Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Commercial Development
8-10 Lee Street, Haymarket

Prepared for
Atlassian Pty Ltd

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

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1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed commercial development at 8-10 Lee Street, Haymarket. The investigation was commissioned by Avenor Pty Ltd (Avenor) on behalf of Atlassian Pty Ltd (Atlassian), using a consultancy agreement dated 11 June 2019, and was undertaken in accordance with our proposal SYD190190 dated 28 May 2019.

It is understood that the proposed development at the site is to be sub-divided into a 'Developer Works zone' and a 'State Works – Link Zone'. The Developer Works are proposed to include the excavation of two basement levels close to the western side of Central Station (to an elevation of RL5.6 m) followed by construction of a multi-storey, commercial tower, whereas the State Works to the west of the tower include a proposed future basement to a similar elevation, with a north-south connection to other proposed, adjoining basement levels.

Geotechnical investigations were undertaken by Douglas Partners Pty Ltd (DP) to provide information on the subsurface profile and groundwater levels for the assessment of excavation conditions, and to provide information for the design of the basement excavation, shoring systems and foundations. The geotechnical investigation comprised drilling nine boreholes (including three shallow boreholes), installation of three standpipes with data loggers, and laboratory testing of selected soil and rock samples. Details of the field work are given in this report, together with comments relevant to design and construction practice.

2. Site Description

The site incorporates Lots 116 and 117 of DP1078271, and part of Lot 13 of deposited plan DP1062447, and is an irregular, 'L'-shape (refer Drawing 1). The site is bounded by Ambulance Avenue to the north (also known as Lower Carriage Lane), the Adina Hotel and Upper Carriage Lane to the west, Central Station Country Platform 0 to the east, and both the Devonshire pedestrian tunnel and Henry Deane Plaza to the south.

The two sub-divided areas of the site include the 'State Works – Link Zone' to the west and the 'Developer Works Zone' to the east. The proposed 'Developer Works' basement has an approximate area of 1800 m^2, with an overall site area of approximately 3500 m^2. Descriptions of the eastern and western areas of the site are set out below.

- Central and Western area of the site ('State Works - Link Zone'):
    - This area includes an asphalt-surfaced, open-air, access ramp/road (ie Upper Carriage Lane, at approximate Upper Ground Floor level) which connects with Lee Street to the west (refer Photos 1 and 2 on Plate 1, Appendix B);

- The eastern part of this area is suspended above an access corridor, areas of material storage and other facilities, which are accessed from Ambulance Avenue at Lower Ground Floor level (refer Photo 3 on Plate 2 for a general site view): the western part of the access ramp/road is assumed to be underlain by soil fill materials;
- The open-air ramp is supported along the northern property boundary by a brick retaining wall, through which there is an access portal and driveway leading to the south, for the Adina Hotel basement;
- The access corridor, aligned in an approximately north-east / south-west direction (refer Photo 4, Plate 2), connects Ambulance Avenue with Henry Deane Plaza (to the south). Toilet and bin room facilities were observed on the western side of the access corridor, whilst a materials storage area was present adjacent to the corridor (refer Photos 5 and 6 on Plate 3).

- Eastern area of the site ('Developer Works Zone'):
  - This area is occupied by the former Inward Parcels Shed, which has both Upper Ground and Lower Ground Floor levels;
  - The Upper Ground Floor is accessed from Upper Carriage Lane (approximate elevation of RL21.2 m), and is currently occupied by the Railway Square YHA Youth Hostel (YHA);
  - Four former rail carriages are present on the eastern side of the YHA building, mounted on steel rails which are apparently supported by grey rail ballast and soil. These carriages, modified to become dormitory rooms / accommodation, are accessed from a concrete-surfaced platform (refer Photos 7 to 9 on Plates 4 and 5);
  - The height difference between the platform and dormitory carriage rail / ballast level was measured to be about 1.1 m;
  - The eastern part of the site is also accessed at Lower Ground Floor level from Ambulance Avenue (approximate elevation of RL15.5 m), and is currently occupied by rail catering facilities operated by GateGourmet Rail Pty Ltd (Gate Gourmet), including food storage areas and cool rooms / freezers (refer Plates 6 to 8); and
  - The north-eastern corner of the Gate Gourmet catering facility (ie at Lower Ground Floor level) is connected, via a concrete-lined rail access tunnel, to a series of other subterranean rail access tunnels which pass beneath Central Station (refer Photo 10, Plate 5).

3. Geology

Reference to the Sydney 1:100 000 Geological Series Sheet (Geological Survey of NSW: Herbert, 1983) indicates that the site is underlain by Triassic age Ashfield Shale overlying Hawkesbury Sandstone, and that the site is located near Quaternary age alluvial sediments, including transgressive dune sands.

Although not shown on the geological map, the Mittagong Formation is likely to be present at the transition between the Ashfield Shale and Hawkesbury Sandstone geological units. The Quaternary sediments typically comprise medium to fine grained marine sand. The Ashfield Shale typically comprises black to dark grey shales and laminite, the Mittagong Formation consists of interbedded shale, laminite and fine grained quartz sandstone, and the underlying Hawkesbury Sandstone typically comprises horizontally bedded and vertically jointed, massive and cross-bedded, medium grained quartz sandstone with a few shale interbeds.

The 1:25 000 Acid Sulfate Soil Risk map for Botany Bay (Murphy, 1997) indicates that the site does not lie within an area known for acid sulfate soils, nor does the site occur within areas known for soil salinity issues.

Site investigations during the present study encountered sandstone, with shale not encountered. The cored boreholes were all terminated within Hawkesbury Sandstone. Six of the seven cored boreholes encountered an upper, weathered layer of fine to medium grained sandstone with numerous weak clay seams, which is possibly the Mittagong Formation (denoted on the cross-sections as 'fine and medium grained sandstone'). Alluvial sediments were encountered in three of the boreholes drilled within the southern part of the site (ie Boreholes BH1, BH2 and BH8).

4. Field Work Methods

The field work for the geotechnical investigation was completed in conjunction with a detailed site investigation for contamination (DSI), over a five-day period (including two night-shifts) between 10 July 2019 and 14 July 2019. The work included the drilling of nine boreholes at the locations shown in Drawing 1, Appendix C. Drilling of boreholes within the Lower Ground Floor were carried out during a weekend 'rail shutdown' period, between the evenings of 12 July to 14 July 2019.

Two boreholes were drilled from Upper Ground Floor level on the eastern side of the YHA (Boreholes BH1 and BH2), five boreholes were drilled from Lower Ground Floor level within the Gate Gourmet catering facility (BH3 to BH5, BH7 and BH9), and two boreholes were drilled from the Lower Ground Floor level within the access corridor and store room (BH6 and BH8).

Following coring of concrete slabs and/or buried concrete, the following equipment was used to complete the scope of drilling work:

- a man-portable 'Pro-line' drilling rig was utilised to drill Borehole BH1;
- a push-tube sampling rig was utilised to drill to the top of rock for Boreholes BH4, BH5 and BH7;
- a difficult-access, tracked drilling rig was utilised to drill Boreholes BH2 to BH5 and BH8 to BH9, including coring of the underlying sandstone; and
- a hand auger was used to drill Borehole BH6.

The boreholes were advanced within soils using a combination of techniques (eg hand augers, 110 mm diameter spiral flight augers, wash bore and push-tube drilling). Seven of the boreholes were cased and advanced into the underlying sandstone using NMLC-sized diamond core drilling equipment, to obtain 50 mm diameter, continuous samples of the rock for identification and strength testing purposes. Selected soil samples obtained during auger drilling were submitted to an analytical laboratory, with analysis of soil pH, electrical conductivity, sulfate and chloride concentrations.

The depths of the boreholes drilled from the Upper Ground Floor ranged between 20.0 m and 23.27 m, whereas borehole depths in the Lower Ground Floor ranged between either 2.35 m and 15.27 m (Gate Gourmet), or 1.27 m to 15.0 m (access corridor and storeroom, respectively).

Three standpipe piezometers were installed at the site to measure groundwater levels, including one screened within the alluvial and residual soil in Borehole BH1 (slotted casing installed between 4.3-6.3 m

depth), and two screened within the sandstone (Boreholes BH5 and BH8: slotted casing installed to depths of between 2.2-15.17 m and 2.9-15.0 m, respectively).

All field work was carried out under the full-time supervision of a geotechnical engineer, engineering geologist or environmental scientist. Logging of the soil and rock materials within the boreholes was generally undertaken in accordance with Australian Standard AS 1726 (2017).

Co-ordinates and surface levels for the Upper Ground Floor test locations (ie Boreholes BH1 and BH2) were obtained using a high-precision differential GPS. Surface levels for the other boreholes were obtained using a laser level, with co-ordinates interpolated from known locations using tape measurements. The inferred accuracy of the co-ordinates for Boreholes BH1 and BH2 is 0.1 m (in plan view), whereas the inferred accuracy of the co-ordinates for Boreholes BH3 to BH9 is 3 m. The inferred accuracy of the reported surface levels (elevations) for all boreholes is 0.1 m.

Subsequent to the drilling field work, the following groundwater measurement, sampling and monitoring activities were completed:

- 23 July 2019: Measurement of water levels in all three standpipes, followed by purging of water from Boreholes BH5 and BH8 (pumped dry, requiring the extraction of about 40 litres of water from each standpipe);
- 30 July 2019: Measurement of water levels in all three standpipes, and installation of data loggers within Boreholes BH1 and BH5 (configured to automatically measure groundwater levels at 1 minute time intervals). Borehole BH1 was pumped dry (about 20 litres of water extracted), and groundwater samples obtained from Boreholes BH5 and BH8 (with measurement of water quality parameters during sampling);
- 31 July 2019: Measurement of water levels in all three standpipes, and installation of a data logger within Borehole BH8. Demineralised water was added to Borehole BH1, and a falling-head test carried out. Purging of water from Boreholes BH5 and BH8 was carried out (pumped dry, requiring the extraction of about 50 litres of water from BH5, and about 100 litres from BH8), and rising-head tests carried out in these boreholes (water levels measured by the data logger at 1 minute increments);
- 7 August 2019: Measurement of water level completed for Borehole BH1 (approx. 1 litre of water in standpipe), and a limited volume of groundwater obtained from BH1 for chemical analysis (to be reported separately); and
- 14 August 2019: Measurement of water levels in all three standpipes, and a second falling-head test completed in Borehole BH1 following the addition of demineralised water. Data from each of the data loggers was retrieved, and the data loggers re-configured for a measurement interval of 1 hour.

Assessment and interpretation of the groundwater data from the data loggers and the permeability testing, and the results and interpretation of the groundwater chemical analytical results, will be reported under separate covers.

Further details of the methods and procedures employed during the site investigation are presented in the attached Notes About This Report.

5. Field Work Results

The subsurface conditions encountered in the boreholes are presented on the attached borehole logs in Appendix D, along with standard notes defining the descriptive terms and the classification methods used. Photographs of the rock core and selected photographs of the concrete cores are included together with the borehole logs.

The subsurface conditions encountered in the boreholes can be summarised as:

CONCRETE:	Single or multiple concrete slabs, with or without a brick pavement, asphalt layer, or surface ballast layer (0.15-1.8 m thick); over
FILL	Gravelly sand, sand, or clay fill (including clayey sand, silty sand, silty clay and sandy clay), low to medium plasticity clay fines, moist to wet, to depths ranging between 4.0-8.0 m on the eastern side of the YHA (Upper Ground Floor), or 0.0-1.7 m depth within the Lower Ground Floor. The fill materials were generally in a soft / very loose to medium dense condition. Anthropogenic inclusions (eg ash, slag, glass, brick and ceramic tile fragments) were encountered in three of the boreholes on the eastern part of the site (ie closest to Central Station: BH1, BH2 and BH4), to a depth of 3.2 m below the current ground surface or rail access tunnel levels.
ALLUVIAL SAND:	Very loose, fine to medium, yellow or orange-brown alluvial sand, with or without trace gravel, moist (1.3-2.0 m thick: Boreholes BH1 and BH8 only); over
RESIDUAL SILTY CLAY:	Soft to hard, orange, red, pale grey or grey mottled red or yellow residual silty clay, with fine to medium grained sand, with or without relict rock texture (0.5-1.0 m thick, absent in Borehole BH8); over
RESIDUAL SANDY CLAY:	Very stiff to hard, pale grey or grey mottled red residual sandy clay, fine to medium grained sand, trace gravel (0.5-0.8 m thick, present in Borehole BH2 and BH5); over
FINE to MEDIUM GRAINED SANDSTONE:	Very low to low or medium strength, fine to medium grained, highly or moderately weathered, fractured sandstone (1.2-2.0 m thick: absent in Borehole BH2). Numerous clay seams (up to 270 mm thick) or zones of core loss (up to 480 mm thick: inferred to be seams of clay or extremely low or very low strength rock) were encountered; over
MEDIUM GRAINED SANDSTONE:	Medium or high strength, medium grained, moderately weathered to fresh, slightly fractured to unbroken, with widely spaced, thin (ie 2-5 mm) clay seams.

Surface levels and depths at which various materials were encountered in the boreholes during the investigation are summarised in Table 1.

Table 1: Borehole Surface levels and Summary of Subsurface Profile

Bore hole	Surface RL (m AHD)	Top of Alluvial soil		Top of Residual soil		Top of Weathered Rock (fine to medium grained)		Top of Weathered Rock (medium grained)	
		Depth (m)	RL [2]	Depth (m)	RL [2]	Depth (m)	RL [2]	Depth (m)	RL [2]
BH1	20.1	4.0	16.1	6.0	14.1	6.5	13.6	7.7	12.4
BH2	21.2	8.0	13.2	8.0	13.2	*ne*	*ne*	9.5	11.7
BH3	15.5	*ne*	*ne*	0.9	14.6	1.8	13.7	2.8	12.7
BH4	15.5	*ne*	*ne*	1.7	13.8	2.3	13.2	*ne*	*ne*
BH5	15.5	*ne*	*ne*	0.4	15.1	1.2	14.3	3.0	12.5
BH6	15.5	*ne*	*ne*	0.2	15.3	1.0	14.5	*ne*	*ne*
BH7	15.5	*ne*	*ne*	1.6	13.9	2.2	13.3	*ne*	*ne*
BH8	15.5	0.6	14.9	*ne*	*ne*	2.1	13.4	4.2	11.3
BH9	15.5	*ne*	*ne*	0.3	15.2	1.7	13.8	3.7	11.8

Notes: (1) "*ne*" indicates Not Encountered
(2) Elevation (RL) are metres AHD.

Wet sand was observed within Borehole BH2 at a depth of 6.2 m (ie within sand filling), whereas groundwater (or other signs of water) was not observed in the other boreholes during auger drilling, prior to the commencement of rotary coring (the use of water as a drilling fluid during rotary coring prevented groundwater observations).

Three groundwater standpipe piezometers were installed into completed boreholes (ie Boreholes BH1, BH5 and BH8), comprising screened PVC pipe with gravel backfill, a bentonite pellet seal and 'gatic' cover at ground level (refer to Borehole Logs for specific details). Borehole BH1 was screened within alluvial sand, whereas the other two boreholes were screened 0.8-1 m below the top of sandstone (ie screened within both the fine to medium and medium grained sandstone).

The standpipes were flushed and subsequently pumped to remove drilling fluids. Measurement of water levels within standpipes was carried out five occasions between 23 July 2019 and 14 August 2019, data loggers installed on 30 July 2019 (31 July 2019 for Borehole BH8), and permeability testing carried out (falling-head tests in BH1, rising head tests in BH5 and BH8). The results of the permeability testing are to be reported separately when further analysis has been carried out. Groundwater level observations are summarised in Table 2 on the following page.

Table 2: Groundwater Observations

Bore hole	Standing Water Level Measurements									
	23 July 2019		30 July 2019		31 July 2019		7 August 2019		14 August 2019	
	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]	Depth (m)	RL[2]
BH1	5.95	14.2	6.07	14.0	5.95	14.2	6.15	14.0	6.27	13.8
BH5	2.6	12.9	2.44	13.1	2.44	13.1	nr[1]	nr[1]	2.41	13.1
BH8	2.3	13.2	2.3	13.2	nr[1]	nr[1]	nr[1]	nr[1]	2.33	13.2

Notes: (1) "nr" indicates Not Recorded.
(2) Elevation (RL) are metres AHD.

6. Laboratory Testing

Eighty-one samples selected from the better quality rock core were tested for axial point load strength index ($Is_{(50)}$). The results of the point load strength testing, presented on the borehole logs, generally indicates Is_{50} values of 0.15 MPa to 1.5 MPa in the fine to medium grained sandstone, and 0.15 MPa to 3.1 MPa in the medium grained sandstone, indicating rock ranging from low strength to very high strength. To obtain inferred unconfined compressive strengths (UCS) from point load strength test results, a conversion factor of 18 is often used, indicating a UCS of up to about 55 MPa for the rock encountered during the investigation.

Five selected soil samples from the boreholes were tested in a NATA-accredited analytical laboratory to determine soil aggressivity (pH, electrical conductivity, sulfate and chloride ion concentrations), including one sample of alluvial sand, one sample of sand fill, two samples of residual silty clay, and one sample of sandy clay fill.

The soil aggressivity results are summarised in Table 3, with the laboratory test reports included in Appendix E.

Table 3: Laboratory Test Results for Aggressivity to Buried Concrete and Steel

Sample ID	Sample Description	Elevation of Sample[1] (RL m)	pH	EC[2] (µS/cm)	Chloride (mg/kg)	Sulfate (mg/kg)
BH1, 4.3-4.5m	Alluvial SAND	15.8	6.0	20	<10	10
BH4, 0.3-0.4m	Filling, Sandy CLAY	15.2	8.9	170	25	61
BH5, 1.1-1.2m	Residual Silty CLAY	14.4	4.9	92	29	42
BH6, 0.5-0.6m	Residual Silty CLAY	15.0	5.1	89	10	72
BH7, 0.4-0.5m	Filling, Silty SAND	15.1	8.3	120	20	42

Notes: (1) Elevation quoted is for the 'top' of the sample.
(2) EC = Electrical Conductivity.
(3) Analysed soil was tested as a 1:5 mixture of soil:water.

7. Proposed Development

It is understood that the proposed development within the 'Developer Works Zone', adjacent to the western side of Central Station, will include the retention of both the former Inward Parcels Shed (ie the YHA building) and the existing goods lift to Station platform level, removal of the carriage dormitories and rails, and excavation below the Lower Ground Floor level of the existing building for a two-level basement (to RL5.6 m), followed by construction of a multi-storey commercial tower.

