Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Detailed Site Investigation for Contamination

Proposed Rezoning and Sale
73 Swallow Drive, Erskine Park

Prepared for
Penrith City Council

Project 85512.01
September 2016

Douglas Partners
Geotechnics | Environment | Groundwater

Document History

Document details

Project No.	85512.01	Document No.	R.001.Rev0
Document title	Report on Detailed Site Investigation for Contamination Proposed Rezoning and Sale		
Site address	73 Swallow Drive, Erskine Park		
Report prepared for	Penrith City Council		
File name	85512.01.R.001.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Draft A	David Walker	Tim Wright	5 August 2016
Draft B	David Walker	Tim Wright	13 September 2016
Revision 0	David Walker	Tim Wright	29 September 2016

Distribution of copies

Status	Electronic	Paper	Issued to
Draft A	1	0	Amanda McMurtrie
Draft B	1	0	Poppy Halkias
Revision 0	1	0	Poppy Halkias

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author	[redacted]	29 September 2016
Reviewer	[redacted]	29 September 2016

bsi. ISO 9001 Quality Management

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666
Fax (02) 9809 4095

Douglas Partners
Geotechnics | Environment | Groundwater

Table of Contents

Page

APPENDICES

Report on Detailed Site Investigation for Contamination
Proposed Rezoning and Sale
73 Swallow Drive, Erskine Park

1. Introduction

This report presents the results of a Detailed Site Investigation (DSI) for contamination undertaken for the proposed rezoning and sale of 73 Swallow Drive, Erskine Park. The investigation was commissioned by Penrith City Council and was undertaken in accordance with Douglas Partners Pty Ltd's (DP's) proposal dated 1 July 2016 (reference: SYD160815), subsequent correspondence and agreed Terms and Conditions of Engagement dated 28 July 2016. The proposed rezoning is from Public Recreation – RE1 to Low Density Residential – R2.

The preliminary investigation for contamination at the site was reported in:

- DP, *Report on Preliminary Site Investigation for Contamination with Limited Sampling, Proposed Rezoning, 73 & 85 Swallow Drive, Erskine Park* (Project 85512), June 2016 [PSI].

Although contamination was not identified in the PSI from limited soil sampling, significant building rubble was observed in the filling at the site and, it was considered that this could be indicative of possible (unidentified) contamination. For this reason, it was recommended that further investigation of the site be undertaken to assess the filling. Therefore, the objectives of this DSI were to:

- Undertake sampling to assess the filling;
- Determine the contamination status of filling at the site; and
- Provide an opinion on the suitability of the site for the proposed future residential land use.

2. Scope of Works

Field work and laboratory analysis for the DSI was undertaken in two stages. The scope of works for the first stage included:

- Excavation of eight test pits for the collection of soil samples;
- Screening samples for volatile organic compounds using a photo-ionisation detector (PID);
- Conducting on-site sieving/screening on selected filling samples for potential asbestos-containing materials (ACM); and
- Laboratory analysis on selected samples for the following:
  - Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
  - Total recoverable hydrocarbons (TRH);
  - Benzene, toluene, ethylbenzene and xylene (BTEX);
  - Polycyclic aromatic hydrocarbons (PAH);

- Polychlorinated biphenyls (PCB);
- Organochlorine pesticides (OCP);
- Organophosphorus pesticides (OPP); and
- Asbestos.

The scope of works for the second stage included:

- Excavation of four test pits for the collection of soil samples;
- Conducting on-site sieving/screening on selected filling samples for potential ACM; and
- Laboratory analysis on selected samples for asbestos.

The findings from each stage of works have been included in this PSI.

3. Site Identification and Description

The site comprises Lot 3280 in Deposited Plan 786811 which has the street address 73 Swallow Drive, Erskine Park, NSW. This site covers approximately 4400 m^2 and is bounded by Swallow Drive to the north, Regulus Street to the west, and residential Lots to the east and south. The site is shown on Drawing 1, Appendix A.

The site is a park which is grass covered with some mature trees and has gentle to moderate slopes down to the south east. The steepest slopes are at the north of the site, adjacent to Swallow Drive. Some shrubs with small mounds of soil were present alongside the fences at the southern and eastern boundaries of the site. Fences are not present at the northern and western site boundaries. Some general litter and some evidence of fly tipping are present on the ground surface.

The surrounding area is used for low density residential purposes.

4. Summary of PSI

The PSI was conducted for the proposed rezoning of two areas from Public Recreation – RE1 to Low Density Residential – R2. One of the areas is the current site. The scope of the PSI included a review of site history information, soil sampling from eight test pits, laboratory analysis of soil samples for suites of common contaminants and an assessment of the results with regards to the proposed future land use.

Findings from the PSI relevant to the current site are summarised in the following sub-sections.

4.1 Regional Topography, Geology and Hydrogeology

The site is at an approximate elevation of 70 m AHD. Slopes at and around the site are generally down to the south and east It is expected that the majority of rainfall at the site would infiltrate soils although some runoff is likely to enter the local stormwater drainage system as an onsite stormwater pit is present. Groundwater at the site is likely to flow to the east in the direction of Ropes Creek which located approximately 1.1 km to the east.

According to the Penrith 1:100 000 Geology Sheet, the site is underlain by Bringelly Shale which comprises shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff. According to the Penrith 1:100 000 Soils Landscape Sheet, the natural soils in the vicinity of the site are residual soils formed by weathering of natural rock.

4.2 Site History

The site history review included a review of historical aerial photographs, historical title deeds, planning certificates, regulatory notices and other information sourced from Council.

According to historical aerial photographs, the site has not been subject to building works although some disturbance of the site was likely during development of the surrounding area during the 1980s when the surrounding land transitioned from being used for grazing to being used for low density residential purposes as well as roadways. Filling may have been imported and used to form the site for use as parkland. Fly tipping has likely occurred at the site during its use as parkland.

4.3 Field Work Observations

Five of the eight test pits were excavated (on 2 June 2016) at the current site. The five sample points (Test Pits 1 to 5) were positioned to provide general coverage of the park as shown in Drawing 1, Appendix A. Test pit logs are provided in Appendix B.

The observed filling depths and material types were variable and were summarised as follows:

- At Test Pit 1, brown silty clay filling with a trace of gravel and roots (and a piece of concrete) was observed to a depth of 0.25 m;
- At Test Pit 2, brown silty clay filling with a trace of roots, gravel, cobbles, brick, tile, metal, plastic, timber, glass and concrete was observed to a depth of 0.45 m;
- At Test Pit 3, brown silty clay filling with a trace of sandstone fragments, brick and metal to a depth of 0.45 m was underlain by brown silty clay filling to a depth of 0.7 m , then brown silty clay filling with a trace of bricks, timber, concrete pieces and plastic to a depth of greater than 0.9 m;
- At Test Pit 4, brown sandy, silty clay filling with a trace of gravel and rootlets was observed to a depth of 0.15 m; and
- At Test Pit 5, brown silty clay filling with some sand and boulder sized concrete and a trace of rootlets, cobbles, gravel and brick to a depth of 0.35 m was underlain by brown silty clay filling with a trace of cobbles to a depth of 0.7 m.

Natural soil was not encountered at Test Pit 3 as a layer of boulder sized concrete fragments was encountered at a depth of 0.9 m and could not be penetrated by the excavator bucket, even after lengthening the test pit. Natural red-brown mottled grey silty clay was encountered beneath filling at the other test pits (Test Pits 1, 2, 4 and 5).

Possible ACM was not observed in any of the test pits, despite the presence of building rubble (which can sometimes be associated with ACM) observed in filling. ACM was not observed on the ground surface during the site walkover.

Free groundwater was not observed in any of the test pits.

4.4 Analytical Results

Selected soil samples were analysed for metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), TRH, BTEX, PAH, OCP, OPP, PCB and asbestos. Results are summarised in Table 7 (Section 7.2).

Concentrations of chemical contaminants were assessed against site assessment criteria listed in Section 6. Concentrations were within the assessment criteria.

Analysis for asbestos was conducted on (approximate) 40 gram soil samples. Despite the presence of building rubble, no asbestos was detected at the laboratory's limit of reporting (0.1 g/kg).

5. Field Work, Analysis and QA/QC

5.1 Sample Locations and Rationale

The site covers approximately 0.44 ha. According to NSW EPA *Sampling Design Guidelines*, 1995, a minimum of 12 systematic sampling points are required to characterise a site of this size. For the first stage of field work, eight sampling locations (Test Pits 101 to 108) were positioned to complement the previous five sampling points (Test Pits 1 to 5) and meet the minimum sampling density as well as sample near Test Pit 3 where relatively deep filling with building rubble was encountered (in the PSI).

For the second stage of field work, four sampling locations (Test Pits 106a to 106d) were 'stepped-out' in different directions from Test Pit 106 where one piece of ACM was identified in filling. Each sampling location was positioned approximately 6 m from Test Pit 106. The reason for adopting this step-out sampling approach was to undertake additional systematic sampling (as a suggested option provided in NEPC, 2013) as there was uncertainty that the health screening level for asbestos in ACM in soil had been exceeded at Test Pit 106. The findings for ACM in soil are discussed in Sections 7.1 and 8.2.

It is noted that the total number of sampling points (17) for the site exceeds the recommended number of sample points (12) for a 0.44 ha site suspected to have asbestos according to Western Australian (WA) Department of Health (DOH), *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia,* (2009). The sample density is greatest (i.e. approximately double the recommended sample density) at the part of the site where significant building rubble was identified in filling.

Sample locations are shown on Drawing 1, Appendix A.

5.2 Soil Sampling Procedures

Prior to commencing sampling, all test pit locations were cleared for underground services.

For the first stage of field work, soil samples were collected from excavator bucket returns or from the sides of the test pit. Soil samples were collected at regular depth intervals and from different strata. All sampling data was recorded on DP's test pit logs, provided in Appendix B which also has notes about this report. The general sampling procedure adopted for the collection of soil samples for chemical analysis was:

- Collect soil samples using disposable gloves;
- Transfer samples into laboratory-prepared glass jars with Teflon lined lids, completely filled to minimise the headspace within the sample jar, and capping immediately to minimise loss of volatiles;
- Label sample containers with individual and unique identification, including project number, sample location and sample depth; and
- Place the glass jars into a cooled, insulated and sealed container for transport to the laboratory.

Replicate samples were collected in zip-lock bags for volatile screening using a PID.

For the first stage of field work, bulk samples (10 L in volume) of filling from where building rubble was observed, were collected in a bucket for on-site sieving/screening for ACM (see Section 5.3). Where a bulk sample was collected, a 500 mL sample was collected (using disposable gloves) in a zip lock bag from the same filling for the purpose of asbestos analysis. Where a bulk sample was not collected, an approximate 40 g sample was collected (using disposable gloves) for the purpose of asbestos analysis. A fragment of fibre-cement was also collected in a zip-lock bag for the purpose of asbestos analysis.

For the second stage of field work, bulk samples (10 L in volume) of filling were collected in a bucket from excavator bucket returns from each test pit for the purpose of on-site sieving/screening for ACM. A 500 mL sample was collected (using disposable gloves) in a zip lock bag from the same filling. Filling with building rubble was targeted for this sampling. Samples from other soil horizons were collected in zip-lock bags (for visual reference purposes only). A fragment of fibre-cement was also collected in a zip-lock bag.

5.3 Sieving/Screening for Asbestos Containing Materials

The screening of soil samples for asbestos quantification was undertaken according to the procedure outlined in the DP *Field Procedures Manual* and is based on the methods described in Western Australian Department of Health, *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia,* May 2009 and Schedule B2 of NEPC (2013). The screening for asbestos procedure was as follows:

- The mass of the 10 L bucket sample was weighed using an electronic scale;
- The sample was sieved through a 7 mm sieve (as much as possible);
- Clods of soil which could not pass through the sieve were broken by hand;

- Non-asbestos materials retained on the sieve were removed by hand;
- All the observed bonded ACM and fibrous asbestos (FA) (if any) were removed and collected in a single plastic bag for measurement of weight;
- The condition of the ACM was noted; and
- The 10 L sample was returned to the test pit as close as possible to the depth at which the sample was collected.

Sampling for each stage of field work was undertaken following significant rainfall, and hence the soil was already ‘wetted’ at the times of sampling.

5.4 Analytical Scheme and Rationale

Samples for laboratory analysis, listed in Table 1, were selected primarily based on field observations. All soil samples analysed were from filling as an objective of this DSI was to characterise the filling. Each selected primary filling sample from the first stage of field work was subject to analysis for a common suite of chemical contaminants. Where on-site sieving/screening for asbestos was undertaken (at a total of ten locations), a 500 mL sample was subject to analysis for asbestos. Asbestos analysis was undertaken on approximate 40 g filling samples from (two) locations where building rubble was not observed during the first stage of the investigation. Fragments of fibre-cement (samples A1 and A2) were also subject to analysis for asbestos.

