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TOGA WICKS PARK DEVELOPMENTS PTY LTD

Geotechnical Investigation Report

182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW

E24098.G03
12 February 2019

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1. Introduction

1.1 Background

At the request of TOGA Wicks Park Developments Pty Ltd (the Client), EI Australia (EI) has carried out a Report re Geotechnical Investigation Report (GI) for the proposed development at 182-198 Victoria Road, Marrickville, NSW (the site).

This GI report has been prepared to provide advice and recommendations to assist in the preparation of designs for the proposed development. The assessment has been carried out in accordance with the agreed scope of works outlined in EI's proposal referenced P16989.1, dated 12 December 2018, and with the Client's signed authorisation to proceed.

1.2 Proposed Development

The following documents, supplied by the Client, were used to assist with the preparation of this GI report:

- Architectural Drawings prepared by TURNER Studio – Project No. 18003, Drawing Nos. A-DA-001, A-DA-002, A-DA-008 to A-DA-023, DA-350-001, DA-350-111, DA- 350-112, DA-350-114, A-DA-120 and A-DA-180 to A-DA-189, latest Revision D, dated 6 February 2019.
- Geotechnical Investigation Report prepared by Aargus – Report NO. GS5611/1A, dated 22 January 2014.
- Structural Design Report prepared by Taylor Thomson Whitting – Referenced 181392, dated 23 May 2018;
- Survey prepared by JBW Surveyors Pty Ltd – Plan Ref. 125017 Wicks Park Site 'A' Boundaries, dated 1 February 2018. The datum is in Australian Height Datum (AHD). All levels referred to in this report are in reference to AHD.
- Detailed Survey prepared by True North Surveys – Drawing No. 8333DU, Job Ref. 8333, dated 1 September 2016;
- Email from Client (dated 12 February 2019, subject "RE: Wicks Park Reports - Comments for Final Report")

Based on the provided documents, EI understands that the proposed development involves the demolition of the existing site structures and the construction of a six to fourteen-storey mixed use building overlying a two-level basement. However, this investigation has taken into consideration a possible third basement level. The second basement level is proposed to have a finished floor level (FFL) of RL -3.2m Australian Height Datum (AHD). The possible third basement level is assumed to require a FFL of RL -6.2m AHD. A Bulk Excavation Level (BEL) of RL -6.4m AHD is assumed for the construction which includes allowance for a concrete basement slab. To achieve the BEL, an excavation depth between about 8.5m to 10.0m Below Existing Ground Level (BEGL) is expected. Locally deeper excavations may be required for footings, service trenches, crane pads, and lift overrun pits.

1.3 Assessment Objectives

The objective of the GI was to assess site surface and subsurface conditions at the nine borehole locations to provide geotechnical advice and recommendations addressing the following:

- Dilapidation Surveys;
- Excavation methodologies and monitoring requirements, including rock excavation;
- Vibration considerations;
- Groundwater considerations;
- Excavation support requirements, including geotechnical design parameters;
- Building foundation options, including;
  - Design parameters.
  - Earthquake loading factor in accordance with AS1170.4:2007.
- The requirement for additional geotechnical works.

1.4 Scope of Works

The scope of works for the GI included:

- Preparation of a Work Health and Safety Plan;
- Review of relevant geological maps for the project area;
- Scanning of proposed borehole locations for buried conductive services using a licensed service locator with reference to Dial Before You Dig (DBYD) plans;
- Auger drilling of nine boreholes, BH1M, BH2, BH3M, BH5, BH7, BH8, BH9M, BH12, and BH14 by a track-mounted drill rig using solid flight augers equipped with a 'Tungsten-Carbide' (T-C) bit, to depths between 4.6m to 7.5m BEGL, or RLs between -2.4m to -5.1m. The surface levels shown on the borehole logs were approximated from spot levels shown on the supplied survey plans. Approximate borehole locations are shown on **Figure 2**.
- Standard Penetration Testing (SPT) during auger drilling of the boreholes to assess soil strength/relative densities. Selected soil samples were sent to Macquarie Geotechnical Pty Ltd (Macquarie) and SGS Australia Pty Ltd (SGS), which are National Australian Testing Authority (NATA) accredited laboratories, for testing and storage. The test results are attached to the end of this report;
- Continuation of all boreholes using NMLC diamond coring techniques to termination depths between 12.1m to 13.9m BEGL, or RLs between -9.5m to -11.4m. Rock cores recovered from the boreholes were boxed, logged, photographed and sent to Macquarie for point load strength index testing and storage. The test results are presented in **Appendix B**, and the rock core photographs are presented in **Appendix A**;
- The strength of the shale bedrock in the augered sections of the boreholes was assessed by observation of the auger penetration resistance using a T-C drill bit and examination of the recovered rock cuttings. It should be noted that rock strengths assessed from augered boreholes are approximate and strength variances can be expected.

- The boreholes were monitored for possible groundwater seepage during and shortly after completion of auger drilling.
- Groundwater monitoring wells were installed in BH1M, BH3M, BH5M, BH9M, and BH12M to allow for long term groundwater monitoring at the property.
- Following the completion of the fieldwork, the boreholes were backfilled with drilling spoil to surface; and
- Preparation of this GI report.

An EI Engineering Geologist was present on site to set out the borehole locations, direct the testing and sampling, log the subsurface conditions and record the groundwater levels.

1.5 Assessment Constraints

The GI was limited by the intent of the assessment and the presence of the existing site structures. The discussions and advice presented in this report are intended to assist in the preparation of designs for the proposed development. Also, geotechnical inspections should be carried out during construction to confirm the geotechnical and groundwater models, and the design parameters provided in this report.

2. Site description

2.1 Site Description and Identification

The site identification details and associated information are presented in **Table 2-1** below while the site locality is shown on **Figure 1.** For the sake of this report, Victoria Road is taken as the western site boundary.

Table 2-1 Summary of Site Information

Information	Detail
Street Address	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW
Lot and Deposited Plan (DP) Identification	Lot 6, DP 226899 (182 Victoria Road, Marrickville) Lot 100, DP 1239681 (184-188 Victoria Road, Marrickville) Lot 1, DP 74200 (190A Victoria Road, Marrickville) Lot 10, DP 701368 (190-198 Victoria Road, Marrickville) Lot 4, DP 226899 (28 Faversham Street, Marrickville)
Local Government Authority	Inner West Council
Brief Site Description	At the time of the assessment, the site was occupied by five industrial warehouse/factory buildings as well as one residential building. A gravel laneway runs along the northern boundary providing access to a two-storey brick building and one storey metal building in the north-east quarter of the site. These are currently tenanted by a steel fabrication company and a prop hire company. The gravel laneway terminates into a concrete paved laneway which runs along the northern half of the eastern boundary. This laneway continues to the north and terminates onto the back of the concrete block factory building to the south. The north-western quarter of the site is occupied by a one storey metal building currently tenanted by a mechanic/auto shop as well as a one storey residential brick cottage which run along the southern edge of the mechanic. These are both accessed directly from Victoria Road. Between the mechanic and steel fabrication buildings is a gravel parking area about 13m wide. The south east corner of the block is occupied by a large concrete block factory building currently tenanted by a stone warehouse. The south west corner of the site is mainly occupied by a large concrete paved car park which provides access to the stone warehouse. Some cracks are visible in the concrete in areas which are being used to store stone. An L-shaped, two storey brick office building runs along the western half of the southern boundary and partially up along the western boundary, fronting Victoria road. This section of the building is fronted by six car parking spaces. All site structures appeared to be in good condition.
Site Area	The site area is approximately 8748m^2 (based on survey provided), which is comprised of 7,262m^2 (182-198 Victoria Road) and 1486m^2 (28-30 Faversham Street)

2.2 Local Land Use

The site is situated within an area of commercial use. Current uses on surrounding land at the time of our presence on site are described in **Table 2-2** below.

Table 2-2 Summary of Local Land Use

Direction Relative to Site	Land Use Description
North	A two storey concrete factory complex which abuts the northern site boundary.
East	A two storey brick factory complex abuts the northern half of the eastern boundary. A two storey brick factory complex is set back approx. 9m from the southern half of the eastern site boundary, separated by a concrete paved carpark.
South	'Wicks Park', a public reserve, including tennis courts abutting the eastern half of the southern boundary, and a grassed park abutting the western half of the southern boundary. There is a brick substation set back about 0.5m from the southern boundary at the western end of the site, fronting Victoria Road.
West	Victoria Road, a four lane asphaltic paved road set back approx. 3m from the site boundary, followed by a row of single storey terrace houses, as well as a single storey commercial building and a large timber yard/warehouse.

2.3 Regional Setting

The site topography and geological information for the locality is summarised in **Table 2-3** below**.**

Table 2-3 Topographic and Geological Information

Attribute	Description
Topography	The site is located on the low east side of Victoria Road within a very gently south dipping topography with site levels varying from RL3.3m in the north west corner of the site to RL1.8m – 2.0m in the south eastern corner.
Regional Geology	Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 Geological Series Sheet 9130 (DMR 1983) indicates the site is on the border of Holocene deposits (Qhs), which typically comprises peat, sandy peat and mud towards the south, and Ashfield Shale, which consists of dark grey to black shale and laminite towards the north.

3. Assessment results

3.1 Stratigraphy

For the development of a site-specific geotechnical model, the stratigraphy observed in the GI has been grouped into five lithological units. A summary of the subsurface conditions across the site, interpreted from the assessment results, is presented in **Table 3-1** below. More detailed descriptions of subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**. The details of the method of soil and rock classification, explanatory notes and abbreviations adopted on the borehole logs are also presented in **Appendix A.**

Table 3-1 Summary of Subsurface Conditions

Unit	Material[2]	Depth to top of Unit (m BEGL)[1]	Approx. RL of top of Unit (m AHD)[1]	Observed Thickness (m)	Material Description[2]	Comments
1	Concrete/ Fill	Surface	1.9 to 3.3	0.2 to 1.7	Concrete/ Clayey to Gravelly Sand	Concrete pavement of 90mm to 170mm thickness (not encountered in BH9M) underlain by mixed fill of clayey sand or gravelly sand, with gravel and brick fragments.
2	Residual Soil	0.2 to 1.7	0.9 to 2.8	3.1 to 6.2	Silty Clay/ Sandy Clay	Silty Clay, high plasticity, very soft to hard, with ironstone gravels, grading to sandy clay and sand (assessed to be extremely weathered sandstone) with depth.
3	Very Low to Low Strength Sandstone	4 to 7.7	-5.1 to -0.9	0.8 to 3.5	Sandstone	Very low to low strength, distinctly to slightly weathered sandstone, with rare shale seams.
4	Medium Strength Sandstone	5.8 to 9.3	-6.7 to -3.2	0.7 to 6.3 [3]	Sandstone	Medium strength, slightly weathered to fresh sandstone.
5	High Strength Sandstone	8.6 to 11.3	-9.0 to -5.5	0.9 to 4.0 [4]	Sandstone	High strength, fresh sandstone. Observed in BH2, BH3M, BH5M, BH7, and BH12 only.

1 Approximate depth and level at the time of our assessment. Depths and levels may vary across the site.
2 For more detailed descriptions of the subsurface conditions, reference should be made to the borehole logs attached to **Appendix A.**
3 Observed up to termination depth in BH1M, BH8, BH9M, and BH14M
4 Observed up to termination depth in BH2, BH3M, BH5M, BH7, and BH12

3.2 Groundwater Observations

Groundwater seepage was encountered in all boreholes except BH2 and BH7 at depths between 2.0m to 4.5m BEGL. These are presented in **Table 3-2** below.

Table 3-2 Summary of Groundwater Observations

Borehole	Date of Observation	Depth to Standing Ground Water (m BEGL)	Standing Water Level (m AHD)	BEL (m AHD)
BH1M	9 January 2019	1.1	2.0	-6.4
BH3M	9 January 2019	1.2	1.4	
	23 January 2019	1.2	1.4	
BH5M	9 January 2019	1.9	1.2	
	23 January 2019	1.0	1.9	
BH9M	9 January 2019	1.3	2.0	
BH14M	11 January 2019	0.3	1.7	
	23 January 2019	0.3	1.7	

Pump-out tests were performed in three of the monitoring wells to estimate the permeability of the soil screened by the monitoring wells, and were calculated using the Hvorslev method (1951). The pump out test results are summarised in **Table 3-3** below.

Table 3-3 Pump-out Test results

Well ID	Total Well Depth (m BEGL)	Screen Length (m)	Screened Material	Date of Test	Estimated Permeability
BH3M	7	5	Residual Silty CLAY	23-Jan-19	2.3×10^{-7}
BH5M	11	5	SANDSTONE	9-Jan-19	4.0×10^{-8}
BH14M	4	2	Residual Silty CLAY / Clayey SAND	23-Jan-19	1.8×10^{-7}

3.3 Laboratory Test Results

Four soil samples were selected for laboratory testing to assess the following:

- Soil aggressivity (pH, Chloride and Sulfate content and electrical conductivity); and
- Atterberg Limits

A summary of the soil test results is provided in **Table 3-4** below. Laboratory test certificates are presented in **Appendix B**.

Table 3-4 Summary of Soil Laboratory Test Results

Test/ Sample ID		BH1M_0.0-0.95	BH9M_3.0-3.45	BH14M_1.5-1.95	BH3M_2.9-3.0
Unit		2	2	2	2
Material Description [1]		Silty CLAY	Silty CLAY	Silty CLAY	Silty CLAY
Aggressivity	pH	7.7	6.9	6.5	-
	Electrical Conductivity (µS/cm)	62	72	82	-
	Sulfate SO_4 (ppm)	41	110	100	-
	Chloride Cl (ppm)	14	19	57	-
Linear Shrinkage (%)		-	-	-	-
Attergerg Limits	Liquid Limit (%)	-	-	-	60
	Plastic Limit (%)	-	-	-	16
	Plasticity Index (%)	-	-	-	44
Moisture Content (%)		19	14	15	-

1 More detailed descriptions of the subsurface conditions at each borehole location are available on the borehole logs presented in **Appendix A**.

The Atterberg Limit results on Unit 2 indicated that the clays to be of high plasticity.

The assessment indicated low permeability soil was present above the groundwater table. In accordance with Tables 6.4.2(C) and 6.5.2(C) of AS 2159:2009 'Piling – Design and Installation', the results of the pH, chloride and sulfate content and electrical conductivity of the soil provided the following exposure classifications:

- 'Non-aggressive' for buried concrete structural elements; and
- 'Non-aggressive' for buried steel structural elements.

In accordance with Table 4.8.1 of AS3600-2009 'Concrete Structures' these soils would be classified as exposure classification 'A1' for concrete in sulfate soils.

