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Report on
Geotechnical Investigation

Proposed Sydney Swans HQ & Community Centre
Royal Hall of Industries, 1 Driver Avenue, Moore Park

Prepared for
Sydney Swans Limited
c/- APP Corporation Pty Ltd

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

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Executive Summary

This report presents the results of a geotechnical investigation undertaken for the proposed Sydney Swans Headquarters and Community Centre at the Royal Hall of Industries (RHI), 1 Driver Avenue, Moore Park. The investigation was commissioned in a letter dated 25 February 2019 by Anthony Murphy of APP Corporation Pty Ltd (APP) on behalf of Sydney Swans Limited and was undertaken in accordance with Douglas Partners Pty Ltd (DP's) proposal SY190086.P.001.Rev2 dated 21 February 2019.

It is understood that the proposed development at the site will include fitout and redevelopment of the existing RHI building and construction of a new two-storey sporting facility to the south of the existing RHI including an in-ground swimming pool and spas. The aim of the geotechnical investigation was to inform the preparation of the Environmental Impact Statement (EIS) for the site and for design purposes.

The investigation included a review of previous investigations carried out on the site, the drilling of sixteen boreholes, the installation of three groundwater monitoring wells, laboratory testing and engineering analysis.

The intrusive investigation indicated that the site is underlain by filling (including building rubble, coal and charcoal) to variable depths overlying some natural sands and clayey sands with an approximately 0.8 m to 1.1 m thick layer of extremely low to low strength sandstone overlying low, medium and high strength sandstone from depths of 2.2 m to 6.6 m. The sandstone bedrock progressively increases in strength with depth.

Water levels measured in monitoring wells ranged between depths of 2.6 m and 6.0 m below ground surface and were below the top of sandstone bedrock. This is likely to be seepage water running above and through the rock rather than the regional groundwater table. The regional groundwater table is likely to be well below the bedrock surface.

The report includes comments on excavation conditions, earthworks, retaining structures, foundations and the impact of the development on groundwater. The following preliminary comments are provided on geotechnical aspects:

- Bulk excavation for the pool and modification of the building will generally encounter filling, natural soils and possibly bedrock. Excavation within the filling, natural soils and extremely low to low strength bedrock should be readily achieved by conventional earthmoving equipment. If excavation in low strength and stronger sandstone is required then heavy ripping equipment, rock hammers and/or rock saws will be needed for effective removal.
- It is anticipated that the excavation within fill and soils will result in relatively minor vibrations. Excavation of rock with rock hammers will result in vibration of the surrounding ground and it would be important to manage vibrations on the adjacent buildings/structures, especially the sensitive/heritage items in close proximity.
- It is generally expected that the excavation in soils and weathered rock will need to be supported by a retaining structure both during construction and as part of the final structure. Parameters for the design of the retaining walls have been provided.
- Vertical cuts in the medium strength or stronger sandstone should be able to stand vertically

without retaining support unless unfavourable jointing is exposed. Such excavation should therefore be carried out under close geotechnical supervision to ensure that any stability measures required can be actioned accordingly.

- The groundwater levels measured during the current field work vary between RL 31.3 m and RL 34.7 m AHD. It is likely that the groundwater intercepted in the wells is water seepage along the top of the rock and through joints and partings within the rock mass. The regional groundwater table may be deeper. Further monitoring of water levels within wells should be carried out to assess fluctuations if this is important for design and construction.
- The comments on groundwater include reference to the NSW Department for Planning and Environment who have issued a Secretary's Environmental Assessment of Requirements (SEARs) for the preparation of an Environmental Impact Statement (Application Number SSD8800 dated 6 November 2017). Groundwater levels have been recorded below the proposed basement levels. Based on current groundwater recordings and previous measurements the development is not expected to interfere with the aquifer or require licensing in accordance with the definitions of aquifer interference or licensing as defined by the NSW DPI Aquifer Interference Policy 2012.
- Foundations that could be considered include shallow or piled footings. Parameters for the design of foundations have been provided.
- Advice on earthworks for subgrade preparation below pavements and ground slabs has been provided in the report.

DP has also undertaken a contamination assessment for the site, which is reported separately (refer to Report 86724.00.R.001).

Report on Geotechnical Investigation
Proposed Sydney Swans HQ & Community Centre
Royal Hall of Industries, 1 Driver Avenue, Moore Park

1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed Sydney Swans Headquarters and Community Centre at the Royal Hall of Industries (RHI), 1 Driver Avenue, Moore Park. The investigation was commissioned in a letter dated 25 February 2019 by Anthony Murphy of APP Corporation Pty Ltd (APP) on behalf of Sydney Swans Limited and was undertaken in accordance with Douglas Partners Pty Ltd (DP's) proposal dated 21 February 2019. DP has also undertaken a contamination assessment for the site, which is reported separately (refer to Report 86724.00.R.001).

It is understood that the proposed development at the site will include fitout and redevelopment of the existing RHI building and construction of a new two-storey sporting facility to the south of the existing RHI including an in-ground swimming pool and spas. The aim of the geotechnical investigation was to inform the preparation of the Environmental Impact Statement (EIS) for the site and for design purposes.

The investigation included review of published information and previous projects at the site, a site walkover by a geotechnical engineer, the drilling of 16 boreholes and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations about the geotechnical components relevant to the proposed development.

2. Previous Investigations

Previous investigations carried out at the RHI by DP include:

- Geotechnical investigation for proposed modifications and refurbishment at the Hordern Pavilion and RHI (DP Project 24967, dated 22 April 1998). Field work included cone penetration testing (CPT) and dynamic cone penetrometer testing (DCP) inside and outside the Hordern Pavilion and RHI. Within the RHI, CPT6 and CPT6A were undertaken to depths of 2.0 m and 3.7 m, respectively.
- Geotechnical investigation at the RHI for structural alterations and modifications to the building (DP Project 24967-1, dated 21 July 1998). Four boreholes (Bores 1 to 4) were drilled using a truck-mounted drilling rig to depths of 4.3 m to 8.7 m. Boreholes were drilled using solid flight augers down to the top of bedrock and then NMLC rotary core drilling techniques were used to extend the boreholes into bedrock.
- Geotechnical investigation undertaken in areas of proposed new external pavements surrounding the Hordern Pavilion and RHI (DP Project 24967-2, dated 29 July 1998). Four boreholes (Bores 6 to 9) were drilled within the RHI site using a truck-mounted drilling rig to depths of 0.8 m to

1.8 m. Boreholes were drilled using solid flight augers to refusal on bedrock. Standard penetration tests (SPTs) were generally undertaken at depths of 0.5 m and 1.5 m within the boreholes.