Table 1: Analytical Scheme

Sample Location	Sample Depth (m)	Sample Type	Metals	TRH & BTEX	PAH	OCP, OPP & PCB	Asbestos ~40 g	Asbestos ~500 mL	Asbestos ID in material
Samples collected from the first stage of field work									
101	0.1-0.3	Filling	√	√	√	√		√	
102	0.5-0.8	Filling	√	√	√	√		√	
BD1-250716	0.5-0.8	Filling	√		√				
103	0.2-0.4	Filling	√	√	√	√		√	
104	0-0.1	Filling	√	√	√	√	√		
105	0-0.1	Filling	√	√	√	√	√		
106	0.1-0.4	Filling	√	√	√	√		√	
A1	0.2	Material							√
107	0.1-0.4	Filling	√	√	√	√		√	
108	0-0.15	Filling	√	√	√	√		√	
Samples collected from the second stage of field work									
106a	0-0.2	Filling						√	
106b	0.1-0.5	Filling						√	
106c	0.1-0.5	Filling						√	
106c	0.7-1.0	Filling						√	
106d	0.4-0.75	Filling						√	
106d	0.9-1.1	Filling						√	
A2	1	Material							√

Notes: BD1-250716 is blind replicate of sample Test Pit 102, depth 0.5-0.8 m.
A1 is fibre-cement sample from Test Pit 106, depth 0.2 m
A2 is fibre-cement sample from Test Pit 106d, depth 1 m.

5.5 Quality Assurance and Quality Control

The field QC procedures for sampling were undertaken as prescribed in Douglas Partners' *Field Procedures Manual.* The results of field QA/QC procedures as well as a discussion of Data Quality Objectives (DQO) and Data Quality Indicators (DQI) for the assessment are provided in Appendix C.

The analytical laboratory, accredited by NATA, is required to conduct in-house QA/QC procedures. These are normally incorporated into every analytical run and include reagent blanks, spike recovery, surrogate recovery and duplicate samples. These results are included in the laboratory certificates in Appendix D and discussed in Appendix C.

6. Site Assessment Criteria

The Site Assessment Criteria (SAC) used in this investigation are sourced from the PSI, except for the criteria used for the assessment of asbestos contamination as a detailed investigation for asbestos was undertaken for this DSI (but not for the PSI).

The SAC (used for a Tier 1 assessment) comprise the investigation and screening levels of Schedule B1, *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC, 2013). The NEPC guidelines are endorsed by the NSW EPA under the CLM Act 1997.

The investigation and screening levels are applicable to generic land use settings and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. Rather, they establish concentrations above which further appropriate investigation (e.g. Tier 2 assessment) should be undertaken. They are intentionally conservative and are based on a reasonable worst-case scenario.

The site is proposed to be used for low density residential use. Therefore, the SAC are investigation levels, screening levels and management limits for a generic residential land use that includes gardens or accessible soil (i.e. the 'Residential A' land use scenario).

6.1 Health Investigation and Screening Levels

The Health Investigation Levels (HIL) and Health Screening Levels (HSL) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential human health risk from chronic exposure to contaminants.

HIL are applicable to assessing health risk arising via all relevant pathways of exposure for a range of metals and organic substances. The HIL are generic to all soil types and apply generally to a depth of 3 m below the surface for residential use.

HSL are applicable to selected petroleum compounds and fractions to assess the risk to human health via the inhalation pathway. The HSL depend on the soil types and depths to contamination.

The generic HIL and HSL are considered to be appropriate for the assessment of contamination at the site. HIL A and HSL A have been adopted as the applicable Tier 1 criteria for the proposed residential land use. As soils at the site primarily comprised silty clay, the most conservative HSL for the clay and silt soil types have been adopted. HSL are for the top 1 m of the soil profile which are more conservative than those for greater depths.

The adopted HIL and HSL are shown in Table 2.

Table 2: HIL and HSL for Soil Contaminants

Contaminant	HIL A (mg/kg)	HSL A for vapour intrusion (mg/kg)
Metals and Inorganics		
Arsenic	100	-
Cadmium	20	-
Chromium (VI)	100	-
Copper	6000	-
Lead	300	-
Mercury (inorganic)	40	-
Nickel	400	-
Zinc	7400	-
TRH		
C6 – C10 (less BTEX)	-	40
>C10-C16 (less Naphthalene)	-	230
BTEX		
Benzene	-	0.6
Toluene	-	390
Ethylbenzene	-	NL
Xylenes	-	95
PAHs		
Benzo(a)pyrene TEQ	3	-
Naphthalene	-	4
Total PAHs	300	-
OCP		
DDT+DDE+DDD	240	-
Aldrin + Dieldrin	6	-
Chlordane	50	-
Endosulfan (total)	270	-
Endrin	10	-
Heptachlor	6	-
HCB	10	-
Methoxychlor	300	-
OPP		
Chlorpyrifos	160	-
Other Organics		
PCBs (non dioxin- like PCB only)	1	-

Note: TEQ is Toxic Equivalency Quotient.

NL is 'Not Limiting'. If the derived soil HSL exceeds the soil saturation concentration, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, the HSL is given as NL.

6.2 Ecological Investigation and Screening Levels

Ecological Investigation Levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

EIL = ABC + ACL,

The adopted EIL which were established for the PSI, are shown in Table 3.

Table 3: Ecological Investigation Levels (EIL)

Analyte		EIL – Urban Residential (mg/kg)
Metals	Arsenic	100
	Copper	85
	Nickel	180
	Chromium III	410
	Lead	1100
	Zinc	350
PAH	Naphthalene	170
OCP	DDT	180

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESL apply to the top 2 m of the soil profile as for EIL.

ESL have been derived in NEPC (2013) for petroleum fractions F1 to F4 as well as BTEX and benzo(a)pyrene. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 4 and are for an urban residential land use scenario. ESL for fine grained soils have been adopted as soils at the site are predominately fine grained (silts and clays).

Table 4: Ecological Screening Levels (ESL)

Analyte		ESL – Urban Residential (mg/kg)
TRH	C6 – C10 [F1] (less BTEX)	180*
	>C10-C16 [F2]	120*
	>C16-C34 [F3]	1300
	>C34-C40 [F4]	5600
BTEX	Benzene	65
	Toluene	105
	Ethylbenzene	125
	Xylenes	45
PAH	Benzo(a)pyrene	0.7

Note: All ESLs are low reliability apart from those marked with * which are moderate reliability

6.3 Management Limits for Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSLs and ESLs, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. The adopted Management Limits, from Table 1B(7), Schedule B1 of NEPC (2013) are shown in Table 5. The following site specific data and assumptions have been used to determine the Management Limits:

- The Management Limits will apply to any depth within the soil profile;
- The Management Limits for a residential land use scenario applies; and
- The Management Limits for fine textured soils has been adopted as the soil types encountered were primarily fine grained (silts and clays).

Table 5: Management Limits

Analyte	Management Limit – Residential (mg/kg)
TRH $C_6 – C_{10}$	800
TRH $>C_{10}$-C_{16}	1000
TRH $>C_{16}$-C_{34}	3500
TRH $>C_{34}$-C_{40}	10000

6.4 Asbestos in Soil

Bonded ACM is the most common form of asbestos contamination across Australia, generally arising from:

- Inadequate removal and disposal practices during demolition of buildings containing asbestos products;
- Widespread dumping of asbestos products and asbestos containing fill on vacant land and development sites; and
- Commonly occurring in historical fill containing unsorted demolition materials.

Mining, manufacturing or distribution of asbestos products may result in sites being contaminated by friable asbestos including free fibres. Severe weathering or damage to bonded ACM may also result in the formation of friable asbestos comprising FA and/or asbestos fines (AF).

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix such as cement or resin, it is not readily made airborne except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

According to Table 7 of Schedule B1 of NEPC (2013), the health screening levels for asbestos contamination in soil for a residential site with minimal garden/accessible soil (Column A) is:

- 0.01 % (w/w) bonded ACM;
- 0.001 % (w/w) friable asbestos (FA and AF); and
- No visible asbestos for surface soil.

7. Field Work Observations and Analytical Results

7.1 Field Observations and Results

Test pit logs are provided in Appendix B.

Test pits for the first stage of soil sampling were excavated on 25 July 2016. Observed filling depths and material types were variable and are summarised as follows:

- At Test Pit 101, a thin layer of red silty clay filling (0.1 m thick) was underlain by brown sand filling with some clay and a trace of sand, concrete fragments and rock fragments. Sandy clay filling (noted as a possible old topsoil horizon) was observed from a depth of 0.3 to 0.5 m;
- At Test Pit 102, brown sand and clay filling to a depth of 0.3 m was underlain by brown sandy clay filling with some rock fragments and a trace of concrete fragments, timber and glass to a depth of 0.8 m. Brown sandy clay filling with some sandstone fragments and tree roots and a trace of hessian was observed from a depth of 0.8 m to 1.5 m;

- At Test Pit 103, brown and grey sand and clay filling with a trace of gravel was observed to a depth of 0.4 m. A piece of tile was observed at a depth of 0.35 m;
- At Test Pit 104 and Test Pit 105, silty clay filling with a trace of sand and rock fragments was observed to depths of 0.2 m and 0.1 m, respectively;
- At Test Pit 106, red-brown and brown silty clay filling with some sand and a trace of rock fragments was observed to a depth of 0.5 m. A piece of concrete and a piece of fibre-cement was observed at a depth of 0.2 m. The piece of fibre-cement, collected as sample 'A1', was approximately 50 mm in diameter and was observed to be in "good condition" (i.e. the fibre-cement could not be easily crumbled by hand). No other pieces of fibre-cement were observed;
- At Test Pit 107, brown silty clay filling was observed to a depth of 0.4 m. A piece of brick and a piece of wire was observed at a depth of 0.3 m; and
- At Test Pit 108, brown silty clay filling with some sand and a trace of rock fragments and plastic was observed to a depth of 0.18 m.

Test pits for the second stage of soil sampling were excavated on 30 August 2016. Observed filling depths and material types were variable and are summarised as follows:

- At Test Pit 106a, brown silty clay filling within some sand and a trace of rock fragments was observed to a depth of 0.2 m;
- At Test Pit 106b, a thin layer of brown silty clay filling with some sand (0.05 m thick) was underlain by brown silty clay filling with a trace of rock fragments, brick, tiles, plastic and concrete fragments to a depth of 0.65 m. Boulder sized concrete fragments were encountered at a depth of 0.3 m to 0.6 m. Dark brown silty clay filling with a trace of rock fragments was encountered at a depth of 0.65 m to 0.8 m and was described as a possible old topsoil horizon;
- At Test Pit 106c, a thin layer of brown sandy silty clay filling (0.08 m thick) was underlain by brown silty clay filling with a trace of rock fragments, plastic, concrete fragments, brick, metal pieces, timber, glass and tree roots; and
- At Test Pit 106d, a thin layer of brown sandy silty clay filling (0.15 m thick) was underlain by brown silty filling which had some concrete fragments and brick fragments and a trace of tile, plastic, glass, cardboard from a depth of 0.4 m Boulder sized concrete fragments were encountered from a depth of 0.7 m. A piece of fibre-cement, collected as sample 'A2', was observed in the sieved sample from a depth of 0.9 to 1.1 m. The piece of fibre-cement was approximately 15 mm in diameter and was observed to be in "good condition". No other pieces of fibre-cement were observed.

Test Pits 106c and 106d were discontinued at depths of 1.1 m and 1.2 m, respectively, due to boulder sized concrete fragments (in filling) that could not be penetrated by the excavator bucket, even after lengthening each test pit.

For the first stage of field work, natural brown, red-brown and grey silty clay was observed beneath filling at all sampling locations except Test Pit 102 where groundwater flooded the pit from a depth of 1 m. The groundwater in this pit appeared to be perched, possibly on natural soil/rock or on buried filling material. Free groundwater was not observed at any of the other test pits.

For the second stage of field work, natural orange-brown and light grey silty clay was observed at Test Pits 106a and 106b. Free groundwater was not observed in any of the test pits.

The results of asbestos screening/sieving conducted in the field are shown in Table 6.

Table 6: Asbestos Sieving/Screening Results

Sample Location (Test Pit)	Sample Depth (m)	Weight of 10 L Bulk Sample (kg)	Number of Fragments >7mm	Weight of ACM (g)	Concentration of asbestos in ACM in soil* (% w/w)
101	0.1-0.3	13.4	0	0	0
102	0.5-0.8	13.5	0	0	0
103	0.2-0.4	13.7	0	0	0
106	0.1-0.4	13.3	1	33.47	**0.038**
107	0.1-0.4	14.1	0	0	0
108	0-0.1	13.8	0	0	0
106a	0-0.2	12.6	0	0	0
106b	0.1-0.5	11.6	0	0	0
106c	0.1-0.5	13.4	0	0	0
106c	0.7-1.0	13.8	0	0	0
106d	0.4-0.75	14.7	0	0	0
106d	0.9-1.1	14.8	1	1.72	0.0017
Health Screening Level for Asbestos in Soil					0.01% (w/w) bonded ACM

Note: *Assumes an asbestos content of 15% in ACM

As shown on Table 6, concentrations of ACM in soil are within the health screening level except for the sample from Test Pit 106, depth 0.1-0.4 m. It is noted that only one piece of fibre-cement (sample A1) was observed in Test Pit 106 which suggests that there is uncertainty as to whether the calculated result of 0.038 % is truly representative of the filling at the site.

