Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Site 53 Redevelopment
2 Figtree Drive, Sydney Olympic Park

Prepared for
Mirvac Projects Pty Ltd

Project 73946
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Douglas Partners
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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.

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Table of Contents

Report on Geotechnical Investigation
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1. Introduction

This report describes the results of a geotechnical investigation undertaken for the proposed redevelopment of Site 53, 2 Figtree Drive, Sydney Olympic Park. The work was undertaken for Mirvac Projects Pty Ltd, prospective purchaser and developer of the site.

It is understood that the project involves the construction of a multi-storey residential unit building over a common basement. The basement is expected to have three levels (lowest level at RL 8.4 m AHD) with localised deeper excavations for footings and lift pits.

Geotechnical investigation was undertaken to provide information on subsurface conditions on the site and included the drilling of cored boreholes, installation of groundwater monitoring wells, laboratory testing and engineering analysis. Details of the field work and comments relating to design and construction are provided in this report.

2. Previous Investigations

Golder Associates undertook a geotechnical investigation on the site in 1994 (Ref. 94620080). This investigation included the drilling of boreholes and the excavation of test pits for the building which currently occupies the site. The borehole logs indicate a variable depth of filling at the time of the Golder investigation of between 0.5 m and >5 m depth.

Douglas Partners undertook site inspections in 1995 during construction of the building which currently occupies the site. The inspection records indicate that the building is supported by piles founded in medium to high strength shale at depths of 2.5 m to 6 m below the surface levels at the time of construction.

3. Site Description and Geology

Site 53 is a near rectangular-shaped lot with an area of approximately 1.27 ha. It is bounded by Figtree Drive to the north, Australia Avenue to the east, a pathway and the Sydney Olympic Park railway loop to the south, and commercial premises to the west. The ground surface slopes gently to the south; site levels vary from about RL 20 m AHD in the north-western corner to about RL 12.5 m AHD along the southern boundary.

At the time of the investigation the site was occupied by a commercial building in the northern and eastern portions of the site with on-grade parking areas in the western and southern areas.

The *Sydney 1:100 000 Geological Series Sheet* shows that the site is underlain by Ashfield Shale which typically comprises black to dark grey shale and laminite. Some filling is also expected to be present on the site as a result of previous development activities.

4. Field Work Methods

The current field work included the drilling of eight boreholes (BH1 to BH8) to depths of 6.2 m to 10.4 m using a truck-mounted Scout drilling rig. They were commenced using solid flight augers to drill through the overburden materials and standard penetration tests (SPTs) were undertaken at regular depth intervals. Soon after rock was encountered, the bores were advanced using NMLC-sized diamond core drilling equipment to obtain 50 mm diameter continuous samples of the rock for identification and strength testing purposes.

The field work was supervised by a geotechnical engineer who was also responsible for collecting soil samples for chemical analysis. This involved the use of disposable and decontaminated sampling equipment, the placement of samples in appropriate jars, storage of the samples in a cooled container, and transport of the samples to the laboratory.

Groundwater monitoring wells were installed in three of the boreholes (BH1, BH3 and BH8) at the completion of drilling using Class 18 uPVC components. The construction details are provided in the remarks section at the base of the borehole logs.

The locations of the boreholes are shown on Drawing 1 in Appendix B. The ground surface levels at the bores were measured to AHD using an automatic level, relative to known benchmarks near the site.

5. Field Work Results

The subsurface conditions encountered in the current boreholes are presented in the borehole logs in Appendix C. Notes defining descriptive terms and classification methods are included in Appendix A.

The materials encountered in the current boreholes can be described as follows:

- FILLING – asphalt and roadbase in the pavement areas, and sandy and clayey filling with silt, gravel, shale, sandstone, concrete, brick, charcoal, timber, slag and rootlets to depths of 0.2 m to 3.2 m;
- RESIDUAL SOIL – stiff to hard clay and shaly clay to depths of 0.8 m to 4.0 m in all bores except BH1, BH3 and BH5 in which the filling was directly underlain by weathered bedrock; and
- BEDROCK – laminite and shale below depths of between 0.7 m and 4.0 m to the base of the bores at 6.2 m to 10.4 m depth. The rock was typically weathered near the bedrock surface, becoming medium strength and/or high strength rock below depths of 1.2 m to 5.0 m. Numerous steeply dipping joints were observed in the core samples including a significant crushed zone in BH6.

Table 1 summarises the levels at which different materials were encountered in the current boreholes. The rock has been classified in accordance with a system developed by Pells et al (1998) which classifies rock strata depending on strength, fracturing and defects. Class V rock is typically very low strength, highly weathered and highly fractured rock whereas Class I rock is typically high strength, fresh and unbroken rock.

Table 1: Summary of Material Strata Levels and Rock Classifications

Stratum	RL of Top of Stratum (m, AHD)							
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Ground Surface	19.8	17.3	14.3	18.1	13.5	14.6	14.1	13.1
Residual Soil	NE	14.1	NE	17.4	NE	14.3	13.9	10.1
Class V/IV Shale	19.1	13.3	12.7	16.8	11.3	13.8	12.1	9.5
Class III Shale	18.6	13.0	NE	15.3	8.9	9.1	9.5	8.2
Class II/I Shale	16.6	11.5	9.7	11.5	8.5	NE	8.9	5.5
Base of Borehole	13.6	8.1	6.8	9.1	5.2	4.2	5.9	3.4

Notes: Rock classification in accordance with Pells et al (1998); NE = not encountered

Free groundwater was not observed during augering and the use of drilling fluid prevented groundwater observations during coring. The water levels were measured in the monitoring wells approximately 1 month after drilling as outlined in Table 2.

Table 2: Groundwater Level Observations in Monitoring Wells

Date	RL of Groundwater (m, AHD)		
	BH1	BH3	BH8
8 August 2014	15.3	9.7	7.2

6. Laboratory Testing

6.1 Rock Samples

Fifty-five samples selected from the rock core were tested for axial point load strength index (Is_{50}). The results ranged between 0.1 MPa and 1.7 MPa which correspond to very low to low strength and very high strength rock, respectively. These Is_{50} results suggest unconfined compressive strength (UCS) values in excess of 35 MPa for the very high strength rock encountered during the investigation.

6.2 Soil Samples

Twelve soil samples were sent to a NATA accredited analytical laboratory and were analysed for a range of potential organic and inorganic contaminants to provide preliminary information for waste classification purposes. The results of the analysis are summarised in Tables 3 to 6. The detailed results are included in Appendix D.

Table 3: Analytical Results for Selected Organic Compounds in Soil (mg/kg)

Sample/ Depth (m)	Benzene	Toluene	Ethyl-benzene	Xylene	TRH $_{C6-C9}$	TRH $_{C10-C36}$
BH1/0.5	<0.2	<0.5	<1	<3	<25	<250
BH3/1-1.45	<0.2	<0.5	<1	<3	<25	<250
BH6/0.5	<0.2	<0.5	<1	<3	<25	<250
BH8/1-1.45	<0.2	<0.5	<1	<3	<25	<250
BH2/0.3	<0.2	<0.5	<1	<3	<25	<250
BH2/1-1.45	<0.2	<0.5	<1	<3	<25	<250
BH2/2.5-2.95	<0.2	<0.5	<1	<3	<25	<250
BH4/0.5	<0.2	<0.5	<1	<3	<25	<250
BH5/0.1	<0.2	<0.5	<1	<3	<25	<250
BH5/1.0	<0.2	<0.5	<1	<3	<25	<250
BH7/0.5	<0.2	<0.5	<1	<3	<25	<250
BH8/0.5	<0.2	<0.5	<1	<3	<25	<250

Notes: TRH = total recoverable hydrocarbons

Table 4: Analytical Results for Selected Organic Compounds in Soil (mg/kg)

Sample/ Depth (m)	Total PAH	Benzo(a) pyrene	OCP	PCB	Phenol
BH1/0.5	0.06	0.06	0.1	NIL+ve	<5
BH3/1-1.45	NIL+ve	<0.05	NIL+ve	NIL+ve	<5
BH6/0.5	NIL+ve	<0.05	NIL+ve	NIL+ve	<5
BH8/1-1.45	0.26	0.06	NIL+ve	NIL+ve	<5
BH2/0.3	NIL+ve	<0.05	NIL+ve	NIL+ve	<5
BH2/1-1.45	NIL+ve	<0.05	NIL+ve	NIL+ve	<5
BH2/2.5-2.95	NIL+ve	<0.05	NIL+ve	NIL+ve	<5
BH4/0.5	8.4	0.79	NIL+ve	NIL+ve	<5
BH5/0.1	1.5	0.17	NIL+ve	NIL+ve	<5
BH5/1.0	1.0	0.12	NIL+ve	NIL+ve	<5
BH7/0.5	0.32	0.06	0.4	NIL+ve	<5
BH8/0.5	3.2	0.32	NIL+ve	NIL+ve	<5

Notes: PAH = polycyclic aromatic hydrocarbons; OCP = organochlorine pesticides; PCB = polychlorinated biphenyls

Table 5: Analytical Results for Selected Physical Properties in Soil

Sample/Depth (m)	pH (pH units)	EC (µS/cm)	Asbestos (Y/N)
BH1/0.5	10.0	150	N
BH3/1-1.45	8.8	230	N
BH6/0.5	5.4	56	N
BH8/1-1.45	5.5	140	N
BH2/0.3	9.5	230	N
BH2/1-1.45	7.1	160	N
BH2/2.5-2.95	6.4	87	N
BH4/0.5	7.8	300	N
BH5/0.1	8.9	510	N
BH5/1.0	5.7	410	N
BH7/0.5	6.2	45	N
BH8/0.5	6.9	220	N

Notes: EC = electrical conductivity

Table 6: Analytical Results for Selected Heavy Metals in Soil (mg/kg)

Sample/ Depth (m)	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BH1/0.5	20	<0.4	10	8	47	<0.1	4	20
BH3/1-1.45	<4	<0.4	10	5	14	<0.1	3	20
BH6/0.5	10	<0.4	24	15	22	<0.1	6	18
BH8/1-1.45	9	<0.4	15	35	33	<0.1	9	66
BH2/0.3	<4	<0.4	10	9	12	<0.1	7	25
BH2/1-1.45	<4	0.4	8	49	21	<0.1	38	140
BH2/2.5-2.95	9	<0.4	14	27	27	<0.1	10	64
BH4/0.5	9	<0.4	12	32	28	0.2	9	150
BH5/0.1	<4	<0.4	14	36	18	<0.1	56	54
BH5/1.0	7	<0.4	25	24	28	<0.1	11	50
BH7/0.5	9	<0.4	24	25	29	<0.1	8	29
BH8/0.5	9	<0.4	39	39	31	<0.1	14	74

7. Geotechnical Model

A geotechnical model for the site is presented in Section A-A and Section B-B in Drawings 2 and 3 in Appendix B. A summary of the geotechnical model is shown in Table 7.

Table 7: Summary of Geotechnical Model

Geological Unit	Description
Unit A	Sandy and clayey filling with silt, gravel, shale, sandstone, concrete, brick, charcoal, timber, slag and rootlets
Unit B	Residual clay and shaly clay, stiff to hard in consistency
Unit C	Class V/IV shale/laminite of extremely low/very low strength with some higher strength bands
Unit D	Class III shale/laminite of low to medium strength
Unit E	Class II/I shale/laminite of medium and high strength

The regional groundwater table is expected to be below the proposed bulk excavation level, although some seepage through joints and partings within the bedrock should be expected. The water observed in the wells is likely to be seepage rather than the regional water table.