4. Recommendations

4.1 Geotechnical issues

Based on the results of the assessment, we consider the following to be the main geotechnical issues for the proposed development:

- Basement excavation and retention to limit lateral deflections and ground loss as a result of excavations, resulting in damage to nearby structures;
- Rock excavation;
- Groundwater within the depth of the excavation;
- Foundation design for building loads.

4.2 Excavation Methodology

4.2.1 Excavation Assessment

Prior to any excavation commencing, we recommend that reference be made to the WorkCover Excavation Work Code of Practice – July 2015.

EI assumes that the proposed development will require a BEL of RL -6.4m for the basement, or an excavation depth of between about 8.5m and 10.0m BEGL. Locally deeper excavations for footings, service trenches, crane pads and lifts overrun pits may be required.

Based on the borehole logs, the proposed basement excavations will therefore extend through all units as outlined in **Table 3-1** above. As such, an engineered retention system must be installed prior to excavation commencing.

Units 1 and 2 could be excavated using buckets of large earthmoving Hydraulic Excavators, particularly if fitted with 'Tiger Teeth'. Excavation of Units 3, 4 and 5 (where encountered) may present hard or heavy ripping, or "hard rock" excavation conditions. Ripping would require a high capacity and heavy bulldozer for effective production. Wear and tear should also be allowed for. The use of a smaller size bulldozer will result in lower productivity and higher wear and tear, and this should be allowed for. Alternatively, hydraulic rock breakers, rock saws, ripping hooks or rotary grinders could be used, though productivity would be lower and equipment wear increased, and this should be allowed for.

Should rock hammers be used for the excavation of the bedrock, excavation should commence away from the adjoining structures and the transmitted vibrations monitored to assess how close the hammer can operate to the adjoining structures while maintaining transmitted vibrations within acceptable limits. To fall within these limits, we recommend that the size of rock hammers do not exceed a medium sized rock hammer, say 900 kg, such as a Krupp 580, and be trialled prior to use. The transmitted vibrations from rock hammers should be measured to determine how close each individual hammer can operate to the adjoining buildings.

The vibration measurements can be carried out using either attended or an unattended vibration monitoring. An unattended vibration monitoring system must be fitted with an alarm in the form of a strobe light or siren or alerts sent directly to the site supervisor to make the plant operator aware immediately when the vibration limit is exceeded. The vibration monitor must be set to trigger the alarm when the overall Peak Particle Velocity (PPV) exceeds set limits outlined by a vibration monitoring plan. Reference should be made to **Appendix C** for a guide to acceptable limits of transmitted vibrations.

If it is found that transmitted vibrations by the use of rock hammers are unacceptable, then it would be necessary to change to a smaller excavator with a smaller rock hammer, or to a rotary grinder, rock saws, jackhammers, ripping hooks, chemical rock splitting and milling machines. Although these are likely to be less productive, they would reduce or possibly eliminate risks of damage to adjoining properties through vibration effects transmitted via the ground. Such equipment would also be required for detailed excavation, such as footings or service trenches, and for trimming of faces. Final trimming of faces may also be completed using a grinder attachment rather than a rock breaker in order to assist in limiting vibrations. The use of rotary grinders generally generates dust and this may be supressed by spraying with water.

To assist in reducing vibrations and over-break of the sandstone, we recommend that initial saw cutting of the excavation perimeters through the bedrock may be provided using rock saw attachments fitted to the excavator. Rock sawing of the excavation perimeter has several advantages as it often reduces the need for rock bolting as the cut faces generally remain more stable and require a lower level of rock support than hammer cut excavations, ground vibrations from rock saws are minimal and the saw cuts will provide a slight increase in buffer distance for use of rock hammers. However, the effectiveness of such approach must be confirmed by the results of vibration monitoring.

Also, there is a potential for poorly oriented defects within the excavated bedrock to result in localized rock slide/topple failure with potential impact to the work site or the adjacent structures. However through selection of suitable excavation equipment, geotechnical inspections and mapping during the excavation works along with the installation of support measures as determined necessary by the inspections, the risk from the proposed works can be maintained within ‘Acceptable’ levels. In addition, we recommend that only excavation contractors with appropriate insurances and experience on similar projects be used. The contractor should also be provided with a copy of this report to make his own judgement on the most appropriate excavation equipment.

Groundwater seepage monitoring should be carried out during bulk excavation works and prior to finalising the design of a pump out facility. Outlets into the stormwater system will require Council approval.

Furthermore, any existing buried services, which run below the site, will require diversion prior to the commencement of excavation or alternatively be temporarily supported during excavation, subject to permission or other instructions from the relevant service authorities. Enquiries should also be made for further information and details, such as invert levels, on the buried services.

4.2.2 Excavation Monitoring

Consideration should be made to the impact of the proposed development upon neighbouring structures, roadways and services. Basement excavation retention systems should be designed so as to limit lateral deflections.

Contractors should also consider the following limits associated with carrying out excavation and construction activities:

- Limit lateral deflection of temporary or permanent retaining structures;
- Limit vertical settlements of ground surface at common property boundaries and services easement.
- Limit Peak Particle Velocities (PPV) from vibrations, caused by construction equipment or excavation, experienced by any nearby structures and services.

Monitoring of deflections of retaining structures and surface settlements should be carried out by a registered surveyor at agreed points along the excavation boundaries and along existing

building foundations/ services/ pavements and other structures located within or near the zone of influence of the excavation. Owners of existing services adjacent to the site should be consulted to assess appropriate deflection limits for their infrastructures. Measurements should be taken:

- Before commencement of retaining structures where appropriate to determine the baseline readings. Two independent sets of measurements must be taken confirming measurement consistency;
- After construction of the retaining structures, but before commencement of excavation;
- After excavation to the first row of supports or anchors, but prior to installation of these supports or anchors;
- After excavation to any subsequent rows of supports or anchors, but prior to installation of these supports or anchors;
- After excavation to the base of the excavation;
- After de-stressing and removal of any rows of supports or anchors; and
- One month after completion of the permanent retaining structure or after three consecutive measurements not less than a week apart showing no further movements, whichever is the latter.

4.3 Groundwater Considerations

Groundwater was observed in all monitoring wells as detailed in **Table 3-2**, all of which are above the assumed BEL RL of -6.4m.

Based on the results of the Seep/W analysis by EI, due to the low permeability of the bedrock profile any groundwater inflows into the excavation should not have an adverse impact on the proposed development or on the neighbouring sites and should be manageable. However, we expect that some groundwater inflows into the excavation along the soil/rock interface and through any defects within the sandstone bedrock (such as jointing, and bending planes, etc.) particularly following a period of rainfall. The initial flows into the excavation may be locally high, but would be expected to decrease considerably with time as the bedding seams/joints are drained. We recommend that monitoring of seepage be implemented during the excavation works to confirm the capacity of the drainage system.

We expect that any seepage that does occur will be able to be controlled by a conventional sump and pump system. We recommend that a sump-and-pump system be used both during construction and for permanent groundwater control below the basement floor slab.

In the long term, drainage should be provided behind all basement retaining walls, around the perimeter of the basement and below the basement slab. The completed excavation should be inspected by the hydraulic engineer to confirm that adequate drainage has been allowed for. Drainage should be connected to the sump-and-pump system and discharging into the stormwater system. The permanent groundwater control system should take into account any possible soluble substances in the groundwater which may dictate whether or not groundwater can be pumped into the stormwater system.

The design of drainage and pump systems should take the above issues into account along with careful ongoing inspections and maintenance programs.

4.4 Excavation Retention

4.4.1 Support Systems

From a geotechnical perspective, it is critical to maintain the stability of all adjacent structures and infrastructures during demolition, excavation and construction works.

Based on the above, the encountered subsurface conditions, the shallow groundwater, and the required excavation depth, temporary batters are not recommended for this site. Unsupported vertical cuts of the soil are not recommended for this site as these carry the risk of potential collapse especially after a period of wet weather. Collapse of the material may result in injury to personnel and/or damage to nearby structures/infrastructures and equipment.

A suitable retention system will be required for the support of the entire depth of the excavation. For this site, we consider that an anchored and/or propped soldier pile wall with mass concrete in between the piles installed to below BEL to be the most suitable. Anchors/props and mass concrete must be installed progressively as excavation proceeds.

Bored piles are considered the most suitable for this site. Tremie pumps may be required where high groundwater seepage inflows are present during the drilling of the bored piles. However, relatively large capacity piling rigs will be required for drilling through the sandstone bedrock. The proposed pile locations should take into account the presence of the presence of buried services. Further advice should be sought from prospective piling contractors who should be provided with a copy of this report.

4.4.2 Retaining Wall Design Parameters

The following parameters may be used for static design of temporary and permanent retaining walls at the subject site:

- For progressively anchored or propped walls where minor movements can be tolerated (provided there are no buried movement sensitive services), we recommend the use of a trapezoidal earth pressure distribution of 6H kPa for soil, where H is the retained height in meters. These pressures should be assumed to be uniform over the central 50% of the support system, tapering to nil at top and bottom;
- For progressively anchored or propped walls which support areas which are highly sensitive to movement (such as areas where movement sensitive structures or infrastructures or buried services are located in close proximity), we recommend the use of a trapezoidal earth pressure distribution of 8H kPa for soil, where ‘H’ is the retained height in meters. These pressures should be assumed to be uniform over the central 50% of the support system, tapering to nil at top and bottom;
- All surcharge loading affecting the walls (including from construction equipment, construction loads, adjacent high level footings, etc.) should be adopted in the retaining wall design as an additional surcharge using an ‘at rest’ earth pressure coefficient, Ko, of 0.58;
- The retaining walls should be designed as drained and measures are to be taken to provide complete and permanent drainage behind the walls. Strip drains protected with a non-woven geotextile fabric should be used behind the shotcrete infill panels for soldier pile walls or inserted between gaps in contiguous piles. Alternatively, for the contiguous pile walls, weepholes comprising 20mm diameter PVC pipes grouted into holes or gaps between adjacent piles at 1.2m centres (horizontal and vertical), may be used. The embedded end of the pipes must, however, be wrapped with a non-woven geotextile fabric (such as Bidim A34) to act as a filter against subsoil erosion;

- For piles embedded into Unit 4 or better, the allowable lateral toe resistance values outlined in **Table 4-1** below may be adopted. These values assume excavation is not carried out within the zone of influence of the wall toe and the rock does not contain adverse defects etc. The upper 0.3m depth of the socket should not be taken into account to allow for tolerance and disturbance effects during excavation.

- If temporary anchors extend beyond the site boundaries, then permission from the neighbouring properties would need to be obtained prior to installation. Also, the presence of neighbouring basements and/or services and their levels must be confirmed prior to finalising anchor design**.**
- Anchors should have their bond length within Unit 3 or better. For the design of anchors bonded into Unit 3 or better, the allowable bond stress value outlined in **Table 4-1** below may be used, subject to the following conditions:

  1. Anchor bond lengths of at least 3m behind the 'active' zone of the excavation (taken as a 45 degree zone above the base of the excavation) is provided;
  2. Overall stability, including anchor group interaction, is satisfied;
  3. All anchors should be proof loaded to at least 1.33 times the design working load before locked off at working load. Such proof loading is to be witnessed by and engineer independent of the anchoring contractor. We recommend that only experienced contractors be considered for anchor installation with appropriate insurances;
  4. If permanent anchors are to be used, these must have appropriate corrosion provisions for longevity.

Table 4-1 Geotechnical Design Parameters

Material [1]		Unit 1 Concrete/ Fill	Unit 2 Residual Soil	Unit 3 Very Low to Low Strength Sandstone	Unit 4 Medium Strength Sandstone	Unit 5 High Strength Sandstone
RL of Top of Unit (m AHD) [2]		1.9 to 3.3	0.9 to 2.8	-5.1 to -0.9	-6.7 to -3.2	-9.0 to -5.5
Bulk Unit Weight (kN/m^3)		18	20	23	24	24
Friction Angle, ϕ' (°)		25	25	35	40	45
Earth Pressure Coefficients	At rest, K_o [3]	0.58	0.58	0.43	-	-
	Active, K_a [3]	0.41	0.41	0.27	-	-
	Passive, K_p [3]	-	-	-	-	-
Allowable Bearing Pressure (kPa) [5]		-	-	-	3500	3500
Allowable Shaft Adhesion (kPa) [4, 5]	in Compression	-	-	100	350	350
	in Uplift	-	-	50	175	175
Allowable Toe Resistance (kPa)		-	-	-	350	350
Allowable Bond Stress (kPa)		-	-	100	300	300
Ultimate Bearing Pressure (kPa) [5]		-	-	-	15000	15000
Ultimate Shaft Adhesion (kPa) [4,6]		-	-	-	800	800
Earthquake Site Risk Classification		▪ AS 1170.4:2007 indicates an earthquake subsoil class of Class D_e.(Soft Soil) ▪ AS 1170.4:2007 indicates that the hazard factor (z) for Sydney is 0.08.				

Notes:

1 More detailed descriptions of subsurface conditions are available on the borehole logs presented in **Appendix A.**

2 Approximate levels of top of unit at the time of our investigation. Levels may vary across the site.

3 Earth pressures are provided on the assumption that the ground behind the retaining walls is horizontal.

4 Side adhesion values given assume there is intimate contact between the pile and foundation material and should achieve a clean socket roughness category R2 or better. Design engineer to check both 'piston pull-out' and 'cone liftout' mechanics in accordance with AS4678-2002 Earth Retaining Structures.

5 To adopt these parameters we have assumed that:

- Footings have a nominal socket of at least 0.3m, into the relevant founding material;
- For piles, there is intimate contact between the pile and foundation material (a clean socket roughness category of R2 or better);
- Potential soil and groundwater aggressivity will be considered in the design of piles and footings;
- Piles should be drilled in the presence of a Geotechnical Engineer prior to pile construction to verify that ground conditions meet design assumptions. Where groundwater ingress is encountered during pile excavation, concrete is to be placed as soon as possible upon completion of pile excavation. Pile excavations should be pumped dry of water prior to pouring concrete, or alternatively a tremmie system could be used;
- The bases of all pile, pad and strip footing excavations are cleaned of loose and softened material and water is pumped out prior to placement of concrete;
- The concrete is poured on the same day as drilling, inspection and cleaning.
- The allowable bearing pressures given above are based on serviceability criteria of settlements at the footing base/pile toe of less than or equal to 1% of the minimum footing dimension (or pile diameter).

