asbestos and Asbestos Fines as an equivalent weight of 100% Asbestos
  Percentages for Asbestos content in ACM are based on the 2013 NEPM default values.
  All calculations of percentage Asbestos under this method are approximate and should be used as a guide only.
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Trace' - Asbestos fibres ("Free Fibres") detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200 Legend
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.
- EA200N: ALS laboratory procedures and methods used for the identification and quantitation of asbestos are consistent with AS4964-2004 and the requirements of the 2013 NEPM for Assessment of Site Contamination
- EA200: For samples larger than 30g, the <2mm fraction may be sub-sampled prior to trace analysis as outlined in ISO23909:2008(E) Sect 6.3.2-2
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).
- EA200: 'Yes' - Asbestos detected by polarised light microscopy including dispersion staining.
- EA200: 'No*' - No asbestos found, at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining. Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg.
- EA200: 'No' - No asbestos found at the reporting limit 0.1g/kg, by polarised light microscopy including dispersion staining.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S1/1-1	21649/S2-1	21649/S2-2	21649/S2-3	21649/S2-4
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731937-001	ES1731937-002	ES1731937-003	ES1731937-004	ES1731937-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.4	----	5.0	5.2	5.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	724	----	437	640	780
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	15.0	10.8	17.8	15.2	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	No	No	----	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	No	No	----	----	----
Asbestos Type	1332-21-4	-	--	-	-	----	----	----
Sample weight (dry)	----	0.01	g	320	152	----	----	----
APPROVED IDENTIFIER:	----	-	--	S.SPOONER	S.SPOONER	----	----	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	<0.0004	<0.0004	----	----	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	<0.001	<0.001	----	----	----
ø Weight Used for % Calculation	----	0.0001	kg	0.320	0.152	----	----	----
ø Fibrous Asbestos >7mm	----	0.0004	g	<0.0004	<0.0004	----	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	1.0	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	10.1	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	0.1	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	3.1	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	14.2	----
Exchangeable Sodium Percent	----	0.1	%	----	----	----	21.5	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	----	180	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	12	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	<1	----	----
Chromium	7440-47-3	2	mg/kg	8	----	26	----	----
Copper	7440-50-8	5	mg/kg	11	----	15	----	----
Lead	7439-92-1	5	mg/kg	16	----	13	----	----
Nickel	7440-02-0	2	mg/kg	5	----	3	----	----
Zinc	7440-66-6	5	mg/kg	18	----	7	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S1/1-1	21649/S2-1	21649/S2-2	21649/S2-3	21649/S2-4
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731937-001	ES1731937-002	ES1731937-003	ES1731937-004	ES1731937-005
					Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	----	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	<0.05	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S1/1-1	21649/S2-1	21649/S2-2	21649/S2-3	21649/S2-4
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731937-001	ES1731937-002	ES1731937-003	ES1731937-004	ES1731937-005
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	<0.2	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**81.4**	**82.1**	**85.2**	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**79.0**	**76.0**	**79.0**	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S2-5	21649/S2-6	21649/S2-7	21649/S2-8	21649/S3/1-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731937-006	ES1731937-007	ES1731937-008	ES1731937-009	ES1731937-010
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.1	5.4	6.2	7.2	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	741	790	723	693	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	12.7	14.6	----	9.6	12.7
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	----	----	No
Asbestos (Trace)	1332-21-4	5	Fibres	----	----	----	----	No
Asbestos Type	1332-21-4	-	--	----	----	----	----	-
Sample weight (dry)	----	0.01	g	----	----	----	----	427
APPROVED IDENTIFIER:	----	-	--	----	----	----	----	S.SPOONER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	----	----	----	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	----	----	----	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	----	----	----	----	0.427
ø Fibrous Asbestos >7mm	----	0.0004	g	----	----	----	----	<0.0004
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	0.2	0.3	----	0.3	----
Exchangeable Magnesium	----	0.1	meq/100g	9.0	6.2	----	3.2	----
Exchangeable Potassium	----	0.1	meq/100g	0.2	0.2	----	0.1	----
Exchangeable Sodium	----	0.1	meq/100g	4.2	2.9	----	1.2	----
Cation Exchange Capacity	----	0.1	meq/100g	13.7	9.7	----	4.8	----
Exchangeable Sodium Percent	----	0.1	%	30.4	29.9	----	24.6	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	80	160	----	100	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	----	----	----	5
Cadmium	7440-43-9	1	mg/kg	----	----	----	----	<1
Chromium	7440-47-3	2	mg/kg	----	----	----	----	16
Copper	7440-50-8	5	mg/kg	----	----	----	----	28
Lead	7439-92-1	5	mg/kg	----	----	----	----	19
Nickel	7440-02-0	2	mg/kg	----	----	----	----	9
Zinc	7440-66-6	5	mg/kg	----	----	----	----	22