8. Proposed Development

It is understood that the project involves the construction of a multi-storey residential unit building over a common basement. The basement is expected to have three levels (lowest level at RL 8.4 m AHD) with localised deeper excavations for footings and lift pits.

The geotechnical issues considered relevant to the proposed development include excavation, excavation support, groundwater and foundations. Comments on seismicity, soil aggressivity and waste classification are also provided.

9. Comments

9.1 Excavation

Excavation will be required within filling, residual soils and shale/laminite bedrock. Excavation in the filling, soils and Class V/IV rock should be readily achievable using a hydraulic excavator with bucket attachment. Excavation in Class III and Class II/I rock will require the use of heavy ripping equipment, rock-hammers, rock saws etc.

The laboratory testing undertaken on the core samples indicates UCS values in excess of 35 MPa for the high strength laminite encountered in the bores. The earthworks contractor should be made aware of the expected rock strengths to ensure appropriate equipment is employed and appropriate production rates are assumed. Low productivity should be expected in the stronger materials.

The use of heavy excavation equipment will result in vibrations with the potential to damage nearby structures. It is suggested that a maximum peak particle velocity of 8 mm/s be allowed at the foundation level of the adjacent building to reduce the risk of damage to architectural features and to reduce discomfort to occupants. Vibration monitoring on the adjacent building is therefore suggested during excavation. Vibration monitoring elsewhere on the site is unlikely to be required.

9.2 Excavation Support

9.2.1 General

Vertical excavations in filling, soil and weathered rock are unlikely to be stable for any significant period of time. Temporary batters may be feasible in some areas of the site and should be cut no steeper than 1(H):1(V) for depths of up to 3 m. Deeper cuts should incorporate intermediate benches to reduce the overall slope to at least 1.5(H):1(V).

Shoring support will be required in areas where temporary batters are not possible. Soldier pile walls with infill shotcrete panels would be suitable for the site and are constructed by installing piles at 2 m to 3 m centres prior to the commencement of excavation works. Excavation is then undertaken and infill panels of reinforced shotcrete are provided at about 2.5 m drops as the excavation proceeds. Temporary ground anchors will be required to provide lateral restraint for the walls until such time as the basement floor slabs have been constructed to prop the walls in the longer term.

It may also be possible to support the excavation faces using soil nails, rock bolts and/or ground anchors with shotcrete cover. This negates the need for shoring piles but will require significantly more drilling and grouting compared with a soldier pile wall.

9.2.2 Earth Pressures

Excavation faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to the top of Class III rock. Table 8 outlines material and strength parameters that could be used for the preliminary design of excavation support structures.

Table 8: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Unit Weight (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)	Ultimate Passive Earth Pressure (kPa)
Filling	20	0.4	0.6	-
Residual Soil	20	0.3	0.45	-
Class V/IV Rock	22	0.15[1]	0.25[1]	750[2]
Class III Rock	23	0[1]	0[1]	3,000[2]
Class II/I Rock	24	0[1]	0[1]	6,000[2]

Notes: [1] Unless unfavourably jointed; [2] Only below bulk excavation level and where jointing is favourable

The design of temporary and permanent support will need to consider the possibility that 45° joints in the bedrock will daylight near the base of the excavation leading to large wedges of rock requiring support by the temporary and permanent retaining structures. Sufficient anchoring of the shoring wall should be undertaken to prevent movements along 45° joints, even though there is a low probability that a joint would run the full length and height of the excavation.

It is suggested that preliminary design be carried out such that the support system has a factor of safety of 1.1 against sliding along the most unfavourable 45° joint. The support system would typically comprise anchors spaced over the rock face. These anchors should have their bond lengths behind a line projected at 45° above the bulk excavation level and should provide sufficient force to resist the movement of a wedge of rock projected at 45° from just below the anchor to the ground surface. The frictional resistance of the wedge along the joint may be calculated assuming an angle of friction of 20°. Regular rock-face inspections will be required to determine whether the assumed factor of safety is adequate. Additional anchors may be required to increase the factor of safety if large wedges are observed during excavation.

Rock sockets below the bulk excavation level for the purpose of passive restraint should have a minimum length of two pile diameters below the lowest level of any nearby excavation (including any detailed excavations).

It is likely that shoring of the deeper excavation faces will need to incorporate more than one row of anchors. The lateral pressure distribution on a multi-anchored or braced wall is complex and for preliminary design purposes a uniform distribution with depth (i.e. rectangular) should be assumed. It is recommended that a proven commercial software package such as WALLAP, FLAC or PLAXIS be used to analyse the shoring system to refine the preliminary design prior to commencement of construction.

Lateral pressures due to surcharge loads from sloping ground surfaces, pavements and construction machinery should be included where relevant. Hydrostatic pressure acting on the shoring walls should also be included in the design where adequate drainage is not provided behind the full height of the walls.

9.2.3 Ground Anchors

Where necessary, the use of declined tie-back (ground) anchors is suggested for the temporary lateral restraint of the perimeter piled wall systems. Such ground anchors should be declined below the horizontal to allow anchorage into the stronger bedrock materials at depth. The design of temporary ground anchors for the support of piled wall systems may be carried out using the allowable average bond stresses at the grout-rock interface given in Table 9.

Table 9: Bond Stresses for Anchor Design

Material Description	Allowable Average Bond Stress (kPa)
Class V/IV Rock	100
Class III Rock	250
Class II/I Rock	500

Ground anchors should be designed to have a free length equal to their height above the base of the excavation and minimum 3 m bond length. After installation they should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes.

The parameters given above assume that the anchor holes are clean and adequately flushed, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing.

In normal circumstances the building will restrain the basement excavation over the long term and therefore ground anchors are expected to be temporary only. The use of permanent anchors would generally require careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed at this site.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors around the perimeter of the site. In addition, care should be taken to avoid damaging adjacent basement walls, buried services and pipes during anchor installation.

9.3 Groundwater

The regional groundwater table is expected to be below the bulk excavation level. However, some seepage through and along strata boundaries should be expected and a suitably designed sump-type drainage system should be installed in the basement to collect and discharge seepage. A pump may also need to be used to remove water from pile excavations, if bored piles are used on the site.

9.4 Foundations

9.4.1 Spread Footings

The bulk excavation works are expected to expose Class III and/or Class II/I rock across most of the site. Spread footings (e.g. pad and strip footings) will be suitable for supporting the proposed structures and could be designed on the basis of an allowable bearing pressure of 3500 kPa in the Class III rock and 6000 kPa in the Class II/I rock, providing rock defects are not present within the zone of influence of the footings. If defects are present then specific footing excavations may need to be taken deeper and filled with mass concrete prior to the construction of the actual footing.

The settlement of a footing is dependent on the size of the footing, the load applied and the foundation conditions below the footing. Spread footings designed using the allowable bearing pressures in this report should experience settlements of less than 1% of the footing width upon application of the design load.

Spoon-testing in at least 50% of all footing excavations will be required to check for the presence of defects if a bearing pressure of 6000 kPa is adopted. Spoon-testing should be undertaken below the base of the footings to a depth equal to 1.5 times the footing width. All remaining footings should also be inspected by an experienced geotechnical professional to check the suitability of the foundation material.

9.4.2 Piles

Bored piles used for shoring support, and founded below the bulk excavation level, could also be used to support structural loads where necessary. Piles could be proportioned using the parameters shown in Table 10.

Table 10: Design Parameters for Bored Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion[1] (kPa)
Filling/Soil	0	0
Class V/IV Rock	1000	50
Class III Rock	3500	300
Class II/I Rock	6000	500

Notes: [1] Only below bulk excavation level and only where adequate socket-roughness is achieved

The settlement of a pile is dependent on the size of the pile, the load applied and the foundation conditions below the toe. Piles designed using the information contained in this report should experience settlements of less than a few millimetres upon application of the design load.

All foundation piles should be inspected by an experienced geotechnical professional to check the suitability of the foundation material, the socket roughness and the base cleanliness.

9.5 Seismicity

A Hazard Factor (*Z*) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class would be Class C_e.

9.6 Soil Aggressivity

Aggressivity to steel and concrete piles was assessed using the laboratory test results. The exposure classification for both concrete and steel piles is assessed as being Mild in accordance with Australian Standard AS 2159 – 2009 *Piling – Design and installation*.

9.7 Waste Classification

All materials requiring removal from the site will need to be classified in accordance with *Waste Classification Guidelines* (Department of Environment, Climate Change and Water NSW, 2009). The laboratory testing undertaken during this investigation can be used to provide a preliminary indication of the classification of the materials requiring disposal.

The waste classification guidelines include the following six-step process for waste classification:

- Establish if the waste is 'special waste'
- Establish if the waste is 'liquid waste'
- Establish if the waste is 'pre-classified' by the EPA
- Establish if the waste possesses hazardous characteristics
- Determine the contaminant concentrations of the waste
- Establish if the waste is putrescible

Visual inspection and the laboratory analysis indicated that asbestos was not present in the soil samples tested. The soil samples did not contain clinical waste or tyres and therefore the soils on the site are not classified as special waste.

The samples analysed were not in liquid form and therefore could not be described as liquid waste.

The EPA has pre-classified glass, plastic, rubber, bricks, concrete, building and demolition waste, and asphalt waste as General Solid Waste (non-putrescible). The materials within the samples were typically soil and therefore not pre-classified.

The samples analysed did not possess any obvious hazardous characteristics and could not be described as hazardous waste prior to chemical analysis. All samples analysed were assessed on a visual and tactile basis as being incapable of significant biological transformation and are therefore considered to be non-putrescible.

The total concentrations in the samples of filling tested were compared to the threshold criteria provided in the guidelines. All samples met the criteria for General Solid Waste (non-putrescible) CT1 and should be disposed of at a facility that is licenced to receive this category of waste.

The laboratory test results were also compared to the criteria outlined in *The excavated natural material exemption 2012*, issued under the *Protection of the Environment Operations (Waste) Regulation 2005*. On the basis of the laboratory test results, the chemical concentrations within the samples also met the ENM criteria.

The natural soils and rock below the filling should be able to be described as virgin excavated natural material (VENM) upon excavation, providing they are not cross-contaminated during excavation works. VENM can usually be transported to a site for use as filling rather than requiring disposal at landfill.

10. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for Site 53, 2 Figtree Drive, Sydney Olympic Park in accordance with DP's proposal dated 27 June 2014 and acceptance received from Mirvac Projects Pty Ltd. The report is provided for the use of Mirvac Projects Pty Ltd for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Subsurface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic 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 limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with all of the attached notes 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 a statement, interpretation, outcome or conclusion given 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.

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

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.