Based on the preliminary drawings provided, it is understood that the proposed basement within the 'Developer Works Zone' will extend close to the northern and eastern property boundaries, and near to the Devonshire pedestrian tunnel to the south. The drawings indicate that, as part of the 'State Works – Link Zone', two basement entry ramps are to be constructed along both the northern side (ie from Lee Street) and north-eastern corner of the Adina Hotel, and a connection is proposed from the second basement level to potential future basements to the south of the site (ie beneath the pedestrian tunnel).

The drawings also show that the proposed Upper Ground and Lower Ground Floors are at elevations of RL21.0 m and RL15.3 m (respectively), and that the proposed basement levels are RL10.3 m (Basement 1) and RL5.6 m (Basement 2). Based on current surface levels within the site, the depth of excavation will vary between about 14.5 m on the eastern side (ie adjacent to Central Station, within the 'Developer Works Zone'), to about 10 m on the western side (ie within the 'State Works – Link Zone').

8. Geotechnical Model

The field work results are summarised on four geotechnical cross-sections (Inferred Geotechnical Cross-Sections A-A', Drawing 2, to D-D', Drawing 5 in Appendix C), which show the interpreted filling, alluvial and residual soil and sandstone units between selected test locations. The interpreted boundaries shown on the sections are accurate only at the test locations and layers shown diagrammatically on the drawings are inferred only. Bands of lower or higher strength rock may be present within the generalised sandstone layers. Single or multiple concrete slabs were present at the surface over most of the site, with rail ballast encountered over concrete within the rail carriage dormitory area.

The geotechnical model for the site is:

- Eastern part of the site (ie below the eastern part of the YHA building, from Upper Ground Floor level): soft or very loose to firm or medium dense filling (clay or sand: up to 8 m thick, below the current ground surface), over very loose sand alluvium (up to 2.0 m thick), over soft to hard silty clay residual soil (about 0.5 m thick), overlying an upper, very low to low strength, fine to medium grained sandstone (0.5-1.5 m thick) with seams or bands of lower strength material, overlying medium to high strength, medium grained sandstone;
- Central part of the site (ie from Lower Ground Floor level, below the western section of the YHA building and the eastern section of the 'State Works – Link Zone'): dense sand filling (to depths of between 0-1.7 m below current surface levels), over very loose sand alluvium (up to 1.3 m thick), over very stiff to hard sandy or silty clay residual soil (up to 1 m thick), overlying an upper, very low to low strength, fine to medium grained sandstone (about 2 m thick) with seams or bands of lower strength material, overlying medium to high strength, medium grained sandstone;

- Western part of the site (ie below the existing asphalt-surfaced open-air ramp, within the 'State Works – Link Zone': based on borehole data obtained by others): inferred sand filling to 1-3m depth (inferred elevation of base of filling about RL15.2 m), over clay residual soil (up to about 2 m thick), overlying very low to low strength shale (about 1 m thick), overlying an upper, very low to low strength sandstone (up to about 1 m thick), overlying medium to high strength, medium grained sandstone.

The rock materials encountered in the boreholes (summarised in Table 4) have been classified in accordance with the procedures given in Pells et. al. (1998), and Bertuzzi and Pells (2002). It should be noted that the profiles are accurate at the borehole locations only, and that variations must be expected away from the boreholes.

Table 2: Summary of Material Strata Levels and Rock Classifications

Borehole ID	Top of Stratum[1]									
	Class V [2]		Class IV [2]		Class III [2]		Class II [2]		Class I [2]	
	Depth (m)	Level (RL)	Depth (m)	Level (RL)	Depth (m)	Level (RL)	Depth (m)	Level (RL)	Depth (m)	Level (RL)
BH1	6.5	13.6	-	-	7.7	12.4	8.5	11.6	9.9	10.2
BH2	9.5	11.7	-	-	10.3	10.9	11.5	9.7	12.6	8.6
BH3	1.8	13.7	-	-	3.3	12.2	-	-	5.1	10.4
BH4	2.3	13.2	-	<13.2	-	<13.2	-	<13.2	-	<13.2
BH5	1.2	14.3	1.9	13.6	2.8	12.7	-	-	6.7	8.8
BH6	1.0	14.5	-	<14.5	-	<14.5	-	<14.5	-	<14.5
BH7	2.2	13.3	-	<13.3	-	<13.3	-	<13.3	-	<13.3
BH8	2.1	13.4	3.6	11.9	4.9	10.6	-	-	7.9	7.6
BH9	1.7	13.8	2.3	13.2	3.7	11.8	-	-	5.9	9.6

Notes: (1) Depths and levels shown are to the top of rock classes in boreholes, with depths in metres and elevations in m AHD.
(2) Rock classifications are based on Pells et. al (1998) and Bertuzzi and Pells (2002).
(3) '-' indicates the material was not encountered within the drilled length.

In the process of preparing the rock classes and geotechnical model, and for the purposes of simplicity, some of the encountered rock classes have been downgraded due to the presence of either significant weak seams / core losses or closely spaced defects, and that bands of higher strength rock can occur within rock of lower strength.

9. Comments

9.1 Geotechnical Issues

Some of the primary geotechnical issues that need to be considered for the proposed development are:

- Stabilisation of the existing Inwards Parcels Shed (ie YHA building) such as by underpinning, due to excavation below the building for the two basement levels;
- Maintaining the stability and integrity of adjoining structures, services and tunnels (ie the Adina hotel, Central Station infrastructure, Henry Deane Plaza buildings, and the existing pedestrian tunnel and buried stormwater/sewer services adjacent to the southern site boundary);
- Excavation-induced movement adjacent to Lee Street, which is a Roads and Maritime Services (RMS) asset;
- Excavation induced movement adjacent to the eastern site boundary, which is a Sydney Trains Rail corridor;
- Groundwater is likely to be present within the basement excavation envelope;
- Shoring walls will need to be designed to reduce groundwater inflow, and to control drawdown of water levels on adjacent sites, as this has the potential to cause settlement;
- The shoring will need to be socketed into competent rock, which can be problematic for some shoring systems and can result in decompression and loosening of the surrounding soils leading to other issues;
- Design of the shoring walls and anchoring (if required) on the southern and western sides of the 'Developer Zone works' will need to take into consideration the positions of future proposed basement levels and connections;
- If cut-off walls into rock are successfully constructed to reduce inflow and drawdown of water levels, then it is technically feasible to construct a drained basement, however, this will be subject to review and approval by both the Council and by Water NSW;
- Alternatively, a tanked basement could be constructed to reduce the need for long term collection, possible treatment and removal of groundwater inflows. A tanked basement will need to be designed for hydrostatic uplift.

9.2 Site Preparation

Site preparation for the 'Developer Works Zone' may require the partial demolition of portions of the existing structures to facilitate access for machinery (at Lower Ground Floor level), and removal of existing equipment (eg industrial freezers, rail dormitory carriages). Access tracks and ramps may be required to enable machinery (eg piling rigs) to access the eastern part of the site (ie the Upper Ground Floor level of the eastern side of the YHA building), for which it is likely that removal and replacement of loose filling materials (eg including sand filling or rail ballast) and construction of working platforms will be required. Subject to confirmation testing, existing concrete slabs may be suitable as working platforms for piling rigs, prior to their removal as part of the bulk excavation works. Further geotechnical advice should be sought when further details are known.

Prior to the commencement of basement excavation works, a strategy to stabilise the Inwards Parcels Shed (such as by underpinning) and to monitor building movement during the construction period (including the Adina Hotel swimming pool) will need to be implemented. It is expected that the foundation system of this building is shallow footings (at Lower Ground Floor level) founded on the underlying sandstone, however, this will need to be confirmed at a later stage of the project.

Installation of shoring walls (possibly including / incorporating cut-off walls) around the 'Developer Works Zone' site perimeter will be required, prior to the commencement of the basement bulk excavation works. Low-height equipment is likely to be required, if piling works are to be carried out within indoor areas.

Loose/soft sand and clay filling is likely to be exposed within the upper 4-8 m of the eastern side of the excavation (ie below Upper Ground Floor level), which is likely to pose challenges for construction vehicles with pneumatic tyres. Some rutting / surface damage should be expected, particularly if traversed following periods of prolonged rainfall. It is anticipated that tracked machines would be able to safely traverse and work upon this material while it is exposed.

If placement of filling is required, or there is a need to improve the allowable bearing capacity of the underlying site soils, additional site preparation will be required. Typical site preparation measures could include:

- Removal of loose soil to create a level surface, to a depth to be determined on a case-by-case basis by a geotechnical professional;
- Compact the exposed material, then test roll the exposed surface using at least six passes of a minimum 12-tonne roller in non-vibration mode. The final pass should be witnessed by an experienced geotechnical engineer to detect any weak zones which would require additional rectification work, as directed by the geotechnical engineer;
- If required, replacement fill material should be free of oversize particles (>100 mm) and materials which could break down or degrade, should be placed in layers of loose thickness not greater than 200 mm (dependent upon the size of compaction machinery), and compacted to a dry density ratio of at least 98% relative to Standard compaction. Moisture contents should be maintained within 2% of Standard optimum moisture content. Compaction should be increased to a dry density ratio of 100% relative to Standard compaction for the top layer of the fill material (if the replacement filling used is sand, compact to a density index of 75%);
- Moisture conditioning (ie drying or wetting) of the replacement fill material may be required, to enable a greater degree of compaction to be achieved; and
- All filling should be placed in accordance with Australian Standard AS 3798 (2007), with earthworks quality control testing undertaken to verify that the required compaction/moisture criteria are achieved.

For the adjoining 'State Works – Link Zone', it is expected that similar site preparations will be required. Stabilisation of both the brick retaining wall along the northern property boundary and the Adina Hotel basement access portal will be required, if these are to be retained as part of the works.

Dilapidation surveys should be carried out on adjacent properties, including structures, pathways, walls or roadways within about 30 m of the proposed excavation, prior to commencement of the works. The dilapidation survey should document existing conditions and the presence of defects, and thereby allow appropriate responses should any claims arise from construction at this site. Buildings supported on shallow foundations are especially prone to the detrimental effects of settlement and vibration.

9.3 Excavation

Following completion of the site preparation works (including stabilisation of the Inward Parcels Shed and installation of shoring / cut-off walls), excavation for the basement levels is expected to be required through up to 9.5 m of soil (including clay and sand filling, alluvial sand, and residual silty and sandy clay: thickest on the eastern side of the excavation), then through rock of varying strength, including high strength sandstone.

The filling, alluvial and residual soils should be readily excavated using conventional earthmoving equipment (particularly if fitted with 'rock teeth'): very low to low strength rock will likely require light to medium ripping. The use of heavy ripping equipment, rock hammers or rock saws will be required to excavate medium or high strength rock.

Rippability of the sandstone is critically dependent upon the spacing of bedding and vertical joints, as well as on strength. Effective removal of the medium or higher strength sandstone within the lower levels of the excavation should be achieved by heavy bulldozers ripping in conjunction with rock hammers, however, excavation contractors should make their own assessment of likely productivity depending on their equipment capabilities and operator skills. Detailed footing excavations adjacent to boundary lines can be achieved by use of rock hammers or hydraulic rotary rock saws, or milling heads. Rock saws should also be used along the site boundaries to minimise over-break.

9.4 Vibration Control

Noise and vibration will be caused by excavation and earthworks activities at the site. The use of rock hammers will cause vibrations which, if not controlled, could possibly result in damage to nearby structures and disturbance to occupants, and it will be necessary to use appropriate methods and equipment to keep ground vibrations at adjacent buildings and structures within acceptable limits.

Based on previous experience and with reference to Australian / International Standard AS/ISO 2631.2 (2014), an initial vibration limit of 8 mm/sec vector sum peak particle velocity (VSPPV) is suggested at the foundation level of adjacent buildings, for human comfort considerations. This initial vibration limit may need to be reduced if there are vibration-sensitive buildings or equipment in the area (eg Sydney Trains rail signals services). It is noted that brick buildings or structures near to the proposed excavation (eg the Inward Parcels Shed, the Central Station buildings, and the brick retaining wall on the northern property boundary) may be founded on pad or strip footings at shallow depths, which could be affected by ground vibration. The owners of any in-ground utilities within and around the property should also be consulted with regard to allowable vibration levels.

If generation of construction vibration is a potential problem, consideration should be given to rock sawing and rock milling methods of rock excavation. A site-specific vibration monitoring trial may be required to determine vibration attenuation, once excavation plant and methods have been finalised.

9.5 Disposal of Excavated Material

Off-site disposal of excavated material will require assessment and/or environmental testing for re-use or classification, in accordance with *Waste Classification Guidelines* (NSW EPA, 2014), prior to disposal to an appropriately licensed landfill or receiving site. This includes fill materials and virgin excavated

natural materials (VENM), such as may be removed from this site. The type and extent of testing undertaken will depend on the final use or destination of the spoil, and requirements of the receiving site.

9.6 Batter Slopes

Based upon the preliminary drawings provided, excavation up to the property boundaries is proposed. Although batters are not shown in the elevation drawings, it is likely that they will be required during construction for site access / driveways. Vertical excavations along the site boundaries in the surficial soils and very low to low strength rock cannot be relied upon to remain stable and will require shoring.

Suggested maximum grades of batters for temporary or permanent slopes are 1.5H:1V and 2H:1V, respectively, for excavations up to 1.5 m high in filling and/or natural sand, above the water table and where not subjected to surcharge loads. The maximum batter slopes recommended for the design of temporary batters of up to 1.5 m height are presented in Table 3.

Table 3: Recommended Maximum Batter Slopes for Excavated Slopes

Excavated material	Temporary Batter	Permanent Batter
Filling	1.5H:1V	2H:1V
Residual soils	1.5H:1V	2H:1V
Extremely low to low strength sandstone	0.5H:1V	1H:1V
Medium strength sandstone (or better)	Vertical [1]	Vertical [1]

Note: (1) Should be inspected by an engineering geologist for unstable wedges, which should be cleared or rock bolted

In the absence of specific geotechnical advice, where batters are required adjacent to existing buildings supported on high level footings, an additional preliminary 'set-back' distance of at least 1 m should be used. An assessment of stability using analytical techniques would be necessary for excavations deeper than 1.5 m, and flatter batters would usually be appropriate.

Care should be taken where any surcharge loads are planned at the crest of batter slopes (eg placement of scaffolding sole boards). A slope stability analysis should be undertaken for batters subjected to surcharge loads on a case-by-case basis, following inspection and testing by a geotechnical engineer. Material stockpiles and machinery / equipment should not be stored at the crest of unsupported excavations.

Given the proximity of adjacent structures, Sydney Trains assets and the depth of excavation, retaining/shoring walls are likely to be required for the entire excavation perimeter.

If the shoring wall design requires piles to terminate above the basement floor level (ie RL5.6 m), then excavations below the shoring (ie within the medium to high strength sandstone) can be cut vertically and left unsupported as the excavation progresses, subject to a detailed assessment of jointing and rock conditions by a suitably qualified geotechnical engineer/engineering geologist.

Regular inspections of the rock face will be required during excavation (recommended at about every 1.5 m 'drop'), to determine whether conditions are as anticipated. Where issues are identified in these

inspections, rectification works considered to be necessary to maintain stability will be specified, such as spot bolting or installation of steel mesh-reinforced shotcrete. Based upon the quality of the medium to high strength sandstone encountered in boreholes during the investigation, it is expected that extensive areas of shotcrete will not be required within the medium to high strength sandstone.

9.7 Groundwater

9.7.1 General

Groundwater measurements from standpipe piezometers indicate that the proposed design floor level of 'Basement 2' (ie RL 5.6 m) will be below the groundwater table, with potentially perched groundwater also present within the alluvial sand. Additional investigation will be required to confirm whether the groundwater measured in the standpipes screened within the underlying sandstone is confined to the upper sandstone layer (ie fine to medium grained sandstone with clay seams), and the potential variability in groundwater levels (which may rise or fall relative to the measured level). The seams and other fractures in this weathered material may also be acting as conduits for water flow, and/or temporary water storage.

Previous experience indicates that the groundwater from the geological units at the site can have moderate concentrations of dissolved solids, including iron. Once groundwater comes into contact with the atmosphere, precipitation of iron oxides is likely to occur and provision should be made for the filtering and/or cleaning of this precipitate from subsoil drains, sumps, pumps and other fittings over the medium to longer term.

If dewatering activities at the site result in excessive drawdown of groundwater levels beneath surrounding sites, then this has the potential to induce settlement beyond the boundaries of the site. The presence of existing groundwater contamination on the site (if present: refer to DP Report 86767.01.R.001.Rev0, dated August 2019), and the potential for groundwater contamination sources on adjoining sites, should also be considered in the planning.

9.7.2 Seepage Rates and Groundwater Drawdown

Further detailed investigations and groundwater modelling will be required to predict seepage rates and drawdown in the short and long term, and to assess whether a cut-off wall into rock below the basement design floor level may be used to permit a drained basement. The modelling may indicate that a tanked basement is required, to reduce long-term groundwater drawdown to within acceptable limits. Collection and analysis of data obtained from standpipes at the site (over a relatively short time period) is ongoing, with the results to be reported under separate cover.

It is suggested that the design of the basement within the 'Developer Works Zone' should target a groundwater drawdown for adjacent properties (below existing water levels) of no more than 1.5 m. To achieve this, it is anticipated that the basement construction will need to include a relatively water-tight perimeter 'cut-off' wall. This could be either socketed a minimum of 2 m into competent, slightly weathered to fresh, slightly fractured and unbroken, medium to high strength sandstone (ie founding above the basement floor), or drilled through the medium or high strength sandstone to below the base of the excavation. If excessive water ingress is an issue during excavation for walls which have been terminated above the basement design floor level, grouting of open joints and bedding partings may be necessary.

Where cut-off walls are extended below the basement floor level, seepage flows would be expected to be significantly reduced, as seepage will only be able to occur though the medium to high strength rock below the basement floor (which is inferred to be of relatively low permeability). This option may effectively reduce inflow rates into the basement to the extent that a drained basement may be justified, without significant impact on groundwater levels for the surrounding sites. It will be necessary to provide under-floor drainage to safeguard against uplift pressures if the slab is designed for drained conditions. This could comprise a minimum 100 mm thick, durable open graded crushed rock with subsurface drains and sumps.

Approval for a drained basement will be subject to review and approval by Council and by Water NSW. If a drained basement slab is not permitted, then a water-tight 'tanked' basement will be required for the permanent basement structure. A tanked basement would need to be designed to resist uplift forces associated with (hydrostatic) groundwater pressures (which could be in the order of 8 m of hydraulic head).