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S2-5	21649/S2-6	21649/S2-7	21649/S2-8	21649/S3/1-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731937-006	ES1731937-007	ES1731937-008	ES1731937-009	ES1731937-010
				Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	----	----	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	----	----	----	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	----	----	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	----	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	----	----	----	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg	----	----	----	----	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	----	----	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	----	----	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	----	----	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg	----	----	----	----	<0.05
Diazinon	333-41-5	0.05	mg/kg	----	----	----	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	----	----	----	----	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S2-5	21649/S2-6	21649/S2-7	21649/S2-8	21649/S3/1-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731937-006	ES1731937-007	ES1731937-008	ES1731937-009	ES1731937-010
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	----	----	<0.2
Malathion	121-75-5	0.05	mg/kg		----	----	----	----	<0.05
Fenthion	55-38-9	0.05	mg/kg		----	----	----	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	----	----	<0.05
Parathion	56-38-2	0.2	mg/kg		----	----	----	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	----	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	----	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	----	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	----	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		----	----	----	----	<0.05
Ethion	563-12-2	0.05	mg/kg		----	----	----	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		----	----	----	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	----	----	<0.05
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	----	----	----	**94.3**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	----	----	----	**88.2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S3/2-1	21649/S4/1-1	21649/S4/2-1	21649/S4/5-1	21649/S4/6-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731937-011	ES1731937-013	ES1731937-014	ES1731937-017	ES1731937-018
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	6.9	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	226	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	14.4	11.5	12.8	11.0	10.3
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	----	No	No
Asbestos (Trace)	1332-21-4	5	Fibres	----	----	----	No	No
Asbestos Type	1332-21-4	-	--	----	----	----	-	-
Sample weight (dry)	----	0.01	g	----	----	----	25.2	22.1
APPROVED IDENTIFIER:	----	-	--	----	----	----	S.SPOONER	S.SPOONER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	----	----	<0.0004	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	----	----	<0.001	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	----	----	----	0.0252	0.0221
ø Fibrous Asbestos >7mm	----	0.0004	g	----	----	----	<0.0004	<0.0004
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	10	10	<5	7
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	13	19	18	13	12
Copper	7440-50-8	5	mg/kg	33	14	16	36	31
Lead	7439-92-1	5	mg/kg	19	19	9	14	13
Nickel	7440-02-0	2	mg/kg	14	8	4	22	21
Zinc	7440-66-6	5	mg/kg	40	32	7	65	47
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S3/2-1	21649/S4/1-1	21649/S4/2-1	21649/S4/5-1	21649/S4/6-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731937-011	ES1731937-013	ES1731937-014	ES1731937-017	ES1731937-018
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	----	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	----	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	----	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	----	<0.2	----
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	----	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	----	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S3/2-1	21649/S4/1-1	21649/S4/2-1	21649/S4/5-1	21649/S4/6-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731937-011	ES1731937-013	ES1731937-014	ES1731937-017	ES1731937-018
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	----	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	----	<0.05	----
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	----	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	----	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	----	<0.05	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**119**	**92.8**	----	**88.7**	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**97.4**	**85.3**	----	**78.1**	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S6/1-1	21649/S6/2-1	21649/S7/1-1	----	----
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	----	----
Compound	CAS Number	LOR	Unit	ES1731937-020	ES1731937-021	ES1731937-024	--------	--------
				Result	Result	Result	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.0**	----	**6.8**	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**52**	----	**84**	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**11.3**	**13.2**	**10.6**	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	**No**	----	**No**	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	**No**	----	**No**	----	----
Asbestos Type	1332-21-4	-	--	**-**	----	**-**	----	----
Sample weight (dry)	----	0.01	g	**324**	----	**311**	----	----
APPROVED IDENTIFIER:	----	-	--	**S.SPOONER**	----	**S.SPOONER**	----	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	<0.0004	----	<0.0004	----	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	<0.001	----	<0.001	----	----
ø Weight Used for % Calculation	----	0.0001	kg	**0.324**	----	**0.311**	----	----
ø Fibrous Asbestos >7mm	----	0.0004	g	<0.0004	----	<0.0004	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**7**	**10**	**8**	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg	**19**	**16**	**16**	----	----
Copper	7440-50-8	5	mg/kg	**25**	**44**	**15**	----	----
Lead	7439-92-1	5	mg/kg	**18**	**17**	**14**	----	----
Nickel	7440-02-0	2	mg/kg	**17**	**18**	**12**	----	----
Zinc	7440-66-6	5	mg/kg	**38**	**50**	**26**	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	<0.05	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S6/1-1	21649/S6/2-1	21649/S7/1-1	----	----
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1731937-020	ES1731937-021	ES1731937-024	--------	--------
					Result	Result	Result	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
Aldrin	309-00-2	0.05	mg/kg		<0.05	----	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	----	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg		<0.05	----	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	----	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	----	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	----	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg		<0.05	----	<0.05	----	----
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	----	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg		<0.05	----	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	----	<0.05	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		<0.05	----	<0.05	----	----
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	----	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	----	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	----	<0.05	----	----
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	----	<0.2	----	----
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	----	<0.05	----	----
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	----	<0.2	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		<0.05	----	<0.05	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg		<0.05	----	<0.05	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	----	<0.05	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	----	<0.05	----	----
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	----	<0.2	----	----
Dimethoate	60-51-5	0.05	mg/kg		<0.05	----	<0.05	----	----
Diazinon	333-41-5	0.05	mg/kg		<0.05	----	<0.05	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	----	<0.05	----	----
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	----	<0.2	----	----
Malathion	121-75-5	0.05	mg/kg		<0.05	----	<0.05	----	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	----	<0.05	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	----	<0.05	----	----
Parathion	56-38-2	0.2	mg/kg		<0.2	----	<0.2	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	----	<0.05	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	----	<0.05	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	----	<0.05	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S6/1-1	21649/S6/2-1	21649/S7/1-1	----	----
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1731937-020	ES1731937-021	ES1731937-024	--------	--------
					Result	Result	Result	----	----
EP068B: Organophosphorus Pesticides (OP) - Continued									
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	----	<0.05	----	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	----	<0.05	----	----
Ethion	563-12-2	0.05	mg/kg		<0.05	----	<0.05	----	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	----	<0.05	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	----	<0.05	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**77.0**	----	**90.5**	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**70.0**	----	**83.8**	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in Soils		
EA200: Description	21649/S1/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S2-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S3/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S4/5-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S4/6-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S6/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S7/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1731925**	Page	: 1 of 24
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Customer Services ES
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 21649	Date Samples Received	: 14-Dec-2017 16:02
Order number	: E-2017-713	Date Analysis Commenced	: 18-Dec-2017
C-O-C number	: ----	Issue Date	: 02-Jan-2018 17:24
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 36		
No. of samples analysed	: 33		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	Brisbane Inorganics, Stafford, QLD
Matt Frost	Senior Organic Chemist	Brisbane Organics, Stafford, QLD
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW
Shaun Spooner	Asbestos Identifier	Newcastle - Asbestos, Mayfield West, NSW

