CONSULTING EARTH SCIENTISTS

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

6A WATSFORD ROAD, CAMPBELLTOWN, NEW SOUTH WALES

PREPARED FOR IBIZ DESIGN AND CONSTRUCTION PTY LTD

CES DOCUMENT REFERENCE: CES180704-IDC-AB

Written by: Henry Noakes

Reviewed by: D. Lowe

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Client: Ibiz Design and Construction Pty Ltd

Date: 18 October 2018

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Document Control

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1 INTRODUCTION

Consulting Earth Scientists Pty Ltd (CES) was commissioned by Ibiz Design and Construction Pty Ltd (the Client) to undertake a Preliminary Geotechnical Investigation (PGI) at 6A Watsford Road, Campbelltown, New South Wales (the Site). The Site is currently in due diligence phase and intended for development. Based on correspondence with the Client, CES understands that the development will consist of an approximately 15 metre-high building with a single level basement car park.

The purpose of this preliminary geotechnical investigation is to assess the subsurface ground conditions and provide information on the following:

- The subsurface conditions for the Site;
- Expected groundwater conditions;
- Likely excavation conditions and support;
- Suitable foundation system and allowable bearing pressures; and
- Potential presence of Acid Sulfate Soils

This report presents findings of the preliminary geotechnical investigation which was undertaken in general accordance with CES proposal reference CES180704-IBC-AA dated 04 July 2018. Contemporaneous with the PGI, a preliminary environmental investigation was also undertaken; the results of this preliminary environmental investigation are presented in CES document reference CES180704-IBC-AC, dated 27 September 2018. This report should be read in conjunction with the preliminary environmental site investigation

2 THE SITE

2.1 SITE LOCATION & DESCRIPTION

The Site is located at 6A Watsford Road, Campbelltown, NSW. The Site is bounded to the north by Watsford Road, to the east and west by a single storey warehouse/office building and to the south by the Campbelltown to Central Station railway. The total site area is 1,747 m^2 and is identified as Lot 113 in Deposited Plan (DP) 1183297. At the time of investigation, the Site was

vacant and covered in landscaped grasses and included a garden bed in the south-west corner of the Site containing some evenly spaced 3 to 4 metre trees. The Site location is shown in Figure 1.

2.2 SURROUNDING LAND USE

Based on observations made during the fieldwork and through a review of available aerial photographs, the land surrounding the Site is classified by Campbelltown City Council as B5-Business Development.

2.3 REGIONAL GEOLOGY

A review of the Wollongong-Port Hacking 1:100,000 scale map for the area, Geological Series, Sheets 9029 to 9129 (Geological Survey of NSW, Department of Mineral Resource, 1985) indicates that the Site is underlain by Quaternary alluvial deposits comprising quartz and lithic fluvial sand, silt and clay.

2.4 ACID SULFATE SOILS

A review of the Atlas of Australian Acid Sulfate Soils (ASS) maps provided by the Department of Planning and Environment shows the Site has an extremely low probability of ASS occurring.

2.5 TOPOGRAPHY

A review of the NATMAP Digital Topographical – Zone 56 Mosaic for Campbelltown and Nearmap aerial imagery indicated the area around the Site to be sloping very gently down to the southwest. Georges River lies approximately 4 kilometres east and the Nepean river approximately 8 kilometres west of the Site.

3 METHOD OF INVESTIGATION

3.1 FIELDWORK

3.1.1 Borehole Drilling

Two boreholes were drilled across the Site on 29 August 2018 using a Hanjin track mounted geotechnical drilling rig. Table 1 provides a summary of borehole coordinates, interpolated ground levels and termination depths. The ground levels have been interpolated using Near-map software and the borehole coordinates were determined using a hand-held GPS. The boreholes were not surveyed.

Table 1: Borehole Summary

Borehole Reference	Easting (MGA 56)	Northing (MGA 56)	Elevation (m AHD)	Termination	
				Depth (m)	Lithology
BH01	298532.79	6228905.86	62.5	8.5	Low strength Shale
BH02	298504.26	6228930.33	61.5	8.4	Low strength Shale

4 RESULTS OF THE INVESTIGATION

4.1 SUMMARY OF SUBSURFACE CONDITIONS

An inferred geotechnical model has been prepared for the Site based on the geotechnical boreholes. The inferred geotechnical model is presented in Table 2. The depths of the various strata are based on the depths encountered at the borehole locations and may be different at other parts of the Site. Detailed descriptions and depths of materials encountered are presented on the geotechnical borehole logs enclosed in Appendix A.