6 For side shear only sockets (in tension), we recommend a geotechnical reduction factor, Φ_g, of 0.5 to be used.

4.5 Foundations

Following bulk excavations, we expect Unit 4 or 5 materials to be exposed at BEL.

It is recommended that the footings for the building be founded within the sandstone bedrock of similar strength of at least Unit 4 or better to provide uniform support and reduce the potential for differential settlements.

As Unit 5 quality sandstone was only observed in five of the nine boreholes drilled, we recommend that the footings be designed to be founded in Unit 4 sandstone.

Pad or strip footings founded within Unit 4 may be preliminarily designed for an allowable bearing capacity of 3500kPa, based on serviceability.

Geotechnical inspections of foundations are recommended to determine that the required bearing capacity has been achieved and to determine any variations that may occur between the boreholes and inspected locations.

4.6 Basement Floor Slab

Following bulk excavations for the proposed basement, sandstone bedrock is expected to be exposed at the basement floor BEL.

Following the removal of all loose and softened materials, we recommend that underfloor drainage be provided and should comprise a strong, durable, single sized washed aggregate such as ‘blue metal gravel’. Joints in the concrete floor slab should be designed to accommodate shear forces but not bending moments by using dowelled and keyed joints. The basement floor slab should be isolated from columns. The completed excavation should be inspected by the hydraulic engineer to confirm the extent of the drainage required.

In addition, a system of sub-soil drains comprising a durable single sized aggregate with perforated drains/pipes leading to sumps should be provided. The basement floor slab should be isolated from columns.

Permission may need to be obtained from the NSW Department of Primary Industries (DPI) and possibly Council for any permanent discharge of seepage into the drainage system. Given the subsurface conditions, we expect that seepage volumes would be low and within the DPI limits. However, if permission for discharge is not obtained, the basement may need to be designed as a tanked basement.

5. Further geotechnical inputs

Below is a summary of the previously recommended additional work that needs to be carried out:

- Dilapidation surveys;
- Design of working platforms (if required) for construction plant by an experienced and qualified geotechnical engineer;
- Classification of all excavated material transported off site;
- Witnessing installation and proof-testing of anchors.
- Geotechnical inspections of foundations; and
- Ongoing monitoring of groundwater inflows into the bulk excavation;

We recommend that a meeting be held after initial structural design has been completed to confirm that our recommendations have been correctly interpreted. We also recommend a meeting at the commencement of construction to discuss the primary geotechnical issues and inspection requirements.

6. Statement of limitations

This report has been prepared for the exclusive use of TOGA Wicks Park Developments Pty Ltd and EI Australia who is the only intended beneficiary of EI's work. The scope of the assessment carried out for the purpose of this report is limited to those agreed with TOGA Wicks Park Developments Pty Ltd and EI Australia

No other party should rely on the document without the prior written consent of EI, and EI undertakes no duty, or accepts any responsibility or liability, to any third party who purports to rely upon this document without EI's approval.

EI has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the geotechnical industry in Australia as at the date of this document. No other warranty, expressed or implied, is made or intended. Each section of this report must be read in conjunction with the whole of this report, including its appendices and attachments.

The conclusions presented in this report are based on a limited investigation of conditions, with specific sampling and test locations chosen to be as representative as possible under the given circumstances.

EI's professional opinions are reasonable and based on its professional judgment, experience, training and results from analytical data. EI may also have relied upon information provided by the Client and other third parties to prepare this document, some of which may not have been verified by EI.

EI's professional opinions contained in this document are subject to modification if additional information is obtained through further investigation, observations, or validation testing and analysis during construction. In some cases, further testing and analysis may be required, which may result in a further report with different conclusions.

We draw your attention to the document "Important Information", which is included in **Appendix D** of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by EI, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Should you have any queries regarding this report, please do not hesitate to contact EI.

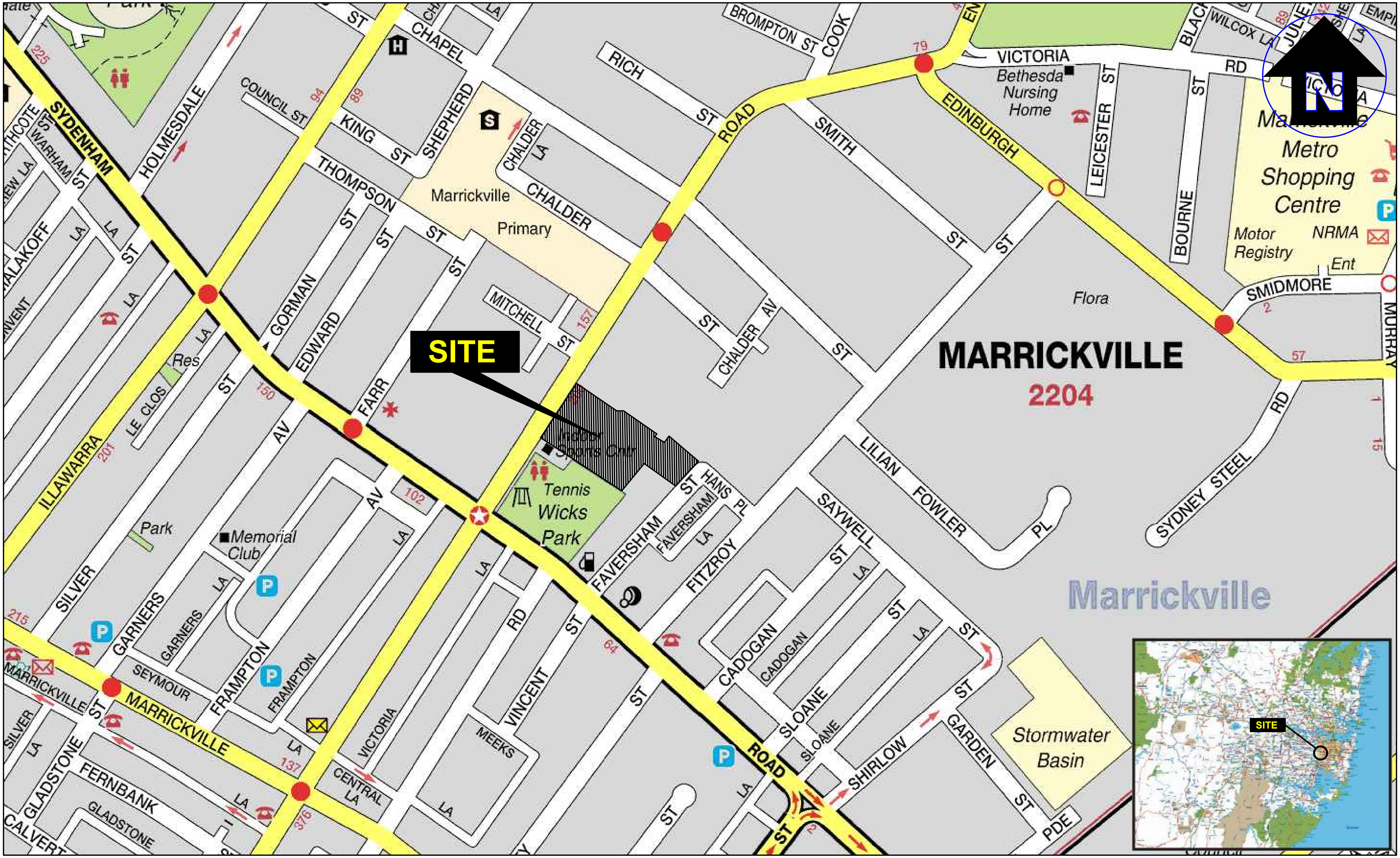
References

- AS1726:1993, *Geotechnical Site Investigations*, Standards Australia.
- AS2159:2009, *Piling – Design and Installation*, Standards Australia.
- AS3600:2009, *Concrete Structures,* Standards Australia
- Excavation Work Code of Practice – July 2015 – WorkCover NSW,
- NSW Department of Finance and Service, Spatial Information Viewer, maps.six.nsw.gov.au.
- NSW Department of Mineral Resources (1983) Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1). Geological Survey of New South Wales, Department of Mineral Resources.

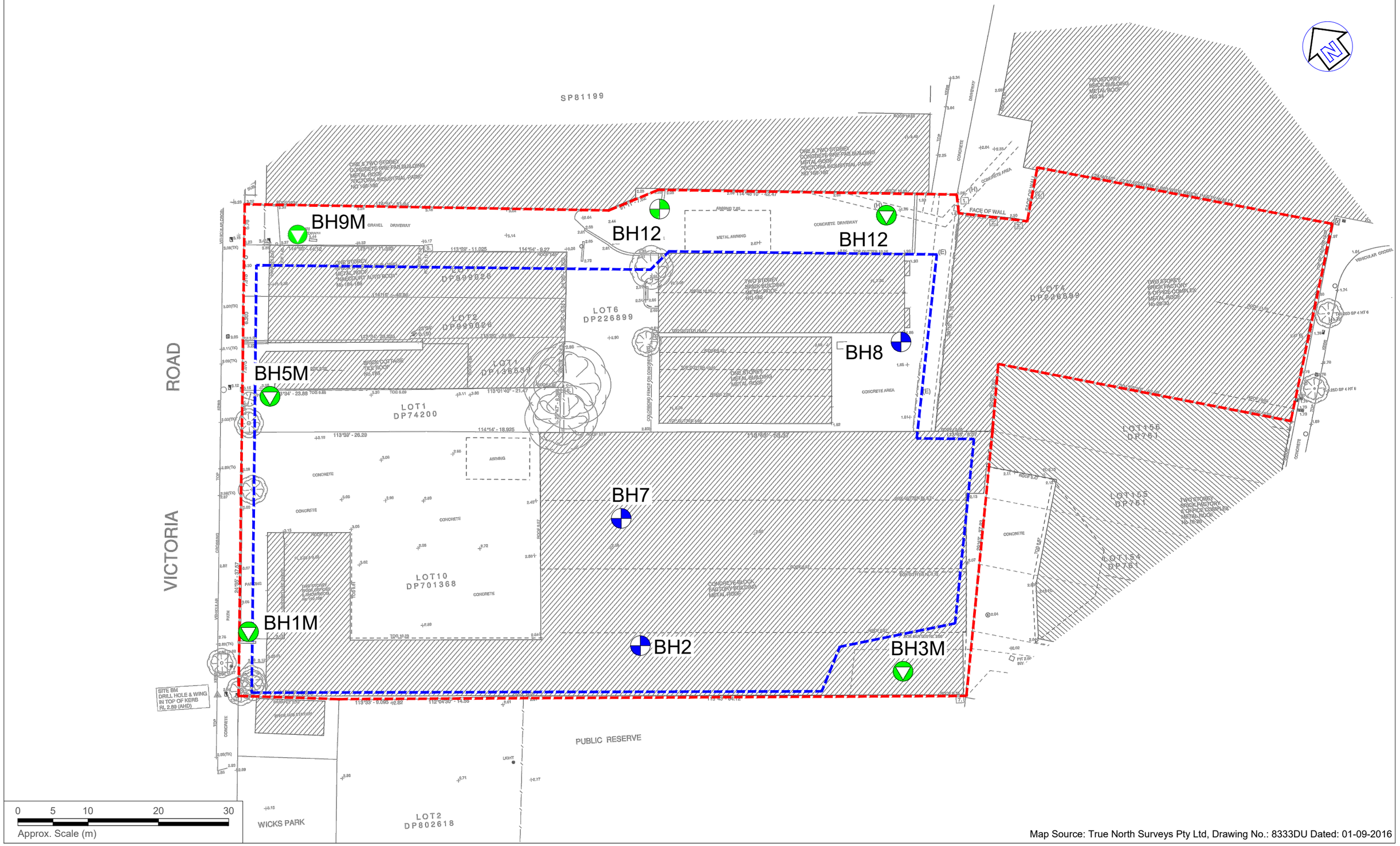
Abbreviations

AHD	Australian Height Datum
AS	Australian Standard
BEGL	Below Existing Ground Level
BH	Borehole
DBYD	Dial Before You Dig
DP	Deposited Plan
EI	EI Australia
GI	Geotechnical Investigation
NATA	National Association of Testing Authorities, Australia
RL	Reduced Level
SPT	Standard Penetration Test
T-C	Tungsten-Carbide
UCS	Unconfined Compressive Strength

Figures



eiaustralia Contamination | Remediation | Geotechnical Suite 6.01, 55 Miller Street, PYRMONT 2009 Ph (02) 9516 0722 Fax (02) 9518 5088	Drawn: AM.H. Approved: S.K. Date: 12/2/19 Scale: Not To Scale	**TOGA Wicks Park Developments Pty Ltd** Geotechnical Investigation 182-198 Victoria Road and 28-30 Faversham Street, Marrickville NSW Site Locality Plan	Figure: 1 Project: E24098.G03



Map Source: True North Surveys Pty Ltd, Drawing No.: 8333DU Dated: 01-09-2016

LEGEND

- Approximate site boundary
- Approximate basement boundary
- Approximate borehole location
- Approximate monitoring well location

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Ph (02) 9516 0722 Fax (02) 9518 5088

Drawn:	D.R.
Approved:	S.K.
Date:	12-02-19

Toga Wicks Park Developnments Pty Ltd
Geotechnical Investigation
182-198 Victoria Rd & 28-30 Faversham St, Marrickville, NSW

Sampling Location Plan

Figure: 2

Project: E24098.G03

Appendix A - Borehole Logs And Explanatory Notes

BOREHOLE LOG

BH NO. 1M

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	20/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	0.14				-	CONCRETE; 140 mm thick.	-	-	CONCRETE HARDSTAND
				2.96				-	FILL: Clayey SAND; medium to coarse grained, dark grey, with gravels.	M	-	FILL
				0.50								
				2.60	BH1M_0.5-0.95 SPT 0.50-0.95 m 1,1,1 N=2			CH	Silty CLAY; high plasticity, grey mottled with red, with ironstone gravels.			RESIDUAL SOIL
		09/01/19	1	1.00 2.10					From 1.0 m, red mottled with grey.	M (>PL)	S	
					BH1M_1.5-1.95 SPT 1.50-1.95 m 3,5,8 N=13							
			2	2.00 1.10					From 2.0 m, high plasticity, grey mottled with red.		St	
	-			3.00								
AD/T			3	0.10	BH1M_3.0-3.45 SPT 3.00-3.45 m 5,8,10 N=18				From 3.0 m, grey, trace sub-angular, ironstone gravels, grading into extremely weathered sandstone.	M (<PL)	VSt	
		20/12/2018	4	4.50								
				-1.40	BH1M_4.5-4.95 SPT 4.50-4.95 m 12,25,21 N=46			-	SANDSTONE; fine to medium grained, red-grey, very low to low strength, distinctly weathered, with ironstone bands.			BEDROCK
	M-H		5							-	-	
	H		6	6.60								
									Continued as Cored Borehole			
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 1M