9.7.3 Disposal

It is noted that off-site disposal of collected groundwater will need to be carried out in accordance with New South Wales Government Legislation (1997), and that water to be discharged into the natural environment should comply with the relevant guidelines (e.g. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council (ANZECC) and/or Agricultural and Resource Management Council of Australia and New Zealand). It is considered that preparation of a dewatering management plan (which includes a groundwater quality assessment) will likely be required during a later stage of the project.

9.8 Excavation Support

9.8.1 General

Shoring will be required around the perimeter of both the 'Developer Works' and 'State Works – Link Zone' basement excavations. As outlined in Section 9.7.2, the installation of a watertight retaining wall system around the basement perimeter may be required.

9.8.2 Shoring / Retaining Walls

Shoring / retaining wall systems which could be considered include diaphragm walls and interlocking secant pile walls, as follows:

- Diaphragm walls may be used as the permanent basement wall. They are usually considered to have a reduced risk of adverse construction issues, but are relatively slow to construct and consequently more expensive. They are constructed using a large 'grab' bucket, which excavates the soil and rock in vertical panels which are supported by bentonite fluid. Each panel is then cast using concrete tremmied into the bentonite-supported excavation, with steel reinforcement cages installed prior to the concrete being tremmied. The joints between the panels are sealed with a 'waterstop', so that a completely water-tight wall is achieved; and
- Interlocking secant pile walls are typically formed by drilling alternate 'soft' grout or concrete piles and then installing 'hard' reinforced concrete piles by cutting into the previously drilled soft piles.

This overlap typically ensures that piles are sealed, but some mis-alignment can occur even at relatively shallow depths to create minor gaps in the wall. The potential for mis-alignment (and therefore seepage ingress and soil migration / loss through the wall) in deep secant pile walls is very high. Drilling of piles into rock can also be problematic for secant piles, and may result in decompression / disturbance of the surrounding soils, which can result in damage to adjacent buildings. The use of segmental casing would be required to avoid issues associated with decompression, and hole collapse in sandy soils, and pumps are likely to be needed to remove seepage from pile excavations prior to placement of concrete. The design would need to consider the effects of hydrostatic pressures.

9.8.3 Design of Excavation Support

The shoring will need to be supported by internal bracing and / or ground anchors to control deflections. It is noted that Sydney Trains do not allow any anchors (temporary or permanent) within their corridor, and as such internal bracing / props are likely to be required along the eastern and southern site boundaries (depending on the final basement configuration).

Shoring walls should be founded at least 1 m below the basement design floor level (possibly deeper to reduce water inflows: refer Section 9.7.2), to provide lateral restraint at the base of the excavation and to avoid the risk of adversely inclined joints or wedges undermining the shoring.

Excavation faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to the top of medium strength rock. The values of active earth pressure coefficient (K_a) given in Table 4 on the following page could be used for a level ground surface and a flexible wall allowing for some lateral movement. 'At rest' earth pressure (K_o) values should be used where the wall movement needs to be reduced.

The design for lateral earth pressures where single or multiple anchored walls (including propping) are required may be based on a trapezoidal earth pressure distribution, with additional allowances made (where relevant) for surcharge loads from adjacent buildings, sloping ground surfaces, the rail corridor, and construction machinery. Hydrostatic pressures acting on the full height of the shoring wall should also be included in the design where adequate drainage is not provided behind its full height (such as for cut-off walls).

The following earth pressure magnitudes are considered appropriate, where H is the height of soil and rock to be retained (in metres):

- 4H kPa, where some lateral movement is allowed; and
- 6H kPa, where lateral movements need to be minimised (eg next to buildings or services).

In each case the maximum pressure generally acts over the central 60% of the wall height, reducing to zero at the top and base of the wall.

Passive resistance for shoring founded in rock below the base of the basement design floor level (including allowance for services or footings) may be based on the ultimate passive restraint values provided in Table 5 on the following page. These ultimate values represent the pressure mobilised at high displacements and therefore it will be necessary to incorporate an appropriate factor of safety (eg greater than or equal to 2) to limit wall movement. The top 0.5 m length of the socket should be ignored due to possible disturbance and over-excavation.

Table 4: Preliminary Design Parameters for Shoring Systems

Material Description	Unit Weight (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure 'at Rest' (K_o)	Effective Cohesion (c': kPa)	Effective Friction Angle (Degrees)
Sand and Clay Filling, very loose or loose alluvial sand, or soft Clay	18	0.35	0.6	0	28
Very Stiff to Hard Residual Clay	18	0.25	0.5	3	25
Extremely low to low strength sandstone	22	0.1	0.2	100	25
Medium strength or stronger sandstone	24	0*	0*	300	40

Note * subject to geotechnical inspection.

Table 5: Preliminary Passive Resistance Values

Foundation Stratum	Ultimate Passive Pressure (kPa)
Extremely low to very low strength sandstone	400
Low strength sandstone	2,000
Medium strength or stronger sandstone	4,000

Detailed design of shoring should preferably be carried out using WALLAP, PLAXIS or other accepted computer analysis programs capable of modelling progressive excavation and anchoring, and predicting potential lateral movements, stresses and bending moments. PLAXIS (or similar) would be required if it is necessary to assess ground movements on surrounding properties (eg Lee Street and Sydney Trains Rail Corridor / Tracks), as WALLAP can only assess wall movements.

9.8.4 Ground Anchors

For estimation purposes the design of temporary ground anchors for the support of shoring systems may be carried out on the basis of the maximum bond stresses given in Table 6. The anchors should preferably have their bond length within the medium strength or stronger sandstone.

To prevent excessive lateral deformation, installation of temporary ground anchors may be required below any adjoining footings (ie located on or close to the site boundaries), or into the toes of shoring piles installed above the basement design floor level. Additional anchors may be required if large blocks or wedges are observed during excavation.

Table 6: Preliminary Bond Stresses for Rock Anchor Design

Material Description	Maximum Allowable Bond Stress (kPa)	Maximum Ultimate Bond Stress (kPa)
Very low strength sandstone	100	200
Low strength sandstone	200	400
Medium strength or stronger sandstone	500	1000

The design of temporary ground anchors for the support of potentially unstable rock wedges may be carried out using the typical bond stresses at the grout-rock interface given in Table 6. These parameters assume that the anchor holes are clean and adequately flushed, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing. The use of permanent anchors would require careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed at this site.

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

For the permanent situation, the basement structure should provide the required lateral support to the perimeter excavation once the temporary anchors are de-stressed, however, the designer should take into consideration the potential influence of future basement excavations, such as are proposed for the northern, southern and western sides of the site.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors that will extend beyond the site boundaries. In addition, care should be taken to avoid damaging buried services, pipes and subsurface structures (possibly including neighbouring piled footings) during anchor installation. Anchoring should only be carried out by an experienced contractor with demonstrated experience in similar ground conditions.

Vertical anchors for uplift support could also be designed using the parameters given in Table 6. The designer should check the cone-pull-out failure mechanism by assuming a 90-degree cone for both the soil and rock.

9.9 Excavation-Induced Ground Movement

9.9.1 RMS Infrastructure and Sydney Trains Rail Corridor

Lee Street is a Roads and Maritime Services (RMS) asset, and Central Station is a Sydney Trains asset. Reference should be made to Roads and Maritime Services (2012: Geotechnical Technical Direction), which outlines requirements for excavations adjacent to RMS infrastructure, and includes the level of

geotechnical investigation required, dilapidation surveying, instrumentation and monitoring during construction, trigger levels and contingency plans. Sydney Trains / RMS or other local authorities may have specific requirements, which will need to be discussed and implemented before construction commences.

A Geotechnical Impact Assessment (GIA, ie numerical modelling) will typically be required as part of a Development Application (imposed by both RMS and Sydney Trains). The purpose of the GIA is to assess the likely amount of excavation-induced ground movement resulting from the proposed excavation.

During construction, instrumentation (eg inclinometers) and survey monitoring is typically required where the excavation exceeds heights of either 3 m (for cantilevered shoring walls) or 6 m (for anchored or propped shoring walls). A geotechnical monitoring plan is likely to be required by RMS prior to construction for this site.

Depending on the setback of the basement excavation from the Sydney Trains Rail corridor, a site-specific track monitoring plan may also be required. It should be noted that this will likely involve the placement of survey markers within the rail corridor and on the nearest track, which has its own complications regarding the delays / costs associated in obtaining the necessary approvals from Sydney Trains.

9.9.2 Stress Relief

For an excavation which extends to a depth of about 6 m below the top of medium or high strength sandstone, there will be some inward horizontal movement due to the effects of stress relief. It is impracticable to provide restraint for the relatively high in-situ horizontal stresses present within the Hawkesbury Sandstone. Release of these stresses due to the excavation will generally cause horizontal movement along the rock bedding surfaces and partings.

Based on monitoring experience for excavations in the Sydney region, excavation of about 6 m depth into medium to high strength rock may give rise to lateral movements of between 0.5 mm and 1 mm for every 1 m of excavation into medium to high strength rock (ie in the order of 3 – 6 mm at the top of medium strength rock). This movement will be most important on the eastern side of the excavation, as this area is indicated to have a greater thickness of Class I and Class II sandstone above the proposed 'Basement 2' design floor level. Provided there is a sufficient gap between the structure and the rock face (to be confirmed via inspection), this movement should not adversely affect the structure.

Stress-relief related movements can cause damage to adjacent buildings. It is recommended that appropriate allowance also be made for the repair of pavements and public utilities, where excavations are carried out close to structures.

Regular monitoring of survey targets along the excavation perimeter during construction, such as following each successive 'drop' in excavation level, should be undertaken to monitor the effects of stress relief.

9.10 Foundations

It is anticipated that the foundations for the proposed building within the 'Developer Works Zone' will be constructed within a uniform founding stratum, at or below the floor level of 'Basement 2' (ie RL5.6 m). As depicted in the interpreted cross-sections (Drawings 2 to 5, Appendix C), high strength, medium grained Hawkesbury Sandstone (assessed to be Class I sandstone) is expected to be exposed at this level within both the 'Developer Works Zone' and the 'State Works – Link Zone'.

On the basis of the materials anticipated to be exposed at the basement design floor level, spread footings (ie pad footings) should be suitable for supporting the proposed building loads within the excavation footprint. These may be designed for the support of axial compression loads using the preliminary maximum allowable (and ultimate) bearing pressures, shaft adhesions and modulus values presented in Table 7, and can be adopted on the assumption that the excavations are clean and free of loose debris, with pile sockets free of smear and adequately roughened immediately prior to concrete placement. Shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the values for compression.

Table 7: Recommended Design Parameters and Moduli for Foundation Design

Foundation Stratum[1]	Allowable Parameters		Ultimate Parameters[3]		Field Elastic Modulus (MPa)
	End Bearing (MPa)	Shaft Adhesion (kPa)[2]	End Bearing (MPa)	Shaft Adhesion (kPa)[2]	
Sandstone – Class V	1.0	75	3	150	50
Sandstone – Class IV	1.0	100	4	250	100
Sandstone – Class III	3.5	350	20	800	350
Sandstone – Class II	6.0	600	60	1500	900
Sandstone – Class I	10.0	600	120	3000	2000

Notes (1) Rock Classification based on Pells et. al (1998) and Bertuzzi and Pells (2002).
(2) Shaft adhesion applicable to the design of bored piles, uncased over the rock socket length, where adequate sidewall cleanliness and roughness are achieved.
(3) Ultimate end bearing parameters mobilized at large settlements (ie >5% of pile diameter).

If higher bearing pressures are used in design, then additional testing will be required in the form of cored boreholes and spoon testing of footings, to ensure there are no defects beneath footings. Spoon testing involves drilling a 50 mm diameter hole below the base of the footing, to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak/clay bands. If weak seams are detected, then footings may need to be taken deeper to reach suitable foundation material. Alternatively, if a lower allowable bearing pressure of 3.5 MPa is adopted then testing during construction could be limited to inspection of foundations.

To use a bearing pressure value for design of 10 MPa, 100% of the footings should be spoon tested to a depth equivalent to 1.5 times the footing width and two boreholes should be drilled to 3 m below bulk excavation level. The amount of proving of the founding material of the footings could be reduced to spoon testing 33% of the footings if the bearing pressure is reduced to 6 MPa. (Note that further drilling

should be carried out to confirm the rock strength before the suggested bearing pressures can be adopted.)

Where footings are located within the zone of influence of adjacent excavations, drawn upward at 45 degrees from the toe of the excavation (such as lift shafts or tanks), the allowable bearing pressure should be reduced by 25% and the excavation floor carefully inspected for adversely oriented joints. Alternatively, the footings may be taken deeper, below the zone of influence.

The settlement of a spread footing is dependent on the loads applied to the footing and the foundation conditions below the footing. The total settlement of a spread footing designed using the allowable parameters provided in Table 7 should be less than 1% of the footing width upon application of the design load. Differential settlements between adjacent footings may be in the order of 50% of the value of total settlement. The design of footings is usually governed by settlement criteria and performance rather than the ultimate bearing capacity or Ultimate Limit State condition.

For limit state design, selection of the geotechnical strength reduction factor (ϕ_g) in accordance with Australian piling code AS 2159 (2009) is based on a series of individual risk ratings (IRR), which are weighted on numerous factors and lead to an average risk rating (ARR). Therefore, it is recommended that an appropriate geotechnical strength reduction factor be calculated by the pile designer. Preliminary design could be based on a ϕ_g of 0.4, and refined as the design progresses. Footing settlements may be calculated for assessment of the serviceability limiting state using the elastic modulus values given in Table 7.

All spread footings should be inspected by an experienced geotechnical professional to check the adequacy of the foundation material and proof drilled or spoon tested as appropriate.

9.11 Soil Aggressivity to Concrete and Steel Structures

In accordance with Australian Standard AS 2159 (2009), the results of the chemical laboratory testing indicate that:

- all of the soils tested are non-aggressive to buried steel;
- the alluvial sand (above the water table) and the sandy clay and silty sand filling materials are non-aggressive to buried concrete; and
- the silty clay residual soils are mildly aggressive to buried concrete.

It is considered that the silty clay residual soils are likely to be derived from weathering of the fine to medium grained sandstone, and so the upper, fine to medium grained sandstone is also likely to be mildly aggressive to buried concrete and non-aggressive to buried steel.

9.12 Seismic Design

In accordance with the Earthquake Loading Standard, AS 1170.4 (2007), the site has a hazard factor (z) of 0.08. Given that the majority of the basement excavation is in Class V rock or better, a site sub-soil class of rock (B_e) is considered appropriate, assuming that all major structural loads are carried to rock of at least extremely low to very low strength.

10. Further Geotechnical Investigation

It is recommended that supplementary geotechnical investigation, in conjunction with environmental investigations, be completed at a later stage of the project. The supplementary investigations include:

- Intrusive investigations comprising cored boreholes at 3 to 4 locations, drilled to at least 3 m below the proposed bulk excavation level to confirm subsurface conditions, obtain soil samples for laboratory testing, permit the installation of additional groundwater monitoring wells, and to provide information for detailed design. It is noted that the total number of boreholes required will be dependent on the required foundation design parameters (eg if high performance footings of 6 MPa or more are required) and the final basement layout;
- Exposures of existing footings for the Inward Parcels Shed, from Lower Ground Floor level, to provide information for the design of a building stabilisation strategy (such as underpinning), prior to the commencement of other site excavations;
- Installation of monitoring wells in completed boreholes, screened within the fine to medium grained sandstone, potentially including duplicate 'nested' wells screened in either alluvial soil or the underlying medium grained Hawkesbury Sandstone, to confirm the depth to groundwater within the basement excavation and to permit both further environmental sampling and testing and permeability testing;
- Completion of groundwater analyses to assess the feasibility of a drained basement at the site;
- Numerical modelling of the shoring wall adjacent to Lee Street (RMS asset) and eastern site boundary (Sydney Trains Rail corridor), to assess the likely amount of excavation-induced ground movement as a result of the proposed excavation. It is noted that both RMS and Sydney Trains will typically require this as part of the DA application;
- Preparation of a geotechnical monitoring plan (Lee Street for RMS) and track monitoring plan (eastern site boundary for Sydney Trains). It is noted that both RMS and Sydney Trains will typically require this as part of the DA application;
- Instrumentation (inclinometers and survey markers) during construction to monitor excavation-induced movements, and to confirm that they are within the approved / tolerable limits specified in both the geotechnical monitoring plan and track monitoring plan;
- Dilapidation surveys;
- Waste Classification of all material to be excavated and transported off site; and
- Footing inspections during construction.

It is recommended that a meeting be held after the initial design has been completed to confirm that these recommendations have been interpreted correctly.

11. References

AS 1170.4:2007, *Structural design actions Part 4: Earthquake actions in Australia*, Standards Australia.

AS 1726:2017, *Geotechnical Site Investigations*, Standards Australia.

AS 2159:2009, *Piling Design and Installation*, Standards Australia.

AS 3798:2007, *Guidelines on earthworks for commercial and residential developments*", Standards Australia.

AS/ISO 2631.2: 2014, *Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)*, Standards Australia / International Standards Organisation.

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Pells, P.J.N., Mostyn, G., Walker, B.F. (1998), *Foundations on Sandstone and Shale in the Sydney Region*, Australian Geomechanics Journal, December 1998.

Roads and Maritime Services (2012), *RMS Geotechnical Technical Direction 2012/001*, April 2012.

12. Limitations

Douglas Partners (DP) has prepared this report for this project at 8-10 Lee Street, Haymarket, in accordance with DP's proposal SYD190190 (Revision 2), dated 28 May 2019, and acceptance received from Avenor Pty Ltd on behalf of Atlassian Pty Ltd on 11 June 2019. The work was carried out under a consultancy agreement dated 11 June 2019. This report is provided for the exclusive use of Atlassian Pty Ltd or their agents, for this project only and for the purposes as described in the report. It should not be used by or be relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

The scope for work for this investigation included the assessment of sub-surface materials for contaminants within the site, which is presented under separate cover. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

Asbestos has not been detected by observation or by laboratory analysis of soil samples, at the test locations sampled and analysed. Building demolition materials, such as glass, brick, ceramic tile, were, however, located in previous below-ground filling, and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to parts of the site being inaccessible and not available for inspection/sampling. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

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

Site Photographs

Photo 1 – View east along Upper Carriage Lane towards the YHA building (Adina Hotel to the right of the field of view), with Central Station in the background.

Photo 2 – View north across the asphalt-surfaced carpark towards Lee Street, from the western side of the YHA building (Upper Ground Floor level).

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 1 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Photo 3 – View to the east from Ambulance Avenue / Lower Carriage Lane, located west of Central Station (visible in the background), and north of both the YHA building and a rail catering facility (at Lower Ground Floor level).