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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 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:

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

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

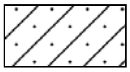
Soils


Topsoil

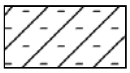

Peat


Clay

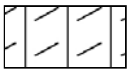

Silty clay

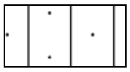

Sandy clay

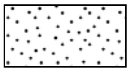

Gravelly clay

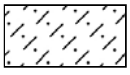

Shaly clay

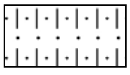

Silt


Clayey silt


Sandy silt

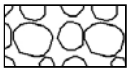

Sand

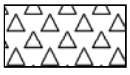

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

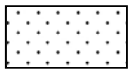

Talus

Sedimentary Rocks

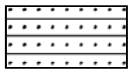

Boulder conglomerate

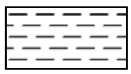

Conglomerate


Conglomeratic sandstone

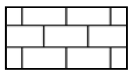

Sandstone


Siltstone


Laminite

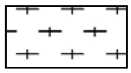

Mudstone, claystone, shale

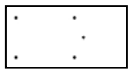

Coal


Limestone

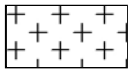
Metamorphic Rocks

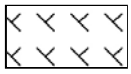

Slate, phyllite, schist

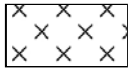

Gneiss

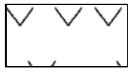

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia

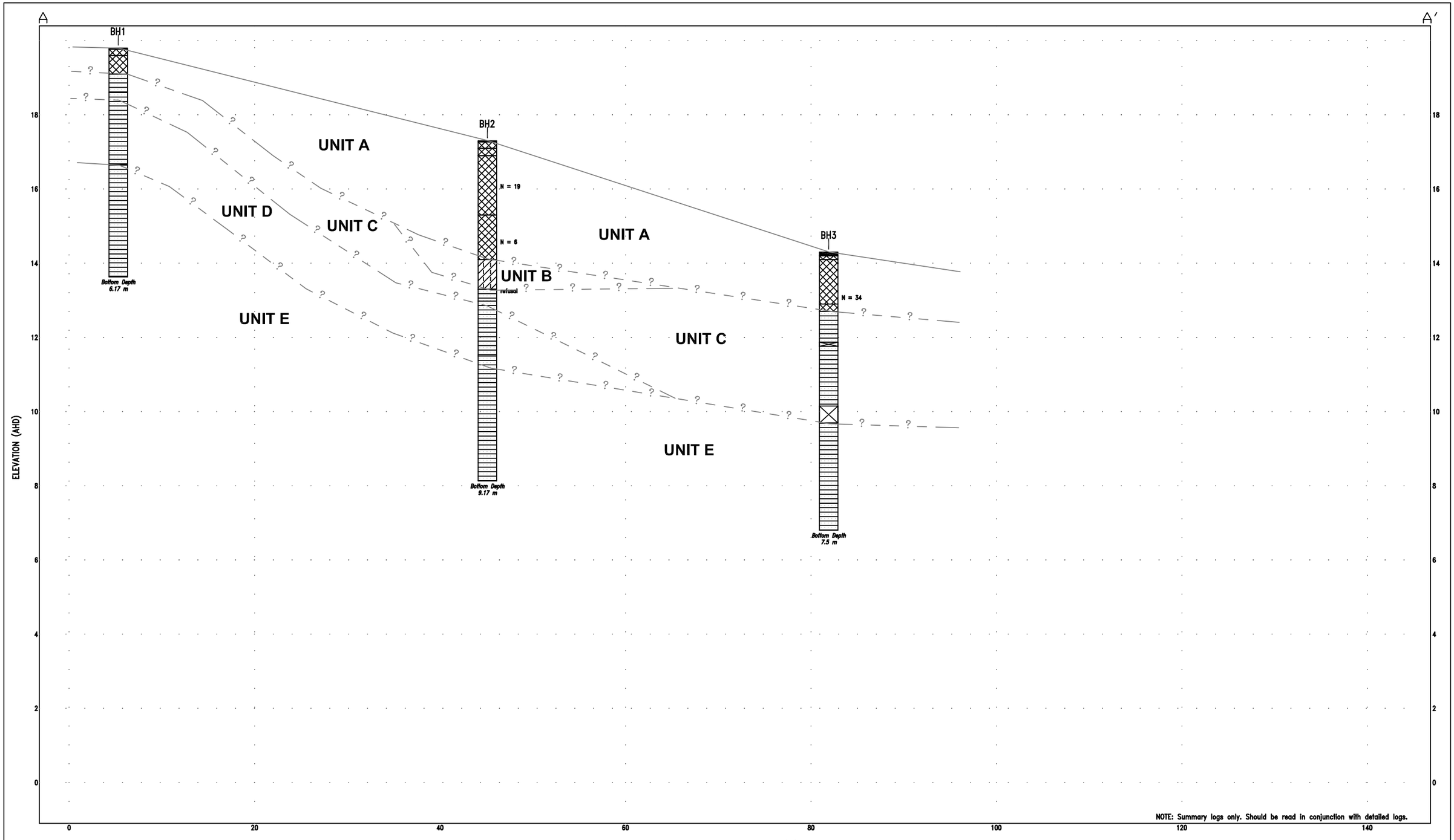

Porphyry

Appendix B

Drawings

● Borehole

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Mirvac Projects Pty Ltd	**Borehole Locations**	PROJECT No: 73946
	OFFICE: Sydney	**Site 53 - 2 Figtree Drive**	DWG No: 1
	DATE: 8 Aug 2014	**Sydney Olympic Park**	REVISION: 0



LEGEND

- Core Loss
- Asphaltic Concrete
- Filling
- Laminite
- Silty Clay

UNIT A Filling
UNIT B Residual soils
UNIT C Class V/IV shale/laminite
UNIT D Class III shale/laminite
UNIT E Class II/I shale/laminite

TESTS / OTHER
N – Standard penetration test value

0 1 2 3 4 5
1:100 @ A3 V

0 2 4 6 8 10 15 20
1:400 @ A3 H

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Projects Pty Ltd		TITLE: **Geotechnical Cross-Section A-A**	PROJECT No: 73946
OFFICE: Sydney	DRAWN BY: PSCH	**Site 53 - 2 Figtree Drive**	DRAWING No: 2
SCALE: As shown	DATE: 8.8.2014	**Sydney Olympic Park**	REVISION: 0

B

B′

BH3

BH5

BH8

BH7

N = 34

refusal

refusal

N = 15

N = 18

refusal

N = 27

refusal

Bottom Depth 7.5 m

Bottom Depth 8.3 m

Bottom Depth 9.65 m

Bottom Depth 8.2 m

UNIT A

UNIT D

UNIT E

UNIT A

UNIT B

UNIT C

UNIT D

UNIT E

UNIT A

UNIT B

UNIT C

UNIT D

UNIT E

ELEVATION (AHD)

14 12 10 8 6 4 2 0 −2 −4 −6

0 20 40 60 80 100 120 140

DISTANCE ALONG PROFILE (m)

NOTE: Summary logs only. Should be read in conjunction with detailed logs.

LEGEND

- Core Loss
- Asphaltic Concrete
- Filling
- Laminite
- Silty Clay

UNIT A Filling
UNIT B Residual soils
UNIT C Class V/IV shale/laminite
UNIT D Class III shale/laminite
UNIT E Class II/I shale/laminite

TESTS / OTHER
N – Standard penetration test value

0 1 2 3 4 5
1:100 @ A3 V

0 2 4 6 8 10 15 20
1:400 @ A3 H

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Projects Pty Ltd		TITLE: **Geotechnical Cross-Section B-B**	PROJECT No: 73946
OFFICE: Sydney	DRAWN BY: PSCH	**Site 53 - 2 Figtree Drive**	DRAWING No: 3
SCALE: As shown	DATE: 8.8.2014	**Sydney Olympic Park**	REVISION: 0

Appendix C

Results of Current Field Work

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 19.8 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 73946
DATE: 8/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
19	0.03	ASPHALT						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	A/E			
	0.2	FILLING - grey, fine to coarse gravelly silty sand filling, humid							A/E			
	0.7	FILLING - orange-brown, fine to medium sand filling with some silt (ripped sandstone), humid							A/E			
1	1.2	LAMINITE - very low strength, highly weathered, grey and red-brown laminite with some ironstaining						1.2-1.4m: B (x4) 0°, fe,cly	C	100	0	PL(A) = 0.7
18		LAMINITE - medium strength, highly to moderately then moderately weathered, fragmented to fractured, grey-brown laminite with approximately 20% fine sandstone laminations and some clay bands						1.4-1.6m: J, sv (70°-90°) pl, ro, cln 1.54-1.75m: fg, fe 1.75m: J55°, pl, sm, cln & J75°, un, ro, cln 1.9m: J30°, pl, ro, cln 2.06m: J75°, pl, ro, cly 2.18-2.24m: cly 2.24m: J55°, pl, ro, cly 2.34-2.5m: J45° & 90°, st, ro, cln 2.52,2.55 & 2.71m: B's 0°- 5°, cly, 2-10mm 2.75m: J30°- 70°, cu, ro, fe 2.77-2.82m: cly 2.86-2.9m: B0°, cly 3.06m: J55°, pl, ro, cln 3.13m: B0°, cly, 30mm 3.4-3.65m: J85°, pl, ro, cln 3.72 & 3.8m: B0°, fe, cly 3.86-4.16m: B's, 0°, fe, cly 4.6-5.26m: B (x4) 0°, cly 5.35m: J70°, un, ro, fe	C	100	60	PL(A) = 0.4
17												
3	3.15	LAMINITE - medium then high strength, moderately then slightly weathered, slightly fractured, brown then grey-brown, laminite with approximately 25% fine sandstone laminations										PL(A) = 0.5
16												
4												PL(A) = 0.8
15									C	100	85	
5												PL(A) = 0.5
14												
6	6.17	Bore discontinued at 6.17m										PL(A) = 1.3
13												
7												
12												
8												
11												
9												
10												

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 1.0m

TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.2m; NMLC-Coring to 6.17m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 6.0m (screen 1.0-6.0m; gravel 0.5-6.0m; bentonite to GL; gatic cover)

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 17.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 73946
DATE: 11/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
17	0.03	ASPHALT							A/E			
	0.2	FILLING - grey-brown, slightly gravelly, sandy silt filling							A/E			
	0.4	FILLING - orange-brown, fine to medium sand filling (ripped sandstone) with some fine to medium gravel with a trace of concrete, humid							A			
16	1	FILLING - brown, silty clay filling with some ripped shale and with a trace of fine sand, charcoal and fine ironstone gravel, humid							A/E S			2,9,10 N = 19
15	2	FILLING - brown-grey, silty clay filling with a trace of fine gravel, charcoal, rootlets and fine sand, moist							E/S			2,2,4 N = 6
14	3	SILTY CLAY - stiff to very stiff, brown, silty clay with a trace of ironstone gravel, moist 3.8m: hard, humid						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
13	4	LAMINITE - very low then very low to low strength, highly weathered, grey and grey-brown, laminite with a trace of carbonaceous material							S C	100	0	25/90mm refusal
12	5	LAMINITE - medium strength, highly to moderately then slightly weathered, fractured and slightly fractured, grey-brown, laminite with approximately 20% fine sandstone laminations and some clay bands						4.32-4.62m: B (x6) 0°, cly, 2-5mm 4.75m: B0°, cly co, 2mm 4.9m: B0°, cly, 15mm 4.93m: B0°, cly, 30mm 4.99m: B0°, cly, 5mm 5.12m: J40°, pl, ro, fe 5.17m: B0°, cly co 5.5m: B0°, cly, 5mm 5.6m: J70°, pl, ro, cln 5.65-5.75m: B (x3) 0°, fe, cly, 2-5mm 6.1-6.95m: B (x3) 0°, fe, cly	C	100	62	PL(A) = 0.5 PL(A) = 0.6
11	6	LAMINITE - high and medium to high strength, fresh, slightly fractured then unbroken, light grey to grey laminite with approximately 20% fine sandstone laminations										PL(A) = 1.4
10	7											PL(A) = 1
9	8							7.62m: J85°, pl, ro, cln 7.8m: J35°, pl, ro, cln 7.87m: J50°, pl, ro, cln	C	100	97	PL(A) = 1.2
8	9											PL(A) = 1.5
	9.17	Bore discontinued at 9.17m										

