Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Preliminary Geotechnical Investigation

Proposed Mixed-Use Development

87-91 Union Rd, 634-638 High St, Penrith

Prepared for
Toga Development and Construction Pty Ltd

Project 85867.00
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Douglas Partners
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Preliminary Geotechnical Investigation
Proposed Mixed-Use Development
87-91 Union Rd, 634-638 High St, 640-652 High St Penrith

1. Introduction

This report presents the results of a geotechnical investigation undertaken by Douglas Partners Pty Ltd (DP) for the site at 87-91 Union Rd, 634-638 High St, and 640-652 High St, Penrith as shown on the attached Drawing 1. The work was commissioned by Mr Bernardo Reiter Landa on behalf of Toga Penrith Developments Pty Ltd (Toga) and was carried out in general accordance with DP's proposal SYD170044 dated 23rd January 2017 and subsequent emails and DP's general conditions of engagement.

The site is located at 87-91 Union Road / 634-638 High Street in Penrith (Site 1). Toga has another site at 640-652 High Street, Penrith (Site 2) which will be progressed in a separate Development Application. Toga's sites are dissected by John Tipping Grove which is a council owned road. This document has been prepared for the Development Application on Site 1, 87-91 Union Road / 634-638 High Street, Penrith.

The proposed development will comprise two multi-storey buildings over a common three level basement. Details of the proposed development are shown on drawings prepared by SJB Architects, job number 6111..

The field work for the investigation was undertaken in conjunction with a contamination investigation, which has been reported separately (DP Reference 85867.02). Groundwater monitoring was carried out over 2017-2018 after completion of the initial investigation field work. .
The objective of the geotechnical investigation was to provide preliminary information on subsurface conditions for planning and design of earthworks, shoring and footings.

2. Site Description and Geology

The site is bounded by High Street to the north, Mulgoa Road to the west, Union Road to the south and to the east an open parking area, residential development and a vacant lot.

The site is generally flat with a slight slope to the west. It is situated at an elevation of RL 28 m AHD. It is understood that stormwater flows into a drainage network across the site however ponding of water was noted across the site during recent field investigations by DP in 2017.

It is anticipated that the direction of groundwater flow would be to the west and towards the Nepean River located approximately 800 m west of the site. It is also likely that stormwater at the site and region discharges to the Nepean River.

The Penrith 1:100,000 Soil Landscape Sheet and Geological Series Sheet indicate that the site is underlain by Richmond soils over the Cranebrook Formation from the Quaternary Period. Richmond

soils comprise clay loams (silt), clays and sands. The Cranebrook Formation comprises gravel, sand, silt and clay. DP's experience in the area suggests that these alluvial sediments are underlain by Bringelly Shale of the Wianamatta Group, which consists of shale, carbonaceous claystone, laminate and lithic sandstone.

3. Review of Previous Reports

DP was provided with the following report:

- Geotechnique (2007) Geotechnical Investigation, Lot 1 in DP 884193, 616 High Street Penrith dated June 2007 (Geotechnique, 2007)

This report covers the site immediately to the east and included five boreholes.

The investigation encountered filling to a depth of about 0.5 m over alluvium comprising sand/silt to depths of 1.8 m to 3.4 m depth over gravels. Below depths of 12.5 m to 13.0 m residual clay was encountered, with shale bedrock below 13.0 m to 13.8 m depth.

Groundwater levels were assessed to be in excess of 6 m. Various geotechnical recommendations were provided in the report.

4. Field Work

4.1 Methods

The field work for the investigation in 2017 included:

- drilling of four rock cored boreholes;
- drilling of six augered boreholes;
- installation of three groundwater wells; and
- installation of groundwater data loggers in two boreholes for longer term, continuous monitoring.

The locations of the tests are shown on Drawing 1 in Appendix B.

The rock cored boreholes (BH1, BH2A, BH3 and BH4) were drilled with a sonic drilling rig to depths of between 16.0 m and 17.5 m. Sonic drilling utilises a core barrel that is rotated and vibrated at around 150 Hz to cause the soil to liquefy and 'flow' into the core barrel. Standard penetration tests were undertaken within the soil strata at regular depths to assess the in-situ strength of the soils.
HQ sized coring was then conducted to collect continuous samples of the bedrock. BH2A was drilled adjacent to BH2, which was terminated prematurely due to an issue with the drill rig.

The augered boreholes (BH5, BH6, BH7, BH8, BH9 and BH10) were drilled using a 3.5 tonne excavator fitted with spiral flight augers to a maximum depth of 1.5 m. The boreholes were sampled by a geotechnical engineer and surveyed using a differential GPS.

4.2 Field Work Results

Details of the subsurface conditions encountered are given in the borehole logs in Appendix C, together with notes explaining descriptive terms and classification methods.

The sequence of subsurface materials encountered is described below in increasing depth order:

PAVEMENT: Typically 20-50 mm of asphalt or concrete. BH1, BH6 and BH9 encountered no pavement.

FILLING: Brown and grey sandy gravel filling and clayey sand to depths of 0.1 m to 0.9 m.

Silty CLAY: Generally stiff, brown silty clay between depths of 0.2 m to 2.5 m in BH1, BH3, BH5, BH9 and BH10.

Clayey SAND / Silty SAND: Generally loose to medium dense, brown, clayey sand and silty sand between depths of 0.1 m to 3.5 m in BH1, BH2, BH3, BH6, BH7 and BH8.

GRAVEL Dense to very dense, brown and grey gravel within a matrix of silty sand extending from depths of 1.7 m to 3.5 m to depths of 12.1 m to 13.8 m

LAMINITE: Extremely low to low strength laminite (interbedded sandstone and siltstone) below depths of 12.1 m to 13.8 m. Medium and high strength, slightly weathered to fresh laminite below depths of 12.8 m to 14.3 m.

4.3 Groundwater Measurements

Groundwater monitoring wells were installed in (BH1, BH2A and BH3) to depths between 16.0 m and 16.8 m to allow for measurement of water levels and sampling of groundwater for the contamination investigation. The wells were developed on 16 March 2017 and data loggers were installed in BH2A and BH3 to allow for continuous long term monitoring of water levels. Recorded water levels in the monitoring wells installed at Bores 1, 2A and 3 are summarised in Table 1.

Table 1: Summary of Groundwater Measurements in Monitoring Wells

Borehole (Well)	Well Depth (m)	Depth (m) *(RL [m AHD])*	
		1 March 2017	16 March 2017
1	16.0	7.0 *(19.4)*	N/A (well silted up)
2A	16.0	9.0 *(18.3)*	6.8 *(20.5)*
3	16.8	Not encountered	6.5 *(20.4)*

Rising head tests were attempted in BH2A and BH3, however, the pump was unable to lower the water level within either well by more than 200 mm. This suggests that the gravels are highly permeable (approx. $k \geq 5 \times 10^{-4}$ to 5×10^{-5} m/s).

The groundwater levels obtained from the data loggers between 30 March 2017 to 5 November 2018 are presented in Figure 1 and 2 below. The results show the groundwater levels together with rainfall measurements recorded at Penrith Lakes AWS (BOM Station Number 067113, www.bom.gov.au).