Photo 4 – View south-west along an access corridor from Ambulance Avenue, west of the rail catering facility (Lower Ground Floor level). The location of Borehole BH6 is indicated as shown. Bin rooms and other facilities are present to the right of the field of view, and the rail catering facility is obscured behind the left-hand wall of the access corridor.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 2 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Photo 5 – General view south-west within a storage area adjacent to the access corridor (Lower Ground Floor level). The position of Borehole BH8 is to the right and behind the field of view.

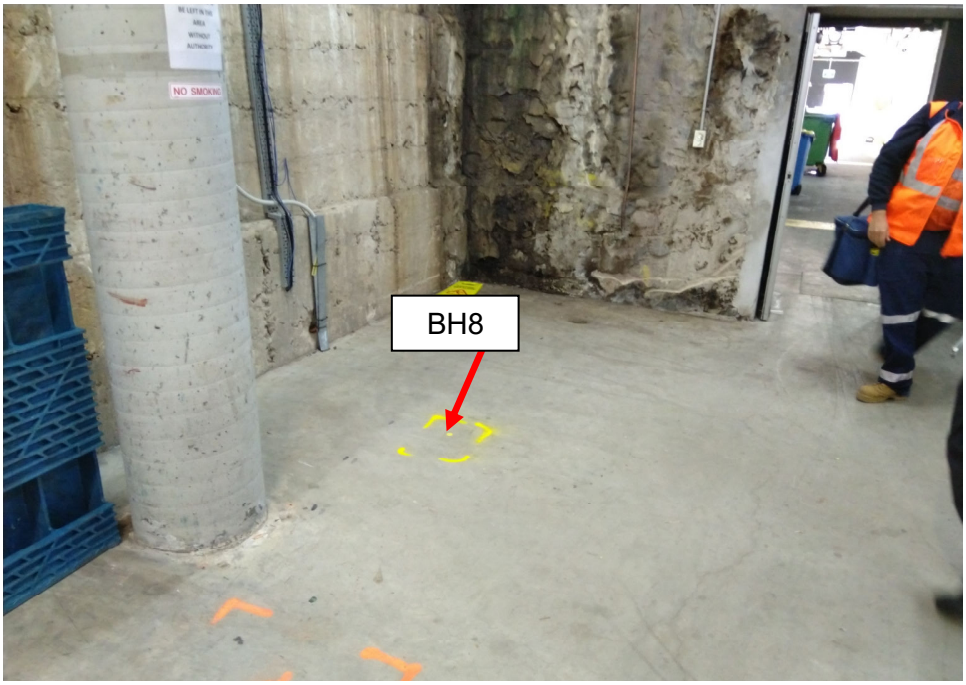


Photo 6 – View to the north-east within a storage area adjacent to the access corridor (Lower Ground Floor level), with the borehole location indicated as shown. The access doors to the right of the field of view are those visible at the end of the access corridor in Photo 4.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 3 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Photo 7 – View north-east along the western side of the YHA building from Upper Carriage Lane (Upper Ground Floor level), in the direction of Ambulance Avenue.

Photo 8 – View south-west along a former rail platform, on the eastern side of the YHA building (Upper Ground Floor level). Carriage dormitories are present to the left of the field of view. The location of Borehole BH2 is indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 4 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Photo 9 – View north-east between carriage dormitories on the eastern side of the YHA building (Upper Ground Floor level). The location of Borehole BH1 is indicated as shown.

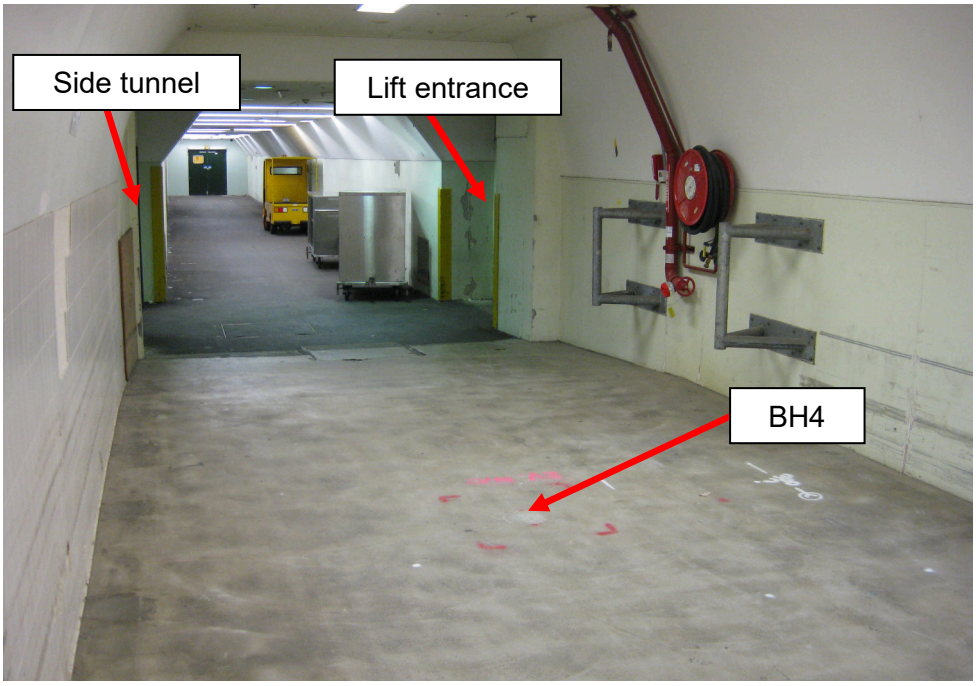


Photo 10 – View to the east along a rail access tunnel below Central Station, at approx. Lower Ground Floor level, east of the rail catering facility. The location of Borehole BH4 is indicated as shown.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 5 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Photo 11 – View south-west within the rail catering facility (Lower Ground Floor level), with the general location of Borehole BH7 indicated as shown. Commercial freezers are present on the left of the field of view.

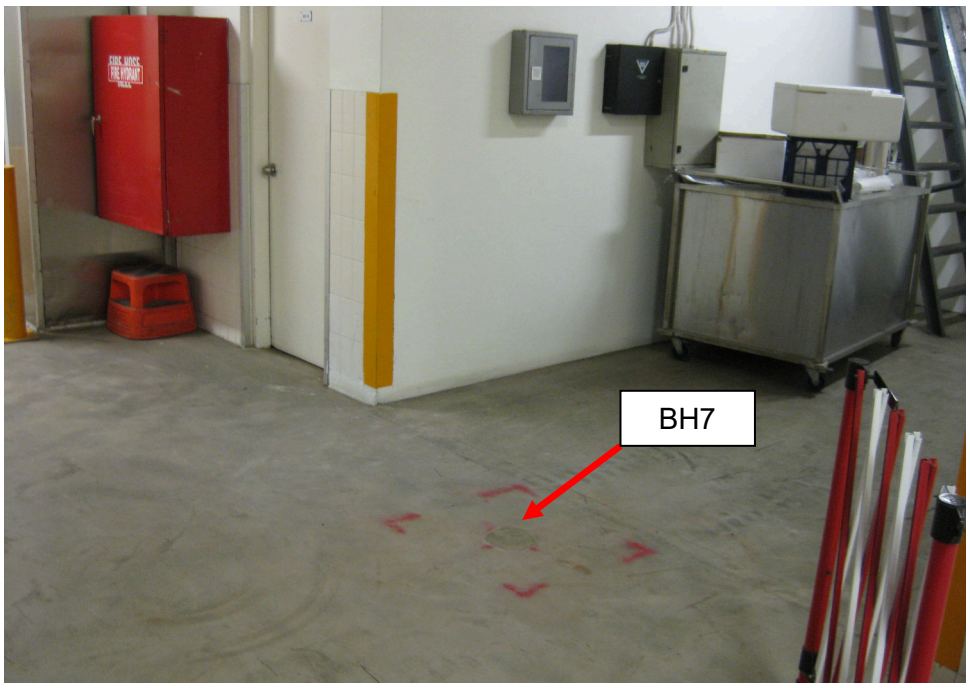


Photo 12 – View to the east at the location of Borehole BH7, indicated as shown. Commercial freezers are present to the left and background of the field of view.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 6 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Photo 13 – View north-east within the rail catering facility towards Ambulance Avenue (Lower Ground Floor level). The location of Borehole BH5 is indicated as shown. Commercial freezers are present on the right of the field of view.

Photo 14 – View to the north-east at the location of Borehole BH5, indicated as shown. A metal lid covers the hole, below which a standpipe piezometer has been installed.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 7 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

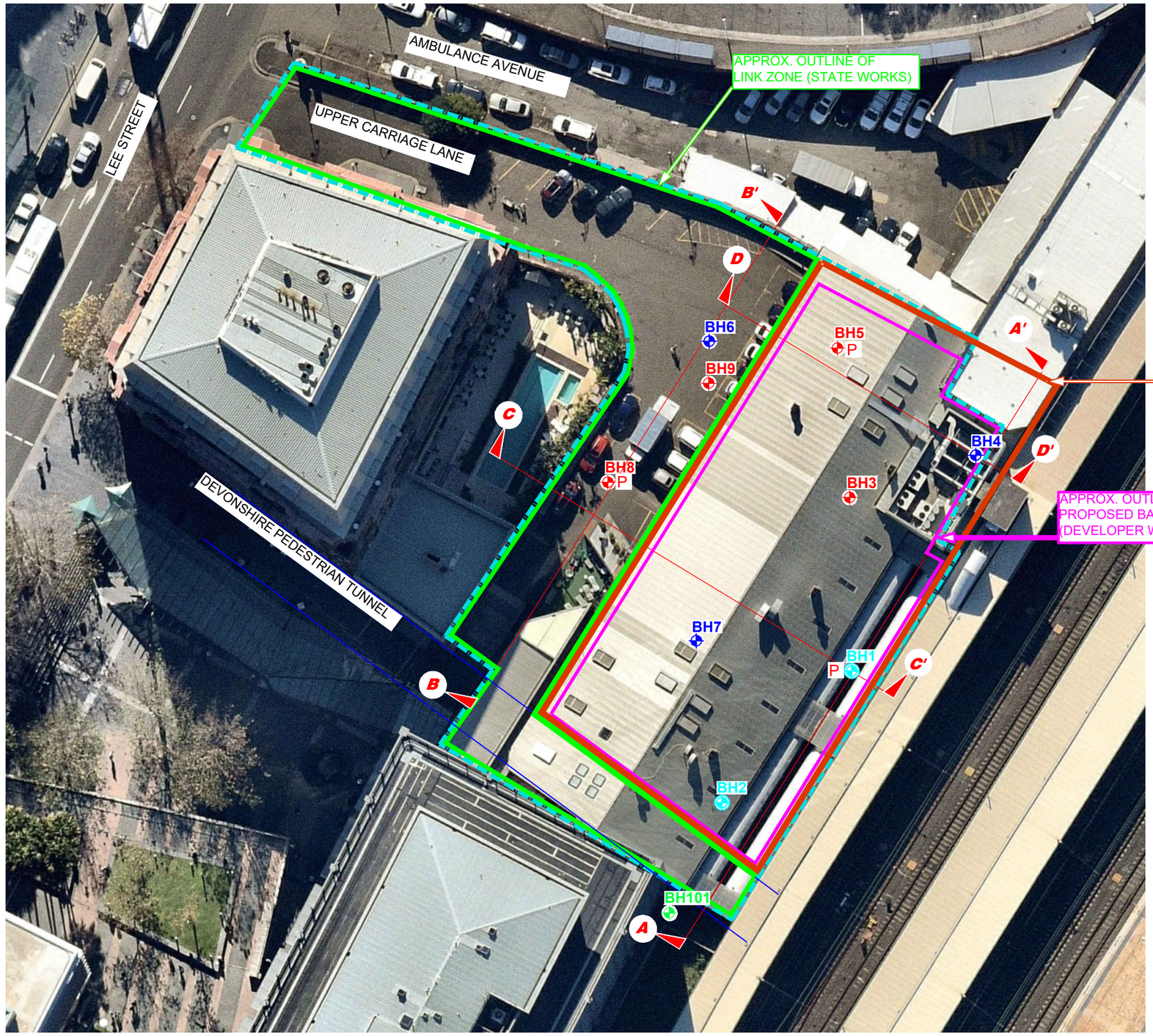
Photo 15 – View west within the rail catering facility, with the location of Borehole BH9 indicated.

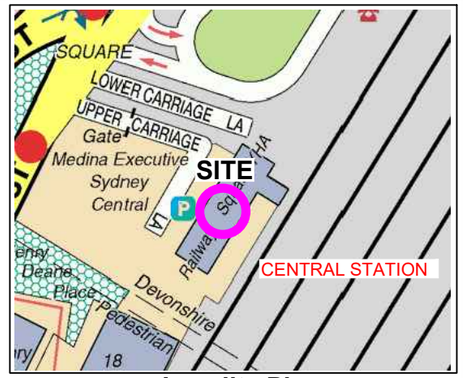
Photo 16 – View to the north-west within the rail catering facility, with the location of Borehole BH9 indicated as shown. The wall at the rear of the view separates the catering facility from an access corridor.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: 8 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 14/08/2019

Appendix C

Drawings





Locality Plan

NOTE:
1: Base image from Nearmap.com (Dated 1.7.2019)
2: Test locations are approximate only and are shown with reference to existing features.
3. Approximate Development Outlines are as provided by Avenor Pty Ltd on 12 August 2019.

0 5 10 15 20 30 40 50m

1:500 @ A3

LEGEND

- Previous geotechnical borehole (1999)
- Current environmental borehole - Lower Ground Floor
- Current geotechnical & environmental borehole - Lower Ground Floor
- Current geotechnical & environmental borehole - Upper Ground Floor
- P Standpipe piezometer
- A A' Geotechnical Cross Section A-A'
- Approximate site boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Atlassian Pty Ltd		TITLE: **Test Location Plan** **Proposed Commercial Development** **8-10 Lee Street, HAYMARKET**
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:500 @ A3	DATE: 13.8.2019	

N

PROJECT No:	86767.00
DRAWING No:	1
REVISION:	1

A

A'

SITE BOUNDARY/ STATE WORKS BOUNDARY

APPROX. DEVONSHIRE STREET TUNNEL

INTERSECTION C-C'

INTERSECTION D-D'

PROPERTY BOUNDARY (LOT 118)

DEVELOPER WORKS

BUILDING ABOVE

BUILDING ABOVE

BH101
Offset 4.2m
Rock Strength
EL VL L M H VH EH

BH2
Offset 5.7m
Rock Strength
EL VL L M H VH EH

BH1
Offset - 0.7m
Rock Strength
EL VL L M H VH EH

RAIL BALLAST

RAIL BALLAST

PEDESTRIAN TUNNEL

RAIL ACCESS TUNNEL BH4
Offset 3.3m

Concrete

Concrete

FILLING

FILLING

(during drilling)

ALLUVIAL SAND

RESIDUAL SILTY CLAY

SANDSTONE (FINE TO MEDIUM)

SAND

RESIDUAL SILTY CLAY

SANDSTONE (FINE TO MEDIUM GRAINED)

RESIDUAL SILTY CLAY

RESIDUAL SANDY CLAY

SANDSTONE (MEDIUM GRAINED)

SANDSTONE (MEDIUM GRAINED)

SANDSTONE (MEDIUM GRAINED)

N = 6
N = 3
N = 3
N = 2
N = 7
N = 4
N = 19
N = 2
N = 0
N = 4
N = 2
N = 1
refusal

Bottom Depth 14.2 m

Bottom Depth 23.27 m

Bottom Depth 20 m

Bottom Depth 2.35 m

BASEMENT 2: RL 5.6m

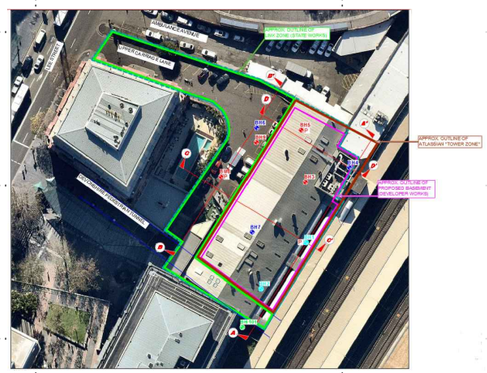
PROPOSED BASEMENT PROFILE

ELEVATION (AHD)

30
25
20
15
10
5
0
-5
-10

0
10
20
30
40
50
60
70

DISTANCE ALONG PROFILE (m)



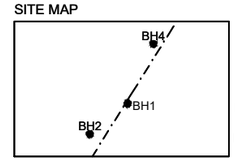
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level indicative only.

LEGEND

- Concrete
- Bricks
- Filling
- Sandy Clay
- Sand
- Silty Clay
- Sandstone

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

SITE MAP



0 4
Horizontal Scale (metres)
Natural Scale

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Atlassian Pty Ltd		TITLE: **Interpreted Geotechnical Cross-Section A-A'**	PROJECT No: 86767.00
OFFICE: Sydney	DRAWN BY: HDS	**Proposed Commercial Development**	DRAWING No: 2
SCALE: 1:200 (H) 1:200 (V) @ A3	DATE: 26.08.2019	**8-10 Lee Street, HAYMARKET**	REVISION: 1

B

B'

SITE BOUNDARY

INTERSECTION C-C'

INTERSECTION D-D'

SITE BOUNDARY

APPROX. DEVONSHIRE STREET TUNNEL

STATE WORKS 'LINK ZONE'

Brick parapet

Metal awning

ASPHALT SURFACED CAR PARKING AND LOADING ZONE (LEVEL ASSUMED)

SUSPENDED FLOOR

CURVED METAL ROOF

STAIRS

PEDESTRIAN AREA

STORAGE AREA / VOID

ACCESS CORRIDOR/ VOID

FILL

Concrete

BH8
Offset 0.1m
Rock Strength

BH9
Offset - 3.4m
Rock Strength

BH6
Offset 0.3m

Concrete

LOWER CARRIAGE LANE/ AMBULANCE AVENUE

ALLUVIAL SAND

RESIDUAL SILTY CLAY

RESIDUAL SILTY CLAY

BURIED SERVICES CORRIDOR

SANDSTONE (FINE TO MEDIUM GRAINED)

SANDSTONE (FINE TO MEDIUM GRAINED)

SANDSTONE (FINE TO MEDIUM)

SANDSTONE (MEDIUM GRAINED)

SANDSTONE (MEDIUM GRAINED)

Bottom Depth 1.27 m

RL 5.6m

PROPOSED FUTURE BASEMENT LEVEL (STATE WORKS)

Bottom Depth 15 m

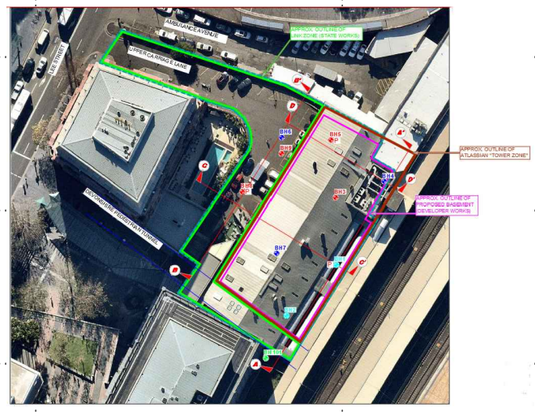
Bottom Depth 14.6 m

ELEVATION (AHD)

30 25 20 15 10 5 0 -5 -10

0 10 20 30 40 50 60 70

DISTANCE ALONG PROFILE (m)



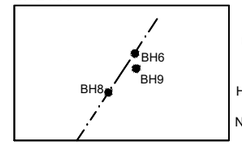
NOTE:
1. Subsurface conditions are accurate at the test locations only and variations may occur away from the test locations.
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level indicative only.