Table 2: Geotechnical Model of the Site

Unit	Geotechnical Unit	Approximate Depth to base of Unit (m)	Estimated Thickness (m)	Typical Description
Unit 1	Topsoil	0.1 to 0.15	0.1 to 0.15	Sandy Clay, low plasticity, pale brown. Sands fine grained, sub-rounded with some silt and fine gravels. Trace organics including fine roots.
Unit 2	Alluvium	4.8 to 5.4	4.7 to 5.25	Sandy Gravelly Clay, low plasticity, mottled brown, grey and pale orange. Sands typically fine grained and sub-rounded. Gravels sub-rounded. Trace silt. Stiff to very stiff.

Unit	Geotechnical Unit	Approximate Depth to base of Unit (m)	Estimated Thickness (m)	Typical Description
Unit 3	Residual Soil	5.5 to 5.7	0.1 to 0.9	Silty Clay, low plasticity, dark grey. Residual soil from extremely weathered rock underlying the site, fragments of very low strength Shale present. Very stiff to hard.
Unit 4	Extremely and Highly Weathered Shale (Class IV) *	6.2 to 7.1m	0.7 to 1.4m	Shale, fine grained, highly to extremely weathered and low to very low strength [Ashfield Shale]
Unit 5	Moderately and Slightly Weathered Shale (Class III) *	Greater than 8.4m	Greater than 2.1m	Shale, fine grained, slightly to moderately weathered and medium strength [Ashfield Shale]

*Shale classification in accordance with P.J.N Pells et al[1]

4.2 GROUNDWATER OBSERVATIONS

Groundwater inflow was not observed in the boreholes during auger drilling to the base of Unit 3 residual soils, core drilling was used to progress through the Unit 4 and Unit 5 shale formation and large groundwater inflows were not observed. It should be noted that groundwater levels may vary over time due to changes in climatic conditions.

4.3 EARTHWORKS AND SITE PREPARATION

Topsoil and unsuitable materials including soils with high organic or silt content should be stripped from the Site area to be developed. Topsoil should be stockpiled for re-instatement of landscaped areas requiring re-vegetation. Where trees are required to be removed, stumps should be grubbed out and root systems cleared.

If areas are required to be raised as part of the development, filling will be required. The nominated areas should be filled using suitable geotechnical material obtained from excavations on the Site or imported fill. Suitable geotechnical material is a fill that is capable of being compacted to form a homogeneous mass capable of supporting structural elements of the proposed development and which does not contain the following unsuitable materials:

- Organic soils such as topsoil, severely root affected subsoils and peat;
- Offsite derived material that is not assessed as Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) or materials not subject to a General or Specific Resource Recovery Exception as approved by the NSW Environment Protection Authority. Imported fill should be accompanied by documentation adequately demonstrating the material's compliance with the exemption conditions;
- Materials containing substances which can be dissolved or leached out in the presence of moisture, or which undergo volume change or loss of strength when disturbed and exposed to moisture;
- Silts or materials that have the deleterious engineering properties of silt;
- Fill which contains wood, metal, plastic, boulders or other deleterious material;
- Loose, soft, wet or unstable soil or rock; and
- Material deemed unsuitable by the geotechnical practitioner.

Suitable fill should be placed in near horizontal layers of uniform thickness systematically across the fill area. The fill should be placed in layers no greater than 250mm compacted thickness and compacted to a minimum density ratio of 98% based on the Standard Maximum Dry Density Ratio (SMDDR) to ± 2 % of Optimum Moisture Content (OMC). Fill within 0.5m of slab or pavement subgrade level should be compacted to a minimum of 100% SMDDR to within ± 2 % of OMC.

Erosion and sediment controls should be implemented during the earthworks to avoid sediment discharge into the stormwater utilities on Watsford Road. Controls should be implemented in accordance with the requirements of Landcom Publication "Managing Urban Stormwater: Soils and Construction".

4.4 EXCAVATION CONDITIONS AND SUPPORT

4.4.1 Excavatability

Conventional plant such as bulldozers, hydraulic excavators and backhoes should be adequate for excavation of the Unit 2 Alluvium, Unit 3 Residual Soil and Unit 4 Extremely and Highly Weathered Shale. The excavation of Unit 5 Moderately and Slightly Weathered Shale may require more effort such as using rippers, impact hammers and rock saws. Vibration damages or structural stress on neighbouring structures should be considered if using these methods.