General Comments

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

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

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

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

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

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

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

- EA200N: Asbestos weights and percentages are not covered under the Scope of NATA Accreditation.
  Weights of Asbestos are based on extracted bulk asbestos, fibre bundles, and/or ACM and do not include respirable fibres (if present)
  The Asbestos (Fines and Fibrous) weight is calculated from the extracted Fibrous Asbestos and Asbestos Fines as an equivalent weight of 100% Asbestos
  Percentages for Asbestos content in ACM are based on the 2013 NEPM default values.
  All calculations of percentage Asbestos under this method are approximate and should be used as a guide only.
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Trace' - Asbestos fibres ("Free Fibres") detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200 Legend
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.
- EA200N: ALS laboratory procedures and methods used for the identification and quantitation of asbestos are consistent with AS4964-2004 and the requirements of the 2013 NEPM for Assessment of Site Contamination
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR.
  Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EA200: For samples larger than 30g, the <2mm fraction may be sub-sampled prior to trace analysis as outlined in ISO23909:2008(E) Sect 6.3.2-2
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).
- EA200: 'Yes' - Asbestos detected by polarised light microscopy including dispersion staining.
- EA200: 'No*' - No asbestos found, at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining. Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg.
- EA200: 'No' - No asbestos found at the reporting limit 0.1g/kg, by polarised light microscopy including dispersion staining.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S7/2-1	21649/S8-1	21649/S8-2	21649/S8-3	21649/S8-4
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-001	ES1731925-004	ES1731925-005	ES1731925-006	ES1731925-007
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	6.1	6.2	8.7	8.7
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	76	155	997	1120
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	9.6	8.8	10.5	----	14.8
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	No	----	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	----	No	----	----	----
Asbestos Type	1332-21-4	-	--	----	-	----	----	----
Sample weight (dry)	----	0.01	g	----	218	----	----	----
APPROVED IDENTIFIER:	----	-	--	----	S.SPOONER	----	----	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	<0.0004	----	----	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	<0.001	----	----	----
ø Weight Used for % Calculation	----	0.0001	kg	----	0.218	----	----	----
ø Fibrous Asbestos >7mm	----	0.0004	g	----	<0.0004	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	----	----	10.9
Exchangeable Magnesium	----	0.2	meq/100g	----	----	----	----	10.8
Exchangeable Potassium	----	0.2	meq/100g	----	----	----	----	<0.2
Exchangeable Sodium	----	0.2	meq/100g	----	----	----	----	1.5
Cation Exchange Capacity	----	0.2	meq/100g	----	----	----	----	23.3
Exchangeable Sodium Percent	----	0.2	%	----	----	----	----	6.6
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	9.6	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	7.0	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	0.2	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	1.9	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	18.7	----	----
Exchangeable Sodium Percent	----	0.1	%	----	----	10.3	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	10	----	140
EG005T: Total Metals by ICP-AES								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S7/2-1	21649/S8-1	21649/S8-2	21649/S8-3	21649/S8-4
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-001	ES1731925-004	ES1731925-005	ES1731925-006	ES1731925-007
					Result	Result	Result	Result	Result
EG005T: Total Metals by ICP-AES - Continued									
Arsenic	7440-38-2	5	mg/kg		<5	**10**	**11**	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg		**11**	**14**	**18**	----	----
Copper	7440-50-8	5	mg/kg		**24**	**13**	**14**	----	----
Lead	7439-92-1	5	mg/kg		**14**	**17**	**15**	----	----
Nickel	7440-02-0	2	mg/kg		**11**	**7**	**8**	----	----
Zinc	7440-66-6	5	mg/kg		**29**	**22**	**18**	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		<0.05	<0.05	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		<0.05	<0.05	----	----	----
beta-BHC	319-85-7	0.05	mg/kg		<0.05	<0.05	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg		<0.05	<0.05	----	----	----
delta-BHC	319-86-8	0.05	mg/kg		<0.05	<0.05	----	----	----
Heptachlor	76-44-8	0.05	mg/kg		<0.05	<0.05	----	----	----
Aldrin	309-00-2	0.05	mg/kg		<0.05	<0.05	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	<0.05	----	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg		<0.05	<0.05	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg		<0.05	<0.05	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	<0.05	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	<0.05	----	----	----
Dieldrin	60-57-1	0.05	mg/kg		<0.05	<0.05	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	<0.05	----	----	----
Endrin	72-20-8	0.05	mg/kg		<0.05	<0.05	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	<0.05	----	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		<0.05	<0.05	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	<0.05	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	<0.05	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	<0.05	----	----	----
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	<0.2	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	<0.05	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S7/2-1	21649/S8-1	21649/S8-2	21649/S8-3	21649/S8-4
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-001	ES1731925-004	ES1731925-005	ES1731925-006	ES1731925-007
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg	<0.05	<0.05	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	----	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	----	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	----	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	----	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**74.4**	**119**	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**70.5**	**84.1**	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S8-5	21649/S8-6	21649/S8-7	21649/S8-8	21649/S9-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-008	ES1731925-009	ES1731925-010	ES1731925-011	ES1731925-012
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.7	9.2	9.1	8.8	5.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	944	666	736	570	430
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	16.3	----	11.1	----	11.9
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	5.4	----	4.4	----	----
Exchangeable Magnesium	----	0.2	meq/100g	10.2	----	7.8	----	----
Exchangeable Potassium	----	0.2	meq/100g	0.2	----	<0.2	----	----
Exchangeable Sodium	----	0.2	meq/100g	2.4	----	1.2	----	----
Cation Exchange Capacity	----	0.2	meq/100g	18.2	----	13.5	----	----
Exchangeable Sodium Percent	----	0.2	%	13.4	----	9.0	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	120	----	110	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	----	----	----	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	----	----	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	----	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S8-5	21649/S8-6	21649/S8-7	21649/S8-8	21649/S9-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-008	ES1731925-009	ES1731925-010	ES1731925-011	ES1731925-012
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
Endosulfan sulfate	1031-07-8	0.05	mg/kg		----	----	----	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg		----	----	----	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		----	----	----	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		----	----	----	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		----	----	----	----	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg		----	----	----	----	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		----	----	----	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	----	----	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		----	----	----	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg		----	----	----	----	<0.05