APP provided the following reports for the site, which were prepared by other consultants:

- Hazardous Building Materials Survey undertaken by DLA Environmental Services Pty Ltd (DLA) Project DL4062. The survey included visual inspection of construction materials and sampling of suspected potential hazardous materials located in accessible areas of the Hordern Pavilion and RHI. Intrusive investigation was not undertaken as part of the survey.
- Environmental Due Diligence Report undertaken by ERM Services Australia Pty Ltd (ERM) Project 0478061. The investigation included the drilling of eight boreholes (TP1 to TP8) within the RHI site using solid flight augers to depths of 1.6 m to 6.0 m. The logs show that boreholes were terminated in sandstone.

The test locations for previous investigations have been estimated from the test location plans available in the previous reports and are shown on Drawing 1 in Appendix B. The relevant borehole logs and CPT results from the previous investigations have been included in Appendix D for reference. Generally, the previous investigations encountered concrete/pavement at ground surface overlying granular fill to varying depths. Sand, sandy clay and sandstone was typically found beneath the fill. The sandstone was generally of extremely low strength initially, and grading to medium strength with depth.

The 1998 DP investigations noted that groundwater was not observed in the boreholes or CPT holes, except for Bore 3, which noted groundwater below 3.5 m. Groundwater observations were not noted on the ERM borehole logs.

3. Site Description

The site is a trapezoidal shape with maximum plan dimensions of 140 m by 80 m with an area of approximately 1.0 ha. It is bounded by Driver Avenue, Lang Road and Errol Flynn Boulevard to the west, south and east, respectively. An asphalt walkway and the Hordern Pavilion are located to the north of the site.

The RHI building occupies a rectangular shaped area, some 85 m by 60 m in plan dimensions and comprises a single storey structure with mezzanine level and a concrete ground slab. A smaller single storey shed structure is located at the south-east corner of the site and the remainder of the site is covered by concrete or asphalt pavement.

The topography is flat to gently undulating and the site is currently used for miscellaneous activities within the RHI building, such as exhibitions and markets. The ground surface typically ranges between about Reduced Level (RL) 37.1 m and RL 37.7 m relative to Australian Height Datum (AHD). The site is elevated above street level to the west and south with maximum ground level difference of about 2 m in the south-west corner.

4. Site Geology and Mapping

Reference to the Sydney 1:100 000 Geological Series indicates that the site is underlain by transgressive dune deposits of fine to medium grained sands of marine origin deposited during the Quaternary Period. Bedrock in the area is mapped as Hawkesbury Sandstone of the Triassic Age. The previous investigations carried out were generally consistent with the mapped geology.

Reference to the 1:25 000 Acid Sulphate Soils (ASS) Risk map indicates that the site is located within an area with no known occurrence of ASS.

5. Field Work Methods

Field work carried out for the current investigation included the following:

- Drilling of 16 boreholes (BH101 to 116) using a track-mounted drilling rig to depths of 0.9 m to 10.1 m. Drilling was undertaken using 110 mm diameter solid flight augers to bedrock with soil samples collected at regular depth intervals. Three boreholes (BH101, BH108 and BH109) were extended into bedrock using NMLC rotary core drilling techniques;
- Installation, development and measurement of three groundwater monitoring wells (in BH101, BH108 and BH109);
- Laboratory testing of selected samples; and
- Supervision of the drilling and logging of the boreholes by an experienced engineer.

The locations and coordinates of the boreholes were estimated from existing site features. Coordinates are in GDA94/MGA Zone 56 format (Geocentric Datum of Australia 1994 base with Map Grid of Australia projection). Surface levels at the borehole locations were interpolated from the survey drawing by Veris Australia Pty Ltd, Ref: 201062A, dated 12/12/18, which was provided to DP by APP. The test locations are shown on Drawing 1 in Appendix B.

6. Field Work Results

The subsurface conditions encountered at each borehole location within the current investigation are described in the borehole logs included in Appendix C. Notes defining classification methods and terms used to describe the soils and rock are included in Appendix A.

The current investigation indicates that the sub-surface profile includes:

Concrete / Asphaltic Concrete	Concrete and asphaltic concrete at ground surface to depths of 0.02 - 0.4 m in all boreholes.
Fill	Fill to depths of 0.5 - 5.2 m at all borehole locations. The fill generally included varying proportions of sand and gravel. The gravel was typically crushed sandstone or igneous gravel. Some of the fill also had components of clay, silt, concrete, steel, plastic, ceramic tile fragments, glass, ash, coke, charcoal and coal.

Natural Sand / Clayey Sand — Natural sand and clayey sand at depths of between 1.1 - 4.5 m in boreholes 103, 108 and 109 only. Typically pale yellow and yellow-brown mottled grey and fine to coarse grained.

Sandstone — Sandstone from depths of 0.5 - 5.2 m to borehole termination at all locations. Strength typically increased with depth from extremely low strength to medium and high strength. Some medium and high strength ironstone bands were present within the upper extremely low strength layers.

The depths and levels at which different materials were encountered in the boreholes are summarised in Table 1A and 1B.

Table 1A: Summary of Inferred Material Strata Depths and Levels

Stratum	Depth (m) [RL (m, AHD)] of Top of Stratum							
	BH101	BH102	BH103	BH104	BH105	BH106	BH107	BH108
Ground Surface	[37.6]	[37.6]	[37.6]	[37.6]	[37.7]	[37.6]	[37.7]	[37.3]
Fill	0.15 [37.5]	0.15 [37.5]	0.15 [37.5]	0.15 [37.5]	0.4 [37.3]	0.15 [37.5]	0.15 [37.6]	0.18 [37.1]
Sand/Clayey Sand	NE	NE	3.5 [34.1]	NE	NE	NE	NE	1.1 [36.2]
Sandstone: EL-VL	5.2 [32.4]	4.5 [33.1]	4.5 [33.1]	3.6 [34.0]	NE	NE	0.6 [37.1]	1.5 [35.8]
Sandstone: VL-L	NE	NE	NE	NE	0.6 [37.1]	2.2 [35.4]	1.5 [36.2]	2.1 [35.2]
Sandstone: L-M	NE	5.4 [32.2]	NE	4.4 [33.2]	NE	NE	2.2 [35.5]	2.8 [34.5]
Sandstone: M-H	6.6 [31.0]	NE	NE	NE	NE	NE	NE	4.7 [32.6]
Base of Borehole	10 [27.6]	6.0 [31.6]	5.0 [32.6]	5.0 [32.6]	1.4 [36.3]	2.5 [35.1]	3.2 [34.5]	10.1 [27.2]