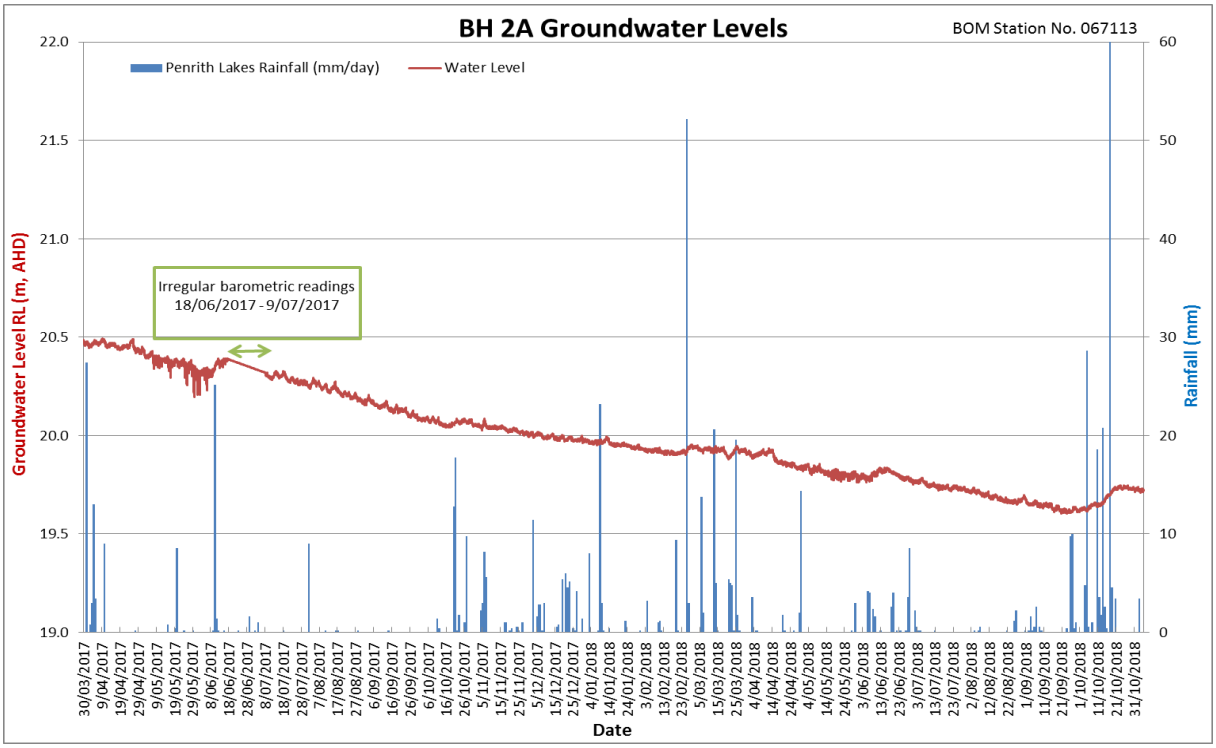

Figure 1 – Data-logger and rainfall data for BH2A

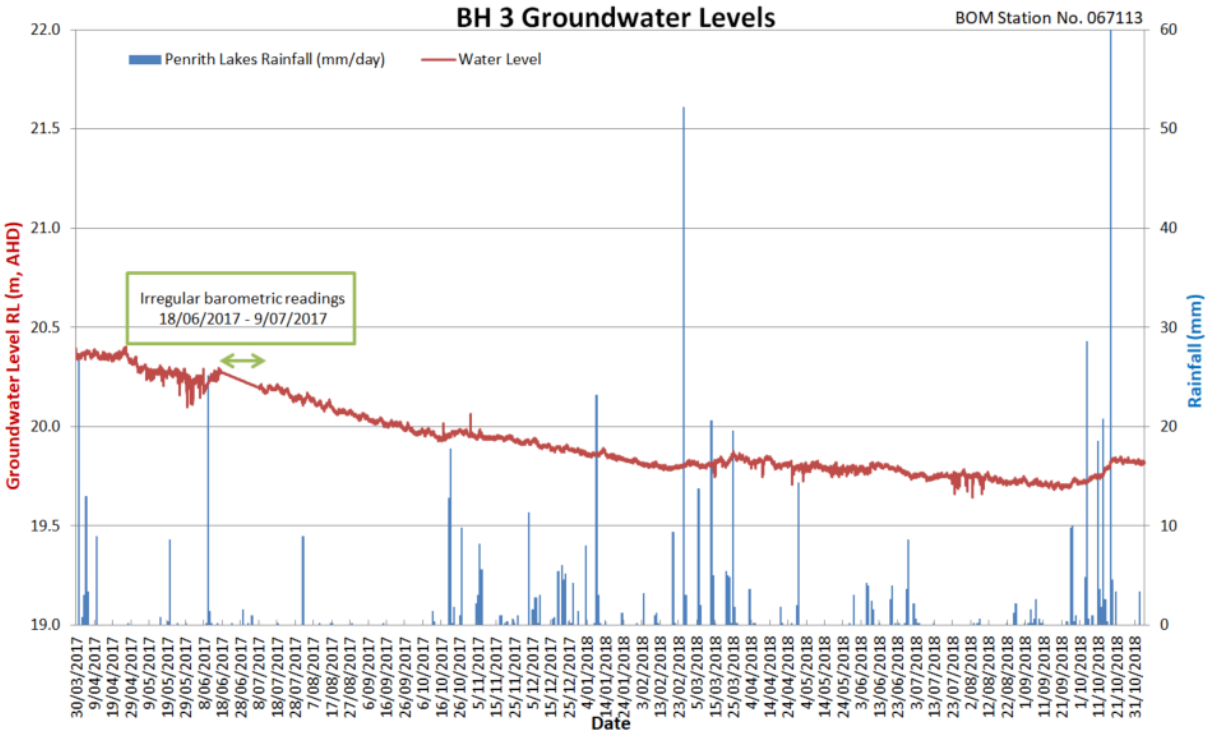

Figure 2 – Data-logger and rainfall data for BH3

5. Laboratory Test Results

Three soil samples were analysed to assess the aggressivity of the soil. A summary of the results is provided in Table 2. The laboratory test report is included in Appendix D.

Table 2: Summary of Soil Aggressivity Results

Borehole	Depth (m)	pH (pH units)	EC (µS/cm)	Chloride (mg/kg)	Sulphate (mg/kg)
1	2.50 – 2.95	6.9	16	<10	<10
4	1.00 – 1.45	6.6	70	10	83
4	8.50 – 8.92	8.0	59	26	21

Notes: EC = electrical conductivity; All samples mixed at a ratio of 1(soil):5(water) prior to testing

Selected samples of the rock core were tested in the laboratory to determine the Point Load Strength Index (Is_{50}) values to assist with the rock strength classification. The results of the testing are shown on the borehole logs at the appropriate depth. The Is_{50} values for the rock ranged from 0.5 MPa to 2.9 MPa, indicating that the rock samples tested were generally of medium to high strength. One test returned an Is_{50} value of 3.7 MPa, indicating very high strength.

6. Geotechnical Model

The interpreted geological model for the site is as follows:

FILLING:	Sandy filling to a typical depth of 0.5 m.
CLAY AND SAND: **(Richmond Soils Landscape)**	Stiff, silty clay to a depth of about 2 m across most of the site, over loose to medium dense clayey sand and silty sand to a depth of 2.5 m to 3 m.
GRAVEL: **(Cranebrook Formation)**	Dense to very dense gravel within a matrix of silty sand to a depth of about 12.5 m to 13.5 m.
LAMINITE: **(Bringelly Shale)**	Class IV laminite (interbedded siltstone and sandstone) to a depth of about 13.5 m to 14.5 m, over Class II (or better) laminite.

The groundwater table was encountered during the field work (drilling, well development and groundwater monitoring programme) at approximately 6.5 m to 9 m depth (between RL 20.5 to RL 18.3 m AHD). Design should allow for a rise in the water table, especially in times of flooding. Records held by DP for Penrith Plaza show groundwater level fluctuations of up to 3 m. A preliminary design groundwater level of RL 23.5 m AHD is therefore recommended, however, higher short term levels may occur during flooding.