No odours were noted whilst sampling in either stage of field work. Replicate soil samples collected in plastic zip lock bags during the first stage of field work were allowed to equilibrate under ambient temperatures before screening for Total Photo-ionisable Compounds (TOPIC) using a calibrated photo-ionisation detector (PID). The PID readings, as shown in the test pit logs in Appendix B, were all <1 ppm indicating a low potential for volatile compounds.

7.2 Laboratory Results

The laboratory certificates of analysis are provided in Appendix D. A summary of results compared to the SAC is shown in Table 7. The table includes results from the PSI.

Table 7: Summary of Results of Soil Analysis (All results in mg/kg unless otherwise stated)

Sample Location (Test Pit) or Sample ID	Sample Depth (m)	Sample Type	Metals								Polycyclic Aromatic Hydrocarbons				Petroleum Hydrocarbons										Organochlorine Pesticides									Organophosphorus Pesticides		Asbestos	
			Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Benzo(a)pyrene	Benzo(a)pyrene TEQ	Naphthalene	Total PAHs	TRH C6-C10 less BTEX	TRH >C10-C16 less Naphthalene	TRH C6-C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylene	DDT	DDT+DDE+DDD	Aldrin + Dieldrin	Chlordane	Endosulfan (total)	Endrin	Heptachlor	HCB	Methoxychlor	Chlorpyriphos	PCBs (total)	FA and AF in 500 mL sample (% w/w)	Asbestos in 40g Sample or Material (detected fibres)
Results from First Stage of Current Investigation (Sampling on 25/7/2016)																																					
101	0.1-0.3	Filling	5	<0.4	14	11	14	<0.1	8	19	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<0.001	-
102	0.5-0.8	Filling	<4	<0.4	12	15	10	<0.1	10	25	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<0.001	-
BD1-250716	0.5-0.8	Filling	6.7	<0.4	13	16	15	<0.05	8.4	27	<0.5	<0.5	<0.5	NIL (+)VE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103	0.2-0.4	Filling	10	<0.4	17	20	17	<0.1	10	36	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<0.001	-
104	0-0.1	Filling	6	<0.4	20	12	16	<0.1	9	43	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
105	0-0.1	Filling	6	<0.4	19	24	20	<0.1	12	46	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
106	0.1-0.4	Filling	5	<0.4	13	14	12	<0.1	9	22	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<0.001	-
A1	0.2	Material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**AD**
107	0.1-0.4	Filling	4	<0.4	14	10	8	<0.1	8	15	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<0.001	-
108	0-0.15	Filling	7	<0.4	20	13	14	<0.1	7	23	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	<0.001	-
Results from Second Stage of Current Investigation (Sampling on 30/8/2016)																																					
106a	0.0-0.2	Filling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-
106b	0.1-0.5	Filling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-
106c	0.1-0.5	Filling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-
106c	0.7-1.0	Filling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-
106d	0.4-0.75	Filling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-
106d	0.9-1.1	Filling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	-
A2	1	Material	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**AD**
Results from PSI (Sampling on 2/6/2016)																																					
1	0.0-0.2	Filling	7	<0.4	18	14	19	<0.1	8	30	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
2	0.0-0.3	Filling	7	<0.4	17	19	16	<0.1	9	30	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
3	0.0-0.3	Filling	5	<0.4	11	20	13	<0.1	10	34	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	NAD
BD2-020616	0.0-0.3	Filling	<4	<0.4	5	18	9	<0.1	4	20	<0.05	<0.5	<0.1	NIL (+)VE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	0.8-0.9	Filling	8	0.7	21	17	28	<0.1	7	120	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
4	0.0-0.1	Filling	<4	<0.4	9	7	10	<0.1	4	24	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
4	0.4-0.5	Natural	7	<0.4	14	19	14	<0.1	6	23	<0.05	<0.5	<0.1	NIL (+)VE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	0.0-0.2	Filling	<4	<0.4	8	8	8	<0.1	13	19	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
5	0.5-0.6	Filling	6	<0.4	15	7	14	<0.1	2	10	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	0.0-0.1	Filling	7	0.5	21	7	15	<0.1	4	13	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
7	0.0-0.1	Filling	8	<0.4	14	12	12	<0.1	4	17	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
7	0.4-0.5	Natural	<4	<0.4	13	11	10	<0.1	2	10	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-
8	0.0-0.1	Filling	7	<0.4	15	12	13	<0.1	3	14	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.7	-	NAD
8 - TRIPLICATE	0.0-0.1	Filling	8	<0.4	11	11	10	<0.1	3	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Site Assessment Criteria																																					
Health Investigation Levels (HIL A)			100	20	100	6000	300	40	400	7400	-	3	-	300	-	-	-	-	-	-	-	-	-	-	-	240	6	50	270	10	6	10	300	160	1	-	-
Health Screening Levels for Vapour Intrusion (HSL A)			-	-	-	-	-	-	-	-	-	-	4	-	40	230	-	-	-	-	0.6	390	NL	95	-	-	-	-	-	-	-	-	-	-	-	-	-
Ecological Investigation Levels (EIL - Residential)			100	-	410	85	1100	-	180	350	-	-	170	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-	-	-	-	-	-	-	-	-	-
Ecological Screening Levels (ESL - Residential)			-	-	-	-	-	-	-	-	0.7	-	-	-	180	-	-	120	1300	5600	65	105	125	45	-	-	-	-	-	-	-	-	-	-	-	-	-
Management Limit (Residential)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	800	1000	3500	10000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Health Screening Level (Residential)			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	-
Adopted Screening Level			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	AD

Notes:

BD1-250716	is blind replicate of sample from Test Pit 102, depth 0.5-0.8 m
A1	is fibre-cement sample from Test Pit 106, depth 0.2 m
A2	is fibre-cement sample from Test Pit 106, depth 1 m
BD2-020616	is blind replicate of sample from Test Pit 3, depth 0 - 0.3 m
8 - TRIPLICATE	is laboratory triplicate of sample from Test Pit 8, depth 0-0.1 m
-	Not tested / Not applicable
TEQ	Toxicity Equivalent Quotient
NL	Not Limiting
NAD	No asbestos detected at limit of reporting (0.1g/kg)
AD	Asbestos detected

8. Discussion

8.1 Analytical Results for Soil

Concentrations of metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) were within the respective HIL and EIL.

Concentrations of TRH, PAH, OCP, OPP and PCB were below the practical quantitation limits and, hence, within the respective HIL, HSL, EIL, ESL and Management Limits.

Asbestos as FA / AF was not reported in the samples submitted to the laboratory for analysis of FA / AF and therefore the reported concentrations were below the FA / AF HSL. However, asbestos was detected in the fibre cement (bonded ACM) samples, A1 (from Test Pit 106) and A2 (from Test Pit 106d).

8.2 ACM and Building Rubble in Soil

As noted in Section 7.1, the calculated concentration of asbestos in ACM in soil (0.038 % w/w) for Test Pit 106, depth 0.1-0.4 m, was based on the inclusion of the one observed piece of ACM (sample A1) in the sieved 10 L sample (as per the method described in NEPC, 2013) and, thus, there was uncertainty as to whether this calculated value was truly representative of the filling at this location. The results for "step-out" sampling (from Test Pits 106a to 106d) did not replicate concentrations of asbestos in ACM in soil above the health screening level and, therefore, it is considered that the calculated value of 0.038 % w/w is not representative of the filling at the site.

Given the results of step-out sampling, the adopted sample density (see Section 5.1), the absence of friable asbestos and that only two pieces of bonded ACM have been observed in a total of 17 test pits (Test Pits 1 to 5, 101 to 108 and 106a to 106d), it is considered that remediation with regards to asbestos in soil is not warranted. It is noted, however, that significant quantities of building rubble (including boulder sized concrete, glass and metal) in filling was observed which may have implications for site development with regards to the geotechnical properties of the filling and the aesthetic quality of the filling. Depending on the nature of the development, the filling should be excavated and "sorted" for geotechnical and aesthetic purposes. It is therefore, recommended that an unexpected finds protocol (UFP) be adopted for excavation works, particularly for the case that ACM is encountered in filling (which could be present in significant quantities between sampling locations). It is also recommended that the top 0.1 m of soil for the development of the site be validated by an environmental consultant as no visible asbestos is to be present in the surface soil (0.1 m thick) according to NEPC (2013). The excavation and sorting of filling and subsequent validation of the surface soil could be undertaken prior to subdivision.

8.3 Conceptual Site Model

Table 8 shows the conceptual site model that was established in the PSI and notes how the 'source-pathway-receptor' linkages have been addressed in this DSI.

Table 8: Conceptual Site Model

Source	Transport Pathway	Receptor	Notes
S1 - Contaminated ground from imported filling or fly tipping	P1 – Ingestion and dermal contact with soil P2 – Inhalation of dust P3 – Inhalation of vapours	R1 – Future site users R2 – Future construction workers and maintenance workers	This detailed investigation has shown that concentrations of potential contaminants are within health-based site assessment criteria except for bonded ACM at Test Pit 106. Step-out sampling in the vicinity of Test Pit 106 has returned results for asbestos in ACM in soil within the health screening levels and, therefore, it is considered that remediation of asbestos in soil is not warranted.
	P2 – Inhalation of dust P3 – Inhalation of vapours	R3 – Adjacent land users	
	P4 – Surface water runoff P6 – Lateral migration of groundwater	R4 – Surface waters	Concentrations of chemical contaminants in soil are low and it is considered that the tested contaminants do not pose a risk to surface waters and groundwater at these concentrations.
	P5 – Leaching of contaminants and vertical migration into groundwater	R5 – Groundwater	
	P7 – Direct contact of contaminated ground	R6 – Terrestrial ecology	This detailed investigation has shown that concentrations of potential contaminants are within ecological-based site assessment criteria. It is considered that further assessment of the potential ecological risk associated with soil is not required.
	P8 – Direct contact of contaminated ground with in ground structures	R7 – In ground building structures	This detailed investigation has shown that concentrations of petroleum hydrocarbons are within Management Limits and, therefore, do not pose a risk to in ground building structures.

9. Conclusions and Recommendations

Concentrations of chemical contaminants and friable asbestos (FA and AF) in soil are within the site assessment criteria. Despite the occurrence (two pieces) of observed ACM in filling, it is considered that remediation with regards to the bonded ACM in soil is not warranted. It is noted, however, that significant quantities of building rubble (including boulder sized concrete, glass and metal) in filling was observed which may have implications for site development with regards to the geotechnical properties of the filling and the aesthetic quality of the filling. Depending on the nature of the development, the filling should be excavated and "sorted" for geotechnical and aesthetic purposes. It is therefore, recommended that an unexpected finds protocol (UFP) be adopted for the case that ACM is encountered in filling (which could be present in significant quantities between sampling locations). It is also recommended that the top 0.1 m of soil for the development of the site be validated by an environmental consultant as no visible asbestos is to be present in the surface soil. The excavation and sorting of filling and subsequent validation of the surface soil could be undertaken prior to subdivision.

Based on the results, it is considered that the site is suitable for the proposed future residential land use from a contamination perspective subject to the adoption of an unexpected finds protocol for excavation works and subsequent validation for the top 0.1 m of soil, where required, as recommended above.

10. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at 73 Swallow Drive, Erskine Park NSW in accordance with DP's proposal dated 1 July 2016, subsequent correspondence and agreed Terms and Conditions of Engagement dated 28 July 2016. This report is provided for the exclusive use of Penrith City Council for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. It is therefore considered possible that hazardous building materials, including asbestos, may be present in untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk.