Notes: NE = not encountered; EL = extremely low strength; VL = very low strength; L = low strength; M = medium strength; H = high strength

Table 1B: Summary of Inferred Material Strata Depths and Levels

Stratum	Depth (m) [RL (m, AHD)] of Top of Stratum							
	BH109	BH110	BH111	BH112	BH113	BH114	BH115	BH116
Ground Surface	[37.3]	[37.3]	[37.4]	[37.4]	[37.5]	[37.2]	[37.4]	[37.4]
Fill	0.18 [37.1]	0.05 [37.3]	0.02 [37.4]	0.02 [37.4]	0.02 [37.5]	0.02 [37.2]	0.18 [37.2]	0.18 [37.2]
Sand/Clayey Sand	3.0 [34.3]	NE	NE	NE	NE	NE	NE	NE
Sandstone: EL-VL	NE	NE	NE	NE	NE	0.7 [36.5]	1.5 [35.9]	NE
Sandstone: VL-L	3.6 [33.7]	0.5 [36.8]	0.5 [36.9]	0.5 [36.9]	0.5 [37.0]	1.0 [36.2]	1.9 [35.5]	2.8 [34.6]
Sandstone: L-M	4.3 [33.0]	NE	NE	NE	NE	NE	NE	NE
Sandstone: M-H	5.6 [31.7]	NE	NE	NE	NE	NE	NE	NE
Base of Borehole	10.0 [27.3]	1.1 [36.2]	1.1 [36.3]	1.0 [36.4]	0.9 [36.6]	1.5 [35.7]	2.1 [35.3]	3.0 [34.4]

Notes: NE = not encountered; EL = extremely low strength; VL = very low strength; L = low strength; M = medium strength; H = high strength

Free groundwater was not encountered in any of the boreholes during auger-drilling to depths of 0.9 to 5.6 m. Use of drilling fluid during core-drilling prevented further groundwater observations with depth at BH101, 108 and 109. Groundwater measurements were obtained from the groundwater monitoring wells on 11 March 2019 (wells were developed on 8 March 2019 prior to these measurements). The results of the groundwater measurements from the wells are provided in Table 2. It is noted that water levels will vary over time.

Table 2: Groundwater Depth and Level Observations

Date	BH101	BH108	BH109
	Depth (m) [RL (m, AHD)]	Depth (m) [RL (m, AHD)]	Depth (m) [RL (m, AHD)]
11 March 2019	6.0 [31.6]	2.6 [34.7]	6.0 [31.3]

7. Laboratory Testing

7.1 Rock

A total of 19 samples were tested for axial point load strength index (Is_{50}). The results ranged between 0.08 MPa and 1.9 MPa, which correspond to very low strength and high strength sandstone, respectively. The results are shown on the borehole logs in Appendix C.

7.2 Soil

Four selected soil samples were tested in a NATA-accredited laboratory to determine electrical conductivity (EC), pH, chloride and sulphate ion concentrations to assess the aggressivity of the site soils to buried concrete and steel. The laboratory results are included in Appendix E, and the results are summarised in Table 3.

Table 3: Chemical Analysis Test Results for Soil Samples

Borehole	Depth (m)	Description	pH*	EC (µS/cm)*	Chloride (mg/kg)*	Sulphate (mg/kg)*
BH102	4.9-5.0	Sandstone	5.0	78	<10	27
BH106	0.9-1.0	Fill	7.4	260	20	190
BH107	1.9-2.0	Sandstone	6.0	50	<10	36
BH115	1.9-2.0	Sandstone	7.6	15	<10	<10

Notes: *Sample mixed 1(soil):5(water) prior to testing

8. Proposed Development

The proposed development at the site will include fitout and redevelopment of the existing RHI building and construction of a new two-storey sporting facility to the south of the existing RHI building including an in-ground swimming pool and spas.

No additional basements are proposed, however excavation up to depths of about 3 m below ground level will be required for the proposed swimming pool and spas, modification of the existing basement toilets, lift pits and new services. The proposed swimming pool, in the south-west corner of the site, is to be constructed within an existing fill platform that is up to 2 m high. The maximum depth of the pool excavation will be up to 1 m below the adjacent road levels (estimated bulk excavation level RL 34.3 m AHD).

It is understood that expected column working loads are in the order of 950 kN.

9. Comments

9.1 Geotechnical Model

The site appears to be underlain by variable depths of fill overlying sandy soils and/or sandstone bedrock. The bedrock encountered in the boreholes was generally weathered and of variable strength initially, becoming medium and high strength and slightly weathered with depth.

Suspected potential or actual acid sulphate soils were not encountered during the investigation and it is considered unlikely that the proposed development would disturb any potential or actual acid sulphate soils.

Free groundwater was not encountered during augering in the boreholes. Water levels measured in monitoring wells ranged between depths of 2.6 m and 6.0 m below ground surface and were below the top of sandstone bedrock. This is likely to be seepage water running above and through the rock rather than the regional groundwater table. The regional groundwater table is likely to be well below the bedrock surface.

This geotechnical model is illustrated in Cross-sections A, B and C in Drawings 2 to 4 in Appendix B.

9.2 Dilapidation Surveys

Prior to the commencement of excavation work on the site, it is recommended that dilapidation (existing building condition) surveys be undertaken on the RHI building and nearby structures, as well as footpaths and roads adjacent to the site boundaries. The condition of the heritage items on and surrounding the site should also be documented. The purpose of the dilapidation survey is to document any existing defects so that any potential claims for damage due to construction related activities can be accurately assessed.

9.3 Excavation

The extent of excavation will depend on the final design levels for the development. It is expected that excavation for the proposed swimming pool and spas, modification of the existing basement toilets, lift pits and new services will be required in fill, sandy soils and possibly bedrock. Excavation in the fill, soil and weathered rock should be readily achievable using conventional earthmoving equipment such as hydraulic excavators with bucket attachments. The presence of buried concrete, steel and other building rubble within the fill and medium and high strength ironstone bands within weathered rock could require the use of hydraulic hammers/saws. Excavation should be carried out with due consideration to adjacent buildings, structures/retaining walls/footings and heritage items.

If excavation in low strength and stronger sandstone is required then heavy ripping equipment, rock hammers and/or rock saws will be needed for effective removal. The sandstone encountered may include rock with an unconfined compressive strength (UCS) in excess of 40 MPa. Earthworks contractors should form their own opinion on productivity based on the borehole logs and core photographs.