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	20/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
					6.60		Continuation from non-cored borehole				
NMLC	100% RETURN	100	66	7	-3.50		SANDSTONE; fine to medium grained, grey-orange, trace shale laminations.	DW		6.69: BP, CN, PR, S 6.82: BP, CN, PR, S 7.09: BP, CN, PR, S 7.18: BP, CN, PR, S 7.20-7.28: XWS 7.35: BP, CN, PR, S	
					7.80						
				8	-4.70		SHALE; dark grey, with sandstone laminations.			7.80-7.83: SM, Clay	
					8.37						
					-5.27		SANDSTONE; fine to medium grained, grey.	SW		8.36: BP, CN, PR, S 8.53-8.63: BPx4, CN, PR, S	
				9							
		100	98	10				FR			

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 1M

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	20/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	98	10			SANDSTONE; fine to medium grained, grey.	FR			
					10.53 -7.43		SANDSTONE; coarse grained, grey, quartzose.			10.55: BP, CN, PR, S	
				11							
				12						11.94-11.95: SM, Clay 12.17: BP, CN, PR, S 12.18: BP, CN, PR, S	
					12.60 -9.50		Hole Terminated at 12.60 m Target Depth Reached				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. 1M

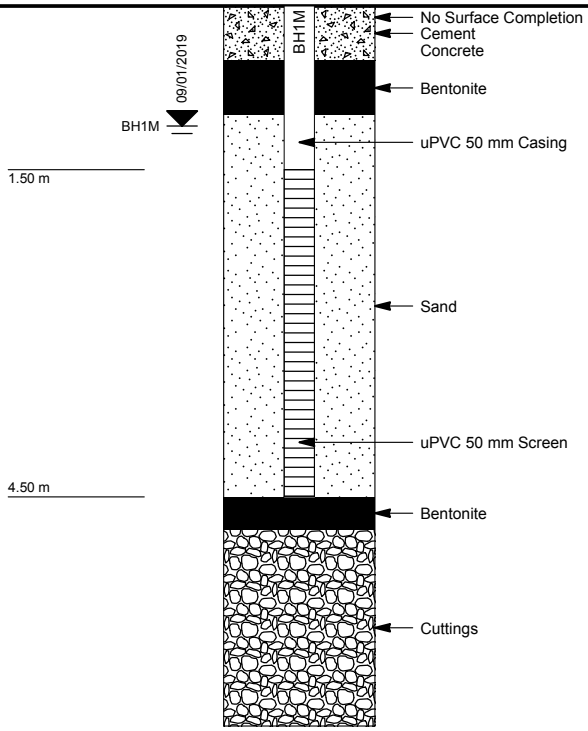
Project	Proposed Development	**Sheet**	1 of 2
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	20/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
DT	-	0			CONCRETE; 140 mm thick.
	09/01/19				FILL: Clayey SAND; medium to coarse grained, dark grey, with gravels.
					Silty CLAY; high plasticity, grey mottled with red, with ironstone gravels.
		2	2		From 1.0 m, red mottled with grey.
					From 2.0 m, high plasticity, grey mottled with red.
AD/T			0		From 3.0 m, grey, trace sub-angular, ironstone gravels, grading into extremely weathered sandstone.
	20/12/2018	4			
			-2		SANDSTONE; fine to medium grained, red-grey, very low to low strength, distinctly weathered, with ironstone bands.
		6			
			-4		SANDSTONE; fine to medium grained, grey-orange, trace shale laminations.
NMLC		8			SHALE; dark grey, with sandstone laminations.
	100% RETURN		-6		SANDSTONE; fine to medium grained, grey.
		10			
			-8		SANDSTONE; coarse grained, grey, quartzose.
		12			
			-10		Hole Terminated at 12.60 m Target Depth Reached

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH1M	Standpipe		4.50 m -1.40 m		



This well log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH1M

Project	Proposed Development	**East**	330163.8	**Depth Range**	6.6m to 12.6m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246419.5	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 3.1m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	BL	**Date**	20 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 2

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	*0.12*				-	CONCRETE; 120 mm thick.	-	-	CONCRETE HARDSTAND
				2.48	BH2_0.2-0.3 DS 0.20-0.30 m			-	FILL: Silty CLAY; dark brown-dark grey to dark red-brown, with fine to medium, with a weathered sandstone layer.			FILL
					BH2_0.5-0.95 SPT 0.50-0.95 m 13,16,8 N=24					M (>PL)	-	
			1									
				1.70	BH2_1.5-1.7 SPT 1.50-1.95 m HW,HW,HW N=0			CH	Silty CLAY; high plasticity, pale grey, with fine to medium, sub-rounded ironstone gravel.		VS	RESIDUAL SOIL
				0.90								
			2		BH2_1.7-1.95 BH2_2.0-2.45 SPT 2.00-2.45 m 5,5,5 N=10							
				2.40					From 2.4 m, no ironstone gravel.			
				0.20								
AD/T	-	GWNE	3		BH2_3.0-3.45 SPT 3.00-3.45 m 4,6,9 N=15						St	
										M (>PL)		
			4									
					BH2_4.5-4.95 SPT 4.50-4.95 m 6,10,14 N=24							
			5	*5.62*							VSt	
									Continued as Cored Borehole			
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 2

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
				5							
					5.62		Continuation from non-cored borehole				
NMLC	100% RETURN	100	58 (58)	6	-3.02		SANDSTONE; fine to medium grained, pale grey, with iron staining.	DW		5.85: XWS, 100 mm 5.97: JT, 90°, Closed 6.05: BP, 0°, Fe SN, PR, RF	
					6.18						
					-3.58		CORE LOSS; 280 mm thick.	-		6.07: CZ, 10 mm 6.11: BPx2, 0°, Fe SN, PR, RF	<<
					6.46						
		83	9 (9)		-3.86		SANDSTONE; fine to medium grained, pale grey, with iron staining.	DW		6.46-6.64: XS, 180 mm 6.74: BP, 0°, Fe SN, PR, RF	
					7.00					6.88: CS, 40 mm	
				7	-4.40		SHALE; dark grey, with weathered sandstone.			7.00: XWS, 10 mm 7.12: CZ, 20 mm 7.22: JT, 70°, Fe CN, PR, RF 7.28: BP, 0°, Fe SN, PR, RF 7.43: BP, 0°, Fe SN, PR, RF 7.48: BP, 0°, Fe SN, PR, RF 7.55-7.69: BPx7, 0°, Fe SN, PR, RF 7.76: XWS, 10 mm 7.87: XWS, 10 mm	
		100	83 (83)	8						8.13: XWS, 5 mm	
					8.66						
					-6.06		SANDSTONE; fine to medium grained, pale grey, with dark grey lamination.	SW			
				9	*9.10*						
		99	95 (95)		-6.50		From 9.1 m, with iron staining.			9.10: BP, 0°, Fe SN, PR, RF 9.16: BP, 0°, Fe SN, PR, RF	
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 2

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	99	95 (95)	10	*10.69* -8.09		SANDSTONE; fine to medium grained, pale grey, with dark grey lamination.	SW			
				11	*11.18* -8.58		From 10.69 m, fine grained, pale grey-grey.			10.69: SZ, 2 mm	
		100	87				From 11.18 m, pale grey.			11.15: SZ, 5 mm	
				12	*12.10* -9.50		Hole Terminated at 12.10 m Target Depth Reached				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH2

Project	Proposed Development	**East**	330204.2	**Depth Range**	5.62m to 12.1m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246384.9	**Contractor**	BG Drilling Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 2.6m	**Drill Rig**	Rig 7		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	FY	**Date**	17 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 3M

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	*0.17*				-	CONCRETE; 170 mm thick.	-	-	CONCRETE HARDSTAND
				2.43				-	FILL: SAND; fine to medium grained, pale brown-brown, with fine to medium, sub-rounded sandstone gravel, with brick fragments.	M	-	FILL
		23/01/19	1	*1.00*				-	FILL: Silty CLAY; pale brown-brown, trace fine to coarse, sub-angular gravel.	M (>PL)		
				1.50								
		17/12/2018		1.10	BH3M_1.5-1.6 DS 1.50-1.60 m			CH	Silty CLAY; high plasticity, grey, trace fine to medium, sub-angular ironstone gravel.			RESIDUAL SOIL
			2									
				3.00	BH3M_2.9-3.0 DS 2.90-3.00 m							
AD/T	-		3	-0.40					From 3.0 m, pale grey.			
				4.20								
			4	-1.60	BH3M_4.2-4.5 DS 4.20-4.50 m				From 4.2 m, brown, with fine to medium grained sand.	M (>PL)	-	
				4.70								
				-2.10					From 4.7 m, pale grey, trace fine to medium grained sand.			
			5									
			6									
			7	*7.52*								
									Continued as Cored Borehole			
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 3M

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	51	0							
				1							
				2							
				3							
				4							
				5							
				6							
				7							
					7.52		Continuation from non-cored borehole				
					7.65		Sandy CLAY; low to medium plasticity, grey-brown, sand is fine to medium grained, grading into sandstone.	-			
					-5.05		SANDSTONE; fine to medium grained, with dark grey lamination, cross bedded at 5-15°, with iron staining.	DW		7.68: BP, 0°, Fe SN, PR, RF 7.87: XWS, 10 mm 8.06-8.09: BPx3, 5°, Fe SN, PR, RF 8.13: XWS, 20 mm 8.20: BP, 0°, Fe SN, PR, RF 8.41-8.70: XWS, 70 mm 8.62: BP, 0°, Fe SN, PR, RF 8.69: SZ, 20 mm 9.04: BP, 0°, Fe SN, PR, RF 9.22: BP, 0°, Fe SN, PR, RF	<<
				8							
		100	98	9				SW			
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 3M

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	98	10			SANDSTONE; fine to medium grained, with dark grey lamination, cross bedded at 5-15°, with iron staining.	SW / FR			
		99	95	11	*11.30* -8.70		From 11.3 m, fine grained, grey.			11.10: BP, 0°, CN, ST, RF 11.29: CZ, 10 mm 11.30: BPx3, 5°, CN, PR, RF	
		100	96	12							
				13	*13.39* -10.79		Hole Terminated at 13.39 m Target Depth Reached			12.84-12.90: very high strength	
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. 3M

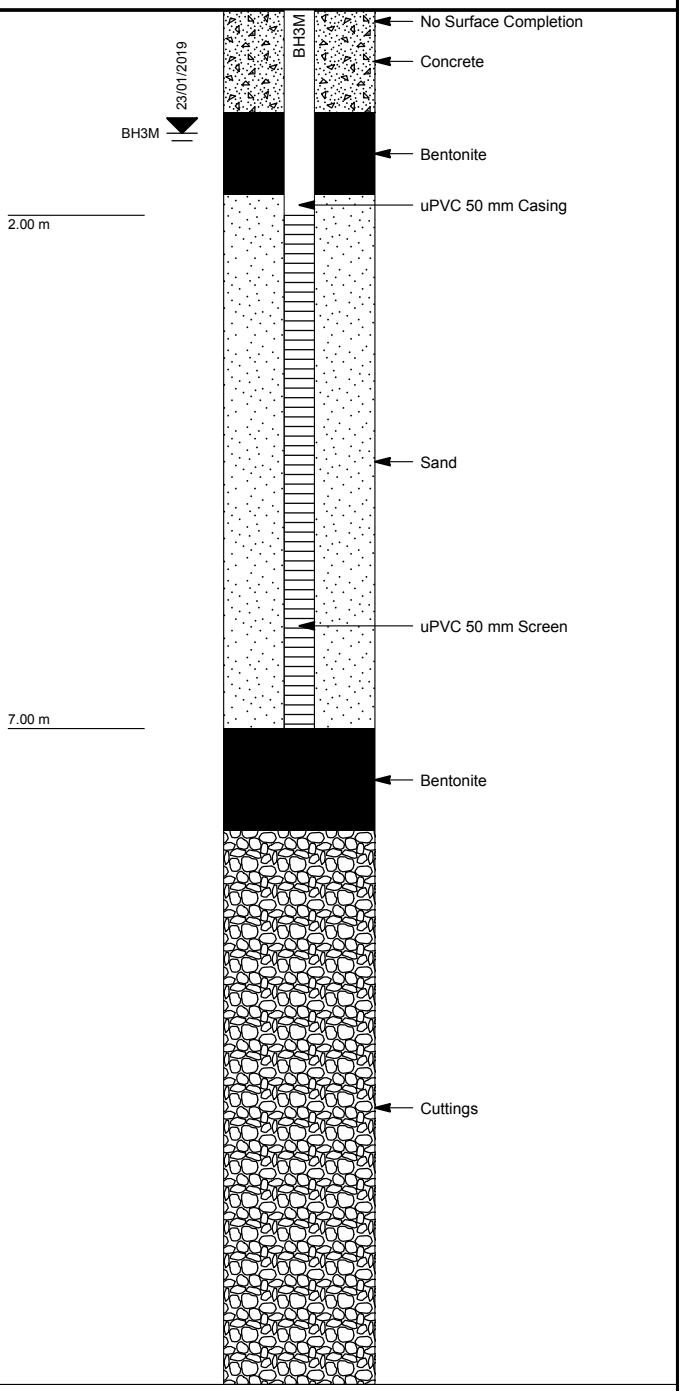
Project	Proposed Development	**Sheet**	1 of 2
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
DT	-	0			CONCRETE; 170 mm thick.
	23/01/19		2		FILL: SAND; fine to medium grained, pale brown-brown, with fine to medium, sub-rounded sandstone gravel, with brick fragments.
					FILL: Silty CLAY; pale brown-brown, trace fine to coarse, sub-angular gravel.
AD/T	17/12/2018	2	0		Silty CLAY; high plasticity, grey, trace fine to medium, sub-angular ironstone gravel.
					From 3.0 m, pale grey.
		4	-2		From 4.2 m, brown, with fine to medium grained sand.
					From 4.7 m, pale grey, trace fine to medium grained sand.
		6	-4		
NMLC	100% RETURN	8	-6		Sandy CLAY; low to medium plasticity, grey-brown, sand is fine to medium grained, grading into sandstone.
					SANDSTONE; fine to medium grained, with dark grey lamination, cross bedded at 5-15°, with iron staining.
		10	-8		
					From 11.3 m, fine grained, grey.
		12	-10		
		14	-12		Hole Terminated at 13.39 m Target Depth Reached

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date Static Water Level
BH3M	Standpipe		7.00 m -4.40 m	