7. Comments

7.1 Proposed Development

The proposed development will comprise two multi-storey buildings over a common three level basement. It is anticipated that the Basement 3 level (RL18.6 m) may require bulk excavation to depths of about 8.5 m to 9.0 m (RL18.1 m) allowing for 0.5 m deeper excavation for the slab and services/drainage. The actual excavation will depend on structural design.

Structural loads have not been provided at this stage.

7.2 Earthworks

7.2.1 Excavation Conditions

Excavations are expected to be carried out through shallow filling, natural sands, firm to stiff clays and dense to very dense gravels, which should be generally removed using conventional earthmoving equipment such as tracked excavators. Large excavators may be required to efficiently remove the gravels, which can be rounded and include cobbles and possible boulders.

Groundwater was encountered between RL20.5 m AHD to RL18.3 m AHD which is about 6.5 m to 9 m depth below the existing site levels. The proposed bulk excavation is assumed to be RL18.1 m and will be 2.4 m below the highest water level measured during groundwater monitoring programme undertaken between 30 March 2017 to 5 November 2018. There is potential for groundwater levels to

temporarily rise by at least 3 m during and following prolonged heavy rainfall and possibly higher during floods and this should be considered.

Trafficability on the site should not prove difficult due to the gravelly soils, even when saturated.

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the *Waste Classification Guidelines* (EPA, 2014). Reference should be made to the contamination report (DP Ref. 85867.02.R.001) for details on the contamination status of the soils.

7.2.2 Dilapidation Surveys

Dilapidation (building condition) reports should be undertaken on surrounding properties prior to commencing work on the site to document any existing defects so that any claims for damage due to construction related activities can be accurately assessed.

7.2.3 Vibrations

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibrations at adjacent buildings and structures within acceptable limits. Most of the excavation is expected to be within sands and gravels should result in relatively minor vibrations.

7.3 Excavation Support

The northern, western and southern sides of the excavation will extend up to the site boundaries. It is understood that the eastern boundary will be at least 10 m from the edge of the proposed excavation.

Vertical excavations on the site will require retaining structures both during construction and as part of the final structure. A relatively watertight shoring wall, socketed into competent rock (Class II), should be adopted to reduce seepage into the excavation, minimise sand/silt loss from behind the wall and to minimise the risk of adverse jointing undermining the toe of the wall. It is anticipated that at least two rows of temporary 'tie-back' anchors will be required to provide lateral restraint and reduce wall movements.

7.3.1 Shoring Wall Systems

The shoring system will need to be designed to reduce wall deflections and groundwater inflows. Tie back anchors or internal bracing will be required to provide lateral restraint to the shoring.

Table 1 shows a brief summary of various shoring wall types and their advantages and disadvantages. This table is not exhaustive, and as support for deep excavations that need to be 'water-tight' is a specialist construction procedure, it would be prudent to seek advice from contractors for preliminary costing and concept design purposes.

Table 1: Type of Potential Cut-off Walls

Type of Wall	Advantages	Disadvantages
Diaphragm Wall	• Good technical solution. • Watertight. • Can support high structural loads. • Several contractors can install, but they need to be specialist with local experience.	• Potential bentonite loss through permeable gravels. • Expensive. • Can be messy on site due to bentonite and concrete spillage. • Close construction supervision needed. • Large site presence required.
Secant pile wall	• Cheaper than diaphragm wall but not considered as robust technical solution to diaphragm walls. • Can be watertight if constructed properly. • Several contractors can install them. • Verticality can be improved by using guide wall template and temporary segmented casing (may be difficult in dense gravels).	• Difficulty in maintaining verticality, particularly if three basement levels are proposed due to possible. deflection in the dense gravel. • Often leak water due to misalignment of piles (i.e. 'gaps'). • May need to grout behind wall to plug 'gaps'.
Secant pile wall with jet-grouted columns	• Similar to secant pile wall above. • Jet-grouted columns replace the 'soft' piles and can plug gaps created by verticality issues.	• Similar to secant pile wall above. • Jet grouting from outside the site boundary can be a problem because of access. • Difficulty ensuring tight seal to bedrock.
Cutter-soil mix (CSM)	-	• Considered unsuitable due to inability to effective blend cement into gravels and install reinforcement.
Sheet piling	-	• Considered unsuitable due to inability to install sheets into gravels and vibration issues. Preboring may be considered but will not prove the same "seal" in rock.
Jet grouting (deep soil mixing)	-	• Considered unsuitable due to inability to install reinforcement into gravels.

7.3.2 Preliminary Lateral Earth Pressures for Design

The preliminary design of shoring with a single row of anchors may be based on an average unit weight of 20 kN/m^3 for the retained soil and weathered rock, with a triangular earth pressure distribution calculated using an active earth pressure coefficient (k_a) value of 0.4 where some wall movement is acceptable, or an "at-rest" earth pressure coefficient (k_o) value of 0.6 where wall movement is to be reduced.

Preliminary design for lateral earth pressures for a multi-anchored wall system may be based on a uniform rectangular earth pressure distribution. A uniform lateral earth pressure for the retaining wall of 4H kPa should be adopted (where H = Height in metres to be retained above the medium strength sandstone). This should be increased to 6H where lateral movements are to be reduced.

All surcharge loads should be allowed for in the retaining wall design including building footings, inclined slopes behind the wall, traffic and construction related activities.

The impermeable retaining/shoring walls should be designed for full hydrostatic pressures which is in addition to the above earth pressures.

The final or detailed design of retaining walls should be undertaken using interactive computer programs such as WALLAP or FLAC, which can take due regard of soil-structure interaction during the progressive stages of wall construction, anchoring and bulk excavation.

7.3.3 Passive Resistance

Passive resistance for piles founded below the base of the bulk excavation (including allowance for services or footings) may be based on an ultimate passive restraint pressure of 4000 kPa for Class II rock. This ultimate value will need to incorporate an adequate factor of safety to limit wall movement that is required to fully mobilise the passive resistance. The top 0.5 m of the embedded depth/length (i.e. below bulk level) should be ignored due to possible disturbance and over-excavation.

7.3.4 Ground Anchors

The preliminary design of temporary ground anchors for the support of shoring/retaining systems may be carried out on the basis of the parameters and maximum allowable bond stresses given in Table 2.

Table 2: Design Parameters and Allowable Bond Stresses for Anchor Design

Material Description	Soil Friction Angle (degrees)	Maximum Allowable Bond Stress (kPa)	Maximum Ultimate Bond Stress (kPa)
Dense Gravel	38	-	-
Class IV Laminite	-	50	100
Class II (or better) Laminite	-	500	1500

The parameters given in Table 2 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind a line drawn up at 45 degrees from the base of the shoring, or top of Class II laminite. 'Lift-off' tests should be carried out to confirm the anchor capacities. It is suggested that ground anchors should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load.

It is anticipated that the building will support the shoring walls over the long term and therefore the ground anchors are expected to be temporary only. The use of permanent anchors would require careful attention to corrosion protection including full column grouting and the use of an internal

corrugated sheathing over the full length of the anchor and an easement for the anchors. A detailed specification would need to be prepared for the installation and stressing of permanent anchors.

7.3.5 Excavation Induced Ground Movements

It is likely that the excavation will induce some ground movements on the adjacent properties within the area of influence of the excavation. As a guide, well designed shoring walls in sand and gravel supported by anchors may experience lateral wall movements in the order of 1-2 mm for each metre of excavation depth. The extent of movement will depend on the final design and construction methods used.

Precise survey monitoring of the shoring walls and adjacent existing building walls should be carried out to assess vertical and horizontal movements during the excavation. Surveying should commence prior to excavation to provide a baseline and should continue every 1.5 m drop of in excavation height. If surveyed deflections show a rapid increase in the rate of movement or exceed the predicted movements, then the structural engineer and geotechnical engineer should be contacted for immediate review.