9.4 Ground Vibrations

It is anticipated that the excavation within fill and soils will result in relatively insignificant vibrations. Excavation of rock with rock hammers will result in vibration of the surrounding ground and it would be important to manage vibrations on the adjacent buildings/structures, especially the sensitive/heritage items in close proximity.

During excavation it will be necessary to use appropriate methods and equipment to keep ground vibration within acceptable limits. The standards listed below are considered appropriate documents on which to base the management of ground vibration:

- German Standard DIN 4150-3 – 1999, "Structural Vibration – Part 3: Effects of Vibration on Structures"; and
- Australian Standard AS 2670.2 – 1990, "Evaluation of human exposure to whole-body vibrations – Part 2: Continuous and shock-induced vibrations in buildings (1 to 80 Hz)".

Ground vibrations can be strongly perceptible to humans at levels above 3 mm/s component peak particle velocity (PPV). AS 2670.2 – 1990 indicates an acceptable day time limit of 8 mm/s component PPV for human comfort (for daytime occupants of buildings).

The sensitivity and condition of heritage items on and surrounding the site will necessitate a lower vibration limit for excavation than the daytime limit for human comfort. Based on previous experience with rock excavations adjacent to sensitive structures in Sydney and reference to DIN 4150 – 1999, it is suggested that a maximum vector sum peak particle velocity (VSPPV) of 5 mm/s be adopted to reduce the risk of structural damage to surrounding sensitive buildings/structures. This vibration limit is applicable at the foundation level of existing buildings and may need to be modified following review of dilapidation surveys, vibration trials and/or proposed excavation plant.

As the rate of vibration attenuation is site specific, it is recommended that a vibration trial be undertaken at the commencement of rock excavation with each major plant item, for confirmation of suitability of plant and determination of the theoretical distance of closest approach to the adjacent receptors in order to reduce vibration exceedances with respect to the allowed limit.

9.5 Excavation Support

9.5.1 General

Vertical excavations in fill, soil and weathered rock (low strength or weaker sandstone) are not expected to be stable. Recommended maximum temporary batter slopes for different materials up to 3 m deep are shown in Table 4. Vertical cuts in the medium strength or stronger sandstone should be able to stand vertically without retaining support unless unfavourable jointing is exposed. Such excavation should therefore be carried out under close geotechnical supervision to ensure that any stability measures required can be actioned accordingly. Further advice should be sought when planning deep excavations.

Table 4: Suggested Temporary Batter Slopes for Excavations up to 3 m Deep

Material	Temporary (During Construction) Batter Slopes (Horizontal:Vertical)
Fill and Natural Soils	1.5:1
Extremely to Very Low Strength Sandstone	1:1
Very Low to Low Strength Sandstone	0.5:1
Medium and High Strength Sandstone	Vertical*

Note: *Subject to geotechnical inspection at 1.5 m depth intervals to check for adversely inclined joints.

Surcharge loads should be placed no closer to the crest of the batter than a distance equal to the vertical height of the batter, unless specific stability analysis shows that the loads can be placed closer.

Shoring walls may be required if there is insufficient room for temporary batters. At the proposed lift pit down to the existing basement, a contiguous pile wall should be suitable to support the granular fill, sandy soils and weathered rock down to the top of medium strength or stronger sandstone. Permanent retaining walls may also be required around the site, including at the proposed swimming pool. Both shoring and retaining walls could be designed using the parameters provided in Table 5.

Table 5: Material and Strength Parameters for Shoring/Retaining Walls

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of At-Rest Earth Pressure (K_0)	Ultimate Passive Earth Pressure (kPa)[1]
Fill and Natural Soils	20	0.40	0.6	-
EL to VL Sandstone	22	0.30	0.45	250
VL to L Sandstone	22	0.15[2]	0.3[2]	400[2]
M and H Sandstone	24	0[2]	0[2]	6000[2]

Notes: [1]Minimum of 0.5 m embedment should be provided; [2]Provided that adverse jointing is not encountered;
EL = extremely low strength; VL = very low strength; L = low strength; M = medium strength; H = high strength

A triangular active earth pressure distribution could be assumed for cantilevered walls or walls with a single row of support. A trapezoidal active earth pressure distribution could be assumed for multi-anchored walls, with the maximum pressure acting over the middle 60% of the wall. A rectangular pressure distribution could be assumed for the ultimate passive earth pressures given in Table 5, noting that these are ultimate pressures and an appropriate factor of safety should be applied to limit the wall movements required to mobilise the full passive pressure. A suggested factor of safety for the ultimate passive earth pressures is 2. Lateral pressures due to surcharge loads from adjacent buildings, sloping ground surfaces, pavements and construction machinery should be included where

relevant. Hydrostatic pressure acting on retaining walls should also be included in the design where adequate drainage is not provided behind the full height of the walls.

9.5.2 Ground Anchors

Where necessary, the use of inclined tie-back (ground) anchors is suggested for the lateral restraint of perimeter pile walls. Such ground anchors should be inclined below the horizontal to allow anchorage into the stronger bedrock 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 interface given in Table 6.

Table 6: Allowable Bond Stresses for Anchor Design

Material Description	Allowable Bond Stress (kPa)
Extremely Low to Low Strength Sandstone	100
Medium and High Strength Sandstone	300

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 80% of the working load. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes.

The parameters given in Table 6 assume that the anchor holes are clean and adequately flushed, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing.

In normal circumstances the building will restrain the basement/lift pit excavations over the long 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 at 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, pipes and subsurface structures during anchor installation.

9.6 Groundwater and Seepage

The groundwater levels measured during the current field work vary between RL 31.3 m and RL 34.7 m AHD. It is likely that the groundwater intercepted in the wells is water seepage along the top of the rock and through joints and partings within the rock mass. The regional groundwater table may be deeper. Further monitoring of water levels within wells should be carried out to assess fluctuations if this is important for design and construction.

Drainage measures will need to be provided in any subsurface structures/retaining walls to allow seepage water to flow around the structures rather than exert hydrostatic pressures against them, unless they are designed as tanked structures suitable to resist hydrostatic pressures.

9.7 Foundations

Based on the existing subsurface conditions, DP has provided a site classification assessment in accordance with AS 2870 “Residential Slabs and Footings” (2011). Currently, the site is underlain by uncontrolled fill of various materials to depths greater than 0.4 m, which results in Class P for the site. For Class P sites, footing design should be based on “engineering principles”.

It is understood that all new structures will be founded on new foundations, rather than adding load to existing footings. It is ‘good engineering practice’ to support all structures, particularly heavily loaded structures, on material with uniform properties to reduce the potential for differential settlement. Shallow footings and piles founded on sandstone bedrock are recommended.