This well log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH3M

Project	Proposed Development	**East**	330238.4	**Depth Range**	7.52m to 13.39m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246363.2	**Contractor**	BG Drilling Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 2.6m	**Drill Rig**	Rig 7		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	FY	**Date**	17 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 5M

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	3.01				-	CONCRETE; 90 mm thick.	-	-	CONCRETE HARDSTAND
				0.50				-	FILL: Clayey SAND; dark grey, with gravel, with brick fragments and other debris.	M	-	FILL
		23/01/19		2.60	BH5M_0.5-0.95 SPT 0.50-0.95 m 0,0,1 N=1			CI	Silty CLAY; medium plasticity, brown-grey, trace rootlets.			RESIDUAL SOIL
			1	*1.00*								
				2.10				CI-CH	Silty CLAY; high plasticity, red-grey, with sub-angular, fine, ironstone gravel.		VS	
				1.50								
	-			1.60	BH5M_1.5-1.95 SPT 1.50-1.95 m 0,1,3 N=4				From 1.5 m, high plasticity, grey, trace sub-angular, fine ironstone gravel, trace ash, grading into extremely weathered sandstone.	M (>PL)	F	
			2									
			3	*3.20*	BH5M_3.0-3.24 SPT 3.00-3.24 m 4,14/90mm HB N>50					M (<PL)	H	
AD/T				-0.10				SP	SAND; fine grained, grey, with clay and ironstone bands. (Extremely weatered SANDSTONE)	M	-	
				4.00								
	M	19/12/2018	4	-0.90				-	SANDSTONE; fine to medium grained, grey, very low to low strength, distinctly weathered.			BEDROCK
					BH5M_4.5-4.65 SPT 4.50-4.65 m 19 HB N>30							
	M-H		5							-	-	
			6	*6.50*								
									Continued as Cored Borehole			
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 5M

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
					6.50		Continuation from non-cored borehole				
NMLC	100% RETURN	100	75	7	-3.40 *7.05* -3.95		SANDSTONE; fine grained, grey, trace shale bands. From 7.05 m, medium grained, grey.	SW		6.52: JT, CN, PR, S, sub-vertical 6.54-6.64: BPx15, CN, PR, S, horizontal 6.71: BP, CN, PR, S, horizontal 6.83: BP, CN, PR, S, horizontal 6.95: BP, CN, PR, S, horizontal 7.05: BP, CN, PR, S, horizontal 7.19: BP, CN, PR, S, horizontal 7.45: BP, CN, PR, S, horizontal	
					7.94						
				8	-4.84		SHALE; dark grey, with sandstone laminations.			7.98: JT, CN, PR, S, sub-vertical 8.29: BP, CN, PR, S, horizontal	
					8.55						
					-5.45		SANDSTONE; coarse grained, grey, quartzose.			8.52: BP, CN, PR, S, horizontal 8.64: BP, CN, PR, S, horizontal	
				9							
		100	96							9.27: BP, CN, PR, S, horizontal 9.34: BP, CN, PR, S, horizontal 9.40: BP, CN, PR, S, horizontal 9.52: BP, CN, PR, S, horizontal	
				10	*10.00*						

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 5M

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	96	10	-6.90		SANDSTONE; coarse grained, grey, quartzose. From 10.0 m, fine grained, grey.	SW		9.95-10.00: BPx5, CN, PR, S, horizontal	
					10.38						
					-7.28		From 10.38 m, coarse grained, grey.	FR		10.37: BP, CN, PR, S, horizontal 10.47: BP, CN, PR, S, horizontal	
				11						10.81: BP, CN, PR, S, horizontal	
										11.26: BP, CN, PR, S, horizontal	
				12						11.72-11.73: SM, Clay	
					12.55						
					-9.45		Hole Terminated at 12.55 m Target Depth Reached				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. 5M

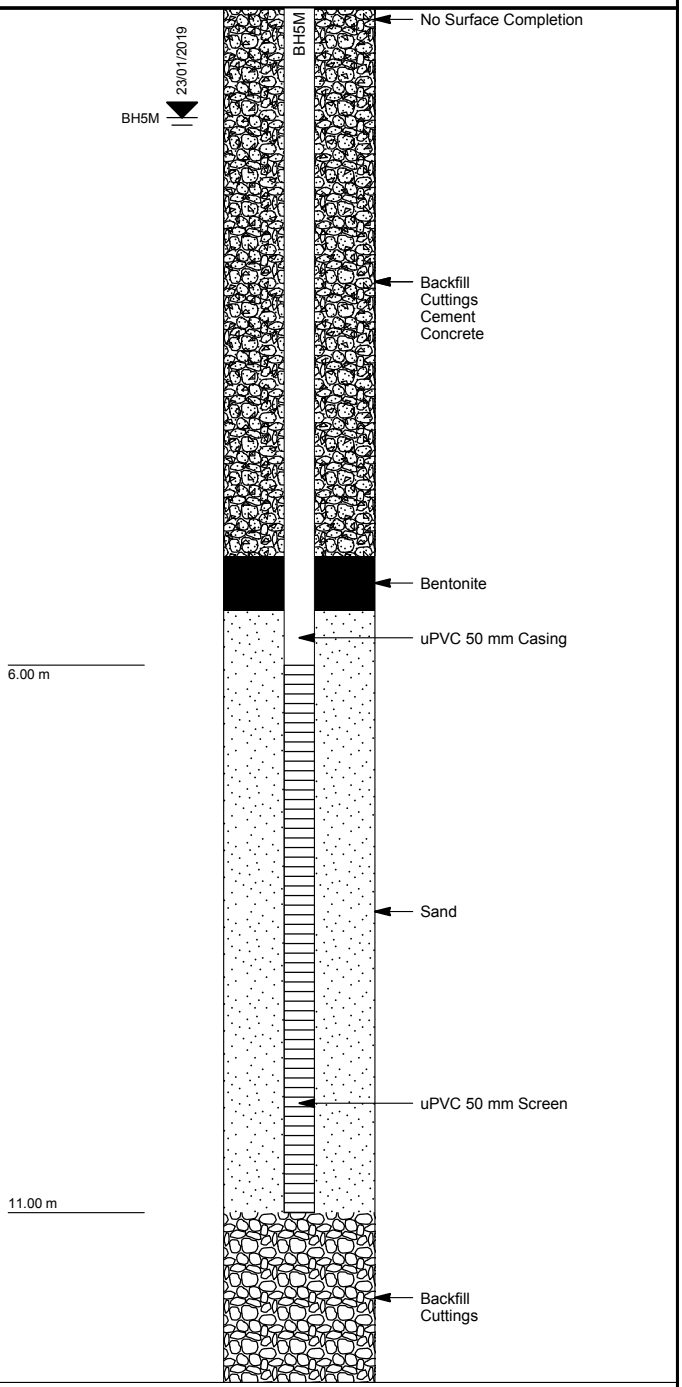
Project	Proposed Development	**Sheet**	1 of 2
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	20/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 20/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
DT	23/01/19	0			CONCRETE; 90 mm thick.
					FILL: Clayey SAND; dark grey, with gravel, with brick fragments and other debris.
					Silty CLAY; medium plasticity, brown-grey, trace rootlets.
		2	2		Silty CLAY; high plasticity, red-grey, with sub-angular, fine, ironstone gravel.
					From 1.5 m, high plasticity, grey, trace sub-angular, fine ironstone gravel, trace ash, grading into extremely weathered sandstone.
		2	0		SAND; fine grained, grey, with clay and ironstone bands. (Extremely weatered SANDSTONE)
AD/T	19/12/2018	4	-2		SANDSTONE; fine to medium grained, grey, very low to low strength, distinctly weathered.
		6			SANDSTONE; fine grained, grey, trace shale bands.
			-4		From 7.05 m, medium grained, grey.
NMLC	100% RETURN	8			SHALE; dark grey, with sandstone laminations.
			-6		SANDSTONE; coarse grained, grey, quartzose.
		10			From 10.0 m, fine grained, grey.
			-8		From 10.38 m, coarse grained, grey.
		12			
			-10		Hole Terminated at 12.55 m Target Depth Reached

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date Static Water Level
BH5M	Standpipe		11.00 m -7.90 m	



This well log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH5M

Project	Proposed Development	**East**	330179.4	**Depth Range**	6.5m to 12.55m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246439.0	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 3.1m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	BL	**Date**	20 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 7

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	0.14				-	CONCRETE; 140 mm thick.	-	-	CONCRETE HARDSTAND
				2.46				-	FILL: Gravelly CLAY; low plasticity, dark grey, gravel is fine to medium, sub-angular.	M (>PL)	-	FILL
				0.50	BH7_0.3-0.4 DS 0.30-0.40 m							
				2.10				-	FILL: Silty CLAY; medium plasticity, brown-dark grey to dark brown, trace fine to medium, sub-angular gravel.			
				0.70	BH7_0.5-0.95							
				1.90	SPT 0.50-0.95 m 2,3,3 N=6			CH	Silty CLAY; high plasticity, pale grey, with fine to medium, sub-angular ironstone gravel.			RESIDUAL SOIL
			1									
					BH7_1.5-1.95 SPT 1.50-1.95 m 2,2,4 N=6						F	
			2									
AD/T	-	GWNE		3.00						M (>PL)		
			3	-0.40	BH7_3.0-3.45 SPT 3.00-3.45 m 18,7,12 N=19				From 3.0 m, trace fine to coarse grained sand.		VSt	
			4									
				4.50								
				-1.90	BH7_4.5-4.95 SPT 4.50-4.84 m 11/40mm HB				From 4.5 m, grading into extremely weathered material.		H	
				4.95								
			5						Continued as Cored Borehole			
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 7

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
					4.95		Continuation from non-cored borehole				
NMLC	100% RETURN	89	76	5	-2.35		SANDSTONE; fine to medium grained, pale grey, with iron staining.	DW		5.00-5.05: SZ, 50 mm 5.10: BPx2, 0°, Fe SN, PR, RF	
										5.40: BP, 0°, Fe SN, PR, RF 5.44: XWZ, 20 mm 5.56: XWZ, 10 mm 5.65: x5, 3 mm	
		96	60	6	*6.08* -3.48 -3.60		From 6.08 m, fine grained, grey. From 6.2 m, fine to medium grained, pale grey.	SW		5.74: BPx2, 0°, CN, PR, RF 5.81: BP, 0°, CN, PR, RF 6.18: BP, 0°, Fe SN, PR, RF 6.27: BP, 0°, Fe SN, PR, RF 6.30: BP, 0°, Fe SN, PR, RF 6.59: CZ, 20 mm	
				7	*7.06*						
		100	77		-4.46 *7.58* -4.98		SHALE; dark grey, interbedded with pale gey sandstone. SANDSTONE; fine to medium grained, pale grey, with dark grey lamination.	FR		7.10: CZ, 50 mm 7.49: BP, 0°, CN, PR, RF 7.54: BP, 0°, Clay VNR, PR, RF, 2 mm 7.57: CZ, 5 mm 7.64: SZ, 5 mm 7.95: CZ, 3 mm 7.96: BP, 0°, CN, PR, RF 8.30: SF, 10 mm	
				8							
		100	100	9	*9.14* -6.54		From 9.14 m, pale brown.			9.14: BP, 0°, CN, PR, RF	
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 7

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** FY	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	BG Drilling Pty Ltd	**Surface RL**	≈2.60 m AHD
Drill Rig	Rig 7	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	100	10			SANDSTONE; fine to medium grained, pale grey, with dark grey lamination.	FR		10.23: BP, 0°, CN, PR, RF	
		100	100	11							
				12	*12.18* -9.58		Hole Terminated at 12.18 m Target Depth Reached				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH7

Project	Proposed Development	**East**	330216.3	**Depth Range**	4.95m to 12.18m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246411.2	**Contractor**	BG Drilling Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 2.6m	**Drill Rig**	Rig 7		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	FY	**Date**	18 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 8

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈1.90 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	*0.11*				-	CONCRETE; 110 mm thick.	-	-	CONCRETE HARDSTAND
				0.30				-	FILL: SAND; medium grained, poorly graded, with clay.	M		FILL
				1.60	BH8_0.5-0.95 SPT 0.50-0.95 m HW,HW,HW N=0			-	FILL: Silty CLAY; medium plasticity, dark grey, with fine to medium sand, with sub-angular, fine to medium gravels.	M (>PL)	-	
			1	*1.00*								
		18/12/18		0.90				Cl	Silty CLAY; medium plasticity, red mottled with orange, with sub-angular, fine ironstone gravels.			RESIDUAL SOIL
				1.50								
				0.40	BH8_1.5-1.95 SPT 1.50-1.95 m 1,4,4 N=8				From 1.5 m, medium to high plasticity, grey, trace rootlets, trace ash, grading into extremely weathered sandstone.	M (>PL)	St	
	-		2									
					BH8_3.0-3.45 SPT 3.00-3.45 m 4,8,16 N=24					M (<PL)	VSt	
AD/T		18/12/2018	3									
				4.00								
			4	-2.10				SC	Clayey SAND; medium grained, purple-grey. (Extremely weatered SANDSTONE)	W	-	
				4.62	BH8_4.5-4.62							
				-2.72	SPT 4.50-4.92 m 15/120mm HB N>30			-	SANDSTONE; medium grained, purple-grey, very low strength, distinctly weathered.			BEDROCK
	M		5									
			6							-	-	
	H			*7.00*								
			7						Continued as Cored Borehole			
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 8

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈1.90 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
				7	*7.00*		Continuation from non-cored borehole				
NMLC	100% RETURN	100	87		-5.10		SHALE; dark grey, with sandstone laminations.	SW		7.00-7.05: BPx10, CN, PR, S	
					7.31						
				8	-5.41		SANDSTONE; fine grained, grey, trace shale laminations.	FR		7.30-7.31: XWS 7.40: BP, CN, PR, S 7.67: BP, CN, PR, S 7.91: BP, CN, PR, S 8.13: BP, CN, PR, S 8.25-8.28: XWS	
					8.71						
				9	-6.81		SANDSTONE; coarse grained, grey, massive bedding, quartzose, trace shale laminations.			9.45: BP, CN, PR, S 9.65: BP, CN, PR, S	
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 8

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈1.90 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	87	10			SANDSTONE; coarse grained, grey, massive bedding, quartzose, trace shale laminations.	FR		10.29: BP, CN, PR, S	
				11						10.66-10.69: SM, Clay 10.80: BP, CN, PR, S 10.85: BP, CN, PR, S 10.89: BP, CN, PR, S	
		100	90	12						11.32: BP, CN, PR, S 11.47: BP, CN, PR, S	
				13	*13.29*						
					-11.39		Hole Terminated at 13.29 m Target Depth Reached				
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH8