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.1m; NMLC-Coring to 9.17m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 14.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 73946
DATE: 8/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
14	0.1	ASPHALT							A/E			
	0.2	FILLING - light grey, gravelly, sandy silt filling										
		FILLING - orange-brown, fine to medium sand filling with some silt and gravel (ripped sandstone), humid							A.E			
13	1								A/E			
	1.4							Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	E/S			6,17,17 N = 34
	1.6	FILLING - brown, silty clay filling with some ripped shale and fine gravel and a trace of building rubble										
	2	LAMINITE - extremely low and very low strength, extremely and highly weathered, fragmented to highly fractured, grey-brown laminite with some low and medium strength bands						2.1-2.37m: fg, fe, cly	C	76	0	
12	2.54							2.43m: CORE LOSS: 110mm				
								2.59-3.0m: fg, fe, cly				PL(A) = 0.5
	3							3.2m: B0°, fe	C	77	10	
11								3.8-3.9m: fg, fe				
	4							4.15m: CORE LOSS: 460mm				
10	4.61	LAMINITE - medium and medium to high strength, moderately weathered then fresh stained and fresh, slightly fractured, grey-brown then grey, laminite with approximately 25% fine sandstone laminations						4.7m: J30°, pl, ro, cln				PL(A) = 0.6
	5							4.85-4.96m: J, sv, (80°-85°), pl, ro, cln, partially he				
								5.18 & 5.38m: B0°, cly, 5-10mm				PL(A) = 0.9
9								5.45-5.8m: B (x4) 0°, cly co, 2-5mm				
	6							6.16m: B0°, fe	C	97	84	
8								6.36-6.6m: J80°, un, ro, fe				PL(A) = 1
	7							6.81m: B0°, fe				
7												PL(A) = 0.8
	7.5	Bore discontinued at 7.5m										
6	8											
5	9											

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.1m

TYPE OF BORING: Solid flight auger to 2.1m; NMLC-Coring to 7.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Gravel filling 7.0-7.5m then standpipe installed to 7.0m (screen 4.0-7.0m; gravel 3.5-7.0m; bentonite 3.0-3.5m; backfill to GL; gatic cover)

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)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 18.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 73946
DATE: 11/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
18	0.3	FILLING - brown, silty clay filling with some fine sand and fine to medium gravel, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
	0.7	FILLING - grey-brown, silty clay filling with a trace of fine gravel, timber, charcoal and brick, moist										
17	1	SILTY CLAY - very stiff, light brown mottled grey, silty clay with a trace of ironstone gravel, moist										
	1.3											
	1.45	1.0m: becoming shaly clay with some ironstone bands and a trace of rootlets						1.45-1.65m: fg	C	100	34	PL(A) = 1.2
16	1.95	LAMINITE - very low strength, highly weathered, grey shale with some fine bands of low strength, grey-brown laminite						1.75m: CORE LOSS: 200mm 1.95-2.35m: fg, fe				PL(A) = 1.1
	2.3	LAMINITE - high strength, highly to moderately weathered, fragmented, grey-brown laminite with approximately 20% fine sandstone laminations						2.42m: B0°, cly, 10mm 2.46-2.52m: J70°, un, ro, fe, cly 2.56m: B0°, cly, 5mm 2.7m: B0°, cly, 20mm 2.81-2.9m: B0°, fe, cly, 5mm	C	87	62	PL(A) = 0.6
15	3	LAMINITE - medium strength, highly to moderately then moderately weathered, fractured and slightly fractured, grey-brown, laminite with approximately 25% fine sandstone laminations. Some extremely low strength bands						3.13m: J50°, un, ro, fe 3.52-4.17m: B (x4) 0°, cly, 2-5mm				
14	4							4.35m: B0°, cly co, 1mm	C	100	94	PL(A) = 0.7
13	5											PL(A) = 0.6
12	6							5.5m: J35°, un, ro, fe 5.55m: J50° & 85°, st, ro, fe 5.77-6.2m: B's 0°, cly				
	6.6	LAMINITE - high and medium to high strength, fresh, slightly fractured and unbroken, grey laminite with approximately 20% fine sandstone laminations						6.32m: B0°, cly, 20mm 6.46m: J45°, pl, ro, fe 6.56m: B0°, fe, cly, 25mm 6.64m: B0°, fe 6.82-7.68m: B (x3) 0°, cly co, 1-2mm				PL(A) = 0.6 PL(A) = 1.5
11	7								C	100	100	PL(A) = 1
10	8											PL(A) = 1.3
9	8.97	Bore discontinued at 8.97m										

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: Solid flight auger to 1.0m; Rotary to 1.45m; NMLC-Coring to 8.97m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 13.5 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 73946
DATE: 10/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
13	0.02	ASPHALT							A/E			
	0.3	FILLING - grey, gravelly clay filling with a trace of brick and concrete							A/E			
12	1	FILLING - brown and grey, silty clay filling with some fine gravel (mostly ironstone and shale) and a trace of charcoal 0.6m: trace of brick 1.0m: trace of fine slag gravel and ripped sandstone 1.2m: some thin bands of ripped shale							A/E E/S			2,9,25/90mm refusal
	1.8	FILLING - brown, silty clay filling with a trace of fine ironstone gravel, charcoal and ripped shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	A			
11	2.2	LAMINITE - extremely low strength, extremely weathered, grey shale with some thin bands of very low to low strength, grey-brown laminite							S			19,25/80mm refusal
	3							2.8m: CORE LOSS: 450mm				
10	3.25	LAMINITE - low to medium then medium strength, highly to moderately then moderately weathered, fragmented to fractured, grey-brown, laminite with approximately 20% fine sandstone laminations and some very low strength bands						3.25-3.65m: fg, fe 3.65-3.7m: Ds	C	80	14	PL(A) = 0.3
	4							4.08m: J50°, un, ro, cly 4.12-4.26m: fg, fe 4.3m: J40°, pl, ro, fe, cly				PL(A) = 0.3
9	4.63							4.38-4.45m: J85°, un, ro, fe 4.53m: CORE LOSS: 100mm 4.63-4.84m: fg, fe 4.84-5.0m: B (x9) 0°, fe				PL(A) = 0.8
	5	LAMINITE - high strength, fresh, slightly fractured, light grey to grey laminite with approximately 25% fine sandstone laminations						5.37-5.71m: B (x3) 0°, fe				PL(A) = 1.6
8	6							6.07m: J30°, un, ro, cln	C	96	73	PL(A) = 1.7
	7							6.7-6.83m: J55°- 79°, cu, sm, fe 6.85-7.25m: J85°, pl, ro, cln				PL(A) = 0.9
6	7.0	SHALE - medium strength, fresh, slightly fractured, grey shale						7.45-7.6m: J90°, pl, ro, cln 7.65m: J85°, pl, ro, cln	C	100	100	
	8							8.05 & 8.17m: J65°, pl, sm, cln				PL(A) = 0.6
5	8.3	Bore discontinued at 8.3m										
	9											
4												

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 2.8m; NMLC-Coring to 8.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 14.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 73946
DATE: 9/7/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
14	0.0	FILLING - brown, silty clay filling with some rootlets and a trace of fine to medium gravel, humid							A/E			
	0.3	SILTY CLAY (possible filling) - red-brown, silty clay with some fine ironstone gravel							A/E			
13	0.8	LAMINITE - very low strength, highly weathered, grey and red-brown laminite with a trace of rootlets and ironstone gravel						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	A/E S			5,13,25/110mm refusal
12	2.0	LAMINITE - extremely low to very low strength, extremely to highly weathered, fragmented to fractured, grey-brown laminite with some low to medium and medium strength bands						2m: CORE LOSS: 370mm 2.5-2.64m: fg 2.77-2.79m: cly 2.85-2.91m: B's 0°, cly 3.05m: B0°, cly, 5mm	C	78	0	PL(A) = 0.6 PL(A) = 0.4
11	2.37											
10	3.82	LAMINITE - low to medium and medium strength, moderately weathered, fragmented to fractured and slightly fractured, grey-brown laminite with approximately 20% fine sandstone laminations						3.77-3.84m: cly 3.88m: B0°, cly 3.95m: J70°, pl, ro, fe 4.0-4.06m: fg 4.12m: J60°, un, ro, cly 4.18-4.3m: J80°, un, ro, fe 4.43m: CORE LOSS: 220mm 4.65-4.73m: fg 4.77-4.88m: cly 4.9-5.05m: fg 5.05m: J70°, un, ro, cln 5.2m: J75°, un, ro, cln 5.3m: J75°, pl, ro, fe 5.45m: J45°, pl, ro, cln 5.65m: J90°, pl, sm, cln 5.9m: J55°, pl, sm, cln 6.17m: B0°, cly, 10mm	C	89	40	PL(A) = 0.3 PL(A) = 0.4
9	4.65											
8	6.2	LAMINITE - high strength, slightly weathered then fresh, slightly fractured then unbroken, light grey to grey laminite with approximately 25% fine sandstone laminations						6.67 & 6.93m: B0°, fe	C	100	100	PL(A) = 1.2 PL(A) = 1.5
7	8.3	LAMINITE - low to medium and medium strength, fresh, fragmented to fractured then slightly fractured, grey to grey laminite with approximately 20% fine sandstone laminations. Some very low strength bands						8.3m: J60°, un, ro, cln 8.35-8.5m: J70°, un, ro, fe 8.5m: J45°- 70°, pl, sm, cln 8.74-8.9m: B's -°, cly 8.9m: J85°- 90°, pl, sm, cly 9.04-9.22m: fg, cly 9.26m: J55°, pl, sm, cly 9.4-9.46m: Cz, cly 9.5m: J45°, pl, sm, cln	C	100	68	PL(A) = 1.2 PL(A) = 0.3 PL(A) = 0.9
6												
5												

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.0m

TYPE OF BORING: Solid flight auger to 2.0m; NMLC-Coring to 10.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 14.6 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 73946
DATE: 9/7/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
								9.6m: J90°, pl, sm, cln 9.63-9.73m: Cz 10.12m: J65°- 70°, pl, sm & J85°, un, ro, cln 10.35m: J70°, pl, sm, cln	C	100	68	PL(A) = 0.8
	10.4	Bore discontinued at 10.4m										

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.0m
TYPE OF BORING: Solid flight auger to 2.0m; NMLC-Coring to 10.4m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 14.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 73946
DATE: 14/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
14	0.2	FILLING - brown, slightly gravelly, clayey silty sand filling with some rootlets, humid							A/E			
	0.7	SILTY CLAY (possible filling) - hard, brown, silty clay, humid							A/E			
13	1	SHALY CLAY - hard, red-brown and orange-brown mottled grey, shaly clay with some ironstone bands/gravel and a trace of rootlets							A/E S			6,10,17 N = 27
12	2.0	LAMINITE - extremely low to very low strength, extremely weathered, grey laminite with some ironstone bands						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°	S			13,25/100mm refusal
	2.8	LAMINITE - low and low to medium strength, highly to moderately weathered, fragmented to fractured, grey-brown laminite with some extremely low strength clay bands						2.8-3.12m: fg 3.12-3.32m: B'x 0°, cly, 2-10mm 3.46m: B0°, fe, cly, 10mm 3.5m: J30°, un, ro, fe 3.6m: B0°, fe & J60°, pl, sm, fe 3.66m: B0°, cly, 5mm 3.7-3.9m: fg, fe 3.9m: CORE LOSS: 370mm	C	75	0	PL(A) = 0.2
11	3											
10	4											
	4.27	LAMINITE - medium strength, highly to moderately then moderately weathered, fractured and slightly fractured, grey-brown laminite with approximately 20% fine sandstone laminations and some clay bands						4.27-4.81m: B (x13) 0°, cly co, 1-5mm 4.98-5.17m: B (x3) 0°, fe, cly, 5-10mm 5.35m: J65°, pl, ro, fe				PL(A) = 0.4
9	5											
	5.2	LAMINITE - high then medium strength, fresh stained then fresh, slightly fractured, light grey to grey laminite with approximately 25% fine sandstone laminations							C	100	68	PL(A) = 1.3
8	6							6.22m: J65°, pl, ro, fe 6.82m: J60°, un, ro, fe				PL(A) = 1
7	7							7.05m: J85° & 45°, st, ro, fe				PL(A) = 1.1
6	8							7.91-7.96m: fg, cly 8.13m: J45° - 60°, cu, ro, cln	C	100	90	PL(A) = 0.7
	8.2	Bore discontinued at 8.2m										
5	9											

