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Report on
Geotechnical Investigation

Proposed Redevelopment
One Carrington Street
Sydney

Prepared for
Sovereign Wynyard Centre Pty Ltd

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Report on Geotechnical Investigation
Proposed redevelopment
One Carrington Street, Sydney

1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed commercial development at 2 – 28 Carrington Street and 289 – 317 George Street, Sydney. The investigation was commissioned by Sovereign Wynyard Centre Pty Ltd.

It is understood that the development, referred to as 'One Carrington Street' will comprise demolition of the Menzies Hotel and 301 George Street buildings, and partial demolition of the heritage-listed Shell House, followed by construction of a new commercial development.

The objectives of this report are to detail the results of a geotechnical investigation and provide comments on excavation conditions and support, groundwater, founding conditions and suitable foundation systems. In addition, this report provides a preliminary waste classification of soils and a discussion of results of analytical testing for potential groundwater contamination.

In November, Douglas Partners Pty Ltd (DP) conducted a geotechnical desktop study of available information for the proposed development (DP Ref: 73693), and a desktop study for potential contamination issues (DP Ref: 73693.01).

2. Site Description

The One Carrington Street site has an L-shaped footprint and is located between George and York Streets, Sydney. The site has a total area of 11,124 m^2 and comprises the following properties:

- Former Shell House, an 11-level heritage building (forming part of the Menzies Hotel) located at the corner of Margaret and Carrington Streets (Lot 10, DP 595978);
- Menzies Hotel, a 14 storey hotel at 14-28 Carrington Street (Lot 1, DP 853331). Menzies Hotel also occupies the basement of 301 George Street;
- 301 George Street (formerly Thakral House), a 13 storey commercial building with retain space on the ground and first basement levels (Lot 2, DP 853331);
- Wynyard Lane, a stratum lot that runs above and below Wynyard Lane between 301 George Street and Menzies Hotel (Lot 4, DP 853331);
- Wynyard Lane, airspace above Wynyard Lane;
- 285 George Street, an 8 storey commercial building with retail on ground level (Lot 22 DP 56723 and Lot 23 in DP 59753)
- A public car park beneath Wynyard Park & Carrington Street (not part of the current development);

Surface (street) levels vary from about RL 19.0 m in the west of the site (Carrington Street) to RL 13.5 m in the east of the site (George Street), relative to Australian Height Datum (AHD).

The site has adjacent buildings on its north and southern boundaries. These are: Lisgar House (south of Menzies Hotel), 283 George Street (north of 285 George Street) and the Commonwealth Bank building (south of 301 George Street). In addition, Wynyard concourse links the site with Wynyard train station to the west, which is understood to be approximately 40 m from the site boundary at its closest point. The invert level of the station box is approximately RL 5.0 m (Arup Structural Report, October 2010).

3. Geology

The site is mapped on the Sydney 1:100,000 Series Geological Sheet as being underlain by Hawkesbury Sandstone, which typically comprises medium to coarse grained quartz sandstone with minor shale and laminate lenses.

4. Previous Information

DP previously conducted a geotechnical desktop study for the proposed development in November 2013 (DP Ref: 73693). This desktop report provided information on earthworks, excavation support and foundation design, drawing on factual information held by DP for previous projects in the vicinity of the site. This current report supersedes the desktop study report.

5. Field Work

5.1 Methods

Field work comprised the drilling of six boreholes (BH1 to BH6) to depths of between 0.5 m to 15 m using hand tools, pro line drilling equipment and a small drill rig. The boreholes were commenced via coring through the basement concrete slabs and were subsequently extended through soil and weathered rock using hand tools and solid flight augers (BH1A only). Upon encountering rock, the boreholes were cased and continued using diamond core drilling techniques to obtain continuous core samples of the bedrock (except BH2).

The rock cores recovered from the boreholes were returned to the DP office, photographed and Point Load Strength Index ($Is_{(50)}$) tests were carried out on selected samples of the rock core.

Standpipes were installed within boreholes BH1A and BH4 to allow further measurements of groundwater levels. Construction details of the standpipes are included in the attached borehole logs in Appendix C. Each standpipe was purged of water introduced during drilling.

The test bore surface reduced levels (RL) were interpolated from levels provided on the design architectural drawings by Architectus Pty Ltd as provided by BM.

The location of each borehole is shown on Drawing 1 in Appendix B.

5.2 Results

Details of the subsurface conditions encountered are given in the borehole logs in Appendix C, together with photographs of the rock core samples and notes defining classification methods and descriptive terms.

The sequence of subsurface materials encountered within the boreholes, in increasing depth order, is described below.

CONCRETE: Menzies basement: approximately 200 mm thick;
Shell House basement: approximate 140 mm thick upper layer over a lower 110 mm thick layer, separated by a 10 mm thick rubber membrane.

FILLING: Menzies basement: 0.1 m to 0.3 m thick layer of sandy gravel;
Shell House Basement: 0.2 m to 0.6 m thick layer of sandy gravel with some cobbles;

SANDSTONE: Generally low to medium strength, moderately to slightly weathered, coarse grained sandstone to RL 10 m, overlying medium to high strength sandstone. Below approximately RL 3 m high strength, fresh, fine grained sandstone was encountered.

Bedding planes in the rock core were predominantly less than 15° from horizontal, which is typical for Hawkesbury Sandstone. Extensive cross bedding was encountered, with the planes typically less than 30°. One sub-vertical joint that was undulating, rough and clean was recorded in BH1. Rock Quality Designation (RQD) recorded in the core ranged from 50% to 80% above RL 6 m and was generally 90% to 100% below this level. Decomposed seams comprising clayey material up to 40 mm thick were encountered in the sandstone above RL 6 m.

The upper 0.1 m to 0.4 m of rock core drilled in the Menzies basement (BH3 to BH6) was highly fractured and slightly weathered.

No free groundwater was observed during drilling. The use of water for coring prevented observation of groundwater within the rock. No major water loss was noted during rock coring.

Water was measured at 8.17 m depth (RL 4.5 m) within BH1A seven days after the borehole was drilled and purged, whilst the standpipe in BH4 was dry Additional water level monitoring will be required to confirm these initial readings. Monthly readings, over a period of at least six months, are recommended.

Borehole BH1 was abandoned at 6.65 m depth due to the core barrel becoming jammed whilst extracting the core run from 6.65 m to 8.24 m. The borehole was re-drilled approximately 2.5 m away, labelled BH1A. BH1A was advanced to 2.0 m depth using solid flight augers with a tungsten carbide bit, which is able to penetrate low to medium strength rock. Therefore, the rock description shown on the logs for BH1A above 2.0 m depth was interpreted from the core retrieved from BH1.

6. Laboratory Testing

6.1 Point Load Testing

The results of point load testing carried out at regular intervals on rock cores are shown on the respective borehole logs and are also plotted on Chart 1 in Appendix C. The $Is_{(50)}$ values were used to provide an estimate of the Unconfined Compressive Strength (UCS) of the sandstone based on a UCS:$Is_{(50)}$ ratio of 20:1. The $Is_{(50)}$values for the sandstone typically ranged from 0.1 MPa to 2.0 MPa, indicating that the sandstone tested range from low to high strength (estimated UCS ranging from 2 MPa to 40 MPa).

6.2 Preliminary Waste Classification Testing

Where possible, soil samples were collected from the ripped sandstone filling for preliminary waste classification purposes. Samples were collected using disposable sampling equipment and transferred into laboratory prepared jars. Each sample was labelled with individual and unique identification, including project number and sample location and sample depth. Jars were placed into a cooled, insulated and sealed container for transport to the laboratory (Envirolab Services).

Due to the nature of the observed filling (which included sandstone cobbles which were too large to be transferred into jars) and the limited amount of filling that could be sampled, samples for laboratory analysis were limited to three primary filling samples (from BH1A, BH2 and BH4) and one replicate QA/QC sample (BD1/101213, blind replicate of the sample from BH2). Samples were collected from depths of 0.2 m (BH4) and 0.3 m (BH1A and BH2).

It is noted that a strong diesel odour was recorded in the sandstone core at a depth of between 3.65 m to 3.78 m in BH1A. A suitable sample for laboratory analysis could not be collected from the (limited) odorous sandstone core.

Samples were analysed for a range of common contaminants for preliminary waste classification purposes. Results are summarised in Table D1 in Appendix D, and have been compared to criteria for General Solid Waste from the Department of Environment, Climate Change and Water NSW, *Waste Classification Guidelines,* December 2009. Laboratory certificates and chain of custody documentation are provided in Appendix E.

6.3 Groundwater Sampling

The water level in the well at BH1A was recorded prior to sampling on 17 December 2013, using an electronic interface probe which can detect the presence of separate phase liquid in the water column [such as light non-aqueous phase liquids (LNAPL) including petroleum hydrocarbons]. No phase separated liquid was detected.

Groundwater sampling at BH1A was undertaken using a SS Geosub pump with disposable tubing, following stabilisation of field parameters. Field parameters were obtained using a calibrated 90FLMVF water quality meter, with probes placed inside a flow-through cell. The field parameters

included temperature, dissolved oxygen (DO), electrical conductivity (EC), pH and oxidation reduction potential (redox). The stabilised field parameters are shown in Table D2A, Appendix D.

A primary sample and replicate QA/QC sample (BD1_171213) were collected in laboratory prepared bottles and vials. The groundwater samples collected for metals analysis were filtered in the field through a 45 µm membrane filter into nitric acid preserved bottles. Sample containers were labelled with individual and unique identification, including project number and sample number and placed into a cooled, insulated and sealed container for transport to the laboratory (Envirolab Services).

Groundwater samples were analysed for chemicals associated with fuel storage and dry cleaning operations, as two underground storage tanks and previous dry cleaning operations were considered to be potential groundwater contaminants at the site (see DP letter report titled *Report Review and Site Visit for Potential Contamination Issues, One Carrington Street Site, Sydney*, dated 8 November 2013 (DP Ref: 73693.01). BH1A is located close to two (probable) underground fuel storage tanks within the Shell House basement.. Potential contaminants associated with fuel storage include total petroleum hydrocarbons; benzene, toluene, ethylbezene, and xylenes (BTEX); heavy metals; polycyclic aromatic hydrocarbons (PAH) and phenols. Potential contaminants associated with dry cleaning operations include the volatile organic compounds (VOCs): tetrachloroethene and degradation daughter products. Results of the laboratory analysis are shown in Table D2B, Appendix D.

7. Comments

7.1 Proposed Development

Based on the information provided, our understanding is that the development will comprise:

- Demolition of the Menzies Hotel and 301 George Street and the eastern accessways to Wynyard Station, development above Wynyard Lane, and partial demolition of Shell House (façade to be retained) and 285 George Street;
- Construction of a 27 storey commercial building on the land between Carrington Street and George Street;
- Refurbishment of 285 George Streeet and Shell House for commercial and retail uses.

It is understood that the proposed development will require the following sequence of geotechnical works to be carried out:

- Demolition of the superstructure of the Menzies Hotel, 301 George Street and partial demolition of Shell House;
- Installation of temporary shoring beneath Shell House including temporary anchors;
- Re-use shoring for the Menzies Hotel basement and install new temporary anchors;
- Demolition of the substructure of the buildings;
- Excavation to lower the existing basement level of the southern portion of Shell House (currently at RL 12.7 m) to match the existing basement level of the Menzies Hotel (RL 2.4 m). This will involve the excavation of around 10 m.

- Construction of new footings and excavation of three new building cores. Two cores will be constructed within the existing Shell House footprint, and one will be constructed within the Menzies Hotel footprint. The cores are proposed to be founded approximately 2 m below the existing Menzies basement level, i.e. approximately RL 0.4 m.