Project	Proposed Development	**East**	330264.8	**Depth Range**	7.0m to 13.29m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246400.6	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 1.9m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	BL	**Date**	18 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 9M

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	19/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 19/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.30 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	-	09/01/19	0	3.30				-	FILL: Clayey SAND; medium grained, dark grey, with sub-angular, fine to medium grained gravels, with brick fragments.	M	-	FILL
				0.50								
			1	2.80	BH9M_0.5-0.95 SPT 0.50-1.00 m HW,HW,HW N=0			CH	Silty CLAY; high plasticity, grey-brown, trace ash, trace rootlets.		VS	RESIDUAL SOIL
				1.40								
				1.90					From 1.4 m, red mottled grey, with sub-angular, fine ironstone gravels.			
				1.70	BH9M_1.5-1.95 SPT 1.50-1.95 m 2,3,4 N=7							
			2	1.60					From 1.7 m, grey, trace sub-angular, fine ironstone gravels, grading into extremely weathered sandstone.	M (>PL)	F	
		19/12/2018										
			3		BH9M_3.0-3.45 SPT 3.00-3.45 m 1,7,14 N=21					M (<PL)	VSt	
				4.00								
			4	-0.70				SC	Clayey SAND; fine to medium grained, orange-grey. (Extremely weatered SANDSTONE)	M	-	
				4.85	BH9M_4.5-4.85 SPT 4.50-4.85 m 10,11,7/50mm HB							
	M-H		5	-1.55	N>30			-	SANDSTONE; medium grained, orange-grey, very low strength, distinctly weathered.	-	-	BEDROCK
			6	*6.40*								
									Continued as Cored Borehole			
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 9M

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	19/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 19/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.30 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
				5							
				6							
					6.40		Continuation from non-cored borehole				
NMLC	100% RETURN	100	52	7	-3.10		SANDSTONE; fine grained, grey, carbonaceous laminations.	DW		6.40-6.81: BPx8, CN, PR, S, horizontal 6.81-6.83: XWS 7.05-7.07: XWS 7.13: JT, CN, PR, S, sub-vertical 7.20-7.53: BPx5, CN, PR, S, horizontal	
				8	*7.96*						
					-4.66		SHALE; dark grey, with sandstone laminations.			7.95-7.96: SM, Clay 8.08: JT, CN, PR, S, sub-vertical	
					8.33						
		100	100		-5.03		SANDSTONE; medium grained, grey.	SW		8.33: BP, CN, PR, S, horizontal	
		100	95	9						9.05: BP, CN, PR, S, horizontal 9.40: BP, CN, PR, S, horizontal 9.68: BP, CN, PR, S, horizontal 9.82: BP, CN, PR, S, horizontal	
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 9M

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	19/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 19/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.30 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	95	10			SANDSTONE; medium grained, grey.	FR			
				11	*11.00* -7.70		From 11.0 m, coarse grained, massive bedding, quartzose.			10.68: BP, CN, PR, S, horizontal 10.75: BP, CN, PR, S, horizontal 11.21: BP, CN, PR, S, horizontal	
		100	100	12						12.76: BP, CN, PR, S, horizontal	
				13	*13.00* -9.70		Hole Terminated at 13.00 m Target Depth Reached				
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. 9M

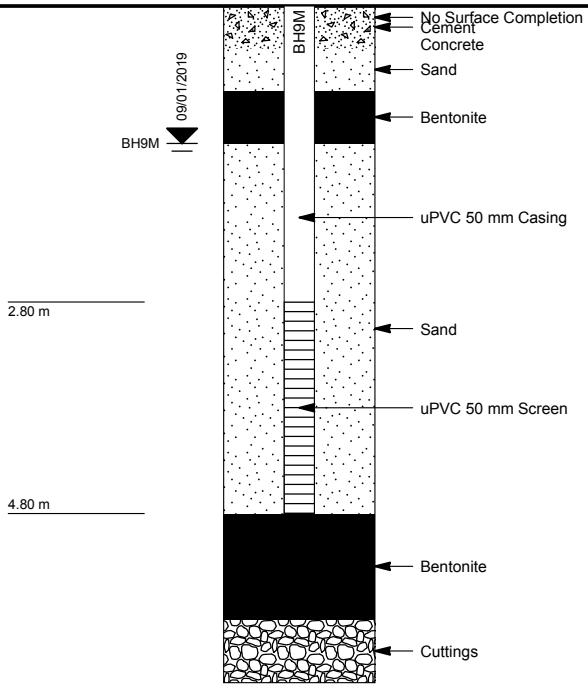
Project	Proposed Development	**Sheet**	1 of 2
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	19/12/2018
Position	Refer to Figure 2	**Date Completed**	19/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 19/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈3.30 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
AD/T	09/01/19 ▼	0			FILL: Clayey SAND; medium grained, dark grey, with sub-angular, fine to medium grained gravels, with brick fragments.
					Silty CLAY; high plasticity, grey-brown, trace ash, trace rootlets.
		2	2		From 1.4 m, red mottled grey, with sub-angular, fine ironstone gravels.
	19/12/2018 ▽				From 1.7 m, grey, trace sub-angular, fine ironstone gravels, grading into extremely weathered sandstone.
			0		
		4			Clayey SAND; fine to medium grained, orange-grey. (Extremely weatered SANDSTONE)
			-2		SANDSTONE; medium grained, orange-grey, very low strength, distinctly weathered.
		6			
NMLC	100% RETURN				SANDSTONE; fine grained, grey, carbonaceous laminations.
			-4		
		8			SHALE; dark grey, with sandstone laminations.
					SANDSTONE; medium grained, grey.
			-6		
		10			
			-8		From 11.0 m, coarse grained, massive bedding, quartzose.
		12			
			-10		Hole Terminated at 13.00 m Target Depth Reached
		14			

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
BH9M	Standpipe		4.80 m -1.50 m		



This well log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH9M

Project	Proposed Development	**East**	330202.4	**Depth Range**	6.4m to 13.0m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246462.3	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 3.3m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	BL	**Date**	19 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 12

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
DT		-	0	*0.15*				-	CONCRETE; 150 mm thick.	-	-	CONCRETE HARDSTAND
				1.90				-	FILL: Gravelly SAND; medium to coarse grained, dark grey, well graded.			FILL
				0.50				CH	Silty CLAY; high plasticity, red mottled with grey.			RESIDUAL SOIL
				1.60	BH12_0.5-0.95 SPT 0.50-0.95 m 1,3,3 N=6				From 0.5 m, grey-red, trace fine, sub-angular ironstone gravels.			
		17/12/18	1									
	-				BH12_1.5-1.95 SPT 1.50-1.95 m 2,3,5 N=8					M (>PL)	F to St	
		17/12/2018	2	*2.00*								
				0.10					From 2.0 m, with fine, sub-angular ironstone gravels.			
				2.50								
				-0.40					From 2.5 m, medium plasticity, dark grey.			
AT/C				*3.00*								
			3	-0.90	BH12_3.0-3.1 SPT 3.00-3.40 m 9/100mm HB N>50			SC	Clayey SAND; fine to medium grained, grey-red, with fine, sub-angular ironstone gravels, grading to weathered sandstone. (Extremely weatered SANDSTONE)			
	M									W	H	
				4.80								
	H			-2.70				-	SANDSTONE; fine to medium grained, distinctly weathered.	-	-	BEDROCK
			5	*5.10*					Continued as Cored Borehole			
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 12

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
				2							
				3							
				4							
				5	*5.10*		Continuation from non-cored borehole				
NMLC	100% RETURN	100	19	6	-3.00		SANDSTONE; fine grained, grey, with shale laminations, with carbonaceous laminations.	DW		5.10-6.04: BPx30, horizontal	
					6.22					6.04: XWS	
					-4.12		SANDSTONE; medium grained, grey.	SW		6.17-6.20: XWS	
				7	*7.08*					6.47-6.50: XWS	
					-4.98		SHALE; dark grey, with sandstone laminations.			6.70: BP, CN, PR, S	
					7.46					6.87: BP, CN, PR, S	
					-5.36		SANDSTONE; medium to coarse grained, grey, trace shale laminations.	FR		7.05: BP, CN, PR, S	
		100	87	8						7.16: BP, CN, PR, S	
										7.33-7.64: BPx5, CN, PR, S	
										8.11: BP, CN, PR, S	
				9						8.73: BP, CN, PR, S	
		100	90							9.50: BP, CN, PR, S	
				10						9.68: BP, CN, PR, S	
										9.75: BP, CN, PR, S	
										9.82: BP, CN, PR, S	

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 12

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	17/12/2018
Position	Refer to Figure 2	**Date Completed**	17/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 17/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.10 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	90	10			SANDSTONE; medium to coarse grained, grey, trace shale laminations.	FR		10.28: BP, CN, PR, S	
				11							
				12						11.88: BP, CN, PR, S	
					12.45 -10.35					12.20: BP, CN, PR, S 12.24: BP, CN, PR, S	
							Hole Terminated at 12.45 m Target Depth Reached				
				13							
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH12

Project	Proposed Development	**East**	330241.7	**Depth Range**	5.1m to 12.45m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246439.9	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 2.1m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	BL	**Date**	17 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

BOREHOLE LOG

BH NO. 14M

Project	Proposed Development	**Sheet**	1 of 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.00 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY REL. DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
-			0	***0.14***				-	CONCRETE; 140 mm thick.	-	-	CONCRETE HARDSTAND
				1.86				-	FILL: Gravelly SAND; medium to coarse grained, dark grey, with brick fragments, with clay.	M	-	FILL
		23/01/19		***0.85***	BH14M_0.5-0.95 SPT 0.50-0.95 m HW,HW,2 N=2							
			1	1.15				CH	Silty CLAY; high plasticity, red mottled with grey, with fine, sub-angular ironstone gravels.	M (>PL)	S	RESIDUAL SOIL
				1.10					From 1.1 m, grey mottled with red, rare ash, grading into extremely weathered sandstone.			
				0.90								
AD/T	-		2		BH14M_1.5-1.95 SPT 1.50-1.95 m 2,3,4 N=7					M (=PL)	F	
		18/12/2018		***3.00***								
			3	***3.15***	BH14M_3.0-3.45 SPT 3.00-3.45 m 2,7,20 N=27			SC	Clayey SAND; fine to medium grained, grey.			
				3.30				CI	Silty CLAY; medium plasticity, grey.			
				-1.30				SC	Clayey SAND; medium grained, red-purple, with ironstone gravels. (Extremely weatered SANDSTONE)	W	MD	
				4.00								
	H		4	-2.00				-	SANDSTONE; fine to medium grained, red-orange, very low strength, distinctly weathered, with clay seams.	-	-	BEDROCK
				4.60								
									Continued as Cored Borehole			
			5									
			6									
			7									
			8									
			9									
			10									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 14M

Project	Proposed Development	**Sheet**	2 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.00 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN			0							
				1							
				2							
				3							
				4							
					4.60		Continuation from non-cored borehole				
					-2.60		SANDSTONE; fine grained, orange-grey.	DW		4.60-5.00: BP, CN, PR, S, horizontal	
				5						5.00-5.55: BPx6, CN, PR, S, horizontal	
					5.30						
					-3.30		From 5.3 m, grey, with carbonaceous laminae.			5.42: JT, 45°, CN, PR, S	
		100	78	6						5.84: JT, 45°, CN, PR, S 5.95: JT, 45°, CN, PR, S	
					6.15						
					-4.15		SANDSTONE; medium grained, grey.	SW		6.35: BP, CN, PR, S, horizontal	
				7	*7.05*						
					-5.05		SHALE; dark grey, with sandstone laminations.			7.05: BP, CN, PR, S, horizontal 7.05-7.47: BPx20, CN, PR, S, horizontal	
		100	53		*7.47*						
					-5.47		SANDSTONE; medium grained, grey, rare shale laminations, extremely bedded at approximately 150 mm.	FR		7.54: BP, CN, PR, S, horizontal 7.65: BP, CN, PR, S, horizontal	
				8						7.99: XWS 8.15: BP, CN, PR, S, horizontal	
				9							
		100	77							9.37: BP, CN, PR, S, horizontal	
										9.65: BP, CN, PR, S, horizontal	
				10							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

CORED BOREHOLE LOG

BH NO. 14M

Project	Proposed Development	**Sheet**	3 OF 3
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.00 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	*DEPTH* RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
NMLC	100% RETURN	100	77	10			SANDSTONE; medium grained, grey, rare shale laminations, extremely bedded at approximately 150 mm.	FR		10.16: JT, CN, PR, S, sub-vertical	
										10.50: JT, CN, PR, S, sub-vertical	
										10.77-10.78: XWS	
				11						10.95: JT, CN, PR, S, sub-vertical	
					11.36 -9.36		From 11.36 m, massive bedding.			11.41: JT, CN, PR, S, sub-vertical	
		100	100	12							
				13	*13.15* -11.15		Hole Terminated at 13.15 m Target Depth Reached				
				14							
				15							
				16							
				17							
				18							
				19							
				20							

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

MONITORING WELL LOG

MW NO. 14M

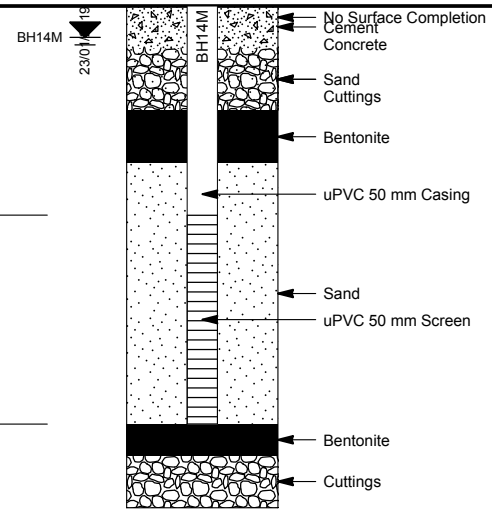
Project	Proposed Development	**Sheet**	1 of 2
Location	182-198 Victoria Road and 28-30 Faversham Street, Marrickville, NSW	**Date Started**	18/12/2018
Position	Refer to Figure 2	**Date Completed**	18/12/2018
Job No.	E24098.G03	**Logged By** BL	**Date** 18/12/2018
Client	Toga Wicks Park Developments Pty Ltd	**Reviewed By** SK	**Date** 31/12/2019

Drilling Contactor	Geosense Drilling Engineers	**Surface RL**	≈2.00 m AHD
Drill Rig	Hanjin D&B 8D	**Inclination**	-90°

METHOD	WATER	DEPTH (m)	RL (m AHD)	GRAPHIC LOG	SOIL/ROCK MATERIAL DESCRIPTION
AD/T	23/01/19	0	2		CONCRETE; 140 mm thick.
					FILL: Gravelly SAND; medium to coarse grained, dark grey, with brick fragments, with clay.
	18/12/2018				Silty CLAY; high plasticity, red mottled with grey, with fine, sub-angular ironstone gravels.
		2	0		From 1.1 m, grey mottled with red, rare ash, grading into extremely weathered sandstone.
					Clayey SAND; fine to medium grained, grey.
					Silty CLAY; medium plasticity, grey.
					Clayey SAND; medium grained, red-purple, with ironstone gravels. (Extremely weatered SANDSTONE)
		4	-2		SANDSTONE; fine to medium grained, red-orange, very low strength, distinctly weathered, with clay seams.
NMLC	100% RETURN				SANDSTONE; fine grained, orange-grey.
					From 5.3 m, grey, with carbonaceous laminae.
		6	-4		SANDSTONE; medium grained, grey.
					SHALE; dark grey, with sandstone laminations.
					SANDSTONE; medium grained, grey, rare shale laminations, extremely bedded at approximately 150 mm.
		8	-6		
		10	-8		
					From 11.36 m, massive bedding.
		12	-10		
					Hole Terminated at 13.15 m Target Depth Reached
		14	-12		

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date Static Water Level
BH14M	Standpipe		4.00 m -2.00 m	



This well log should be read in conjunction with EI Australia's accompanying standard notes.