RIG: Scout 1 **DRILLER:** SS **LOGGED:** SI **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5m; Rotary to 2.8m; NMLC-Coring to 8.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Site 53 Geotechnical Investigation
LOCATION: 2 Figtree Drive, Sydney Olympic Park

SURFACE LEVEL: 13.1 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 73946
DATE: 17/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
13	0.03	ASPHALT							A/E			
	0.2	FILLING - grey, gravelly silty sand filling, humid							A/E			
		FILLING - brown, silty clay filling with some gravel, humid										
	0.8	FILLING - grey and brown, silty clay and ripped shale filling with some gravel and a trace of rootlets, charcoal and fine slag gravel, humid							A/E			
12	1								S			5,6,9 N = 15
11	2											
	2.7	FILLING - brown, slightly gravelly, silty clay filling with a trace of fine sand, humid							E/S A			3,9,9 N = 18
10	3								A			
	3.0	SILTY CLAY - very stiff to hard, brown mottled grey and red-brown, silty clay, humid										
	3.6	LAMINITE - very low strength, highly weathered, grey and brown laminite with a trace of organic material						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
9	4								S			14,18,25/100mm refusal
	4.45	LAMINITE - very low to low strength, highly weathered, fragmented to fractured, grey-brown laminite						4.45-4.6m: fs, fe				
	4.9	LAMINITE - medium and high strength, moderately then slightly weathered, fractured and slightly fractured, brown then grey-brown laminite with approximately 25% fine sandstone laminations						4.64m: B0°, fe, cly, 20mm 4.71m: B0°, fe, 2mm 4.76-4.93m: B0°, fe	C	100	70	PL(A) = 0.1
8	5							5.5-6.11m: B (x6) 0°, fe, cly, 5-20mm				PL(A) = 0.7
	6							6.15-6.2m: fg, fe 6.27-6.61m: B (x6) 0°, fe, cly, 2-10mm				PL(A) = 1.4
7	7							6.65m: J40°, fe 6.79m: B0°, fe, cly, 5mm 6.81m: J50°, pl, sm 6.86-7.18m: B (x4) 0°, fe 7.25-7.51m: B (x9) 0°, cly, fe, 0-2mm				PL(A) = 0.7
	7.6	LAMINITE - high strength, fresh, slightly fractured, light grey to grey laminite with approximately 20% fine sandstone laminations						7.67m: J40°, fe, cly 7.73m: J50°, pl, ro	C	100	62	
6	8							8.2m: J40°, pl, sm 8.28m: J40°, pl, ro 8.38m: J65°, pl, sm				PL(A) = 1.1
5	9							8.96m: B0°, fe	C	100	100	PL(A) = 1.5
4	9.65	Bore discontinued at 9.65m						9.55-9.64m: J80°, pl, ro, fe				

RIG: Scout 1 **DRILLER:** SS **LOGGED:** IW/SI **CASING:** HW to 4.0m

TYPE OF BORING: Solid flight auger to 4.0m; Rotary to 4.45m; NMLC-Coring to 9.65m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 9.65m (screen 4.65-9.65m; gravel 3.0-9.65m: bentonite 2.5-3.0m; backfill to GL; gatic cover)

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

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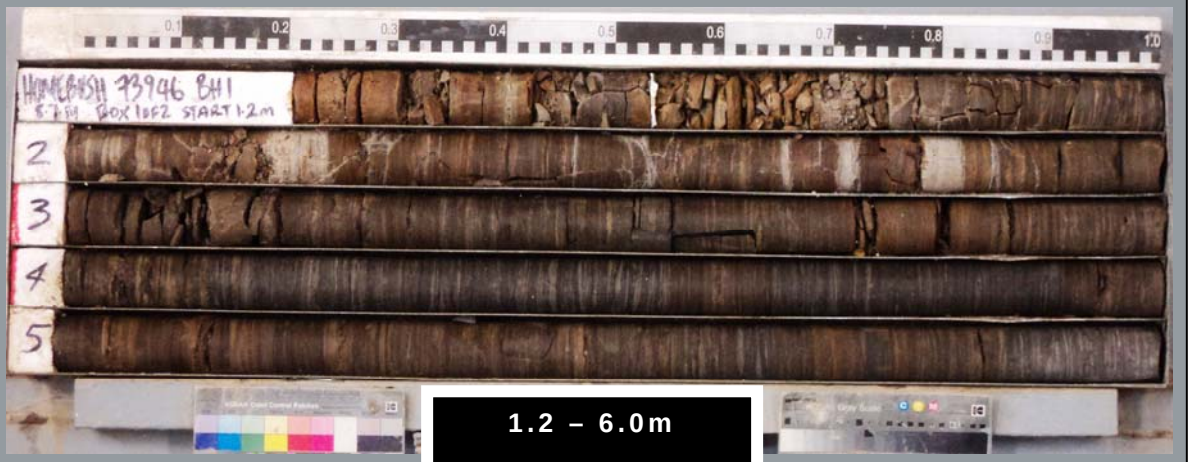
SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 73946 JUL 2014

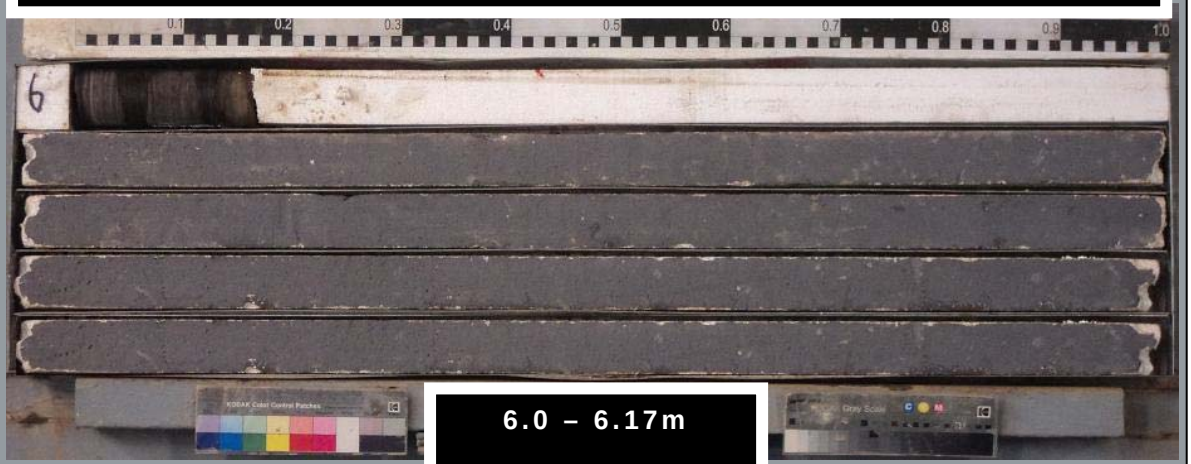


1.2 – 6.0m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 1 PROJECT 73946 JUL 2014

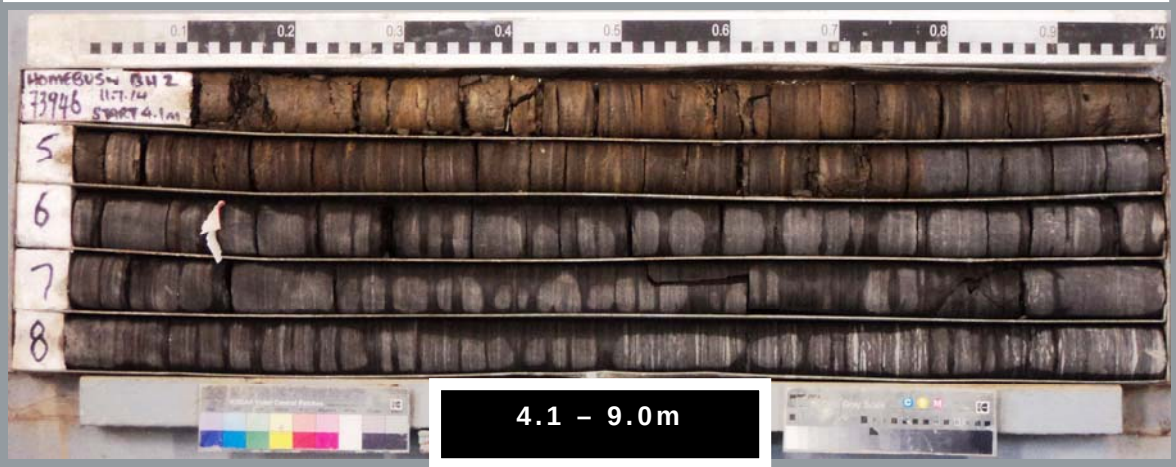


6.0 – 6.17m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 2 PROJECT 73946 JUL 2014

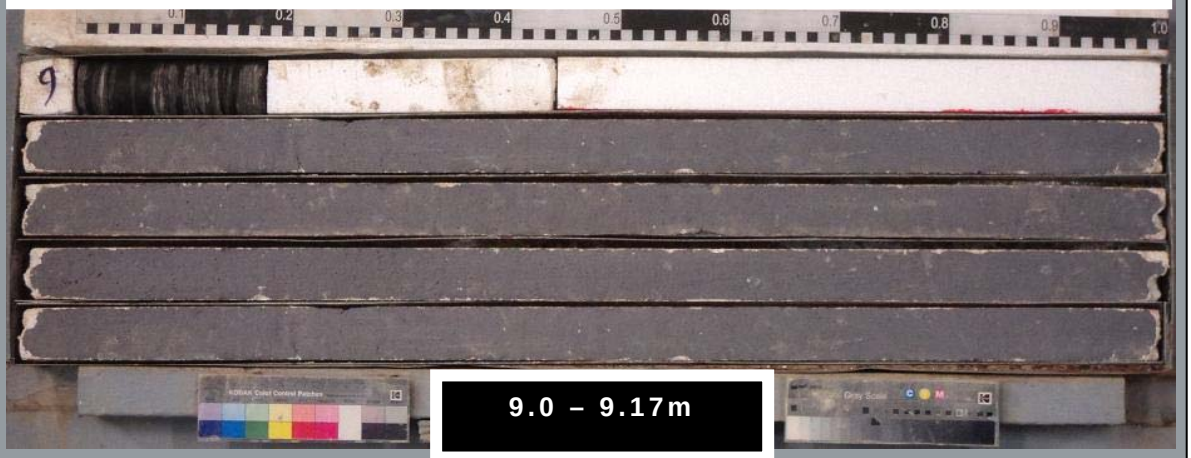


4.1 – 9.0m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 2 PROJECT 73946 JUL 2014



9.0 – 9.17m

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BORE 3 PROJECT 73946 JUL 2014