7.2 Geotechnical Model

A preliminary geological model of the site, based on the results of the current investigation and from information from surrounding geotechnical investigations is presented in the form of two cross-sections (A-A' and B-B') in Drawings 2 and 3 in Appendix B. The existing basement levels of the buildings within the site, which are approximately RL 12.7 m (Shell House) and RL 2.4 m (Menzies Hotel and 301 George Street), and those of neighbouring structures are shown in the cross-sections for reference.

7.3 Excavation

7.3.1 Expected Conditions during Excavation

After demolition of the existing structures on the site, excavation will involve the removal of substantial quantities of sandstone of medium and higher strength to achieve excavation of approximately 10 m depth beneath the current Shell House.

Excavation of near surface soils and filling should be readily achieved by conventional earthmoving equipment. Excavators on rock benches are likely to be required to pass material from the excavation base up to a load-out platform at ground level. Rock sawing equipment may be required to saw sandstone along or close to the boundaries and for detailed excavations such as pad footings and the lift pits. Hydraulic rock hammers will be required to excavate the rock.

Groundwater seepage is likely to occur into the excavation from within the overburden materials and through joints in the sandstone, particularly as the proposed excavation is deeper than those of neighbouring buildings.

7.3.2 Excavation Support

Careful consideration must be given to the planning and design of excavation and excavation retention system(s) to reduce the risk of destabilising and causing damage to the adjacent buildings and surrounding public footpaths/roads.

Excavated faces in medium strength or better sandstone are generally self-supporting, apart from where adversely oriented jointing is present. The two major joint sets (NNE and ESE) are offset by approximately 25° to the NS trending excavation faces. Only one sub-vertical joint was recorded in the cored boreholes. It should be noted that the vertical boreholes drilled as part of the investigation provide little information on these joints. It is therefore recommended that all rock faces be inspected by an engineering geologist during excavation to confirm that the site conditions are consistent with the design assumptions, to verify the stability of the faces and advise on any bolting or anchoring requirements. Joints near parallel to the excavation faces will require rock bolting, with feather edges

to be pinned back. Local shotcreting may also be required where beds of extremely or very low strength rock or shale are encountered within higher strength sandstone, secured with rockbolts where necessary.

The proposed shoring system may need to be modified to ensure support to adjacent buildings and roads, during and after demolition. This may include major underpinning or permanent rock benches, depending on conditions. It will therefore be necessary to systematically expose adjacent building foundations and assess the underpinning requirements. A design and construct approach is recommended in areas where insufficient information is available. It is assumed that the permanent structure will support the excavation in the long-term.

7.3.3 Excavation Inspections

The full implications of the jointing in the bedrock beneath the subject site will not be fully apparent until excavation is underway. The intersection of these joints or highly weathered zones within the rock mass, or pockets of deeper soil/fill cover could lead to wedge or slip failures within the excavation. Therefore, all excavated faces should be progressively inspected by a suitably experienced geotechnical engineer, at maximum 1.5 m depth intervals.

7.3.4 Temporary Unsupported Batters

Maximum batter slopes recommended for the design of temporary excavations are shown below in Table 1.

Table 1: Recommended Maximum Temporary Batter Slopes

Material	Temporary Batter Slope (H:V)	Maximum Batter Height (m)
Filling or natural clay soils	1:1	3
Extremely Low and Very Low Strength rock	0.75:1	None (1)
Medium Strength or stronger rock	Vertical (1)	None (1)

Note: (1) Provided that the rock mass is not adversely affected by discontinuities (Geotechnical engineer to carry out face inspections to confirm)

Additional stabilisation of steeply battered or vertical rock faces may include shotcrete cover of fractured or highly weathered zones. Where adverse joints form potentially unstable wedges of rock, and where adjacent buried structures are not present beyond the site boundary, temporary rockbolts or tensioned ground anchors may be used.

7.3.5 Shoring Systems

For the excavation beneath the existing Shell House, retaining or shoring structures will be required both during basement construction and as part of the final structure. The use of temporary ground anchors may also be required. Permanent lateral support should be provided by the main structure, unless permanent anchors are used. Further details on excavation support are provided in the following section.

Table 2 provides specific comments relating to the perimeters of the proposed excavation beneath the Shell House footprint.

Table 2: Comments on Proposed Excavation Beneath Existing Shell House Footprint

Excavation Perimeter	Excavation Adjacent to:	Comments Relating to Excavation Support
North	Existing Shell House basement	Shell house basement is expected to be in sandstone. Temporary and permanent shoring for any additional excavation may not be required. Faces can be cut near vertical (steeply battered), provided that the rock mass is not adversely affected by discontinuities (Geotechnical engineer to carry out face inspections to confirm).
West (1)	Carrington Street	Temporary and permanent shoring is likely to be necessary to retain anticipated filling which overlies the sandstone. The shoring wall should be founded on the medium strength sandstone and may require anchoring. Underpinning of Shell house façade footings may be required.
West (2)	Basement Concourse (to Wynyard station)	Expected to be in sandstone. Temporary and permanent shoring for any additional excavation may not be required subject to assessment of surcharge loading from the concourse. Faces can be cut vertically provided that the rock mass is not adversely affected by discontinuities (Geotechnical engineer to carry out face inspections to confirm).
South	Existing Menzies Hotel basement	None required as Menzies Hotel basement is already at approximately RL 2.4 m. Temporary anchoring of the existing basement walls will, however, be required.
East	Wynyard Lane	Temporary and permanent shoring is likely to be necessary to retain anticipated filling which overlies the sandstone. The shoring wall should be founded on the medium strength sandstone and may require anchoring. Underpinning of Shell house façade footings may be required.

Note that all existing basement walls will require anchoring in the temporary case to allow demolition of the existing buildings and construction of the new building.

Particular attention should be given to the provision of drainage measures behind all shoring and final basement walls. Failure to achieve permanent effective drainage will result in a significant increase in the lateral loads that need to be resisted. Drainage is normally provided behind shoring wall systems using one of a number of proprietary strip drains combining a filter fabric and a cellular plastic matrix, installed at 1.5 m vertical centers over the full height of the face. Strip drains are typically connected to “spitter” pipes, which penetrate the shotcrete and allow accumulated water to exit the shoring and run into the basement drainage system.

7.3.6 Design of Shoring Systems

Retaining structures will be subjected to lateral earth pressures. The active earth pressures and bulk unit weights in Table 3 are recommended for the design of cantilevered or single row anchored shoring systems.

Table 3: Recommended Earth Pressure Coefficients and Bulk Unit Weights

Material	Active Earth Pressure Coefficient		Bulk Unit Weight (kN/m3)
	Short Term / Temporary	Long Term/ Permanent	
Filling or Natural Soils	0.3	0.4	20
Very Low and Low Strength Sandstone	0.1	0.15	22
Medium Strength or Stronger Sandstone (1)	0	0	24

Note: (1) Provided that the rock mass is not adversely affected by discontinuities (Geotechnical engineer to carry out face inspections to confirm)

The above pressure coefficients assume a level ground surface behind the top of the wall.

The pressure distribution given above does not include hydrostatic pressure due to the build-up of groundwater behind any shoring wall. The full hydrostatic head should be considered in design of impermeable walls if positive drainage measures are not incorporated to prevent groundwater pressure build-up, while at the same time account for the buoyant condition.

Additional surcharge pressures due to foundations, plant and structures should be considered.

7.3.7 Anchor Design

Anchoring of a shoring wall can be accomplished by prestressed type anchors. It is suggested that anchors be inclined no steeper than 35° below horizontal and installed progressively with the excavation. The use of anchors will require approval by local council and neighbouring property owners as the anchors would extend beyond the site boundaries. The use of anchors would be governed by adjacent buried services, tunnels and structures.

The bond length for anchors should allow for potentially adverse rock joints dipping at 45° above horizontal and striking parallel to the excavation face. Appropriate ultimate bond stresses for anchor design are outlined in Table 4.

Table 4: Recommended Design Parameters for Anchor Design

Rock Strength	Ultimate Bond Stress (kPa) (1)
Very Low Strength Sandstone	200
Medium Strength or Stronger Sandstone	1000

Note: (1) Provided the anchor holes have been properly cleaned (clay smear removed from side walls)

Ultimately, it is the contractor's responsibility to ensure that the correct design values (specific to the anchor system and method of installation) are used and that the anchor holes are carefully cleaned out prior to grouting. After anchors have been installed, it is recommended that they be tested to 125% of nominal working load and then locked off at between 60% and 80% of their working loads. Checks should be carried out, however, to ensure that the load is maintained in the anchors throughout the construction period and is not lost due to creep effects or to other causes.

Permission should be sought from neighbours or relevant authorities, if the proposed anchors extend beyond the boundary of the site.

7.3.8 Stress Relief

Locked in stresses are present in the rock. During excavation these stresses will be released, which is generally associated with lateral movement of the rock mass. These lateral movements may increase the risk of cracking of adjacent structures. They may also cause increases in the loads on anchors.

Based on previous experience lateral movements of the edge of the excavation in the order of 1 mm to 2 mm per metre depth of rock excavation can be expected at the centre of the face, generally reducing towards the corners of the excavation.

Consideration should be given to the locations of internal columns, connections with perimeter walls and other design issues so that potential stress relief movements as a result of construction or from excavation of future basements in nearby buildings do not affect the new building.

7.3.9 Ground Vibration due to Excavation

Noise and vibration will be caused by excavation work on the site. Precautions will be required when excavating close to site boundaries where the adjacent buildings and infrastructure along the site boundaries are nearby. The level of acceptable vibration is dependent on various factors including the type of building structure (e.g. reinforced concrete, brick, etc.), its structural condition, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

The Australian Standard AS 2187.2 1993 (Explosives Code) recommends the maximum peak particle velocity (PPV) of 25 mm/sec for commercial and industrial buildings or structures of reinforced concrete or steel construction subjected to vibration. A lower PPV limit of 10 mm/sec is suggested for houses and low-rise residential or commercial buildings. Ground vibration arising from excavation plant is of a continuous nature, as opposed to being transient such as with blasting events. Therefore, more stringent vibration limits than given for blasting should generally apply. The foundation conditions for the neighbouring structures located directly adjacent to the site boundary (Carrington Street concourse, Lisgar House, 275-281 and 285 George Street, and the Commonwealth Bank building) are unknown at this stage; however, they are expected to be founded on sandstone bedrock. It is suggested that the vector sum peak particle velocity (VSPPV) be initially limited to 20 mm/sec at the foundation level of the adjacent buildings.

A human comfort criterion is proposed as the control parameter. It is recommended that a Provisional Allowed Vibration Limit (PAVL) of 8.0 mm/sec (VSPPV) be set during normal working hours, at ground floor level of potentially affected building(s).

It is noted that vibration levels above 2 - 3 mm/sec may be disturbing to the adjacent property owners and some complaints from neighbouring occupants are possible. Vibration monitoring is recommended so as to provide reassurance that vibration is within safe limits.

DP maintains a database of vibration trial results which can provide guidance for the selection of plant. The database suggests buffer distance ranges, such as those shown for selected excavation plant in Table 5, which should be maintained in order to reduce the likelihood of vibration exceeding the Provisional Allowed Vibration Limit (PAVL). These estimates should be confirmed and adjusted where required.

