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200004.01.R.001.Rev0
4 April 2022
PMO

Mirvac
Level 28, 200 George Street
SYDNEY NSW 2000

Attention: Ms Anne Ng

Dear Sirs

Geotechnical Statement – Excavation Development Application
'Harbourside'
Darling Harbour

This letter confirms that the following report prepared by Douglas Partners is fully relevant and applicable to the scope of works of the Excavation Development Application:

- Report on Geotechnical Investigation, Harbourside Development (Ref. 200004.00.R.001.Rev0) dated 1 March 2021.

Douglas Partners has viewed the Development Application drawings (AR-SSDA1-0000, 0100, 0200, 0300, 0400, 0500, 0550, 0700 and 0750 prepared by Hassell Snohetta), supports the Development Application from a geotechnical perspective and confirms that the site is suitable for the development from a geotechnical perspective.

The geotechnical report referenced above is attached to this letter.

Please contact the undersigned if further information is required.

Yours faithfully,
Douglas Partners Pty Ltd

Peter Oitmaa
Principal

Attachment: Geotechnical Report (Ref. 200004.00.R.001.Rev0)

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Harbourside Redevelopment
2 – 10 Darling Drive, Darling Harbour

Prepared for
Mirvac Projects Pty Ltd

Project 200004.00
March 2021

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

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

	Signature	Date
Author		1 March 2021
Reviewer		1 March 2021

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Report on Geotechnical Investigation
Harbourside Redevelopment
2 – 10 Darling Drive, Darling Harbour

1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed Harbourside Redevelopment at 2 – 10 Darling Drive, Darling Harbour. The work was commissioned by Mirvac Projects Pty Ltd.

It is understood that the project will involve the demolition of the existing Harbourside shopping centre followed by the construction of a new building incorporating four basement levels over the central portion of the site, six levels of retail and commercial space over entire site, and a 41-storey residential tower built over the central portion of the retail/commercial footprint. The basement construction will require excavation to depths of approximately 16 m below the existing ground surface.

Geotechnical investigation was undertaken to primarily provide information on rock levels and included the drilling of eight boreholes, the installation of three temporary groundwater monitoring wells, laboratory testing and engineering interpretation. Details of the field work and comments relevant to design and construction are given in this report.

2. Previous Investigations

2.1 Coffey Geotechnics Pty Ltd

Mirvac provided nine borehole logs prepared by Coffey in 2013. These boreholes (BH201 to BH209) were drilled to depths of between 1.8 m and 20.8 m for the International Convention Centre (ICC) Hotel development immediately to the south-west of Harbourside. The locations of relevant boreholes are shown on Drawing 1 in Appendix B. The borehole logs are provided in Appendix D.

2.2 Jeffery & Katauskas Pty Ltd

Jeffery & Katauskas (J&K) undertook geotechnical investigation on the site in 1985 for the original Harbourside development. This included drilling 18 boreholes to depths of between 2.3 m and 16.4 m. The locations of relevant boreholes are shown on Drawing 1 in Appendix B. The borehole logs are provided in Appendix D.

3. Site Description

The Harbourside site is located on the western side of Darling Harbour. It is bounded by Pyrmont Bridge and the Australian National Maritime Museum to the north, Darling Harbour to the east, the International Convention Centre (ICC) and the Sofitel Hotel to the south, and Darling Drive and the light rail corridor to the west. The areas to the north, east and south of the existing building are typically paved public walkways. Loading docks and back-of-house facilities are located on the western side of the building.

The ground surface over the site is relatively level with surface levels at or about RL 3 m AHD. A seawall is located between the site and Darling Harbour as shown on the survey plan prepared by Beveridge Williams which is attached for information in Appendix B (Ref. DET-001 RevA dated 10 August 2020). The site area is approximately 15,000 m^2.

4. Geology and Hydrogeology

The *Sydney 1:100 000 Geological Series Sheet* shows that the site is close to a boundary between Hawkesbury Sandstone (medium to coarse-grained sandstone with minor shale and laminite lenses) and Quaternary-aged alluvium and estuarine sediment (silty/peaty sand, silt, clay, common shell layers). The area to the south of Darling Harbour is mapped as having man-placed fill placed over the Quaternary sediments as a result of land reclamation works.

An extract of the geological mapping is provided in Figure 1.

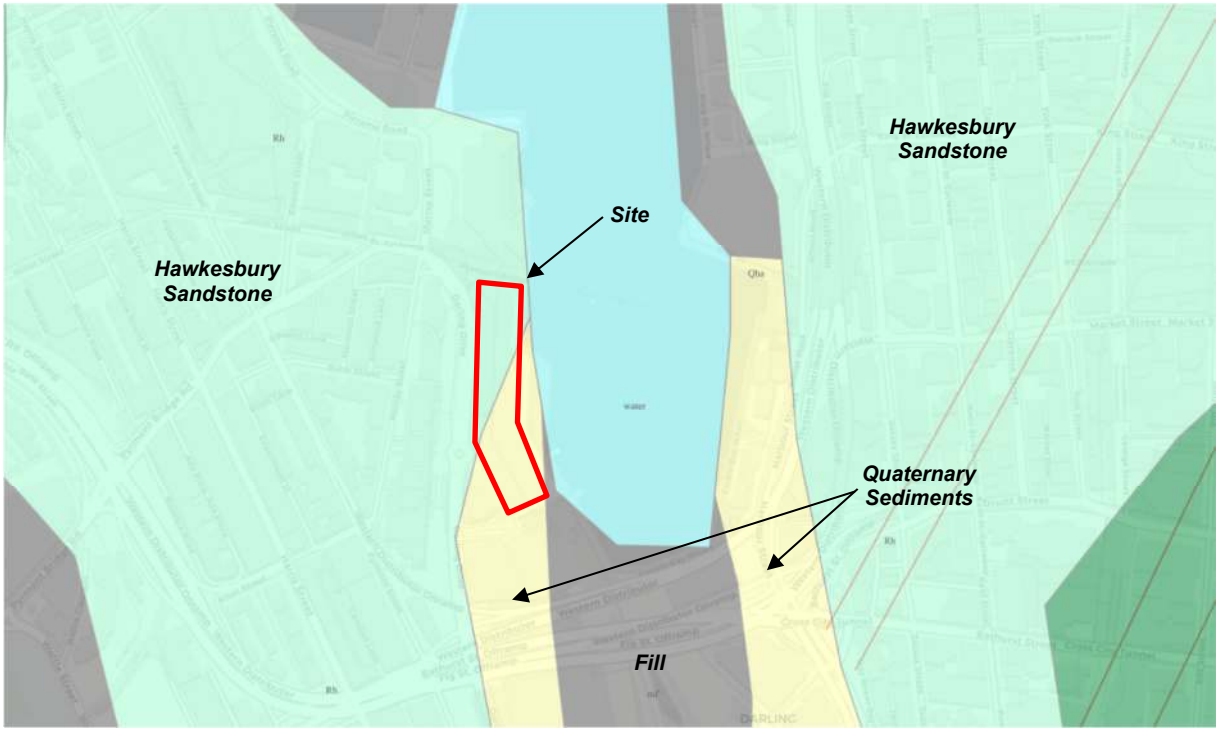

Figure 1: Extract of geological mapping

The site topography and geology would suggest that groundwater is likely to flow in an easterly direction towards Darling Harbour.

5. Current Field Work Methods

5.1 Boreholes

The current field work included the drilling of eight boreholes (BH1 to BH8) to depths of between 3.5 m and 18.0 m using a Comacchio Geo205 track-mounted drilling rig. They were commenced using a Diatube to drill through the ground surface (where relevant) and non-destructive drilling techniques to check for the presence of services. Solid flight augers and rotary wash-boring equipment were then used to drill through the soils.

Once weathered rock was encountered, NMLC-sized diamond core drilling equipment was used to obtain 50 mm diameter continuous core samples of the rock for identification and strength testing purposes. Bores that did not require the installation of groundwater monitoring wells were backfilled at the completion of drilling.

It is noted that BH3 was attempted at two locations but had to be abandoned due to the risk of striking services at this location.

5.2 Groundwater Monitoring Wells

Four current boreholes (BH1, BH6, BH7 and BH8) were converted into temporary groundwater monitoring wells at the completion of drilling. This involved inserting Class 18 uPVC screen and casing to the required depth, backfilling the screened length with gravel, plugging the top of the gravel with bentonite pellets and backfilling the casing with drilling spoil. A steel lid was concreted flush with the ground surface at each location to complete the installations.

The construction details of the groundwater monitoring wells are provided in Table 1.

Table 1: Construction Details of Groundwater Monitoring Wells

Well Location	RL of Ground Surface	RL of Top of Screen	RL of Base of Screen
BH1	3.0	-2.1	-6.6
BH6	3.4	-2.8/3.4*	-7.3/1.3*
BH7	3.2	1.0	-2.0
BH8	2.1	1.1	-0.9

Notes: All levels are in metres and relative to AHD; *Nested wells (2) installed in BH6

All test locations are shown on Drawing 1 in Appendix B. The ground surface levels at the bores were measured to AHD using either a high-precision differential global positioning system (dGPS) receiver or an automatic level.

6. Field Work Results

6.1 Boreholes

The subsurface conditions encountered in the boreholes are presented in the borehole logs in Appendix C (current investigation) and Appendix D (previous investigations). Notes defining descriptive terms and classification methods are included in Appendix A. The boreholes encountered:

- HARDSTAND – pavers, asphalt, concrete and/or ceramic tiles at all borehole locations.
- FILL – typically roadbase, sandy, gravelly and clayey fill with sandstone gravel and boulders to depths of between 2.7 m and 11.9 m. There was a buried concrete slab in BH3.
- NATURAL SOILS – typically very soft to soft sandy clay and loose sand, with shells, to depths of between 3.0 m and 7.9 m. Soft organic clay with sand and wood particles between 11.9 m and 12.9 m depth in BH7. No natural soil in BH8 (fill directly over sandstone).
- BEDROCK – typically a thin layer of weathered sandstone over medium, medium to high and high strength sandstone from depths of between 3.2 m and 13.0 m to the base of the boreholes. Some higher strength bands were also present. A very low and low strength band of sandstone and siltstone was encountered in BH6 between 7.5 m and 9.1 m depth.

Table 2 summarises the levels at which different materials were encountered in the current boreholes. The rock has been classified in accordance with a system developed by Pells et al (1998) which classifies rock strata depending on strength, fracturing and defects. Class V rock is typically very low strength, highly weathered and highly fractured rock whereas Class I rock is typically high strength, fresh and unbroken rock.

Table 2: Summary of Material Strata Levels and Rock Classifications

Strata	RL of Top of Material Strata (m, AHD)							
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Surface/Filling	3.0	3.0	2.5	3.5	3.5	3.4	3.2	2.1
Natural Soils	0.0	-2.0	-0.5	-3.7	0.5	0.7	-8.7	NE
Class V/IV Rock	-0.9	-2.6	NE	-4.4	-0.3	-1.8	-9.7	-0.9
Class III Rock	-1.0	-3.6	NE	-4.5	NE	-5.7	-9.8	-1.1
Class II Rock	-4.9	-6.4	NE	NE	-0.4	NE	-11.8	-1.4
Base of Borehole	-6.6	-8.3	-1.0	-5.4	-4.9	-7.3	-14.8	-6.1
Groundwater	0.6	0.4	-0.1	0.0	0.5	0.7	-0.3	0.6

Notes: NE = not encountered; Rock classification in accordance with Pells et al (1998)

Groundwater was observed at depths of between 1.5 m and 3.5 m (between RL 0.7 m and RL -0.3 m AHD) during augering in the boreholes. The groundwater levels are expected to be influenced by climatic events as well as tidal fluctuations within Darling Harbour.

7. Laboratory Testing

7.1 Soils

Laboratory testing on soil samples is underway and includes aggressivity, California bearing ratio (CBR) and plasticity (Atterberg limits). A complete summary of the results will be included in Table 3 when all testing is completed. The reports are/will be included in Appendix E.

Table 3: Summary of Laboratory Test Results

Sample/Depth (m)	pH units	EC µS/cm	Cl^- mg/kg	SO_4^{2-} mg/kg	CBR %	W_L %	W_P %	PI %	W_F %	LS %
BH1/2.5 (BH4/2.0)	-	-	-	-	-	TBC	TBC	TBC	TBC	TBC
BH1/4.0	8.6	310	79	460	-	-	-	-	-	-
BH2/0.2-0.6	-	-	-	-	TBC	-	-	-	-	-
BH2/4.0	9.1	1700	2200	400	-	-	-	-	-	-
BH3/0.4-1.0	-	-	-	-	TBC	-	-	-	-	-
BH4/2.0	8.5	560	610	210	-	-	-	-	-	-
BH5/3.0	9.6	670	680	180	-	-	-	-	-	-
BH6/1.0	8.8	150	24	120	-	-	-	-	-	-
BH6/4.0 (BH5/3.0)	-	-	-	-	-	TBC	TBC	TBC	TBC	TBC
BH7/11.5	8.6	1800	2400	260	-	-	-	-	-	-

Notes: NT = not tested; EC = electrical conductivity; Cl = chloride ion; SO_4 = sulfate ion; CBR = California bearing ratio
W_L = liquid limit; W_P = Plastic limit; PI = plasticity index; W_F = field moisture content; LS = linear shrinkage
Samples in brackets denote composite samples tested

7.2 Rock

36 samples selected from the better quality rock core were tested for axial point load strength index (Is_{50}). The results ranged between 0.2 MPa and 2.5 MPa which correspond to low strength and high strength rock, respectively. These Is_{50} results suggest an unconfined compressive strength (UCS) in excess of 50 MPa for the high strength rock encountered during the investigation. One thin band in BH7 exhibited an Is_{50} of 5.2 MPa which is very high strength. The individual values are shown on the relevant borehole logs in Appendix C.

8. Geotechnical Model

The site is underlain by between 2.7 m and 11.9 m of fill which appears to have been placed over either a thin layer of natural soil or bedrock. The fill is generally sandy with varying proportions of gravel, boulders and clay. The natural soils comprise soft clays and loose sands, with some organic clay encountered in BH7.

The bedrock profile generally consists of a thin layer of weathered sandstone overlying medium, medium to high and high strength sandstone below levels of between RL -0.4 m and RL -9.8 m AHD. The rock levels are relatively consistent along the western side of the site but do vary, and generally fall to the south, along the eastern side.

The groundwater levels have been observed at between RL -0.3 m and RL 0.7 m AHD during auger drilling. These levels are expected to vary with rainfall events and tidal influences.

This inferred geotechnical model is shown in Sections A-A and B-B (Drawings 2 and 3) in Appendix B.

9. Proposed Development

It is understood that the project will involve the demolition of the existing Harbourside shopping centre followed by the construction of a new building incorporating four basement levels over the central portion of the site, six levels of retail and commercial space over entire site, and a 41-storey residential tower built over the central portion of the retail/commercial footprint. The basement construction will require excavation to depths of approximately 16 m below the existing ground surface. Localised deeper excavations will be required for footings and lift pits/cores.