Douglas Partners Pty Ltd

Appendix A

Drawing

N

Locality Plan

Legend

Site Boundary

Previous Test Pit Location (2/6/2016)

Test Pit Location (26/7/2016)

Test Pit Location (30/8/2016)

Approximate Scale

0 10 m

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Penrith City Council		TITLE: **Location of Site and Test Pits**	PROJECT No:	85512.01
	OFFICE: Sydney	DRAWN BY: DW	**Proposed Rezoning & Sale**	DRAWING No:	1
	SCALE: As shown	DATE: 30 Aug 2016	**73 Swallow Drive, Erskine Park**	REVISION:	0

Appendix B

Test Pit Logs

Notes About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Descriptions

Douglas Partners

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General

- Asphalt
- Road base
- Concrete
- Filling

Soils

- Topsoil
- Peat
- Clay
- Silty clay
- Sandy clay
- Gravelly clay
- Shaly clay
- Silt
- Clayey silt
- Sandy silt
- Sand
- Clayey sand
- Silty sand
- Gravel
- Sandy gravel
- Cobbles, boulders
- Talus

Sedimentary Rocks

- Boulder conglomerate
- Conglomerate
- Conglomeratic sandstone
- Sandstone
- Siltstone
- Laminite
- Mudstone, claystone, shale
- Coal
- Limestone

Metamorphic Rocks

- Slate, phyllite, schist
- Gneiss
- Quartzite

Igneous Rocks

- Granite
- Dolerite, basalt, andesite
- Dacite, epidote
- Tuff, breccia
- Porphyry

Document Set ID: 9893125
Version: 1, Version Date: 28/01/2022

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~69.8m AHD^
EASTING:
NORTHING:

PIT No: 1
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown, silty clay filling with a trace of gravel and roots (possibly reworked natural) - trace of concrete at 0.05m		E*	0.0 – 0.2		PID<1		
	0.25	SILTY CLAY - very stiff, red-brown mottled grey silty clay		E	0.4 – 0.5		PID<1		
	1			E	0.9 – 1.2		PID<1		
	1.3	Pit discontinued at 1.3m - target depth reached							

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)
*BD1-020616 is blind replicate from 0.0-0.2m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~68.7m AHD^
EASTING:
NORTHING:

PIT No: 2
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - brown, silty clay filling with a trace of roots, gravel, cobbles, brick, tile, metal, plastic, timber, glass and concrete		E	0.0 – 0.3		PID<1		
	0.45	SILTY CLAY - very stiff, red-brown mottled grey silty clay		E	0.5 – 0.6		PID<1		
		- possibly filling to 0.7m							
	1			E	0.9 – 1.0		PID<1		1
	1.35	Pit discontinued at 1.35m - target depth reached							

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~69.8m AHD^
EASTING:
NORTHING:

PIT No: 3
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown, silty clay filling with a trace of sandstone fragments, brick and metal		E*	0.0 – 0.3		PID<1		
	0.45	FILLING - brown, silty clay filling		E	0.5		PID<1		
	0.7	FILLING - brown, silty clay filling with a trace of bricks, timber, concrete pieces and plastic		E	0.7				
					0.8 – 0.9		PID<1		
	0.9	Pit discontinued at 0.9m - refusal on boulder sized concrete fragments in filling							
	1								1

Dynamic Penetrometer Test scale: 5, 10, 15, 20

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)
*BD2-020616 is blind replicate from 0.0-0.3m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~72.7m AHD^
EASTING:
NORTHING:

PIT No: 4
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown sandy silty clay filling with a trace of sand and rootlets		E	0.0 – 0.1		PID<1		
	0.15	SILTY CLAY - very stiff, red-brown mottled grey silty clay with a trace of tree roots - possibly reworked to 0.3m		E	0.4 – 0.5		PID<1		
				E	0.9 – 1.0		PID<1		
	1								1
		- some brown shale from 1.2m							
	1.25	Pit discontinued at 1.25m - target depth reached							

Dynamic Penetrometer Test scale: 5, 10, 15, 20

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~72.7m AHD^
EASTING:
NORTHING:

PIT No: 5
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown silty clay filling with some sand and boulder sized concrete and a trace of rootlets, cobbles, gravel and brick		E	0.0–0.2		PID<1		
	0.35	FILLING - brown silty clay filling with a trace of cobbles		E	0.5–0.6		PID<1		
	0.7	SILTY CLAY - very stiff, red-brown mottled grey silty clay with a trace of ironstone gravel		E	0.9–1.0		PID<1		
	1.35	Pit discontinued at 1.35m - target depth reached							

RIG: 3.5 tonne excavator with 300mm bucket
LOGGED: D Walker
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~66.7m AHD^
EASTING:
NORTHING:

PIT No: 6
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - brown silty clay filling with a trace of gravel and rootlets (possibly natural)		E*	0.0 / 0.1		PID<1		
	0.18	SILTY CLAY - very stiff to hard, brown mottled grey silty clay		E	0.4 / 0.5		PID<1		
				E	0.9 / 1.0		PID<1		
1	1.0	Pit discontinued at 1.0m - target depth reached							1

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)
*BD3-020616 is blind replicate from 0.0-0.1m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~67.7m AHD^
EASTING:
NORTHING:

PIT No: 7
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling Type	Sampling Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown, silty clay filling with a trace of gravel (possibly reworked natural)		E	0.0 – 0.1		PID<1		
	0.2	SILTY CLAY - very stiff to hard, red-brown mottled grey silty clay		E	0.4 – 0.5		PID<1		
		- trace of shale from 0.9m		E	0.9 – 1.0		PID<1		
	1								1
	1.1	Pit discontinued at 1.1m							

Dynamic Penetrometer Test scale: 5, 10, 15, 20

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning
LOCATION: 73 and 85 Swallow Drive, Erskine Park

SURFACE LEVEL: ~68.2m AHD^
EASTING:
NORTHING:

PIT No: 8
PROJECT No: 85512.00
DATE: 2/6/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown silty clay filling with a trace of rootlets (possibly natural)		E*	0.0 / 0.1		PID<1		
	0.15	SILTY CLAY - very stiff to hard, brown mottled grey silty clay		E	0.4 / 0.5		PID<1		
		- trace of shale from 0.9m		E	0.9 / 1.0		PID<1		
	1.1	Pit discontinued at 1.1m - target depth reached							

RIG: 3.5 tonne excavator with 300mm bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed whilst excavating

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)
*BD4-020616 is blind replicate from 0.0-0.1m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~68.7m AHD^
EASTING: 296457
NORTHING: 6256840

PIT No: 101
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - red silty clay filling with a trace of rootlets		E	0.0 – 0.05		PID<1		
	0.1	FILLING - brown sand filling with some clay and a trace of sand, concrete fragments and rock fragments		E	0.1		PID<1		
	0.3	FILLING - grey sandy clay filling with a trace of roots (possible old topsoil horizon)		E	0.3		PID<1		
	0.5	SILTY CLAY - stiff, red mottled grey silty clay with a trace of ironstone gravel			0.5				
				E	0.8 – 0.9		PID<1		
1	1.0	Pit discontinued at 1.0m - target depth reached							1

RIG: 3.5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~69.4m AHD^
EASTING: 296453
NORTHING: 6256863

PIT No: 102
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling Type	Sampling Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown sand and clay filling - trace of rootlets at 0.0-0.1m		E	0.0 - 0.2		PID<1		
	0.3	FILLING - brown sandy clay filling with some rock fragments and a trace of concrete fragments, timber and glass		E*	0.5 - 0.8		PID<1		
	0.8	FILLING - brown sandy clay filling with some sandstone fragments and tree roots and a trace of hessian		E	1.0 - 1.2		PID<1	▼ (1.0)	
	1.5	Pit discontinued at 1.5m - Test pit inundated with water							

RIG: 3.5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016). *BD1-250716 is blind replicate of sample from 0.5-0.8m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~69.3m AHD^
EASTING: 296472
NORTHING: 6256867

PIT No: 103
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - brown and grey sand and clay filling with a trace of gravel - rootlets at 0.0-0.1m - a piece of tile at 0.35m		E	0.0		PID<1		
				E	0.2		PID<1		
	0.4	SILTY CLAY - stiff to very stiff, red mottled grey silty clay with a trace of ironstone gravel - possibly reworked to 0.6m			0.4				
				E	0.6		PID<1		
					0.9				
	1								1
	1.1	Pit discontinued at 1.1m - target depth reached							

RIG: 3.5 tonne excavator with 300mm wide bucket
LOGGED: D Walker
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.8m AHD^
EASTING: 296458
NORTHING: 6256883

PIT No: 104
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - red-brown silty clay filling with a trace of sand, rock fragments and rootlets		E*	0.0–0.1		PID<1		
	0.2	SILTY CLAY - very stiff, mottled grey silty clay with a trace of roots and shale fragments		E	0.3–0.4		PID<1		
				E	0.7–0.9		PID<1		
	0.9	Pit discontinued at 0.9m - target depth reached							

RIG: 3.5 tonne excavator with 300mm wide bucket
LOGGED: D Walker
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016). *BD2-250716 is blind replicate of sample from 0.0-0.1m

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~71.3m AHD^
EASTING: 296439
NORTHING: 6256882

PIT No: 105
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - brown silty clay filling with a trace of sand, rock fragments and rootlets		E	0.0		PID<1		
	0.1				0.1				
		SILTY CLAY - stiff to very stiff, brown mottled grey silty clay with a trace of shale fragments		E	0.3		PID<1		
					0.4				
	0.7	Pit discontinued at 0.7m - target depth reached							
	1								1

RIG: 3.5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.6m AHD^
EASTING: 296442
NORTHING: 6256870

PIT No: 106
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown silty clay filling with some sand and a trace of rock fragments - some rootlets at 0.0-0.1m - a piece of concrete at 0.2m - a piece of fibre-cement at 0.2m		E	0.0–0.1		PID<1		
				E	0.1–0.4		PID<1 A1 is fibre-cement sample from 0.2m		
	0.5	SILTY CLAY - very stiff to hard, brown mottled grey silty clay with a trace of ironstone gravel - trace of rootlets at 0.5m to 0.7m - possibly reworked from 0.5m to 0.7m		E	0.6–0.7		PID<1		
	1								
				E	1.1–1.3		PID<1		
	1.3	Pit discontinued at 1.3m - target depth reached							

RIG: 3.5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.9m AHD^
EASTING: 296439
NORTHING: 6256876

PIT No: 106a
PROJECT No: 85512.01
DATE: 30/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - brown silty clay filling with some sand and a trace of rock fragments and rootlets		E	0.0 – 0.2				
	0.2	SILTY CLAY - very stiff, mottled orange-brown and light grey silty clay with a trace of fine sand		E	0.5 – 0.6				
	0.7	Pit discontinued at 0.7m - target depth reached							
	1								1

RIG: 5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.6m AHD^
EASTING: 296434
NORTHING: 6256867

PIT No: 106b
PROJECT No: 85512.01
DATE: 30/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.05	FILLING - brown silty clay filling with some sand and rootlets							
		FILLING - brown silty clay filling with trace of rock fragments, brick, tiles, plastic and concrete fragments - boulder sized concrete at 0.3m to 0.6m		E	0.1 0.5				
	0.65	FILLING - dark brown silty clay filling with a trace of rock fragments and rootlets (possible old topsoil horizon)		E	0.7 0.8				
	0.8	SILTY CLAY - very stiff, orange-brown mottled light grey silty clay		E	0.9 1.0				
	1								1
	1.2	Pit discontinued at 1.2m - target depth reached							

RIG: 5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~69.9m AHD^
EASTING: 296442
NORTHING: 6256863

PIT No: 106c
PROJECT No: 85512.01
DATE: 30/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown sandy silty clay filling with a trace of rootlets							
	0.08	FILLING - brown silty clay filling with a trace of rock fragments, plastic, concrete fragments, brick, metal pieces, timber, glass and tree roots		E	0.1 – 0.5				
				E	0.7 – 1.0				
	1.1	Pit discontinued at 1.1m - refusal on boulder sized concrete fragments in filling							

RIG: 5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.6m AHD^
EASTING: 296447
NORTHING: 6256869

PIT No: 106d
PROJECT No: 85512.01
DATE: 30/8/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown sandy silty clay filling with a trace of rootlets							
	0.15	FILLING - brown silty clay filling with a trace of rock fragments							
		- some concrete fragments and brick fragments and a trace of tile, plastic, glass and cardboard from 0.4m		E	0.4 – 0.75				
		- boulder sized concrete fragments from 0.7m							
	1	- a piece of fibre cement at 1.0m		E	0.9 – 1.0 – 1.1		A2 is fibre cement sample from 1.0m		1
	1.2	Pit discontinued at 1.2m - refusal on boulder sized concrete fragments							

RIG: 5 tonne excavator with 300mm wide bucket **LOGGED:** D Walker **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.9m AHD^
EASTING: 296426
NORTHING: 6256869

PIT No: 107
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - brown silty clay filling with a trace of sand and rock fragments - trace of rootlets at 0.0-0.1m - piece of brick at 0.3m - piece of wire at 0.3m		E	0.0 – 0.1		PID<1 (0.0), PID<1 (0.1)		
				E	0.1 – 0.4				
	0.4	SILTY CLAY - stiff to very stiff, red-brown mottled grey silty clay - possibly reworked to 0.6m			0.4				
				E	0.5 – 0.7		PID<1 (0.5)		
	0.9	Pit discontinued at 0.9m - target depth reached							

Depth scale: 1

Dynamic Penetrometer Test scale: 5, 10, 15, 20

RIG: 3.5 tonne excavator with 300mm wide bucket
LOGGED: D Walker
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Penrith City Council
PROJECT: Proposed Rezoning & Sale
LOCATION: 73 Swallow Drive, Erskine Park

SURFACE LEVEL: ~70.1m AHD^
EASTING: 296429
NORTHING: 6256851

PIT No: 108
PROJECT No: 85512.01
DATE: 25/7/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - brown silty clay filling with some sand and a trace of rock fragments and plastic		E	0.0 – 0.15		PID<1		
	0.18	SILTY CLAY - stiff to very stiff, red-brown mottled grey silty clay with a trace of tree roots		E	0.4 – 0.5		PID<1		
	0.8	Pit discontinued at 0.8m - target depth reached							
	1								1

RIG: 3.5 tonne excavator with 300mm wide bucket
LOGGED: D Walker
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Interpolated from contour plan provided by client (dated 30 May 2016)

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix C

QA/QC Procedures and Results

QA/QC PROCEDURES AND RESULTS

Q1. Data Quality Objectives

The Detailed Site Investigation has been devised broadly in accordance with the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC 2013). The DQO process is outlined as follows:

- Stating the Problem;
- Identifying the Decision;
- Identifying Inputs to the Decision;
- Defining the Boundary of the Assessment;
- Developing a Decision Rule;
- Specifying Acceptable Limits on Decision Errors; and
- Optimising the Design for Obtaining Data.