LEGEND

- Core Loss
- Asphaltic Concrete
- Clay
- Concrete
- Filling
- Sand
- Sandstone
- Silty Clay

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

SITE MAP



0 4
Horizontal Scale (metres)
Natural Scale

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Atlassian Pty Ltd		TITLE: **Interpreted Geotechnical Cross-Section B-B'**	PROJECT No: 86767.00
OFFICE: Sydney	DRAWN BY: HDS	**Proposed Commercial Development**	DRAWING No: 3
SCALE: 1:200 (H) 1:200 (V) @ A3	DATE: 26.08.2019	**8-10 Lee Street, HAYMARKET**	REVISION: 1

C

C'

SITE BOUNDARY

STATE WORKS 'LINK ZONE'

DEVELOPER WORKS

PROPERTY BOUNDARY (LOT 118)

INTERSECTION B-B'

YHA BUILDING ABOVE

Parapet

Masonry wall

ASPHALT SURFACED CAR PARK

Concrete

Concrete Platform

CENTRAL STATION PLATFORM

SUSPENDED FLOOR

FILL / SUSPENDED FLOOR

SWIMMING POOL (Level unknown)

FILL?

Machine Rooms?

BH8 Offset 6.7m

BH7 Offset - 5.3m

BH1 Offset 0.2m

Rock Strength

FILL

ALLUVIAL SAND

RESIDUAL SILTY CLAY

SANDSTONE (FINE TO MEDIUM)

SANDSTONE (MEDIUM GRAINED)

Bottom Depth 15 m

Bottom Depth 2.4 m

Bottom Depth 20 m

RL 5.6m

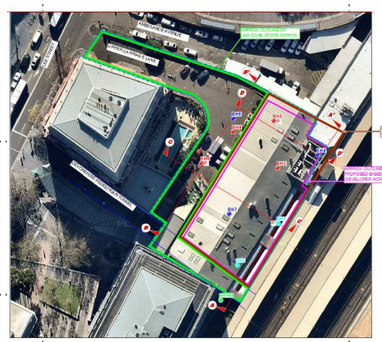
PROPOSED FUTURE BASEMENT LEVEL (STATE WORKS)

BASEMENT 2: RL 5.6m

PROPOSED BASEMENT PROFILE

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)



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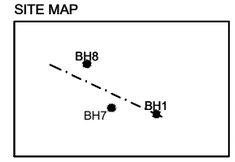
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level indicative only.

LEGEND

Core Loss
Bricks
Concrete
Filling
Sand
Sandstone
Silty Clay

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

SITE MAP



0 4
Horizontal Scale (metres)
Natural Scale

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Atlassian Pty Ltd		TITLE: **Interpreted Geotechnical Cross-Section C-C'**	PROJECT No: 86767.00
OFFICE: Sydney	DRAWN BY: HDS	**Proposed Commercial Development**	DRAWING No: 4
SCALE: 1:200 (H) 1:200 (V) @ A3	DATE: 26.08.2019	**8-10 Lee Street, HAYMARKET**	REVISION: 1

D

D'

INTERSECTION B-B'

STATE WORKS
'LINK ZONE'

DEVELOPER WORKS

PROPERTY
BOUNDARY
(LOT 118)

YHA BUILDING
ABOVE

Mechanical
plant for
lift

Concrete

CENTRAL STATION PLATFORM

ASPHALT SURFACED CAR PARK

SUSPENDED FLOOR

SUSPENDED FLOOR/METAL ROOF

FILL ABOVE TUNNEL?

ACCESS CORRIDOR/
VOID

COMMERCIAL SPACE / VOID

BIN ROOMS

RAIL ACCESS TUNNEL

BH6
Offset - 4.3m

BH5
Offset 1.8m

Rock Strength

BH4
Offset - 0.8m

Concrete

Concrete

RESIDUAL SILTY CLAY

FILL

RESIDUAL SILTY CLAY

SANDSTONE (FINE TO MEDIUM)

SANDSTONE (FINE TO MEDIUM)

RESIDUAL SILTY CLAY

Bottom Depth
1.27 m

Bottom Depth
15.27 m

Bottom Depth
2.35 m

SANDSTONE
(MEDIUM GRAINED)

SANDSTONE
(MEDIUM GRAINED)

RL 5.6m

PROPOSED FUTURE BASEMENT LEVEL
(STATE WORKS)

BASEMENT 2: RL 5.6m

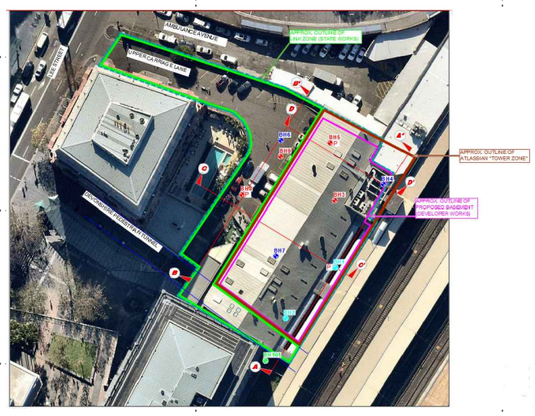
PROPOSED BASEMENT PROFILE

ELEVATION (AHD)

30
25
20
15
10
5
0
-5
-10

-10
0
10
20
30
40
50

DISTANCE ALONG PROFILE (m)



NOTE:
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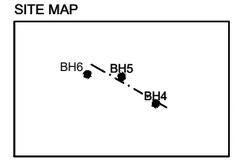
2. Strata layers and rock classification shown are generalised and each layer can include bands of lower or higher strength rock and also bands of less or more fractured rock.
3. Summary logs only. Should be read in conjunction with detailed logs.
4. Ground surface level indicative only.

LEGEND

- Core Loss
- Asphaltic Concrete
- Concrete
- Filling
- Sandstone
- Sandy Clay
- Silty Clay

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

SITE MAP



0 4
Horizontal Scale (metres)
Natural Scale

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Atlassian Pty Ltd		TITLE: **Interpreted Geotechnical Cross-Section D-D'**	PROJECT No: 86767.00
OFFICE: Sydney	DRAWN BY: HDS	**Proposed Commercial Development**	DRAWING No: 5
SCALE: 1:200 (H) 1:200 (V) @ A3	DATE: 26.08.2019	**8-10 Lee Street, HAYMARKET**	REVISION: 1

Appendix D

Field Work Results

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, 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 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate 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 $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

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 longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

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

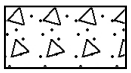
Symbols & Abbreviations

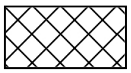
Graphic Symbols for Soil and Rock

General

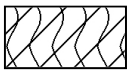

Asphalt

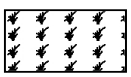

Road base

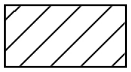

Concrete

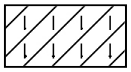

Filling

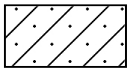
Soils


Topsoil

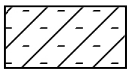

Peat

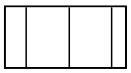

Clay

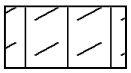

Silty clay

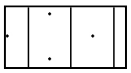

Sandy clay

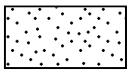

Gravelly clay

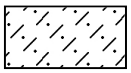

Shaly clay

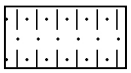

Silt


Clayey silt


Sandy silt

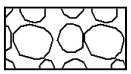

Sand

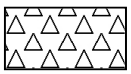

Clayey sand


Silty sand


Gravel

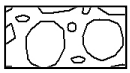

Sandy gravel


Cobbles, boulders

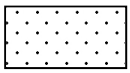

Talus

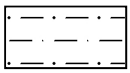
Sedimentary Rocks

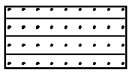

Boulder conglomerate

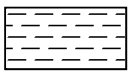

Conglomerate


Conglomeratic sandstone

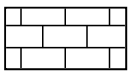

Sandstone


Siltstone

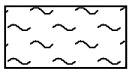

Laminite

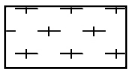

Mudstone, claystone, shale

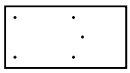

Coal


Limestone

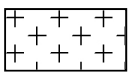
Metamorphic Rocks

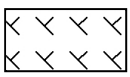

Slate, phyllite, schist

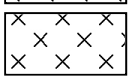

Gneiss

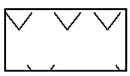

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333983.4
NORTHING: 6249262.5
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 86767.00
DATE: 10 - 12/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
20	0.03	BALLAST (BLUE METAL), PLASTIC										
	0.075											
	0.38	CONCRETE										
		BRICK PAVEMENT										
		CONCRETE										
19	1	1.3m: interface with lower concrete slab										
	1.8	FILL/Sandy CLAY: low plasticity, grey mottled red-brown, fine grained sand, trace ironstone bands, slag and ash, w<PL, apparently in a very soft condition							E			PID<1
18	2								E			PID<1
									E			PID<1
17	3	3.0m: with ash and slag, trace glass, brick and ceramic tile fragments										
	3.2	FILL/SAND: fine to medium grained sand, dark brown to black, moist, apparently in a very loose condition							E			PID<1
									E			PID<1
16	4	4.0 SAND SP: fine to medium grained sand, orange brown, moist, very loose, alluvial soil							E			PID<1
		4.3m: grading to pale yellow-grey										
15	5											
14	6	6.0 Silty CLAY CI-CH: medium to high plasticity, orange, red and pale grey, with fine to medium grained sand, with relict rock texture, w<PL, residual soil										
	6.54	SANDSTONE: medium grained, orange-red, medium strength with very low strength bands, highly weathered, fractured, Hawkesbury Sandstone?						6.63m: B 0°, pl, ro, fe 6.63 to 6.76m: Ds 120mm 6.78 to 6.8m: Ds 20mm 6.88m: B 2°, un, ro, fe 6.93 to 7.0m: Ds 70mm 7.0 to 7.09m: J 90°, un, ro 7.1m: B 0°, pl, ro 7.12m: B 30°, pl, ro, fe 7.24m: B 20°, st, ro 7.28 to 7.38m: J 85°, st, ro, he 7.39 to 7.5m: Ds 110mm 7.62 to 7.7m: Ds 80mm 8.41m: B 0°, pl, ro, fe 8.81 to 8.84m: (x4) B 5°, pl, ro 8.97m: B 0°, un, ro, 2mm cly	C	100	10	PL(A) = 0.97
13	7											
	7.7	SANDSTONE: medium grained, brown and pale yellow, medium to high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone							C	100	95	PL(A) = 0.15
12	8											PL(A) = 0.52
	8.23	SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone										
11	9								C	100	100	
	10.0											PL(A) = 1.3

RIG: Proline **DRILLER:** Tightsite **LOGGED:** WFY/NB **CASING:** HW to 6.44m

TYPE OF BORING: Diacore 0-1.3m; Hand auger 1.3m-5.0m; NMLC coring 5.0-20.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 20-7.2m backfilled with sand, 7.2-6.3m bentonite, 6.3-4.3m screened PVC with sand backfill, 4.3-4.2m blank PVC with sand backfill, 4.2-0.2m blank PVC with bentonite backfill, 0.2-0m sand, gatic cover at surface

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: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 20.1 AHD
EASTING: 333983.4
NORTHING: 6249262.5
DIP/AZIMUTH: 90°/--

BORE No: BH1
PROJECT No: 86767.00
DATE: 10 - 12/7/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
10	10	SANDSTONE: medium grained, pale grey, high strength, fresh, unbroken, cross-bedding 5°-10°, Hawkesbury Sandstone						9.91m: B 2°, un, ro, clay 1mm	C	100	100	
9	11								C	100	100	PL(A) = 0.89
8	12											PL(A) = 1.6
		12.4-12.49m: with thin black carbonaceous laminations						12.44m: B 0°, pl, sm, cbs 12.47m: B 1°, ro, pl				
7	13							13.16m: B 0°, pl, sm 13.27m: Ds 2mm	C	100	100	PL(A) = 1.2
6	14								C	100	100	PL(A) = 1.5
5	15											PL(A) = 1.2
4	16							>>	C	100	100	PL(A) = 1.6
3	17											PL(A) = 1.9
		17.35-14.42m: with black carbonaceous laminations										
2	18								C	100	100	PL(A) = 1.9
1	19								C	100	100	PL(A) = 1.9
	20.0	Bore discontinued at 20.0m										PL(A) = 0.9

RIG: Proline **DRILLER:** Tightsite **LOGGED:** WFY/NB **CASING:** HW to 6.44m

TYPE OF BORING: Diacore 0-1.3m; Hand auger 1.3m-5.0m; NMLC coring 5.0-20.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 20-7.2m backfilled with sand, 7.2-6.3m bentonite, 6.3-4.3m screened PVC with sand backfill, 4.3-4.2m blank PVC with sand backfill, 4.2-0.2m blank PVC with bentonite backfill, 0.2-0m sand, gatic cover at surface

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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BORE: BH1 PROJECT: HAYMARKET AUGUST 2019

6 – 10m

BORE: BH1 PROJECT: HAYMARKET AUGUST 2019

10m – 15m

BORE: BH1 PROJECT: HAYMARKET AUGUST 2019

15m – 20m

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333968
NORTHING: 6249250
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 86767.00
DATE: 10 - 11/7/2019
SHEET 1 OF 3

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
21	0.00	CONCRETE SLAB										
	0.28	0.08m: interface with lower concrete slab							A/E*			PID<1
		FILL/SAND: fine to medium grained sand, brown, moist, apparently moderately compacted							A/E			PID<1
20	1								A/E			PID<1
		1.5m: trace ash and slag							A/E S			PID<1 0,0,2 N = 2
19	2								A/E			PID<1
		2.1m: with clay, trace shale gravel, moderately compacted										
	2.5	Fill/Clayey SAND: fine to coarse grained sand, brown, 15% plastic fines, trace gravel 2-5mm, moist, apparently moderately compacted							A/E			PID<1
18	3								A/E S			PID<1 0,0,0 N = 0
17	4											
	4.0	Fill/Silty CLAY: medium plasticity, brown-grey, trace sand, w<PL										
		Below 4.8m: with angular shale and ironstone gravel to 20mm							A/E S			PID<1 2,2,2 N = 4
16	5											
	5.2	Fill/Silty SAND: fine grained sand, grey and dark grey, trace gravel 2-5mm, moist, apparently variably compacted										
	6											
15	6.2	Fill/SAND: fine grained sand, grey, with silt, wet, apparently variably compacted				10-07-19			A/E S			PID<1 1,1,1 N = 2
14	7											
									A/E S			PID<1 0,0,1 N = 1
13	8											
	8.0	Silty CLAY CI-CH: medium to high plasticity, orange brown, with fine to medium grained sand and ironstone gravel, w<PL, soft, residual soil										
12	9											
	9.0	Sandy CLAY CL: low plasticity, pale grey, fine to medium grained sand, w<PL, hard, residual soil							S			25/100 refusal
	9.47	SANDSTONE: refer following page										
	10.0							9.74 to 9.80m: J 65°, st, ro	C	100	95	PL(D) = 1.4

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.9m

TYPE OF BORING: Diacore 0-0.28m; solid flight auger (TC Bit) 0.28-7.5m; Wash bore 7.5-9.47m; NMLC coring 9.47-23.27m

WATER OBSERVATIONS: Saturated sand (fill) encountered at 6.2m

REMARKS: *BD1 at 0.28m

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: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333968
NORTHING: 6249250
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 86767.00
DATE: 10 - 11/7/2019
SHEET 2 OF 3

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
11	11	SANDSTONE: medium grained, pale grey and brown, medium strength with some very low strength bands, moderately weathered, slightly fractured, Hawkesbury Sandstone						10.2 to 10.3m: Ds 100mm	C	100	95	
								10.82m: B 15°, pl, sm, fe				PL(D) = 1.5
	11.12							11.08m: Cs 10mm				
10		SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone						11.35m: B 5°, fe, pl, ro				
								11.52m: Ds 10mm				
	12	Below 12m: unbroken										PL(D) = 1.1
9								12.27m: B 5°, pl, ro				
								12.56m: B 5°, pl, sm	C	100	100	
	13											PL(D) = 1.3
8												
	14											PL(D) = 1.6
7								14.09m: B 2°, un, sm clay 2mm				
	15							14.88m: B 5°, st, sm cly 2mm				PL(D) = 1.4
6									C	100	100	
	16											PL(D) = 1.4
5								16.31m: B 20°, pl, sm				
	17											PL(D) = 1.3
4												
	18							>>				PL(D) = 0.96
3									C	100	100	
	19											PL(D) = 1.3
2		19.52m: carbonaceous laminations, dipping 25°						19.75m: B 5°, un, ro, cly 1mm				PL(D) = 2.2

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.9m

TYPE OF BORING: Diacore 0-0.28m; solid flight auger (TC Bit) 0.28-7.5m; Wash bore 7.5-9.47m; NMLC coring 9.47-23.27m

WATER OBSERVATIONS: Saturated sand (fill) encountered at 6.2m

REMARKS: *BD1 at 0.28m

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: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 21.2 AHD
EASTING: 333968
NORTHING: 6249250
DIP/AZIMUTH: 90°/--