The geotechnical issues considered relevant to the proposed development include excavation, excavation support, groundwater and foundations. Comments on seismicity and aggressivity are also provided.

10. Comments

10.1 Excavation

Excavation for the basement levels will be required in fill, natural soils and predominantly sandstone bedrock of up to high strength. Excavation in the fill, natural soils and thin veneer of weathered sandstone should be readily achievable using conventional earthmoving equipment such as hydraulic excavators with bucket attachments. Bulk excavation in strong rock (i.e. Class III or better) is likely to require the use of heavy ripping, rock hammers etc. for effective removal. Rock sawing along the excavation boundaries, depending on the shoring solution, and for detailed excavation is also likely to be required.

Hammering and ripping of bedrock will induce vibrations which have the potential to damage nearby structures. Vibrations attenuate with distance (both vertical and horizontal) and therefore the effects that vibrations may have on a structure is dependent on its proximity to the source. A vibration trial will be required at the commencement of rock excavation and, depending on the results of the trial, continuous monitoring may be needed close to potentially impacted structures.

As a guide, peak particle velocity limits in the order of 8 mm/s may be required to reduce human discomfort in buildings whereas lower limits of, say, 5 mm/s may be appropriate for older buildings founded on shallow footings in sand.

The excavation will need to be planned having consideration to the seawall on the western side of Darling Harbour to ensure this is not damaged if it is intended that the seawall remain in place. This includes both the wall and any anchors that support it.

Excavation works will need to be undertaken in conjunction with a dewatering programme to reduce the moisture content of the soils and allow machinery to work on the site. This may entail the use of a large pump connected to spear-points within the excavation, sumps within the excavation, or a combination of the two. An appropriate dewatering methodology will need to be developed by the earthworks contractor.

It should be noted that any off-site disposal of spoil will generally require assessment for re-use or classification in accordance with current *Waste Classification Guidelines* (NSW EPA, 2014).

10.2 Excavation Support

10.2.1 General

The advice provided in this section assumes that the basement will be a tanked basement i.e. that the basement walls and floor will be designed to resist hydrostatic pressures and prevent water from entering the basement once the building is occupied.

Shoring walls will need to be installed around the perimeter of the basement footprint prior to excavation. Suitable shoring systems include:

- Secant piles: concrete or grout injected continuous flight auger (CFA) piles installed prior to the commencement of excavation so that adjacent piles overlap to provide a water-tight seal. This can be undertaken by installing stronger piles between lower-strength piles ('hard-soft' type wall), stronger piles around the entire basement perimeter ('hard-hard' type wall) or by installing jet-grout between the stronger piles in lieu of lower-strength piles. The secant piles may also be able to be used as the permanent water-tight basement walls if their water-tightness can be warranted by the piling contractor.
- Diaphragm walls: Diaphragm walls involve constructing a continuous wall below the ground surface prior to the commencement of excavation. This can be achieved using a large clamshell bucket with appropriate support for the sides of the excavation provided by either guide-walls or bentonite slurry. Concrete is then poured into the excavation and steel reinforcement added to create the wall. The diaphragm walls should also be able to be used as the permanent water-tight basement walls.
- Steel sheet piles: Driven steel sheet piles are installed around the perimeter of the basement area prior to the commencement of excavation. The adjacent sheets are interlocked to provide support to the material behind the wall. Driving sheets through the filling may prove problematic and pre-drilling in some areas of the site may be necessary. Vibrations induced by driving equipment may also cause damage to adjacent structures and detract from the suitability of this option. Sheet piles would likely refuse near the top of rock. Separate internal walls would need to be constructed to complete the basement.

Note that cutter-soil mixing (CSM) machines which blend and inject concrete and/or cement into the existing soils have been discounted due to the heterogenous nature of the fill materials that underlie the site. It should also be noted that the presence of existing structural elements below the ground (e.g. current Harbourside piles, old piles for wharves etc.) will need to be considered when developing the construction methodology.

It would be technically possible to terminate the shoring walls at the rock surface (required in the case of sheet piles regardless) and continue excavation below the walls in the sandstone bedrock without shoring support. Localised support (e.g. rock bolts, anchors, shotcrete etc.) may be required if defects are encountered. However this would result in higher volumes of groundwater inflow during construction and require separate internal basement walls to be constructed. Alternatively, secant piles and diaphragm walls could be constructed to below the basement level to reduce groundwater inflows and potentially the need to construct a separate tank (i.e. the hydrostatic floor slab could be joined to the water-tight walls to create the tank).

The piling/shoring wall contractor should make an assessment of the subsurface conditions on the site, particularly the filling, to ensure an appropriate methodology and suitable plant are used for the works. Only contractors experienced in similar conditions should be engaged.

All these wall types are likely to require the use of temporary ground anchors/bracing to provide lateral support during construction. Permanent lateral support would need to be provided by floor slabs.

10.2.2 Earth Pressures

Excavation faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to the top of Class III rock. Table 4 outlines material and strength parameters that could be used for the preliminary design of excavation support structures.

Table 4: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)	Ultimate Passive Earth Pressure
Filling	20	0.4	0.6	NA
Loose Sands	20	0.4	0.6	NA
Soft Clays	20	0.5	0.7	NA
Class V/IV Rock	22	0.2	0.3	NA
Class III Rock	22	NA*	NA*	3000 kPa**
Class II Rock	23	NA*	NA*	6000 kPa**

Notes: NA = not applicable; *Provided that adverse jointing is not exposed; **Only below bulk excavation level

The lateral pressure distribution on a multi-anchored or braced wall is complex and for preliminary design purposes a uniform distribution with depth (i.e. rectangular) could be assumed. It is recommended that an engineering software package such as WALLAP, PLAXIS or FLAC be used to analyse the shoring system to refine the preliminary design.

Lateral pressures due to surcharge loads from adjacent buildings, sloping ground surfaces, road pavements and construction machinery should be included where relevant. Hydrostatic pressure acting on the shoring walls and basement floor should also be included.

10.2.3 Ground Anchors

Where necessary, the use of declined tie-back (ground) anchors is suggested for the lateral restraint of the perimeter piled walls. Such ground anchors should be declined below the horizontal to allow anchorage into the stronger materials at depth. The design of temporary ground anchors for the support of piled wall systems may be carried out using the allowable average bond stresses at the grout-rock/soil interface given in Table 5.

Table 5: Allowable Bond Stresses for Anchor Design

Material Description	Allowable Bond Stress (kPa)
Filling/Natural Soils	15
Class V/IV Rock	70
Class III Rock	300
Class II Rock	750

It is unlikely that conventional anchors will have sufficient capacity unless they are installed in the bedrock. Secondary-grouted anchors could be used in the filling and natural soils to increase the anchor capacity. This technique involves installing a conventionally-grouted anchor and then, once cured, injecting grout into the anchor at a higher pressure to crack the primary grout and densify the surrounding materials. This technique is fairly specialised and only experienced contractors should be engaged for the design and installation of secondary-grouted anchors.

Ground anchors should be designed to have a free length equal to their height above the base of the excavation and have a minimum 3 m bond length. After installation they should be proof loaded to 125% of the design working load and locked-off at no higher than 75% of the working load. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes.

The parameters given in Table 5 assume that the anchor holes are clean, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing.

The excavation and anchoring methodology will need to be confirmed by the shoring wall designer, however it is common practice that excavation is only allowed to occur to a nominal depth of, say, 0.5 m below each design anchor elevation until the anchors have been installed and adequately stressed. The anchors should also be placed to avoid clashes with the basement slab levels.

In normal circumstances the building will restrain the basement excavation over the longer term and therefore ground anchors are expected to be temporary only. The use of permanent anchors would require careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed on this site.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors that will extend beyond the perimeter of the site. In addition, care should be taken to avoid damaging buried services and pipes during anchor installation.

Anchoring of the eastern side of the excavation will probably not be possible due to the close proximity of Darling Harbour and the existing seawall. This wall may require internal props, bracing or buttresses for stability until such time as the basement floor slabs have been constructed. This may include some form of top-down excavation methodology.

10.3 Groundwater

The groundwater levels measured during the field work varied between RL -0.3 m and RL 0.7 m AHD, however are also expected to vary with rainfall events and be influenced by the tide. The highest current tide elevation is in the order of RL 1.15 m AHD and this may increase to be in the order of RL 2 m to RL 2.5 m over the life of the structure, noting that predictions of sea level increases are only forecasts. Further, flood levels may govern groundwater levels on the western side of the building. A preliminary design groundwater level of RL 2.0 m AHD could be considered at this stage, pending discussions with the structural and flood engineers for the project.

As such, it is likely that the basement will need to be tanked to, or close to, the ground surface levels surrounding the basement footprint. The walls and floor slab will need to be designed to resist hydrostatic pressure both globally (i.e. uplift of the entire building) and locally (i.e. pressure between column/slab supports).

Groundwater inflow assessment will need to be undertaken to confirm approval and discharge requirements during construction. As it currently stands with NSW Department of Primary Industries – Water (formerly the NSW Office of Water):

- For <3ML per year: a Water Supply Approval is required; and
- For >3ML per year: a Water Access Licence, accompanied by the requisite number of Water Shares for the particular aquifer, is required.

Preliminary inflow assessment has been undertaken by assuming a rock mass permeability of 10^{-7} m/s (typical of Hawkesbury sandstone that does not contain significant geological defects). In the case of cut-off walls to the base of the excavation, the preliminary inflow estimate is in the order of 65 m^3/day (0.8 L/s). In the case of cut-off walls only to Class III sandstone (RL -4 m AHD assumed), the preliminary inflow estimate is in the order of 120 m^3/day (1.4 L/s). Rock defects will increase inflow volumes. Detailed modelling will be required to refine these estimates, however the inflows are likely to be well above 3 ML per year.

As the basement will be tanked, approval for long-term pumping will not be required.

10.4 Foundations

10.4.1 Spread Footings

Bulk excavation for the basement is expected to expose Class III or Class II sandstone bedrock over the basement footprint. Spread footings (i.e. pad footings and strip footings) should be suitable for supporting the proposed structure above the basement footprint and could be designed using the parameters provided in Table 6.

Table 6: Design Parameters for Spread Footings

Material Description	Allowable End-Bearing Pressure (kPa)	Ultimate End-Bearing Pressure (kPa)	Young's Modulus (MPa)
Class III Sandstone	3500	15,000	500
Class II Sandstone	6000	30,000	1000

These allowable bearing pressures assume there are no adverse defects below the footings. Spoon testing will be required in at least 50% of the footings designed for an allowable bearing pressure of greater than 3500 kPa to check for the presence of defects within the zone of influence of the footings (i.e. a depth equal to 1.5 times the footing width). Alternatively, the footings could be designed on the basis of an allowable bearing pressure of 3500 kPa in the Class II sandstone and spoon testing would not be required in this case.

Settlement of a spread footing is dependent on the loads applied to the footing and the foundation conditions below the footing. The total settlement of a spread footing designed using the allowable parameters provided in this report should be less than 1% of the footing width upon application of the design (working) load. Differential settlements between footings should be less than 50% of the value of total settlement.

All spread footings should be inspected by an experienced geotechnical professional to check the adequacy of the foundation material and to undertake spoon-testing as required.

10.4.2 Piles

Piles will be required to support the portions of the structure that are outside the basement. Suitable pile types include concrete or grout-injected CFA piles, bored piles drilled with temporary or permanent casing, or driven pile-types such as precast concrete, steel tube or steel H-section piles. It should be noted that a CFA rig is unlikely to be able to achieve a significant socket in the high strength rock encountered on the site. If sockets are required for uplift resistance then a traditional bored pile, using steel casing to support the filling, may be required. A tremie system will be needed to place the concrete under water in this case. It should also be noted that the possibility of deleterious inclusions in the filling may result in the requirement for pre-drilling of driven piles in some areas of the site. The use of driven piles will also be subject to assessment and consideration of vibrations on adjacent properties.

It should also be noted that the presence of existing structural elements below the ground (e.g. current Harbourside piles, old piles for wharves etc.) will need to be considered when developing the piling methodology regardless of the pile type chosen.

CFA piles and bored piles could be designed using the parameters provided in Table 7. Parameters for both the working stress and limit-state design approaches have been provided.

Table 7: Design Parameters for CFA Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)[1]	Ultimate End-Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)[1]	Young's Modulus (MPa)
Class V/IV Sandstone	1000	50	3000	150	200
Class III Sandstone	3500	300	15,000	800	500
Class II Sandstone	6000	600	30,000	1500	1000

Notes: [1]Reduce by 50% for uplift loads and ensure cone-pullout criteria are met

It should be noted that the serviceability limit-state is likely to govern the design of the piles and the ultimate bearing pressures provided in Table 7 are unlikely to be able to be achieved in practice. An appropriate geotechnical strength reduction factor (ϕ_g) should be selected by the pile designer using the risk assessment process outlined in Australian Standard AS 2159. A preliminary ϕ_g value of 0.5 could be assumed at this stage.

Settlement of a pile is dependent on the loads applied to the pile and the foundation conditions in the socket zone and below the pile toe. The total settlement of a pile designed using the 'allowable' parameters provided in Table 7 would be expected to be less than about 10 mm upon application of the design load.

Driven piles are often used to support high column loads on sites in which driving is practicable. The capacity of a pile driven to near-refusal in rock is likely to be governed by the structural capacity of the pile and the weight/efficiency of the driving equipment. The installation of test piles and pile load testing should then be undertaken to confirm driving conditions, pile set, pile capacity and an appropriate geotechnical strength reduction factor.

Settlement of a driven pile should be estimated using load test data obtained during the design confirmation stage of the piling process.

Vertical uplift loads could be resisted by socketing the piles into the bedrock (where possible) or by permanent anchors designed using the parameters provided in Section 10.2.3. The cone-pullout failure mechanism needs to be considered for vertical anchors.

10.5 Seismicity

A Hazard Factor (*Z*) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class would be either a Class C_e or Class D_e based on the strengths of the materials encountered in the boreholes and the depending on the extent of earthworks proposed.

10.6 Aggressivity

Advice on aggressivity will be confirmed upon receipt of the laboratory test results.

11. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for the Harbourside Redevelopment at 2 – 10 Darling Drive, Darling Harbour in accordance with DP's proposal SYD200661.P.001.Rev3 dated 15 December 2020. The report is provided for the use of Mirvac Projects Pty Ltd for this project only and for the purpose(s) described in the report. The report should not be used for other projects or by other parties. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

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Appendix A

About this Report

About this Report

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Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling Methods

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Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

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

In fine grained soils (>35% fines)

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

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

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

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

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

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

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

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

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

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

Moisture Condition – Coarse Grained Soils

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

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

Moisture Condition – Fine Grained Soils

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

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

Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

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

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

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

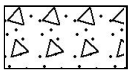
Symbols & Abbreviations

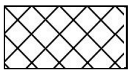
Graphic Symbols for Soil and Rock

General

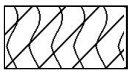

Asphalt

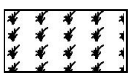

Road base

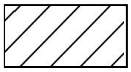

Concrete

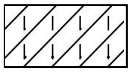

Filling

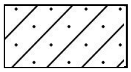
Soils


Topsoil

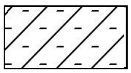

Peat

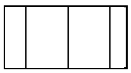

Clay

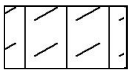

Silty clay

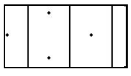

Sandy clay

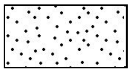

Gravelly clay

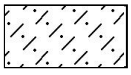

Shaly clay

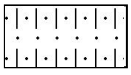

Silt


Clayey silt


Sandy silt

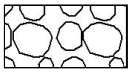

Sand

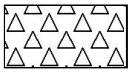

Clayey sand


Silty sand


Gravel

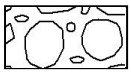

Sandy gravel


Cobbles, boulders

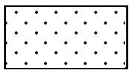

Talus

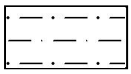
Sedimentary Rocks

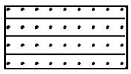

Boulder conglomerate

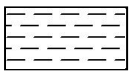

Conglomerate


Conglomeratic sandstone

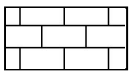

Sandstone


Siltstone

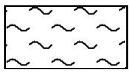

Laminite

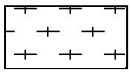

Mudstone, claystone, shale

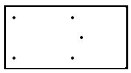

Coal


Limestone

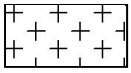
Metamorphic Rocks

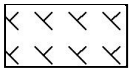

Slate, phyllite, schist

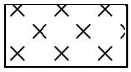

Gneiss

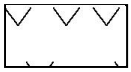

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

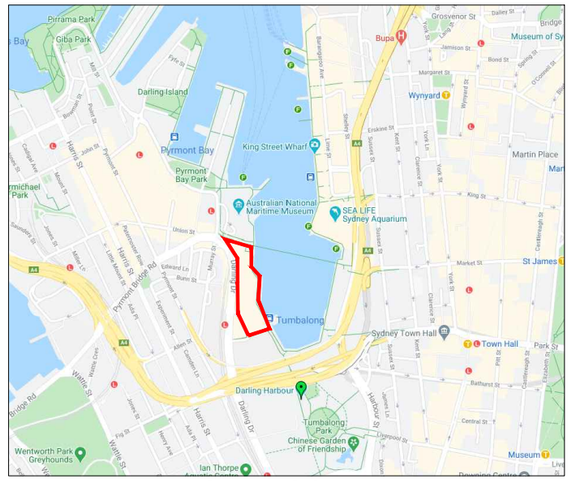

Dacite, epidote


Tuff, breccia


Porphyry

Appendix B

Drawings



SITE LOCALITY

LEGEND

- Borehole Location and Number (DP)
- Borehole Location and Number (JK, 1985)
- Borehole Location and Number (Coffey, 2013)
- Site Boundary
- Cross Section

NOTE:
1: Base image from MetroMap.com.au (Dated 04.12.2020)

0 5 10 20 30 40 50 75 100 125m

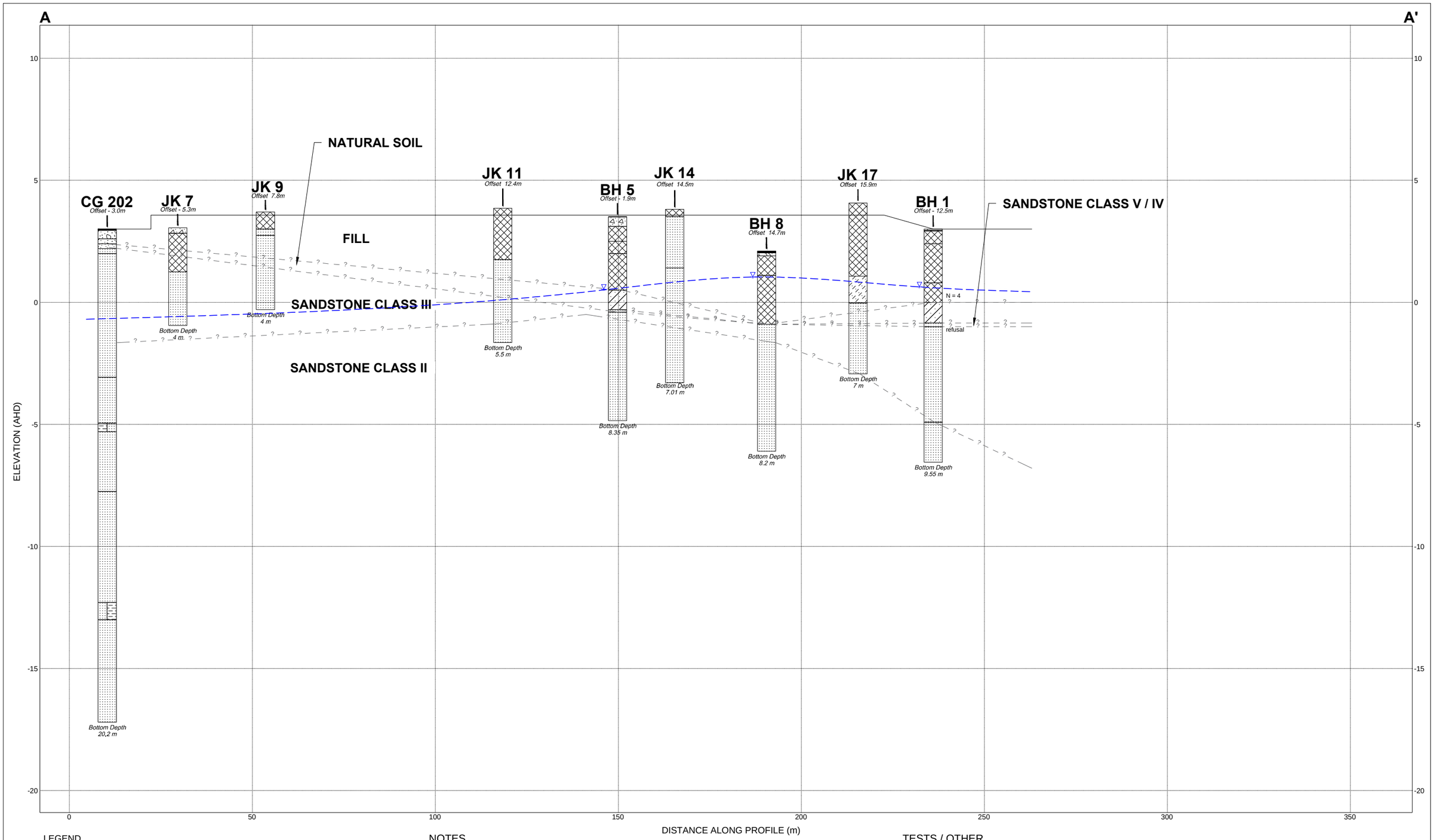
1:1250 @ A3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Projects Pty Ltd		TITLE: **Borehole Locations** **Harbourside Redevelopment** **2 - 10 Darling Harbour, Sydney**
OFFICE: Sydney	DRAWN BY: CJ	
SCALE: 1:1250 @ A3	DATE: 1.03.2021	

N

PROJECT No:	200004.00
DRAWING No:	1
REVISION:	1



LEGEND

Cemented sand	Concrete	Sand
Asphaltic Concrete	Filling	Sandstone
Bricks	Gravelly Sand	Sandy Clay
Clayey Sand	Roadbase	Shale

NOTES

1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

TESTS / OTHER

- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary
- ▽ - Water level
- – – – – - Inferred water level

0 20

Horizontal Scale (metres)

Vertical Exaggeration = 6.7

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Projects Pty Ltd		TITLE: **Cross-section A-A'**	PROJECT No: 200004.00
OFFICE: Sydney	DRAWN BY: CJ	**Proposed Habourside Redevelopment**	DRAWING No: 2
SCALE: 1:1000 (H) 1:150 (V) @ A3	DATE: 1.03.2021	**2-10 Darling Drive, Darling Harbour**	REVISION: 1

B B' B''

BH 7 Offset 5.0m
JK 3 Offset - 7.9m
JK 6 Offset - 9.2m
BH 6 Offset - 5.2m
JK 13 Offset - 3.1m
BH 4 Offset 5.5m
BH 2 Offset 0.7m
JK 18 Offset 8.7m
BH 1 Offset 19.8m

SANDSTONE CLASS V / IV

FILL

NATURAL SOIL

SANDSTONE CLASS III

SANDSTONE CLASS II

N = 7
N = 7
N = 8
N = 25
N = 33
N = 9
N = 6
refusal
Bottom Depth 18 m
Bottom Depth 12.7 m
Bottom Depth 14.47 m
Bottom Depth 10.67 m
Bottom Depth 10 m
Bottom Depth 8.88 m
N = 8
N = 16
refusal
Bottom Depth 11.3 m
Bottom Depth 14 m
N = 4
refusal
Bottom Depth 9.55 m

ELEVATION (AHD)

10 5 0 -5 -10 -15 -20

0 50 100 150 200 250 300 350

DISTANCE ALONG PROFILE (m)

LEGEND

Core Loss
Bricks
Clay
Concrete
Filling
Organic Clay
Pavers
Sand
Sandstone
Sandy Clay
Siltstone
Silty Sand
Silty Sandy Clay

NOTES

1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

TESTS / OTHER

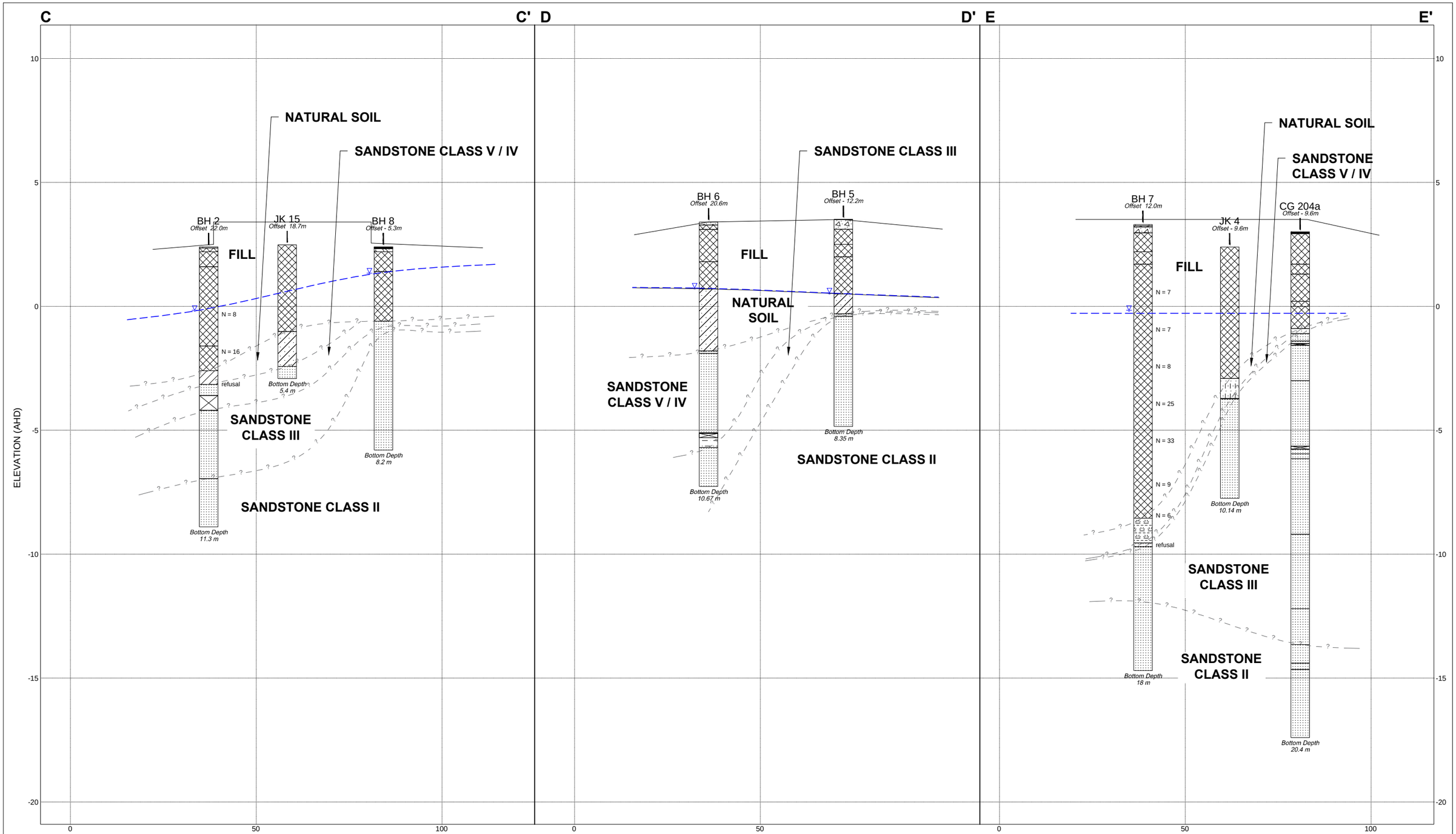
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
▽ - Water level
– – – – - Inferred water level

0 20
Horizontal Scale (metres)

Vertical Exaggeration = 6.7

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Projects Pty Ltd		TITLE: **Cross-section B-B'-B''**	PROJECT No: 200004.00
OFFICE: Sydney	DRAWN BY: CJ	**Proposed Habourside Redevelopment**	DRAWING No: 3
SCALE: 1:1000 (H) 1:150 (V) @ A3	DATE: 1.03.2021	**2-10 Darling Drive, Darling Harbour**	REVISION: 1



LEGEND

- Core Loss
- Asphaltic Concrete
- Bricks
- Clay
- Filling
- Roadbase
- Sandstone
- Sandy Clay

NOTES

1. Subsurface conditions are accurate at the borehole locations only.
   Variations in subsurface conditions may occur between borehole locations.
   Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

TESTS / OTHER

- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary
- ▽ - Water level
- – – – – - Inferred water level

0 20

Horizontal Scale (metres)

Vertical Exaggeration = 6.7

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Mirvac Projects Pty Ltd		TITLE: **Cross-sections C-C', D-D' and E-E'** **Proposed Habourside Redevelopment** **2-10 Darling Drive, Darling Harbour**
OFFICE: Sydney	DRAWN BY: JDB	
SCALE: 1:1000 (H) 1:150 (V) @ A3	DATE: 01.03.2021	

PROJECT No: 200004.00
DRAWING No: 4
REVISION: 0

Appendix C

Results of Current Field Work

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3 AHD
EASTING: 333414
NORTHING: 6250752
DIP/AZIMUTH: 90°/--