7.3.6 Excavation Adjacent to RMS Infrastructure

Reference should be made to the TfNSW Geotechnical Technical Direction (GTD) 2020/001 dated 2 July 2020, with regards to excavation/shoring adjacent to Hill Street and Mulgoa Road (both TfNSW state classified roads). This document outlines requirements for excavations adjacent to TfNSW infrastructure and includes the level of geotechnical investigation required, dilapidation surveying, instrumentation and monitoring during construction, trigger levels and contingency plans.

Instrumentation (e.g. inclinometers) and monitoring is typically required where the excavation exceeds 3 m in height (for cantilevered shoring walls) or 6 m in height (for anchored or propped shoring walls). A geotechnical monitoring plan may be required by TfNSW prior to construction for this site.

7.4 Groundwater and Dewatering

Based on the groundwater levels at RL20.5 to RL18.3 measured during the investigation and groundwater monitoring programme, the bulk excavation for Basement 3 (assumed RL18.1 m) will be 2.4 m below the highest measured water level. There is potential for groundwater levels to rise by at least 3 m during and following prolonged heavy rainfall and possibly higher during floods and this should be considered. Longer term groundwater monitoring is recommended to assess current groundwater levels and to further assess fluctuations and response to rainfall.

Temporary dewatering will be required to control and temporarily lower the groundwater table to allow construction of the lowest, third basement level. Generally the groundwater level should be lowered to at least 0.5 m below the bulk excavation to allow machinery to operate and traverse the site. On this basis, the groundwater level may need to be temporarily lowered by approximately 3 m to 4 m depth.

The need to tank the basement will be dependent on discussions with the WaterNSW, DPIE and Council. It is likely, however, that at a minimum the third basement level will need to be tanked and designed for hydrostatic uplift if it can be accepted that inflows will occur during short term rises and flooding events. A partially tanked basement consisting of watertight basement walls socketed into the bedrock, with the basement floor being drained could be considered but will also be subject to approvals. This will also be subject to assessment inflow and drawdown impacts.

Dewatering on sites underlain by granular soils is usually undertaken with spears installed at regular spacings within the confines of the excavation. Spears (slotted PVC pipes) are installed below the groundwater table and generally spaced at about 1 m to 2 m centres around the perimeter of the excavation. The spears are connected by a series of pumps and hoses which collect groundwater, usually in a sedimentation tank, prior to discharge off-site. Sump and pump dewatering methods are unlikely to be practical or effective for the high permeability sandy soils. Difficulty may arise in installing dewatering spears through the dense gravels.

The dewatering system design should give due consideration to drawdown effects on adjacent properties and dewatering of the site should be carried out by a contractor with demonstrated experience in similar conditions. The use of recharge wells or infiltration trenches may be considered to reduce drawdown of groundwater levels outside the site, subject to approval from relevant authorities (i.e. Council and WaterNSW).

It is anticipated that the dewatering system will require lowering of the normal groundwater table by approximately 3 m to 4 m. Due to the dense gravelly soils, this drawdown will result in negligible settlement of the alluvial soils surrounding the site.

Groundwater levels should be monitored during construction. This is generally achieved by installing monitoring wells in accessible areas on the site and adjacent areas, with levels monitored twice daily during initial dewatering, reducing to once per week in the long term until dewatering ceases.

The groundwater removed from the site will require disposal. Generally, water resulting from dewatering operations should be suitable for disposal by pumping to stormwater drains subject to confirmation testing and approval from Council. Re-injection into the aquifer may be considered to minimise off-site disposal, however, further review and engineering input would be required together with approval from relevant authorities (i.e. Council and WaterNSW). Further investigation and analysis of the groundwater quality should be carried out prior to detailed design and planning. This further work would be best carried out after the existing buildings are demolished.

7.5 Foundations

It is expected that the bulk excavation level may expose dense to very dense gravels, with bedrock at about a further 3 m to 6 m below bulk level.

7.5.1 Shallow Foundations

For shallow pad or strip footings founded on the dense gravel with an embedment of about 0.75 m to 1 m, an allowable bearing pressure of 500 kPa would be appropriate. As a guide, settlements equal to about 1% of the footing width may occur for footings designed for these allowable bearing pressures, although there is always enhanced risk with the estimate of settlement of footings bearing in loose sand.

7.5.2 Raft Foundation

Due to the dense gravels, consideration may be given to the use of a raft slab foundation. This however, may require additional excavation and reworking the exposed material. As a guide, preliminary design of raft slabs to support distributed loadings may be based on a modulus of subgrade reaction of the order of 5 - 10 kPa/mm for broadly uniformly loaded areas (say 20 m by 20 m). It is noted that the modulus of subgrade reaction value relates to the settlement under a specific loading, and it is very dependent on the size of the loaded area and the rigidity of the raft system.

7.5.3 Pile Foundations

Recommended maximum bearing pressures for the various rock strata are presented in Table 3. For piles, shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the values for compression. For detailed design of the large building footings deeper cored boreholes will be required assuming rock socketed piles will be adopted.

Table 3: Recommended Design Parameters for Foundation Design

Foundation Stratum	Maximum Allowable Pressure		Maximum Ultimate Pressure	
	End Bearing (kPa)	Shaft Adhesion* (Compression) (kPa)	End Bearing (kPa)	Shaft Adhesion* (Compression) (kPa)
Class IV Laminite	1,500	150	6,000	350
Class II (or better) Laminite	3,500	350	20,000	800

NOTE: * Shaft adhesion applies to pile foundations for which the socket sidewalls are adequately cleaned and roughened to “R2” standard (or better) as defined in Pells et. al. (1998)

7.6 Soil Aggressivity

The laboratory test results for soil aggressivity were compared with the exposure classifications outlined in Australian Standard AS 2159 – 2009 *Piling – Design and installation*. The results indicate that the soils are ‘mild to buried concrete elements and ‘non-aggressive’ to buried steel elements.

8. Further Investigation

It is recommended that further investigation is carried out for detailed design and construction. This should include additional rock cored boreholes to confirm rock levels for shoring and foundation design, and further long term groundwater monitoring to assess groundwater fluctuations.

9. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at 87-91 Union Rd, 634-638 High St, 640-652 High St Penrith in accordance with DP's proposal SYD170044 dated 23 January 2017 and subsequent emails. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Toga Penrith Developments Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

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Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

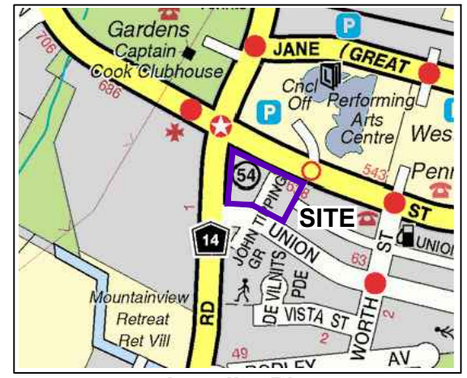
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate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

Site Inspection

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

Appendix B

Drawing 1



Locality Plan

NOTE:
1: Base image from Nearmap.com (Dated Feb. 2017)
2: Test locations are approximate only and were located using hand-held GPS.