Diazinon	333-41-5	0.05	mg/kg		----	----	----	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	----	----	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	----	----	<0.2
Malathion	121-75-5	0.05	mg/kg		----	----	----	----	<0.05
Fenthion	55-38-9	0.05	mg/kg		----	----	----	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	----	----	<0.05
Parathion	56-38-2	0.2	mg/kg		----	----	----	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	----	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	----	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	----	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	----	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		----	----	----	----	<0.05
Ethion	563-12-2	0.05	mg/kg		----	----	----	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		----	----	----	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	----	----	<0.05
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	----	----	----	**119**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	----	----	----	**82.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S10-1-1	21649/S11-1	21649/S12/1-1	21649/S13/1-1	21649/S14/1-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-013	ES1731925-014	ES1731925-015	ES1731925-016	ES1731925-018
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	6.3	6.0	6.7	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	155	87	58	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	8.4	11.6	8.1	----	7.8
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	No	----	----	No
Asbestos (Trace)	1332-21-4	5	Fibres	----	No	----	----	No
Asbestos Type	1332-21-4	-	--	----	-	----	----	-
Sample weight (dry)	----	0.01	g	----	156	----	----	137
APPROVED IDENTIFIER:	----	-	--	----	S.SPOONER	----	----	S.SPOONER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	<0.0004	----	----	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	<0.001	----	----	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	----	0.156	----	----	0.137
ø Fibrous Asbestos >7mm	----	0.0004	g	----	<0.0004	----	----	<0.0004
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	13.0	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	3.6	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	0.2	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	0.2	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	17.1	----
Exchangeable Sodium Percent	----	0.1	%	----	----	----	1.4	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	9	8	----	16
Cadmium	7440-43-9	1	mg/kg	----	<1	<1	----	<1
Chromium	7440-47-3	2	mg/kg	----	13	23	----	24
Copper	7440-50-8	5	mg/kg	----	16	13	----	26
Lead	7439-92-1	5	mg/kg	----	24	21	----	41
Nickel	7440-02-0	2	mg/kg	----	6	7	----	12
Zinc	7440-66-6	5	mg/kg	----	39	37	----	110
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.1	<0.1	----	<0.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S10-1-1	21649/S11-1	21649/S12/1-1	21649/S13/1-1	21649/S14/1-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-013	ES1731925-014	ES1731925-015	ES1731925-016	ES1731925-018
				Result	Result	Result	Result	Result
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	----	----	----	766	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg	<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S10-1-1	21649/S11-1	21649/S12/1-1	21649/S13/1-1	21649/S14/1-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-013	ES1731925-014	ES1731925-015	ES1731925-016	ES1731925-018
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	----	----	----	----
Malathion	121-75-5	0.05	mg/kg		<0.05	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	----	----	----	----
Parathion	56-38-2	0.2	mg/kg		<0.2	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	----	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	----	----	----	----
Ethion	563-12-2	0.05	mg/kg		<0.05	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**118**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**83.9**	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S14/1-2	21649/S15-1	21649/S15-2	21649/S15-3	21649/S15-4
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-019	ES1731925-020	ES1731925-021	ES1731925-022	ES1731925-023
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.9	6.4	6.4	8.8	8.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	100	87	112	446	350
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	10.3	11.8	16.2	13.7	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	No	----	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	----	No	----	----	----
Asbestos Type	1332-21-4	-	--	----	-	----	----	----
Sample weight (dry)	----	0.01	g	----	126	----	----	----
APPROVED IDENTIFIER:	----	-	--	----	S.SPOONER	----	----	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	<0.0004	----	----	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	<0.001	----	----	----
ø Weight Used for % Calculation	----	0.0001	kg	----	0.126	----	----	----
ø Fibrous Asbestos >7mm	----	0.0004	g	----	<0.0004	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	----	16.9	----
Exchangeable Magnesium	----	0.2	meq/100g	----	----	----	13.4	----
Exchangeable Potassium	----	0.2	meq/100g	----	----	----	<0.2	----
Exchangeable Sodium	----	0.2	meq/100g	----	----	----	2.7	----
Cation Exchange Capacity	----	0.2	meq/100g	----	----	----	33.0	----
Exchangeable Sodium Percent	----	0.2	%	----	----	----	8.2	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	6.2	----	10.5	----	----
Exchangeable Magnesium	----	0.1	meq/100g	9.4	----	9.4	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.1	----	0.2	----	----
Exchangeable Sodium	----	0.1	meq/100g	2.0	----	3.0	----	----
Cation Exchange Capacity	----	0.1	meq/100g	17.7	----	23.1	----	----
Exchangeable Sodium Percent	----	0.1	%	11.5	----	12.9	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	90	120	----
EG005T: Total Metals by ICP-AES								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S14/1-2	21649/S15-1	21649/S15-2	21649/S15-3	21649/S15-4
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-019	ES1731925-020	ES1731925-021	ES1731925-022	ES1731925-023
					Result	Result	Result	Result	Result
EG005T: Total Metals by ICP-AES - Continued									
Arsenic	7440-38-2	5	mg/kg		**15**	**12**	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg		**19**	**18**	----	----	----
Copper	7440-50-8	5	mg/kg		**31**	**21**	----	----	----
Lead	7439-92-1	5	mg/kg		**20**	**68**	----	----	----
Nickel	7440-02-0	2	mg/kg		**52**	**14**	----	----	----
Zinc	7440-66-6	5	mg/kg		**124**	**55**	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	----	----	----
EK072: Phosphate Sorption Capacity									
Phosphate Sorption Capacity	----	250	mg P sorbed/kg		**1090**	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S15-5	21649/S15-6	21649/S15-7	21649/S15-8	21649/S16/1-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-024	ES1731925-025	ES1731925-026	ES1731925-027	ES1731925-028
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.7	8.6	9.1	9.5	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	192	224	240	337	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	9.6	10.6	----	----	7.7
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	----	----	No
Asbestos (Trace)	1332-21-4	5	Fibres	----	----	----	----	No
Asbestos Type	1332-21-4	-	--	----	----	----	----	-
Sample weight (dry)	----	0.01	g	----	----	----	----	317
APPROVED IDENTIFIER:	----	-	--	----	----	----	----	S.SPOONER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	----	----	----	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	----	----	----	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	----	----	----	----	0.317
ø Fibrous Asbestos >7mm	----	0.0004	g	----	----	----	----	<0.0004
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	21.1	18.0	----	----	----
Exchangeable Magnesium	----	0.2	meq/100g	9.8	8.4	----	----	----
Exchangeable Potassium	----	0.2	meq/100g	<0.2	<0.2	----	----	----
Exchangeable Sodium	----	0.2	meq/100g	<0.2	<0.2	----	----	----
Cation Exchange Capacity	----	0.2	meq/100g	30.9	26.5	----	----	----
Exchangeable Sodium Percent	----	0.2	%	<0.2	<0.2	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	10	20	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	----	----	----	16
Cadmium	7440-43-9	1	mg/kg	----	----	----	----	<1
Chromium	7440-47-3	2	mg/kg	----	----	----	----	26
Copper	7440-50-8	5	mg/kg	----	----	----	----	15
Lead	7439-92-1	5	mg/kg	----	----	----	----	28
Nickel	7440-02-0	2	mg/kg	----	----	----	----	8
Zinc	7440-66-6	5	mg/kg	----	----	----	----	40