BORE No: BH 1
PROJECT No: 200004.00
DATE: 20 - 21/1/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Water	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.05	BRICK PAVERS				A/E			
	0.08	FILL/SAND: medium, brown, moist				A/E			
	0.6	FILL/ROADBASE GRAVEL and SAND: fine to medium, grey to dark grey, angular to subangular, 40% coarse sand, well compacted, slightly cemented, moist				A/E			
	1	FILL/SAND and GRAVEL: medium to coarse, grey, 40% gravel, apparently moderately compacted, moist, ripped sandstone			Unless otherwise stated, rock is fractured along rough planer bedding dipping at 0°-10°	A/E			
	2.2	FILL/Sandy CLAY: low plasticity, brown, 30% fine sand, trace sandstone gravel, poorly compacted, w>PL		20-01-21		S			1,1,3 N = 4
	3.0	Sandy CLAY CL: low plasticity, grey to dark grey, 20% fine sand, trace seashell, soft, marine sediments, w>PL							
	3.85	SANDSTONE: medium grained, pale grey brown, very low to low strength, Hawkesbury Sandstone				S			20/80mm refusal
	4.0	SANDSTONE: medium grained, pale grey brown, thinly cross bedded (5°-10°), medium and high strength, slightly weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone			4.1m: J60°, pl, ro, cly 4.35m: J70°, un, ro, cln 4.65m: B0°, cly 10mm	C	100	100	PL(A) = 0.7 PL(A) = 1.1
					5.98m: J30°, un, ro, fe	C	100	99	PL(A) = 0.9 PL(A) = 0.7
	7.91	SANDSTONE: medium to coarse grained, pale grey, thickly bedded, high strength, fresh, slightly fractured, Hawkesbury Sandstone			7.9m: B0°, cly 10mm 8.75m: J20°, un, ro, cln	C	100	100	PL(A) = 1.3
		Between 9.1-9.4m: some siltstone clasts and quartz gravels			9.10-9.30m: siltstone clast and qtz gravels 9.25m: J30°, un, ro, cly 9.45m: B5°, cbs co, 5mm				PL(A) = 1.2
	9.55	Bore discontinued at 9.55m							

RIG: Geo 205/ Scout 1 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 4.10m, HQ to 4.0m

TYPE OF BORING: Diatube to 0.05m, Spiral Flight Auger (TC-bit) to 3.9m, NMLC Coring to 9.55m

WATER OBSERVATIONS: Groundwater observed at 2.4m whilst augering

REMARKS: Standpipe installed to 9.55m, Slotted PVC 9.55m to 5.05m from Blank PVC to 0.1m, Gravel to 4.5m, Bentonite to 3.5m, Backfill to 0.1m, Cement Mix to Ground Level with Gatic Cover

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 2.4 AHD
EASTING: 333429
NORTHING: 6250680
DIP/AZIMUTH: 90°/--

BORE No: BH 2
PROJECT No: 200004.00
DATE: 19/1/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.05	BRICK PAVERS										
	0.2	FILL/SAND: fine to medium, brown, moist							A/E			
		FILL/GRAVEL and SAND: medium to coarse, grey to dark grey, angular, rectangular, roadbase gravel, 30% coarse sand, apparently well compacted, moist							A/E			
1	0.8	FILL/GRAVEL and SAND: fine to medium, gravel, 30% medium sand, apparently well compacted, moist						Unless otherwise stated, rock is fractured along rough planer bedding dipping at 0°-10°	A/E			
		Below 1.0m: sandstone boulder										
0						19-01-21			S			2,3,5 N = 8
-1												
-2	4.0	FILL/SAND and GRAVEL: medium to coarse, brown sand, 40% sandstone gravel, with boulders, apparently well compacted							S			2,7,9 N = 16
-3	5.0	CLAY: grey, trace fine sand, apparently very soft, w>PL, marine										
	5.55	SANDSTONE: medium grained, brown, low to medium strength, Hawkesbury Sandstone (possible boulder)							S			50/20mm refusal
-4								6m: CORE LOSS: 600mm				
	6.6	SANDSTONE: medium grained, pale brown to red brown, cross bedded (10°-15°), medium strength, highly to moderately weathered, slightly fractured and unbroken, Hawkesbury Sandstone						6.60-6.70m: B(x4)0°-5°, fe, fg 20mm 6.9m: B5°, fe, cly 7.01m: B10°, fe 7.25m: B5°, cly 5mm	C	87	75	PL(A) = 0.4 PL(A) = 0.5
-5												
-6												PL(A) = 0.7
								8.5m: J45°, pl, ro, fe 8.6m: B5°, fe				
-7	9.35	SANDSTONE: *Refer next page*						9.1m: J30°, pl, ro, fe 9.30-9.35m: Cs 9.5m: B10°, fe 9.7m: B0°, cly 5mm	C	100	98	PL(A) = 1.9

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 6.1m, HQ to 6.1m

TYPE OF BORING: Hand Auger to 0.7m, Spiral Flight Auger (TC-bit) to 5.5m, Rotary to 6.0m, NMLC Coring to 11.3m

WATER OBSERVATIONS: Groundwater observed at 2.6m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 2.4 AHD
EASTING: 333429
NORTHING: 6250680
DIP/AZIMUTH: 90°/--

BORE No: BH 2
PROJECT No: 200004.00
DATE: 19/1/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8	11	SANDSTONE: medium to coarse grained, pale grey brown, high strength, moderately to slightly weathered then fresh, slightly fractured, Hawkesbury Sandstone *(continued)*						10.3m: B5°, cbs co	C	100	98	PL(A) = 1.8
	11.3							11.17m: B5°, cbs co, 2mm 11.27m: B5°, cly 10mm				PL(A) = 1.6
-9		Bore discontinued at 11.3m										
-10	12											
-11	13											
-12	14											
-13	15											
-14	16											
-15	17											
-16	18											
-17	19											

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 6.1m, HQ to 6.1m

TYPE OF BORING: Hand Auger to 0.7m, Spiral Flight Auger (TC-bit) to 5.5m, Rotary to 6.0m, NMLC Coring to 11.3m

WATER OBSERVATIONS: Groundwater observed at 2.6m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3 AHD
EASTING: 333383
NORTHING: 6250662
DIP/AZIMUTH: 90°/--

BORE No: BH 3
PROJECT No: 200004.00
DATE: 12/1/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.09	ASPHALTIC CONCRETE										
	0.3	ROADBASE GRAVEL: grey, angular to subangular, fine to medium, moist							A/E			
		FILL/SAND and GRAVEL: fine to medium, pale grey brown, 30% fine to medium, angular to subrounded roadbase gravel, moderately compacted, moist							A/E B			
1	1.0								A/E			
	1.25	CONCRETE SLAB										
	1.6	FILL/GRAVEL and SAND: pale brown, fine to medium sand, 30% medium angular roadbase gravel, apparently poorly/moderately compacted							A/E			
2		SAND: fine to medium, pale brown, trace silt, loose, wet, (possibly fill)				12-01-21			A/E			
	3.0	SAND: fine to medium, pale grey, trace seashell, loose, wet, marine							A/E			
3	3.5	Bore discontinued at 3.5m - Auger broken and left in hole, unable to recover. BH 3 moved 0.8m north as BH 3A										
4												
5												
6												
7												
8												
9												

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI/RMM **CASING:** Uncased

TYPE OF BORING: NDD to 1.0m, Diacore to 1.25m, Spiral Flight Auger (TC-bit) to 3.5m

WATER OBSERVATIONS: Free goundwater observed at 2.6m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3 AHD
EASTING: 333383
NORTHING: 6250662
DIP/AZIMUTH: 90°/--

BORE No: BH 3A
PROJECT No: 200004.00
DATE: 13/1/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
3	0.05	ASPHALTIC CONCRETE										
		ROADBASE GRAVEL: grey, angular to subangular, fine to medium, well compacted, moist										
	0.5	FILL/SAND and GRAVEL: fine to medium, pale grey brown, 30% fine to medium, angular to subrounded roadbase gravel, moderately compacted, moist							B			
2	1.0											
	1.1	CONCRETE SLAB										
		Bore discontinued at 1.1m - Redundant service encountered. Borehole abandoned										
1	2											
0	3											
-1	4											
-2	5											
-3	6											
-4	7											
-5	8											
-6	9											

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** Uncased

TYPE OF BORING: Hand Auger to 1.0m, Diatube to 1.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3.5 AHD
EASTING: 333422
NORTHING: 6250642
DIP/AZIMUTH: 90°/--

BORE No: BH 4
PROJECT No: 200004.00
DATE: 8/2/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.18	CONCRETE SLAB										
		FILL/SAND and GRAVEL: coarse, grey sand and 30% fine to medium angular to subangular road base gravel, apparently well compacted, moist							A A A A			
	2.0	FILL/Sandy CLAY: pale grey brown, 30% fine to medium sand, 10% ripped sandstone gravel, apparently poorly compacted, moist							A			
	3.5	FILL/CLAY: grey brown, 20% fine sand, trace crushed/ripped sandstone gravel, apparently poorly compacted, soft, wet				08-02-21						
	4.5	FILL/Sandy CLAY, light grey to grey, 20% fine sand, apparently very soft, wet, possibly fill										
	5.2	FILL/Sandy CLAY: brown, fine to medium sand, trace wood fragments, minimal drilling resistance (apparently soft), possibly fill Below 6.8m: apparently firm to stiff										
	7.2	SAND: fine to medium, light brown, apparently loose, inferred from drilling resistance										
	7.85 7.95	SANDSTONE: very low strength, inferred										
		SANDSTONE: medium to coarse grained, pale brown and grey, medium strength, slightly weathered, unbroken, Hawkesbury Sandstone							C	100	100	
	8.88	Bore discontinued at 8.88m										

RIG: Comacchio 205 **DRILLER:** GM **LOGGED:** SI/JB **CASING:** HW to 5.6m, HQ to 7.85m

TYPE OF BORING: Diatube to 0.18m, Spiral Flight Auger (TC-bit) to 5.2m, Rotary (blade) to 7.95m, NLMC Coring to 8.88m

WATER OBSERVATIONS: Groundwater observed at 3.5m.

REMARKS: 100% drilling water return 5.2m-7.2m, 30% return 7.2m to 7.85m, 100% return during coring

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3.5 AHD
EASTING: 333396
NORTHING: 6250667
DIP/AZIMUTH: 90°/--

BORE No: BH 5
PROJECT No: 200004.00
DATE: 27/1/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.003	CERAMIC TILES, CEMENTED SAND										
	0.39	CONCRETE SLAB (2): steel bar 5mm diameter							A/E			
		FILL/SAND: fine to medium, brown, apparently poorly compacted, moist										
	1.0	FILL/ROADBASE GRAVEL: medium to coarse, grey, angular to subangular, 20% medium to coarse sand, poorly compacted, dry						Unless otherwise stated, rock is fractured along rough planer bedding dipping at 0°-10°	A/E			
	1.5	FILL/SAND and GRAVEL: pale grey brown, medium sand, 40% ripped sandstone gravel with trace sandstone boulders, apparently moderately compacted, moist then wet							A/E			
	3.0	Sandy CLAY: low plasticity, dark grey, 20-30% fine sand, apparently very soft, w>PL, marine				27-01-21			A/E			
	3.8	SANDSTONE: medium grained, pale grey brown, low to medium strength, Hawkesbury Sandstone							A/E			PL(A) = 1.4
	3.9	SANDSTONE: medium to coarse grained, pale grey and brown, trace siltstone clasts and laminations, medium and high strength, slightly weathered and fresh, slightly fractured and unbroken, Hawkesbury Sandstone							C	100	100	PL(A) = 0.9
								5.55-5.70m: J85°-90°, sv, un, ro, cly 5.63-5.70m: Cs	C	100	90	PL(A) = 1.6
								6.22m: B0°, cly co, 2mm	C	100	100	PL(A) = 1.4
								7.75m: B0°, cly 10mm 7.93m: B5°, cly co, 3mm	C	100	99	PL(A) = 0.8 PL(A) = 0.9
	8.35	Bore discontinued at 8.35m										

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 3.9m

TYPE OF BORING: Diatube to 0.39m, Hand Auger to 1.2m, Spiral Flight Auger (TC-bit) to 3.5m, Rotary to 3.9m, NMLC Coring to 8.35m

WATER OBSERVATIONS: Groundwater observed at 3.0m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3.4 AHD
EASTING: 333429
NORTHING: 6250576
DIP/AZIMUTH: 90°/--

BORE No: BH 6
PROJECT No: 200004.00
DATE: 2/2/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.12	CONCRETE SLAB										
	0.3	FILL/SAND: fine to medium, pale grey, trace roadbase gravel, apparently poorly compacted, dry							A/E			
		FILL/SAND and GRAVEL: medium to coarse, grey, 30% roadbase gravel, angular and subangular, fine to medium, apparently variably compacted, moist						Unless otherwise stated, rock is fractured along rough planer bedding dipping at 0°-10°	A/E			
	1.6	FILL/GRAVEL and SAND: pale brown, ripped sandstone gravel and boulder, 40% medium to coarse sand, apparently variably compacted, moist							A/E			
	2.7	Sandy CLAY: low plasticity, grey, 30% fine sand, apparently very soft, w>PL, marine				02-02-21			A/E			
	5.2								A/E			
	5.3	SANDSTONE: medium grained, pale grey, very low strength, Hawkesbury Sandstone							C	100	100	PL(A) = 0.4
		SANDSTONE: medium to coarse grained, pale grey and brown, low and medium strength, moderately and slightly weathered, slightly fractured, Hawkesbury Sandstone						5.7m: B5°, cly co, 5mm 5.88m: B10°, cly vn				
								6.3m: B20°, cly vn, ti	C	100	90	PL(A) = 0.6
								6.85m: B/J30°, pl, ro, fe 6.92m: J30°, pl, ro, cly	C	100	100	PL(A) = 0.4
								7.72m: siltstone clasts				
								8.2-8.4m: fg 50mm	C	87	65	PL(A) = 0.16
	8.5	SILTSTONE: grey, very low strength, highly weathered, fractured, Hawkesbury Sandstone Formation						8.53m: CORE LOSS: 170mm 8.7-9.1m: Ds 8.75m: J70°, un, ro, cly	C	100	66	PL(A) = 0.9
	8.7											
	9.1	SANDSTONE: medium grained, pale grey, medium strength, fresh, unbroken, Hawkesbury Sandstone						9.7m: J85°, pl, ro, cln	C	100	100	

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HQ to 5.2m

TYPE OF BORING: Diatube to 1.2m, Spiral Flight Auger (TC-bit) to 5.2m, Rotary to 5.3m, NMLC Coring to 10.67m

WATER OBSERVATIONS: Groundwater observed at 2.7m

REMARKS: Nested Well Installed. Well 1 - Standpipe installed to 10.7m, Screen 6.2m to 10.7m, Solid PVC 0.1m to 6.2m, Backfill with Gravel 5.3m to 10.7m, Bentonite 2.1m to 5.3m, Gravel 0.1m to 2.1m, Concrete 0.1m to Ground Level, Stick up 0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3.4 AHD
EASTING: 333429
NORTHING: 6250576
DIP/AZIMUTH: 90°/--

BORE No: BH 6
PROJECT No: 200004.00
DATE: 2/2/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7		SANDSTONE: medium grained, pale grey, medium strength, fresh, unbroken, Hawkesbury Sandstone *(continued)*						10.5m: J45°, pl, ro, ti	C	100	100	PL(A) = 0.9
	10.67	Bore discontinued at 10.67m										
-8	11											
-9	12											
-10	13											
-11	14											
-12	15											
-13	16											
-14	17											
-15	18											
-16	19											

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HQ to 5.2m

TYPE OF BORING: Diatube to 1.2m, Spiral Flight Auger (TC-bit) to 5.2m, Rotary to 5.3m, NMLC Coring to 10.67m

WATER OBSERVATIONS: Groundwater observed at 2.7m

REMARKS: Nested Well Installed. Well 1 - Standpipe installed to 10.7m, Screen 6.2m to 10.7m, Solid PVC 0.1m to 6.2m, Backfill with Gravel 5.3m to 10.7m, Bentonite 2.1m to 5.3m, Gravel 0.1m to 2.1m, Concrete 0.1m to Ground Level, Stick up 0.4m.