0 10 20 30 40 50 75 100m
1:1000 @ A3

LEGEND

- Cored Borehole Location
- Shallow Borehole Location
- W Groundwater monitoring well
- Geotechnique Borehole Location (2007)

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Toga Development and Construction Pty Ltd		TITLE: **Locations of Boreholes and Wells**
OFFICE: Sydney	DRAWN BY: PSCH	**Proposed Mixed Use Development, 634-652A High Street,**
SCALE: 1:1000 @ A3	DATE: 31.3.2017	**87-89 Union Road and 6 John Tipping Grove, PENRITH**

N

PROJECT No:	85867.00
DRAWING No:	1
REVISION:	0

Appendix C

Borehole and Well Logs

Sampling Methods

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Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. 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	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

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

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with ‘Mix of Soil and Cobbles/Boulders’ with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

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
Friable	Fr	-

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	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

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;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- ‘Moist, dry of plastic limit’ or ‘w <PL’ (i.e. hard and friable or powdery).
- ‘Moist, near plastic limit’ or ‘w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- ‘Moist, wet of plastic limit’ or ‘w >PL’ (i.e. soils usually weakened and free water forms on the hands when handling).
- ‘Wet’ or ‘w ≈LL’ (i.e. near the liquid limit).
- ‘Wet’ or ‘w >LL’ (i.e. wet of the liquid limit).

Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it 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 Point Load Strength Index $Is_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

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

* 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
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured , usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

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 occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

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

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

where 'sound' rock is assessed to be rock of low strength or stronger. 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

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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

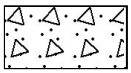
Symbols & Abbreviations

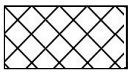
Graphic Symbols for Soil and Rock

General

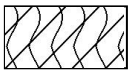

Asphalt

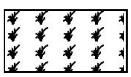

Road base

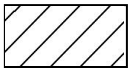

Concrete

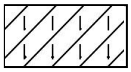

Filling

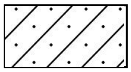
Soils


Topsoil

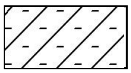

Peat

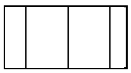

Clay

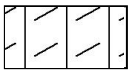

Silty clay

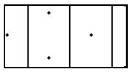

Sandy clay

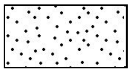

Gravelly clay

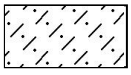

Shaly clay

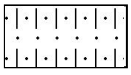

Silt


Clayey silt


Sandy silt

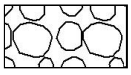

Sand

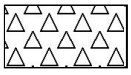

Clayey sand


Silty sand


Gravel

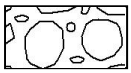

Sandy gravel


Cobbles, boulders

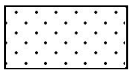

Talus

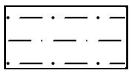
Sedimentary Rocks

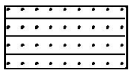

Boulder conglomerate

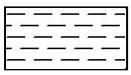

Conglomerate


Conglomeratic sandstone

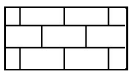

Sandstone


Siltstone

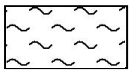

Laminite

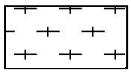

Mudstone, claystone, shale

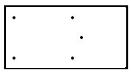

Coal


Limestone

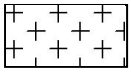
Metamorphic Rocks

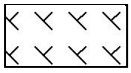

Slate, phyllite, schist

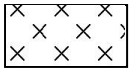

Gneiss

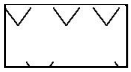

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.4 AHD
EASTING: 285841
NORTHING: 6263031
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85867.00
DATE: 6-3-2017
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
26		FILLING - brown silty clay filling with some gravel, damp							E			PID=1.8
									E*			PID=2.0
	0.7	SILTY CLAY - stiff, brown silty clay, MC<PL, apparently low plasticity										
25	1								S/E			8,5,6 N = 11
	2.0	CLAYEY SAND - medium dense, brown and light brown medium grained clayey sand, moist										
24	2								S			4,5,7 N = 12
	3.0	SILTY SANDY GRAVEL - dense to very dense, brown, fine to medium grained sandy gravel and cobbles with some silty clay and possible boulders										
23	3											
	4								S			5/0mm refusal bouncing
22												
	5											
21												
	6											
20												
	7					▼			S			21/140mm refusal bouncing
19												
	8											
18												
	9											
17									S			5/0mm

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.0m

TYPE OF BORING: Sonic to 13.03m; HQ-Coring to 16.0m

WATER OBSERVATIONS: Free groundwater observed at 7.0m during drilling

REMARKS: *BD2 taken at 0.5m. Standpipe installed to 16.0m

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: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.4 AHD
EASTING: 285841
NORTHING: 6263031
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85867.00
DATE: 6-3-2017
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
16		SILTY SANDY GRAVEL - dense to very dense, brown, fine to medium grained sandy gravel and cobbles with some silty clay and possible boulders *(continued)*										refusal bouncing
11												
15												
12	12.1	LAMINITE - extremely low to very low strength, grey laminite						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
14												
13	13.03	INTERBEDDED SANDSTONE & SILTSTONE - medium then high strength, slightly weathered then fresh, slightly fractured, grey and light grey fine grained sandstone interbedded/laminated with siltstone						13.08-13.1m: B0°- 5°, cly 13.32m: J25°				PL(A) = 1.57
13												
14												PL(A) = 2.48
12								14.42m: B5°, cly, 2m 14.67m: J60°	C	100	99	
11												PL(A) = 2.99
15												
16	16.0	Bore discontinued at 16.0m - limit of investigation										
10												
17												
9												
18												
8												
19												
7												

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.0m

TYPE OF BORING: Sonic to 13.03m; HQ-Coring to 16.0m

WATER OBSERVATIONS: Free groundwater observed at 7.0m during drilling

REMARKS: *BD2 taken at 0.5m. Standpipe installed to 16.0m

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


Douglas Partners
Geotechnics | Environment | Groundwater
Project No: 85867.00
BH ID: BH 1
Depth: 13.03 - 16.00 m
Core Box No.: 1
85867.00 PENRITH 06/03/17 BH1 START CORING 13.03m
13.03
14
15

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.4 AHD
EASTING: 285841
NORTHING: 6263031
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85867.00
DATE: 6-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown silty clay filling with some gravel, damp		E	0.1		PID=1.8		
				E*	0.5		PID=2.0		
	0.7	SILTY CLAY - stiff, brown silty clay, MC<PL, apparently low plasticity		S/E	1.0		8,5,6 N = 11		
					1.45				
	2.0	CLAYEY SAND - medium dense, brown and light brown medium grained clayey sand, moist		S	2.5		4,5,7 N = 12		Backfill
	3.0	SILTY SANDY GRAVEL - dense to very dense, brown, fine to medium grained sandy gravel and cobbles with some silty clay and possible boulders			2.95				
				S	4.0		5/0mm refusal bouncing		Bentonite
									Sand Backfill
				S	7.0		21/140mm refusal bouncing	▼	Slotted Pipe
					7.14				
				S	10.0		5/0mm refusal bouncing		
	12.1	LAMINITE - extremely low to very low strength, grey laminite							
	13.03	INTERBEDDED SANDSTONE & SILTSTONE - medium then high strength, slightly weathered then fresh, slightly fractured, grey and light grey fine grained sandstone interbedded/laminated with siltstone			13.03				
					13.25		PL(A) = 1.57		
				C	14.2		PL(A) = 2.48		
					15.2		PL(A) = 2.99		Sand Backfill
									Slotted Pipe
	16.0	Bore discontinued at 16.0m - limit of investigation			16.0				

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.0m

TYPE OF BORING: Sonic to 13.03m; HQ-Coring to 16.0m

WATER OBSERVATIONS: Free groundwater observed at 7.0m during drilling

REMARKS: *BD2 taken at 0.5m. Standpipe installed to 16.0m

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: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285921
NORTHING: 6263009
DIP/AZIMUTH: 90°/--