Table 5: Buffer Distances for Selected Excavation Plant and a Provisional Allowed Vibration Limit of 8 mm/s VSPPV

Excavation Plant	Approximate buffer distance from plant by which vibration would attenuate to the PAVL	
	From DP trial maxima	From DP trial averages
Rock Saw on Excavator	1.1 m	0.6 m
Ripper on 20t Excavator	3.4 m	1.2 m
Rock Hammer < 500 kg operating weight	7.4 m	3.0 m
Rock Hammer 501 - 1000 kg operating	7.5 m	3.3 m
Rock Hammer 1001 - 2000 kg operating	12.4 m	5.4 m
Rock Hammer > 2000 kg operating weight	7.4 m	4.9 m

Notes:

1. Smaller distances can generally be determined from individual trials, as indicated by those from trial averages;
2. Buffer distances for rock hammers increase with increasing hammer operating weight up to approximately 2000 kg, however a trend reversal is apparent in currently available data for heavier hammers (on heavier carriers), which is attributed to more efficient application of force;
3. Buffer distances for rock hammers may be reduced by prior saw cutting along, or parallel to, excavation boundaries, to reduce vibrations transmitted in surface waves. These cuts should be progressively deepened and extended laterally, to maintain a barrier to direct surface waves between the hammer and the structures to be protected;
4. Loading effects from adjacent buildings may reduce vibration levels, to enable boundary saw cuts with few exceedances; and
5. The use of diamond saws (not represented in DP trial data), may produce negligible foundation vibrations, even when cutting immediately adjacent to those foundations.

The above suggested vibration limits and approach distances should be modified on the basis of vibration trials at the commencement of bulk excavation. It is also noted that monitoring of vibration can lend to a wide spread of PPV for the same equipment. Therefore the above values should be used with caution and should be confirmed by a site specific trial.

To reduce the effects of hydraulic rock hammers, the work method should allow for:

- Excavation of loose or rippable sandstone blocks by bucket or single tyne attachments prior to commencement of rock hammering. Care should be taken to ensure that existing, loosened blocks do not continue into the adjacent sites.
- Rock sawing around the perimeter of the excavation.
- Progressive breakage from open excavated faces.

- Selective breakage along open joints where these are present.
- Use of rock hammers in short bursts to prevent generation of resonant frequencies.
- The movement of large blocks away from existing structures prior to breaking up for transport from site.

The proposed development is located at least 40 m away from the station box at Wynyard railway station. Therefore, the vibrations produced during the excavation works are unlikely to have an adverse impact on the existing railway infrastructure.

7.4 Groundwater

The use of water during drilling precluded any observation of groundwater within the boreholes. The standpipe installed in BH1A encountered water at 8.17 m depth (RL 4.5 m). This is most likely to be an elevated water table, with the permanent groundwater table expected at greater depth.

Groundwater seepage can be expected to enter the excavation along the top of the soil/rock interface following heavy periods of rainfall and through joints and bedding planes within the rock mass.

Consideration will need to be given to the collection and disposal of any seepage (or runoff infiltrating from the surface). The usual approach would be to provide subfloor drainage, with a collection sump and intermittent pumping. The likely extent of groundwater seepage will be better known at the end of bulk excavation, at which time pumps and sumps can be appropriately sized.

Based on previous experience with basement excavations in Hawkesbury Sandstone, seepage through jointing in sandstone may give rise to precipitation of a red-brown iron oxide sludge from the groundwater. Perimeter and subfloor drains should therefore be designed for easy access to allow for inspection, maintenance (e.g. "rodding") and periodic cleaning. An extra precaution would be the provision of additional sumps to promote settling and removal of iron-oxide precipitate prior to disposal off site. The likelihood of the above occurring at this site is currently unknown and can be assessed by sampling and testing of any seepage, if encountered, during the bulk earthworks.

7.5 Foundations

Based on the boreholes drilled on the site and adjacent sites, high strength sandstone is expected to be exposed at the lower foundation level (RL 2.4 m),). It is therefore likely that pad footings would be suitable to support column loads at the lower foundation level, designed for an allowable bearing pressure of 6 MPa. Low to medium strength sandstone is expected to be exposed at the upper foundation level (Shell House basement RL 12.7 m) and pad footings can be designed for an allowable bearing pressure of 3.5 MPa.

'Spoon' testing should be undertaken in at least 1/3 of pad footings proportioned on the basis of design allowable bearing pressures of 6 MPa. The purpose of spoon testing is to check that no significant weak seams exist within a depth of 1.5 times the minimum footing dimension below the founding level. Test holes for spoon testing should be at least 45 mm in diameter. A reduced allowable bearing pressure of 3.5 MPa should be adopted if spoon testing is not undertaken.

The preliminary design of footings may be based on the maximum allowable pressures and modulus values given in Table 6.

Table 6: Preliminary Design Parameters and Moduli for Foundation Design

Rock Strength	Allowable End Bearing Pressure (MPa)	Field Elastic Modulus (MPa)
Low to Medium Strength Sandstone	3.5	500
Medium to High and High Strength Sandstone (1)	6 up to 12	1000

Note: (1) Subject to confirmation spoon testing by a Geotechnical Engineer.

The foundation design parameters given in Table 6 assume that the foundation excavations are clean and free of loose debris immediately prior to concrete placement. An experienced geotechnical professional should inspect the bases of pad footings prior to the placement of blinding, steel and concrete.

New footings founded on the upper foundation level should be suitably located away from the edge of the proposed excavation. If this is not possible then reduced bearing capacities, deepening/extending of footing dimensions and/or footing rectification will be required.

Foundations proportioned on the basis of the above parameters would be expected to experience total settlements of less than 1% of the minimum footing width under the applied working (i.e. serviceability) load, with differential settlements between adjacent columns expected to be less than half of this value.

7.6 Ground Slabs

The floors at basement level can be designed as slabs on ground, assuming proper compaction is given to the subgrade (if not on rock) on which the slabs are cast. Only suitable material should be used to backfill over-excavated areas, compacted to a minimum 98% standard maximum density prior to the casting of the slabs.

It will be necessary to provide under-floor drainage to safeguard against uplift pressures if the basement is designed as drained. This can comprise a 100 mm thick durable open graded crushed rock with subsoil drains and sumps.

7.7 Earthquake Design

The Site Subsoil Class, as defined in AS1170.4 – 2007, is 'Class B_e – Rock'. The shear wave velocity of medium to high strength sandstone is expected to be around 3000 m/s.

7.8 Results of Preliminary Waste Classification

Results of preliminary waste classification testing (summarised in Table D1, Appendix D) revealed that concentrations of heavy metals (arsenic, cadmium, chromium, lead, mercury, nickel), benzo(a)pyrene, total PAH, TRH, BTEX, endosulfan, organochlorine pesticides (OCP) and polychlorinated biphenyls (PCB) were within the criteria of General Solid Waste. Phenols were not detected in analysed samples. Asbestos was not detected in analysed samples andsigns of possible asbestos contamination (such as building rubble) were not identified in the observed filling. It is therefore considered that the observed ripped sandstone filling (see bore logs, Appendix C, for detailed descriptions) has a preliminary classification as General Solid Waste (non-putrescible).

Sandstone at BH1A, depth 3.65 m to 3.78 m, was noted to have a strong diesel odour. Although part of the natural rock profile, this odorous sandstone cannot be classified as Virgin Excavated Natural Material (VENM) as the odour is considered a sign of contamination. Given the proposed excavations within the Shell House, it is anticipated that odorous soil/rock will be encountered during excavations. These materials will need to be segregated from the other soil/rock (not showing signs of contamination) for further waste classification assessment. It is considered that sandstone (as described in the bore logs, Appendix C) that does not show signs of contamination can be classified as VENM.

As recommended in DP's desktop study (Ref: 73693.01), the underground storage tanks (USTs) within the Shell House Basement should be removed and any associated contaminated soil should be remediated. Given that signs of fuel-related contamination have been identified in the sandstone at BH1A, it is reasonably likely that contaminated soils/rock will be encountered in the vicinity of the USTs. Soils surrounding the USTs will need to be excavated and assessed for waste classification and the tank pits will need to be validated by soil sampling and laboratory analysis.

Given that the extent of the odorous sandstone at BH1A has not been defined/delineated, it is recommended that periodic inspections of excavated material from the vicinty of the USTs and BH1A be undertaken by an environmental consultant to keep a record of any observed contamination and confirm VENM / waste classification. A record of the disposal of any contaminated materials can be included in the validation report, which is required to document the removal and disposal of the USTs and associated contaminated soils (as recommended in the DP's desktop study, Ref: 73693.01).

7.9 Results of Groundwater Analysis

Results of groundwater analysis (summarised in Table D2B, Appendix D) have been compared to Groundwater Investigation Levels (GIL) adopted from *National water quality management strategy, Australian and New Zealand guidelines for fresh and marine water quality*, Australian and New Zealand Conservation Council & Agriculture, and Resource Management Council of Australia, and New Zealand, 2000 [ANZECC & ARMCANZ (2000)]. The GILs adopted for this assessment are for marine water as groundwater is expected to migrate towards Sydney Harbour, a marine water ecosystem. In the absence of trigger values from ANZECC & ARMCANZ (2000), assessment criteria have been adopted from *National water quality management strategy, Australian drinking water guidelines*, National Health and Medical Research Council and National Resource Management Ministerial Council, Australia, 2011 [NHMRC & NRMMC (2011)]. To assess for the potential vapour intrusion health risk associated with petroleum hydrocarbons, Health Screening Levels (HSLs) for

vapour intrusion sourced from the National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013 (ASC NEPM, 2013) have been included as assessment criteria.

Recorded concentrations of arsenic, cadmium, chromium, lead and mercury were within the GILs for both the primary and replicate sample from BH1A. Recorded concentrations of copper, nickel and zinc were above the GILs for both the primary and replicate samples, however, these concentrations are considered to be similar to typical background concentrations within the Sydney region.

Concentrations of naphthalene, acenapthene, fluorene and phenathrene were recorded at concentrations above the practical quantitation limits (PQL) but within the respective GILs. Concentrations of other PAH were recorded within the PQLs.

Recorded concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were below the PQLs and within the GILs. Concentrations of TRH were recorded in both the primary and replicate samples. Review of the TRH chromatogram suggests that the recorded TRH may be as a result of a combination of diesel and oil. The originating source of a portion of the detected TRH may be the underground tanks at the site. The concentrations of TRH are within the HSLs for vapour intrusion.

VOC that were recorded above the PQL include chloroform, trichloroethene, bromodichloromethane, tetrachloroethene and cis-1,2-dichloroethene. Concentrations of chloroform, trichloroethene, and tetrachloroethene were within the respective GILs. Concentrations of cis-1,2-dichloroethene and bromodichloromethane were within the drinking water guideline values. The detected tetrachloroethene [or perchloroethylene (PCE)], trichloroethene (TCE), and chloroform may be as a result of previous dry cleaning operations at, or in the vicinity of, the site as these chemicals have been used as solvents for dry cleaning. TCE and cis-1,2-dichlororethene are also degradation daughter products of PCE.

The recorded concentration of total phenols is less than the PQL.

Results for both field and laboratory pH measurements indicate that the groundwater is acidic (i.e. below the neutral pH of 7). The result for hardness indicates the groundwater is ‘soft’ water.

Although hydrocarbons and VOC have been recorded in the groundwater, the concentrations of contaminants encountered are at levels which do not pose a significant ecological risk. The recorded concentrations of petroleum hydrocarbons do not pose a vapour intrusion health risk. Given that concentrations of copper, nickel and zinc are above the GIL and pH are outside a neutral range (typically considered to be 6.5 – 8.0), if dewatering is undertaken, groundwater is unlikely to be suitable for discharge to the stormwater system unless it is treated first.

8. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for a project at One Carrington Street, Sydney, NSW in accordance with DP's proposal dated 10 September 2013. The work was carried out in general accordance with the terms of the Agreement between DP and Sovereign Wynyard Centre Pty Limited for this project. The report is provided for the exclusive use of Sovereign Wynyard Centre Pty Limited 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. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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 an expressed 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. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

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.