The DQOs have been addressed within the report as shown in Table Q1.

Table Q1: Data Quality Objectives

Data Quality Objective	Report Section Where Addressed
State the Problem	S1 Introduction
Identify the Decision	S8 Discussion S9 Conclusion
Identify Inputs to the Decision	S1 Introduction S4 Summary of PSI S6 Site Assessment Criteria S7 Field Work Observations and Analytical Results
Define the Boundary of the Assessment	S3 Site Identification and Description
Develop a Decision Rule	S6 Site Assessment Criteria
Specify Acceptable Limits on Decision Errors	S5 Field Work, Analysis and QA/QC
Optimise the Design for Obtaining Data	S2 Scope of Works S5 Field Work, Analysis and QA/QC

Q2. FIELD QUALITY ASSURANCE AND QUALITY CONTROL

The field QC procedures for sampling as prescribed in Douglas Partners' *Field Procedures Manual* were followed at all times during the assessment.

Q2.1 Sampling Team

Field sampling was undertaken by a DP Environmental Engineer, David Walker who has completed DP's in-house Asbestos Competency Programme and is therefore appointed by DP as a Competent Person to conduct assessment of asbestos in soil.

Sampling was undertaken on 25 July 2016 and 30 August 2016. Sampling was undertaken during cool to warm and sunny weather conditions.

Q2.2 Sample Collection

Soil samples were collected from excavator bucket returns or from the sides of the test pit. Further details of the sampling methodology is presented in Section 5 of the report.

Q2.3 Logs

Logs for each soil sampling location were recorded in the field. The individual samples were recorded on the field logs along with the sample identity, location, depth, initials of sampler and replicate locations.

Q2.4 Decontamination

Samples were collected using disposal gloves between each sampling event. Stainless steel sampling equipment was not used, and therefore, decontamination of sampling equipment was not required.

Q2.5 Chain of Custody

Chain of custody information was recorded on the Chain-of-Custody (COC) sheets and accompanied samples to the analytical laboratory.

Q2.6 Replicate Samples

Replicate samples were collected in the field for the first stage of field work as a measure of accuracy, precision and repeatability of the results.

Field replicate samples for soil were collected from the same location and an identical depth to the primary sample. Equal portions of the primary sample were placed into the sampling jars and sealed. The sample was split to prevent the loss of volatiles from the soil but not homogenised in a bowl. Replicate samples were labelled with a DP identification number, recorded on DP's test pit logs, so as to conceal their relationship to their primary sample from the analytical laboratory.

A measure of the consistency of results for field samples is derived by the calculation of relative percentage differences (RPDs) for replicate samples. A RPD of 30% is generally considered typically acceptable for inorganic analytes by NSW EPA, although in general a wider RPD range (50%) may be acceptable for organic analytes. RPDs have only been considered where a concentration is greater than five times the PQL.

Replicate samples were collected at a rate of approximately one replicate sample for every ten primary samples collected.

An inter-laboratory replicate was analysed as a check of the reproducibility of results between the primary laboratory (Envirolab Services) and the second laboratory (Eurofins mgt) and as a measure of consistency of sampling techniques. The comparative results of analysis between original and replicate sample is summarised in Table Q2.

Table Q2: Inter-laboratory Results

Analyte	Primary Sample [Test Pit 102, depth 0.5-0.8 m] Concentration (mg/kg)	Replicate Sample [BD1-250716] Concentration (mg/kg)	Difference (mg/kg)	RPD (%)
Arsenic	<4	6.7	2.7	50
Cadmium	<0.4	<0.4	0	0
Chromium	12	13	1	8
Copper	15	16	1	6
Lead	10	15	5	40
Mercury	<0.1	<0.05	0	0
Nickel	10	8.4	1.6	17
Zinc	25	27	2	4
All PAHs	NIL (+)VE	NIL (+)VE	0	0

The calculated RPD values were within the acceptable range including those above 30 % given that the concentrations were less than five times the PQL.

Overall, the inter-laboratory comparisons indicate that the sampling technique was consistent and that the primary laboratory results are repeatable and therefore the results are useable and representative of the conditions encountered.

Q2.7 Field Instrument Calibration

The photoionisation detector (PID) was calibrated and serviced at Active Environmental Solutions on 23 March 2016 and prior to the first stage of field work using isobutylene gas.

Q3. LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL

Q3.1 Holding Times

A review of the laboratory certificates of analysis and chain-of-custody documentation indicated that holding times were met as summarised in Table Q3.

Table Q3: Holding Times for Soil Samples

Analyte	Recommended maximum holding time	Holding time met
Metals	6 months	Yes
TRH C_6-C_9	14 days	Yes
TRH C_{10}-C_{36}	14 days	Yes
BTEX	14 days	Yes
PAH	14 days	Yes
OCP	14 days	Yes
OPP	14 days	Yes
PCB	14 days	Yes

Q3.2 Analytical Laboratories

Envirolab Services Pty Ltd is NATA accredited for the analysis undertaken except for analysis for asbestos in 500 mL soil samples. The analytical method for asbestos in 500 mL samples was that as described in in NEPC (2013) and is considered to be suitable for this investigation.

Eurofins mgt is NATA accredited for the analysis undertaken.

Q3.3 Analytical Methods

The laboratory analytical methods are provided on the laboratory certificates of analysis.

Q3.4 Results of Laboratory QA/QC Procedures

The following QA/QC procedures were conducted by the laboratories. The results are included in the laboratory certificates of analysis.

Q3.4.1 Surrogate Spike

This sample is prepared by adding a known amount of surrogate, which behaves similarly to the analyte, prior to analysis of each sample. The recovery result indicates the proportion of the known concentration of the surrogate that is detected during analysis. These results are within acceptance limits as specified by the laboratories indicating that the extraction technique was effective.

Q3.4.2 Practical Quantitation Limits (PQL)

The PQL is the lowest quantity of an analyte which can be measured with a high degree of confidence that the analyte is present at or above that concentration. PQL at different analytical laboratories can differ based on the analytical techniques.

Q3.4.3 Reference and Daily Check Sample Results – Laboratory Control Sample (LCS)

This sample comprises spiking either a standard reference material or a control matrix (such as a blank of sand or water) with a known concentration of specific analytes. The LCS is then analysed and the results are compared against each other to determine how the laboratory has performed with regard to sample preparation and analytical procedure. LCS are analysed at a frequency of 1 in 20, with a minimum of one analysed per batch. The laboratory QC for LCS was within the acceptance standards.

Q3.4.4 Laboratory Replicate Results

These are additional portions of a sample which are analysed in exactly the same manner as all other samples. The laboratory acceptance criteria for replicate samples is: in cases where the level is <5xPQL – any RPD is acceptable; and in cases where the level is >5xPQL – a 30% or 50% RPD is acceptable depending on the analyte. RPDs were within the acceptance standards set by the laboratories.

Q3.4.5 Laboratory Blank Results

The laboratory blank, sometimes referred to as the method blank or reagent blank is the sample prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus. This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, it can be determined by processing solvents and reagents in exactly the same manner as for samples. Laboratory blanks are typically analysed at a frequency of 1 in 20, with a minimum of one per batch. The laboratory QC for method blanks was within the acceptance standards.

Q3.4.6 Matrix Spike

This is a sample replicate prepared by adding a known amount of analyte prior to analysis, and then treated exactly the same as all other samples. The recovery result indicates the proportion of the known concentration of the analyte that is detected during analysis. The laboratory acceptance criteria for matrix spike samples is generally 70-130% for inorganic/metals and 60-140% for organics.

Recorded matrix spike results were within the acceptance standards except for some PAH spike recovery results in sample S16-JI22896 (laboratory certificate 509541-S). It was noted that an acceptable recovery was obtained for the laboratory control sample indicating sample matrix interference.

Q3.4.7 Overall Laboratory QA/QC

It is considered that an acceptable level of laboratory precision and consistency was achieved and that surrogate spikes, LCS, laboratory replicate results, method blanks and matrix spike results were of an acceptable level overall. On the basis of this assessment, the laboratory data sets are considered to be reliable and useable for this assessment.

Q4. QA/QC DATA EVALUATION

Field and laboratory procedures were assessed against the following data quality indicators (DQIs):

- Completeness – a measure of the amount of usable data from a data collection activity;
- Comparability – the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness – the confidence (qualitative) of data representativeness of media present on-site;
- Precision – a measure of variability or reproducibility of data; and
- Accuracy – a measure of closeness of the data to the 'true' value.

The DQIs were assessed as outlined in Table Q4.

Table Q4: DQI Assessment

DQI	Considerations as specified in NEPM Schedule B2	Comment
Completeness		
Field Considerations	All critical locations sampled	All critical locations sampled in accordance with the proposals.
	All samples collected (from grid and at depth)	Approximate grid based soil sampling has been used to provide coverage of the site. Some targeted and step out sampling was also undertaken where building rubble was observed.
	Standard operating practices (SOPs) appropriate and complied with	Field staff followed SOPs as defined in the DP *Field Procedures Manual.*
	Experienced sampler	DP environmental engineer with more than *7* years experience undertook the sampling.
	Documentation correct	Field staff followed SOPs as defined in the DP *Field Procedures Manual.* Documentation reviewed and signed off by project reviewer.
Laboratory Considerations	All critical samples analysed according to the proposal and site information	All critical samples analysed according to the proposals and site information.

DQI	Considerations as specified in NEPM Schedule B2	Comment
	All analytes analysed according to proposals	All analytes analysed according to the proposals. Any variation has been recorded in the report.
	Appropriate methods and PQLs/LOR	NATA approved methods have been adopted except for the majority of asbestos analysis where the NEPC (2013) method was used. Limits of reporting (LORs) and practical quantitation limits (PQLs) in accordance with the method have been used by the contract laboratory.
	Sample Documentation complete	Chain-of-custody (CoC) maintained and appended to the Certificates of Analysis. All Certificates of Analysis are complete and appended to the report.
	Sample holding times complied with	Sample holding times complied with the NATA accredited Laboratory.
Comparability		
Field Considerations	Same SOPs used on each occasion	Field staff followed SOPs sampling as defined in the DP *Field Procedures Manual*
	Experienced sampler	DP environmental engineer with more than *7* years experience undertook the sampling.
	Climatic conditions	Field staff recorded the climatic conditions at the time of sampling
	Same types of samples collected	Field staff followed SOPs as defined in the DP *Field Procedures Manual* and sampling regime defined in the proposal.
Laboratory Considerations	Sample analytical methods used	Laboratories used are accredited by NATA for the analyses undertaken except for the majority of asbestos analysis where the NEPC (2013) method was used. Laboratory methods are as stated on the Certificates of Analysis

DQI	Considerations as specified in NEPM Schedule B2	Comment
	Sample PQLs / LORs	PQL or LOR set by the laboratories are below the adopted site criteria or indicate across-the-board lack of detection.
	Same laboratories	Envirolab Services Pty Ltd was used for all primary sample analysis. Eurofins mgt was used for replicate analysis.
	Same units	All laboratory results are expressed in consistent units for each media type.
Representativeness		
Field Considerations	Appropriate media sampled according to the proposals	Appropriate media were sampled in accordance with the proposals
	All media identified in proposals sampled	All media identified in proposals were sampled.
Laboratory Considerations	All samples analysed according to the proposals	All samples analysed according to proposal
Precision		
Field Considerations	SOPs appropriate and complied with	Field staff followed SOPs as defined in the DP *Field Procedures Manual*
Laboratory Considerations	Analysis of: 1) intra-laboratory replicates 2) field duplicates	Laboratory acceptance limits are: 1) Average relative percentage difference (RPD) result <5 times PQL/LOR, no limit; results >5 times PQL/LOR, 30% or 50% depending on analyte 2) Average relative percentage difference (RPD) result <5 times PQL/LOR, no limit; results >5 times PQL/LOR, 30% or 50% depending on analyte

DQI	Considerations as specified in NEPM Schedule B2	Comment
Accuracy (bias)		
Field Considerations	SOPs Appropriate and complied with	Field staff to follow SOPs as defined in the DP *Field Procedures Manual*
Laboratory Considerations	Analysis of: 1) field blanks 2) reagent blank/method blank 3) matrix spike 4) surrogate spike 5) reference material 6) laboratory control sample	Laboratory acceptance limits are 1) Concentrations of analytes are <PQL/LOR 2) Results are within acceptance limits as specified by the laboratory *(recovery usually within 60-140%).* 3) Results are within acceptance limits as specified by the laboratory *(recovery within 70-130% for inorganics and 60-140% for organics)* or otherwise accepted where there has been sample matrix interference. 4) Results are within acceptance limits as specified by the laboratory (recovery within 70-130% for inorganics and 60-140% for organics). 5) Analysis within the acceptable limits of the certificate of analysis for the reference material. These results are generally not contained in the certificate of analysis. 6) Results are within acceptance limits as specified by the laboratory (recovery within 70-130% for inorganics and 60-140% for organics).