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3.3 AHD
EASTING: 333453
NORTHING: 6250484
DIP/AZIMUTH: 90°/--

BORE No: BH 7
PROJECT No: 200004.00
DATE: 14/1/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
3.25	0.05	PAVERS										
3.2	0.1	FILL/SAND: fine to medium, pale brown, moist							A/E			
2.91	0.34	CONCRETE							A/E			
		FILL/SAND and GRAVEL: medium to coarse, 40% roadbase gravel, slightly cemented, apparently well compacted, moist							A/E			
2.2	1.1	FILL/SAND: medium to coarse, brown, apparently poorly compacted, moist										
1.7	1.6	FILL/SAND and GRAVEL: medium to coarse, pale brown, 40% sandstone gravel, apparently poorly compacted, moist then wet							A/E			
									S			4,4,3 N = 7
						14-01-21						
									A/E			
									S			3,5,2 N = 7
									S			3,5,3 N = 8
		Below 7.0m: with sandstone boulders							S			6,9,16 N = 25
									S			5,16,17 N = 33

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 12.0m, HQ to 13.0m

TYPE OF BORING: Diatube to 0.34m, Hand Auger to 1.2m, Spiral Flight Auger (TC-bit) to 3.5m, Rotary Drilling to 13.0m, NMLC Coring to 18.0m

WATER OBSERVATIONS: Groundwater observed at 3.5m whilst augering

REMARKS: Standpipe installed to 5.2m, Screen 5.2m to 2.2m, Gravel 5.2m to 1.5m, Bentonite 1.5m to 1.0m, Backfill to 0.1m, Gatic Cover and Concrete to Ground Level

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 3.3 AHD
EASTING: 333453
NORTHING: 6250484
DIP/AZIMUTH: 90°/--

BORE No: BH 7
PROJECT No: 200004.00
DATE: 14/1/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7		FILL/SAND and GRAVEL: medium to coarse, pale brown, 40% sandstone gravel, apparently poorly compacted, moist then wet *(continued)*							S			19,3,6 N = 9
-8	11											
	11.85	Organic CLAY: dark grey to black, trace fine sand and wood particles/chip, apparently soft, marine						Unless otherwise stated, rock is fractured along rough planer bedding dipping at 0°-10°	S			3,3,3 N = 6
-9	12											
	12.85	SANDSTONE: medium grained, pale grey brown, low strength, highly weathered, Hawkesbury Sandstone							S			150/25mm refusal
	13 13.0	SANDSTONE: medium grained, pale brown then pale grey, medium then high strength, slightly weathered then fresh, slightly fractured and unbroken, Hawkesbury Sandstone										PL(A) = 0.5
-10	14							13.97m: B5°, cly 5mm				PL(A) = 0.7
-11									C	100	98	
	15							15.05m: B0°, cly 20mm				PL(A) = 1.9
-12		Between 15.60-15.68m: very high strength siltstone						15.6m: J, sv, pl, ro, ti				PL(A) = 5.2
	16											
-13								16.5m: B5°, cly co, 2mm				PL(A) = 1.6
	17								C	100	100	
-14								17.4m: J/B30°, pl, ro, cln				PL(A) = 1.4
	18 18.0	Bore discontinued at 18.0m - target depth reached										
-15	19											
-16												

RIG: Geo 205 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 12.0m, HQ to 13.0m

TYPE OF BORING: Diatube to 0.34m, Hand Auger to 1.2m, Spiral Flight Auger (TC-bit) to 3.5m, Rotary Drilling to 13.0m, NMLC Coring to 18.0m

WATER OBSERVATIONS: Groundwater observed at 3.5m whilst augering

REMARKS: Standpipe installed to 5.2m, Screen 5.2m to 2.2m, Gravel 5.2m to 1.5m, Bentonite 1.5m to 1.0m, Backfill to 0.1m, Gatic Cover and Concrete to Ground Level

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Mirvac Projects Pty Ltd
PROJECT: Proposed Habourside Redevelopment
LOCATION: 2-10 Darling Drive, Darling Harbour

SURFACE LEVEL: 2.4 AHD
EASTING: 333383
NORTHING: 6250709
DIP/AZIMUTH: 90°/--

BORE No: BH 8
PROJECT No: 200004.00
DATE: 8/1/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.07	ASPHALTIC CONCRETE										
	0.2	ROADBASE										
		FILL/SAND and GRAVEL: fine to medium, pale grey brown, 30% fine to medium, sandstone and igneous gravel, angular to subrounded, apparently moderately compacted, moist										
	1.0	FILL/SAND: fine, light brown, trace gravel, wet				09-01-21		Unless otherwise stated, rock is fractured along rough planer bedding dipping at 0°-10°	A			
	3.0	SANDSTONE: medium grained, red-brown and pale brown, medium then high strength, moderately to highly weathered, slightly fractured, Hawkesbury Sandstone							A			
								3.35m: B10°-20°, ro, un, fe stn 3.46m: B0°-5°, ro, un, cly vn 3.49m: B0°-5°, ro, un, cly vn 3.57m: B0°-5°, ro, un, cly vn	C	100	96	PL(A) = 1.9 PL(A) = 1.5
		Below 4.3m: fresh							C	100	100	
								5.02m: B0°-5°, ro, un, cly vn 5.04m: B0°-5°, ro, un, cly vn 5.06m: Cs, 10mm 5.4m: B0°-10°, ro, un, cln 5.42m: B0°-10°, ro, un, cln 6.2m: B5°-10°, ro, un, cln 6.65m: B°-10°, ro, un, cbs vn 6.78m: B°-10°, ro, un, cbs vn 7.1m: B0°-5°, ro, pl, cbs vn 7.1m: J30°, ti	C	100	100	PL(A) = 1.4 PL(A) = 1 PL(A) = 1.7 PL(A) = 2.5
	8.2	Bore discontinued at 8.2m										

RIG: Geo 205 **DRILLER:** GM **LOGGED:** RMM **CASING:** HW to 3.0m

TYPE OF BORING: Diatube to 0.1m; NDD to 2.5m, Spiral Flight Auger (TC-bit) to 3.15m, NMLC Coring to 8.2m

WATER OBSERVATIONS: Groundwater observed at 1.45m during NDD. Water Level at 1.1m after 24 hours.

REMARKS: Standpipe installed to 3.0m, Screen 3.0m to 1.0m, Gravel 3.0m to 0.5m, Bentonite 0.5m to 0.2m, Backfill and Gatic Cover to Ground Level, Gravel to 4.0m to 8.2m, Bentonite 4.0m to 3.0m

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH1 PROJECT: 200004.00 JANUARY 2021

4.00 – 8.00m

BORE: BH1 PROJECT: 200004.00 JANUARY 2021

8.00 – 9.55m

BORE: BH2 PROJECT: 200004.00 JANUARY 2021

6.00 – 11.00m

BORE: BH2 PROJECT: 200004.00 JANUARY 2021

11.00 – 11.35m

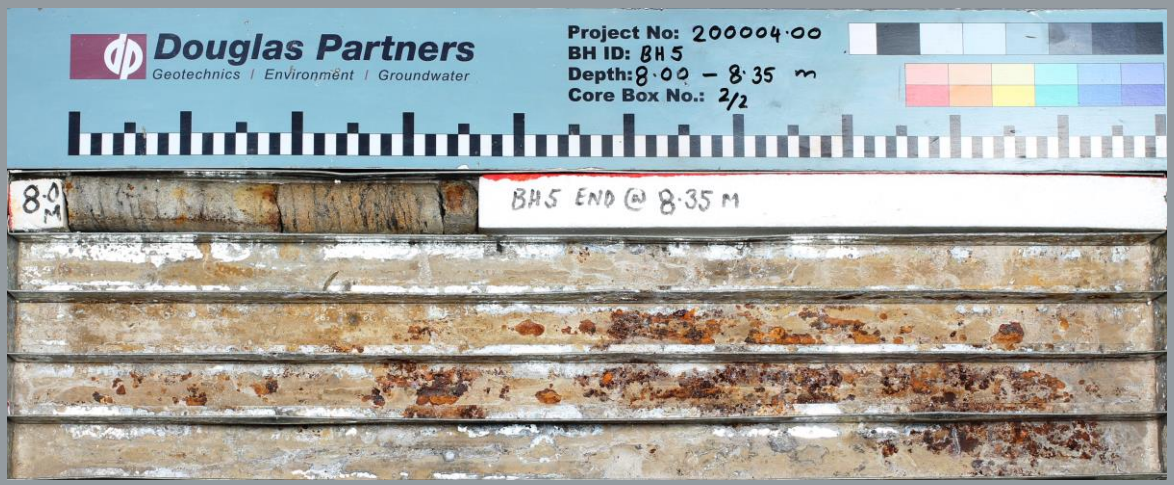
BORE: BH4 PROJECT: 200004.00 JANUARY 2021

7.95 – 8.88m

BORE: BH5 PROJECT: 200004.00 JANUARY 2021

3.90 – 8.00m

BORE: BH5 PROJECT: 200004.00 JANUARY 2021



8.00 – 8.35m

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BORE: BH6 PROJECT: 200004.00 JANUARY 2021


5.30 – 10.00m

BORE: BH6 PROJECT: 200004.00 JANUARY 2021


10.00 – 10.70m
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BORE: BH7 PROJECT: 200004.00 JANUARY 2021

13.00 – 17.00m

BORE: BH7 PROJECT: 200004.00 JANUARY 2021

17.00 – 18.00m

BORE: BH8 PROJECT: 200004.00 JANUARY 2021

3.15 – 7.00m

BORE: BH8 PROJECT: 200004.00 JANUARY 2021

7.00 – 8.20m

Appendix D

Results of Previous Field Work

coffey geotechnics

Engineering Log - Borehole

Borehole ID.	***BH202***
sheet:	1 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***23 May 2013***
principal:	date completed: ***23 May 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***CL***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,384.50; N: 6,250,527.50 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track Casing Diameter : HQ

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T — HA — HQ Casing			E E E SPT 15/100mm N*=R	3				**ASPHALT**: 0.05m.	D			**PAVEMENT**
								Gravelly SAND: fine coarse, dark grey, fine to medium grained igneous gravel.				**ROADBASE** PID = 0.4ppm at 0.2m
							SP	**Gravelly SAND**: fine coarse, grey mottled brown, fine to medium grained gravel.		D		**FILL** PID = 0ppm at 0.5m
								SAND: fine, orange brown, with a trace of sandstone gravel.				**RESIDUAL SOIL**
				2	1.0			**SANDSTONE**: pale grey mottled orange brown, moderately weathered to slightly weathered, medium strength.				PID = 0ppm at 0.6m **BEDROCK**
								Borehole BH202 continued as cored hole				
				1	2.0							
				0	3.0							
				-1	4.0							
				-2	5.0							
				-3	6.0							
				-4	7.0							

CDF_0_9_04AL.GLB Log COF BOREHOLE: NON CORED GEOTLCOV24303AH BH20X SERIES.GPJ <<DrawingFile>> 11/07/2013 15:12

method
AD auger drilling*
AS auger screwing*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
* bit shown by suffix
e.g. AD/T

support
M mud
C casing
N nil

penetration
1 2 3
no resistance
ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
U## undisturbed sample ##mm diameter
D disturbed sample
B bulk disturbed sample
E environmental sample
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear peak/remouded (uncorrected kPa)
R refusal

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Cored Borehole

Borehole ID.	***BH202***
sheet:	2 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***23 May 2013***
principal:	date completed: ***23 May 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***CL***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,384.50; N: 6,250,527.50 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track Casing Diameter : HQ

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
		3									
					start coring at 1.00m						
NMLC		2	1.0		**SANDSTONE**: fine to medium grained, pale grey, with dark grey laminae, distinctly cross bedded at 0-15° 1.30m to 1.70m: some iron staining	SW					180 mm, XW zone
											JT, 45°, ST, RO, CO
									90%		PT, 0°, PL, RO, SN
		1	2.0			FR		a=0.96 d=0.76			PT, 0°, PL, RO, CO
								a=0.83 d=1.24			PT, 0°, PL, RO, CN
											SM XW, 10 mm
		0	3.0					a=1.34 d=1.04			PT, 0°, PL, RO, CN
									100%		PT, IR, RO, CO
		-1	4.0								PT, 0°, PL, RO, CN
								a=0.84 d=1.25			PT, 5°, PL, RO, CO
		-2	5.0					a=1.35 d=1.24			
									99%		
		-3	6.0		**SANDSTONE**: medium to coarse grained, pale grey, with some dark grey shale lentices, iron stained from 6.07m to 6.28m, some iron staining from 7.3m to 7.65m						SM, 40 mm
								a=1.15 d=1.32			
		-4	7.0					a=1.27 d=2.29			PT, 0°, PL, RO, CO
									70%		PT, 0°, PL, RO, CO PT, 0°, PL, RO, CN

CDF_0_9_04AL.GLB Log COF BOREHOLE: CORED GEOTLCOV24303AH BH20X SERIES.GPJ <<DrawingFile>> 11/07/2013 15:09

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL: water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run & RQD

- barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Cored Borehole

Borehole ID.	***BH202***
sheet:	3 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***23 May 2013***
principal:	date completed: ***23 May 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***CL***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,384.50; N: 6,250,527.50 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track Casing Diameter : HQ

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC		-6	9.0		**INTERLAMINATED SHALE (80%) & SANDSTONE (20%)**: shale dark grey, sandstone fine grained, grey *(continued)*	XW / HW			70%		SM XW/HW, 350 mm PT, 0°, PL, RO, CO
						FR					
					SANDSTONE: fine grained, pale grey, with dark grey laminae, distinctly cross bedded at 0-15°			a=1.49 d=1.46			
		-7	10.0					a=0.80 d=0.88	94%		
		-8	11.0		**SANDSTONE**: fine to medium grained, pale grey, with some carbonaceous flecks, massive			a=1.47 d=1.65 a=1.38 d=1.50			PT, 5°, PL, RO, CO SM XW, 30 mm
		-9	12.0					a=1.36 d=1.56	100%		
		-10	13.0								
		-11	14.0					a=2.08 d=2.14	99%		
		-12	15.0					a=1.85 d=1.89			
					15.21m to 15.24m: shale band						PT, 0°, PL, RO, CN PT, 0°, PL, RO, CN
					INTERLAMINATED SHALE (30%) & SANDSTONE (70%): fine grained, pale grey, shale is dark grey			a=2.85 d=1.51	96%		