Copyright

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

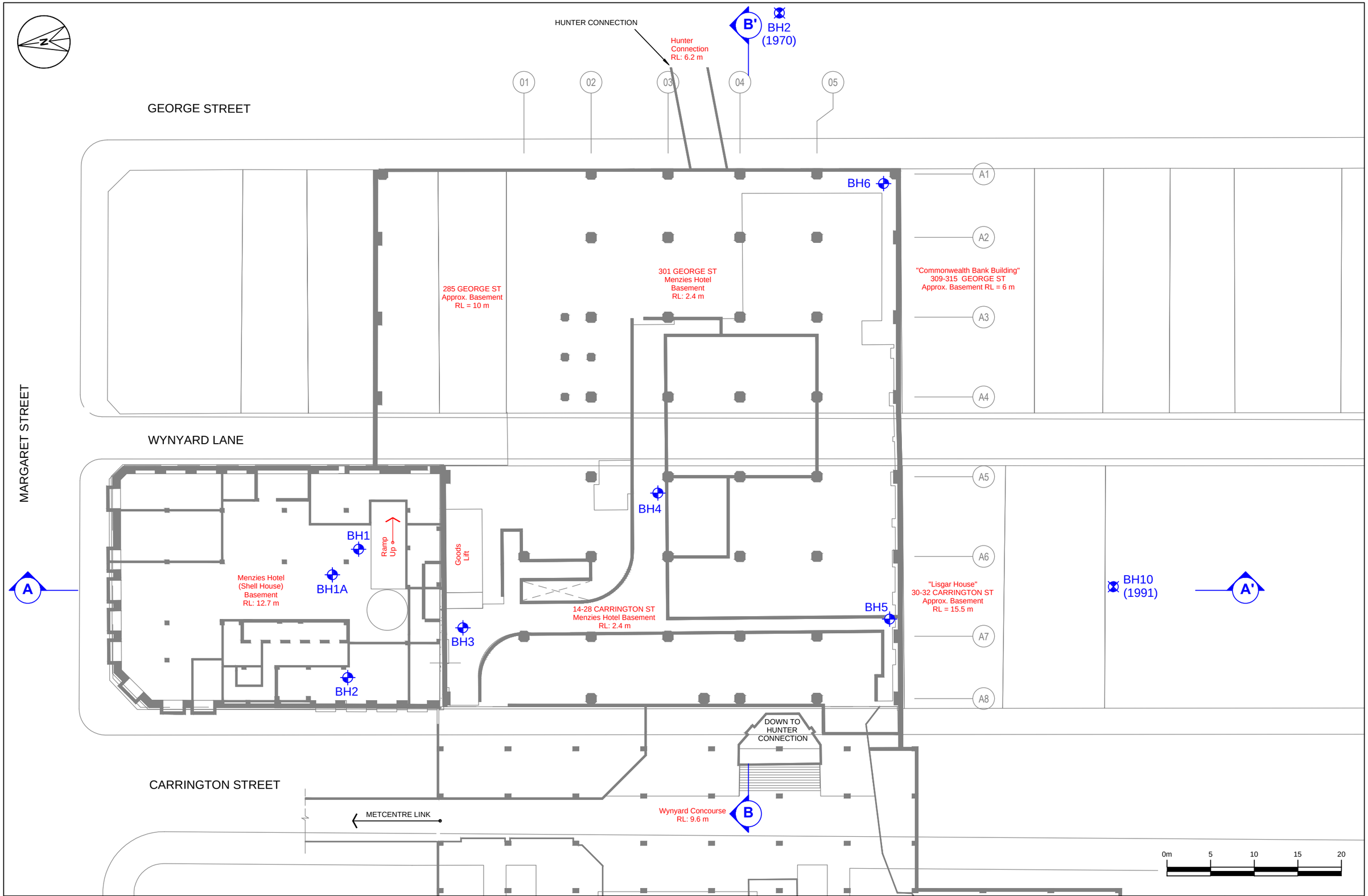
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate 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.

Appendix B

Drawings



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Sovereign Wynyard Centre Pty Ltd	TITLE: **Borehole Location Plan** **One Carrington Street** **Menzies Hotel, Wynyard**	PROJECT No: 73693.02
	OFFICE: Sydney DRAWN BY: LJH		DRAWING No: 1
	SCALE: 1:400 (H) @ A3 DATE: 29.4.2014		REVISION: A

A □□orth□

□So□th□A'

ELEVATION (AHD)

30
25
20
15
10
5
0
-5
-10

MARGARET ST

Shell House

14-28 Carrington Street

EXISTING BASEMENT

285 George St
Approx. Basement Level

Low Strength

Low to Medium Strength Sandstone

Medium to High Strength Sandstone

High Strength Sandstone

BH1A
Offset -0.7m

BH1
Offset 1.5m

BH3
Offset - 6.5m

BH4
Offset 18.4m

BH5
Offset - 5.5m

L
L-M
M
M-H
H

Lisgar House
(30-32 Carrington St)
Approx. Basement Level

Low Strength Sandstone

Low to Medium Strength

Commonwealth Bank Building
(309-315 George St)
Approx. Basement Level

Medium to High Strength Sandstone

High Strength Sandstone

BH10
(1991)
Offset - 0.4m

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
- Concrete
- Filling
- Sandstone
- Shale

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
- Water level

0 8
Horizontal Scale (metres)

Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Sovereign Wynyard Centre Pty Ltd

OFFICE: Sydney

DRAWN BY: LJH

SCALE: 1:400 (H) 1:200 (V) @ A3

DATE: 18.12.2013

TITLE: **□nter□reted □eotechnical Cross Section A□A'**
One Carrington Street
Menzies Hotel, Wynyard

PROJECT No: 73693.02

DRAWING No: 2

REVISION:

B □West□ □□ast□B'

14-28 Carrington Street 301 George Street

CARRINGTON ST

WYNYARD LANE

GEORGE ST

Wynyard Concourse

Hunter Connection

EXISTING BASEMENT

BH2 (1970) Offset 2.4m

BH3 Offset 20.3m

BH5 Offset - 28.7m

BH4 Offset - 1.9m

BH6 Offset - 26.9m

Filling and Residual Soil

Extremely Low to Very Low Strength

Low to Medium Strength Sandstone

High Strength Sandstone

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

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

LEGEND

Core Loss
Concrete
Filling
Sand
Sandstone

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

TESTS / OTHER
N - Standard penetration test value
Water level

Horizontal Scale (metres) 0 8

Vertical Exaggeration = 2.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Sovereign Wynyard Centre Pty Ltd

OFFICE: Sydney DRAWN BY: LJH

SCALE: 1:400 (H) 1:200 (V) @ A3 DATE: 18.12.2013

TITLE: □nter□reted □eotechnical Cross Section B□B'
One Carrington Street
Menzies Hotel, Wynyard

PROJECT No: 73693.02

DRAWING No: 3

REVISION:

Appendix C

Borehole Logs and Core Photographs
Chart 1: Point Load Test Results
Standpipe Logs

Sampling Methods

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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

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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

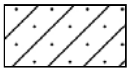
Soils


Topsoil

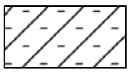

Peat


Clay

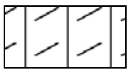

Silty clay

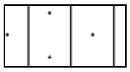

Sandy clay

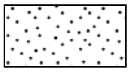

Gravelly clay

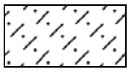

Shaly clay

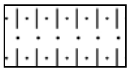

Silt


Clayey silt


Sandy silt

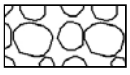

Sand

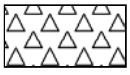

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

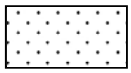

Talus

Sedimentary Rocks

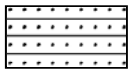

Boulder conglomerate

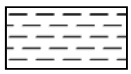

Conglomerate


Conglomeratic sandstone

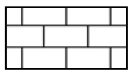

Sandstone


Siltstone


Laminite

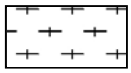

Mudstone, claystone, shale

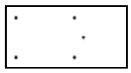

Coal


Limestone

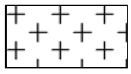
Metamorphic Rocks

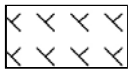

Slate, phyllite, schist

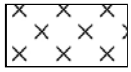

Gneiss

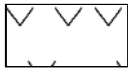

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 12.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 73693.02
DATE: 9/12/2013
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
12	0.13	CONCRETE - 5mm reinforcement at 0.12m depth						Unless otherwise stated rock is fractured along rough planar bedding typically dipping at 0°-5°	E			
	0.14											
	0.25	RUBBER										
	0.47	CONCRETE										
	0.85	FILLING - Red-brown, sandy gravel filling with some cobbles (ripped sandstone)						0.76m: B0°, cly 5mm 0.83m: to 0.85m; Ds cly 20mm	C	100	39	PL(A) = 0.1
1	1.32	SANDSTONE - Low to medium strength, slightly weathered, fragmented, pale grey and brown, fine to coarse grained sandstone						0.93m: B0°, cly 5mm 1.09m: B5°, pl, sm 1.19m: B15°, pl, sm 1.28m: B30°, pl, sm 1.29m: B40°, pl, sm 1.45m: B0°, pl, sm 1.55m: B0°, pl, sm				PL(A) = 0.3
11	1.36											
	2.15	SANDSTONE - Low to medium strength, fresh stained, fractured, pale grey, medium to coarse grained sandstone						1.95m: CORE LOSS: 200mm 2.28m: B30°, pl, sm 2.42m: B30°, pl, sm				PL(A) = 0.2
2		SHALE - Low strength, slightly weathered, dark grey shale/mudstone						2.71m: B0°, cly 5mm	C	87	66	PL(A) = 0.4
10		SANDSTONE - Low to medium strength, fresh stained, fractured to slightly fractured, pale grey, medium to coarse grained sandstone						3.11m: B5°, cly 5mm 3.2m: B5°, pl, sm 3.34m: B15°, pl, sm				
3	3.6	SANDSTONE - Medium to high strength, slightly fractured, pale grey, medium to coarse grained sandstone										PL(A) = 0.8
9									C	100	80	
4												PL(A) = 1.4
8								5.11m: B15°, pl, sm				
5								5.47m: to 5.53m; Ds cly 60mm				PL(A) = 0.7
7									C	100	95	
6								6.1m: to 6.62m; J80-90°, un, ro				
6	6.65	Bore discontinued at 6.65m - Hole abandonned - Core barrel jammed whilst extracting core run from 6.65m to 8.24m										
7												
5												
8												
4												
9												
3												

RIG: Pro Line **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 0.47m

TYPE OF BORING: Diacore to 0.25m; Hand Tools to 0.47m; NMLC to 6.65m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

REMARKS: Core barrel jammed and hole abandonned. Moved to BH1A, 2.5m away.