Contractors should be required to examine borehole records to make their own assessment of excavation plant and production rates.

4.4.2 Permanent and Temporary Batter Slopes

Excavations in the Unit 2 Alluvium should stand at temporary slopes of 2 horizontal to 1 vertical (2H:1V) and 2.5H:1V for permanent batter slopes, if unprotected. Protected slopes should stand at 1.75H:1V if temporary and 2.25H:1V if permanent.

Safe batter angles of temporary excavations in the Unit 4 Shale will be dependent upon the nature and orientation of discontinuities such as joints and bedding and groundwater ingress.

Cut slope batters in the Unit 4 and Unit 5 Shale should be finalised during detailed investigation and design, but as a preliminary guide these materials should stand at 0.5H:1V if temporary.

The relatively small site may potentially restrict basement excavations to be cut back to safe batter angles without the need for excavation support. Potential support methods include temporary shoring or an engineered retaining solution.

Soil and weathered rock stability characteristics are time dependent and the method of excavation and support should be considered in conjunction with the design and construction methodology. The depth of the water table will have an impact upon the temporary and permanent works design and may require further investigation as construction details develop.

Surcharge loads should be kept well clear of the crests of excavations, approximately at a distance equivalent to the slope height or better. If a batter of steeper gradient than recommended above is required, or a surcharge is required to be placed close to the crest of the batter, an engineered retaining solution is recommended.

4.5 FOOTINGS

4.5.1 Strip or Pad Footings

Strip or pad footings may be founded in the Unit 2 alluvium. This material is considered suitable as a bearing stratum for flexible structures.

The bearing capacity of a pad or strip footing constructed on the Unit 2 alluvium will be dependent on the geometry of the footing. To limit settlement, it is suggested that a factor of safety of 3 be applied to the ultimate bearing capacity calculated for the particular footing geometry. The maximum allowable bearing pressure should be limited to 150kPa.

Exposed materials in footing excavations should be assessed by a suitably qualified and experienced geotechnical engineer prior to blinding and construction of the footings.

4.5.2 Deep Footings

Pile footings may be considered and appropriate pile types are summarised below. Noise and vibration should however be considered when selecting the pile design and construction methodology appropriate for the Site. Piles should be founded in the Unit 4 or Unit 5 Shale.

4.5.2.1 Bored Piles

Open bored piles or Continuous Flight Auger (CFA) piles could be adopted. It would be expected that with appropriate capacity, piling rigs should be able to penetrate into the Unit 4 and Unit 5 Shale. An experienced geotechnical engineer should observe boring of the piles to assess the rock levels and to confirm that the rock is suitable for the adopted design parameters and depths. Preliminary allowable design parameters for bored piles are provided in Table 3. The use of the recommended allowable bearing pressures would be expected to result in pile settlement of about 1% of the pile diameters.

For uplift capacity, the shaft adhesion value should be multiplied by 0.6. In addition to shaft adhesion, the uplift capacity should be checked for a cone pull-out failure mode assuming a cone angle of 70° considering the submerged weight of the soil or rock and adopting a factor of safety of 1.0 against pull-out.

Table 3: Preliminary Design Parameters for Piles

Geotechnical Unit	Unit End Bearing Resistance (kPa)	Unit Shaft Adhesion (kPa)
Unit 2 Alluvium	Not Applicable	20
Unit 3 Residual Soil	Not Applicable	20
Unit 4: Extremely and Highly Weathered Shale (Class IV)	1000	150
Unit 5: Moderate and Slightly Weathered Shale (Class III)	2000	200

Notes:

(a) Shaft adhesion should only be assumed where piles have a minimum embedment of at least 3 pile diameters into the nominated stratum and a rough socket (at least grooves of depth 1mm to 4mm and width greater than 5mm spacing of 50mm to 200mm). The socket should be cleaned and roughened by a suitable scraper such as a tooth, orientated perpendicular to the auger shaft.

4.5.2.2 Displacement Piles

Displacement piles such as driven precast piles, driven cast-in situ piles and displacement screw piles can provide high shaft and end bearing resistances. Displacement piles could be installed to bear on the Unit 4 or Unit 5 shale. Consideration should be given to potential difficulties of driving piles through the Unit 3, stiff to very stiff alluvium observed during the investigation.