BORE No: BH2
PROJECT No: 86767.00
DATE: 10 - 11/7/2019
SHEET 3 OF 3

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
1		SANDSTONE: medium grained, pale grey, high strength, fresh, slightly fractured, cross bedding 5°-10°, Hawkesbury Sandstone *(continued)*							C	100	100	
0	21											PL(D) = 1.3
								21.24m: Ds 5mm 21.4m: Ds 5mm				
-1	22								C	100	100	PL(D) = 1.7
								22.42m: Ds 5mm				
-2	23											PL(D) = 1.7
	23.27	Bore discontinued at 23.27m										
-3	24											
-4	25											
-5	26											
-6	27											
-7	28											
-8	29											

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 8.9m

TYPE OF BORING: Diacore 0-0.28m; solid flight auger (TC Bit) 0.28-7.5m; Wash bore 7.5-9.47m; NMLC coring 9.47-23.27m

WATER OBSERVATIONS: Saturated sand (fill) encountered at 6.2m

REMARKS: *BD1 at 0.28m

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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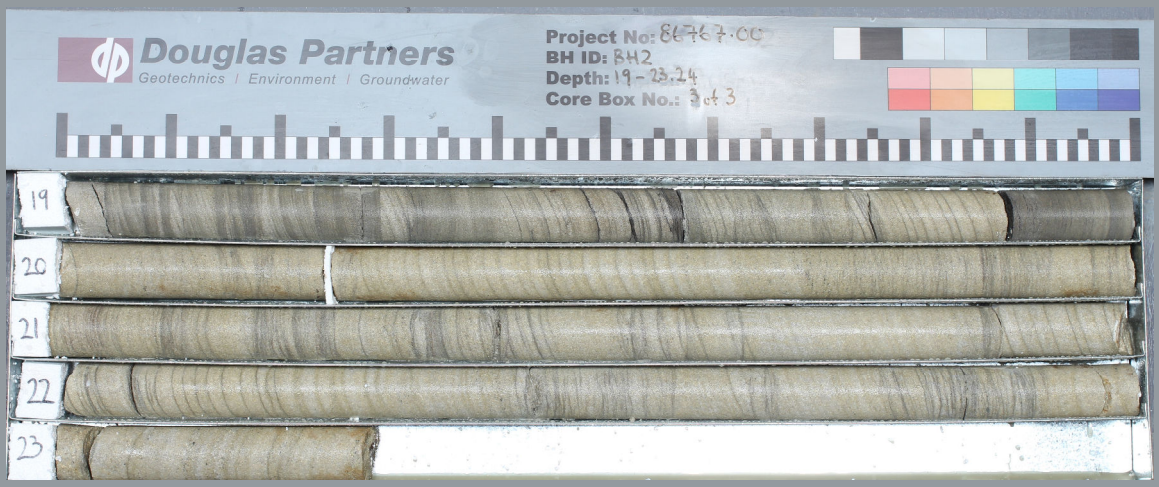
BORE: BH2 PROJECT: HAYMARKET AUGUST 2019

9.57 – 14m

BORE: BH2 PROJECT: HAYMARKET AUGUST 2019

14m – 19m

BORE: BH2 PROJECT: HAYMARKET AUGUST 2019



19m – 23.24m

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333982
NORTHING: 6249281
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.15	CONCRETE SLAB										
	0.2	Fill/SAND: fine to medium grained sand, yellow-grey, moist, apparently poorly to moderately compacted							E			PID<1
	0.7	Fill/Silty CLAY: medium plasticity, grey and red-brown, with medium grained sand and angular basalt gravel to 70mm, w<PL							E			PID<1
	0.9	Fill/SAND: fine to medium grained sand, yellow, moist, apparently moderately compacted						Unless otherwise specified, defects are B 0-5°, pl, sm				
	1.8	Silty CLAY CH: high plasticity, grey mottled red, trace ironstone gravel 2-3mm, w<PL, very stiff, residual soil						1.8m: CORE LOSS: 120mm				
	1.92	SANDSTONE: medium grained, brown and grey, medium strength, highly and moderately weathered, fractured, Hawkesbury Sandstone?						2.18m: B 2°, st, ro 2.22m: B 5°, un, ro	C	66	33	PL(A) = 1
	3.03	SANDSTONE: medium grained, yellow-grey, high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						2.52m: Cs 0°, 5mm, white 2.6m: Cs, 2mm, grey 2.7m: B 2°, st, ro, fe 2.72m: B 0°, st, ro, fe 2.79m: B 0°, pl, ro, fe 2.84m: Cs 10mm 2.85 to 3.21m: B 0° (x10), pl, ro, fe	C	100	95	PL(A) = 0.92
	3.56	SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone						2.97m: B 2°, pl, ro, fe 2.99m: B 1°, pl, ro, fe 3.07m: J 20°, pl, ro 3.25m: B 2°, un, ro 3.27 to 3.61m: B 0° (x3), ro, pl, fe 3.45m: Cs, 2mm 3.56m: Cs, 4mm				
								4.89m: J 15°, pl, ro, open 4.9m: J 15°, pl, ro, open 5.09m: Ds 5mm				PL(A) = 1.6
									C	100	100	PL(A) = 1.4
												PL(A) = 1.3
		7.35 - 7.41m: carbonaceous laminations						7.35m: B 5°, un, carbonaceous clay 15mm				
												PL(A) = 1.1
								8.23m: Ds, 20mm				
									C	100	100	
												PL(A) = 1.7
		9.96-10.12m: fine grained sandstone, dark grey						9.63m: B 0°, pl, sm, carbonaceous clay 1mm				PL(A) = 2

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 2.0m

TYPE OF BORING: Diacore 0-0.15m; Hand auger 0.15-0.9m; Solid flight auger (TC Bit) 0.9-1.8m; NMLC coring 1.8-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

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: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333982
NORTHING: 6249281
DIP/AZIMUTH: 90°/--

BORE No: BH3
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
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
		SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	
		10.6-10.7m: carbonaceous laminations										PL(A) = 1.5
	11											
	12								C	100	100	PL(A) = 1.2
								12.5m: B 0°, st, ro				
	13							12.84m: Ds 5mm				PL(A) = 1.4
	14								C	100	100	PL(A) = 0.92
	15	15.0 Bore discontinued at 15.0m										PL(A) = 0.74
	16											
	17											
	18											
	19											

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HWT to 2.0m

TYPE OF BORING: Diacore 0-0.15m; Hand auger 0.15-0.9m; Solid flight auger (TC Bit) 0.9-1.8m; NMLC coring 1.8-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

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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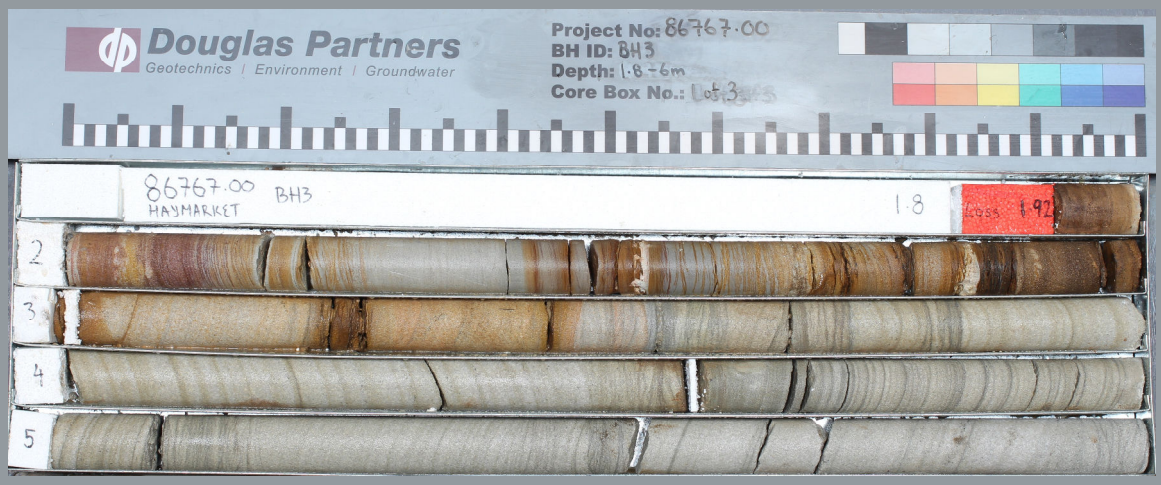
BORE: BH3 PROJECT: HAYMARKET AUGUST 2019



1.8 – 6m

BORE: BH3 PROJECT: HAYMARKET AUGUST 2019

6m – 11m

BORE: BH3 PROJECT: HAYMARKET AUGUST 2019

11m – 15m

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333994
NORTHING: 6249287
DIP/AZIMUTH: 90°/--

BORE No: BH4
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
15	0.15	CONCRETE SLAB							
	0.16	Fill/SAND: fine to medium grained sand, moist, apparently loose, moderately compacted							
	0.3	CONCRETE SLAB							
	0.4	Fill/Sandy CLAY: fine to medium grained sand, with approx. 15% black ash, w<PL, generally in a stiff condition							
		Fill/Silty CLAY: medium plasticity, brown, pale grey and red, with fine to medium grained sand and angular ironstone gravel up to 5-10mm, w<PL, generally in a firm condition							
		0.8-0.9m: with angular to sub-rounded ironstone gravel, up to 50mm							
14	1.0	FILL/Sandy CLAY: low to medium plasticity, fine to medium grained sand, brown, with 15-30mm angular to sub-angular ironstone gravel, w~PL, generally in a soft condition		E	1.4 1.5		PID<1		
	1.7	Silty CLAY CH: high plasticity, grey mottled red and yellow, w~PL, firm to stiff, residual soil		E	2.0 2.1		PID<1		
13	2.3 2.35	SANDSTONE: medium strength, grey, Hawkesbury Sandstone							
		Bore discontinued at 2.35m Refusal on sandstone							
12									
11									

RIG: Miniprobe **DRILLER:** Terratest **LOGGED:** NB/AS **CASING:** NA

TYPE OF BORING: Diacore 0-0.16m; hand auger 0.16-1m; Pushtube and solid flight auger (TC Bit) 1.0-2.35m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249298
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 86767.00
DATE: 13/7/2019
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
	0.3	CONCRETE SLAB										
15	0.4	FILL/Gravelly SAND: medium grained sand, grey, fine to medium 5-15mm sub-rounded to sub-angular gravel, dry							E E			PID<1 PID<1
	1.0	Sandy CLAY CI: medium plasticity, grey mottled red, fine to medium grained sand, with fine gravel, w~PL, residual soil						Unless otherwise specified, defects are B 0-5°, pl, ro, fe	E E			PID<1 PID<1
	1.2 1.3 1.36											
14		SILTY CLAY CI: medium plasticity, grey mottled red and yellow, trace fine sand, w~PL, residual soil						1.3m: CORE LOSS: 60mm 1.44m: Ds 20mm 1.74m: Ds 10mm 1.89m: Ds 50mm	C	95	60	
	2	SANDSTONE: highly weathered, ironstained, Hawkesbury Sandstone?						2.1m: B 0°, st, ro 2.21m: B 0°, st, ro				PL(A) = 0.2
13		SANDSTONE: medium grained, pale grey and orange, medium strength with bands of very low strength, highly weathered, fractured, Hawkesbury Sandstone?						2.46m: Ds 10mm 2.51m: B 0°, pl, ro 2.64m: B 10°, un, ro, fe				PL(A) = 0.16
	2.83 3											
12		SANDSTONE: medium grained, pale grey, medium and high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						3.21m: Cs, 20mm, dark grey 3.45m: J 25°, pl, ro, open	C	100	85	PL(A) = 0.72
	3.6 4											
11		SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone						4.27m: B 0°, pl, ro, cly vn 4.37m: Cs 10mm				
	5							4.93m: Cs 10mm				PL(A) = 1.2
10									C	100	98	
	6							6.13m: B 5°, pl, ro, clay co 1mm 6.39m: B 5°, ir, ro, cln 6.44m: B 0°, pl, ro, st 6.6m: B 2°, pl, cly co 1mm				PL(A) = 1
9		6.60-6.65m: carbonaceous laminations										
	7											PL(A) = 1.2
8												
	8							8.03m: Cs 10mm				PL(A) = 2.1
7									C	100	100	
	9											PL(A) = 1.8
6								9.31m: B 0°, pl, sm, mica 9.48m: B 5°, pl, sm, cly vn				

RIG: Hand tools, Miniprobe and XC **DRILLER:** Terratest **LOGGED:** AS/NB/KR **CASING:** HW to 1.1m

TYPE OF BORING: Diacore 0-0.3m; Pushtube and solid flight auger (TC Bit) 0.3-1.3m; NMLC coring 1.3-15.27m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.17-2.2m screened PVC with sand backfill, 2.2-1.8m blank PVC with sand backfill, 2.2-0m blank PVC, 1.8-0.8m bentonite backfill, 0.8-0m backfilled, gatic cover at surface. Refusal to TC-bit auger at 1.2m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333980
NORTHING: 6249298
DIP/AZIMUTH: 90°/--

BORE No: BH5
PROJECT No: 86767.00
DATE: 13/7/2019
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
5		SANDSTONE: medium grained, pale grey, high strength, slightly weathered then fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	PL(A) = 1.2
	11							10.7m: B 10°, pl, sm, mica				PL(A) = 1.9
4									C	100	100	
	12							11.77m: B 20°, pl, sm, mica				PL(A) = 1.2
3		12.3-12.57m: fine grained sandstone, cross-bedded at base										
	13											PL(A) = 1.5
2												
	14											PL(A) = 1.1
1									C	100	100	
	15							14.57m: B 5°, ir, sm, cly vn 14.75m: Cs 20mm				PL(A) = 1.4
	15.27	Bore discontinued at 15.27m										
0	16											
-1	17											
-2	18											
-3	19											
-4												

RIG: Hand tools, Miniprobe and XC **DRILLER:** Terratest **LOGGED:** AS/NB/KR **CASING:** HW to 1.1m

TYPE OF BORING: Diacore 0-0.3m; Pushtube and solid flight auger (TC Bit) 0.3-1.3m; NMLC coring 1.3-15.27m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.17-2.2m screened PVC with sand backfill, 2.2-1.8m blank PVC with sand backfill, 2.2-0m blank PVC, 1.8-0.8m bentonite backfill, 0.8-0m backfilled, gatic cover at surface. Refusal to TC-bit auger at 1.2m

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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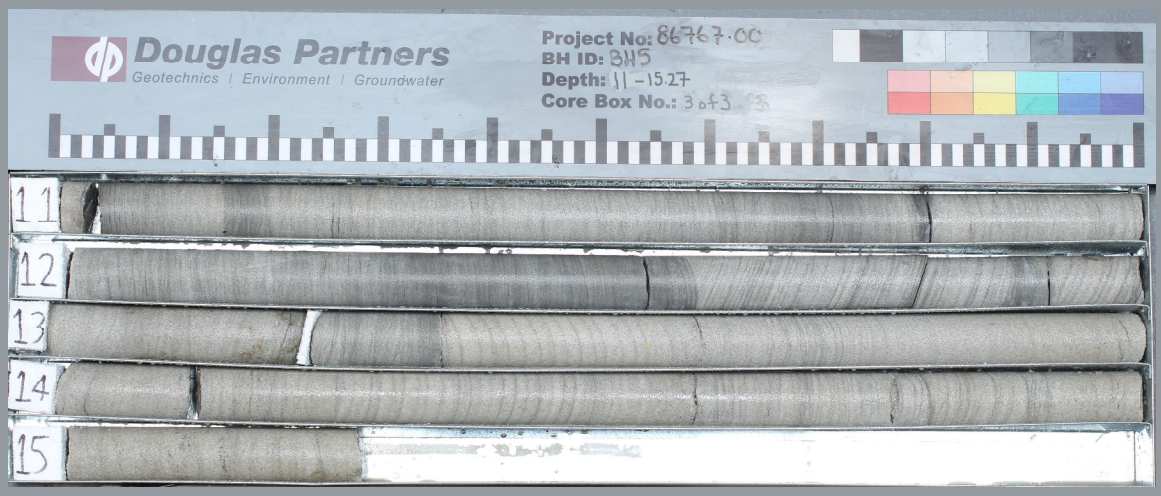
BORE: BH5 PROJECT: HAYMARKET AUGUST 2019

1.3 – 6m

BORE: BH5 PROJECT: HAYMARKET AUGUST 2019

6m – 11m

BORE: BH5 PROJECT: HAYMARKET AUGUST 2019



11m – 15.27m

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333966
NORTHING: 6249299
DIP/AZIMUTH: 90°/--

BORE No: BH6
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
15	0.06	CONCRETE SLAB: platy aggregate to 6mm, with voids							
	0.09	ASPHALT							
	0.23	CONCRETE SLAB: fine to medium igneous aggregate to 25mm, 8mm diameter steel reinforcement bar at 0.15m, voids below 0.21m		E	0.2 0.3		PID<1		
		Silty CLAY CH: high plasticity, orange-grey, with fine ironstone gravel, w<PL, residual soil		A	0.5 0.6		PID<1		
14	1.0	SANDSTONE: medium strength, grey, Hawkesbury Sandstone?							
	1.27	Bore discontinued at 1.27m Refusal on sandstone							

RIG: Hand tools **DRILLER:** NB **LOGGED:** NB **CASING:** NA

TYPE OF BORING: Diacore 0-0.2m; hand auger 0.2-1.27m

WATER OBSERVATIONS: No groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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Photo D1 – View of concrete core from Borehole BH6, showing two separate concrete slabs separated by a 30 mm thick asphalt layer. Reinforcement steel (8 mm diameter) was encountered in the lower concrete slab.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: D1 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 15/08/2019

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333965
NORTHING: 6249265
DIP/AZIMUTH: 90°/--

BORE No: BH7
PROJECT No: 86767.00
DATE: 12 - 13/7/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
15	0.2	CONCRETE SLAB, 8mm diameter reinforcement steel							
		CONCRETE SLAB, angular igneous aggregate		E	0.2 0.3		PID<1		
	0.38	Fill/Silty SAND: fine to medium grained sand, brown, 15% non plastic fines, moist, trace of crushed brick above 0.5m							
	0.6	Fill/SAND: fine to medium grained sand, pale grey, trace silt, moist, generally in a dense condition							
14	1			E	1.0 1.1		PID<1		1
				E*	1.4 1.5		PID<1		
	1.6	Silty CLAY CH: high plasticity, grey, mottled red and yellow, trace fine to medium sandstone gravel, w~PL, very stiff, residual soil		E	1.6 1.7		PID<1		
	1.85	1.80-1.85m: crushed ironstone gravel							
	2	Silty CLAY CI: medium plasticity, red mottled grey, with sand and fine to medium sandstone and ironstone gravel, w~PL, hard, residual soil		E	2.0 2.1		PID<1		2
	2.2	SANDSTONE: medium strength, grey, Hawkesbury Sandstone?							
13	2.4	Bore discontinued at 2.4m Refusal on sandstone							
	3								3
12									
	4								4
11									