CDF_0_9_04AL.GLB Log COF BOREHOLE: CORED GEOTLCOV24303AH BH20X SERIES.GPJ <<DrawingFile>> 11/07/2013 15:09

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL: water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run & RQD

- barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Cored Borehole

Borehole ID.	***BH202***
sheet:	4 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***23 May 2013***
principal:	date completed: ***23 May 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***CL***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,384.50; N: 6,250,527.50 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track Casing Diameter : HQ

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC		13									SM, 10 mm
					SANDSTONE: fine to medium grained, pale grey, with pale grey laminae, distinctly cross bedded at 0-10°	FR					PT, 0°, PL, RO, CN
									96%		PT, 0°, PL, RO, CN
		-14	17.0					a=2.66 d=1.90 a=1.70 d=1.96			JT, 35°, PL, RO, CN
											PT, 0°, PL, RO, CN PT, 0°, PL, RO, CN
		-15	18.0								
									95%		
		-16	19.0					a=2.08 d=2.39 a=2.40 d=2.23			PT, 0°, PL, RO, CO PT, 0°, PL, RO, CO JT, 10°, PL, RO, CO
		-17	20.0								
					Borehole BH202 terminated at 20.20 m						
		-18	21.0								
		-19	22.0								
		-20	23.0								

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method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

core recovered (graphic symbols indicate material)
no core recovered

core run & RQD

barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

PointID : BH202 Depth Range: 1.00 - 7.00 m

drawn	
approved	
date	**07/06/2013**
scale	**N.T.S.**
original size	**A4**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH202

project no: GEOTLCOV24303AH | fig no: **FIGURE 3** | rev:

PointID : BH202 Depth Range: 7.00 - 12.00 m

drawn	
approved	
date	**07/06/2013**
scale	**N.T.S.**
original size	**A4**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client:	Lend Lease Development Pty Ltd
project:	SICEEP - International Convention Centre (ICC) Hotel Darling Harbour, Sydney
title:	**CORE PHOTOGRAPH BH202**
project no:	GEOTLCOV24303AH
fig no:	**FIGURE 4**
rev:	

PointID : BH202 Depth Range: 12.00 - 17.00 m

drawn	
approved	
date	07/06/2013
scale	N.T.S.
original size	A4

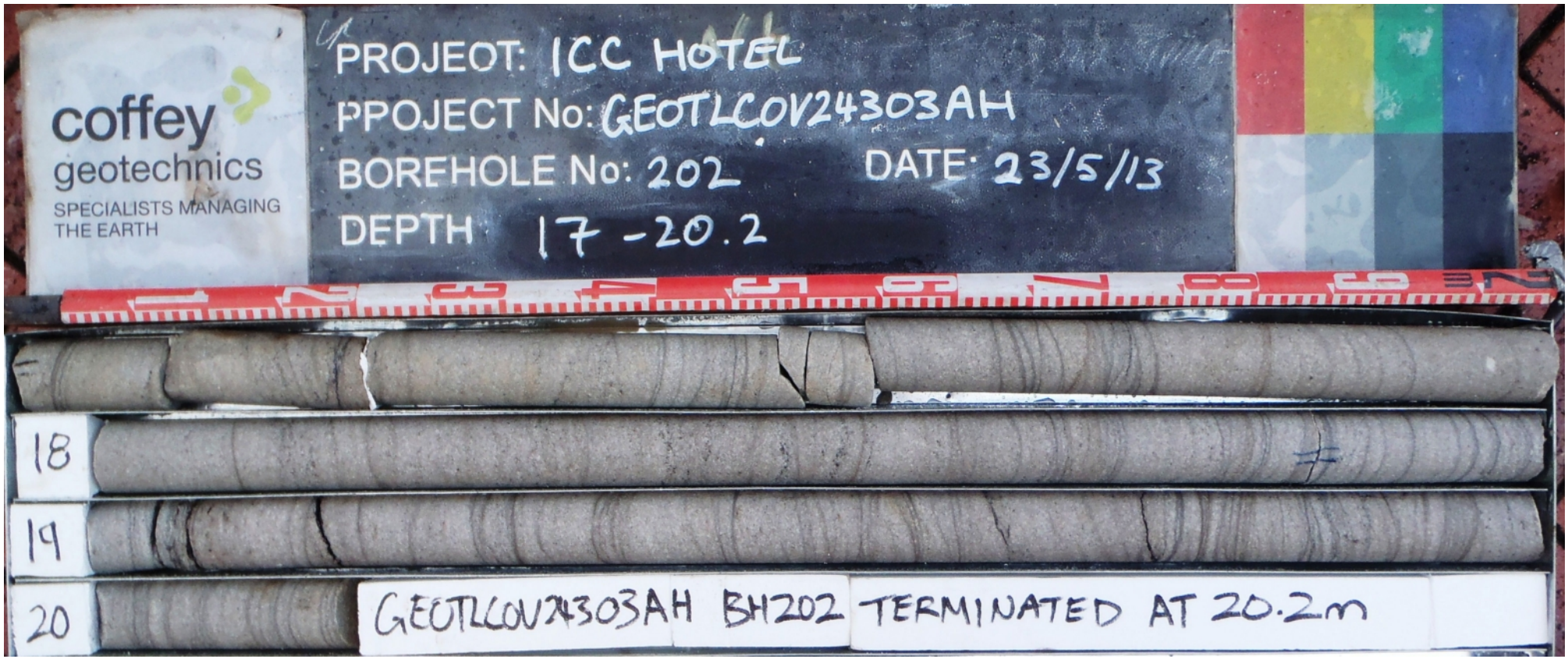
coffey
geotechnics
SPECIALISTS MANAGING
THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH202

project no: GEOTLCOV24303AH | fig no: **FIGURE 5** | rev:



PointID : BH202 Depth Range: 17.00 - 20.20 m

drawn	
approved	
date	07/06/2013
scale	N.T.S.
original size	A4

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH202

project no: GEOTLCOV24303AH | fig no: **FIGURE 6** | rev:

coffey geotechnics

Engineering Log - Borehole

Borehole ID.	***BH204***
sheet:	1 of 1
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***14 May 2013***
principal:	date completed: ***14 May 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***JW***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,405.80; N: 6,250,490.50 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
DT				3				**CONCRETE**: 0.15m.				**PAVEMENT**
HA			E					**FILL: SAND**: fine, grey, with some fine to medium sandstone gravel.	D			**FILL** PID = 0.1ppm at 0.3m, no odour or staining
			E									PID = 0ppm at 0.6m, no odour or staining
			E	2	1.0			**FILL: SAND**: fine, dark grey, trace of fine gravel.				PID = 0ppm at 0.8m, no odour or staining
			SPT 6, 5, 4 N*=9					**FILL: SAND**: fine, orange brown, trace of high plasticity clay.	M			PID = 0ppm at 1.3m, no odour or staining
			E	1	2.0			**FILL: Clayey SAND**: fine to medium, pale grey, orange pink, clay is high plasticity.				
			E					**FILL: CLAY**: high plasticity, mottled dark grey, orange and red brown, trace of shale gravel.				PID = 0.1ppm at 2.5m, no odour or staining
AD/T		▶	E	0	3.0		SP	**SAND**: medium to coarse, dark grey, black, trace of clay and with some plant roots.	M	MD		**ALLUVIUM** PID = 0ppm at 3.2m, no odour or staining
			SPT 3, 4, 3 N*=7				SP	**Clayey SAND**: medium to coarse, mottled pale grey, brown and dark red, trace of fine to medium sandstone gravel.		MD / D		**RESIDUAL SOIL**
				-1	4.0							
								Borehole BH204 terminated at 4.25 m				
				-2	5.0							
				-3	6.0							
				-4	7.0							

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method
AD auger drilling*
AS auger screwing*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
* bit shown by suffix
e.g. AD/T

support
M mud N nil
C casing

penetration
1 2 3 — no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
U## undisturbed sample ##mm diameter
D disturbed sample
B bulk disturbed sample
E environmental sample
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear peak/remouded (uncorrected kPa)
R refusal

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Borehole

Borehole ID.	***BH204a***
sheet:	1 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***07 Jun 2013***
principal:	date completed: ***07 Jun 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***RC***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,405.50; N: 6,250,490.90 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track hole diameter : 100 mm

drilling information | **material substance**

method & support	penetration 1 2 3	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description (SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components)	moisture condition	consistency / relative density	hand penetrometer (kPa) 100 200 300 400	structure and additional observations
AD/T				3				**ASPHALT**: 0.07m.	D			**PAVEMENT**
								FILL: Gravelly SAND: fine to medium, dark grey, cement stabilised.				**FILL**
				2	1.0			becoming black				
								FILL: SAND: medium, pale brown, trace of white shell fragments.				
				1	2.0			**FILL: Sandy CLAY**: low plasticity, white and pale brown, medium grained sand with some ironstone gravel.	<Wp			
		▶							>Wp			
			SPT 1, 4, 5 N*=9					with some dark grey shale rock fragments within the fill	W			
			SPT 4, 10, 5 N*=15	0	3.0			**FILL: Silty SAND**: medium, dark grey, trace of shells.	W / >Wp			
								FILL: MIXTURE OF SAND AND CLAY: fine to medium, low plasticity, brown and grey.				
			SPT 5, 10, 16/30mm N*=R	-1	4.0		SM	**Silty SAND**: medium, dark grey, with some shells.	W	MD / D		**ALLUVIUM**
								SANDSTONE: medium grained, red brown, highly weathered, low strength				**BEDROCK**
								Borehole BH204a continued as cored hole				
				-2	5.0							
				-3	6.0							
				-4	7.0							

CDF_0_9_04AL.GLB Log COF BOREHOLE: NON CORED GEOTLCOV24303AH BH20X SERIES.GPJ <<DrawingFile>> 11/07/2013 15:12

method
AD auger drilling*
AS auger screwing*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
* bit shown by suffix
e.g. AD/T

support
M mud
C casing
N nil

penetration
1 2 3 no resistance ranging to refusal

water
10-Oct-12 water level on date shown
water inflow
water outflow

samples & field tests
U## undisturbed sample ##mm diameter
D disturbed sample
B bulk disturbed sample
E environmental sample
HP hand penetrometer (kPa)
N standard penetration test (SPT)
N* SPT - sample recovered
Nc SPT with solid cone
VS vane shear peak/remouded (uncorrected kPa)
R refusal

classification symbol & soil description
based on Unified Classification System

moisture
D dry
M moist
W wet

consistency / relative density

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

coffey geotechnics

Engineering Log - Cored Borehole

Borehole ID.	***BH204a***
sheet:	2 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***07 Jun 2013***
principal:	date completed: ***07 Jun 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***RC***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,405.50; N: 6,250,490.90 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track hole diameter : 100 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
		3									
		2	1.0								
		1	2.0								
		0	3.0								
		-1	4.0		start coring at 4.40m						
NMLC		-2	5.0		**SANDSTONE**: medium to coarse grained, brown, iron stained, indistinctly cross bedded	MW					
					NO CORE: 0.07 m	MW		a=1.67 d=1.52	74%		PT, 0°, PL, RO, SN
					SANDSTONE: medium to coarse grained, brown and grey, iron stained, indistinctly cross bedded						PT, 0°, PL, RO, SN
		-3	6.0								PT, 20°, PL, RO, SN
					SANDSTONE: medium to coarse grained, orange brown and red brown, indistinctly cross bedded at 10°-20°, with some fine quartz gravel inclusions			a=1.73 d=1.53			Defects are:PT, 5 - 15°, PL, RO, SN, unless otherwise described
		-4	7.0					a=1.34 d=1.03	97%		
								a=0.94 d=1.05			SM, 5°, PL, RO, Clay, 5 mm
											PT, 20°, PL, RO, SN

CDF_0_9_04AL.GLB Log COF BOREHOLE: CORED GEOTLCOV24303AH BH20X SERIES.GPJ <<DrawingFile>> 11/07/2013 15:09

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL: water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run & RQD

- barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Cored Borehole

Borehole ID.	***BH204a***
sheet:	3 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***07 Jun 2013***
principal:	date completed: ***07 Jun 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***RC***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,405.50; N: 6,250,490.90 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track hole diameter : 100 mm

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC					**SANDSTONE**: medium to coarse grained, orange brown and red brown, indistinctly cross bedded at 10°-20°, with some fine quartz gravel inclusions *(continued)*	MW HW		a=0.52 d=1.27	97%		PT, 30°, PL, RO, Clay VN
					NO CORE: 0.12 m						SM, 5°, PL, RO, Clay, 35 mm
		-6	9.0		**SANDSTONE**: medium to coarse grained, orange brown and red brown, indistinctly cross bedded at 10°-20°, with some fine quartz gravel inclusions	FR		a=1.07 d=0.85			PT, 10°, PL, RO, Clay CO, 2 mm
					SANDSTONE: medium grained, pale grey, distinctly cross bedded at 10° -15°						
		-7	10.0		**SANDSTONE**: medium grained, pale grey, massive, with carbonaceous flecks			a=1.45 d=1.63	85%		
		-8	11.0					a=1.58 d=1.49			
		-9	12.0		**SANDSTONE**: medium to coarse grained, pale grey and grey, distinctly cross bedded at 15°-20°						PT, 20°, PL, RO, CN
		-10	13.0					a=1.72 d=1.76	100%		PT, 20°, PL, RO, CN
											PT, 15°, PL, RO, CN
		-11	14.0					a=1.64 d=1.49			PT, 15°, PL, RO, Clay VN
		-12	15.0					a=1.87 d=1.42			PT, 10°, PL, RO, Clay VN
					SANDSTONE: medium to coarse grained, grey and pale grey, distinctly cross bedded at 25° with some fine siltstone gravel clasts				97%		PT, 10°, UN, SO, Coal CO PT, 5°, UN, SO, Coal CO
											PT, 30°, UN, SO, Coal CO

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

- 10/10/12, water level on date shown
- water inflow
- complete drilling fluid loss
- partial drilling fluid loss
- 25uL: water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

- core recovered (graphic symbols indicate material)
- no core recovered

core run & RQD

- barrel withdrawn

RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

roughness

SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

coating

CN	clean
SN	stain
VN	veneer
CO	coating

coffey geotechnics

Engineering Log - Cored Borehole

Borehole ID.	***BH204a***
sheet:	4 of 4
project no.	***GEOTLCOV24303AH***
client: ***Lend Lease Development Pty Ltd***	date started: ***07 Jun 2013***
principal:	date completed: ***07 Jun 2013***
project: ***SICEEP - International Convention Centre (ICC) Hotel***	logged by: ***RC***
location: ***Darling Harbour, Sydney***	checked by: ***DS***

position: E: 333,405.50; N: 6,250,490.90 (Datum Not Specified) surface elevation : 3.00m (Datum Not Specified) angle from horizontal: 90°

drill model: DP520 mounting: Track hole diameter : 100 mm

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
NMLC		13			**SANDSTONE**: medium to coarse grained, grey and pale grey, distinctly cross bedded at 25° with some fine siltstone gravel clasts *(continued)*	FR		a=2.20 d=1.60			PT, 30°, PL, RO, CN
					with siltstone clasts, 5mm to 50mm				97%		PT, 20°, UN, SO, CN, siltstone clast
		-14	17.0		**SANDSTONE**: coarse grained, pale grey, massive			a=1.80 d=1.83			
					with some laminations at 20°						
					SANDSTONE: fine to medium grained, grey, closely spaced distinct laminations at 10°			a=1.42 d=1.57			PT, 10°, PL, RO, CN PT, 15°, PL, RO, CN
		-15	18.0		**SANDSTONE**: medium grained, pale grey, distinctly cross bedded at 15° with some siltstone gravel clasts, 10mm to 40mm diameter						
								a=2.02 d=1.80	100%		
		-16	19.0								
								a=2.78 d=2.11			
		-17	20.0								PT, 15°, PL, RO, Clay VN
					Borehole BH204a terminated at 20.40 m						
		-18	21.0								
		-19	22.0								
		-20	23.0								