BORE No: 2A
PROJECT No: 85867.00
DATE: 3 - 6/3/2017
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
27	0.05	CONCRETE										
		FILLING - light grey-brown, clayey sand, crushed sandstone and roadbase gravel filling										
26	0.9	SILTY SAND - loose, orange-brown, fine to medium grained silty sand, moist										
25	2.5	GRAVELLY SILTY SAND/SILTY SANDY GRAVEL - dense, light brown, fine to medium grained sub-rounded to sub-angular river gravel and silty sand, moist										
24												
23												
22												
21	6.5	SANDY GRAVEL - dense, light brown, fine to medium sandy gravel and cobbles (subrounded, rounded and angular), moist				30-03-17						
20												
19												
18												

RIG: Sonic Rig **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.4m

TYPE OF BORING: Sonic to 13.46m; HQ-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 6.0m. Water measured in standpipe at 6.8m on 30/03/17

REMARKS: Standpipe installed to 16.5m

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: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285921
NORTHING: 6263009
DIP/AZIMUTH: 90°/--

BORE No: 2A
PROJECT No: 85867.00
DATE: 3 - 6/3/2017
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
17	11	SANDY GRAVEL - dense, light brown, fine to medium sandy gravel and cobbles (subrounded, rounded and angular), moist *(continued)*						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
16	12											
15	13											
14	13.2	LAMINITE - extremely low to very low strength, grey laminite										
	13.46	LAMINITE - medium strength, slightly weathered, fractured, grey and light grey laminite						13.53m: B0°- 5°, cly, sm 13.62-13.67m: 3x B0°- 5°, cly sm 13.73-14.03m: 12x B0°- 5°, cly sm 14.15m: B0°, cly, partially he 14.27m: J30°, cly, sm 14.29m: B0°- 5°, cly, sm 14.41m: J20°, cly, sm				
13	14											
	14.4	INTERBEDDED SANDSTONE & SILTSTONE - high strength, fresh, slightly fractured to unbroken, grey and light grey, fine grained sandstone (60%) interbedded/interlaminated with siltstone (40%)							C	100	84	PL(A) = 0.73 PL(A) = 1.62
12	15											
11	16											
	16.5	Bore discontinued at 16.5m										
10	17											
9	18											
8	19											

RIG: Sonic Rig **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.4m

TYPE OF BORING: Sonic to 13.46m; HQ-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 6.0m. Water measured in standpipe at 6.8m on 30/03/17

REMARKS: Standpipe installed to 16.5m

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


Douglas Partners
Geotechnics | Environment | Groundwater
Project No: 85867.00
BH ID: BH 2A
Depth: 13.46 - 16.50 m
Core Box No.: 1
85867.00 PENRITH BH2A START CORING 13.46m
14
15
16
EOH 16.5m

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285921
NORTHING: 6263009
DIP/AZIMUTH: 90°/--

BORE No: 2A
PROJECT No: 85867.00
DATE: 3 - 6/3/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
27.25	0.05	CONCRETE							
		FILLING - light grey-brown, clayey sand, crushed sandstone and roadbase gravel filling							
26.4	0.9	SILTY SAND - loose, orange-brown, fine to medium grained silty sand, moist							Backfill
25.8	2.5	GRAVELLY SILTY SAND/SILTY SANDY GRAVEL - dense, light brown, fine to medium grained sub-rounded to sub-angular river gravel and silty sand, moist							Bentonite; Sand Backfill
21.8	6.5	SANDY GRAVEL - dense, light brown, fine to medium sandy gravel and cobbles (subrounded, rounded and angular), moist						30-03-17	Slotted Pipe
14.1	13.2								
13.86	13.46	LAMINITE - extremely low to very low strength, grey laminite			13.46				
		LAMINITE - medium strength, slightly weathered, fractured, grey and light grey laminite							
13.4	14.4	INTERBEDDED SANDSTONE & SILTSTONE - high strength, fresh, slightly fractured to unbroken, grey and light grey, fine grained sandstone (60%) interbedded/interlaminated with siltstone (40%)		C	14.55		PL(A) = 0.73		Sand Backfill; Slotted Pipe
					15.65		PL(A) = 1.62		
10.8	16.5	Bore discontinued at 16.5m			16.5				

RIG: Sonic Rig **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.0m

TYPE OF BORING: Sonic to 13.46m; HQ-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 6.0m. Water measured in standpipe at 6.8m on 30/03/17

REMARKS: Standpipe installed to 16.5m

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: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.9 AHD
EASTING: 285831
NORTHING: 6262952
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 85867.00
DATE: 1-3-2017
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
	0.02	ASPHALTIC CONCRETE							E*			PID<1
	0.4	FILLING - brown silty clay filling with some gravel and cobbles and a trace of sand, damp - with some brick rubble from 0.3m							E			PID<1
26	0.8 1	FILLING - brown silty clay filling with some brick fragments SILTY CLAY - firm, brown silty clay, MC<PL, apparently low plasticity							S/E			3,2,4 N = 6 PID<1
25	2											
	2.5	CLAYEY SAND - loose to medium dense, brown and light brown clayey sand, damp to moist							S			5,4,4 N = 8
24	3											
	3.5	SILTY SANDY GRAVEL - dense to very dense, brown and grey fine to medium sandy gravel and cobbles with some silty clay and possible boulders							S			5/20mm refusal bouncing
23	4											
22	5											
21	6					30-03-17						
20	7								S			4/10mm refusal bouncing
19	8											
18	9											
17									S			5/10mm

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 12.8m

TYPE OF BORING: Sonic to 12.85m; HQ-Coring to 17.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 4.0m. Water measured in standpipe at 6.5m on 30/03/17

REMARKS: Standpipe installed to 16.8m

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: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.9 AHD
EASTING: 285831
NORTHING: 6262952
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 85867.00
DATE: 1-3-2017
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
16	11	SILTY SANDY GRAVEL - dense to very dense, brown and grey fine to medium sandy gravel and cobbles with some silty clay and possible boulders *(continued)*						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				refusal bouncing
15	12											
	12.2	LAMINITE - extremely low to very low strength, grey laminite										
14	12.85											
13	13	SHALE - medium strength, slightly weathered, fractured then slightly fractured, grey shale with some fine sandstone laminations						13m: B0°- 5°, cly 13.02m: B0°- 5°, cly 13.12-13.49m: 9x B5°- 15°, cly 13.7m: B0°- 5°, fe				PL(A) = 0.5 PL(A) = 0.98
13	13.95	INTERBEDDED SANDSTONE & SILTSTONE - high and very high strength, fresh, unbroken, light grey to grey, fine grained sandstone (50%) interbedded with siltstone (50%)							C	100	80	PL(A) = 3.74
12	15							14.8m: J80°, cu (partially he)				PL(A) = 2.86
	15.65	LAMINITE - medium strength, fresh, unbroken, light grey to grey laminite with approximately 25% fine grained sandstone laminations							C	100	100	PL(A) = 0.93
10	16											
	17 17.0	Bore discontinued at 17.0m										
9	18											
8	19											
7												

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 12.8m

TYPE OF BORING: Sonic to 12.85m; HQ-Coring to 17.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 4.0m. Water measured in standpipe at 6.5m on 30/03/17

REMARKS: Standpipe installed to 16.8m

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
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Douglas Partners
Geotechnics | Environment | Groundwater
Project No: 85867.00
BH ID: BH 3
Depth: 12.85 - 16.00
Core Box No.: 1
85867.00 PENRITH 01/03/17 BH 3 START CORING 12.85 m
13
14
15


Douglas Partners
Geotechnics | Environment | Groundwater
Project No: 85867.00
BH ID: BH 3
Depth: 16.00 - 17.00
Core Box No.: 2
16