2.1 – 7.0m

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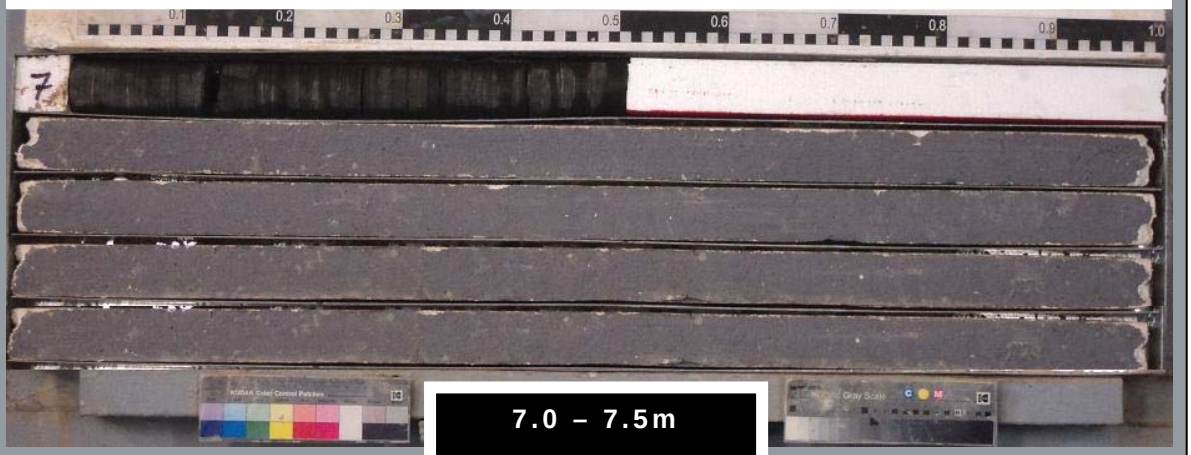
SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 3 PROJECT 73946 JUL 2014



7.0 – 7.5m

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SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

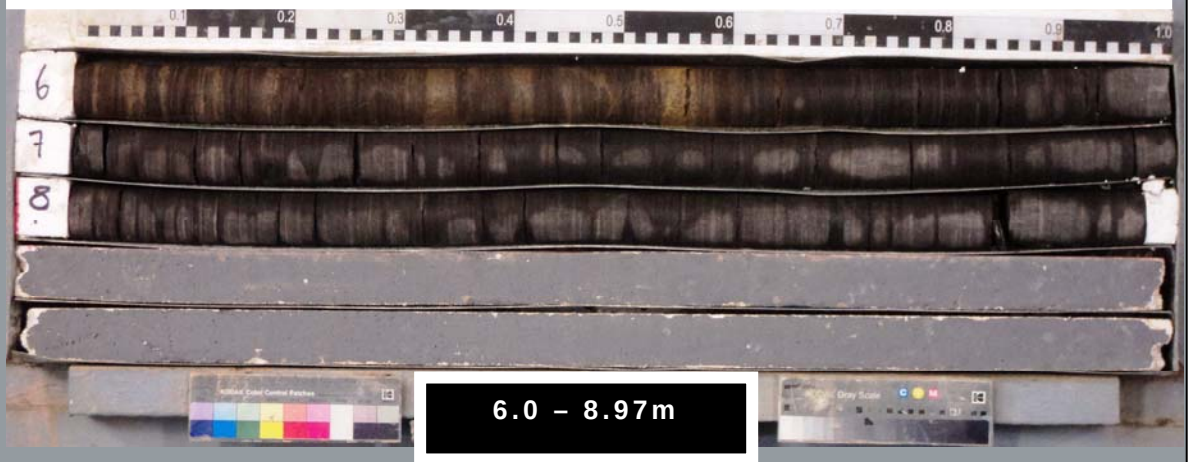
BORE 4 PROJECT 73946 JUL 2014

1.45 – 6.0m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 4 PROJECT 73946 JUL 2014



6.0 – 8.97m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 5 PROJECT 73946 JUL 2014

2.8 – 7.0m

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SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 5 PROJECT 73946 JUL 2014

7.0 – 8.3m

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SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

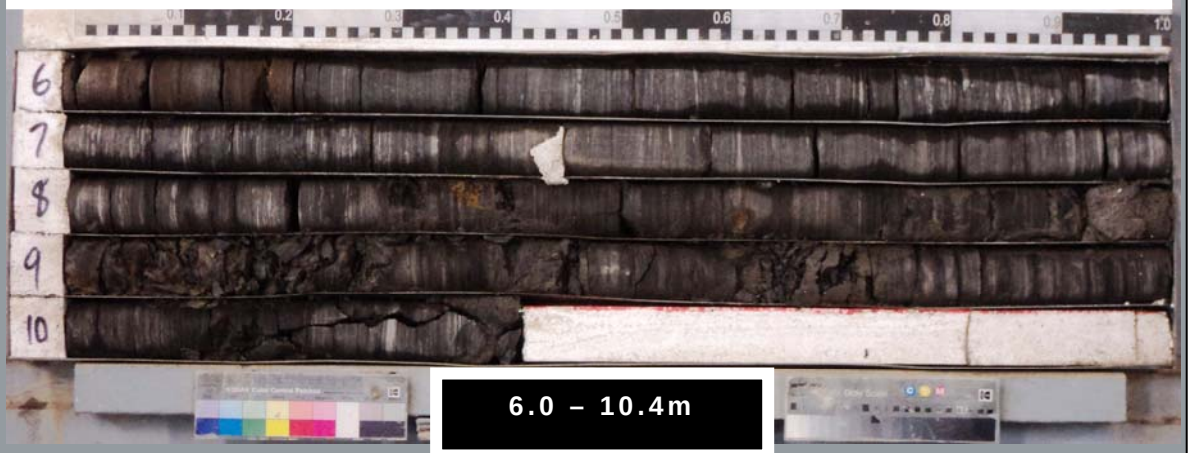
BORE 6 PROJECT 73946 JUL 2014

2.0 – 6.0m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 6 PROJECT 73946 JUL 2014

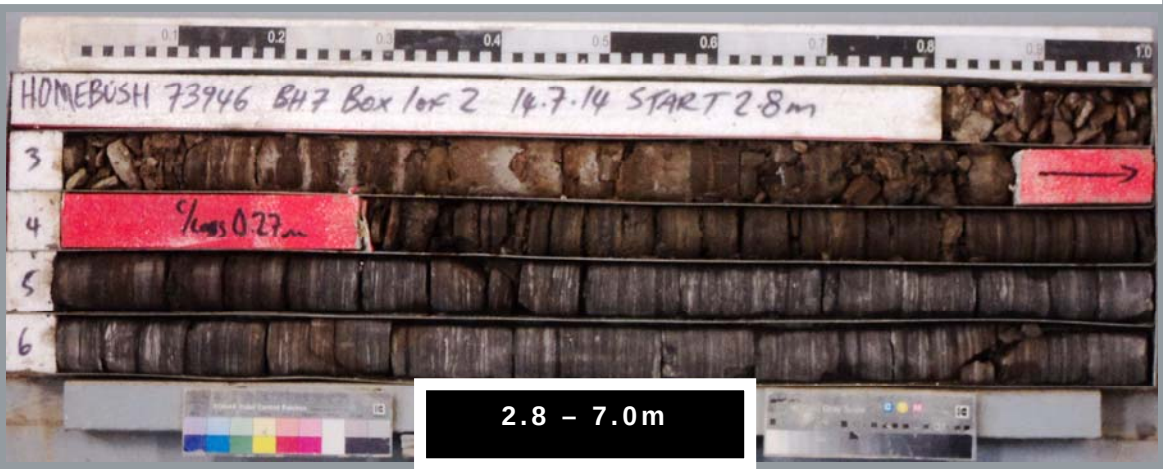


6.0 – 10.4m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 7 PROJECT 73946 JUL 2014

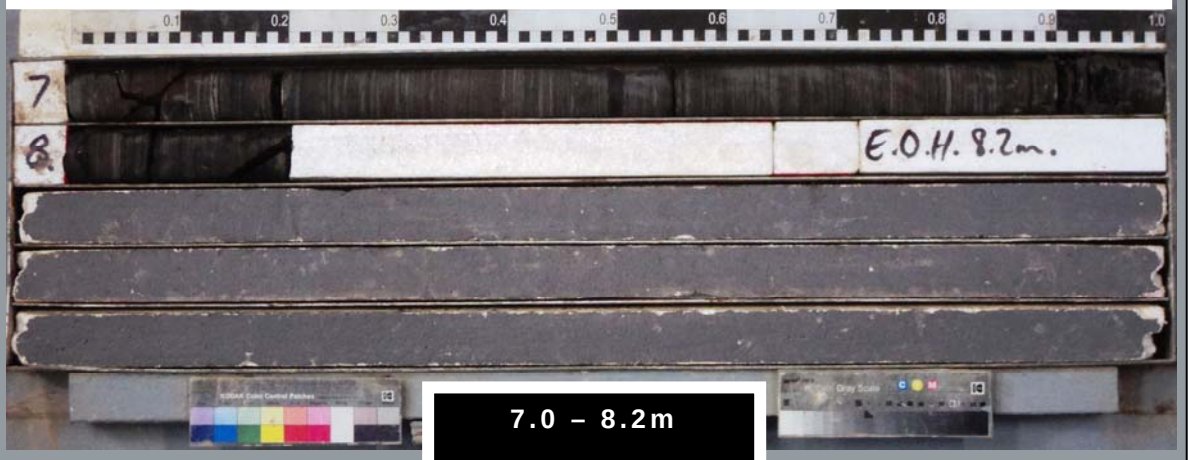


2.8 – 7.0m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 7 PROJECT 73946 JUL 2014

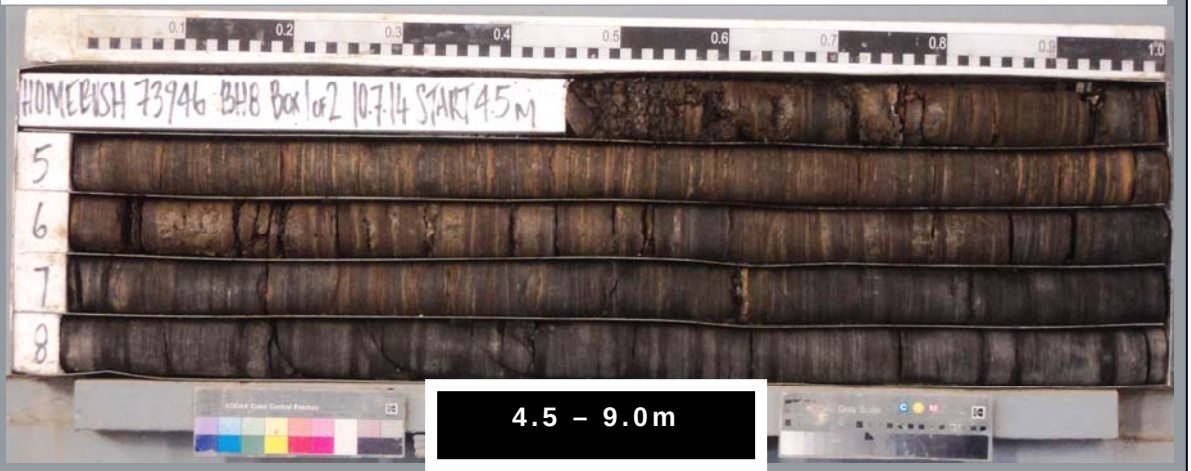


7.0 – 8.2m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 8 PROJECT 73946 JUL 2014