RIG: Hand tools and Miniprobe **DRILLER:** NB/Terratest **LOGGED:** NB/AS **CASING:** NA

TYPE OF BORING: Hand auger 0.2-1.0m; Pushtube and solid flight auger (TC Bit) 1.0-2.4m

WATER OBSERVATIONS: No groundwater observed

REMARKS: *BD1 and BT120190713

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

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333955
NORTHING: 6249283
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 86767.00
DATE: 14/7/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.28	CONCRETE SLAB: angular to subangular aggregate to 15mm, negligible voids, 10mm diameter steel reinforcement at 0.09m and 0.10m, plastic at lower interface							A/E			PID<1
	0.6	Fill/Clayey SAND: fine to coarse grained sand, brown and yellow, 15% plastic fines, with fine gravel, apparently moderately compacted, moist										
	1.9	SAND SW: fine to medium grained sand, yellow, with clay, trace gravel, moist, alluvial soil						Unless otherwise specified, defects are B 0°, pl, ro				
	2.12	SANDSTONE: medium grained, orange-red and grey, low to medium strength, with some very low strength bands, highly weathered, fractured, Hawkesbury Sandstone?						1.9m: CORE LOSS: 220mm 2.12m: Ds 270mm 2.49m: B 4°, st, ro 2.6m: B 0°, st, ro 2.61m: B 0°, st, sm 2.83m: B 0°, st, ro 2.93m: Ds 140mm	C	82	20	PL(A) = 1.5
	3.07	SANDSTONE: medium grained, orange and red, medium strength with some very low strength bands, highly weathered, fractured, Hawkesbury Sandstone?						3.07m: CORE LOSS: 480mm 3.8m: Ds 60mm 3.92m: Cs 20mm	C	66	33	PL(A) = 0.15
	4.13	SANDSTONE: medium grained, yellow-grey, medium then high strength, moderately weathered, slightly fractured, Hawkesbury Sandstone						4.29m: J 30°, pl, ro, open 4.37m: J 30°, pl, ro, open 4.79m: J 15°, pl, ro, clay 1mm 4.82m: B 10°, pl, ro, fe stn 4.84m: B 5°, un, ro	C	100	100	PL(A) = 0.66 PL(A) = 1.2 PL(A) = 1.3
	4.85	SANDSTONE: medium grained, grey, high strength, fresh, unbroken, Hawkesbury Sandstone						7.45m: B 0°, pl, sm 7.46m: B 0°, pl, sm 7.88m: B 0°, pl, sm 7.89m: B 0°, pl, sm	C	100	100	PL(A) = 1.9 PL(A) = 1.2
								9.1m: Ds 20mm				PL(A) = 1.4

Degree of Weathering: EW, HW, MW, SW, FS, FR
Rock Strength: Ex Low, Very Low, Low, Medium, High, Very High, Ex High
Fracture Spacing (m): 0.01, 0.05, 0.10, 0.50, 1.00
Discontinuities: B - Bedding, J - Joint, S - Shear, F - Fault

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 1.9m

TYPE OF BORING: Diacore 0-0.28m; Hand auger 0.28-1.0m; solid flight auger (TC Bit) 1.0-1.9m; NMLC coring 1.9-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.0-2.9m screened PVC with sand backfill, 2.9-2.4m blank PVC with sand backfill, 2.4-0m blank PVC, 2.4-0m bentonite backfill, gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333955
NORTHING: 6249283
DIP/AZIMUTH: 90°/--

BORE No: BH8
PROJECT No: 86767.00
DATE: 14/7/2019
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
		SANDSTONE: medium grained, grey, high strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*							C	100	100	
		10.2-10.9m: dark grey, fine grained sandstone										PL(A) = 2.5
								>>	C	100	100	PL(A) = 1.5
		12.4-12.55m: carbonaceous laminations										PL(A) = 1.1
								13.48m: Ds 20mm 13.77m: B 20°, pl, sm, cbs	C	100	100	PL(A) = 1.3
								14.55m: B 0°, pl, sm, clay co 2mm				
	15.0	Bore discontinued at 15.0m										PL(A) = 1.3

RIG: XC **DRILLER:** Terratest **LOGGED:** NB **CASING:** HQ to 1.9m

TYPE OF BORING: Diacore 0-0.28m; Hand auger 0.28-1.0m; solid flight auger (TC Bit) 1.0-1.9m; NMLC coring 1.9-15.0m

WATER OBSERVATIONS: No groundwater observed during auger drilling

REMARKS: Groundwater well installed: 15.0-2.9m screened PVC with sand backfill, 2.9-2.4m blank PVC with sand backfill, 2.4-0m blank PVC, 2.4-0m bentonite backfill, gatic cover at surface.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

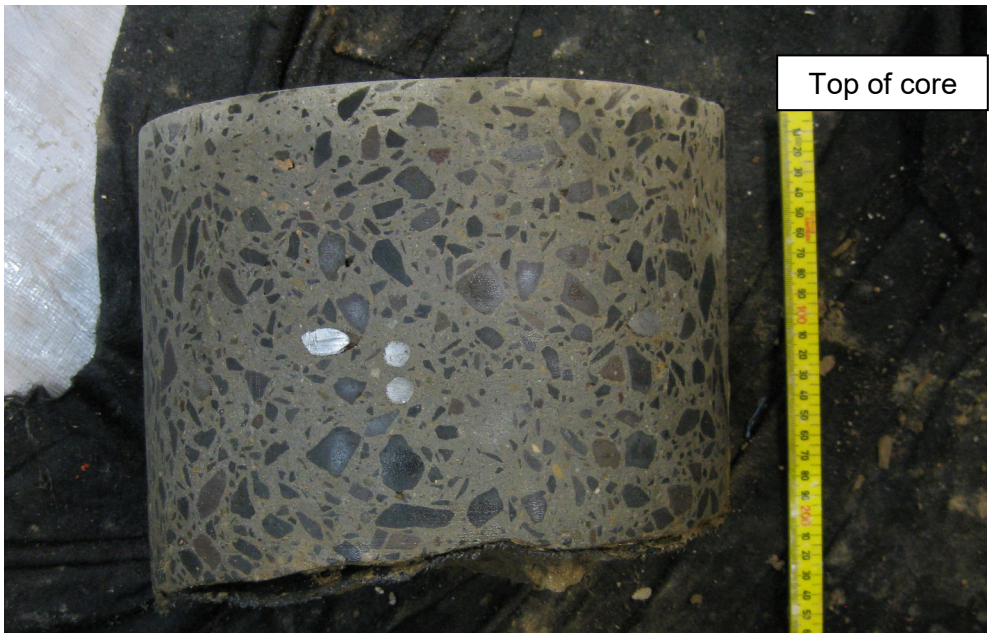
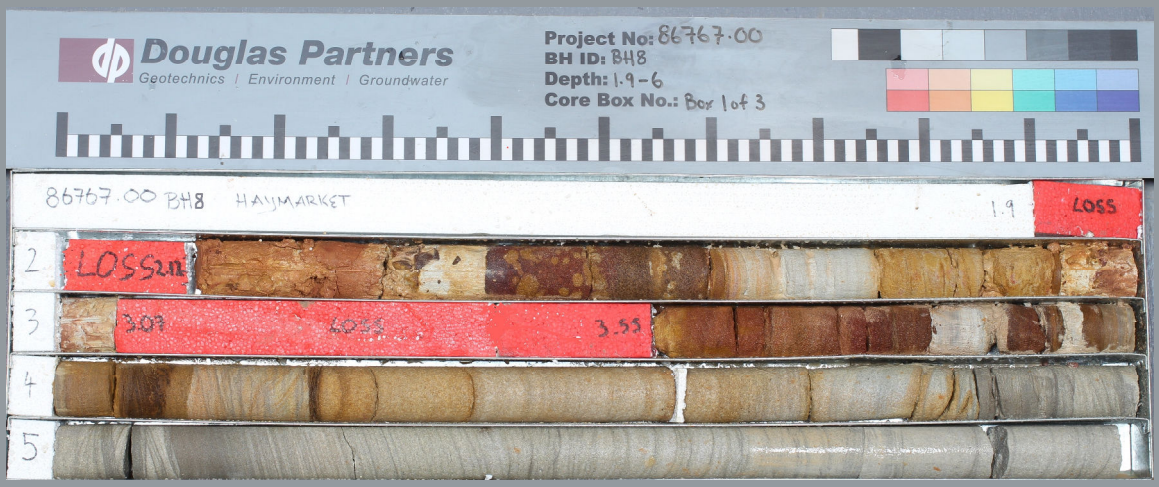


Photo D2 – View of concrete core from Borehole BH8. Two layers of reinforcement steel (10 mm diameter) were encountered at 0.09 m and 0.10 m depth, with a layer of plastic at the underside of the slab.

Douglas Partners Geotechnics / Environment / Groundwater	**Borehole Photographs** **Proposed Commercial Development** **8-10 Lee Street, Haymarket**	PROJECT: 86867.00 PLATE No: D2 REV: 0
	CLIENT: Atlassian Pty Ltd	DATE: 15/08/2019

BORE: BH8 PROJECT: HAYMARKET AUGUST 2019



1.9 – 6m

BORE: BH8 PROJECT: HAYMARKET AUGUST 2019

6m – 11m

BORE: BH8 PROJECT: HAYMARKET AUGUST 2019

11m – 15.19m

BOREHOLE LOG

CLIENT: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333966
NORTHING: 6249295
DIP/AZIMUTH: 90°/--

BORE No: BH9
PROJECT No: 86767.00
DATE: 11 - 12/7/2019
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
15	0.33	CONCRETE SLAB										
	0.65	CLAY CL: low to medium plasticity, pale grey and yellow, with fine to medium grained sand, trace fine ironstone gravel, w>PL, residual soil							E/A			PID<1
									E/A			PID<1
14	1	Silty CLAY CL-CI: low to medium plasticity, pale grey and red, with fine grained sand, trace fine ironstone gravel, w<PL, residual soil							E/A			PID<1
	1.65	0.85-1.4m: w~PL 1.4m: fine ironstone gravel, w<PL						Unless otherwise specified, defects are B 0-5°, pl, ro, cly vn	E/A			PID<1
13	2	SANDSTONE: fine grained, orange-grey, very low to medium strength with extremely low strength bands, highly to moderately weathered, fractured, Hawkesbury Sandstone?						1.71m: Cs 40mm 1.82m: B 0°, pl, ro, cly co 1mm 1.82-1.85m: J 80°, pl, ro, cly co 1mm	C	100	44	
	3							1.85m: B 0°, pl, ro, cly co 1mm 1.85-1.89m: J 80°, pl, ro, cly co 1mm 1.89m: B 0°, pl, ro, cly co 1mm 1.89-1.94m: J 80°, pl, ro, cly co 1mm	C	100	53	PL(A) = 0.88
12								1.94m: B 5°, pl, ro, cbs 1.94-1.97m: J 80°, pl, ro, cbs B 10°, pl, ro, cbs 1.9-2.0m: J 80°, pl, ro, cbs 2m: B 0°, pl, ro, cbs 2.06m: Cs 30mm 2.2m: B 0°, ir, ro, cly vn 2.83-3.03m: B0-2° (x5), pl, ro, cbs	C	100	87	PL(A) = 0.28
	3.72	SANDSTONE: medium grained, grey, medium to high strength, slightly weathered then fresh, slightly fractured, Hawkesbury Sandstone										
	4											
11	5							3.08m: B 0°, pl, ro, clay co 1mm 3.16m: B 10°, pl, ro, cbs 3.21m: B 0°, ir, ro, cbs 3.31m: B 0°, pl, ro, cly co 2mm 3.34m: B 0°, pl, ro, cly co 1mm 3.39m: Ds 30mm 3.43m: B 0°, pl, ro, cbs 3.47m: B 5°, pl, ro, cly co 1mm 3.51-3.53m: Fg 5.43m: B 10°, pl, ro, cly vn 5.9m: Cs 10mm		100	100	PL(A) = 0.94
10	6	Below 5.91m: unbroken										PL(A) = 1.6
9	7							7.33m: B 0°, pl, ro, cly co 1mm	C	100	100	PL(A) = 1.3
8	8											PL(A) = 0.76
7	9							8.68m: B 0°, pl, ro, cly co 1mm	C	100	100	PL(A) = 1.9
6		9.50-9.56m: with carbonaceous laminations						9.79m: B 0°, pl, ro, cbs	C	100	100	PL(A) = 0.97

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.32m; hand auger 0.32-1.0m; Solid flight auger (TC Bit) 1.0-1.6m; NMLC coring 1.6-14.6m

WATER OBSERVATIONS: No groundwater observed during auger drilling

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: Atlassian Pty Ltd
PROJECT: Proposed Commercial Development
LOCATION: 8-10 Lee Street, Haymarket

SURFACE LEVEL: 15.5 AHD
EASTING: 333966
NORTHING: 6249295
DIP/AZIMUTH: 90°/--

BORE No: BH9
PROJECT No: 86767.00
DATE: 11 - 12/7/2019
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
		SANDSTONE: medium grained, grey, medium to high strength, slightly weathered then fresh, slightly fractured, Hawkesbury Sandstone *(continued)*							C	100	100	
	11	11.17-11.30m: with carbonaceous laminations						11.27m: B 0°, pl, ro, cbs	C	100	100	PL(A) = 1.3
	12							12.29m: B 0°, pl, sm, cbs 12.62m: B 0°, pl, sm, cbs	C	100	100	PL(A) = 1.5
	13							13.1m: B 0°, pl, sm, cbs				PL(A) = 3.1
	14							13.56m: B 0°, pl, sm, cbs 13.63m: B 0°, pl, sm, clay vn	C	100	100	PL(A) = 1.3
	14.6	Bore discontinued at 14.6m										PL(A) = 1
	15											
	16											
	17											
	18											
	19											

RIG: XC **DRILLER:** Terratest **LOGGED:** KR **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.32m; hand auger 0.32-1.0m; Solid flight auger (TC Bit) 1.0-1.6m; NMLC coring 1.6-14.6m

WATER OBSERVATIONS: No groundwater observed during auger drilling

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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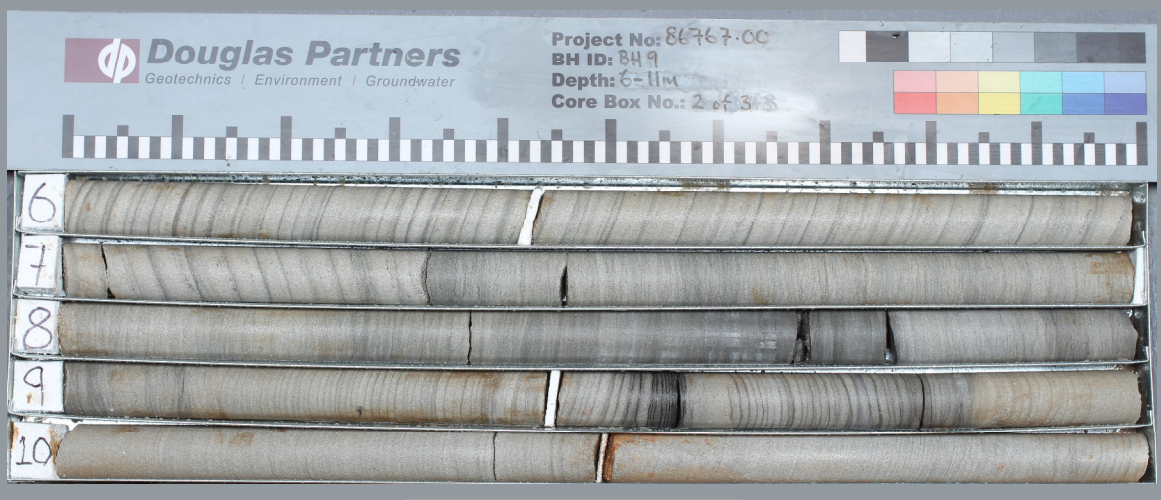
BORE: BH9 PROJECT: HAYMARKET AUGUST 2019

1.65 – 6m

BORE: BH9 PROJECT: HAYMARKET AUGUST 2019



6m – 11m

BORE: BH9 PROJECT: HAYMARKET AUGUST 2019

11m – 14.60m

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

Results of Dynamic Penetrometer Tests

Client Atlassian Pty Ltd
Project Proposed Commercial Development
Location 8-10 Lee Street, Haymarket

Project No. 86767.00
Date 10-14/07/2019
Page No. 1 of 2

Test Locations	BH1	BH3	BH4	BH6	BH7	BH9			
RL of Test (AHD)	20.1	15.5	15.5	15.5	15.5	15.5			
Depth (m)	**Penetration Resistance** Blows/150 mm								
0.00 – 0.15	E	E	E	E	E	E			
0.15 – 0.30	E	E	E	E	E	E			
0.30 – 0.45	E	5	4	11	E	E			
0.45 – 0.60	E	6	2	12	E	E			
0.60 – 0.75	E	6	2	12	E	E			
0.75 – 0.90	E	7	3	20	E	E			
0.90 – 1.05	E	9	1	20	E	E			
1.05 – 1.20	E	12	1	25	E	E			
1.20 – 1.35	E	16	8	Ref	8	11			
1.35 – 1.50	E	15	4		9	8/149			
1.50 – 1.65	E	16	4		13	HB			
1.65 – 1.80	E	25	4		8				
1.80 – 1.95	0	HB	2		8/80				
1.95 – 2.10	0		2		HB				
2.10 – 2.25	0		9						
2.25 – 2.40	0		6						
2.40 – 2.55	0		25/100						
2.55 – 2.70	0		Ref						
2.70 – 2.85	0								
2.85 – 3.00	0								
3.00 – 3.15	0								
3.15 – 3.30	5								
3.30 – 3.45	3								

Test Method AS 12829.6.3.2, Cone Penetrometer ☑
Remarks E = Excavated, HB = Bouncing, 25 / 100 indicates 25 blows for 100 mm penetration, Ref = Refusal

Tested By NB
Checked By HDS

Douglas Partners Pty Ltd
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Results of Dynamic Penetrometer Tests

Client Atlassian Pty Ltd
Project Proposed Commercial Development
Location 8-10 Lee Street, Haymarket