The design ultimate geotechnical strength of a piles or pile groups should be determined as per AS2159 – 2009 by considering factors including negative friction, soil swelling, cyclic loading and earthquake loading. The piles should be designed in consideration of serviceability requirements including settlement, lateral deflection and rotation such that they are within the appropriate limit for the structures and their intended use.

As a preliminary guide, piles designed using the limit state or working stress approach could be proportioned using the geotechnical parameters provided below in Table 3. A geotechnical reduction factor (Øg) of 0.5 should be adopted in accordance with AS2159-2009 for preliminary design.

If piles are required to penetrate to the Unit 4 Shale (Class III) or better to adopt the higher associated bearing pressures, additional boreholes should be drilled and inspected by a qualified geotechnical engineer to confirm the level of the Unit 4 Shale (Class III).

4.6 RETAINING WALLS AND SHORING

Where retaining walls are cantilevered or supported by a single row of anchors and some wall movement can be tolerated (flexible wall), retaining walls can be designed assuming a triangular earth pressure distribution. Flexible retaining wall design parameters for the different soil units are provided in Table 4.

Table 4: Preliminary Retaining Structure Design Parameters

Geotechnical Unit	Bulk Density (kN/m^3)	Cu Undrained Shear Strength (kPa)	c' Effective Cohesion (kPa)	Effective Friction Angle (degrees)	Active Earth Pressure Coefficient (Ka)	Passive Earth Pressure Coefficient (Kp)
Unit 2 Alluvium	20	50	20	26	0.39	2.6
Unit 3 Residual Soil	22	80	50	28	0.36	2.8

The active pressure coefficient shown above (Ka) assumes that the ground behind the wall will be horizontal. Where ground anchors or internal props restrain retaining wall movement, or where significant movements cannot be tolerated (rigid wall), an 'at-rest' earth pressure coefficient (Ko) of 0.5 should be adopted with a trapezoidal pressure distribution. However, it should be noted that walls designed for this 'at rest' coefficient will still undergo some lateral movements, depending on the wall used and construction sequence.

The design of any retaining structures should make allowance for all applicable surcharge loading including construction activities around the perimeter of the excavation and adjacent buildings. In addition to lateral earth pressures and surcharge loads, consideration should be given to the possibility of a hydrostatic pressure due to build-up of water behind the wall (e.g. from broken services) unless permanent subsurface drainage can be provided.

5 GEOTECHNICAL CONSTRAINTS

- Excavation and footing installation methodology should consider potential impacts to the adjacent properties and infrastructure resulting from ground movement and/or vibration; and
- Further investigation works may be required at the detailed design stage and a suitably qualified and experienced geotechnical practitioner should be engaged during the construction phase to assess the stability of batter slopes and suitability of footing foundations.

6 LIMITATIONS OF THIS REPORT

This report has been prepared for use by the client who commissioned the works in accordance with the project brief and based on information provided by the client. The advice contained in this report relates only to the current project and all results, conclusions and recommendations should be reviewed by a competent person with experience in geotechnical and environmental investigations before being used for any other purpose. Consulting Earth Scientists Pty Ltd (CES) accepts no liability for use or interpretation by any person or body other than the client. This report must not be reproduced except in full and must not be amended in any way without prior approval by the client and CES.

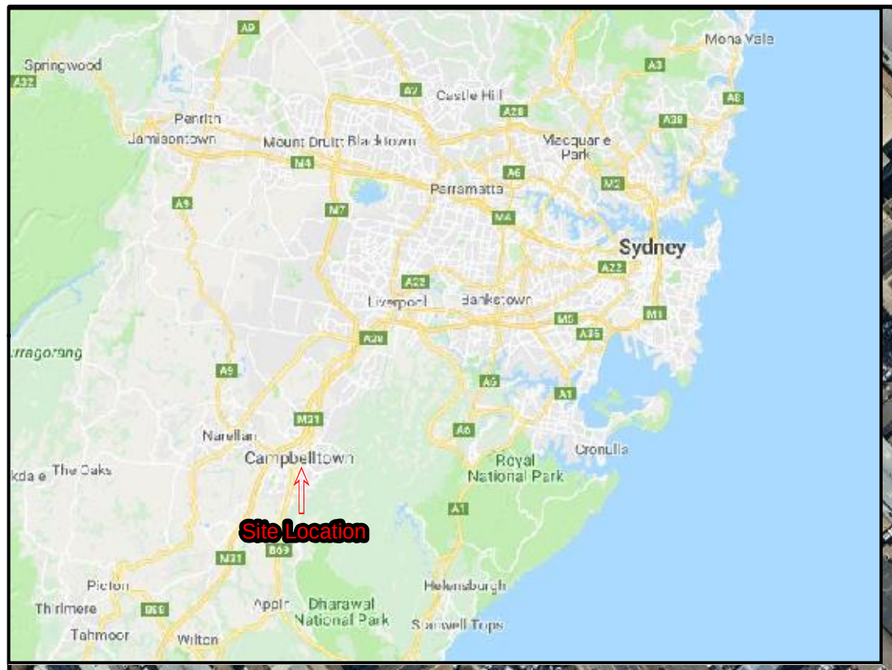
It should be noted that boreholes were drilled within the site during the investigation. Therefore, the geotechnical model was inferred only and may not fully represent the accuracy of the overall ground conditions across the site. Spatial variability in ground conditions within the site can occur even at very small distance between any two test points. Excavation for footings, pavement and retaining walls construction will confirm the likelihood of such ground variability.