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S15-5	21649/S15-6	21649/S15-7	21649/S15-8	21649/S16/1-1
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-024	ES1731925-025	ES1731925-026	ES1731925-027	ES1731925-028
				Result	Result	Result	Result	Result
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	----	----	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	----	----	----	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	----	<0.05
Aldrin	309-00-2	0.05	mg/kg	----	----	----	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	----	----	----	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	----	----	----	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	----	----	----	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	----	----	----	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	----	----	----	----	<0.05
Endrin	72-20-8	0.05	mg/kg	----	----	----	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	----	----	----	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	----	----	----	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	----	----	----	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	----	----	----	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg	----	----	----	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	----	----	----	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	----	----	----	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	----	----	----	----	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-3	0.05	mg/kg	----	----	----	----	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	----	----	----	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	----	----	----	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	----	----	----	----	<0.2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S15-5	21649/S15-6	21649/S15-7	21649/S15-8	21649/S16/1-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-024	ES1731925-025	ES1731925-026	ES1731925-027	ES1731925-028
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Dimethoate	60-51-5	0.05	mg/kg		----	----	----	----	<0.05
Diazinon	333-41-5	0.05	mg/kg		----	----	----	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	----	----	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	----	----	<0.2
Malathion	121-75-5	0.05	mg/kg		----	----	----	----	<0.05
Fenthion	55-38-9	0.05	mg/kg		----	----	----	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	----	----	<0.05
Parathion	56-38-2	0.2	mg/kg		----	----	----	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	----	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	----	----	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	----	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	----	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		----	----	----	----	<0.05
Ethion	563-12-2	0.05	mg/kg		----	----	----	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		----	----	----	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	----	----	<0.05
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	0.5	mg/kg		----	----	----	----	<0.5
2-Chlorophenol	95-57-8	0.5	mg/kg		----	----	----	----	<0.5
2-Methylphenol	95-48-7	0.5	mg/kg		----	----	----	----	<0.5
3- & 4-Methylphenol	1319-77-3	1	mg/kg		----	----	----	----	<1
2-Nitrophenol	88-75-5	0.5	mg/kg		----	----	----	----	<0.5
2.4-Dimethylphenol	105-67-9	0.5	mg/kg		----	----	----	----	<0.5
2.4-Dichlorophenol	120-83-2	0.5	mg/kg		----	----	----	----	<0.5
2.6-Dichlorophenol	87-65-0	0.5	mg/kg		----	----	----	----	<0.5
4-Chloro-3-methylphenol	59-50-7	0.5	mg/kg		----	----	----	----	<0.5
2.4.6-Trichlorophenol	88-06-2	0.5	mg/kg		----	----	----	----	<0.5
2.4.5-Trichlorophenol	95-95-4	0.5	mg/kg		----	----	----	----	<0.5
Pentachlorophenol	87-86-5	2	mg/kg		----	----	----	----	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		----	----	----	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		----	----	----	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		----	----	----	----	<0.5
Fluorene	86-73-7	0.5	mg/kg		----	----	----	----	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S15-5	21649/S15-6	21649/S15-7	21649/S15-8	21649/S16/1-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-024	ES1731925-025	ES1731925-026	ES1731925-027	ES1731925-028
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Phenanthrene	85-01-8	0.5	mg/kg		----	----	----	----	<0.5
Anthracene	120-12-7	0.5	mg/kg		----	----	----	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		----	----	----	----	<0.5
Pyrene	129-00-0	0.5	mg/kg		----	----	----	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		----	----	----	----	<0.5
Chrysene	218-01-9	0.5	mg/kg		----	----	----	----	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		----	----	----	----	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		----	----	----	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		----	----	----	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		----	----	----	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		----	----	----	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		----	----	----	----	<0.5
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg		----	----	----	----	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg		----	----	----	----	<0.5
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg		----	----	----	----	**0.6**
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg		----	----	----	----	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		----	----	----	----	<10
C10 - C14 Fraction	----	50	mg/kg		----	----	----	----	<50
C15 - C28 Fraction	----	100	mg/kg		----	----	----	----	<100
C29 - C36 Fraction	----	100	mg/kg		----	----	----	----	<100
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg		----	----	----	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		----	----	----	----	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg		----	----	----	----	<10
>C10 - C16 Fraction	----	50	mg/kg		----	----	----	----	<50
>C16 - C34 Fraction	----	100	mg/kg		----	----	----	----	<100
>C34 - C40 Fraction	----	100	mg/kg		----	----	----	----	<100
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg		----	----	----	----	<50
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg		----	----	----	----	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		----	----	----	----	<0.2
Toluene	108-88-3	0.5	mg/kg		----	----	----	----	<0.5