It is likely that shallow footings will be appropriate at areas on site where sandstone is present at shallow depths, and piles will be required in areas where rock is deeper. Given the presence of granular fill and sandy soils, CFA piles or cased bored piles should be appropriate piling methods. Conventional bored piles will be unsuitable as the uncased excavation will be prone to collapse. It is noted that obstructions within the fill, medium and high strength ironstone bands within weathered sandstone, and medium and high strength sandstone bedrock would require the use of a high-torque piling rig with an experienced operator.

Recommended maximum pressures and elastic modulus values for the design of footings and piles in various sandstone strengths are presented in Table 7. For piles, shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the values for compression.

Table 7: Design Parameters for New Footings and Bored Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion[1] (kPa)	Ultimate End-Bearing Pressure (kPa)	Ultimate Shaft Adhesion[1] (kPa)	Young’s Modulus (MPa)
EL to VL Sandstone	700	50	3,000	100	50
VL to L Sandstone	1,000	100	4,000	250	100
L to M or stronger Sandstone	3,500	350	15,000	800	500

Notes: [1]Only for piles below 1 m depth and where adequate socket roughness has been achieved;
EL = extremely low strength; VL = very low strength; L = low strength; M = medium strength; H = high strength

Higher bearing pressures could be justified, if required, and subject to further investigation.

9.8 Subgrade Preparation

Existing fill that is required to support additional loads on slabs and pavements would need to be reworked to reduce the potential for unacceptable settlements associated with poorly or variably compacted fill. New fill will also need to be placed in accordance with an engineering specification.

Typical subgrade preparation measures could include:

- Remove fill to at least 0.6 m below the design subgrade level, or to the top of natural sand/sandstone, whichever is shallower.
- Compact the exposed surface and proof-roll using a roller of 10 tonne deadweight (or equivalent) in the presence of a geotechnical engineer. Any areas exhibiting unacceptable movements during the proof-roll may require further rectification;
- Place fill in maximum 250 mm thick layers and compact to achieve a dry density ratio of between 98% and 102% relative to Standard compaction. If the replacement fill used is sand, compact to a density index of 75%. The upper 0.5 m of pavement subgrade areas should be compacted to achieve a dry density ratio of between 100% and 102% relative to Standard compaction;
- The moisture content should be within 2% of the Standard optimum moisture content of the material if it exhibits clay-like properties. Moisture conditioning (i.e. drying or wetting) may be required for compaction of fill.
- Poor trafficability should be expected across unpaved areas of the site, particularly during and following periods of wet weather. A layer of granular product (e.g. roadbase, recycled crushed concrete, etc.) should be considered as the top layer of fill to improve trafficability on site;
- All fill should be placed in accordance with AS 3798 – 2007 “Guidelines on earthworks for commercial and residential developments” with earthworks quality control testing undertaken to verify that the required compaction/moisture criteria are achieved.

If existing fill is left in place without reworking and compaction, there will be a potential for higher settlements, particularly if additional load is applied to the uncontrolled fill. Differential settlements could be variable and high due to the variability of the fill. This will also be almost entirely differential to the columns that will be supported on rock. If additional load is to be applied to the uncontrolled fill, further investigation with CPTs would be required to provide accurate information on the fill consistency/compaction to estimate settlements.

From a geotechnical perspective, the predominantly sand fill is considered to be suitable for re-use as engineered fill, provided that it is free of oversize particles (>100 mm) and deleterious material. The suitability of re-using site-won fill and natural soil should also be considered from a contamination perspective.

9.9 Ground Slabs and Pavements

Floors at the basement level can be designed as slabs on ground, assuming subgrade preparation is carried out in accordance with Section 6.8 of this report.

Based on previous experience in the area, a design CBR of 10% is suggested for the preliminary design of pavements, assuming subgrade preparation is carried out in accordance with Section 6.8 of this report and assuming a granular subgrade (e.g. sand or gravel).

9.10 Aggressivity

The laboratory test results indicate that the samples tested are non-aggressive to mildly aggressive to buried concrete and buried steel elements in accordance with the provisions of Australian Standard AS 2159 "Piling – Design and Installation" (2009).

9.11 Seismicity

A Hazard Factor (*Z*) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 "Structural design actions – Part 4: Earthquake actions in Australia" (2007). The site sub-soil class is Class C_e.

10. Limitations

Douglas Partners (DP) has prepared this report for this project at the Royal Hall of Industries, Moore Park in accordance with DP's proposal SYD190086.P.001.Rev2, dated 21 February 2019 and acceptance received from Anthony Murphy of APP, on behalf of Sydney Swans Ltd, dated 25 February 2019. The work was carried out under the conditions outlined in "Sydney Swans HW & Community Centre Consultant Letter of Appointment", dated 25 February 2019 and signed by DP on 27 February 2019. This report is provided for the exclusive use of Sydney Swans Ltd and their agents for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and their agents.