This report does not provide a complete assessment of the geotechnical or environmental status of the site and is limited to the scope defined therein. Should information become available regarding conditions at the site including previously unknown sources of contamination, CES reserves the right to review the report in the context of the additional information.

7 REFERENCES

- Geological Series sheet 9029 to 9129, Geological Survey of NSW, Department of Mineral Resource published in 198.
- Standard Australia, 2017. AS1726- Geotechnical Site Investigation.
- Pells, P.J.N., Mostyn, G., and Walker, B.F. (1998), Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal. [1]

FIGURE 1: SITE LOCATION PLAN



Legend

Site Boundary

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Title

Figure 1: Site Location Plan

CES Project ID:	Date:
CES180704-IDC	11/09/2018
Prepared By: H.Noakes	Checked By; D.Lowe

FIGURE 2: SITE LAYOUT PLAN

N

BH2

BH1

0 1.5 3 6 9 12 15
Metres

Source: Nearmap

Legend

- Borehole Locations
- Fill Mound
- Site Boundary

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Title

Figure 2: Site Layout Plan

CES Project ID:	Date:
CES180704-IDC	11/09/2018
Prepared By: H.Noakes	Checked By; D.Lowe

APPENDIX A: GEOTECHNICAL BOREHOLE LOGS

Project ID:	CES180704-IDC
Client:	Ibiz Design & Construction
Project:	Preliminary Geotechnical Investigation
Location:	6A Watsford Rd, Campbelltown

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LOG ID: BH01

Sheet: 1 of 1

X-Coord:	298504.3	**Date Commenced:**	29/08/2018	**Logged by:**	H.N.
Y-Coord:	6228930.3	**Date Completed:**	29/08/2018	**Checked by:**	D.L.
Surface Elevation (R.L) :	61.5 m AHD	**Hole Diameter (mm):**	115mm		

Drilling Information				LITHOLOGY					Samples	Tests		
Depth (mBGL)	R.L. (m)	Method (Support)	Water	Symbol	USCS Symbol	Description SOIL TYPE: plasticity or particle characteristics colour, moisture, secondary and minor component	Consistency / Density	Moisture	Sample ID	SPT	Pocket Penetrometer (kPa)	Notes and additional observations
0.0	62	125mm Auger			CL	TOPSOIL: Sandy CLAY, low plasticity, pale grey/brown. Sand is fine grained, sub rounded, with gravel, fine, angular, with silt, trace fine roots.	Soft	MC<PL				[TOPSOIL]
0.5						Sandy CLAY: low plasticity, pale grey/orange/brown mottled. Sand is fine grained, sub rounded, with silt and fine gravel, angular, trace fine roots in top 0.5m.	Hard					[ALLUVIAL]
1.0									ENV (1.0m-1.45m)	SPT at 1-1.45m 10,11,24 N=35		
1.5	61											
2.0					CI	CLAY: medium plasticity, pale grey, with sand, fine grained, angular.	Stiff					
2.5	60				CL	Sandy CLAY: Low plasticity, mottled pale grey/brown, sand is fine grained, sub-angular, with gravels, fine grained, sub-rounded and rounded, iron rich gravels.	V.Stiff			SPT at 2.5-2.95m 6,10,13 N=23		
3.0												
3.5	59											
4.0									ENV (4.0m-4.45m)	SPT at 4-4.45m 5,9,15 N=24		
4.5	58											
5.0					CL	Silty CLAY: Low plasticity, dark grey, (extremely weathered shale, fragments present).						[RESIDUAL]
5.5	57									SPT at 5.5-5.95m 19,>30 Refusal, hammer bounce at 5.7m		
6.0		NMLC				Begin core drilling at 5.7m bgl. Refer to BH01 corelog for details.						