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S15-5	21649/S15-6	21649/S15-7	21649/S15-8	21649/S16/1-1
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-024	ES1731925-025	ES1731925-026	ES1731925-027	ES1731925-028
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
Ethylbenzene	100-41-4	0.5	mg/kg		----	----	----	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		----	----	----	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		----	----	----	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg		----	----	----	----	<0.2
^ Total Xylenes	----	0.5	mg/kg		----	----	----	----	<0.5
Naphthalene	91-20-3	1	mg/kg		----	----	----	----	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		----	----	----	----	114
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	----	----	----	116
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	----	----	----	120
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		----	----	----	----	83.8
2-Chlorophenol-D4	93951-73-6	0.5	%		----	----	----	----	84.0
2.4.6-Tribromophenol	118-79-6	0.5	%		----	----	----	----	87.6
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		----	----	----	----	94.5
Anthracene-d10	1719-06-8	0.5	%		----	----	----	----	99.2
4-Terphenyl-d14	1718-51-0	0.5	%		----	----	----	----	91.0
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	----	----	----	116
Toluene-D8	2037-26-5	0.2	%		----	----	----	----	125
4-Bromofluorobenzene	460-00-4	0.2	%		----	----	----	----	120

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	21649/S17/1	21649/S18/1-1	21649/S19/1-1	TRIP 1	TRIP 2
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	ES1731925-029	ES1731925-030	ES1731925-031	ES1731925-032	ES1731925-033
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.9	----	6.0	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	37	----	46	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	----	8.6	----	9.5	9.0
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	No	----	----	----
Asbestos (Trace)	1332-21-4	5	Fibres	----	No	----	----	----
Asbestos Type	1332-21-4	-	--	----	-	----	----	----
Sample weight (dry)	----	0.01	g	----	223	----	----	----
APPROVED IDENTIFIER:	----	-	--	----	S.SPOONER	----	----	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	<0.0004	----	----	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	<0.001	----	----	----
ø Weight Used for % Calculation	----	0.0001	kg	----	0.223	----	----	----
ø Fibrous Asbestos >7mm	----	0.0004	g	----	<0.0004	----	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	11	----	----	11
Cadmium	7440-43-9	1	mg/kg	----	<1	----	----	<1
Chromium	7440-47-3	2	mg/kg	----	28	----	----	17
Copper	7440-50-8	5	mg/kg	----	15	----	----	16
Lead	7439-92-1	5	mg/kg	----	26	----	----	22
Nickel	7440-02-0	2	mg/kg	----	7	----	----	10
Zinc	7440-66-6	5	mg/kg	----	38	----	----	35
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.1	----	----	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S17/1	21649/S18/1-1	21649/S19/1-1	TRIP 1	TRIP 2
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-029	ES1731925-030	ES1731925-031	ES1731925-032	ES1731925-033
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
Aldrin	309-00-2	0.05	mg/kg		----	----	----	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		----	----	----	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg		----	----	----	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		----	----	----	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		----	----	----	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		----	----	----	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		----	----	----	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg		----	----	----	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		----	----	----	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		----	----	----	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		----	----	----	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg		----	----	----	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		----	----	----	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		----	----	----	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg		----	----	----	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		----	----	----	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		----	----	----	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		----	----	----	<0.05	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg		----	----	----	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		----	----	----	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	----	----	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		----	----	----	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		----	----	----	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		----	----	----	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	----	----	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	----	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		----	----	----	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		----	----	----	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	----	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		----	----	----	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	----	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	----	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	----	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	21649/S17/1	21649/S18/1-1	21649/S19/1-1	TRIP 1	TRIP 2
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1731925-029	ES1731925-030	ES1731925-031	ES1731925-032	ES1731925-033
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	----	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		----	----	----	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		----	----	----	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		----	----	----	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	----	<0.05	<0.05
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	----	----	**81.0**	**96.8**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	----	----	**79.5**	**89.1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	DUP 1	DUP 2	DUP 3	----	----
			Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	----	----
Compound	CAS Number	LOR	Unit	ES1731925-035	ES1731925-036	ES1731925-037	--------	--------
				Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**10.4**	**10.1**	**14.0**	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	**10**	**13**	----	----
Cadmium	7440-43-9	1	mg/kg	----	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg	----	**21**	**20**	----	----
Copper	7440-50-8	5	mg/kg	----	**18**	**18**	----	----
Lead	7439-92-1	5	mg/kg	----	**20**	**18**	----	----
Nickel	7440-02-0	2	mg/kg	----	**10**	**9**	----	----
Zinc	7440-66-6	5	mg/kg	----	**43**	**44**	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.1	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	----	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	----	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	----	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	DUP 1	DUP 2	DUP 3	----	----
				Client sampling date / time	14-Dec-2017 00:00	14-Dec-2017 00:00	14-Dec-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1731925-035	ES1731925-036	ES1731925-037	--------	--------
					Result	Result	Result	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	<0.2	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg		<0.05	<0.05	----	----	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg		<0.05	<0.05	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	<0.05	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	<0.05	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	<0.2	----	----	----
Dimethoate	60-51-5	0.05	mg/kg		<0.05	<0.05	----	----	----
Diazinon	333-41-5	0.05	mg/kg		<0.05	<0.05	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	<0.05	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	<0.2	----	----	----
Malathion	121-75-5	0.05	mg/kg		<0.05	<0.05	----	----	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	<0.05	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	<0.05	----	----	----
Parathion	56-38-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	<0.05	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	<0.05	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	<0.05	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	<0.05	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	<0.05	----	----	----
Ethion	563-12-2	0.05	mg/kg		<0.05	<0.05	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	<0.05	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	<0.05	----	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**119**	**98.6**	----	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**119**	**116**	----	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in Soils		
EA200: Description	21649/S8-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S11-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S14/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S15-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S16/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.
EA200: Description	21649/S18/1-1 - 14-Dec-2017 00:00	Mid brown clay soil.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1732087**	Page	: 1 of 5
Client	: **SMEC TESTING SERVICES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Customer Services ES
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: ----	Date Samples Received	: 18-Dec-2017 11:30
Order number	: ----	Date Analysis Commenced	: 18-Dec-2017
C-O-C number	: ----	Issue Date	: 22-Dec-2017 17:03
Sampler	: ----		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	19161/3850-S1	19161/3827-S1	19161/3851-S1	19161/3811-S1	19161/3824-S1
				Client sampling date / time	15-Dec-2017 09:30	15-Dec-2017 00:00	15-Dec-2017 00:00	15-Dec-2017 00:00	15-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		ES1732087-003	ES1732087-004	ES1732087-005	ES1732087-006	ES1732087-007
					Result	Result	Result	Result	Result
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.5**	**8.4**	**8.3**	**9.0**	**7.4**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**182**	**285**	**497**	**111**	**311**
EA055: Moisture Content									
Moisture Content	----	1.0	%		**14.2**	**9.0**	**11.3**	**5.2**	**10.1**
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	**20**	**280**	<10	**80**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	19710/610-S1	20463/137-S1	----	----	----
				Client sampling date / time	15-Dec-2017 00:00	15-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1732087-008	ES1732087-009	--------	--------	--------
					Result	Result	----	----	----
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.8**	**5.5**	**----**	**----**	**----**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**95**	**82**	**----**	**----**	**----**
EA055: Moisture Content									
Moisture Content	----	1.0	%		**13.2**	**15.7**	**----**	**----**	**----**
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	**70**	**----**	**----**	**----**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**21649-SAL1**	**21649-SAL2**	**----**	**----**	**----**
				Client sampling date / time	18-Dec-2017 09:20	18-Dec-2017 09:30	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1732087-001**	**ES1732087-002**	**--------**	**--------**	**--------**
					Result	Result	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.54**	**7.10**	**----**	**----**	**----**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**35500**	**33000**	**----**	**----**	**----**

APPENDIX C – BUREAU OF METEOROLOGY DATA

Australian Government
Bureau of Meteorology

Climate statistics for Australian locations

Monthly climate statistics

All years of record

Note: Many statistics are updated quarterly and recent weather events may not be represented in the statistics below. For more current information on recent extreme values, please refer to the corresponding Daily rainfall, Maximum temperature and Minimum temperature data tables for this site, and our Australian Climate and Weather Extremes Monitoring System. Missing observations associated with the observer being unavailable (where observations are undertaken manually), a failure in the observing equipment, or when an event has produced suspect data may result in an extreme event not being recorded.

Site name: PROSPECT RESERVOIR **Site number:** 067019 **Commenced:** 1887 Map
Latitude: 33.82° S **Longitude:** 150.91° E **Elevation:** 61 m **Operational status:** Open

View: Main statistics / All available **Period:** Use all years of data **Text size:** Normal / Large

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Temperature															
Maximum temperature															
Mean maximum temperature (°C)	28.5	28.0	26.4	23.7	20.4	17.4	16.9	18.8	21.5	24.0	25.6	27.5	23.2	52	1965 2017
Highest temperature (°C)	45.1	43.3	39.5	37.1	29.4	25.6	27.1	29.4	35.0	39.0	42.0	42.7	45.1	52	1965 2017
Date	18 Jan 2013	11 Feb 2017	13 Mar 1998	04 Apr 1986	10 May 1967	06 Jun 1997	30 Jul 2017	26 Aug 1995	25 Sep 1972	21 Oct 1988	20 Nov 2009	21 Dec 1994	18 Jan 2013		
Lowest maximum temperature (°C)	17.5	18.0	16.0	14.3	12.5	10.0	7.8	10.5	11.7	12.0	12.5	11.7	7.8	52	1965 2017
Date	28 Jan 1978	24 Feb 1992	09 Mar 1980	17 Apr 1983	31 May 1977	12 Jun 1975	23 Jul 1968	11 Aug 1973	05 Sep 1967	06 Oct 1978	16 Nov 1988	08 Dec 1966	23 Jul 1968		
Decile 1 maximum temperature (°C)	22.5	22.5	21.8	19.6	17.0	14.6	14.2	15.4	16.7	18.3	19.7	21.6		52	1965 2017
Decile 9 maximum temperature(°C)	35.4	34.0	31.1	27.9	23.8	20.0	19.8	22.7	27.1	31.0	32.5	34.0		52	1965 2017
Mean number of days ≥ 30 °C	11.0	8.4	5.5	0.9	0.0	0.0	0.0	0.0	1.1	3.9	5.7	9.3	45.8	52	1965 2017
Mean number of days ≥ 35 °C	3.6	2.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.4	2.4	10.6	52	1965 2017
Mean number of days ≥ 40 °C	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	1.4	52	1965 2017
Minimum temperature															
Mean minimum temperature (°C)	17.7	17.8	16.2	13.0	9.9	7.5	6.1	6.8	9.4	12.1	14.4	16.4	12.3	52	1965 2017