Based on the above, it is considered that the DQIs have been complied with. As such, it is concluded that the field and laboratory test data obtained are reliable and useable for this assessment.

Appendix D

Laboratory Certificates

Chain of Custody Documentation

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

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

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

CERTIFICATE OF ANALYSIS 150745

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: David Walker

Sample log in details:

Your Reference:	**85512.01, Erskine Park**
No. of samples:	8 Soils 1 Material
Date samples received / completed instructions received	26/07/16 / 26/07/16

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

Report Details:

Date results requested by: / Issue Date:	2/08/16 / 2/08/16
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

[redacted]

David Springer
General Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-4	150745-5
Your Reference	-------------	101	102	103	104	105
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	27/07/2016	27/07/2016	27/07/2016	27/07/2016	27/07/2016
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	93	95	94	90	91

vTRH(C6-C10)/BTEXN in Soil				
Our Reference:	UNITS	150745-6	150745-7	150745-8
Your Reference	-------------	106	107	108
Depth	------------	0.1-0.4	0.1-0.4	0-0.15
Date Sampled		25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	27/07/2016	27/07/2016	27/07/2016
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	93	94	90

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-4	150745-5
Your Reference	-------------	101	102	103	104	105
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	27/07/2016	27/07/2016	27/07/2016	27/07/2016	27/07/2016
TRHC $_{10}$ - C $_{14}$	mg/kg	<50	<50	<50	<50	<50
TRHC $_{15}$ - C $_{28}$	mg/kg	<100	<100	<100	<100	<100
TRHC $_{29}$ - C $_{36}$	mg/kg	<100	<100	<100	<100	<100
TRH>C $_{10}$-C $_{16}$	mg/kg	<50	<50	<50	<50	<50
TRH>C $_{10}$ - C $_{16}$ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH>C $_{16}$-C $_{34}$	mg/kg	<100	<100	<100	<100	<100
TRH>C $_{34}$-C $_{40}$	mg/kg	<100	<100	<100	<100	<100
Surrogate o-Terphenyl	%	92	94	93	93	94

svTRH (C10-C40) in Soil				
Our Reference:	UNITS	150745-6	150745-7	150745-8
Your Reference	-------------	106	107	108
Depth	------------	0.1-0.4	0.1-0.4	0-0.15
Date Sampled		25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	27/07/2016	27/07/2016	27/07/2016
TRHC $_{10}$ - C $_{14}$	mg/kg	<50	<50	<50
TRHC $_{15}$ - C $_{28}$	mg/kg	<100	<100	<100
TRHC $_{29}$ - C $_{36}$	mg/kg	<100	<100	<100
TRH>C $_{10}$-C $_{16}$	mg/kg	<50	<50	<50
TRH>C $_{10}$ - C $_{16}$ less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH>C $_{16}$-C $_{34}$	mg/kg	<100	<100	<100
TRH>C $_{34}$-C $_{40}$	mg/kg	<100	<100	<100
Surrogate o-Terphenyl	%	93	92	93

PAHs in Soil						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-4	150745-5
Your Reference	------------- -	101	102	103	104	105
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	95	103	98	96	101

PAHs in Soil				
Our Reference:	UNITS	150745-6	150745-7	150745-8
Your Reference	-------------	106	107	108
Depth	------------	0.1-0.4	0.1-0.4	0-0.15
Date Sampled		25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Total Positive PAHs	mg/kg	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	101	93	94

Organochlorine Pesticides in soil						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-4	150745-5
Your Reference	-------------	101	102	103	104	105
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	91	89	92	93	91

Organochlorine Pesticides in soil				
Our Reference:	UNITS	150745-6	150745-7	150745-8
Your Reference	-------------	106	107	108
Depth	------------	0.1-0.4	0.1-0.4	0-0.15
Date Sampled		25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016
HCB	mg/kg	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	90	90	92

Document Set ID: 9893125
Version: 1, Version Date: 28/01/2022

Organophosphorus Pesticides Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- --------------	150745-1 101 0.1-0.3 25/07/2016 Soil	150745-2 102 0.5-0.8 25/07/2016 Soil	150745-3 103 0.2-0.4 25/07/2016 Soil	150745-4 104 0-0.1 25/07/2016 Soil	150745-5 105 0-0.1 25/07/2016 Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	91	89	92	93	91

Organophosphorus Pesticides Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- --------------	150745-6 106 0.1-0.4 25/07/2016 Soil	150745-7 107 0.1-0.4 25/07/2016 Soil	150745-8 108 0-0.15 25/07/2016 Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	90	90	92

PCBs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- ------------	150745-1 101 0.1-0.3 25/07/2016 Soil	150745-2 102 0.5-0.8 25/07/2016 Soil	150745-3 103 0.2-0.4 25/07/2016 Soil	150745-4 104 0-0.1 25/07/2016 Soil	150745-5 105 0-0.1 25/07/2016 Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	91	89	92	93	91

PCBs in Soil Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ------------- ------------	150745-6 106 0.1-0.4 25/07/2016 Soil	150745-7 107 0.1-0.4 25/07/2016 Soil	150745-8 108 0-0.15 25/07/2016 Soil
Date extracted	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1
Surrogate TCLMX	%	90	90	92

Acid Extractable metals in soil						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-4	150745-5
Your Reference	-------------	101	102	103	104	105
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Arsenic	mg/kg	5	<4	10	6	6
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	14	12	17	20	19
Copper	mg/kg	11	15	20	12	24
Lead	mg/kg	14	10	17	16	20
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	8	10	10	9	12
Zinc	mg/kg	19	25	36	43	46

Acid Extractable metals in soil				
Our Reference:	UNITS	150745-6	150745-7	150745-8
Your Reference	-------------	106	107	108
Depth	------------	0.1-0.4	0.1-0.4	0-0.15
Date Sampled		25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil
Date prepared	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	26/07/2016	26/07/2016	26/07/2016
Arsenic	mg/kg	5	4	7
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	13	14	20
Copper	mg/kg	14	10	13
Lead	mg/kg	12	8	14
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	9	8	7
Zinc	mg/kg	22	15	23

Moisture						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-4	150745-5
Your Reference	------------- -	101	102	103	104	105
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/07/2016	26/07/2016	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	27/07/2016	27/07/2016	27/07/2016	27/07/2016	27/07/2016
Moisture	%	14	14	18	16	18

Moisture				
Our Reference:	UNITS	150745-6	150745-7	150745-8
Your Reference	------------- -	106	107	108
Depth	------------	0.1-0.4	0.1-0.4	0-0.15
Date Sampled		25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil
Date prepared	-	26/07/2016	26/07/2016	26/07/2016
Date analysed	-	27/07/2016	27/07/2016	27/07/2016
Moisture	%	15	16	18

Asbestos ID - materials		
Our Reference:	UNITS	150745-9
Your Reference	-------------	A1
Depth	------------	-
Date Sampled		25/07/2016
Type of sample		material
Date analysed	-	27/07/2016
Mass / Dimension of Sample	-	60x45x6mm
Sample Description	-	Grey fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected

Asbestos ID - soils			
Our Reference:	UNITS	150745-4	150745-5
Your Reference	-------------	104	105
Depth	------------	0-0.1	0-0.1
Date Sampled		25/07/2016	25/07/2016
Type of sample		Soil	Soil
Date analysed	-	27/07/2016	27/07/2016
Sample mass tested	g	Approx. 55g	Approx. 55g
Sample Description	-	Brown clayey soil	Brown clayey soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected

Asbestos ID - soils NEPM						
Our Reference:	UNITS	150745-1	150745-2	150745-3	150745-6	150745-7
Your Reference	-------------	101	102	103	106	107
Depth	------------	0.1-0.3	0.5-0.8	0.2-0.4	0.1-0.4	0.1-0.4
Date Sampled		25/07/2016	25/07/2016	25/07/2016	25/07/2016	25/07/2016
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	28/07/2016	28/07/2016	28/07/2016	28/07/2016	28/07/2016
Sample mass tested	g	845.74	628.9	715.11	702.99	627.38
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (as per AS4964)	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
ACM >7mm Estimation*	g	0.0000	0.0000	0.0000	0.0000	0.0000
FA and AF Estimation*	g	0.0000	0.0000	0.0000	0.0000	0.0000
FA and AF Estimation*[#2]	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001

Asbestos ID - soils NEPM		
Our Reference:	UNITS	150745-8
Your Reference	-------------	108
Depth	------------	0-0.15
Date Sampled		25/07/2016
Type of sample		Soil
Date analysed	-	28/07/2016
Sample mass tested	g	839.74
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil (as per AS4964)	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	Not applicable
ACM >7mm Estimation*	g	0.0000
FA and AF Estimation*	g	0.0000
FA and AF Estimation*[#2]	%(w/w)	<0.001

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'TEQ PQL' values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'TEQ zero' values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'TEQ half PQL' values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 deg C for a minimum of 12 hours.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres.

Method ID	Methodology Summary
	Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			27/07/2016	150745-1	27/07/2016 || 27/07/2016	LCS-4	27/07/2016
TRHC_6 - C_9	mg/kg	25	Org-016	<25	150745-1	<25 || <25	LCS-4	107%
TRHC_6 - C_{10}	mg/kg	25	Org-016	<25	150745-1	<25 || <25	LCS-4	107%
Benzene	mg/kg	0.2	Org-016	<0.2	150745-1	<0.2 || <0.2	LCS-4	111%
Toluene	mg/kg	0.5	Org-016	<0.5	150745-1	<0.5 || <0.5	LCS-4	100%
Ethylbenzene	mg/kg	1	Org-016	<1	150745-1	<1 || <1	LCS-4	108%
m+p-xylene	mg/kg	2	Org-016	<2	150745-1	<2 || <2	LCS-4	109%
o-Xylene	mg/kg	1	Org-016	<1	150745-1	<1 || <1	LCS-4	106%
naphthalene	mg/kg	1	Org-014	<1	150745-1	<1 || <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	97	150745-1	93 || 95 || RPD: 2	LCS-4	97%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			27/07/2016	150745-1	27/07/2016 || 27/07/2016	LCS-4	27/07/2016
TRHC_{10} - C_{14}	mg/kg	50	Org-003	<50	150745-1	<50 || <50	LCS-4	119%
TRHC_{15} - C_{28}	mg/kg	100	Org-003	<100	150745-1	<100 || <100	LCS-4	116%
TRHC_{29} - C_{36}	mg/kg	100	Org-003	<100	150745-1	<100 || <100	LCS-4	102%
TRH>C_{10}-C_{16}	mg/kg	50	Org-003	<50	150745-1	<50 || <50	LCS-4	119%
TRH>C_{16}-C_{34}	mg/kg	100	Org-003	<100	150745-1	<100 || <100	LCS-4	116%
TRH>C_{34}-C_{40}	mg/kg	100	Org-003	<100	150745-1	<100 || <100	LCS-4	102%
Surrogate o-Terphenyl	%		Org-003	97	150745-1	92 || 93 || RPD: 1	LCS-4	80%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Naphthalene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	LCS-4	106%
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	LCS-4	128%
Phenanthrene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	LCS-4	110%
Anthracene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	LCS-4	106%
Pyrene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	LCS-4	116%
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	LCS-4	97%
Benzo(b,j+k) fluoranthene	mg/kg	0.2	Org-012	<0.2	150745-1	<0.2 || <0.2	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	150745-1	<0.05 || <0.05	LCS-4	104%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	102	150745-1	95 || 96 || RPD: 1	LCS-4	105%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
HCB	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	94%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	111%
Heptachlor	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	108%
delta-BHC	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	109%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	109%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	120%
Dieldrin	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	115%
Endrin	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	113%
pp-DDD	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	117%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	LCS-4	117%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	93	150745-1	91 || 89 || RPD: 2	LCS-4	86%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	94%
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Diazinon	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	98%
Dimethoate	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	98%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	104%
Malathion	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	101%
Parathion	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	100%
Ronnel	mg/kg	0.1	Org-008	<0.1	150745-1	<0.1 || <0.1	LCS-4	98%
Surrogate TCMX	%		Org-008	93	150745-1	91 || 89 || RPD: 2	LCS-4	92%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	LCS-4	115%
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	150745-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	93	150745-1	91 || 89 || RPD: 2	LCS-4	92%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Date analysed	-			26/07/2016	150745-1	26/07/2016 || 26/07/2016	LCS-4	26/07/2016
Arsenic	mg/kg	4	Metals-020	<4	150745-1	5 || 5 || RPD: 0	LCS-4	105%
Cadmium	mg/kg	0.4	Metals-020	<0.4	150745-1	<0.4 || <0.4	LCS-4	105%
Chromium	mg/kg	1	Metals-020	<1	150745-1	14 || 13 || RPD: 7	LCS-4	104%
Copper	mg/kg	1	Metals-020	<1	150745-1	11 || 12 || RPD: 9	LCS-4	105%
Lead	mg/kg	1	Metals-020	<1	150745-1	14 || 12 || RPD: 15	LCS-4	100%
Mercury	mg/kg	0.1	Metals-021	<0.1	150745-1	<0.1 || <0.1	LCS-4	111%
Nickel	mg/kg	1	Metals-020	<1	150745-1	8 || 7 || RPD: 13	LCS-4	98%
Zinc	mg/kg	1	Metals-020	<1	150745-1	19 || 23 || RPD: 19	LCS-4	101%