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

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

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations

or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

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

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

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

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

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

Cohesive Soils

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

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

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

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

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

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

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

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

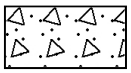
Symbols & Abbreviations

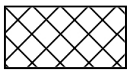
Graphic Symbols for Soil and Rock

General

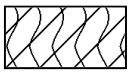

Asphalt

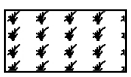

Road base

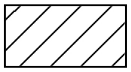

Concrete

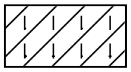

Filling

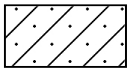
Soils


Topsoil

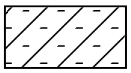

Peat

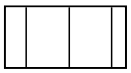

Clay

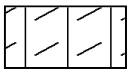

Silty clay

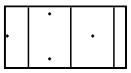

Sandy clay

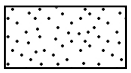

Gravelly clay

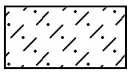

Shaly clay

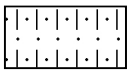

Silt


Clayey silt


Sandy silt

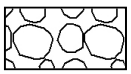

Sand

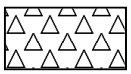

Clayey sand


Silty sand


Gravel

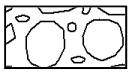

Sandy gravel


Cobbles, boulders

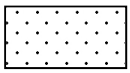

Talus

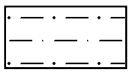
Sedimentary Rocks

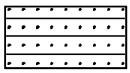

Boulder conglomerate

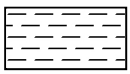

Conglomerate


Conglomeratic sandstone

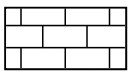

Sandstone


Siltstone

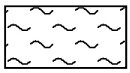

Laminite

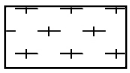

Mudstone, claystone, shale

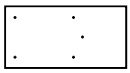

Coal


Limestone

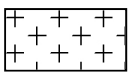
Metamorphic Rocks

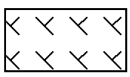

Slate, phyllite, schist

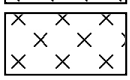

Gneiss

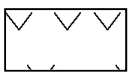

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Cone Penetration Tests

Douglas Partners

Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

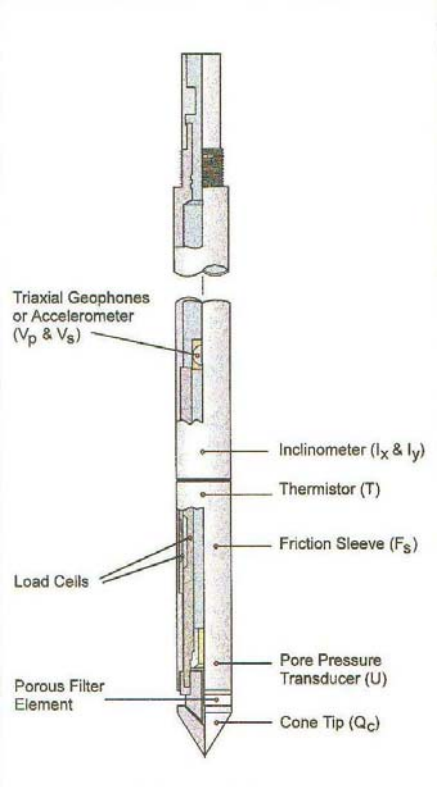


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (q_c, f_s, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (σ) plus basic parameters
Seismic	Shear wave velocity (V_s), compression wave velocity (V_p), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration Tests

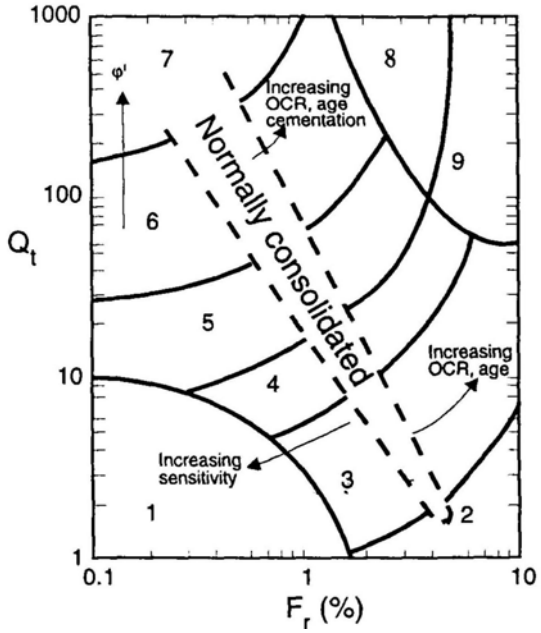


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G_0. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

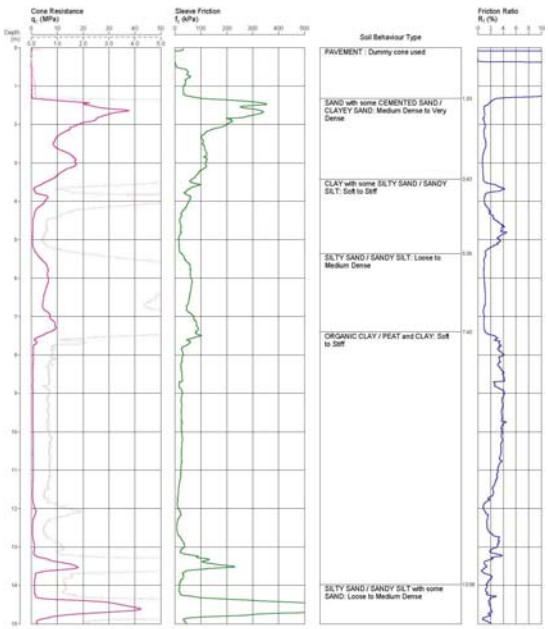
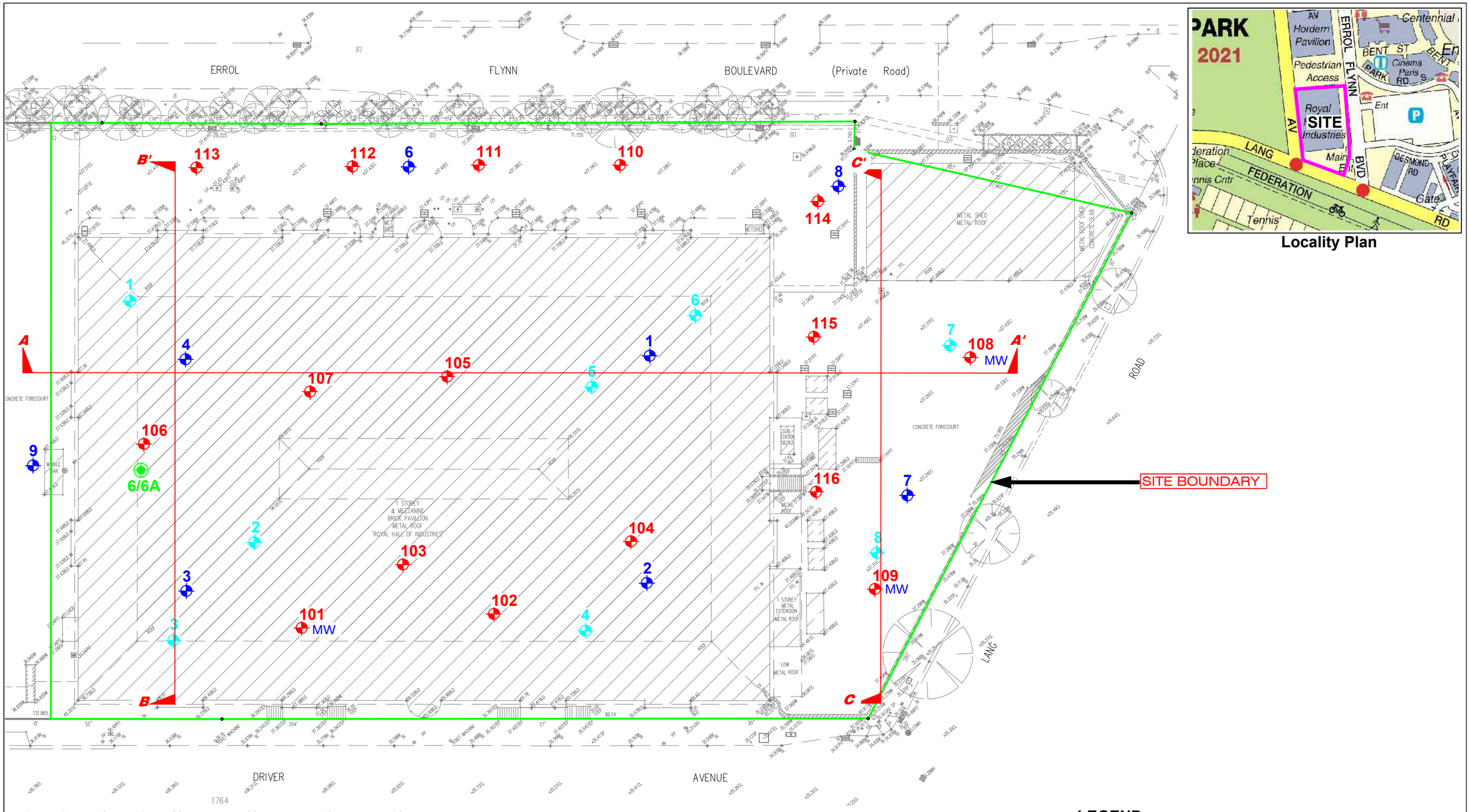