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Lowest temperature (°C)	10.0	10.8	7.9	3.6	1.2	-0.8	-0.6	-0.5	1.7	4.5	6.8	7.8	-0.8	52	1965 2017
Date	16 Jan 1996	18 Feb 1998	30 Mar 1970	23 Apr 2006	29 May 1987	30 Jun 2010	17 Jul 2007	13 Aug 2005	01 Sep 2012	08 Oct 1998	03 Nov 2003	18 Dec 1969	30 Jun 2010		
Highest minimum temperature (°C)	26.7	26.5	23.3	21.9	17.4	15.8	16.3	17.2	19.8	24.0	24.7	25.3	26.7	52	1965 2017
Date	22 Jan 1967	06 Feb 2011	03 Mar 1968	05 Apr 1986	02 May 2000	10 Jun 1995	25 Jul 1990	18 Aug 1988	24 Sep 2003	03 Oct 1981	22 Nov 2006	23 Dec 2000	22 Jan 1967		
Decile 1 minimum temperature (°C)	14.6	15.0	13.0	9.6	6.0	3.9	2.7	3.5	5.7	8.3	10.6	13.0		52	1965 2017
Decile 9 minimum temperature (°C)	20.8	20.6	19.0	16.3	13.6	11.4	9.7	10.5	13.2	15.8	18.0	19.5		52	1965 2017
Mean number of days ≤ 2 °C	0.0	0.0	0.0	0.0	0.0	0.6	1.8	0.8	0.0	0.0	0.0	0.0	3.2	52	1965 2017
Mean number of days ≤ 0 °C	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	52	1965 2017
Ground surface temperature															
Mean daily ground minimum temperature (°C)															
Lowest ground temperature (°C)															
Date															
Mean number of days ground min. temp. ≤ -1 °C															

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Rainfall															
Mean rainfall (mm)	95.8	96.5	98.0	76.6	69.9	77.2	55.7	50.4	46.0	58.1	72.8	75.9	875.0	129	1887 2017
Highest rainfall (mm)	426.7	519.1	380.7	425.0	556.0	531.3	323.7	458.5	186.3	269.0	391.3	338.1	1900.0	131	1887 2017
Date	1951	1956	1890	2015	1889	1950	1904	1986	1892	1916	1961	1920	1950		
Lowest rainfall (mm)	3.9	2.8	5.1	2.0	1.8	1.0	0.0	0.0	0.0	0.0	0.8	2.2	394.6	131	1887 2017
Date	1929	1902	1940	1997	1957	2001	1977	1995	1957	1988	1915	1979	1944		
Decile 1 rainfall (mm)	22.3	12.5	20.7	15.1	10.0	8.9	6.4	5.9	7.4	12.5	15.9	19.9	574.7	131	1887 2017
Decile 5 (median) rainfall (mm)	73.2	73.1	78.3	57.2	38.4	50.0	32.9	30.9	40.2	43.1	60.1	58.0	861.7	131	1887 2017
Decile 9 rainfall (mm)	193.7	197.7	201.7	170.5	169.9	181.0	128.1	129.6	100.5	130.7	141.7	159.4	1178.0	131	1887 2017
Highest daily rainfall (mm)	161.2	164.6	153.9	163.1	314.2	163.4	143.5	321.0	96.5	102.1	126.2	154.9	321.0	131	1887 2018
Date	31 Jan 2001	11 Feb 1956	20 Mar 1892	16 Apr 1946	28 May 1889	11 Jun 1991	10 Jul 1904	06 Aug 1986	02 Sep 1970	05 Oct 1916	14 Nov 1969	13 Dec 1910	06 Aug 1986		
Mean number of days of rain	10.7	10.7	11.0	9.4	8.9	9.5	7.8	7.9	8.4	9.2	9.6	10.0	113.1	131	1887 2017
Mean number of days of rain ≥ 1 mm	8.1	8.1	8.4	7.0	6.4	7.0	5.6	5.7	6.1	6.8	7.3	7.6	84.1	131	1887 2018
Mean number of days of rain ≥ 10 mm	2.6	2.6	2.6	2.1	1.7	2.0	1.4	1.4	1.3	1.7	2.3	2.3	24.0	131	1887 2018
Mean number of days of rain ≥ 25 mm	0.9	1.1	1.0	0.7	0.7	0.7	0.5	0.4	0.3	0.5	0.6	0.7	8.1	131	1887 2018

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
Other daily elements															
Mean daily wind run (km)															
Maximum wind gust speed (km/h)															
Date															
Mean daily sunshine (hours)															
Mean daily solar exposure (MJ/m^2)	22.3	19.2	16.5	13.6	10.4	8.7	9.9	13.2	16.8	19.8	21.2	22.7	16.2	28	1990 2018
Mean number of clear days	6.6	5.0	6.7	8.8	9.0	10.0	11.3	13.2	11.4	8.3	6.8	7.1	104.2	33	1968 2001
Mean number of cloudy days	12.6	11.7	11.7	8.0	9.5	8.3	6.6	6.3	7.1	9.2	10.6	10.5	112.1	33	1968 2001
Mean daily evaporation (mm)	5.5	4.7	3.9	2.9	2.0	1.6	1.7	2.5	3.6	4.4	5.0	5.6	3.6	44	1965 2017