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	27/07/2016
TRH C_6 - C_9	mg/kg	[NT]	[NT]	150745-2	96%
TRH C_6 - C_{10}	mg/kg	[NT]	[NT]	150745-2	96%
Benzene	mg/kg	[NT]	[NT]	150745-2	100%
Toluene	mg/kg	[NT]	[NT]	150745-2	88%
Ethylbenzene	mg/kg	[NT]	[NT]	150745-2	97%
m+p-xylene	mg/kg	[NT]	[NT]	150745-2	98%
o-Xylene	mg/kg	[NT]	[NT]	150745-2	96%
naphthalene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%	[NT]	[NT]	150745-2	90%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	27/07/2016
TRH C_{10} - C_{14}	mg/kg	[NT]	[NT]	150745-2	116%
TRH C_{15} - C_{28}	mg/kg	[NT]	[NT]	150745-2	111%
TRH C_{29} - C_{36}	mg/kg	[NT]	[NT]	150745-2	82%
TRH >C_{10}-C_{16}	mg/kg	[NT]	[NT]	150745-2	116%
TRH >C_{16}-C_{34}	mg/kg	[NT]	[NT]	150745-2	111%
TRH >C_{34}-C_{40}	mg/kg	[NT]	[NT]	150745-2	82%
Surrogate o-Terphenyl	%	[NT]	[NT]	150745-2	94%

QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	26/07/2016
Naphthalene	mg/kg	[NT]	[NT]	150745-2	103%
Acenaphthylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	[NT]	[NT]	150745-2	126%
Phenanthrene	mg/kg	[NT]	[NT]	150745-2	107%
Anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	[NT]	[NT]	150745-2	103%
Pyrene	mg/kg	[NT]	[NT]	150745-2	110%
Benzo(a)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	[NT]	[NT]	150745-2	92%
Benzo(b,j+k)fluoranthene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	[NT]	[NT]	150745-2	94%
Indeno(1,2,3-c,d)pyrene	mg/kg	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%	[NT]	[NT]	150745-2	104%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	26/07/2016
HCB	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	[NT]	[NT]	150745-2	92%
gamma-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	[NT]	[NT]	150745-2	106%
Heptachlor	mg/kg	[NT]	[NT]	150745-2	104%
delta-BHC	mg/kg	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	[NT]	[NT]	150745-2	106%
Heptachlor Epoxide	mg/kg	[NT]	[NT]	150745-2	106%
gamma-Chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	[NT]	[NT]	150745-2	117%
Dieldrin	mg/kg	[NT]	[NT]	150745-2	111%
Endrin	mg/kg	[NT]	[NT]	150745-2	109%
pp-DDD	mg/kg	[NT]	[NT]	150745-2	113%
Endosulfan II	mg/kg	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	[NT]	[NT]	150745-2	111%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Methoxychlor	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%	[NT]	[NT]	150745-2	86%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	26/07/2016
Azinphos-methyl (Guthion)	mg/kg	[NT]	[NT]	[NR]	[NR]
Bromophos-ethyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Chlorpyriphos	mg/kg	[NT]	[NT]	150745-2	92%
Chlorpyriphos-methyl	mg/kg	[NT]	[NT]	[NR]	[NR]
Diazinon	mg/kg	[NT]	[NT]	[NR]	[NR]
Dichlorvos	mg/kg	[NT]	[NT]	150745-2	107%
Dimethoate	mg/kg	[NT]	[NT]	[NR]	[NR]
Ethion	mg/kg	[NT]	[NT]	150745-2	108%
Fenitrothion	mg/kg	[NT]	[NT]	150745-2	99%
Malathion	mg/kg	[NT]	[NT]	150745-2	88%
Parathion	mg/kg	[NT]	[NT]	150745-2	96%
Ronnel	mg/kg	[NT]	[NT]	150745-2	95%
Surrogate TCMX	%	[NT]	[NT]	150745-2	89%

QUALITY CONTROL PCBs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date extracted	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	26/07/2016
Aroclor 1016	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1221	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1232	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1242	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1248	mg/kg	[NT]	[NT]	[NR]	[NR]
Aroclor 1254	mg/kg	[NT]	[NT]	150745-2	116%
Aroclor 1260	mg/kg	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%	[NT]	[NT]	150745-2	89%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	150745-2	26/07/2016
Date analysed	-	[NT]	[NT]	150745-2	26/07/2016
Arsenic	mg/kg	[NT]	[NT]	150745-2	84%
Cadmium	mg/kg	[NT]	[NT]	150745-2	87%
Chromium	mg/kg	[NT]	[NT]	150745-2	92%
Copper	mg/kg	[NT]	[NT]	150745-2	92%
Lead	mg/kg	[NT]	[NT]	150745-2	86%
Mercury	mg/kg	[NT]	[NT]	150745-2	106%
Nickel	mg/kg	[NT]	[NT]	150745-2	78%
Zinc	mg/kg	[NT]	[NT]	150745-2	78%

Report Comments:

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.
This is reported outside our scope of NATA accreditation.

Asbestos ID was analysed by Approved Identifier: Paul Ching
Asbestos ID was authorised by Approved Signatory: Paul Ching

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

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

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

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

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

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Douglas Partners Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET (2)

Project: Erskine Park	**To:** Envirolab Services, 12 Ashley Street Chatswood NSW 2068
Project No: 85512-01	
DP Contact Person: David Walker	**Ph:** 02 9910 6200
Prior Storage: Esky ☐ Fridge ☑ Shelved ☐	**Attn:** Tania Notaras

Do samples contain HBM? Yes ☑ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)

	Sample				Analytes													Notes
	Sample ID	depth (m)	Type S-soil W-water	Lab ID	Date sampled	Combo 6	Combo 6a	Asbestos 500mL NEPM	PAH	Metals (8)	Asbestos							
1.	101	0.1-0.3	S		25/7/16	✓		✓										
2.	102	0.5-0.8				✓		✓										
3.	103	0.2-0.4				✓		✓										
4.	104	0-0.1					✓											
5.	105	0-0.1					✓											
6.	106	0.1-0.4				✓		✓										
7.	107	0.1-0.4				✓		✓										
8.	108	0-0.15				✓		✓										
9.	A1										✓							
*	BD1-250716								✓	✓							* – Send to Eurofins for analysis	
	PQL (S)		mg/kg															
	PQL (W)		mg/L															

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 150745
Date Received: 26/07/16
Time Received: 11:20
Received by: D.T.
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 26/7/16

Total number of samples in container:

Results required by: Standard T/A

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by email

Signature: ....

Date: .... Lab Ref: ....

Send results to: David Walker
Douglas Partners Pty Ltd
Address: 96 Hermitage Rd West Ryde.
Email: david.walker@douglaspartners.com.au

D. Walker

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client Details	
Client	Douglas Partners Pty Ltd
Attention	David Walker

Sample Login Details	
Your Reference	85512.01, Erskine Park
Envirolab Reference	**150745**
Date Sample Received	26/07/2016
Date Instructions Received	26/07/2016
Date Results Expected to be Reported	**02/08/2016**

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	8 Soils 1 Material
Turnaround Time Requested	Standard
Temperature on receipt (°C)	8.7
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	Phone: 02 9910 6200
Fax: 02 9910 6201	Fax: 02 9910 6201
Email: ahie@envirolabservices.com.au	Email: jhurst@envirolabservices.com.au

Sample and Testing Details on following page

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

Sample Id	*vTRH(C6-C10)/BTEXN in Soil*	*svTRH (C10-C40) in Soil*	*PAHs in Soil*	*Organochlorine Pesticides in soil*	*Organophosphorus Pesticides*	*PCBs in Soil*	*Acid Extractable metals in soil*	*Asbestos ID - materials*	*Asbestos ID - soils*	*Asbestos ID - soils NEPM*
101-0.1-0.3	✓	✓	✓	✓	✓	✓	✓			✓
102-0.5-0.8	✓	✓	✓	✓	✓	✓	✓			✓
103-0.2-0.4	✓	✓	✓	✓	✓	✓	✓			✓
104-0-0.1	✓	✓	✓	✓	✓	✓	✓		✓	
105-0-0.1	✓	✓	✓	✓	✓	✓	✓		✓	
106-0.1-0.4	✓	✓	✓	✓	✓	✓	✓			✓
107-0.1-0.4	✓	✓	✓	✓	✓	✓	✓			✓
108-0-0.15	✓	✓	✓	✓	✓	✓	✓			✓
A1								✓		

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Douglas Partners (Syd)
96 Hermitage Road
West Ryde
NSW 2114

Attention: **David Walker**

Report	**509541-S**
Project name	ERSKINE PARK
Project ID	85512.01
Received Date	Jul 27, 2016

Client Sample ID			**BD1-250716**
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**S16-Jl22852**
Date Sampled			**Jul 25, 2016**
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2
Acenaphthene	0.5	mg/kg	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5
Anthracene	0.5	mg/kg	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5
Chrysene	0.5	mg/kg	< 0.5
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5
Fluorene	0.5	mg/kg	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5
Naphthalene	0.5	mg/kg	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5
Pyrene	0.5	mg/kg	< 0.5
Total PAH*	0.5	mg/kg	< 0.5
2-Fluorobiphenyl (surr.)	1	%	88
p-Terphenyl-d14 (surr.)	1	%	92
Heavy Metals			
Arsenic	2	mg/kg	6.7
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	13
Copper	5	mg/kg	16
Lead	5	mg/kg	15
Mercury	0.05	mg/kg	< 0.05
Nickel	5	mg/kg	8.4
Zinc	5	mg/kg	27
% Moisture	1	%	14

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Polycyclic Aromatic Hydrocarbons	Sydney	Jul 30, 2016	14 Day
- Method: E007 Polyaromatic Hydrocarbons (PAH)			
Metals M8	Sydney	Jul 30, 2016	28 Day
- Method: LTM-MET-3040_R0 TOTAL AND DISSOLVED METALS AND MERCURY IN WATERS BY ICP-MS			
% Moisture	Sydney	Jul 27, 2016	14 Day
- Method: LTM-GEN-7080 Moisture			