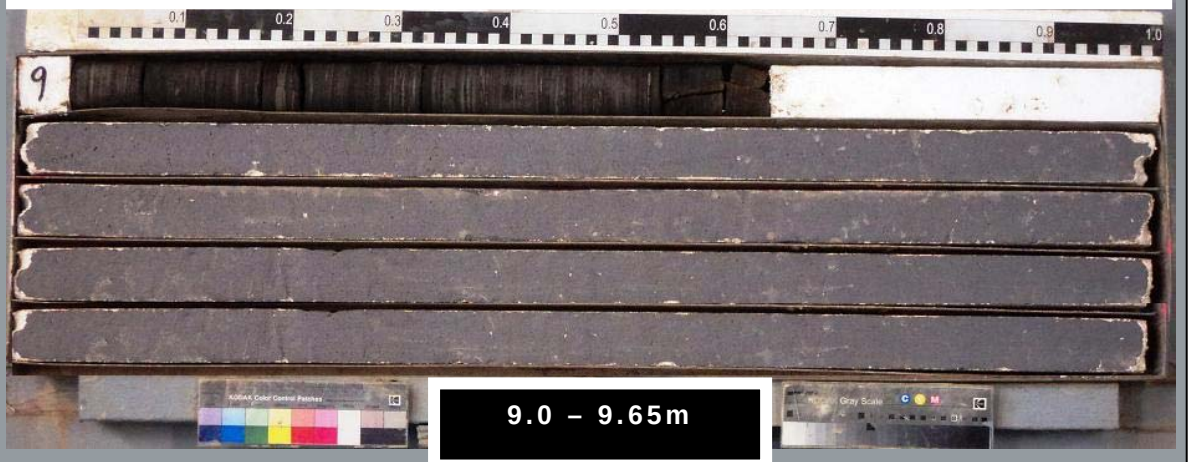


4.5 – 9.0m

DOUGLAS PARTNERS PTY LTD

SITE 53 GEOTECHNICAL INVESTIGATION – SYDNEY OLYMPIC PARK

BORE 8 PROJECT 73946 JUL 2014



9.0 – 9.65m

Appendix D

Laboratory Test Results

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

CERTIFICATE OF ANALYSIS 112861

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

Attention: Peter Oitmaa, Kelly McPhee

Sample log in details:

Your Reference:	**73946, Sydney Olympic Park**
No. of samples:	4 Soils
Date samples received / completed instructions received	10/07/2014 / 10/07/2014

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:	11/07/14 / 11/07/14
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:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
TRHC$_6$ - C$_9$	mg/kg	<25	<25	<25	<25
TRHC$_6$ - C$_{10}$	mg/kg	<25	<25	<25	<25
vTPHC$_6$ - C$_{10}$ less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	90	89	81	92

svTRH (C10-C40) in Soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
TRHC$_{10}$ - C$_{14}$	mg/kg	<50	<50	<50	<50
TRHC$_{15}$ - C$_{28}$	mg/kg	<100	<100	<100	<100
TRHC$_{29}$ - C$_{36}$	mg/kg	<100	<100	<100	<100
TRH>C$_{10}$-C$_{16}$	mg/kg	<50	<50	<50	<50
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH>C$_{16}$-C$_{34}$	mg/kg	<100	<100	<100	<100
TRH>C$_{34}$-C$_{40}$	mg/kg	<100	<100	<100	<100
Surrogate o-Terphenyl	%	71	83	81	84

PAHs in Soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.06	<0.05	<0.05	0.06
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	0.060	NIL (+)VE	NIL (+)VE	0.26
Surrogate p-Terphenyl-d14	%	84	97	97	98

Organochlorine Pesticides in soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	80	93	91	93

PCBs in Soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	84	93	91	93

Total Phenolics in Soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5

Acid Extractable metals in soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date digested	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Arsenic	mg/kg	20	<4	10	9
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	10	10	24	15
Copper	mg/kg	8	5	15	35
Lead	mg/kg	47	14	22	33
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	4	3	6	9
Zinc	mg/kg	20	20	18	66
Manganese	mg/kg	69	38	48	520
Iron	mg/kg	11,000	11,000	82,000	30,000
Sulphur	mg/kg	220	110	180	170

Miscellaneous Inorg - soil					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
pH 1:5 soil:water	pH Units	10.0	8.8	5.4	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	150	230	56	140

Moisture					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Moisture	%	4.8	5.6	15	14

Asbestos ID - soils					
Our Reference:	UNITS	112861-1	112861-2	112861-3	112861-4
Your Reference	----------	BH1	BH3	BH6	BH8
Depth	----------	0.5	1-1.45	0.5	1-1.45
Date Sampled		8/07/2014	8/07/2014	9/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014
Sample mass tested	g	Approx 60g	Approx 60g	Approx 60g	Approx 60g
Sample Description	-	Beige coarse-grained soil & rocks	Beige coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

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 subset	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.
Org-005	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.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
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.

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	-			10/07/2014	[NT]	[NT]	LCS-6	10/07/2014
Date analysed	-			11/07/2014	[NT]	[NT]	LCS-6	11/07/2014
TRHC$_6$ - C$_9$	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-6	102%
TRHC$_6$ - C$_{10}$	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-6	102%
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-6	96%
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-6	105%
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-6	104%
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-6	102%
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-6	105%
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	82	[NT]	[NT]	LCS-6	92%

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	-			10/07/2014	[NT]	[NT]	LCS-6	10/07/2014
Date analysed	-			11/07/2014	[NT]	[NT]	LCS-6	11/07/2014
TRHC$_{10}$ - C$_{14}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-6	104%
TRHC$_{15}$ - C$_{28}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-6	116%
TRHC$_{29}$ - C$_{36}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-6	119%
TRH>C$_{10}$-C$_{16}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-6	104%
TRH>C$_{16}$-C$_{34}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-6	116%
TRH>C$_{34}$-C$_{40}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-6	119%
Surrogate o-Terphenyl	%		Org-003	84	[NT]	[NT]	LCS-6	100%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			10/07/2014	[NT]	[NT]	LCS-1	10/07/2014
Date analysed	-			10/07/2014	[NT]	[NT]	LCS-1	10/07/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	102%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	99%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	108%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	107%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	107%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-1	95%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	[NT]	[NT]	LCS-1	105%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	95	[NT]	[NT]	LCS-1	97%
QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			10/07/2014	[NT]	[NT]	LCS-1	10/07/2014
Date analysed	-			11/07/2014	[NT]	[NT]	LCS-1	11/07/2014
HCB	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	97%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	96%
Heptachlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	93%
delta-BHC	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	94%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	96%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	99%
Dieldrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	98%
Endrin	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	97%
pp-DDD	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	108%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	LCS-1	99%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%		Org-005	89	[NT]	[NT]	LCS-1	87%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			10/07/2014	[NT]	[NT]	LCS-1	10/07/2014
Date analysed	-			11/07/2014	[NT]	[NT]	LCS-1	11/07/2014
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	LCS-1	99%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-006	89	[NT]	[NT]	LCS-1	88%
QUALITY CONTROL Total Phenolics in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			11/07/2014	112861-1	11/07/2014 II 11/07/2014	LCS-1	10/07/2014
Date analysed	-			11/07/2014	112861-1	11/07/2014 II 11/07/2014	LCS-1	11/07/2014
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	112861-1	<5 II <5	LCS-1	98%
QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date digested	-			10/07/2014	[NT]	[NT]	LCS-14	10/07/2014
Date analysed	-			10/07/2014	[NT]	[NT]	LCS-14	10/07/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	[NT]	[NT]	LCS-14	99%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	[NT]	[NT]	LCS-14	101%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	104%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	103%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	100%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	[NT]	[NT]	LCS-14	86%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	103%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	101%
Manganese	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	105%
Iron	mg/kg	1	Metals-020 ICP-AES	<1	[NT]	[NT]	LCS-14	116%
Sulphur	mg/kg	10	Metals-020 ICP-AES	<10	[NT]	[NT]	LCS-14	95%

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			11/07/2014	112861-1	11/07/2014 || 11/07/2014	LCS-1	11/07/2014
Date analysed	-			11/07/2014	112861-1	11/07/2014 || 11/07/2014	LCS-1	11/07/2014
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	112861-1	10.0 || 9.9 || RPD: 1	LCS-1	102%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	112861-1	150 || 130 || RPD: 14	LCS-1	105%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

QUALITY CONTROL Asbestos ID - soils	UNITS	PQL	METHOD	Blank
Date analysed	-			[NT]

Report Comments:

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.

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

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC 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.

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:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde NSW 2114

ph: 02 9809 0666
Fax: 02 9809 4095

Attention: Peter Oitmaa, Kelly McPhee

Sample log in details:

Your reference:	**73946, Sydney Olympic Park**
Envirolab Reference:	**112861**
Date received:	10/07/2014
Date results expected to be reported:	**11/07/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	4 Soils
Turnaround time requested:	24hr
Temperature on receipt (°C)	10.6
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 73946	**To:**	Envirolab Services
Contact Person: Kelly McPhee	**Project Name:** Sydney Olympic Park	**Contact Person:**	Aileen Hie
Project Mgr: Peter Oitmaa	**PO No.:**	**Address:**	12 Ashley Street
Sampler: Kelly McPhee	**lab Quote No. :**		Chatswood NSW 2068
Address: 96 Hermitage Road West Ryde NSW 2114	**Date results required:** ~~Standard~~ 24hr **Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Phone:**	02 9910 6200
		Fax:	02 9910 6201
Phone: 9809 0666 **Mob:** 0419 781 366	**Report format:** esdat / PDF / Excel	**Email:**	ahie@envirolab.com.au
Email: kelly.mcphee @douglaspartners.com.au	**Comments:**	**Laboratory Report No:**	
Prior Storage (Fride, Esky, Shelf)		**Lab Comments:**	

	Sample information					Tests Required												Comments
112861	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	8 metals	TRH/BTEX	PAH	OCP	PCB	Phenol	Asbestos	pH	EC				
1	BH1	0.5	8/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
2	BH3	1-1.45	8/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
3	BH6	0.5	9/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
4	BH8	1-1.45	9/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***
Hand delivered / Courier (by whom)	**Received by (Company):** Fraj	**Samples Received: Cool or Ambient (circle one)**
Condition of Sample at dispatch Cool or Ambient (circle)	**Print Name:** Poonam Raj	**Temperature Received at:** (if applicable)
Temperature (if Applicable):	**Date & Time:** 10/7/2014 10.40	**Transported by: Hand delivered / courier**
Print Name: Kelly McPhee	**Signature:**	
Date & Time: 10/07/2014 8.45am		
Signature:		Page_____of_____

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

Job No: 112861
Date Received: 10.7.2014
Time Received: 10.40am
Received by: RG
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
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CERTIFICATE OF ANALYSIS 113097

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

Attention: Kelly McPhee, Peter Oitmaa

Sample log in details:

Your Reference:	**73946, Sydney Olympic Park**		
No. of samples:	8 Soils		
Date samples received / completed instructions received	15/07/14	/	15/07/14

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

Report Details:

Date results requested by: / Issue Date:	17/07/14	/	17/07/14
Date of Preliminary Report:	Not Issued		

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Results Approved By:

Jacinta Hurst
Laboratory Manager

ACCREDITED FOR TECHNICAL COMPETENCE

vTRH(C6-C10)/BTEXN in Soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	17/07/2014
TRHC$_6$ - C$_9$	mg/kg	<25	<25	<25	<25	<25
TRHC$_6$ - C$_{10}$	mg/kg	<25	<25	<25	<25	<25
vTPHC$_6$ - 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	%	102	101	99	97	106

vTRH(C6-C10)/BTEXN in Soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014
TRHC$_6$ - C$_9$	mg/kg	<25	<25	<25
TRHC$_6$ - C$_{10}$	mg/kg	<25	<25	<25
vTPHC$_6$ - 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	%	100	104	102

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
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	%	91	89	87	90	100

svTRH (C10-C40) in Soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014
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	%	104	88	94