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Client: Ibiz Design & Construction
Project: Geotechnical and Enviormental Investigation
Location: 6A Watsford Rd, Campbelltown

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Corehole ID: BH01

Sheet: 1 of 1

X-Coord: 298504.3
Y-Coord: 6228930.3
Surface Elevation (R.L.): 62.5 mAHD

Date Commenced: 29/08/2018
Date Completed: 29/08/2018
Hole Diameter (mm): 75mm

Logged by: H.N.
Checked by: D.L.

Drilling Information					LITHOLOGY						Natural Defects		
Depth (mBGL)	R.L. (m)	Method (Support)	% Coreloss	Water	Symbol	Rock Description ROCK TYPE: grain characteristics, colour structure, minor components	Weathering	Estimated Strength MPa (0.03 EL, 0.1 VL, 0.3 L, 1 M, 3 H, 10 VH, EH)	Is (50) MPa	RQD %	Spacing (mm) (20, 60, 200, 600, 2000)	Description
5.0												5
5.5	57					Refer to BH01 borelog for details.						
		NMLC	0%			SHALE: fine grained, grey, very low strength, extremely weathered, broken core.	EW			47%		
6.0						SHALE: fine grained, grey, low strength, highly weathered, laminated, 1-2mm spacing.	HW					6 6.03-6.5m, Joint set, J85-90, Sl,Pl, Cl 6.15-6.2m, Sm, C, Co (clay)
6.5	56					SHALE: fine grained, low strength, moderately weathered, fine sandstone, 2-5mm thick, 40-50mm spacing.	MW					6.59-6.61m, CS90, C 6.74-6.76m, CS90, C
7.0						SHALE: fine grained, grey, medium strength, slightly weathered, medium strength, laminations of fine grained sandstone.	SW					7 7.15m, P90, C, Sm, St
7.5	55											
8.0												8
8.5	54					End of hole at 8.5m. Target depth. Water not observed						
9.0												9

Project ID:	CES180704-IDC
Client:	Ibiz Design & Construction
Project:	Preliminary Geotechnical Investigation
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LOG ID: BH02

Sheet: 1 of 1

X-Coord:	298532.8	**Date Commenced:**	29/08/2018	**Logged by:**	H.N.
Y-Coord:	6228905.9	**Date Completed:**	29/08/2018	**Checked by:**	D.L.
Surface Elevation (R.L) :	61.5 m AHD	**Hole Diameter (mm):**	115mm		

Drilling Information				LITHOLOGY					Samples	Tests		
Depth (mBGL)	R.L. (m)	Method (Support)	Water	Symbol	USCS Symbol	Description SOIL TYPE: plasticity or particle characteristics colour, moisture, secondary and minor component	Consistency / Density	Moisture	Sample ID	SPT	Pocket Penetrometer (kPa) 100 200 300 400	Notes and additional observations
0.0	61	125mm Auger			CL	TOPSOIL: Sandy CLAY, low plasticity, pale brown, sand is fine grained, sub rounded, with silt and fine grained gravels, angular, trace fine roots.	Soft V.Stiff	MC<PL				[TOPSOIL] [ALLUVIAL]
0.5					CL	Gravelly CLAY: low plasticity, pale orange/brown, gravel is fine grained, sub-rounded, with silt and fine grained sand.						
1.0						Sandy CLAY: low plasticity, mottled pale grey/orange. Sand is fine, angular to rounded, with silt.			ENV (1.0m-1.45m)	SPT at 1-1.45m 6,10,13 N=23		
1.5	60											
2.0												
2.5	59									SPT at 2.5-2.95m 6,8,10 N=18		
3.0												
3.5	58											
4.0									ENV (4.0m-4.45m)	SPT at 4-4.45m 5,10,14 N=24		
4.5	57											
5.0					CI	CLAY: Medium plasticity, pale grey. Sand is fine grained, sub-angular, with gravel, fine grained, sub-rounded and rounded with iron staining evident on gravel.	Stiff					
5.5	56	NMLC Core			CL	Silty CLAY: low plasticity, dark grey, (extremely weathered shale, fragments present).	V.stiff			SPT at 5.5-5.95m N>30 Refusal, hammer bounce at 5.5m		[RESIDUAL]
6.0						Begin core drilling at 5.5m bgl. Refer to BH02 corelog for details.						