CORE PHOTOGRAPH OF BOREHOLE: BH14M

Project	Proposed Development	**East**	330271.9	**Depth Range**	4.6m to 13.15m BEGL		
Location	182-198 Victoria Road & 28-30 Faversham Street, Marrickville, NSW	**North**	6246420.8	**Contractor**	Geosense Drilling Engineers Pty Ltd		
Position	See Figure 2	**Surface RL**	≈ 2.0m	**Drill Rig**	Hanjin D&B 8D		
Job No.	E24098.G03	**Inclination**	-90°	**Logged**	BL	**Date**	18 / 12 / 2018
Client	Toga Wicks Park Developments Pty Ltd	**Box**	1-2 of 2	**Checked**	DS	**Date**	31 / 1 / 2018

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT LOGS

DRILLING/EXCAVATION METHOD

HA	Hand Auger	**RD**	Rotary blade or drag bit	**NQ**	Diamond Core - 47 mm
DT	Diatube Coring	**RT**	Rotary Tricone bit	**NMLC**	Diamond Core - 52 mm
NDD	Non-destructive digging	**RAB**	Rotary Air Blast	**HQ**	Diamond Core - 63 mm
AS*	Auger Screwing	**RC**	Reverse Circulation	**HMLC**	Diamond Core - 63 mm
AD*	Auger Drilling	**PT**	Push Tube	**BH**	Tractor Mounted Backhoe
***V**	V-Bit	**CT**	Cable Tool Rig	**EX**	Tracked Hydraulic Excavator
***T**	TC-Bit, e.g. AD/T	**JET**	Jetting	**EE**	Existing Excavation
ADH	Hollow Auger	**WB**	Washbore or Bailer	**HAND**	Excavated by Hand Methods

PENETRATION RESISTANCE

L	**Low Resistance**	Rapid penetration/ excavation possible with little effort from equipment used.
M	**Medium Resistance**	Penetration/ excavation possible at an acceptable rate with moderate effort from equipment used.
H	**High Resistance**	Penetration/ excavation is possible but at a slow rate and requires significant effort from equipment used.
R	**Refusal/Practical Refusal**	No further progress possible without risk of damage or unacceptable wear to equipment used.

These assessments are subjective and are dependent on many factors, including equipment power and weight, condition of excavation or drilling tools and experience of the operator.

WATER

Standing Water Level

Partial water loss

Water Seepage

Complete Water Loss

GWNO	GROUNDWATER NOT OBSERVED - Observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave-in of the borehole/ test pit.
GWNE	GROUNDWATER NOT ENCOUNTERED - Borehole/ test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/ test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following a 150mm seating drive
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
Sampling	
DS	Disturbed Sample
ES	Sample for environmental testing
BDS	Bulk disturbed Sample
GS	Gas Sample
WS	Water Sample
U50	Thin walled tube sample - number indicates nominal sample diameter in millimetres
Testing	
FP	Field Permeability test over section noted
FVS	Field Vane Shear test expressed as uncorrected shear strength (sv= peak value, sr= residual value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket Penetrometer test expressed as instrument reading in kPa
WPT	Water Pressure tests
DCP	Dynamic Cone Penetrometer test
CPT	Static Cone Penetration test
CPTu	Static Cone Penetration test with pore pressure (u) measurement

ROCK CORE RECOVERY

TCR=Total Core Recovery (%)

$$= \frac{Length\ of\ core\ recovered}{Length\ of\ core\ run} \times 100$$

SCR=Solid Core Recovery (%)

$$= \frac{\sum Length\ of\ cylindrical\ core\ recovered}{Length\ of\ core\ run} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum Axial\ lengths\ of\ core > 100mm}{Length\ of\ core\ run} \times 100$$

GEOLOGICAL BOUNDARIES

———— = Observed Boundary (position known)

– – – – – – – – – – = Observed Boundary (position approximate)

– –?– –?– –?– – = Boundary (interpreted or inferred)

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT LOGS

	FILL		ORGANIC SOILS (OL, OH or Pt)		CLAY (CL, CI or CH)
	COUBLES or BOULDERS		SILT (ML or MH)		SAND (SP or SW)
	GRAVEL (GP or GW)	Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay			

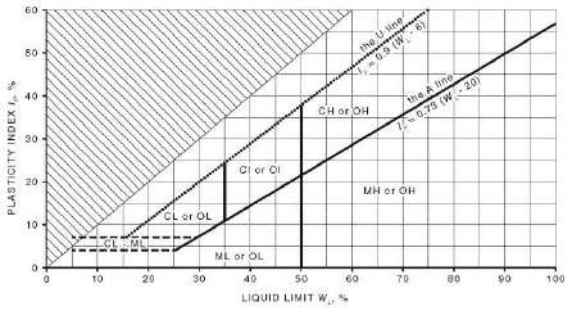
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS 1726:2017, Section 6.1 – Soil description and classification.

PARTICLE SIZE CHARACTERISTICS

Fraction	Components	Sub Division	Size mm
Oversize	BOULDERS		>200
	COBBLES		63 to 200
Coarse grained soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine grained soil	SILT		0.002 to 0.075
	CLAY		<0.002

PLASTICITY PROPERTIES



GROUP SYMBOLS

Major Divisions		Symbol	Description
COARSE GRAINED SOILS More than 65% of soil excluding oversize fraction is greater than 0.075mm	GRAVEL More than 50% of coarse fraction is >2.36mm	GW	Well graded gravel and gravel-sand mixtures, little or no fines.
		GP	Poorly graded gravel and gravel-sand mixtures, little or no fines.
		GM	Silty gravel, gravel-sand-silt mixtures.
		GC	Clayey gravel, gravel-sand-clay mixtures.
	SAND More than 50% of coarse fraction is <2.36 mm	SW	Well graded sand and gravelly sand, little or no fines.
		SP	Poorly graded sand and gravelly sand, little or no fines.
		SM	Silty sand, sand-silt mixtures.
		SC	Clayey sand, sandy-clay mixtures.
FINE GRAINED SOILS More than 35% of soil excluding oversized fraction is less than 0.075mm	Liquid Limit less < 50%	ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands.
		CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
		OL	Organic silts and organic silty clays of low plasticity.
	Liquid Limit > than 50%	MH	Inorganic silts of high plasticity.
		CH	Inorganic clays of high plasticity.
		OH	Organic clays of medium to high plasticity.
	Highly Organic soil	PT	Peat muck and other highly organic soils.

MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Non- cohesive and free-running.
M	Moist	Soils feel cool, darkened in colour. Soil tends to stick together.
W	Wet	Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling.

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit (w < PL); Moist, near plastic limit (w ≈ PL); Moist, wet of plastic limit (w < PL); Wet, near liquid limit (w ≈ LL), Wet, wet of liquid limit (w > LL),

CONSISTENCY

Symbol	Term	Undrained Shear Strength (kPa)	SPT "N" #
VS	Very Soft	≤ 12	≤ 2
S	Soft	>12 to ≤ 25	>2 to ≤ 4
F	Firm	>25 to ≤ 50	>4 to 8
St	Stiff	>50 to ≤ 100	>8 to 15
VSt	Very Stiff	>100 to ≤ 200	>15 to 30
H	Hard	>200	>30
Fr	Friable	-	

DENSITY

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	≤ 15	0 to 4
L	Loose	>15 to ≤ 35	4 to 10
MD	Medium Dense	>35 to ≤ 65	10 to 30
D	Dense	>65 to ≤ 85	30 to 50
VD	Very Dense	>85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.
SPT correlations are not stated in AS1726:2017, and may be subject to corrections for overburden pressure and equipment type.

MINOR COMPONENTS

Term	Assessment Guide	Proportion by Mass
Trace	Presence just detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: ≤ 5% Fine grained soil: ≤ 15%
With	Presence easily detectable by feel or eye but soil properties little or no different to general properties of primary component	Coarse grained soils: 5 - 12% Fine grained soil: 15 - 30%
Prefix	Presence easily detectable by feel or eye in conjunction with the general properties of primary component	Coarse grained soils: >12% Fine grained soil: >30%

TERMS FOR ROCK MATERIAL STRENGTH AND WEATHERING

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL STRENGTH CLASSIFICATION

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa) #	Field Guide
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

 # Rock Strength Test Results

▼ Point Load Strength Index, $Is_{(50)}$, Axial test (MPa)

● Point Load Strength Index, $Is_{(50)}$, Diametral test (MPa)

Relationship between rock strength test result ($Is_{(50)}$) and unconfined compressive strength (UCS) will vary with rock type and strength, and should be determined on a site-specific basis. However UCS is typically 20 x $Is_{(50)}$.

ROCK MATERIAL WEATHERING CLASSIFICATION

Symbol		Term	Field Guide
RS		Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
XW		Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered	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 weathering products in pores. In some environments it is convenient to subdivide into Highly Weathered and Moderately Weathered, with the degree of alteration typically less for MW.
	MW		
SW		Slightly Weathered	Rock slightly discoloured but shows little or no change of strength relative to fresh rock.
FR		Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

CLASSIFICATION AND INFERRED STRATIGRAPHY
Rock is broadly classified and described in Borehole and Test Pit Logs using the preferred method given in AS1726 – 2017, Section 6.2 – Rock identification, description and classification.

ROCK MATERIAL DESCRIPTION

Layering

Term	Description
Massive	No layering apparent
Indistinct	Layering just visible; little effect on properties
Distinct	Layering (bedding, foliation, cleavage) distinct; rock breaks more easily parallel to layering

Structure

Term	Spacing (mm)
Thinly laminated	<6
Laminated	6 – 20
Very thinly bedded	20 – 60
Thinly bedded	60 – 200
Medium bedded	200 – 600
Thickly bedded	600 – 2,000
Very thickly bedded	> 2,000

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES

Defect Type	Abbr.	Description
Joint	JT	Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water or soil or rock substance, which acts as cement.
Bedding Parting	BP	Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/ bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material.
Foliation	FL	Repetitive planar structure parallel to the shear direction or perpendicular to the direction of higher pressure, especially in metamorphic rock, e.g. Schistosity (SH) and Gneissosity.
Contact	CO	The surface between two types or ages of rock.
Cleavage	CL	Cleavage planes appear as parallel, closely spaced and planar surfaces resulting from mechanical fracturing of rock through deformation or metamorphism, independent of bedding.
Sheared Surface	SSU	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.
Sheared Seam/ Zone (Fault)	SS/SZ	Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50 mm) parallel and usually smooth or slickensided joints or cleavage planes.
Crushed Seam/ Zone (Fault)	CS/CZ	Seam or zone composed of disoriented usually angular fragments of the host rock substance, with roughly parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these.
Extremely Weathered Seam/ Zone	XWS/ XWZ	Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places.
Infilled Seam	IS	Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity.
Schistocity	SH	The foliation in schist or other coarse grained crystalline rock due to the parallel arrangement of platy or prismatic mineral grains, such as mica.
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS

Shape	Abbr.	Description	Roughness	Abbr.	Description
Planar	PR	Consistent orientation	Polished	POL	Shiny smooth surface
Curved	CU	Gradual change in orientation	Slickensided	SL	Grooved or striated surface, usually polished
Undulating	UN	Wavy surface	Smooth	SM	Smooth to touch. Few or no surface irregularities
Stepped	ST	One or more well defined steps	Rough	RO	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper
Irregular	IR	Many sharp changes in orientation	Very Rough	VR	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper

Orientation: **Vertical Boreholes –** The dip (inclination from horizontal) of the defect.
Inclined Boreholes – The inclination is measured as the acute angle to the core axis.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING

Coating	Abbr.	Description
Clean	CN	No visible coating or infilling
Stain	SN	No visible coating but surfaces are discoloured by staining, often limonite (orange-brown)
Veneer	VNR	A visible coating of soil or mineral substance, usually too thin to measure (< 1 mm); may be patchy

DEFECT APERTURE

Aperture	Abbr.	Description
Closed	-	Closed.
Open	OP	Without any infill material.
Infilled	-	Soil or rock i.e. clay, talc, pyrite, quartz, etc.