CDF_0_9_04AL.GLB Log COF BOREHOLE: CORED GEOTLCOV24303AH BH20X SERIES.GPJ <<DrawingFile>> 11/07/2013 15:10

method & support

DT	diatube
AS	auger screwing
AD	auger drilling
RR	roller/tricone
CB	claw or blade bit
W	washbore
NMLC	NMLC core (51.9 mm)
NQ	wireline core (47.6mm)
HQ	wireline core (63.5mm)
PQ	wireline core (85.0mm)
SPT	standard penetration test

water

10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery

core recovered (graphic symbols indicate material)
no core recovered

core run & RQD

barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*

RS	residual soil
XW	extremely weathered
HW	highly weathered
DW	distinctly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

*W replaced with A for alteration

strength

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

defect type

PT	parting
JT	joint
SZ	shear zone
SS	shear surface
CS	crushed seam
SM	seam
DB	drilling break

roughness

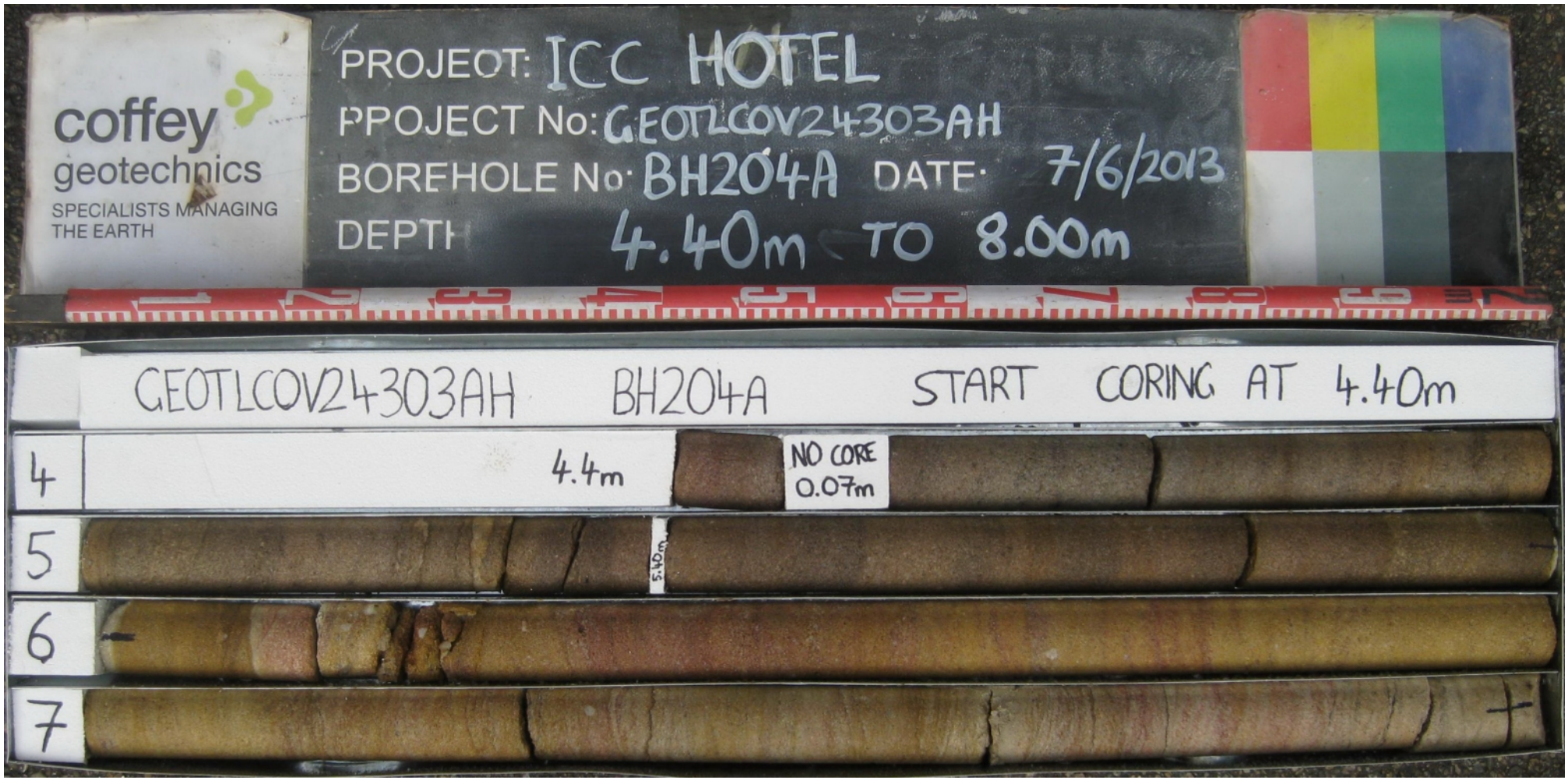
SL	slickensided
POL	polished
SO	smooth
RO	rough
VR	very rough

planarity

PL	planar
CU	curved
UN	undulating
ST	stepped
IR	Irregular

coating

CN	clean
SN	stain
VN	veneer
CO	coating



PointID : BH204a Depth Range: 4.40 - 8.00 m

drawn	RC
approved	
date	11/06/2013
scale	N.T.S.
original size	A4

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH204A

project no: GEOTLCOV24303AH | fig no: **FIGURE 11** | rev:

PointID : BH204a Depth Range: 8.00 - 13.00 m

drawn	RC
approved	
date	11/06/2013
scale	N.T.S.
original size	A4

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH204A

project no: GEOTLCOV24303AH | fig no: **FIGURE 12** | rev:

PointID : BH204a Depth Range: 13.00 - 18.00 m

drawn	RC
approved	
date	11/06/2013
scale	N.T.S.
original size	A4

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geotechnics
SPECIALISTS MANAGING
THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH204A

project no: GEOTLCOV24303AH | fig no: **FIGURE 13** | rev:

PointID : BH204a Depth Range: 18.00 - 20.40 m

drawn	RC
approved	
date	11/06/2013
scale	N.T.S.
original size	A4

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

client: Lend Lease Development Pty Ltd

project: SICEEP - International Convention Centre (ICC) Hotel
Darling Harbour, Sydney

title: **CORE PHOTOGRAPH**
BH204A

project no: GEOTLCOV24303AH | fig no: **FIGURE 14** | rev:

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 1

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 28-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.36m
Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						FILL: Clayey sand, brown with some sandstone floaters.	M	L		POORLY COMPACTED
	DS	N = 4 2, 2, 2	1							
					CL	SANDY CLAY: low plasticity, greyish brown.	MC > PL	F – St.		
			2			SANDSTONE: fine to medium grained, moderately weathered, strong, reddish brown.				"TC" BIT REFUSAL
						END OF BOREHOLE AT 2.25m				
			3							
			4							
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 2 1/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 27-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.40m
Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						BITUMINOUS CONCRETE				
			1			FILL: silty sand & sand, brown with sandstone floaters.	D	MD		MODERATELY WELL COMPACTED
	DS	N = 16 4, 7, 9								
▼			2				W	L		POORLY COMPACTED
	DS	N < 5 2/300mm, 3	3							
	DS	N = 10 4, 5, 5	4							
			5					MD		MODERATELY WELL COMPACTED
	DS	N = 16 7, 8, 8	6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 2 2/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 27 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2·40m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			7			FILL: Sand & sandstone floaters.	W			
			8							
			9							
			10			END OF AUGERING AT 10.0m INSTALLED CASING & COMMENCED WASHBORING				"TC" BIT REFUSAL
										FILL - SANDSTONE FLOATERS
			11							SILTY SAND, DARK GREY
			12			END OF WASHBORING AT 12.25m REFER TO CORED BOREHOLE LOG				SANDSTONE
			13							

JEFFERY AND KATAUSKAS PTY. LTD.

CORED BOREHOLE LOG

Borehole No. 2 3/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 27-11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2.40m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				11						
				12		START CORING AT 12.23m				
						SANDSTONE: fine to medium grained, brown.	MW	W / MS		VERTICAL JOINT
		13.36		13						
						as above, but becoming light grey.	F	S		
				14		SANDSTONE: fine to medium grained, light grey, with some thin dark grey bands.				20mm. SHALE SEAM
				15						BASALT COBBLE INTERSECTED BY CORE
				16		END OF BOREHOLE AT 16.36m				
				17						

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 3 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 28 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.76 m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						FILL: Clayey sand, brown, & sandstone floaters.	M	L		
	DS	N = 29 18, 18, 11	1							POORLY COMPACTED
W.L. AFTER 1 HR.			2							
	DS	N = 28 8, 21, 7	3				W			
			4							
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 3 2/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 28 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.76 m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			7			FILL: clayey sand & sandstone floaters.	W	L		POORLY COMPACTED
			8							
			9							
			10							
			11							
			12		SM	SILTY SAND: fine grained, dark grey.	W	L		
						SANDSTONE: fine to medium grained, moderately weathered strong, light grey.				"TC" BIT REFUSAL
			13			END OF BOREHOLE AT 12.7m				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 4 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 27 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.39 m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						FILL: Silty sand, dark grey, gravel & sandstone floaters.	M	L		POORLY COMPACTED
	DS	N = 9 17, 6, 3	1							
▼			2				W			
	DS	N = 4 5, 2, 2	3							
			4							
			5							
					SM	SILTY SAND: fine to medium grained, dark grey, with shell fragments.	W	L		
			6			SANDSTONE: fine to medium grained, moderately weathered, weak, light grey.				MODERATE - HARD "TC" RESISTANCE
						END OF AUGERING AT 6.35 m REFER TO CORED BOREHOLE LOG				VIRTUAL "TC" BIT REFUSAL

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 4 2/2

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 27-11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2.39m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				6		START CORING AT 6.13m				
						SANDSTONE: fine to medium grained, light grey.	MW	W MS		
				7						VERTICAL JOINT
	7.58						EW	VW		
				8			SW	MS		
	8.55									
				9						
				10		END OF BOREHOLE AT 10.14m				
				11						

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 5

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 28-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.53m
Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						FILL: fine crushed rock.	M			
						FILL: silty sand with gravel & sandstone floaters.				POORLY COMPACTED
	DS	N = 16 3, 9, 7	1							
W.L. AFTER 2 HRS			2							
			3							
			4			SANDSTONE: fine to medium grained, moderately weathered, medium strong to strong, yellowish brown.				
						END OF BOREHOLE AT 4.58 m.				"TC" BIT REFUSAL
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 6 1/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4099
Date: 26-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.77m
Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			0			FILL: Silty sand, brown, & gravel.	M	L		POORLY COMPACTED
	DS	N = 5 2, 1, 4	1			FILL: Sandy clay/clayey sand, brown, with sandstone floaters.				
			2							
▼	DS	N = 4 2, 3, 1	3				W			
	DS	N = 12 6, 4, 8	4							
			5							
			6		CL	SANDY CLAY: low plasticity, banded light grey, yellowish brown.	MC>PL	V. St.		

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 6 2/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4099
Date: -11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.77m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			7		CL	SANDY CLAY: low plasticity, banded light grey, yellowish brown, with some sandstone bands or floaters.	MC>PL	V.St.		
			8							
			9							
						END OF AUGERING AT 9.65m				"TC" BIT REFUSAL
			10			INSTALLED CASING & COMMENCED WASHBORING				SANDY CLAY & SANDSTONE FLOATERS
			11							SILTY SAND, DARK GREY
						END OF WASHBORING AT 11.5m				
			12			REFER TO CORED BOREHOLE LOG				

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 6 3/3

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 26-11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2.77m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				9						
				10						
				11						
						START CORING AT 11.54m				
				12		SANDSTONE: fine to medium grained, brown, with some fine to medium quartz gravel.	MW	MS to S		
	12.90			13		as above, but banded light grey & brown.				50mm. SANDY CLAY
				14						HIGHLY FRACTURED
						END OF BOREHOLE AT 14.47m				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 7

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 20-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 3.05 m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						CONCRETE: 220 m.m.t.				
			1			FILL: Sand, fine to medium grained, light brown.	M	VL		POORLY COMPACTED
W.L. AFTER 18 HRS	DS	N=2 1, 1, 1								
W.L. AFTER 1 HR.	DS		2			SANDSTONE: fine to medium grained, highly weathered, very weak, light grey.				"V" BIT REFUSAL; EASY - MODERATE "TC" BIT RESISTANCE
			3			as above, but moderately weathered, weak to medium strong.				MODERATE "TC" BIT RESISTANCE
						as above, but strong.				MODERATE - HARD "TC" BIT RESISTANCE
			4			END OF BOREHOLE AT 4.0m				
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 8

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 22-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.53
Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
▼	DS	N=6 2, 3, 3	1			FILL: Silty sand, brown with sandstone floaters & timber	D	L		POORLY COMPACTED
			2		CL	SANDY CLAY: low plasticity, yellowish brown.	MC>PL	F – St.		PROBABLY FILL
		4/0mm BOUNCING				as above, but dark grey, with a petrol odour.				
			3			SANDSTONE: fine to medium grained, slightly weathered, strong, banded yellowish brown & light grey.				HARD "TC" BIT RESISTANCE
						END OF BOREHOLE AT 2.95m				"TC" BIT REFUSAL
			4							
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 9 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 19 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 3.70m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						FILL: Clayey sand, dark brown.	M	L		POORLY COMPACTED
						SANDSTONE: fine to medium grained, highly weathered, weak, light grey.				"V" BIT REFUSAL
			1			END OF AUGERING AT 0.96m REFER TO CORED BOREHOLE LOG				
			2							
			3							
			4							
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 9 2/2

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: -11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 3.70m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
						START CORING AT 0.96m				
	AFTER 15 HRS			1		SANDSTONE: fine to medium grained, light grey.	MW	S		
	ON COMPL-ETION			2						IRON INDURATION ON JOINT
		2.45		3						20mm. SANDY CLAY
				4			HW	MS		
						END OF BOREHOLE AT 4.0m				
				5						
				6						