Figure 4: Sample Cone Plot

Appendix B

Drawings



Locality Plan

NOTE:
1: Base drawing from Veris Australia Pty Ltd (Ref 201062A, dated 12.12.2018)
2: Test locations are approximate only and are shown with reference to existing features.

LEGEND

- Approximate location of DP cone penetration test (CPT), March 1998
- Approximate location of DP borehole, June 1998
- Approximate location of ERM borehole, September 2018
- DP borehole location, March 2019
- MW Groundwater monitoring well
- A A' Geotechnical Cross Section A-A'

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Sydney Swans Limited		TITLE: **Site Features and Test Locations** **Proposed Sydney Swans HQ and Community Centre** **Royal Hall of Industries, 1 Driver Avenue, MOORE PARK**
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:500 @ A3	DATE: 14.3.2019	

PROJECT No:	86724.00
DRAWING No:	1
REVISION:	0

A

A'

APPROXIMATE GROUND SURFACE

CONCRETE/ PAVEMENT

DP9 Offset - 9.2m
106 Offset - 10.0m
DP4 Offset 3.2m
107 Offset - 1.4m
105 Offset - 2.0m
ERM5 Offset - 2.2m
DP1 Offset 1.9m
115 Offset 6.2m
ERM7 Offset 2.0m
108 Offset 2.3m

FILLING/ SAND

SANDSTONE: Extremely low to very low strength

SANDSTONE: Very low to low strength

SANDSTONE: Low to medium strength

FILLING/ SAND

SANDSTONE: Medium to high strength

Bottom Depth 1.2 m
Bottom Depth 2.5 m
Bottom Depth 4.3 m
Bottom Depth 3.2 m
Bottom Depth 1.4 m
Bottom Depth 2.1 m
Bottom Depth 4.7 m
Bottom Depth 2.1 m
Bottom Depth 2 m
Bottom Depth 10.06 m

ELEVATION (AHD)

38 37 36 35 34 33 32 31 30 29 28 27

0 20 40 60 80 100 120 140

DISTANCE ALONG PROFILE (m)

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

LEGEND

- Concrete
- Filling
- Sandstone
- Sand
- Sandy Clay
- Asphaltic Concrete
- Roadbase

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

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

0 8
Horizontal Scale (metres)

Vertical Exaggeration = 6.7

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Sydney Swans Limited		TITLE: **Cross-section A**	PROJECT No: 86724.00
OFFICE: Sydney	DRAWN BY: MB/PSCH	**Sydney Swans HQ & Community Centre**	DRAWING No: 2
SCALE: 1:400 (H) 1:60 (V) @ A3	DATE: 01.04.2019	**Royal Hall of Industries, 1 Driver Avenue, MOORE PARK**	REVISION: 0

B

B'

APPROXIMATE GROUND SURFACE

ERM3
Offset 0.7m

DP3
Offset - 0.7m

106
Offset 8.6m

DP4
Offset - 0.6m

ERM1
Offset 6.9m

113
Offset - 2.4m

CONCRETE/ PAVEMENT

FILLING/ SAND

EL-VL

VL-L

Bottom Depth
2.5 m

SANDSTONE:
Extremely low to
very low strength

M

Bottom Depth
1.6 m

VL-L

Bottom Depth
0.9 m

SANDSTONE: Very low to
low strength

Bottom Depth
4.3 m

SANDSTONE: Very low to low strength

VL&L

SANDSTONE: Low to medium strength

M

Bottom Depth
6 m

Bottom Depth
8.75 m

ELEVATION (AHD)

38 37 36 35 34 33 32 31 30 29 28 27

0 10 20 30 40 50 60 70

DISTANCE ALONG PROFILE (m)

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

LEGEND

- Concrete
- Filling
- Sandstone
- Asphaltic Concrete
- Sand

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

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

0 4
Horizontal Scale (metres)

Vertical Exaggeration = 3.3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Sydney Swans Limited		TITLE: **Cross-section B**	PROJECT No: 86724.00
OFFICE: Sydney	DRAWN BY: MB/PSCH	**Sydney Swans HQ & Community Centre**	DRAWING No: 3
SCALE: 1:200 (H) 1:60 (V) @ A3	DATE: 01.04.2019	**Royal Hall of Industries, 1 Driver Avenue, MOORE PARK**	REVISION: 0

C

C'

APPROXIMATE GROUND SURFACE

109 Offset 2.5m

ERM8 Offset 2.7m

DP7 Offset - 1.6m

108 Offset - 12.9m

115 Offset 6.2m

114 Offset 2.7m

DP8 Offset 1.4m

CONCRETE/ PAVEMENT

FILLING/ SAND

SANDSTONE: Extremely low to very low strength

SANDSTONE: Very low to low strength

SANDSTONE: Low to medium strength

SANDSTONE: Medium to high strength

EL-VL

VL-L

L-M

M

H

M-H

Bottom Depth 1.75 m

Bottom Depth 5 m

Bottom Depth 2.1 m

Bottom Depth 1.5 m

Bottom Depth 1.3 m

Bottom Depth 10 m

Bottom Depth 10.06 m

ELEVATION (AHD)