Appendix B - Laboratory Certificates

SOIL CLASSIFICATION REPORT

Client	EI Australia	**Source**	BH3M 2.9-3m
Address	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Sample Description**	Silty CLAY
Project	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No**	S45162-PI
Job No	S18541	**Lab No**	S45162

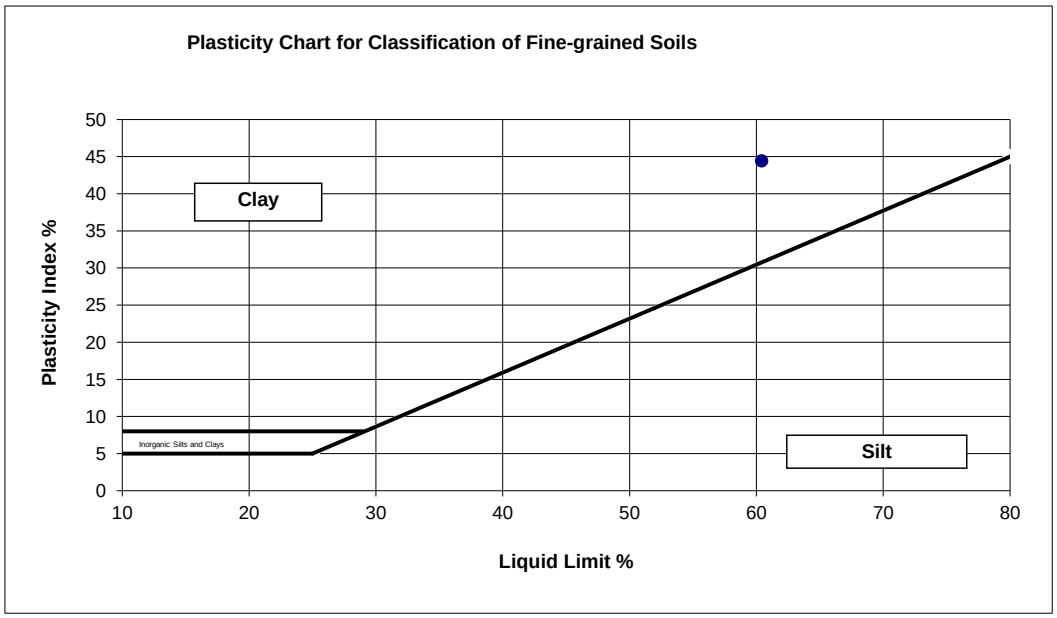
Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☑ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☑ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☐ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Liquid Limit (%)	60	**Linear Shrinkage (%)**	-
Plastic Limit (%)	16	**Plasticity Index**	44



Soil Preparation Method: Dry Sieved
Soil History: Air Dried
Soil Condition:

Notes

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025 -Testing. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

[redacted]
Chris Lloyd

15/01/2019
Date:

MACQUARIE GEOTECH
Macquarie Geotechnical
U7/8 10 Bradford Street
Alexandria NSW 2015

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No:**	S45108-PL
Job No:	S18541	**Date Tested:**	7/01/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45108	BH1M 6.70 - 6.83m	Sandstone							
			Axial	51.6	35.0	0.87	0.38	0.37	1
S45109	BH1M 7.40 - 7.48m	Sandstone							
			Axial	51.8	39.0	1.61	0.62	0.63	1
S45110	BH1M 7.84 - 7.95m	Sandstone							
			Axial	51.9	21.0	0.50	0.36	0.32	1
S45111	BH1M 8.73 - 8.83m	Sandstone							
			Axial	51.9	32.0	1.31	0.62	0.60	1
S45112	BH1M 10.62 - 10.73m	Sandstone							
			Axial	51.7	34.0	1.64	0.73	0.71	1
S45113	BH1M 11.67 - 11.74m	Sandstone							
			Axial	51.8	28.0	0.80	0.43	0.40	1
S45114	BH2 5.89 - 6.00m	Sandstone							
			Axial	51.8	29.0	0.20	0.10	0.10	1
S45115	BH2 7.28 - 7.38m	Sandstone							
			Axial	51.9	27.0	0.29	0.16	0.15	1
S45116	BH2 8.18 - 8.29m	Sandstone							
			Axial	51.8	35.0	1.65	0.71	0.70	1
S45117	BH2 9.69 - 9.81m	Sandstone							
			Axial	51.9	34.0	1.31	0.58	0.57	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA Accredited Laboratory Number: 14874

[redacted] Chris Lloyd

8/01/2019 Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No:**	S45118-PL
Job No:	S18541	**Date Tested:**	7/01/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45118	BH2 10.87 - 11.0m	Sandstone							
			Axial	51.9	36.0	3.76	1.58	1.56	1
S45119	BH2 11.61 - 11.70m	Sandstone							
			Axial	51.9	36.0	4.83	2.03	2.01	1
S45120	BH3M 8.21 - 8.31m	Sandstone							
			Axial	50.7	31.0	0.02	0.01	0.01	1
S45121	BH3M 8.72 - 8.82m	Sandstone							
			Axial	51.6	38.0	0.36	0.14	0.14	1
S45122	BH3M 9.4 - 9.55m	Sandstone							
			Axial	51.9	35.0	1.22	0.53	0.52	1
S45123	BH3M 10.37 - 10.48m	Sandstone							
			Axial	51.9	34.0	3.23	1.44	1.40	1
S45124	BH3M 11.37 - 11.48m	Sandstone							
			Axial	51.8	31.0	3.89	1.90	1.82	1
S45125	BH3M 12.41 - 12.50m	Sandstone							
			Axial	51.9	34.0	2.39	1.06	1.04	1
S45126	BH5M 6.71 - 6.82m	Sandstone							
			Axial	51.8	30.0	2.86	1.45	1.37	1
S45127	BH5M 7.45 - 7.54m	Sandstone							
			Axial	51.7	27.0	0.70	0.39	0.36	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA Accredited Laboratory Number: 14874

[redacted] Chris Lloyd

9/01/2019

Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No:**	S45128-PL
Job No:	S18541	**Date Tested:**	7/01/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45128	BH5M 8.03 - 8.13m	Sandstone							
			Axial	51.7	31.0	0.79	0.39	0.37	1
S45129	BH5M 9.04 - 9.13m	Sandstone							
			Axial	51.7	35.0	2.75	1.19	1.17	1
S45130	BH5M 10.46 - 10.56m	Sandstone							
			Axial	51.8	34.0	2.65	1.18	1.15	1
S45131	BH5M 11.50 - 11.60m	Sandstone							
			Axial	51.8	34.0	1.95	0.87	0.85	1
S45132	BH7 5.31 - 5.40m	Sandstone							
			Axial	51.8	23.0	0.35	0.23	0.20	1
S45133	BH7 6.31 - 6.41m	Sandstone							
			Axial	51.9	36.0	0.93	0.39	0.38	1
S45134	BH7 7.26 - 7.37m	Sandstone							
			Axial	51.9	28.0	0.68	0.37	0.34	1
S45135	BH7 8.12 - 8.21m	Sandstone							
			Axial	51.9	36.0	1.78	0.75	0.74	1
S45136	BH7 9.35 - 9.44m	Sandstone							
			Axial	51.9	36.0	1.21	0.51	0.50	1
S45137	BH7 11.31 - 11.41m	Sandstone							
			Axial	51.9	36.0	3.60	1.51	1.50	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA Accredited Laboratory Number: 14874

[redacted] Chris Lloyd

8/01/2019 Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No:**	S45138-PL
Job No:	S18541	**Date Tested:**	7/01/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45138	BH8 7.12 - 7.19m	Shale							
			Axial	51.8	19.0	0.66	0.52	0.45	1
S45139	BH8 7.72 - 7.82m	Sandstone							
			Axial	51.8	31.0	0.86	0.42	0.40	1
S45140	BH8 8.41 - 8.52m	Sandstone							
			Axial	51.9	36.0	1.88	0.79	0.78	1
S45141	BH8 10.41 - 10.50m	Sandstone							
			Axial	51.7	37.0	2.08	0.85	0.85	1
S45142	BH8 11.56 - 11.67m	Sandstone							
			Axial	51.8	31.0	1.67	0.81	0.78	1
S45143	BH8 12.80 - 12.90m	Sandstone							
			Axial	51.8	36.0	1.61	0.68	0.67	1
S45144	BH9M 6.84 - 6.94m	Sandstone							
			Axial	51.9	25.0	1.78	1.07	0.98	1
S45145	BH9M 7.31 - 7.40m	Sandstone							
			Axial	51.8	26.0	1.38	0.80	0.74	1
S45146	BH9M 8.26 - 8.31m	Sandstone							
			Axial	51.9	19.0	0.58	0.46	0.40	1
S45147	BH9M 8.80 - 8.90m	Sandstone							
			Axial	51.7	26.0	0.80	0.46	0.43	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA Accredited Laboratory Number: 14874

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9/01/2019

Date

MACQUARIE GEOTECH

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Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No:**	S45148-PL
Job No:	S18541	**Date Tested:**	7/01/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45148	BH9M 10.34 - 10.47m	Sandstone							
			Axial	51.8	32.0	1.13	0.53	0.51	1
S45149	BH9M 11.38 - 11.48m	Sandstone							
			Axial	51.8	35.0	0.95	0.41	0.40	1
S45150	BH12 6.26 - 6.36m	Sandstone							
			Axial	51.8	23.0	1.04	0.69	0.61	1
S45151	BH12 7.20 - 7.31m	Sandstone							
			Axial	51.8	32.0	2.08	0.99	0.95	1
S45152	BH12 7.81 - 7.93m	Sandstone							
			Axial	51.8	9.0	1.85	3.11	2.25	1
S45153	BH12 9.08 - 9.15m	Sandstone							
			Axial	51.8	34.0	1.17	0.52	0.51	1
S45154	BH12 11.08 - 11.16m	Sandstone							
			Axial	51.6	36.0	3.71	1.57	1.55	1
S45155	BH12 12.26 - 12.35m	Sandstone							
			Axial	51.6	34.0	2.20	0.98	0.96	1
S45156	BH14 4.85 - 4.96m	Sandstone							
			Axial	51.9	21.0	0.53	0.38	0.33	1
S45157	BH14 5.61 - 5.69m	Sandstone							
			Axial	52.2	37.0	0.03	0.01	0.01	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA Accredited Laboratory Number: 14874

[redacted]

9/01/2019

Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

POINT LOAD STRENGTH INDEX REPORT

Client:	EI Australia	**Moisture Content Condition:**	As received
Address:	Suite 6.01, 55 Miller Street, Pyrmont, NSW 2009	**Storage History:**	Core boxes
Project:	182 - 198 Victoria Road Marrickville (E24098 G03)	**Report No:**	S45158-PL
Job No:	S18541	**Date Tested:**	7/01/2019

Test Procedure: ☑ AS4133 4.1 Rock strength tests - Determination of point load strength index

Sampling: Sampled by Client **Date Sampled:** 17/12/2018

Preparation: Prepared in accordance with the test method

Sample Number	Sample Source	Sample Description	Test Type	Average Width (mm)	Platen Separation (mm)	Failure Load (kN)	Point Load Index Is (MPa)	Point Load Index $Is_{(50)}$ (MPa)	Failure Mode
S45158	BH14 6.24 - 6.30m	Sandstone							
			Axial	51.8	32.0	0.15	0.07	0.07	1
S45159	BH14 7.18 - 7.26m	Shale							
			Axial	51.2	14.0	0.15	0.16	0.13	1
S45160	BH14 8.20 - 8.32m	Sandstone							
			Axial	51.9	35.0	1.07	0.46	0.45	1
S45161	BH14 11.58 - 11.68m	Sandstone							
			Axial	51.6	32.0	1.92	0.91	0.88	1

Failure Modes

1 - Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.

2 - Fracture along bedding.

3 - Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.

4 - Chip or partial fracture.

NATA Accredited Laboratory Number: 14874

[redacted]

9/01/2019

Date

MACQUARIE GEOTECH

Macquarie Geotechn
U7/8 10 Bradford Street
Alexandria NSW

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Frank Yu
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	frank.yu@eiaustralia.com.au
Project	**E24098-G03 182-98 Victoria Rd Marrickvil**
Order Number	**E24098-G03**
Samples	3

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE187929 R0**
Date Received	9/1/2019
Date Reported	16/1/2019

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

[redacted]

pH in soil (1:5) [AN101] Tested: 14/1/2019

PARAMETER	UOM	LOR	BH9M_3.0-3.45 SOIL - 19/12/2018 SE187929.001	BH1M_0.5-0.95 SOIL - 20/12/2018 SE187929.002	BH14M_1.5-1.95 SOIL - 18/12/2018 SE187929.003
pH	pH Units	0.1	**6.9**	**7.7**	**6.5**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 14/1/2019

PARAMETER	UOM	LOR	BH9M_3.0-3.45 SOIL - 19/12/2018 SE187929.001	BH1M_0.5-0.95 SOIL - 20/12/2018 SE187929.002	BH14M_1.5-1.95 SOIL - 18/12/2018 SE187929.003
Conductivity of Extract (1:5 as received)	µS/cm	1	**72**	**62**	**82**
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	**84**	**77**	**96**

Soluble Anions (1:5) in Soil by Ion Chromatography [AN245] Tested: 15/1/2019

PARAMETER	UOM	LOR	BH9M_3.0-3.45 SOIL - 19/12/2018 SE187929.001	BH1M_0.5-0.95 SOIL - 20/12/2018 SE187929.002	BH14M_1.5-1.95 SOIL - 18/12/2018 SE187929.003
Chloride	mg/kg	0.25	19	14	57
Sulfate	mg/kg	5	110	41	100

Moisture Content [AN002] Tested: 14/1/2019

PARAMETER	UOM	LOR	BH9M_3.0-3.45 SOIL - 19/12/2018 SE187929.001	BH1M_0.5-0.95 SOIL - 20/12/2018 SE187929.002	BH14M_1.5-1.95 SOIL - 18/12/2018 SE187929.003
% Moisture	%w/w	0.5	**14**	**19**	**15**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

Appendix C – Vibration Limits

German Standard DIN 4150 – Part 3: 1999 provides guideline levels of vibration velocity for evaluating the effects of vibration in structures. The limits presented in this standard are generally considered to be conservative.

The DIN 4150 values (maximum levels measured in any direction at the foundation, OR, maximum levels measured in (x) or (y) directions, in the plane of the uppermost floor), are summarised in **Table A** below.

It should be noted that peak vibration velocities higher than the minimum figures in **Table A** for low frequencies may be quite 'safe', depending on the frequency content of the vibration and the actual conditions of the structures.

It should also be noted that these levels are 'safe limits', up to which no damage due to vibration effects has been observed for the particular class of building. 'Damage' is defined by DIN 4150 to include even minor non-structural cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls. Should damage be observed at vibration levels lower than the 'safe limits', then it may be attributed to other causes. DIN 4150 also states that when vibration levels higher than the 'safe limits' are present, it does not necessarily follow that damage will occur. Values given are only a broad guide.

Table A DIN 4150 – Structural Damage – Safe Limits for Building Vibration

Group	Type of Structure	Peak Vibration Velocity (mm/s)			
		At Foundation Level at a Frequency of:			Plane of Floor of Uppermost Storey
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 and 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

Note: For frequencies above 100 Hz, the higher values in the 50 Hz to 100 Hz column should be used.

Appendix D - Important Information

Important Information

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client And EI Australia ("EI"). The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

EI has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps and plans. EI has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, EI will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to EI.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g. a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation programme undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation programme and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. EI should be kept appraised of any such events, and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that EI be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. EI assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of EI or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

EI will not be liable to update or revise the report to take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.