Project ID: CES180704-IDC
Client: Ibiz Design & Construction
Project: Geotechnical and Enviormental Investigation
Location: 6A Watsford Rd, Campbelltown

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Corehole ID: BH02

X-Coord: 298532.8
Y-Coord: 6228905.9
Surface Elevation (R.L.): 62.5 mAHD
Date Commenced: 29/08/2018
Date Completed: 29/08/2018
Hole Diameter (mm): 75mm
Logged by: H.N.
Checked by: D.L.

Drilling Information					LITHOLOGY						Natural Defects		
Depth (mBGL)	R.L. (m)	Method (Support)	% Coreloss	Water	Symbol	Rock Description ROCK TYPE: grain characteristics, colour structure, minor components	Weathering	Estimated Strength MPa (0.03 EL, 0.1 VL, 0.3 L, 1 M, 3 H, 10 VH, EH)	Is (50) MPa	RQD %	Spacing (mm) (20, 60, 200, 600, 2000)	Description
5.0	-5	NMLC	0%			Refer to BH02 borelog for details.				78%		
5.5						SHALE: fine grained, grey, low strength, moderately weathered.	MW					5.53m, J90, Sm, U, Co (clay) 5.54m, J10, Sm, C, Co (clay)
6.0	-6					SHALE: fine grained, pale grey, medium strength with sandstone laminations, moderately weathered, 5-10mm spacing, 1-2mm thick.						
6.5						SHALE: fine grained, pale grey, medium strength, moderately weathered, laminations more frequent, 2-3mm thick, 5-10mm spacing.						6.65-6.68m, CS90, R, St, Cl
7.0	-7					SHALE: fine grained, pale grey, medium strength, 2-3mm thick, 5-10mm spacing.						7.15-7.21m, CS90, R, St, Cl
7.5						SHALE: fine grained, grey, medium strength, slightly weathered, laminations of sandstone.	SW					
8.0	-8											
8.5						End of hole at 8.4m. Target depth. Water not observed.						
9.0	-9											

APPENDIX B: SITE PHOTOGRAPHS

Site Walkover Photograph 1

Client Name:	Site Location:	Project Number:
Ibiz Design and Construction	6A Watsford Road, Campbelltown, New South Wales	CES180704-IDC

Date:	Plate 1
28/08/2018	

Description:
Site before drilling works commenced, photograph taken from western end of the Site facing northeast.

Site Walkover Photograph 2

Client Name:	Site Location:	Project Number:
Ibiz Design and Construction	6A Watsford Road, Campbelltown, New South Wales	CES180704-IDC

Date:	Plate 2
29/08/2018	

Description:
Geotechnical drilling rig aligned over Borehole 01, ready to commence drilling.

Drilling Progress Photograph 1

Client Name:	Site Location:	Project Number:
Ibiz Design and Construction	6A Watsford Road, Campbelltown, New South Wales	CES180704-IDC

Date:	Plate 3
29/08/2018	

Description:
Typical SPT sample taken from the fill layer consistent across the Site.

Drilling Progress Photograph 2

Client Name:	Site Location:	Project Number:
Ibiz Design and Construction	6A Watsford Road, Campbelltown, New South Wales	CES180704-IDC

Date:	Plate 4
29/08/2018	

Description:
Typical SPT sample taken from the residual silty clay layer consistent across the Site.

Drilling Progress Photograph 3

Client Name:	Site Location:	Project Number:
Ibiz Design and Construction	6A Watsford Road, Campbelltown, New South Wales	CES180704-IDC

Date:	Plate 5
29/08/2018	

Description:
Ashfield Shale sample core drilled from Borehole 01, note the high fracture frequency in the shallow component of the hole.

Drilling Progress Photograph 4

Client Name:	Site Location:	Project Number:
Ibiz Design and Construction	6A Watsford Road, Campbelltown, New South Wales	CES180704-IDC

Date:	Plate 6
29/08/2018	

Description:
Ashfield Shale sample core drilled from Borehole 02. Note the increased frequency of fine, sandstone laminations at the base of the hole.