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 10 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4099
Date: 21 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.34m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			0			FILL: silty sand and fine gravel, dark grey with timber & sandstone pieces.	D	VL		POORLY COMPACTED
W.L. AFTER 15 HRS ▼		N < 2 2/300mm, 1	1							
▼			2			as above, but brown.	W	L		
W.L. WHILE B'HOLE AT 4.8m	DS	N = 7 4, 4, 3	3		SM	SILTY SAND: fine to medium grained, dark grey with abundant shell fragments and an organic odour.	W	VL		
		N < 1 1 BLOW FOR 800 mm.	4							
			5			SANDSTONE: fine to medium grained, highly weathered, weak, light grey.				
			6			END OF AUGERING AT 5.5m REFER TO CORED BOREHOLE LOG				

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 10 2/2

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 21-11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2.34m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				5		START CORING AT 5.5m				
						SANDSTONE: fine to medium grained, yellowish brown.	EW	EW		
						CORE LOSS				
				6		as above	EW	EW		
		6.27				CORE LOSS				
						as above	EW	EW		
				7		CORE LOSS				
				8		SANDSTONE: fine to medium grained, banded reddish brown, light grey & yellowish brown.	EW	EW		FRAGMENTED ZONE
		8.77				CORE LOSS				
				9		as above, but light grey.	EW	EW		
							SW	MS to S		20mm. VERY WEAK ZONE
				10						20mm SANDY CLAY ON JOINT
				11						10mm SANDY CLAY
						END OF BOREHOLE AT 11.77m				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 11

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER R.L. Surface: 3.85m
Date: 19-11-85 GEMCO 210B Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
DRY ON COMPLETION						FILL: Clayey sand, dark grey.	M	L		POORLY TO MODERATELY WELL COMPACTED
	DS	N = 20 5, 14, 6	1			FILL: Sandy clay, low plasticity, brown, with some sandstone pieces.	MC>PL	St.		
	DS		2			SANDSTONE: fine to medium grained, highly weathered, very weak to weak, light grey.				"V" BIT REFUSAL EASY "TC" BIT RESISTANCE
W.L. AFTER 18 HRS.			3			as above, but moderately weathered, weak to medium strong, banded yellowish brown & light grey.				EASY-MODERATE "TC" BIT RESISTANCE
	DS		4			as above, but becoming medium strong.				
W.L. AFTER 1½ HRS.	DS		5							MODERATE "TC" BIT RESISTANCE
			6			END OF BOREHOLE AT 5.5m				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 12 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER R.L. Surface: 2.47m
Date: 22-11-85 GEMCO 210B Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			0			FILL: Silty sand, gravel & sandstone floaters.	D	L		POORLY COMPACTED
	DS	N=31 4, 23, 8	1				M			
	DS	N=30 1, 22, 8	2							
			3		SM	SILTY SAND: fine to medium grained, dark grey with some shell fragments.	W	L		
	DS	N=11 4, 4, 7	4							
						SANDSTONE: fine to medium grained, moderately weathered, weak becoming strong, yellowish brown.				
			5			END OF AUGERING AT 4.5m REFER TO CORED BOREHOLE LOG				
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 12 2/2

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 22 -11- 85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2.47
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				4						
						START CORING AT 4.77m				
		4.92		5		SANDSTONE: fine to medium grained, yellowish brown.	HW SW	MS		
						as above, but mottled yellowish brown & reddish brown.				
							EW	EW		
				6		CORE LOSS				
		6.45				as above	HW	MS		
		6.52				CORE LOSS				
		6.90				as above	HW	W		HIGHLY FRACTURED
				7		CORE LOSS				
						SANDSTONE: fine to medium grained, light grey.	HW SW	VW S		
				8						FRAGMENTED ZONE 10 mm. SANDY CLAY ON JOINT
		8.47								
							EW SW	EW S		50 mm. SANDY CLAY 5 mm. SANDY CLAY FRAGMENTED ZONE
				9						5 mm. SANDY CLAY ON JOINT
				10		END OF BOREHOLE AT 9.98m				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 13 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER GEMCO 210B R.L. Surface: 2.40 m
Date: 20-11-85 Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			1			FILL: Silty sand, brown with sandstone floaters.	D	L		POORLY COMPACTED
							M			
▼ W.L. AFTER 20 HRS.	DS	N = 7 3, 4, 3				FILL: Sandstone floaters in a clayey sand matrix, brown.	W	VL		
▼ W.L. WHILE B'HOLE AT 7.45 m			2							
	DS	N = 3 2, 3/300mm.	3							
						FILL: Clayey sand, fine to medium grained, banded brown & dark grey.				
	DS	N = 3 <1, 2, 1	4							
			5			SANDSTONE: fine to medium grained, highly weathered, very weak, light grey with frequent bands of dark grey sandy clay.				EASY "TC" BIT RESISTANCE
	DS	N = 21 8, 10, 11	6			as above, but moderately weathered, medium strong, banded light grey & brown.				MODERATE "TC" BIT RESISTANCE
						as above, but highly weathered, weak, with very weak bands.				EASY-MODERATE "TC" BIT RESISTANCE

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 13 2/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER R.L. Surface: 2.40m
Date: 20-11-85 GEMCO 210B Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
	DS	N = 14 18, 12, 2	7			SANDSTONE: fine to medium grained, highly weathered, very weak with extremely weak bands, banded light grey & brown.				EASY "TC" BIT RESISTANCE
			8			as above, but weak.				EASY - MODERATE "TC" BIT RESISTANCE
			9			SANDSTONE: fine to medium grained, moderately weathered, weak to medium strong, banded reddish brown & grey.				MODERATE "TC" BIT RESISTANCE
			10			END OF BOREHOLE AT 10.0m.				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 14 1/2

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 19-11-85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 3.81m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						FILL: Sandy clay, dark grey.	M	L		"V" BIT REFUSAL
			1			SANDSTONE: fine to medium grained, moderately weathered, weak to medium strong yellowish brown.				MODERATE "TC" BIT RESISTANCE
						as above, but highly weathered, extremely to very weak, light grey.				EASY TO EASY-MODERATE "TC" BIT RESISTANCE
			2			END OF AUGERING AT 2.4 m REFER TO CORED BOREHOLE LOG				
			3							
			4							
			5							
			6							

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 14 2/2

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 19-11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 3.81m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				2						
	AFTER 21 HRS. ▼ ▼ AFTER 2 HRS.	3.5		3		START CORING AT 2.4m SANDSTONE: fine to medium grained, banded light grey & yellowish brown	MW	S		10 mm. IRON INDURATED SANDY CLAY 10 mm. SANDY CLAY.
				4						SANDY CLAY ON JOINT 10 mm IRON INDURATED & FRAGMENTED ZONE HIGHLY FRACTURED ZONE
		5.0		5			EW MW HW SW	EW S W S		HIGHLY FRACTURED HIGHLY FRACTURED ZONE
				6						HIGHLY FRACTURED
				7			HW			20 mm. SANDY CLAY. HIGHLY FRACTURED ZONE
						END OF BOREHOLE AT 7.01m				

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 15

BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER GEMCO 210B R.L. Surface: 2.48m
Date: 20-11-85 Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
▼		N=8 3, 4, 4	1			FILL: sand, bricks, timber sandstone cobbles.	D	L		POORLY COMPACTED
	DS	N=3 2, 2, 1	2			FILL: Sandy clay, low plasticity, brown, some gravel.	MC>PL	F		
			3			as above, but grey.				
		N<1 1/450mm	4		CL	SANDY CLAY: low plasticity, bonded dark grey & brown with some shell fragments.	MC>PL	S		
			5			SANDSTONE: fine to medium grained, highly weathered weak with some very weak bonds, reddish brown				BANDED EASY & EASY-MODERATE "TC" BIT RESISTANCE
			6			END OF BOREHOLE AT 5.4m.				"TC" BIT REFUSAL

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 16 1/3

BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER R.L. Surface: 2.43m
Date: 21-11-85 GEMCO 210B Datum: A.H.D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			1			FILL: Silty clay, brown, with sandstone floaters.	MC<PL	VL		POORLY COMPACTED
	DS	N = 25 23, 21, 4								
▼			2			FILL: Clayey sand, brown, with sandstone floaters.	M			
	DS	N = 2 1, 1, 1	3					L		
	DS	N = 10 2, 5, 5	4							
			5			FILL: Bands of fine to medium grained sand & sandy silt, dark grey with an organic odour. Some sandstone pieces.	W (MC>PL)	L & V.S.		
	DS	N < 4 3/300mm, 2	6							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 16 2/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089 Method: SPIRAL AUGER R.L. Surface: 2.43m
Date: 21 - 11 - 85 GEMCO 210B Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
	DS	N = 9 1, 2, 7	7			FILL: Bonds of sandy silt, dark grey & sand, fine to medium grained. Some sandstone pieces.		VS	< 10 < 10 10 10	
		N>>5 5/110 mm BOUNCING	8							
			9			END OF AUGERING AT 8.61m INSTALL CASING & COMMENCE WASHBORING				
						END OF WASHBORING AT 9.06m REFER TO CORED BOREHOLE LOG				
			10							

JEFFERY AND KATAUSKAS PTY. LTD.

Borehole No. 16 1/3

CORED BOREHOLE LOG

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 21-11-85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2·43m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				8						
				9		START CORING AT 9.06m				
						SANDSTONE: fine to medium grained, banded light grey & yellowish brown.	MW	MS		SANDY CLAY ON JOINTS
				10		as above, but reddish brown.	HW	EW		
								S		10mm. FRAGMENTED ZONE
		10.8				CORE LOSS		EW		
				11		as above, but light grey with some sandy clay bands	EW	EW		HIGHLY FRACTURED SANDSTONE BANDED WITH SANDY CLAY
						SANDSTONE: fine to medium grained, light grey.	Fr.	S		
				12						
				13						
				14		END OF BOREHOLE AT 13.75m.				

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 17

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 19 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 4.07m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			1			FILL: Sandy clay/ Clayey sand, mottled dark grey & brown, with some gravel & bricks.	M (MC>PL)	L		POORLY COMPACTED
	DS	N = 7 6, 5, 2								
			2				W			
▼ W.L. AFTER 20 HRS	DS	N = 6 2, 4, 2	3		SC	CLAYEY SAND: fine to medium grained, banded dark grey & brown.	W	L – MD		
	DS	N>>15 15/150 mm BOUNCING	4			SANDSTONE: fine to medium grained, highly weathered, very weak to weak, light grey.				"V" BIT REFUSAL
▼ W.L. ON COMPLETION			5							EASY - MODERATE "TC" BIT RESISTANCE
			6							

END OF BOREHOLE AT 7.0m

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 18 1/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 26 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.50m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			0			FILL: Silty sand, brown, gravel & occasional sandstone floaters.	M	L		POORLY COMPACTED
	DS	N = 6 1, 3, 3	1							
▼						FILL: Clayey sand, brown, with some gravel.	W			POORLY TO MODERATELY WELL COMPACTED
	DS	N = 8 1, 3, 5	2							
			3							
	DS	1 BLOW FOR 450mm.	4		CL	SILTY SANDY CLAY: medium plasticity, dark grey with bands of clayey sand, plant fibres, shell fragments & an organic odour.	MC > PL	F		
			5							
	DS	N = 2 1, 1, 1	6						60 60 75 60	

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 18 2/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No. 4089
Date: 26 - 11 - 85
Method: SPIRAL AUGER GEMCO 210B
R.L. Surface: 2.50m
Datum: A. H. D.

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
	DS	N = 20 16, 17, 3	7			SANDSTONE: fine to medium grained, highly weathered, medium strong, yellowish brown with some bands of sandy clay.				VIRTUAL "TC" BIT REFUSAL
			8			END OF AUGERING AT 7.65 REFER TO CORED BOREHOLE LOG				
			9							

JEFFERY AND KATAUSKAS PTY. LTD.

CORED BOREHOLE LOG

Borehole No. 18 3/3

Client: WARGON CHAPMAN PARTNERS PTY. LTD.
Project: PROPOSED DEVELOPMENT
Location: DARLING HARBOUR, SYDNEY.

Job No: 4089
Date Drilled: 26 - 11 - 85
Drill Type: GEMCO 210B

Core Size: N.M.L.C.
Inclination: VERTICAL
Bearing: N/A

R.L. Surface 2.50m
Datum: A.H.D.

Water Loss	Water Record	Barrel Lift	Core Loss	Depth (m)	Graphic Log	CORE DESCRIPTION	Weathering	Strength	DEFECT DETAILS: DEFECT SPACING (m) .5 .3 .1 .05 .03 .01	DEFECT DETAILS: Description
				7		START CORING AT 7.65m				
	7.91					SANDSTONE: fine to med grained, yellow brown	EW	EW		
						CORE LOSS	EW	EW		
				8		SANDSTONE: fine to medium grained, mottled light grey & yellowish brown.	HW	MS		— 30 mm HIGHLY FRACTURED ZONE
	8.67							VW		— FRACTURED
						CORE LOSS				
				9		as above, but banded yellowish brown & reddish brown.	MW	MS		— HIGHLY FRACTURED
	9.59									
				10						
						as above, but light grey.	SW	S		— DARK GREY CLA ON JOINT
	11.15			11						— DARK GREY CLAY ON JOINT
								MS		
				12						— 5mm. SANDY CLAY ON JOINT
							EW	EW		— FRAGMENTED ZONE WITH THIN LENSES OF CARBONACEOUS MATERIAL.
						as above, with some med. quartz gravel		S		— BASALT COBBLE AT 12.5m
						END OF BOREHOLE AT 12.76 m.				
				13						

Appendix E

Laboratory Test Results

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 262404

Client Details

Client	Douglas Partners Pty Ltd
Attention	Rhys McMillan
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**200004.00, Harbourside Redevelopment**
Number of Samples	6 Soil
Date samples received	22/02/2021
Date completed instructions received	22/02/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	01/03/2021
Date of Issue	25/02/2021

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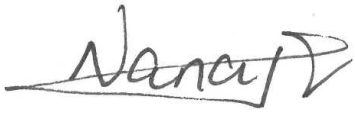
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity						
Our Reference		262404-1	262404-2	262404-3	262404-4	262404-5
Your Reference	UNITS	BH1: 4.0m	BH2: 4.0m	BH4: 2.0m	BH5: 3.0m	BH6: 1.0m
Date Sampled		20/01/2021	19/01/2021	08/02/2021	27/01/2021	02/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	8.6	9.1	8.5	9.6	8.8
Electrical Conductivity 1:5 soil:water	µS/cm	310	1,700	560	670	150
Chloride, Cl 1:5 soil:water	mg/kg	79	2,200	610	680	24
Sulphate, SO4 1:5 soil:water	mg/kg	460	400	210	180	120

Soil Aggressivity		
Our Reference		262404-6
Your Reference	UNITS	BH7 11.5m
Date Sampled		14/01/2021
Type of sample		Soil
pH 1:5 soil:water	pH Units	8.6
Electrical Conductivity 1:5 soil:water	µS/cm	1,800
Chloride, Cl 1:5 soil:water	mg/kg	2,400
Sulphate, SO4 1:5 soil:water	mg/kg	260

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

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	102	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	102	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

All samples were received outside of the recommended Technical Holding Time (THT) for pH and EC, however, the analysis has proceeded as requested.

Samples 1, 2 & 6 were received outside of the recommended Technical Holding Time (THT) for SO4 and Cl, however, the analysis has proceeded as requested.