Project No. 86767.00
Date 10-14/07/2019
Page No. 2 of 2

Test Locations	BH1								
RL of Test (AHD)	20.1								
Depth (m)	**Penetration Resistance** Blows/150 mm								
3.45 – 3.60	2								
3.60 – 3.75	2								
3.75 – 3.90	2								
3.90 – 4.05	6								
4.05 – 4.20	2								
4.20 – 4.35	4								
4.35 – 4.50	3								
4.50 – 4.65	2								
4.65 – 4.80	2								
4.80 – 4.95	3								
4.95 – 5.10	5								
5.10 – 5.25	5								
5.25 – 5.40	6								
5.40 – 5.55	7								
5.55 – 5.70	6								
	End								

Test Method AS 1289.6.3.2, Cone Penetrometer ☑

Tested By NB
Checked By HDS

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Geotechnics / Environment / Groundwater

Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH1
Project Name:	Haymarket DSI
Project Number:	86767.00
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details	
Date/Time:	1400 30.7.19
Purged By:	JSH
GW Level (pre-purge):	6.07 m bgl
GW Level (post-purge):	6.30 m bgl (NB: ~15 L of dem water added)
PSH observed:	Yes / (No) / interface / visual). Thickness if observed: little sediment remaining.
Observed Well Depth:	6.22 m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~20L, dry
Equipment:	Twister pump, interface meter

Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**

Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	Level logger (SN) installed at 6.1m, approx at 1445

3/7.19 - Fully level test; GW level 5.95 prior to filling
1327, GW filled to GL
NB: water fell to below within 45 mins

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_c d_c^2/4 + n(\pi h_f d_f^2/4 - \pi h_f d_c^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_c = height of water column
d_c = diameter of annulus
h_f = length of filter pack
d_c = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH1
Project Name:	Haymarket DSI
Project Number:	86767.00
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-
Bore Development Details	
Date/Time:	07/08/2019 1430
Purged By:	AS
GW Level (pre-purge):	6.15 m bgl
GW Level (post-purge):	6.35 m bgl
PSH observed:	Yes / (No) (interface / visual). Thickness if observed:
Observed Well Depth:	6.35 m bgl
Estimated Bore Volume:	1.44 ~~1.008~~ L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry) ~1.5L (dry, no recharge)
Equipment:	interface metre
Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	6.3 m bgl, very little water in well (silt)
Sample Appearance (e.g. colour, siltiness, odour):	brown, lots of sediment, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_c d_c^2/4 + n(\pi h_f d_a^2/4 - \pi h_f d_c^2/4)$

Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_c = height of water column
d_a = diameter of annulus
h_f = length of filter pack
d_c = diameter of casing

Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH5 (GG)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details	
Date/Time:	23/07/19 12:00
Purged By:	AS
GW Level (pre-purge):	2.6 m bgl
GW Level (post-purge):	14.4 m bgl
PSH observed:	Yes / (No) (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	90 L * Actual bore volume: ~40 L (dry)
Total Volume Purged:	(target: no drill mud, min 3 well vol. or (dry)) 40
Equipment:	pump, battery, interface metre, bailer/line, water cubes

Micropurge and Sampling Details	
Date/Time:	
Sampled By:	
Weather Conditions:	
GW Level (pre-purge):	m bgl
GW Level (post sample):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	L
Equipment:	

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**

Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	clear-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_1 d_2^2/4 + n(\pi h_1 d_1^2/4 - \pi h_2 d_2^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_1 = height of water column
d_1 = diameter of annulus
h_2 = length of filter pack
d_2 = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH5 (GG)
Project Name:	Haymarket DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details	
Date/Time:	
Purged By:	
GW Level (pre-purge):	m bgl
GW Level (post-purge):	m bgl
PSH observed:	Yes / No (interface / visual). Thickness if observed:
Observed Well Depth:	m bgl
Estimated Bore Volume:	L
Total Volume Purged:	(target: no drill mud, min 3 well vol. or dry)
Equipment:	

Micropurge and Sampling Details	
Date/Time:	30.7.14
Sampled By:	JSH
Weather Conditions:	(overcast) indoors
GW Level (pre-purge):	2.44 m bgl
GW Level (post sample):	4.2 m bgl
PSH observed:	Yes / (No) (interface / (visual)). Thickness if observed:
Observed Well Depth:	15.1 m bgl
Estimated Bore Volume:	L
Total Volume Purged:	~3 L (micropurge)
Equipment:	Peristp, WQM, Bailer, Interface meter

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	***0.1° C***	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
13:14	~~17.4~~	3.33	460	5.44	36	187
13:20	~~18.9~~	1.44	431	5.43	21.1	182
13:21	19.1	1.24	420	5.43	25.1	182
13:22	19.2	0.89	428	5.49	22.3	176
13:23	19.2	0.87	428	5.49	19.7	174
6						
7						

Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	~8 m bgl, middle of water column
Sample Appearance (e.g. colour, siltiness, odour):	clear to pale grey
Sample ID:	BH5
QA/QC Samples:	BD1/20190730
Sampling Containers and filtration:	1x Amber, 1x 500mL G, 1x Purple, 1x red (filtered) 3x Vials
Comments / Observations:	Level logger (SN 4205 7242) installed at ~ 14.5m; at 1350

31.7.14
PM test; pre-purge (2.44m), purge finish 1300 approx (SOL to dry)

BH8

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Groundwater Field Sheet

Bore Volume = casing volume + filter pack volume
$= \pi h_c d_c^2/4 + n(\pi h_f d_f^2/4 - \pi h_f d_c^2/4)$
Where: $\pi = 3.14$
n = porosity (0.3 for most filter pack material)
h_c = height of water column
d_c = diameter of annulus
h_f = length of filter pack
d_c = diameter of casing
Bore Vol Normally: 7.2*h

Project and Bore Installation Details	
Bore / Standpipe ID:	BH8 (TOGA)
Project Name:	HAYMARKET DSI
Project Number:	86767.01
Site Location:	
Bore GPS Co-ord:	
Installation Date:	
GW Level (during drilling):	- m bgl
Well Depth:	m bgl
Screened Interval:	m bgl
Contaminants/Comments:	-

Bore Development Details	
Date/Time:	23/07/19 15:00
Purged By:	AS
GW Level (pre-purge):	2.3 m bgl
GW Level (post-purge):	8.9 m bgl
PSH observed:	Yes / (No) (interface / visual). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L * actual bore volume ~40L (dry/slow recharge
Total Volume Purged:	(target: no drill mud, min 3 well vol. or (dry)) 100L
Equipment:	pump, battery, interface metre, bailer/line, water cubes

Micropurge and Sampling Details	
Date/Time:	1500 30.7.19
Sampled By:	JSH
Weather Conditions:	overcast (indoors)
GW Level (pre-purge):	2.3 m bgl
GW Level (post sample):	2.3 m bgl
PSH observed:	Yes / (No) (interface / (visual)). Thickness if observed:
Observed Well Depth:	15.2 m bgl
Estimated Bore Volume:	93 L
Total Volume Purged:	3 L
Equipment:	Peripump, WQM, interface meter, Bailer

Water Quality Parameters

Time / Volume	Temp (°C)	DO (mg/L)	EC (µS or mS/cm)	pH	Turbidity	Redox (mV)
Stabilisation Criteria (3 readings)	**0.1° C**	**+/- 0.3 mg/L**	**+/- 3%**	**+/- 0.1**	**+/- 10%**	**+/- 10 mV**
1515	18.0	3.51	329	5.4	41	189
1516	18.8	2.97	327	5.4	28	184
1517	19.1	2.53	315	5.4	28	160
1518	19.2	2.28	313	5.4	28	157
1519	19.2	1.94	311	5.4	29	154
1520	19.3	1.62	313	5.4	24	151
1521	19.3	1.43	312	5.4	26	150
1522	19.3	1.36	310	5.4	20	148
Additional Readings Following stabilisation:	DO % Sat	SPC	TDS			

Sample Details

Sampling Depth (rationale):	m bgl,
Sample Appearance (e.g. colour, siltiness, odour):	yellow-brown, still, odourless
Sample ID:	
QA/QC Samples:	
Sampling Containers and filtration:	
Comments / Observations:	actual well V ≈ 40 (?) L - slow pumping, water coming out on/off

Post sample purge ~ 100 L ; depth 11.9m to water (dipped)
Installed level logger at 11.8m (SW) at approx 1420

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TPS FLT90 CALIBRATION RECORD

Serial Number: 428561

DP Identification No. DP595

WQM 2

Project: Haymarket.

Project Number: 86767.01

PARAMETER	STANDARD	PRE CALIBRATION READING		POST CALIBRATION READING	
Temperature	* ~~23.0~~ 20.0	20.6	degrees C	20.6	degrees C
pH	10	9.~~70~~	pH units	10.0	pH units
	7	6.89	pH units	7.0	pH units
	4	4.65	pH units	4.0	pH units
Conductivity	0.0** uS/cm		µS/cm		µS/cm
	2.76 mS/cm	2475	~~m~~S/cm	2711	~~m~~S/cm
TDS	0.0** ppm		ppm		ppm
	36.0 ppk		ppk		ppk
Dissolved Oxygen	0.0% sat		ppm		
			%		%
	100.0**% sat	7	ppm	3	
			%		%
Turbidity	0*** NTU		NTU		NTU
	90 NTU	87	NTU	90.1	NTU
ORP #	240 mV	253	mV	-	mV

Calibrated by: JJM

Date: 29.7.19

* use NATA certified reference thermometer from soils clean lab
** air
*** distilled water
# factory calibrated – do a bump test

NOTES:

Form Updated 21Mar2011

Appendix E

Laboratory Test Reports

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

CERTIFICATE OF ANALYSIS 221523-A

Client Details

Client	Douglas Partners Pty Ltd
Attention	Huw Smith
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**86767.01, DSI**
Number of Samples	19 Soil
Date samples received	12/07/2019
Date completed instructions received	23/07/2019

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.

Report Details

Date results requested by	30/07/2019
Date of Issue	15/08/2019
Reissue Details	This report replaces R00 created on 30/07/2019 due to: revised report with additional pH results.

Results Approved By
Nick Sarlamis, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil		
Our Reference		221523-A-3
Your Reference	UNITS	BH1/4.3-4.5
Date Sampled		10/07/2019
Type of sample		Soil
Date prepared	-	26/07/2019
Date analysed	-	26/07/2019
Electrical Conductivity 1:5 soil:water	µS/cm	20
Sulphate, SO4 1:5 soil:water	mg/kg	10
pH 1:5 soil:water	pH Units	6.0
Chloride, Cl 1:5 soil:water	mg/kg	<10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			26/07/2019	3	26/07/2019	26/07/2019		26/07/2019	[NT]
Date analysed	-			26/07/2019	3	26/07/2019	26/07/2019		26/07/2019	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	3	20	[NT]		106	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	3	10	[NT]		101	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	3	6.0	5.9	2	102	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	3	<10	[NT]		97	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

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.
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Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:**	Haymarket	**To:**	Envirolab Services
Project Name:	Haymarket, 8-10 Lee Street, Geo	**Order Number**			
Project Manager:	Huw Smith	**Sampler:**	NB/AS	**Attn:**	Simon Song
Emails:	huw.smith@douglaspartners.com.au			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x			**Email:**	
Prior Storage:	☐ Esky x Fridge x Shelved	Do samples contain 'potential' HBM?	Yes ☐	No x	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Aggressivity (pH, EC, SO4, Cl)								Notes/preservation
3 BH1, 4.3-4.5m	①	10/07/19	S	P	X								①Already at laboratory, previous
BH4, 0.3-0.4m	④	13/07/19	S	P	X								Job No. 86767.01. Previous
BH5, 1.1-1.2m	1	13/07/19	S	G	X								testing completed for separate
BH6, 0.5-0.6m	2	14/07/19	S	P	X								DP job (enviro)
BH7, 0.4-0.5m	3	13/07/19	S	P	X								
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐

ENVIROLAB — Envirolab Services, 12 Ashley St, Chatswood NSW 2067, Ph (02) 9910 6200
Job No: 222176
Date Received: 23/07/2019
Time Received: 9:40
Received by: [illegible]
Temp: Cool/Ambient 19°C
Cooling: Ice/Icepack
Security: Intact/Broken/None

Ref: 221523-A
TAT: Std
Due: 30/7/19

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: ~~8HM unless specified here:~~

Lab Report/Reference No:

Total number of samples in container: 3 **Relinquished by:** Huw Smith **Transported to laboratory by:** COURIER

Send Results to: Douglas Partners Pty Ltd **Address:** 96 Hermitage Road, West Ryde **Phone:** **Fax:**

Signed: [signature] **Received by:** [signature] **Date & Time:** 23/07/2019

24/7/19 4pm.

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

CERTIFICATE OF ANALYSIS 221667-A

Client Details

Client	Douglas Partners Pty Ltd
Attention	Huw Smith
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**86767.01, DSI, Haymarket**
Number of Samples	18 Soil, 1 Water
Date samples received	17/07/2019
Date completed instructions received	23/07/2019

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

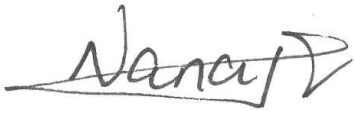
Date results requested by	30/07/2019
Date of Issue	29/07/2019

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Nancy Zhang, Laboratory Manager, Sydney

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil		
Our Reference		221667-A-3
Your Reference	UNITS	BH4/0.3-0.4
Date Sampled		12/07/2019
Type of sample		Soil
Date prepared	-	26/07/2019
Date analysed	-	26/07/2019
pH 1:5 soil:water	pH Units	8.9
Electrical Conductivity 1:5 soil:water	µS/cm	170
Sulphate, SO4 1:5 soil:water	mg/kg	61
Chloride, Cl 1:5 soil:water	mg/kg	25

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			26/07/2019	[NT]	[NT]	[NT]	[NT]	26/07/2019	[NT]
Date analysed	-			26/07/2019	[NT]	[NT]	[NT]	[NT]	26/07/2019	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	98	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
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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.

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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: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

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

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Report Comments

pH - out of recommended holding time

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:** Haymarket	**To:** Envirolab Services
Project Name:	Haymarket, 8-10 Lee Street, Geo	**Order Number**	
Project Manager:	Huw Smith	**Sampler:** NB/AS	**Attn:** Simon Song
Emails:	huw.smith@douglaspartners.com.au		**Phone:**
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x		**Email:**
Prior Storage:	☐ Esky x Fridge x Shelved	Do samples contain 'potential' HBM? Yes ☐ No x (If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Aggressivity (pH, EC, SO4, Cl)								Notes/preservation
BH1, 4.3-4.5m	6	10/07/19	S	P	X								Already at laboratory, previous
3- BH4, 0.3-0.4m	5	13/07/19	S	P	X								Job No. 86767.01. Previous
BH5, 1.1-1.2m	1	13/07/19	S	G	X								testing completed for separate
BH6, 0.5-0.6m	2	14/07/19	S	P	X								DP job (enviro)
BH7, 0.4-0.5m	3	13/07/19	S	P	X								
PQL (S) mg/kg													ANZECC PQLs req'd for all water analytes ☐

ENVIROLAB — Envirolab Services, 12 Ashley St, Chatswood NSW 2067, Ph (02) 9910 6200
Job No: 22167 +6
Date Received: 23/07/2019
Time Received: 9:40
Received by: [illegible]
Temp: Cool/Ambient 19°C
Cooling: Ice/Icepack
Security: Intact/Broken/None

Ref: 22167-A
TAT: std
Due: 30/7/19

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: ~~8HM unless specified here:~~

Lab Report/Reference No:

Total number of samples in container: 3 **Relinquished by:** Huw Smith **Transported to laboratory by:** Courier

Send Results to: Douglas Partners Pty Ltd **Address:** 96 Hermitage Road, West Ryde **Phone:** **Fax:**

~~**Signed:**~~ **Received by:** Tony Doherty **Date & Time:** 23/07/2019

22/7/19 4pm.

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

CERTIFICATE OF ANALYSIS 222176

Client Details

Client	Douglas Partners Pty Ltd
Attention	Huw Smith
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**86768.00, Haymarket**
Number of Samples	3 SOIL
Date samples received	23/07/2019
Date completed instructions received	23/07/2019

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.

Report Details

Date results requested by	30/07/2019
Date of Issue	26/07/2019

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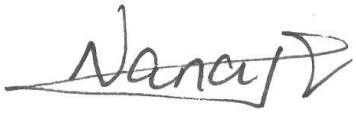
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Nick Sarlamis, Inorganics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity				
Our Reference		222176-1	222176-2	222176-3
Your Reference	UNITS	BH5	BH6	BH7
Depth		1.1-1.2	0.5-0.6	0.4-0.5
Date Sampled		13/07/2019	14/07/2019	13/07/2019
Type of sample		SOIL	SOIL	SOIL
pH 1:5 soil:water	pH Units	4.9	5.1	8.3
Electrical Conductivity 1:5 soil:water	µS/cm	92	89	120
Chloride, Cl 1:5 soil:water	mg/kg	29	10	20
Sulphate, SO4 1:5 soil:water	mg/kg	42	72	42

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
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QUALITY CONTROL: Soil Aggressivity					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	83	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]

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Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	86767.00	**Suburb:**	Haymarket	**To:**	Envirolab Services
Project Name:	Haymarket, 8-10 Lee Street, Geo	**Order Number**			
Project Manager:	Huw Smith	**Sampler:**	NB/AS	**Attn:**	Simon Song
Emails:	huw.smith@douglaspartners.com.au			**Phone:**	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard x			**Email:**	
Prior Storage:	☐ Esky x Fridge x Shelved	Do samples contain 'potential' HBM?	Yes ☐	No x	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Aggressivity (pH, EC, SO4, Cl)								Notes/preservation
BH1, 4.3-4.5m	4	10/07/19	S	P	X								Already at laboratory, previous
BH4, 0.3-0.4m	5	13/07/19	S	P	X								Job No. 86767.01. Previous
BH5, 1.1-1.2m	1	13/07/19	S	G	X								testing completed for separate
BH6, 0.5-0.6m	2	14/07/19	S	P	X								DP job (enviro)
BH7, 0.4-0.5m	3	13/07/19	S	P	X								
PQL (S) mg/kg													**ANZECC PQLs req'd for all water analytes** ☐

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

Job No: 222176
Date Received: 23/07/2019
Time Received: 9:40
Received by: ID
Temp: Cool/Ambient 19°C
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: ~~8HM unless specified here:~~

Lab Report/Reference No:

Total number of samples in container: 3 **Relinquished by:** Huw Smith **Transported to laboratory by:** Courier

Send Results to: Douglas Partners Pty Ltd **Address:** 96 Hermitage Road, West Ryde **Phone:** **Fax:**

Signed: 22/7/19 4pm. **Received by:** Tanya Doherty **Date & Time:** 23/07/2019