Company Name:	Douglas Partners (Syd)	**Order No.:**		**Received:**	Jul 27, 2016 3:31 PM
Address:	96 Hermitage Road West Ryde NSW 2114	**Report #:**	509541	**Due:**	Aug 3, 2016
		Phone:	02 9809 0666	**Priority:**	5 Day
		Fax:		**Contact Name:**	David Walker
Project Name:	ERSKINE PARK				
Project ID:	85512.01				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Polycyclic Aromatic Hydrocarbons	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217						X	X	X
Brisbane Laboratory - NATA Site # 20794								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	BD1-250716	Jul 25, 2016		Soil	S16-Jl22852	X	X	X
Test Counts						1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.05			0.05	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	100			70-130	Pass	
Acenaphthylene	%	97			70-130	Pass	
Anthracene	%	96			70-130	Pass	
Benz(a)anthracene	%	101			70-130	Pass	
Benzo(a)pyrene	%	103			70-130	Pass	
Benzo(b&j)fluoranthene	%	112			70-130	Pass	
Benzo(g.h.i)perylene	%	95			70-130	Pass	
Benzo(k)fluoranthene	%	100			70-130	Pass	
Chrysene	%	103			70-130	Pass	
Dibenz(a.h)anthracene	%	93			70-130	Pass	
Fluoranthene	%	94			70-130	Pass	
Fluorene	%	99			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	93			70-130	Pass	
Naphthalene	%	103			70-130	Pass	
Phenanthrene	%	96			70-130	Pass	
Pyrene	%	96			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	87			70-130	Pass	
Cadmium	%	90			70-130	Pass	
Chromium	%	90			70-130	Pass	
Copper	%	93			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Lead			%	98			70-130	Pass	
Mercury			%	90			70-130	Pass	
Nickel			%	92			70-130	Pass	
Zinc			%	90			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S16-JI22896	NCP	%	95			70-130	Pass	
Acenaphthylene	S16-JI22896	NCP	%	98			70-130	Pass	
Anthracene	S16-JI22896	NCP	%	92			70-130	Pass	
Benz(a)anthracene	S16-JI22896	NCP	%	80			70-130	Pass	
Benzo(a)pyrene	S16-JI22896	NCP	%	84			70-130	Pass	
Benzo(b&j)fluoranthene	S16-JI22896	NCP	%	45			70-130	Fail	Q08
Benzo(g.h.i)perylene	S16-JI22896	NCP	%	82			70-130	Pass	
Benzo(k)fluoranthene	S16-JI22896	NCP	%	67			70-130	Fail	Q08
Chrysene	S16-JI22896	NCP	%	80			70-130	Pass	
Dibenz(a.h)anthracene	S16-JI22896	NCP	%	99			70-130	Pass	
Fluoranthene	S16-JI22896	NCP	%	57			70-130	Fail	Q08
Fluorene	S16-JI22896	NCP	%	94			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S16-JI22896	NCP	%	80			70-130	Pass	
Naphthalene	S16-JI22896	NCP	%	98			70-130	Pass	
Phenanthrene	S16-JI22896	NCP	%	98			70-130	Pass	
Pyrene	S16-JI22896	NCP	%	62			70-130	Fail	Q08
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S16-JI23002	NCP	%	89			70-130	Pass	
Cadmium	S16-JI23002	NCP	%	83			70-130	Pass	
Chromium	S16-JI23002	NCP	%	86			70-130	Pass	
Copper	S16-JI23002	NCP	%	98			70-130	Pass	
Lead	S16-JI23002	NCP	%	95			70-130	Pass	
Mercury	S16-JI23002	NCP	%	81			70-130	Pass	
Nickel	S16-JI24526	NCP	%	97			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g.h.i)perylene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a.h)anthracene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	S16-JI23024	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S16-Jl22898	NCP	mg/kg	3.8	4.4	16	30%	Pass	
Cadmium	S16-Jl22898	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S16-Jl22898	NCP	mg/kg	11	13	18	30%	Pass	
Copper	S16-Jl22898	NCP	mg/kg	11	11	1.0	30%	Pass	
Lead	S16-Jl22898	NCP	mg/kg	11	14	23	30%	Pass	
Mercury	S16-Jl22898	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Nickel	S16-Jl22898	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Zinc	S16-Jl22898	NCP	mg/kg	7.1	7.9	11	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S16-Jn20606	NCP	%	24	22	12	30%	Pass	

Quality Control Analyte Summary Compliance

The table below is the actual occurrence of QC performed on the batch of samples within this report and as defined below

Analysis	Samples Analysed	Laboratory Duplicates Reported	Laboratory Matrix Spikes Reported	Method Blanks Reported	Laboratory Control Samples Reported
Polycyclic Aromatic Hydrocarbons	1	1	1	1	1
Heavy Metals	1	1	1	1	1
% Moisture	1	1	NA	NA	NA

Quality Control Parameter Frequency Compliance follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure April 2011, Schedule B3, Guideline on Laboratory Analysis of Potentially Contaminated Soils and US EPA SW-846 Chapter 1: 'Quality Control'.

It comprises the following when a laboratory process batch is deemed to consist of up to 20 samples that are similar in terms of matrix and test procedure, and are processed as one unit for QC purposes. If more than 20 samples are being processed, they are considered as more than one batch.

Method blank

One method blank per process batch.

Laboratory duplicate

There should be at least one duplicate per process batch, or two duplicates if the process batch exceeds 10 samples.

Laboratory control sample (LCS)

There should be at least one LCS per process batch.

Matrix spikes

There should be one matrix spike per matrix type per process batch.

eurofins | mgt

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference

Authorised By

Nibha Vaidya	Analytical Services Manager
Ivan Taylor	Senior Analyst-Metal (NSW)
Ryan Hamilton	Senior Analyst-Inorganic (NSW)
Ryan Hamilton	Senior Analyst-Organic (NSW)

[redacted]

Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Company Name:	Douglas Partners (Syd)	**Order No.:**		**Received:**	Jul 27, 2016 3:31 PM
Address:	96 Hermitage Road West Ryde NSW 2114	**Report #:**	509541	**Due:**	Aug 3, 2016
		Phone:	02 9809 0666	**Priority:**	5 Day
		Fax:		**Contact Name:**	David Walker
Project Name:	ERSKINE PARK				
Project ID:	85512.01				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Polycyclic Aromatic Hydrocarbons	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217						X	X	X
Brisbane Laboratory - NATA Site # 20794								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	BD1-250716	Jul 25, 2016		Soil	S16-Jl22852	X	X	X
Test Counts						1	1	1

509541

Douglas Partners Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET (2)

Project: Erskine Park	**To:** Envirolab Services, 12 Ashley Street Chatswood NSW 2068
Project No: 85512.01	
DP Contact Person: David Walker	**Ph:** 02 9910 6200
Prior Storage: Esky ☐ Fridge ☑ Shelved ☐	**Attn:** Tania Notaras
Do samples contain HBM? Yes ☑ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)	

	Sample ID	(depth m)	Type S-soil W-water	Lab ID	Date sampled	Combo 6	Combo 6A	Asbestos 500mL NEPM	PAH	Metals (8)	Asbestos								Notes
1.	101	0.1-0.3	S		25/7/16	✓		✓											
2.	102	0.5-0.8				✓		✓											
3.	103	0.2-0.4				✓		✓											
4.	104	0-0.1					✓												
5.	105	0-0.1					✓												
6.	106	0.1-0.4				✓		✓											
7.	107	0.1-0.4				✓		✓											
8.	108	0-0.15				✓		✓											
9.	A1										✓								
*	BD1-250716								✓	✓								*	— Send to Eurofins for analysis
PQL (S)	mg/kg																		
PQL (W)	mg/L																		

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
ENVIROLAB
Job No: 150746
Date Received: 26/07/16
Time Received: 11:20
Received by: D.T.
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 26/7/16 27/07/16 [redacted]

Total number of samples in container: [redacted]

Results required by: Standard T/A 12:88

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by email

Signature: [redacted]

Date: 27/7 Lab Ref:

Send results to: David Walker
Douglas Partners Pty Ltd
Address: 96 Hermitage Rd West Ryde

Email: david.walker@douglaspartners.com.au

Sea EF/MGT 3.31

Sample Receipt Advice

Company name:	**Douglas Partners (Syd)**
Contact name:	David Walker
Project name:	ERSKINE PARK
Project ID:	85512.01
COC number:	Not provided
Turn around time:	5 Day
Date/Time received:	Jul 27, 2016 3:31 PM
Eurofins | mgt reference:	**509541**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to David Walker - david.walker@douglaspartners.com.au.

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

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

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

CERTIFICATE OF ANALYSIS 152620

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: David Walker

Sample log in details:

Your Reference:	**85512.01, Proposed Rezoning & Sale**
No. of samples:	6 Soils, 1 Material
Date samples received / completed instructions received	30/08/16 / 30/08/16

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

Report Details:

Date results requested by: / Issue Date:	6/09/16 / 1/09/16
Date of Preliminary Report:	Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025 - Testing **Tests not covered by NATA are denoted with *.**

Results Approved By:

[redacted]

David Springer
General Manager

ACCREDITED FOR TECHNICAL COMPETENCE

Asbestos ID - soils NEPM Our Reference: Your Reference Depth Type of sample	UNITS ------------- ------------- 	152620-1 106a 0.0-0.2 Soil	152620-2 106b 0.1-0.5 Soil	152620-3 106c 0.1-0.5 Soil	152620-4 106c 0.7-1.0 Soil	152620-5 106d 0.4-0.75 Soil
Date analysed	-	1/09/2016	1/09/2016	1/09/2016	1/09/2016	1/09/2016
Sample mass tested	g	826.11	639.43	760.33	869.4	956.87
Sample Description	-	Brown clayey soil & rock	Brown clayey soil & rock	Brown clayey soil & rock	Brown clayey soil & rock	Brown clayey soil & rock
Asbestos ID in soil (as per AS4964)	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
ACM >7mm Estimation*	g	0.0000	0.0000	0.0000	0.0000	0.0000
FA and AF Estimation*	g	0.0000	0.0000	0.0000	0.0000	0.0000
FA and AF Estimation*[#2]	%(w/w)	<0.001	<0.001	<0.001	<0.001	<0.001

Asbestos ID - soils NEPM Our Reference: Your Reference Depth Type of sample	UNITS ------------- ------------- 	152620-6 106d 0.9-1.1 Soil
Date analysed	-	1/09/2016
Sample mass tested	g	1008.77
Sample Description	-	Brown clayey soil & rock
Asbestos ID in soil (as per AS4964)	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1
Asbestos ID in soil <0.1g/kg*	-	Not applicable
ACM >7mm Estimation*	g	0.0000
FA and AF Estimation*	g	0.0000
FA and AF Estimation*[#2]	%(w/w)	<0.001

Asbestos ID - materials		
Our Reference:	UNITS	152620-7
Your Reference	-------------	A2
Depth	------------	-
Type of sample		Material
Date analysed	-	31/08/2016
Mass / Dimension of Sample	-	40x30x5mm
Sample Description	-	Grey fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected Amosite asbestos detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

Report Comments:

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013.
This is reported outside our scope of NATA accreditation.

Asbestos ID was analysed by Approved Identifier:	Paul Ching
Asbestos ID was authorised by Approved Signatory:	Paul Ching

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

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

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

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

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

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET (2)

Project: Proposed Rezoning & Sale	**To:** Envirolab Services, 12 Ashley Street, Chatswood NSW 2068
Project No: 85512.01	
DP Contact Person:	**Ph:** 02 9910 6200
Prior Storage: Esky ☑ Fridge ☐ Shelved ☐	**Attn:** Tania Notaras
Do samples contain HBM? Yes ☑ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Depth	Type S-soil W-water	Lab ID	Asbestos 500mL NEPM	Asbestos														Notes
106a	0-0.2	S	1	✓															
106b	0.1-0.5	S	2	✓															
106c	0.1-0.5	S	3	✓															
106c	0.7-1.0	S	4	✓															
106d	0.4-0.75	S	5	✓															
106d	0.9-1.1	S	6	✓															
A2		Material	7		✓														
PQL (S)		mg/kg																	
PQL (W)		mg/L																	

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 152620

Date Received: 30.8.16
Time Received: 15.30
Received by: LN
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 30/8/16
Total number of samples in container: 7
Results required by: Standard T/A

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by email
Signature: [redacted]
Date: 30.8.16 Lab Ref: ECS

Send results to: David Walker
Douglas Partners Pty Ltd
Address:
Email: david.walker@douglaspartners.com.au

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client Details	
Client	Douglas Partners Pty Ltd
Attention	David Walker

Sample Login Details	
Your Reference	85512.01, Proposed Rezoning & Sale
Envirolab Reference	**152620**
Date Sample Received	30/08/2016
Date Instructions Received	30/08/2016
Date Results Expected to be Reported	**06/09/2016**

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	6 Soils, 1 Material
Turnaround Time Requested	Standard
Temperature on receipt (°C)	NA
Cooling Method	Not applicable
Sampling Date Provided	

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	Phone: 02 9910 6200
Fax: 02 9910 6201	Fax: 02 9910 6201
Email: ahie@envirolabservices.com.au	Email: jhurst@envirolabservices.com.au

Sample and Testing Details on following page

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

Sample Id	***Asbestos ID - soils NEPM***	***Asbestos ID - materials***
106a-0.0-0.2	✓	
106b-0.1-0.5	✓	
106c-0.1-0.5	✓	
106c-0.7-1.0	✓	
106d-0.4-0.75	✓	
106d-0.9-1.1	✓	
A2		✓