PAHs in Soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
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	0.7	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	0.2	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	1.7	0.2
Pyrene	mg/kg	<0.1	<0.1	<0.1	1.6	0.2
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	0.6	0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	0.6	0.2
Benzo(b+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	1.2	0.3
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	0.79	0.17
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	0.6	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	0.6	0.1
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5	<0.5	1.0	<0.5
Total +ve PAH's	mg/kg	NIL (+)VE	NIL (+)VE	NIL (+)VE	8.4	1.5
Surrogate p-Terphenyl-d14	%	104	105	106	105	109

PAHs in Soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014
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	0.2
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	0.1	0.6
Pyrene	mg/kg	0.2	0.1	0.6
Benzo(a)anthracene	mg/kg	0.1	<0.1	0.3
Chrysene	mg/kg	0.1	<0.1	0.3
Benzo(b+k)fluoranthene	mg/kg	0.2	<0.2	0.5
Benzo(a)pyrene	mg/kg	0.12	0.06	0.32
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0.2
Benzo(a)pyrene TEQ NEPM B1	mg/kg	<0.5	<0.5	<0.5
Total +ve PAH's	mg/kg	1.0	0.32	3.2
Surrogate p-Terphenyl-d14	%	106	104	106

Organochlorine Pesticides in soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
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	%	84	84	84	88	107

Organochlorine Pesticides in soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014
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	0.3	<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	%	88	86	89

PCBs in Soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	84	84	84	88	107

PCBs in Soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014
Arochlor 1016	mg/kg	<0.1	<0.5	<0.5
Arochlor 1221	mg/kg	<0.1	<0.5	<0.5
Arochlor 1232	mg/kg	<0.1	<0.5	<0.5
Arochlor 1242	mg/kg	<0.1	<0.5	<0.5
Arochlor 1248	mg/kg	<0.1	<0.5	<0.5
Arochlor 1254	mg/kg	<0.1	<0.5	<0.5
Arochlor 1260	mg/kg	<0.1	<0.5	<0.5
Surrogate TCLMX	%	88	86	89

Total Phenolics in Soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Total Phenolics in Soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date extracted	-	17/07/2014	17/07/2014	17/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5

Acid Extractable metals in soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date digested	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Arsenic	mg/kg	<4	<4	9	9	<4
Cadmium	mg/kg	<0.4	0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	10	8	14	12	14
Copper	mg/kg	9	49	27	32	36
Lead	mg/kg	12	21	27	28	18
Mercury	mg/kg	<0.1	<0.1	<0.1	0.2	<0.1
Nickel	mg/kg	7	38	10	9	56
Zinc	mg/kg	25	140	64	150	54

Acid Extractable metals in soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date digested	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014
Arsenic	mg/kg	7	9	9
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	100	21	12
Copper	mg/kg	25	24	39
Lead	mg/kg	28	29	31
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	11	8	14
Zinc	mg/kg	50	29	74

Moisture						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014	17/07/2014	17/07/2014
Moisture	%	5.6	14	22	21	5.5

Moisture				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date prepared	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	17/07/2014	17/07/2014	17/07/2014
Moisture	%	11	15	13

Miscellaneous Inorg - soil						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
pH 1:5 soil:water	pH Units	9.5	7.1	6.4	7.8	8.9
Electrical Conductivity 1:5 soil:water	µS/cm	230	160	87	300	510

Miscellaneous Inorg - soil				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date prepared	-	16/07/2014	16/07/2014	16/07/2014
Date analysed	-	16/07/2014	16/07/2014	16/07/2014
pH 1:5 soil:water	pH Units	5.7	6.2	6.9
Electrical Conductivity 1:5 soil:water	µS/cm	410	45	220

Asbestos ID - soils						
Our Reference:	UNITS	113097-1	113097-2	113097-3	113097-4	113097-5
Your Reference	----------	BH2	BH2	BH2	BH4	BH5
Depth	----------	0.3	1.0-1.45	2.5-2.95	0.5	0.1
Date Sampled		11/07/2014	11/07/2014	11/07/2014	11/07/2014	10/07/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	16/07/2014	16/07/2014	16/07/2014	16/07/2014	16/07/2014
Sample mass tested	g	Approx 60g	Approx 60g	Approx 60g	Approx 60g	Approx 60g
Sample Description	-	Tan coarse-grained soil & rocks	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

Asbestos ID - soils				
Our Reference:	UNITS	113097-6	113097-7	113097-8
Your Reference	----------	BH5	BH7	BH8
Depth	----------	1.0	0.5	0.5
Date Sampled		10/07/2014	14/07/2014	9/07/2014
Type of sample		Soil	Soil	Soil
Date analysed	-	16/07/2014	16/07/2014	16/07/2014
Sample mass tested	g	Approx 60g	Approx 60g	Approx 60g
Sample Description	-	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg	No asbestos detected at reporting limit of 0.1g/kg
Trace Analysis	-	No respirable fibres detected	No respirable fibres detected	No respirable fibres detected

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 subset	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.
Org-005	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.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	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.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
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.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Date analysed	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
TRHC$_6$ - C$_9$	mg/kg	25	Org-016	<25	113097-1	<25 || <25	LCS-10	114%
TRHC$_6$ - C$_{10}$	mg/kg	25	Org-016	<25	113097-1	<25 || <25	LCS-10	114%
Benzene	mg/kg	0.2	Org-016	<0.2	113097-1	<0.2 || <0.2	LCS-10	97%
Toluene	mg/kg	0.5	Org-016	<0.5	113097-1	<0.5 || <0.5	LCS-10	113%
Ethylbenzene	mg/kg	1	Org-016	<1	113097-1	<1 || <1	LCS-10	118%
m+p-xylene	mg/kg	2	Org-016	<2	113097-1	<2 || <2	LCS-10	120%
o-Xylene	mg/kg	1	Org-016	<1	113097-1	<1 || <1	LCS-10	124%
naphthalene	mg/kg	1	Org-014	<1	113097-1	<1 || <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	106	113097-1	102 || 102 || RPD: 0	LCS-10	104%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Date analysed	-			17/07/2014	113097-1	17/07/2014 || 17/07/2014	LCS-10	17/07/2014
TRHC$_{10}$ - C$_{14}$	mg/kg	50	Org-003	<50	113097-1	<50 || <50	LCS-10	95%
TRHC$_{15}$ - C$_{28}$	mg/kg	100	Org-003	<100	113097-1	<100 || <100	LCS-10	91%
TRHC$_{29}$ - C$_{36}$	mg/kg	100	Org-003	<100	113097-1	<100 || <100	LCS-10	122%
TRH>C$_{10}$-C$_{16}$	mg/kg	50	Org-003	<50	113097-1	<50 || <50	LCS-10	95%
TRH>C$_{16}$-C$_{34}$	mg/kg	100	Org-003	<100	113097-1	<100 || <100	LCS-10	91%
TRH>C$_{34}$-C$_{40}$	mg/kg	100	Org-003	<100	113097-1	<100 || <100	LCS-10	122%
Surrogate o-Terphenyl	%		Org-003	96	113097-1	91 || 91 || RPD: 0	LCS-10	106%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Date analysed	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	LCS-10	105%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	LCS-10	100%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	LCS-10	104%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	LCS-10	100%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Pyrene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	LCS-10	102%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	LCS-10	99%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	113097-1	<0.2 || <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	113097-1	<0.05 || <0.05	LCS-10	111%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	102	113097-1	104 || 101 || RPD: 3	LCS-10	103%

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	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Date analysed	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
HCB	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	97%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	99%
Heptachlor	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	96%
delta-BHC	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	94%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	98%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	100%
Dieldrin	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	97%
Endrin	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	101%
pp-DDD	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	108%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	LCS-10	99%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	86	113097-1	84 || 86 || RPD: 2	LCS-10	84%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Date analysed	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-10	16/07/2014
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	LCS-10	101%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	113097-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	86	113097-1	84 || 86 || RPD: 2	LCS-10	84%

QUALITY CONTROL Total Phenolics in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			17/07/2014	113097-1	17/07/2014 || 17/07/2014	LCS-1	17/07/2014
Date analysed	-			17/07/2014	113097-1	17/07/2014 || 17/07/2014	LCS-1	17/07/2014
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	113097-1	<5 || <5	LCS-1	97%

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 digested	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-5	16/07/2014
Date analysed	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-5	16/07/2014
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	113097-1	<4 || <4	LCS-5	101%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	113097-1	<0.4 || <0.4	LCS-5	110%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	113097-1	10 || 9 || RPD: 11	LCS-5	107%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	113097-1	9 || 10 || RPD: 11	LCS-5	105%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	113097-1	12 || 13 || RPD: 8	LCS-5	105%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	113097-1	<0.1 || <0.1	LCS-5	88%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	113097-1	7 || 8 || RPD: 13	LCS-5	107%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	113097-1	25 || 29 || RPD: 15	LCS-5	108%

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Date prepared	-			[NT]
Date analysed	-			[NT]
Moisture	%	0.1	Inorg-008	[NT]

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-1	16/07/2014
Date analysed	-			16/07/2014	113097-1	16/07/2014 || 16/07/2014	LCS-1	16/07/2014
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	113097-1	9.5 || 9.6 || RPD: 1	LCS-1	100%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	113097-1	230 || 200 || RPD: 14	LCS-1	98%

Report Comments:

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.

PCB's in soil: PQL has been raised due to interference from analytes(other than those being tested) in the sample/s.

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

INS: Insufficient sample for this test
NA: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC 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.

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:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde NSW 2114

ph: 02 9809 0666
Fax: 02 9809 4095

Attention: Kelly McPhee, Peter Oitmaa

Sample log in details:

Your reference:	**73946, Sydney Olympic Park**
Envirolab Reference:	**113097**
Date received:	15/07/14
Date results expected to be reported:	**22/07/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	8 Soils
Turnaround time requested:	Standard
Temperature on receipt (°C)	3.7
Cooling Method:	Ice Pack
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	Project Number 73946	To:	Envirolab Services
Contact Person: Kelly McPhee	Project Name: Sydney Olympic Park	Contact Person:	Aileen Hie
Project Mgr: Peter Oitmaa	PO No.:	Address:	12 Ashley Street
Sampler: Kelly McPhee	lab Quote No. :		Chatswood NSW 2068
Address: 96 Hermitage Road	Date results required: Standard	Phone:	02 9910 6200
West Ryde NSW 2114	Or choose: standard / same day / 1 day / 2 day / 3 day	Fax:	02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	Email:	ahie@envirolab.com.au
Phone: 9809 0666 Mob: 0419 781 366	Report format: esdat / PDF / Excel	Laboratory Report No:	
Email: kelly.mcphee @douglaspartners.com.au	Comments:	Lab Comments:	
Prior Storage (Fride, Esky, Shelf)			

	Sample information					Tests Required												Comments
	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	8 metals	TRH/BTEX	PAH	OCP	PCB	Phenol	Asbestos	pH	EC				
1	BH2	0.3	11/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
2	BH2	1-1.45	11/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
3	BH2	2.5-2.95	11/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
4	BH4	0.5	11/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
5	BH5	0.1	10/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
6	BH5	1	10/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
7	BH7	0.5	14/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				
8	BH8	0.5	9/07/2014	jar/bag	soil	X	X	X	X	X	X	X	X	X				

Relinquished by: Douglas Partners	Sample Receipt	*Lab use only:*
Hand delivered / Courier (by whom)	Received by (Company): ELS	Samples Received: Cool or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle)	Print Name: JYH	Temperature Received at: 3.7 (if applicable)
Temperature (if Applicable):	Date & Time: 15/7/14 13:30.	Transported by: Hand delivered / courier
Print Name: Kelly McPhee	Signature:	
Date & Time: 15/07/2014		
Signature:		

Page ____ of ____

ENVIROLAB

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

Job No: 113097
Date Received: 15/7/14
Time Received: 13:30
Received by: JYH
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None