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
9 am conditions															
Mean 9am temperature (°C)	21.3	21.0	19.6	16.9	13.5	10.7	9.6	11.1	14.5	17.4	18.4	20.6	16.2	42	1968 2010
Mean 9am wet-bulb temperature (°C)	18.5	18.6	17.3	14.7	11.8	9.0	7.7	8.7	11.3	13.7	15.3	17.2	13.6	39	1968 2010
Mean 9am dew-point temperature (°C)	16.4	17.0	15.6	12.6	10.0	7.0	5.3	5.6	7.8	10.1	12.5	14.5	11.2	37	1974 2010
Mean 9am relative humidity (%)	75	79	79	77	80	79	76	70	65	65	70	70	74	37	1974 2010
Mean 9am cloud cover (oktas)	4.8	4.9	4.5	3.7	3.8	3.6	3.2	2.9	3.2	4.0	4.4	4.5	4.0	45	1965 2010
Mean 9am wind speed (km/h)	7.5	7.0	7.3	8.0	7.7	8.0	8.1	9.2	9.6	10.0	8.5	8.2	8.3	44	1965 2010

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years	
3 pm conditions															
Mean 3pm temperature (°C)	26.8	26.3	24.8	22.4	19.2	16.5	15.9	17.4	19.6	22.1	23.4	25.9	21.7	33	1968 2001
Mean 3pm wet-bulb temperature (°C)	20.0	20.0	18.8	16.4	14.4	12.0	10.8	11.5	13.2	15.3	16.9	18.8	15.7	31	1968 2001
Mean 3pm dew-point temperature (°C)	15.3	15.7	14.4	11.3	9.9	6.9	4.8	4.5	6.3	8.8	11.5	13.5	10.2	28	1974 2001
Mean 3pm relative humidity (%)	52	54	55	52	57	55	50	45	45	46	50	49	51	28	1974 2001
Mean 3pm cloud cover (oktas)	4.8	5.0	4.8	4.2	4.3	4.2	3.9	3.8	3.9	4.4	4.8	4.6	4.4	33	1968 2001
Mean 3pm wind speed (km/h)	12.7	12.4	12.0	11.5	10.3	12.3	12.4	14.3	15.3	15.4	14.4	14.5	13.1	30	1968 2001

red = highest value blue = lowest value

Product IDCJCM0037 Prepared at Thu 11 Jan 2018 02:39:03 AM EST

Monthly statistics are only included if there are more than 10 years of data. The number of years (provided in the 2nd last column of the table) may differ between elements if the observing program at the site changed. More detailed data for individual sites can be obtained by contacting the Bureau.

Related Links

- This page URL: http://www.bom.gov.au/climate/averages/tables/cw_067019_All.shtml
- Summary statistics and locational map for this site:
  http://www.bom.gov.au/climate/averages/tables/cw_067019.shtml
- About climate averages: http://www.bom.gov.au/climate/cdo/about/about-stats.shtml
- Data file (csv): http://www.bom.gov.au/clim_data/cdio/tables/text/IDCJCM0037_067019.csv
- Climate averages home page URL: http://www.bom.gov.au/climate/data/index.shtml
- Bureau of Meteorology website: http://www.bom.gov.au

Page created: Thu 11 Jan 2018 02:39:03 AM EST

This page was created at **on**

GEOTECHNICS PTY LTD
CONSULTING GEOTECHNICAL ENGINEERS

APPENDIX D -WATER BALANCE CALCULATIONS

MONTHLY WATER BALANCE USED TO DETERMINE WET WEATHER STORAGE FOR 998 m^2 AREA

Design Wastewater Flow	Q	l/day	2500
Design Percolation Rate	R	mm/wk	21
Land Area	L	m^2	998

Paramters	**Symbol**	**Formula**	**Units**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Days in Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation	P	-	mm/month	73.2	73.1	78.3	57.2	38.4	50	32.9	30.9	40.2	43.1	60.1	58	635.4
Evaporation	E	-	mm/month	170.5	131.6	120.9	87	62	48	52.7	77.5	108	136.4	150	173.6	1318.2
Crop Factor	C	-	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-
Inputs																
Precipitation	P	-	mm/month	73.2	73.1	78.3	57.2	38.4	50	32.9	30.9	40.2	43.1	60.1	58	635.4
Effluent Irrigation	W	(Q x D) / L	mm/month	77.7	70.1	77.7	75.2	77.7	75.2	77.7	77.7	75.2	77.7	75.2	77.7	914.3
Inputs		P + W	mm/month	150.9	143.2	156.0	132.4	116.1	125.2	110.6	108.6	115.4	120.8	135.3	135.7	1549.7
Outputs																
Evapotranspiration	ET	E x C	mm/month	102.30	78.96	72.54	52.20	37.20	28.80	31.62	46.50	64.80	81.84	90.00	104.16	790.92
Percolation	B	(R / 7) x D	mm/month	93.0	84.0	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0
Outputs		ET + B	mm/month	195.3	163.0	165.5	142.2	130.2	118.8	124.6	139.5	154.8	174.8	180.0	197.2	1885.9
Storage	S	(P + W) - (ET + B)	mm/month	-44.4	-19.7	-9.6	-9.8	-14.1	6.4	-14.1	-30.9	-39.4	-54.1	-44.7	-61.5	-
Cumulative Storage	M	-	mm	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	

Storage	V	Largest M	mm	6.4
		(VxL)/1000	m3	6.4

MONTHLY WATER BALANCE USED TO DETERMINE WET WEATHER STORAGE - NO STORAGE REQUIRED

Design Wastewater Flow	Q	l/day	2500
Design Percolation Rate	R	mm/wk	21
Land Area	L	m^2	1090

Paramters	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation	P	-	mm/month	73.2	73.1	78.3	57.2	38.4	50	32.9	30.9	40.2	43.1	60.1	58	635.4
Evaporation	E	-	mm/month	170.5	131.6	120.9	87	62	48	52.7	77.5	108	136.4	150	173.6	1318.2
Crop Factor	C	-	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-
Inputs																
Precipitation	P	-	mm/month	73.2	73.1	78.3	57.2	38.4	50	32.9	30.9	40.2	43.1	60.1	58	635.4
Effluent Irrigation	W	(Q x D) / L	mm/month	71.1	64.2	71.1	68.8	71.1	68.8	71.1	71.1	68.8	71.1	68.8	71.1	837.2
Inputs		P + W	mm/month	144.3	137.3	149.4	126.0	109.5	118.8	104.0	102.0	109.0	114.2	128.9	129.1	1472.6
Outputs																
Evapotranspiration	ET	E x C	mm/month	102.30	78.96	72.54	52.20	37.20	28.80	31.62	46.50	64.80	81.84	90.00	104.16	790.92
Percolation	B	(R / 7) x D	mm/month	93.0	84.0	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0
Outputs		ET + B	mm/month	195.3	163.0	165.5	142.2	130.2	118.8	124.6	139.5	154.8	174.8	180.0	197.2	1885.9
Storage	S	(P + W) - (ET + B)	mm/month	-51.0	-25.6	-16.1	-16.2	-20.7	0.0	-20.6	-37.5	-45.8	-60.6	-51.1	-68.1	-