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.9 AHD
EASTING: 285831
NORTHING: 6262952
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 85867.00
DATE: 1-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
26.9	0.02	ASPHALTIC CONCRETE		E*	0.1		PID<1		
26.5	0.4	FILLING - brown silty clay filling with some gravel and cobbles and a trace of sand, damp		E	0.5		PID<1		
26.1	0.8	- with some brick rubble from 0.3m			1.0		3,2,4 N = 6		Backfill
				S/E					
25.9	1	FILLING - brown silty clay filling with some brick fragments			1.45		PID<1		
25.4	1.5	SILTY CLAY - firm, brown silty clay, MC<PL, apparently low plasticity			2.5				
24.4	2.5	CLAYEY SAND - loose to medium dense, brown and light brown clayey sand, damp to moist		S	2.95		5,4,4 N = 8		Bentonite
23.9	3.5	SILTY SANDY GRAVEL - dense to very dense, brown and grey fine to medium sandy gravel and cobbles with some silty clay and possible boulders		S	4.0 4.02		5/20mm refusal bouncing		Sand Backfill / Slotted Pipe
20.9	7			S	7.0 7.02		4/10mm refusal bouncing	30-03-17	
16.9	10			S	10.0		5/10mm refusal bouncing		
14.9	12								
14.7	12.2	LAMINITE - extremely low to very low strength, grey laminite							
14.05	12.85	SHALE - medium strength, slightly weathered, fractured then slightly fractured, grey shale with some fine sandstone laminations			12.85 12.9		PL(A) = 0.5		
					13.6		PL(A) = 0.98		
13.1	13.95	INTERBEDDED SANDSTONE & SILTSTONE - high and very high strength, fresh, unbroken, light grey to grey, fine grained sandstone (50%) interbedded with siltstone (50%)		C	14.2		PL(A) = 3.74		
	15				15.1		PL(A) = 2.86		Sand Backfill / Slotted Pipe
11.25	15.65	LAMINITE - medium strength, fresh, unbroken, light grey to grey laminite with approximately 25% fine grained sandstone laminations			15.65				
	16			C	16.2		PL(A) = 0.93		
9.9	17.0	Bore discontinued at 17.0m			17.0				

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS **CASING:** 115mm Sonic Casing to 13.0m

TYPE OF BORING: Sonic to 12.85m; HQ-Coring to 17.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 4.0m. Water measured in standpipe at 6.5m on 30/03/17

REMARKS: Standpipe installed to 16.8m

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285911
NORTHING: 6262903
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 85867.00
DATE: 1 - 2/3/2017
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
27	0.2	FILLING - brown and grey, silty clay filling with some gravel and rootlets							E			PID<1
		SILTY CLAY - very stiff, brown and red-brown silty clay MC<PL, apparently low plasticity							E			PID=1.5
26	1								S			13,10,10 N = 20 PID<1
	1.7	SILTY SANDY GRAVEL - dense to very dense, fine to medium grained sandy gravel and cobbles with some silty clay and possible boulders							S			5/0mm refusal bouncing
23	5								S			5/0mm refusal bouncing
19	9								S			3,8,20/120mm refusal

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS/SI **CASING:** 115mm Sonic Casing to 14.3m

TYPE OF BORING: Sonic to 14.35m; HQ-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 5.0m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285911
NORTHING: 6262903
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 85867.00
DATE: 1 - 2/3/2017
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
17		SILTY SANDY GRAVEL - dense to very dense, fine to medium grained sandy gravel and cobbles with some silty clay and possible boulders *(continued)*							S			5/0mm refusal bouncing
16	11											
15	12											
14	13							Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
13	13.8	LAMINITE - extremely low to very low strength, grey laminite										
13	14.35	INTERBEDDED SANDSTONE & SILTSTONE - medium then high strength, fresh, slightly fractured then unbroken, light grey and grey, fine grained sandstone (70%) interbedded/laminated with siltstone (30%)						14.47m: B0°, cly, 5mm 14.6m: B0°, cly co, 2mm 15.2m: J25°, pl, ro, cln	C	100	99	PL(A) = 0.66 PL(A) = 1.93 PL(A) = 1.9
12	15											
11	16											
10	17											
10	17.45	Bore discontinued at 17.45m										PL(A) = 1.39
9	18											
8	19											

RIG: Sonic **DRILLER:** Terratest **LOGGED:** JS/SI **CASING:** 115mm Sonic Casing to 14.3m

TYPE OF BORING: Sonic to 14.35m; HQ-Coring to 16.0m

WATER OBSERVATIONS: No free groundwater observed before adding water at 5.0m.

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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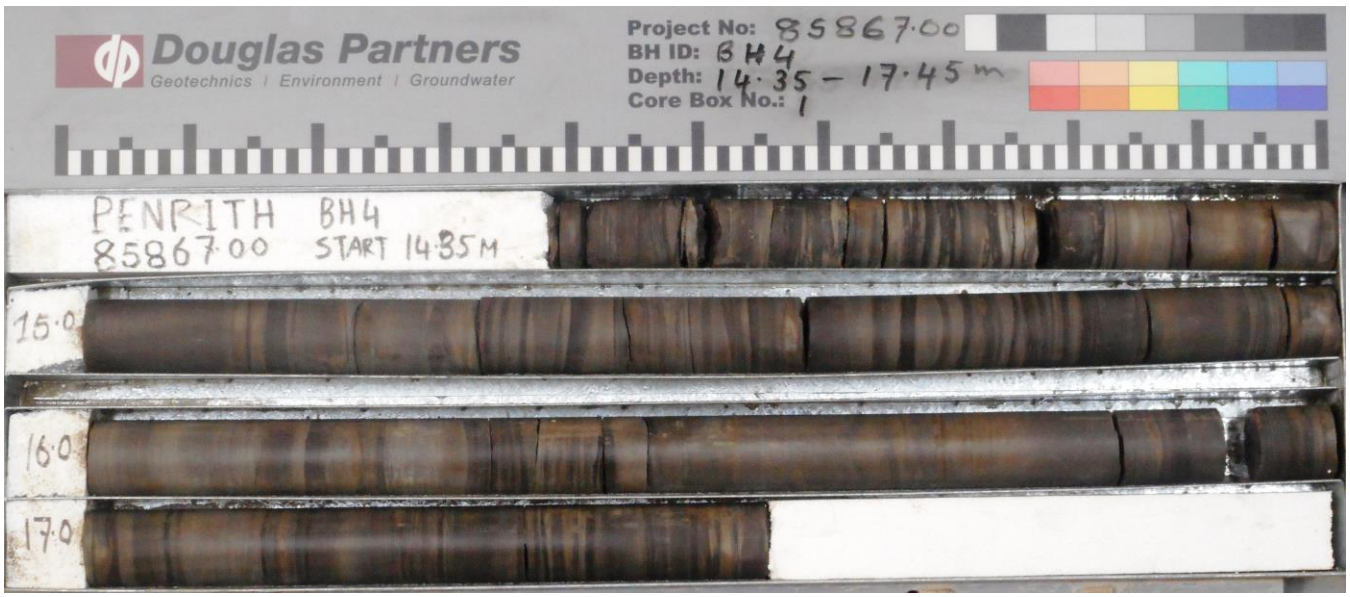
Douglas Partners
Geotechnics | Environment | Groundwater
Project No: 85867.00
BH ID: BH4
Depth: 14.35 - 17.45 m
Core Box No.: 1
PENRITH BH4
85867.00 START 14.35M
15.0
16.0
17.0

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.2 AHD
EASTING: 285883
NORTHING: 6262993
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 85867.00
DATE: 2-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
27	0.02	ASPHALTIC CONCRETE							
		FILLING - brown and grey, sandy gravel filling, damp		E	0.2		PID<1		
	0.25	FILLING - brown silty clay and gravel filling, damp		E	0.5		PID<1		
	0.6	SILTY CLAY - stiff to very stiff, brown silty clay, MC<PL, apparently low plasticity							
26	1			E	1.0		PID<1		1
	1.5	Bore discontinued at 1.5m - limit of investigation							