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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DOUGLAS PARTNERS PTY

ONE CARRINGTON STREET

BORE BH1 PROJECT 73693.02 DEC 2013

0.47 – 6.65 m

BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 12.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1A
PROJECT No: 73693.02
DATE: 10/12/2013
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)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.13	CONCRETE - 5mm reinforcement at 0.12m depth										
	0.14											
	0.24	RUBBER										
	0.5	CONCRETE										
		FILLING - Red-brown, sandy gravel filling with some cobbles (ripped sandstone)										
	1.8	SANDSTONE - Low to medium strength, moderately to slightly weathered, fractured, pale grey with brown, fine to coarse grained sandstone (inferred from BH1)						Unless otherwise stated rock is fractured along rough planar bedding typically dipping at 0°-5° and on cross-beds typically at 30°-40°				
		SANDSTONE - Medium to high strength, slightly weathered to fresh stained, fractured, pale grey, medium to coarse grained sandstone.						2.14m: B20°, pl, sm 2.31m: B30°, pl, sm, fe 2.48m: B5°, 10mm gravelly clay 2.91m: to 2.93m; B5°, Ds 20mm gravelly clay	C	100	76	PL(A) = 0.6
		- Fresh rock below 3.10m - 3.13m to 3.57m: Grey in colour										PL(A) = 1.3
		- 3.65m to 3.78m: Strong diesel odour							C	100	55	PL(A) = 1
								5.58m: B30°, pl, sm, cly 5.63m: B40°, un, sm	C	100	75	PL(A) = 1 PL(A) = 1.3
								7.39m: B10°, un, ro, fe	C	100	97	PL(A) = 1
	8.6	SANDSTONE - High strength, moderately to slightly weathered, slightly fractured, brown, medium to coarse grained sandstone.							C	100	100	PL(A) = 1.1 PL(A) = 1.3
									C	100	86	

RIG: Dando Terrier **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 2.00m

TYPE OF BORING: Diacore to 0.24m; Hand Tools to 0.50m; SFA (TC bit) to 2.00m; NMLC to 15.18m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 12.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1A
PROJECT No: 73693.02
DATE: 10/12/2013
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)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2		SANDSTONE - High strength, moderately to slightly weathered, slightly fractured, brown, medium to coarse grained sandstone. *(continued)*										PL(A) = 1.9
	10.71								C	100	86	
11	10.97	SANDSTONE - Medium strength, slightly weathered, fragmented, pale grey with purple, fine to medium grained sandstone with thin coal seams.						10.71m: to 10.89m; coal seams < 2mm thick 10.75m: B5°, 5mm coal seam 10.86m: B0°, un, ro, coal seam 10.9m: to 10.97m; Cz				
1		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained sandstone.										PL(A) = 1.4
12									C	100	100	
0												PL(A) = 1.4
13								13.02m: J20°, un, sm, gravelly clay				
-1									C	100	98	PL(A) = 1
14												
-2												PL(A) = 1.8
15									C	100	100	
	15.18	Bore discontinued at 15.18m										PL(A) = 1.5
-3												
16												
-4												
17												
-5												
18												
-6												
19												
-7												

RIG: Dando Terrier **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 2.00m

TYPE OF BORING: Diacore to 0.24m; Hand Tools to 0.50m; SFA (TC bit) to 2.00m; NMLC to 15.18m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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DOUGLAS PARTNERS PTY

ONE CARRINGTON STREET

BORE BH1A PROJECT 73693.02 DEC 2013

2.00 – 15.16 m

BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 12.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 73693.02
DATE: 10/12/2013
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
	0.04	CONCRETE										
		CONCRETE										
	0.15											
	0.16	RUBBER										
		CONCRETE										
	0.25	FILLING - Red-brown, sandy gravel filling with some cobbles (ripped sandstone)							E			
	0.46											
	0.5	SANDSTONE - Low to medium strength, moderately to slightly weathered, grey and brown, medium to coarse grained sandstone										
12		Bore discontinued at 0.5m - Due to Crowbar refusal										
	1											
11												
	2											

RIG: Hand Tools **DRILLER:** Tightsite **LOGGED:** LJH **CASING:**

TYPE OF BORING: Diacore to 0.25m; Hand Tools to 0.50m

WATER OBSERVATIONS: No free groundwater observed

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)

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BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 2.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 73693.02
DATE: 6/12/2013
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
2	0.2	CONCRETE - 5mm reinfrocement at 0.09m depth										
2	0.43	FILLING - Yellow-brown, sandy gravel filling (ripped sandstone)										
2	0.62	SANDSTONE - High strength, slightly weathered to fresh, orange and pale grey, highly fractured, fine to medium grained, sandstone						0.37m: CORE LOSS: 60mm 0.43m: to 0.62m; Possible fracturing from basement excavation 0.85m: B5°, pl, sm	C	97	65	PL(A) = 0.9
1		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained, sandstone with <5% dark grey laminations						1.45m: B5°, pl, sm				
0									C	100	98	PL(A) = 1.2
2												PL(A) = 2
3								2.8m: B10°, pl, sm 2.81m: B10°, pl, sm				
-1									C	100	100	PL(A) = 1.6
4								>>				
-2												PL(A) = 1.5
5									C	100	100	
-3												PL(A) = 1.6
6	6.0	SANDSTONE - High strength, fresh, unbroken, pale grey, fine to medium grained, "yellow block" sandstone						6m: B5°, pl, sm				
-4	6.33	Bore discontinued at 6.33m										
7												
-5												
8												
-6												
9												
-7												

RIG: Pro Line **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 0.37m

TYPE OF BORING: Diacore to 0.20m; Hand Tools to 0.37m; NMLC to 6.33m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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DOUGLAS PARTNERS PTY

ONE CARRINGTON STREET

BORE BH3 PROJECT 73693.02 DEC 2013

0.37 – 6.33 m

BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 2.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 73693.02
DATE: 5/12/2013
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
	0.16	CONCRETE							E			
	0.23	FILLING - Grey and brown, sandy gravel filling (ripped sandstone)										
		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained, sandstone with <5% dark grey laminations						0.47m: B10°, pl, ro, fe	C	100	100	PL(A) = 1
								1.41m: B5°, pl, ro	C	100	100	PL(A) = 1.7
									C	100	100	PL(A) = 1.4
								3.85m: B10°, pl, sm	C	100	100	PL(A) = 1.4
								4.8m: B5°, pl, sm	C	100	100	PL(A) = 1
									C	100	100	PL(A) = 1.3
	6.13	Bore discontinued at 6.13m										

RIG: Pro Line **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 0.23m

TYPE OF BORING: Diacore to 0.16m; Hand Tools to 0.23m; NMLC to 6.13m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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DOUGLAS PARTNERS PTY

ONE CARRINGTON STREET

BORE BH4 PROJECT 73693.02 DEC 2013

0.23 – 6.13 m

BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 2.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 73693.02
DATE: 5/12/2013
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
	0.2	CONCRETE										
	0.35	FILLING - Yellow-brown, sandy gravel filling (ripped sandstone)							E			
		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained, sandstone with <5% dark grey laminations						0.36m: B15°, st, ro 0.63m: B10°, pl, sm 1.15m: B5°, pl, sm >> 5.16m: B5°, pl, sm	C	100	99	PL(A) = 1.4 PL(A) = 1.4
									C	100	100	PL(A) = 1.5
									C	100	100	PL(A) = 1.3 PL(A) = 1.7
									C	100	100	PL(A) = 1.6
	6.51	Bore discontinued at 6.51m										PL(A) = 1.2

RIG: Pro Line **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 0.35m

TYPE OF BORING: Diacore to 0.20m; Hand Tools to 0.35m; NMLC to 6.51m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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DOUGLAS PARTNERS PTY

ONE CARRINGTON STREET

BORE BH5 PROJECT 73693.02 DEC 2013

0.35 – 6.51 m

BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 2.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 73693.02
DATE: 6/12/2013
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
	0.28	CONCRETE										
	0.54	FILLING - Yellow-brown, sandy gravel filling with cobbles (ripped sandstone)										
		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained, sandstone with <2% dark grey laminations						0.76m: B5°, pl, sm 1.3m: B15°, pl, sm 1.95m: B0°, coal seam 2.53m: B5°, pl, sm 3.6m: B5°, coal seam	C C C	100 100 100	100 100 100	PL(A) = 1 PL(A) = 0.8 PL(A) = 1.3 PL(A) = 1.6 PL(A) = 1.4
	5.13	Bore discontinued at 5.13m										

RIG: Pro Line **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 0.54m

TYPE OF BORING: Diacore to 0.28m; Hand Tools to 0.54m; NMLC to 5.13m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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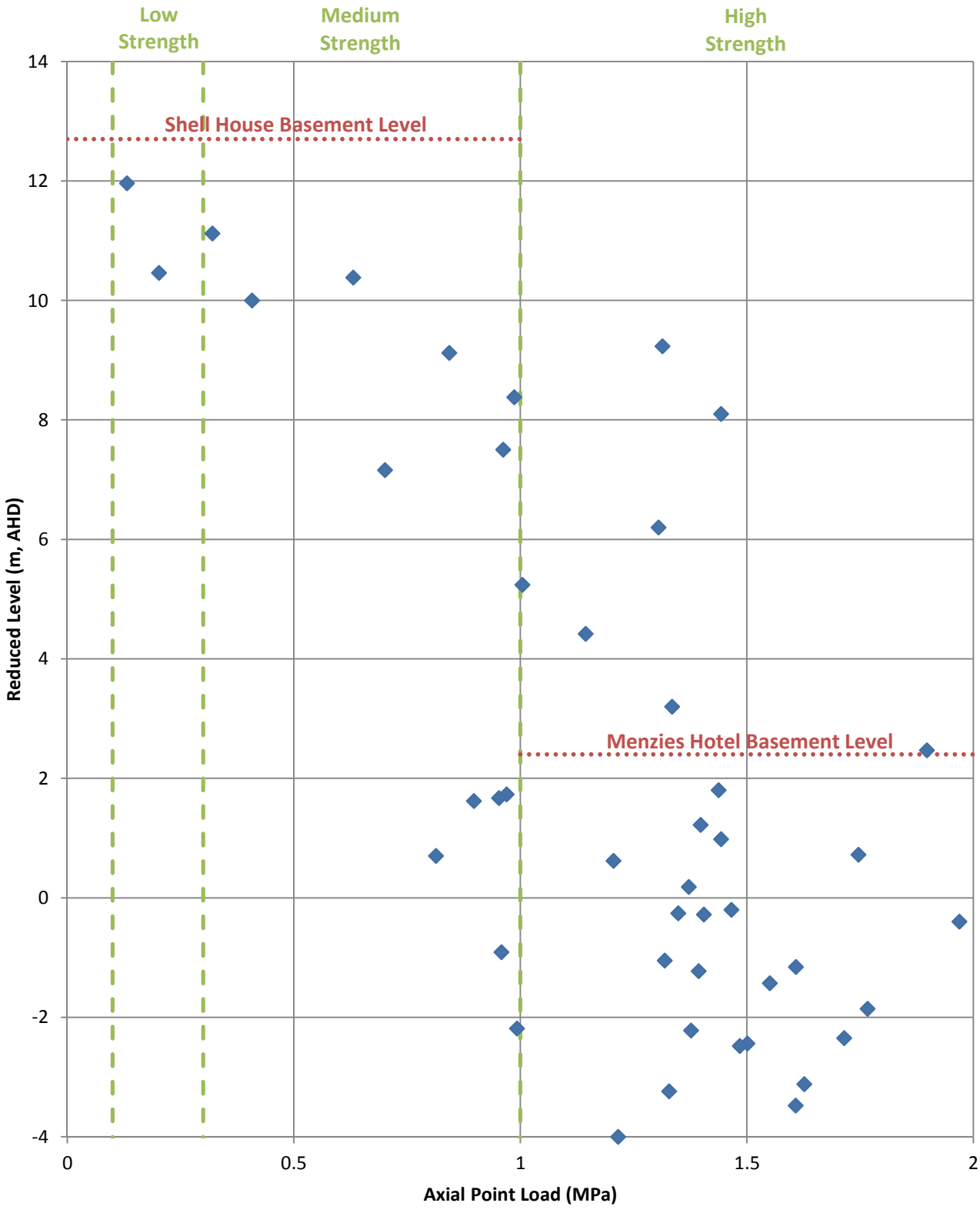
DOUGLAS PARTNERS PTY

ONE CARRINGTON STREET

BORE BH6 PROJECT 73693.02 DEC 2013

0.54 – 5.12 m

Chart 1: Axial Point Load Test Results



BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 12.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1A
PROJECT No: 73693.02
DATE: 10/12/2013
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.13	CONCRETE - 5mm reinforcement at 0.12m depth							Gatic Cover
	0.14	RUBBER							Concrete
	0.24	CONCRETE							Backfill
	0.5	FILLING - Red-brown, sandy gravel filling with some cobbles (ripped sandstone)							Bentonite Seal
		SANDSTONE - Low to medium strength, moderately to slightly weathered, fractured, pale grey with brown, fine to coarse grained sandstone (inferred from BH1)							PVC Pipe
	1.8	SANDSTONE - Medium to high strength, slightly weathered to fresh stained, fractured, pale grey, medium to coarse grained sandstone.							
		- Fresh rock below 3.10m - 3.13m to 3.57m: Grey in colour - 3.65m to 3.78m: Strong diesel odour							
								17-12-13	Gravel Backfill
	8.6	SANDSTONE - High strength, moderately to slightly weathered, slightly fractured, brown, medium to coarse grained sandstone.							Slotted PVC Pipe

RIG: Dando Terrier **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 2.00m

TYPE OF BORING: Diacore to 0.24m; Hand Tools to 0.50m; SFA (TC bit) to 2.00m; NMLC to 15.18m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 12.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH1A
PROJECT No: 73693.02
DATE: 10/12/2013
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
2		SANDSTONE - High strength, moderately to slightly weathered, slightly fractured, brown, medium to coarse grained sandstone. *(continued)*							
	10.71								
1	11 10.97	SANDSTONE - Medium strength, slightly weathered, fragmented, pale grey with purple, fine to medium grained sandstone with thin coal seams.							11
		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained sandstone.							
0	12								12
	13								13
-1	14								14
-2	15								15
	15.18	Bore discontinued at 15.18m							
-3	16								16
-4	17								17
-5	18								18
-6	19								19
-7									

RIG: Dando Terrier **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 2.00m

TYPE OF BORING: Diacore to 0.24m; Hand Tools to 0.50m; SFA (TC bit) to 2.00m; NMLC to 15.18m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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BOREHOLE LOG

CLIENT: Sovereign Wynyard Centre Pty Ltd
PROJECT: One Carrington Street
LOCATION: Menzies Hotel, Wynyard

SURFACE LEVEL: 2.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 73693.02
DATE: 5/12/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.16	CONCRETE							Gatic Cover, Concrete, Filter Sock Seal
	0.23	FILLING - Grey and brown, sandy gravel filling (ripped sandstone)							
		SANDSTONE - High strength, fresh, slightly fractured to unbroken, pale grey, fine to medium grained, sandstone with <5% dark grey laminations							PVC Pipe; Slotted PVC Pipe
	6.13	Bore discontinued at 6.13m							

RIG: Pro Line **DRILLER:** Tightsite **LOGGED:** LJH **CASING:** HQ to 0.23m

TYPE OF BORING: Diacore to 0.16m; Hand Tools to 0.23m; NMLC to 6.13m

WATER OBSERVATIONS: Use of water during drilling precluded groundwater measurement

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)

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Appendix D

Summary of Results for Waste Classification
and Groundwater Testing

Table D1: Summary of Results of Soil Analysis for Preliminary Waste Classification

Sample Identification	Heavy Metals						Polycyclic Aromatic Hydrocarbons		Petroleum Hydrocarbons						Organochlorine Pesticides (OCP)		PCBs (total)	Phenols (total)	Asbestos (fibres)
	Arsenic	Cadmium	Chromium (III + VI)	Lead	Mercury	Nickel	Benzo(a)pyrene	Total PAHs	TRH C6 - C9	TRH +C10 - C36 (Sum of total)	Benzene	Toluene	Ethylbenzene	Total Xylene	Endosulfan (total)	Total OCP			
BH1 / 0.3m	<4	<0.4	7	6	<0.1	<1	<0.05	NIL (+)VE	<25	<PQL	<0.2	<0.5	<1	<3	<0.3	<PQL	<PQL	<5	NAD
BH2 / 0.3m	<4	<0.4	5	13	<0.1	5	<0.05	NIL (+)VE	<25	<PQL	<0.2	<0.5	<1	<3	<0.3	<PQL	<PQL	<5	NAD
BD1/101213	<4	<0.4	4	15	<0.1	5	<0.05	NIL (+)VE	-	-	-	-	-	-	-	-	-	-	-
BH4 / 0.2m	<4	<0.4	7	25	0.4	6	0.1	0.48	<25	<PQL	<0.2	<0.5	<1	<3	<0.3	<PQL	<PQL	<5	NAD
Maximum values of Specific Contaminant Concentration for classification (without TCLP)																			
General Solid Waste	100	20	100 for Cr(IV) only	100	4	40	0.8	200	650	10000	10	288	600	1000	60	<50*	<50	-	NAD

Notes:

BD1/101213	is blind replicate of BH2 / 0.3m
NAD	No asbestos detected
PQL	Practical Quantitation Limit
*	Value for Scheduled Chemicals

Table D2A: Stabilised Field Parameters Prior to Sampling (Test Bore 1A, 17 December 13)

Parameter	Reading
Temperature (^{0}C)	24.3
Dissolved Oxygen (ppm)	0.74
Electrical Conductivity (µS/cm)	217
pH	4.9
Redox (mV)	166

Table D2B: Summary of Results of Groundwater Analysis (All results in µg/L unless otherwise stated)

Sample Location (Test Bore)	Sample date	Heavy Metals (dissolved)								Polycylic Aromatic Hydrocarbons (PAH)						Total Recoverable Hydrocarbons (TRH)						Volitile Organic Compounds (VOC) (including BTEX)											Total Phenolics	pH	Hardness (mgCaCO3/L)
		Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Naphthalene	Benzo(a)pyrene	Acenaphthene	Fluorene	Phenanthrene	All other PAH	TRH C6-C10	TRH C6-C10 less BTEX	TRH >C10-C16	TRH >C10-C16 less napthalene	TRH >C16-C34	TRH >C34-C40	Benzene	Toulene	Ethylbenzene	o-xylene	m+p-xylene	Cis-1,2-dichloroethene	Chloroform	Trichloroethene	Bromodichloromethane	Tetrachloroethene	Other VOC			
Current Investigation Results																																				
1A	17-Dec-13	1	0.3	<1	**47**	<1	<0.05	**67**	**110**	5.8	<0.1	0.2	0.3	0.2	<PQL	69	69	270	260	670	<100	<1	<1	<1	<1	<2	9	15	7	2	36	<PQL	<50	5.1	24
BD1_121713	17-Dec-13	<1	0.2	<1	**43**	<1	<0.05	**63**	**110**	-	-	-	-	-	-	48	48	220	210	1000	<100	<1	<1	<1	<1	<2	-	-	-	-	-	-	-	-	-
Assessment Criteria																																				
Groundwater Investigation Level (GIL) - ANZECC & ARMCANZ (2000), Low to high relaibility trigger values for marine water		2.3 for As (III), 4.5 for As (V)	0.7	27 for Cr (III), 4.4 for Cr (VI)	1.3	4.4	0.1	7	15	50	0.1	-	-	0.6	-	-	-	-	-	-	-	500	180	5	350	75 + 200	-	370	330	-	70	-	-	-	-
Drinking water guidelines - NHMRC & NRMMC (2011) [in absense of ANZECC & ARMCANZ (2000) trigger value]		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60*	-	-	250**	-	-	-	-	-
Health Screening Levels (HSL) for vapour intrusion - Schedule B1 of ASC NEPM, Commercial / industrial site (Sand, depth 2 m to <4 m as conservative value)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	NL	NL	-	-	500	NL	NL	NL			-	-	-	-	-	-	-	-	-

Notes:

ANZECC & ARMCANZ (2000) - *National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality* , Australian and New Zealand Conservation Council & Agriculture, and Resource Management Council of Australia, and New Zealand

NHMRC & NRMMC (2011) - *National water quality management strategy, Australian drinking water guidelines* , National Health and Medical Research Council and National Resource Management Ministerial Council, Australia

ASC NEPM - The National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013

BD1_121713	blind replicate of 1A
*	Value for Cis and Trans-1,2-dichloroethene
**	Value for trihalomethanes
NL	Not Limiting
PQL	Practical Quantitation Limit
-	not defined/ not analysed/ not applicable
Bold	Exceeds GIL

Appendix E

Laboratory Certificates of Analysis
And Chain of Custody

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 102257

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

Attention: David Walker

Sample log in details:

Your Reference:	**73693.01, Sydney**		
No. of samples:	4 soils		
Date samples received / completed instructions received	11/12/13	/	11/12/13

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:	18/12/13	/	18/12/13
Date of Preliminary Report:	Not issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil				
Our Reference:	UNITS	102257-1	102257-2	102257-3
Your Reference	----------	BH1	BH2	BH4
Depth	----------	0.3	0.3	0.2
Date Sampled		10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil
Date extracted	-	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	13/12/2013	13/12/2013	13/12/2013
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	%	92	93	91

svTRH (C10-C40) in Soil				
Our Reference:	UNITS	102257-1	102257-2	102257-3
Your Reference	----------	BH1	BH2	BH4
Depth	----------	0.3	0.3	0.2
Date Sampled		10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil
Date extracted	-	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	12/12/2013	12/12/2013	12/12/2013
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	%	91	95	92

PAHs in Soil					
Our Reference:	UNITS	102257-1	102257-2	102257-3	102257-4
Your Reference	----------	BH1	BH2	BH4	BD1/101213
Depth	----------	0.3	0.3	0.2	-
Date Sampled		10/12/2013	10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	12/12/2013	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	12/12/2013	12/12/2013	12/12/2013	12/12/2013
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	<0.05	<0.05	0.1	<0.05
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	NIL (+)VE	NIL (+)VE	0.48	NIL (+)VE
Surrogate p-Terphenyl-d14	%	96	97	98	96

Organochlorine Pesticides in soil				
Our Reference:	UNITS	102257-1	102257-2	102257-3
Your Reference	----------	BH1	BH2	BH4
Depth	----------	0.3	0.3	0.2
Date Sampled		10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil
Date extracted	-	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	13/12/2013	13/12/2013	13/12/2013
HCB	mg/kg	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	100	104	99

PCBs in Soil				
Our Reference:	UNITS	102257-1	102257-2	102257-3
Your Reference	----------	BH1	BH2	BH4
Depth	----------	0.3	0.3	0.2
Date Sampled		10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil
Date extracted	-	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	13/12/2013	13/12/2013	13/12/2013
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1
Surrogate TCLMX	%	100	104	99

Total Phenolics in Soil				
Our Reference:	UNITS	102257-1	102257-2	102257-3
Your Reference	----------	BH1	BH2	BH4
Depth	----------	0.3	0.3	0.2
Date Sampled		10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil
Date extracted	-	13/12/2013	13/12/2013	13/12/2013
Date analysed	-	13/12/2013	13/12/2013	13/12/2013
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5

Acid Extractable metals in soil					
Our Reference:	UNITS	102257-1	102257-2	102257-3	102257-4
Your Reference	----------	BH1	BH2	BH4	BD1/101213
Depth	----------	0.3	0.3	0.2	-
Date Sampled		10/12/2013	10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil	Soil
Date digested	-	12/12/2013	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	12/12/2013	12/12/2013	12/12/2013	12/12/2013
Arsenic	mg/kg	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	7	5	7	4
Copper	mg/kg	3	3	26	5
Lead	mg/kg	6	13	25	15
Mercury	mg/kg	<0.1	<0.1	0.4	<0.1
Nickel	mg/kg	<1	5	6	5
Zinc	mg/kg	19	23	43	27