RIG: 3.5T Excavator **DRILLER:** BM **LOGGED:** JS **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger to 1.5m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.6 AHD
EASTING: 285933
NORTHING: 6262969
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 85867.00
DATE: 2-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown sandy gravel filling		E	0.1		PID<1		
	0.25	SILTY SAND - brown, fine to medium grained silty sand with some silty clay							
27				E	0.5		PID<1		
	1.0	Bore discontinued at 1.0m		E	1.0		PID<1		1
26									

RIG: 3.5T Excavator **DRILLER:** BM **LOGGED:** JS **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger to 1.0m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 26.4 AHD
EASTING: 285827
NORTHING: 6262992
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 85867.00
DATE: 2-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.01	ASPHALTIC CONCRETE							
		FILLING - grey sandy gravel filling							
	0.1	SILTY SAND - brown, fine to medium grained silty sand with some clay, damp		E	0.1		PID<1		
26				E	0.5		PID<1		
	1 1.0	Bore discontinued at 1.0m		E	1.0		PID<1		1
25									

RIG: 3.5T Excavator **DRILLER:** BM **LOGGED:** JS **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger to 1.0m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.1 AHD
EASTING: 285866
NORTHING: 6262957
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 85867.00
DATE: 2-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
27	0.03	ASPHALTIC CONCRETE							
		FILLING - brown silty clay filling with a trace of gravel, damp		E	0.1		PID<1		
	0.25	FILLING - brown sandy gravel filling, damp		E	0.3		PID<1		
	0.4	SILTY SAND - brown, fine to medium grained silty sand with some silty clay		E	0.5		PID<1		
26	1.0	Bore discontinued at 1.0m - limit of investigation		E	1.0		PID<1		1

RIG: 3.5T Excavator **DRILLER:** BM **LOGGED:** JS **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger to 1.0m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285908
NORTHING: 6262953
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 85867.00
DATE: 2-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
27		FILLING - grey sandy gravel filling, damp - becoming silty sand with gravel filling		E	0.1		PID<1		
	0.4	FILLING - brown silty sand filling, damp (possibly natural)		E	0.5		PID<1		
	0.7	SILTY CLAY - firm, brown silty clay, MC<PL, apparently low plasticity							
	1			E	1.0		PID<1		1
26	1.3	Bore discontinued at 1.3m - limit of investigation							

RIG: 3.5T Excavator **DRILLER:** BM **LOGGED:** JS **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger to 1.3m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Toga Development and Construction Pty Ltd
PROJECT: Proposed Mixed-Use Development
LOCATION: 640-652 & 634-638 High Street & 87-91 Union Road, Penrith

SURFACE LEVEL: 27.3 AHD
EASTING: 285877
NORTHING: 6262920
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 85867.00
DATE: 2-3-2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.01	ASPHALTIC CONCRETE							
		FILLING - brown silty clay filling with some gravel, damp		E	0.1		PID<1		
27	0.2	FILLING - brown silty clay filling with some sand and gravel, moist		E	0.5		PID<1		
	0.8	SILTY CLAY - firm to stiff, brown silty clay, MC<PL, apparently low plasticity, moist							
	1			E	1.0		PID<1		1
26	1.3	Bore discontinued at 1.3m - limit of investigation							

RIG: 3.5T Excavator **DRILLER:** BM **LOGGED:** JS **CASING:** Uncased
TYPE OF BORING: 150mm diameter solid flight auger to 1.3m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix D

Laboratory Test Results

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

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

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

CERTIFICATE OF ANALYSIS 165175

Client:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Luke James Hall

Sample log in details:

Your Reference:	**85867.00, Penrith**		
No. of samples:	3 Soils		
Date samples received / completed instructions received	12/04/17	/	12/04/17

Analysis Details:

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

Report Details:

Date results requested by: / Issue Date:	13/04/17	/	13/04/17
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

David Springer
General Manager

Misc Inorg - Soil				
Our Reference:	UNITS	165175-1	165175-2	165175-3
Your Reference	---------- -	BH1	BH4	BH4
Depth	----------	2.5-2.95	1.0-1.45	8.5-8.92
Date Sampled		1/03/2017	1/03/2017	1/03/2017
Type of sample		Soil	Soil	Soil
Date prepared	-	13/04/2017	13/04/2017	13/04/2017
Date analysed	-	13/04/2017	13/04/2017	13/04/2017
pH 1:5 soil:water	pH Units	6.9	6.6	8.0
Electrical Conductivity 1:5 soil:water	µS/cm	16	70	59
Chloride, Cl 1:5 soil:water	mg/kg	<10	10	26
Sulphate, SO4 1:5 soil:water	mg/kg	<10	83	21

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. Alternatively determined by colourimetry/turbidity using Discrete Analyer.

QUALITY CONTROL Misc Inorg - Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			13/04/2017	165175-1	13/04/2017 || 13/04/2017	LCS-1	13/04/2017
Date analysed	-			13/04/2017	165175-1	13/04/2017 || 13/04/2017	LCS-1	13/04/2017
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	165175-1	6.9 || 7.0 || RPD: 1	LCS-1	101%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	165175-1	16 || 18 || RPD: 12	LCS-1	99%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	165175-1	<10 || <10	LCS-1	82%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	165175-1	<10 || <10	LCS-1	87%

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	165175-2	13/04/2017
Date analysed	-	[NT]	[NT]	165175-2	13/04/2017
pH 1:5 soil:water	pH Units	[NT]	[NT]	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	[NT]	[NT]	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	165175-2	90%
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	165175-2	130%

Report Comments:

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

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

Quality Control Definitions

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

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

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

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

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

Laboratory Acceptance Criteria

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	
Contact Person: Luke James-Hall	
Project Mgr: Luke James-Hall	
Address: 96 Hermitage Road, West Ryde NSW 2114	
Phone: 9809 0666 **Mob:** 0407 216 678	
Email: luke.james-hall @douglaspartners.com.au	
Project Number 85867.00	
Project Name: Penrith	
PO No.:	
lab Quote No. :	
Date results required: ASAP	
Or choose: 24 Hour	
Note: Inform lab in advance if urgent turnaround is required - surcharges apply	
Report format: PDF / Excel	
Comments:	
To: Envirolab Services	
Contact Person: Aileen Hie	
Address: 12 Ashley Street, Chatswood NSW 2068	
Phone: 02 9910 6200	
Fax: 02 9910 6201	
Email: ahie@envirolab.com.au	
Laboratory Report No:	
Lab Comments:	

Sample information						Tests Required									Comments
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	Aggressivity (pH, EC, S04, Cl)									Provide as much information about the sample as you can
1	BH1	2.5-2.95	1/3/17	Bag		X									
2	BH4	1.0-1.45	1/3/17	Bag		X									
3	BH4	8.5-8.92m	1/3/17	Bag		X									

ENVIROLAB GROUP

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

Job No: 165175 12/4
Date Received:
Time Received: 1415
Received by: PH
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	
Hand delivered / Courier (by whom)	
Condition of Sample at dispatch Cool or Ambient (circle)	
Temperature (if Applicable):	
Print Name: Luke James-Hall	
Date & Time: 12 April 2017	
Signature:	
Sample Receipt	
Received by (Company): ES	
Print Name: PH	
Date & Time: 12/4 1415	
Signature:	
Lab use only:	
Samples Received: Cool or Ambient (circle one)	
Temperature Received at: (if applicable)	
Transported by: Hand delivered / courier	

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