Moisture Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	102257-1 BH1 0.3 10/12/2013 Soil	102257-2 BH2 0.3 10/12/2013 Soil	102257-3 BH4 0.2 10/12/2013 Soil	102257-4 BD1/101213 - 10/12/2013 Soil
Date prepared	-	12/12/2013	12/12/2013	12/12/2013	12/12/2013
Date analysed	-	13/12/2013	13/12/2013	13/12/2013	13/12/2013
Moisture	%	8.2	7.7	15	9.2

Asbestos ID - soils				
Our Reference:	UNITS	102257-1	102257-2	102257-3
Your Reference	----------	BH1	BH2	BH4
Depth	----------	0.3	0.3	0.2
Date Sampled		10/12/2013	10/12/2013	10/12/2013
Type of sample		Soil	Soil	Soil
Date analysed	-	18/12/2013	18/12/2013	18/12/2013
Sample mass tested	g	Approx 40g	Approx 40g	Approx 40g
Sample Description	-	Light brown fine-grained soil & rocks	Light brown fine-grained soil & rocks	Light 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
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. 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-030	Total Phenolics - determined colorimetrically following disitillation, based upon APHA 22nd ED 5530 D.
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.
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 || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
Date analysed	-			13/12/2013	102257-1	13/12/2013 || 13/12/2013	LCS-1	13/12/2013
TRHC$_6$ - C$_9$	mg/kg	25	Org-016	<25	102257-1	<25 || <25	LCS-1	115%
TRHC$_6$ - C$_{10}$	mg/kg	25	Org-016	<25	102257-1	<25 || <25	LCS-1	115%
Benzene	mg/kg	0.2	Org-016	<0.2	102257-1	<0.2 || <0.2	LCS-1	111%
Toluene	mg/kg	0.5	Org-016	<0.5	102257-1	<0.5 || <0.5	LCS-1	112%
Ethylbenzene	mg/kg	1	Org-016	<1	102257-1	<1 || <1	LCS-1	114%
m+p-xylene	mg/kg	2	Org-016	<2	102257-1	<2 || <2	LCS-1	120%
o-Xylene	mg/kg	1	Org-016	<1	102257-1	<1 || <1	LCS-1	120%
naphthalene	mg/kg	1	Org-014	<1	102257-1	<1 || <1	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	123	102257-1	92 || 91 || RPD: 1	LCS-1	99%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
Date analysed	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
TRHC$_{10}$ - C$_{14}$	mg/kg	50	Org-003	<50	102257-1	<50 || <50	LCS-1	105%
TRHC$_{15}$ - C$_{28}$	mg/kg	100	Org-003	<100	102257-1	<100 || <100	LCS-1	101%
TRHC$_{29}$ - C$_{36}$	mg/kg	100	Org-003	<100	102257-1	<100 || <100	LCS-1	84%
TRH>C$_{10}$-C$_{16}$	mg/kg	50	Org-003	<50	102257-1	<50 || <50	LCS-1	105%
TRH>C$_{16}$-C$_{34}$	mg/kg	100	Org-003	<100	102257-1	<100 || <100	LCS-1	101%
TRH>C$_{34}$-C$_{40}$	mg/kg	100	Org-003	<100	102257-1	<100 || <100	LCS-1	84%
Surrogate o-Terphenyl	%		Org-003	92	102257-1	91 || 91 || RPD: 0	LCS-1	101%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base || Duplicate || %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
Date analysed	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
Naphthalene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	LCS-1	98%
Acenaphthylene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	LCS-1	101%
Phenanthrene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	LCS-1	101%
Anthracene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	LCS-1	98%

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	102257-1	<0.1 || <0.1	LCS-1	104%
Benzo(a)anthracene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	LCS-1	92%
Benzo(b+k)fluoranthene	mg/kg	0.2	Org-012 subset	<0.2	102257-1	<0.2 || <0.2	[NR]	[NR]
Benzo(a)pyrene	mg/kg	0.05	Org-012 subset	<0.05	102257-1	<0.05 || <0.05	LCS-1	105%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012 subset	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	90	102257-1	96 || 98 || RPD: 2	LCS-1	96%

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	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
Date analysed	-			13/12/2013	102257-1	13/12/2013 || 13/12/2013	LCS-1	13/12/2013
HCB	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	70%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	69%
Heptachlor	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	70%
delta-BHC	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	78%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	78%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	69%
Dieldrin	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	76%
Endrin	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	75%
pp-DDD	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	73%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	LCS-1	75%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	102	102257-1	100 || 100 || RPD: 0	LCS-1	100%

QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-1	12/12/2013
Date analysed	-			13/12/2013	102257-1	13/12/2013 || 13/12/2013	LCS-1	13/12/2013
Arochlor 1016	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	LCS-1	79%
Arochlor 1260	mg/kg	0.1	Org-006	<0.1	102257-1	<0.1 || <0.1	[NR]	[NR]
Surrogate TCLMX	%		Org-006	102	102257-1	100 || 100 || RPD: 0	LCS-1	96%
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	-			13/12/2013	[NT]	[NT]	LCS-1	13/12/2013
Date analysed	-			13/12/2013	[NT]	[NT]	LCS-1	13/12/2013
Total Phenolics (as Phenol)	mg/kg	5	Inorg-030	<5	[NT]	[NT]	LCS-1	88%
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	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-5	12/12/2013
Date analysed	-			12/12/2013	102257-1	12/12/2013 || 12/12/2013	LCS-5	12/12/2013
Arsenic	mg/kg	4	Metals-020 ICP-AES	<4	102257-1	<4 || <4	LCS-5	102%
Cadmium	mg/kg	0.4	Metals-020 ICP-AES	<0.4	102257-1	<0.4 || <0.4	LCS-5	107%
Chromium	mg/kg	1	Metals-020 ICP-AES	<1	102257-1	7 || 6 || RPD: 15	LCS-5	106%
Copper	mg/kg	1	Metals-020 ICP-AES	<1	102257-1	3 || 2 || RPD: 40	LCS-5	106%
Lead	mg/kg	1	Metals-020 ICP-AES	<1	102257-1	6 || 6 || RPD: 0	LCS-5	103%
Mercury	mg/kg	0.1	Metals-021 CV-AAS	<0.1	102257-1	<0.1 || <0.1	LCS-5	98%
Nickel	mg/kg	1	Metals-020 ICP-AES	<1	102257-1	<1 || <1	LCS-5	108%
Zinc	mg/kg	1	Metals-020 ICP-AES	<1	102257-1	19 || 27 || RPD: 35	LCS-5	100%

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: A portion of the supplied sample was sub-sampled for asbestos analysis according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g of sample in its own container.

Asbestos ID was analysed by Approved Identifier: Alex Tam
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: David Walker

Sample log in details:

Your reference:	**73693.01, Sydney**
Envirolab Reference:	**102257**
Date received:	11/12/13
Date results expected to be reported:	**18/12/13**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	4 soils
Turnaround time requested:	Standard
Temperature on receipt (°C)	16.6
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

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

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

Douglas Partners
Geotechnics - Environment - Groundwater

CHAIN OF CUSTODY

Project Name: SYDNEY
Project No: 73693.01 Sampler: Luke James - HWL
Project Mgr: D.W. Mob. Phone:
Email: david.walker@douglaspartners.com.au
Date Required: Standard Lab Quote No.

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W - water	Container type	Analytes: Heavy Metals	BTEX/ TRH	OCPs/ PCBs	PAH	Phenols	Asbestos							Other	Notes
BH1	0.3	1		S	↓	✓	✓	✓	✓	✓	✓								combo 7A
BH2	0.3	2	10.12.13	S		✓	✓	✓	✓	✓	✓								7A
BH4	0.2	3		S		✓	✓	✓	✓	✓	✓								7A
BD1/101213		4	10.12.13	S	↓	✓			✓										

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 102257
Date Received: 11.12.13
Time Received: 18:05
Received by: D. F
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No.
Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114
Phone: (02) 9809 0666
Fax: (02) 9809 4095
Relinquished by: D. Walker Signed: Date & Time: 11/12/13 1.25pm Received By: Daniel Ford, ES Date & Time: 11.12.13 18:05
Relinquished by: Signed: Date & Time: Received By: Date & Time:

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 102777

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

Attention: David Walker

Sample log in details:

Your Reference:	**73693.01, Sydney**		
No. of samples:	2 Waters		
Date samples received / completed instructions received	18/12/2013	/	18/12/2013

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:	7/01/14	/	2/01/14
Date of Preliminary Report:	Not issued		

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Results Approved By:

Jacinta Hurst
Laboratory Manager

VOCs in water Our Reference: Your Reference Date Sampled Type of sample	UNITS ---------- ----------	 102777-1 1A 17/12/2013 Water
Date extracted	-	19/12/2013
Date analysed	-	20/12/2013
Dichlorodifluoromethane	µg/L	<10
Chloromethane	µg/L	<10
Vinyl Chloride	µg/L	<10
Bromomethane	µg/L	<10
Chloroethane	µg/L	<10
Trichlorofluoromethane	µg/L	<10
1,1-Dichloroethene	µg/L	<1
Trans-1,2-dichloroethene	µg/L	<1
1,1-dichloroethane	µg/L	<1
Cis-1,2-dichloroethene	µg/L	9
Bromochloromethane	µg/L	<1
Chloroform	µg/L	15
2,2-dichloropropane	µg/L	<1
1,2-dichloroethane	µg/L	<1
1,1,1-trichloroethane	µg/L	<1
1,1-dichloropropene	µg/L	<1
Cyclohexane	µg/L	<1
Carbon tetrachloride	µg/L	<1
Benzene	µg/L	<1
Dibromomethane	µg/L	<1
1,2-dichloropropane	µg/L	<1
Trichloroethene	µg/L	7
Bromodichloromethane	µg/L	2
trans-1,3-dichloropropene	µg/L	<1
cis-1,3-dichloropropene	µg/L	<1
1,1,2-trichloroethane	µg/L	<1
Toluene	µg/L	<1
1,3-dichloropropane	µg/L	<1
Dibromochloromethane	µg/L	<1
1,2-dibromoethane	µg/L	<1
Tetrachloroethene	µg/L	36
1,1,1,2-tetrachloroethane	µg/L	<1
Chlorobenzene	µg/L	<1
Ethylbenzene	µg/L	<1
Bromoform	µg/L	<1
m+p-xylene	µg/L	<2
Styrene	µg/L	<1
1,1,2,2-tetrachloroethane	µg/L	<1
o-xylene	µg/L	<1
1,2,3-trichloropropane	µg/L	<1

VOCs in water		
Our Reference:	UNITS	102777-1
Your Reference	----------	1A
Date Sampled	----------	17/12/2013
Type of sample		Water
Isopropylbenzene	µg/L	<1
Bromobenzene	µg/L	<1
n-propyl benzene	µg/L	<1
2-chlorotoluene	µg/L	<1
4-chlorotoluene	µg/L	<1
1,3,5-trimethyl benzene	µg/L	<1
Tert-butyl benzene	µg/L	<1
1,2,4-trimethyl benzene	µg/L	<1
1,3-dichlorobenzene	µg/L	<1
Sec-butyl benzene	µg/L	<1
1,4-dichlorobenzene	µg/L	<1
4-isopropyl toluene	µg/L	<1
1,2-dichlorobenzene	µg/L	<1
n-butyl benzene	µg/L	<1
1,2-dibromo-3-chloropropane	µg/L	<1
1,2,4-trichlorobenzene	µg/L	<1
Hexachlorobutadiene	µg/L	<1
1,2,3-trichlorobenzene	µg/L	<1
Surrogate Dibromofluoromethane	%	132
Surrogate toluene-d8	%	86
Surrogate 4-BFB	%	93

vTRH(C6-C10)/BTEXN in Water			
Our Reference:	UNITS	102777-1	102777-2
Your Reference	----------	1A	BD1_121713
Date Sampled	----------	17/12/2013	17/12/2013
Type of sample		Water	Water
Date extracted	-	19/12/2013	19/12/2013
Date analysed	-	20/12/2013	20/12/2013
TRHC$_6$ - C$_9$	µg/L	62	44
TRHC$_6$ - C$_{10}$	µg/L	69	48
TRHC$_6$ - C$_{10}$ less BTEX (F1)	µg/L	69	48
Benzene	µg/L	<1	<1
Toluene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
m+p-xylene	µg/L	<2	<2
o-xylene	µg/L	<1	<1
Naphthalene	µg/L	6	6
Surrogate Dibromofluoromethane	%	132	119
Surrogate toluene-d8	%	86	102
Surrogate 4-BFB	%	92	87

svTRH (C10-C40) in Water			
Our Reference:	UNITS	102777-1	102777-2
Your Reference	----------	1A	BD1_121713
Date Sampled	----------	17/12/2013	17/12/2013
Type of sample		Water	Water
Date extracted	-	19/12/2013	19/12/2013
Date analysed	-	20/12/2013	20/12/2013
TRHC$_{10}$ - C$_{14}$	µg/L	170	130
TRHC$_{15}$ - C$_{28}$	µg/L	570	660
TRHC$_{29}$ - C$_{36}$	µg/L	260	510
TRH>C$_{10}$ - C$_{16}$	µg/L	270	220
TRH>C$_{10}$ - C$_{16}$ less Naphthalene (F2)	µg/L	260	210
TRH>C$_{16}$ - C$_{34}$	µg/L	670	1,000
TRH>C$_{34}$ - C$_{40}$	µg/L	<100	<100
Surrogate o-Terphenyl	%	111	105

PAHs in Water - Low Level		
Our Reference:	UNITS	102777-1
Your Reference	----------	1A
Date Sampled	----------	17/12/2013
Type of sample		Water
Date extracted	-	19/12/2013
Date analysed	-	20/12/2013
Naphthalene	µg/L	5.8
Acenaphthylene	µg/L	<0.1
Acenaphthene	µg/L	0.2
Fluorene	µg/L	0.3
Phenanthrene	µg/L	0.2
Anthracene	µg/L	<0.1
Fluoranthene	µg/L	<0.1
Pyrene	µg/L	<0.1
Benzo(a)anthracene	µg/L	<0.1
Chrysene	µg/L	<0.1
Benzo(b+k)fluoranthene	µg/L	<0.2
Benzo(a)pyrene	µg/L	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5
Total +ve PAH's	µg/L	6.5
Surrogate p-Terphenyl-d14	%	102

Total Phenolics in Water		
Our Reference:	UNITS	102777-1
Your Reference	----------	1A
Date Sampled	----------	17/12/2013
Type of sample		Water
Date extracted	-	19/12/2013
Date analysed	-	19/12/2013
Total Phenolics (as Phenol)	mg/L	<0.05

HM in water - dissolved			
Our Reference:	UNITS	102777-1	102777-2
Your Reference	----------	1A	BD1_121713
Date Sampled	----------	17/12/2013	17/12/2013
Type of sample		Water	Water
Date prepared	-	19/12/2013	19/12/2013
Date analysed	-	19/12/2013	19/12/2013
Arsenic-Dissolved	µg/L	1	<1
Cadmium-Dissolved	µg/L	0.3	0.2
Chromium-Dissolved	µg/L	<1	<1
Copper-Dissolved	µg/L	47	43
Lead-Dissolved	µg/L	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05
Nickel-Dissolved	µg/L	67	63
Zinc-Dissolved	µg/L	110	110

Miscellaneous Inorganics		
Our Reference:	UNITS	102777-1
Your Reference	----------	1A
Date Sampled	----------	17/12/2013
Type of sample		Water
Date prepared	-	20/12/2013
Date analysed	-	20/12/2013
pH	pH Units	5.1

Cations in water Dissolved		
Our Reference:	UNITS	102777-1
Your Reference	----------	1A
Date Sampled	----------	17/12/2013
Type of sample		Water
Date digested	-	20/12/2013
Date analysed	-	20/12/2013
Calcium - Dissolved	mg/L	3.5
Magnesium - Dissolved	mg/L	3.6
Hardness	mgCaCO3 /L	24

Method ID	Methodology Summary
Org-013	Water samples are analysed directly by purge and trap GC-MS.
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-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. 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.
Inorg-030	Total Phenolics - determined colorimetrically following disitillation, based upon APHA 22nd ED 5530 D.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
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+.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.

QUALITY CONTROL VOCs in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Date analysed	-			20/12/2013	[NT]	[NT]	LCS-W1	20/12/2013
Dichlorodifluoromethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NR]	[NR]
Chloromethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NR]	[NR]
Vinyl Chloride	µg/L	10	Org-013	<10	[NT]	[NT]	[NR]	[NR]
Bromomethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NR]	[NR]
Chloroethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NR]	[NR]
Trichlorofluoromethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NR]	[NR]
1,1-Dichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Trans-1,2-dichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,1-dichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	113%
Cis-1,2-dichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Bromochloromethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Chloroform	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	116%
2,2-dichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2-dichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	112%
1,1,1-trichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	118%
1,1-dichloropropene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Cyclohexane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Carbon tetrachloride	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Dibromomethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2-dichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Trichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	127%
Bromodichloromethane	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	94%
trans-1,3-dichloropropene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
cis-1,3-dichloropropene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,1,2-trichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Toluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,3-dichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Dibromochloromethane	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	77%
1,2-dibromoethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Tetrachloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	LCS-W1	112%
1,1,1,2-tetrachloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Chlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Ethylbenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Bromoform	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
m+p-xylene	µg/L	2	Org-013	<2	[NT]	[NT]	[NR]	[NR]
Styrene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,1,2,2-tetrachloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
o-xylene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL VOCs in water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
1,2,3-trichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Isopropylbenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Bromobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
n-propyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
2-chlorotoluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
4-chlorotoluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,3,5-trimethyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Tert-butyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2,4-trimethyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,3-dichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Sec-butyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,4-dichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
4-isopropyl toluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2-dichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
n-butyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2-dibromo-3-chloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2,4-trichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Hexachlorobutadiene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
1,2,3-trichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-013	111	[NT]	[NT]	LCS-W1	109%
Surrogate toluene-d8	%		Org-013	90	[NT]	[NT]	LCS-W1	95%
Surrogate 4-BFB	%		Org-013	88	[NT]	[NT]	LCS-W1	102%

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Date analysed	-			20/12/2013	[NT]	[NT]	LCS-W1	20/12/2013
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	129%
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	129%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	125%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	120%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	130%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	132%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	134%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	111	[NT]	[NT]	LCS-W1	109%
Surrogate toluene-d8	%		Org-016	90	[NT]	[NT]	LCS-W1	85%
Surrogate 4-BFB	%		Org-016	88	[NT]	[NT]	LCS-W1	100%
QUALITY CONTROL svTRH (C10-C40) in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Date analysed	-			20/12/2013	[NT]	[NT]	LCS-W1	20/12/2013
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	104%
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	95%
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	75%
TRH>C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	104%
TRH>C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	95%
TRH>C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	75%
Surrogate o-Terphenyl	%		Org-003	104	[NT]	[NT]	LCS-W1	107%
QUALITY CONTROL PAHs in Water - Low Level	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			19/12/2013	[NT]	[NT]	LCS-W2	19/12/2013
Date analysed	-			20/12/2013	[NT]	[NT]	LCS-W2	20/12/2013
Naphthalene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	85%
Acenaphthylene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	95%
Phenanthrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	91%

QUALITY CONTROL PAHs in Water - Low Level	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	91%
Pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	95%
Benzo(a)anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	85%
Benzo(b+k)fluoranthene	µg/L	0.2	Org-012 subset	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	LCS-W2	94%
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012 subset	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012 subset	115	[NT]	[NT]	LCS-W2	100%
QUALITY CONTROL Total Phenolics in Water	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Date analysed	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-030	<0.05	[NT]	[NT]	LCS-W1	94%
QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Date analysed	-			19/12/2013	[NT]	[NT]	LCS-W1	19/12/2013
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	95%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	[NT]	[NT]	LCS-W1	97%
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	101%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	97%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	103%
Mercury-Dissolved	µg/L	0.05	Metals-021 CV-AAS	<0.05	[NT]	[NT]	LCS-W1	96%

QUALITY CONTROL HM in water - dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	98%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	[NT]	[NT]	LCS-W1	96%
QUALITY CONTROL Miscellaneous Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			[NT]	[NT]	[NT]	LCS-W1	20/12/2013
Date analysed	-			[NT]	[NT]	[NT]	LCS-W1	20/12/2013
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-W1	102%
QUALITY CONTROL Cations in water Dissolved	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date digested	-			[NT]	[NT]	[NT]	LCS-W1	20/12/2013
Date analysed	-			[NT]	[NT]	[NT]	LCS-W1	20/12/2013
Calcium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	93%
Magnesium - Dissolved	mg/L	0.5	Metals-020 ICP-AES	<0.5	[NT]	[NT]	LCS-W1	94%
Hardness	mgCaCO3/L	3		3.0	[NT]	[NT]	[NR]	[NR]

Report Comments:

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

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

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

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

Douglas Partners
Geotechnics · Environment · Groundwater

3.0°C

CHAIN OF CUSTODY

Project Name: SYDNEY
Project No: 73693.01 Sampler: David Walke
Project Mgr: DW Mob. Phone:
Email: david.walke@douglaspartners.com.au
Date Required: Standard Lab Quote No.

To: Envirolab Services
12 Ashley Street, Chatswood NSW 2068
Attn: Tania Notaras
Phone: 02 9910 6200 Fax: 02 9910 6201
Email: tnotaras@envirolabservices.com.au

Sample ID	Sample Depth	Lab ID	Sampling Date	Sample Type S - soil W - water	Container type	Analytes: Heavy Metals (5)	BTEX/ TRH	OCPs/ PCBs	PAH (as lead)	Phenols (total)	Asbestos	VOC						Other	Notes
(a) 1A		1	12/7/13	W	bottles/ vials	✓	✓		✓	✓		✓							combo 4L + VOC
TBD-12/7/13		2	↓	W		✓	✓												

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

Job No: 102777
Date Received: 18/12
Time Received: 1130
Received by: NIC
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No.
Send Results to: Douglas Partners Address: 96 Hermitage Road, West Ryde 2114
Phone: (02) 9809 0666
Fax: (02) 9809 4095

Relinquished by: D. Walke	Signed:	Date & Time: 18/12/13	Received By:	Date & Time: 18/12	1130
Relinquished by:	Signed:	Date & Time:	Received By:	Date & Time:	

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: David Walker

Sample log in details:

Your reference:	**73693.01, Sydney**
Envirolab Reference:	**102777**
Date received:	18/12/2013
Date results expected to be reported:	**7/01/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	2 Waters
Turnaround time requested:	Standard
Temperature on receipt (°C)	3
Cooling Method:	Ice
Sampling Date Provided:	YES

Comments:

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

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