38 37 36 35 34 33 32 31 30 29 28 27

0 10 20 30 40 50 60 70

DISTANCE ALONG PROFILE (m)

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

LEGEND

- Concrete
- Filling
- Sand
- Sandstone
- Clayey Sand
- Asphaltic Concrete
- Roadbase

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

SOIL CONSISTENCY
vs - very soft
s - soft
f - firm
st - stiff
vst - very stiff
h - hard
vl - very loose
l - loose
md - medium dense
d - dense
vd - very dense

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

0 4
Horizontal Scale (metres)

Vertical Exaggeration = 3.3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Sydney Swans Limited		TITLE: **Cross-section C**	PROJECT No: 86724.00
OFFICE: Sydney	DRAWN BY: MB/PSCH	**Sydney Swans HQ & Community Centre**	DRAWING No: 4
SCALE: 1:200 (H) 1:60 (V) @ A3	DATE: 01.04.2019	**Royal Hall of Industries, 1 Driver Avenue, MOORE PARK**	REVISION: 0

Appendix C

Results of Field Work (Current Investigation)

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.6 AHD
EASTING: 335783
NORTHING: 6248069
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 86724.00
DATE: 6/3/2019
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
37	0.15	CONCRETE SLAB										
		FILL: yellow sand fill with a trace of sandstone gravel							A			PID<1
	0.7	FILL: dark brown sand fill with a trace of silt and sandstone gravel							A			PID<1
36	1	- brown from 1.5 m										
	2	- metal obstruction, steel, ceramic tile fragments, glass from 2.0 m							A			PID<1
35	3								A			PID<1
34	4											
	4.0	FILL: red brown sand fill with trace of ash							A			PID<1
33	5								A			PID<1
	5.2	SANDSTONE: apparently extremely low strength, pale grey brown sandstone							A			PID<1
32	5.6	SANDSTONE: extremely low strength, extremely weathered, slightly fractured, red brown and light grey, medium grained sandstone with some high strength ironstone bands				11-03-19		5.6m: J,30°,pl,ro,cly 1mm 5.9-6.5m: J,85°,un,ro,cly 1 mm				PL(A) = 0.08
31	6.6	SANDSTONE: medium and high strength, slightly weathered, slightly fractured and unbroken, medium grained sandstone						6.6m: B,0°,pl,ro,cly 5mm	C	100	59	PL(A) = 0.84
30	7							7.42-7.47m: B(x2),0°,pl,ro,cly 1 mm				PL(A) = 1.5
29	8							8.47m: J,70°,pl,ro,cly 5 mm	C	100	100	PL(A) = 1.9
28	9											
	10	Bore discontinued at 10.0m Target depth reached										PL(A) = 0.82
	10.0											

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT/LS **CASING:** Uncased**

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 5.5m, NMLC to 10.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering, groundwater measured at 5.98 m depth in standpipe on 11/03/19

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. **uncased due to metal obstruction at 2.0m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.6 AHD
EASTING: 335783
NORTHING: 6248069
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 86724.00
DATE: 6/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.15	CONCRETE SLAB							Well Plug and Flush Gatic Cover Concrete
		FILL: yellow sand fill with a trace of sandstone gravel		A	0.4 0.5		PID<1		
	0.7	FILL: dark brown sand fill with a trace of silt and sandstone gravel		A	0.9 1.0		PID<1		
36	1	- brown from 1.5 m							
		- metal obstruction, steel, ceramic tile fragments, glass from 2.0 m		A	1.9 2.0		PID<1		
35	2								
				A	2.9 3.0		PID<1		Blank PVC Backfill
34	3								
	4.0	FILL: red brown sand fill with trace of ash		A	3.9 4.0		PID<1		
33	4								
				A	4.9 5.0		PID<1		
	5.2	SANDSTONE: apparently extremely low strength, pale grey brown sandstone		A	5.4 5.5		PID<1		
32	5.6	SANDSTONE: extremely low strength, extremely weathered, slightly fractured, red brown and light grey, medium grained sandstone with some high strength ironstone bands			5.6 5.8 5.9		PL(A) = 0.08	11-03-19	
	6								Bentonite
31	6.6	SANDSTONE: medium and high strength, slightly weathered, slightly fractured and unbroken, medium grained sandstone		C	6.9 6.94		PL(A) = 0.84		
	7				7.44		PL(A) = 1.5		
30					7.7				
	8								Gravel
29									Machine Slotted PVC Screen
	9			C	8.82		PL(A) = 1.9		
28		Bore discontinued at 10.0m			9.69		PL(A) = 0.82		
	10	Target depth reached			10.0				End Cap

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT/LS **CASING:** Uncased**

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 5.5m, NMLC to 10.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering, groundwater measured at 5.98 m depth in standpipe on 11/03/19

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. **uncased due to metal obstruction at 2.0m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 101 PROJECT: MOORE PARK (86724.00) MARCH 2019

5.60 – 10.00m

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.6 AHD
EASTING: 335789
NORTHING: 6248041
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 86724.00
DATE: 6/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.15	CONCRETE SLAB							
		FILL: pale yellow brown clayey sand fill with trace sandstone gravel		A	0.4 0.5		PID<1		
				A	0.9 1.0		PID<1		
36	1.0	FILL: dark brown clayey sand fill with sandstone gravel							
		- dark brown mottled light grey from 1.8m to 2.2m		A	1.9 2.0		PID<1		
35									
	3.0	- trace of metal at 3.0m		A	2.9 3.0		PID<1		
		FILL: pale grey mottled dark grey sand fill with trace silt and ash		A	3.4 3.5		PID<1		
34		- brown from 3.9m		A	3.9 4.0		PID<1		
33	4.5	SANDSTONE: apparently extremely low to very low strength, pale grey sandstone		A	4.9 5.0		PID<1		
32	5.4	SANDSTONE: apparently low to medium strength, yelllow sandstone							
	6.0	Bore discontinued at 6.0m Refusal on sandstone bedrock, target stratum encountered		A	5.9 6.0		PID<1		
31									
30									
29									
28									

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** AD **CASING:** Uncased

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 6.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.6 AHD
EASTING: 335794
NORTHING: 6248055
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 86724.00
DATE: 7/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.15	CONCRETE SLAB							
		FILL: yellow brown slightly clayey sand fill with trace of silt		A	0.2		PID<1		
	0.4			A	0.3		PID<1		
	0.6	CONCRETE		A	0.4				
		FILL: yellow mottled white sand fill			0.5				
	1			A	0.9		PID<1		1
	1.1	FILL: dark brown clayey sand fill with some charcoal, ash, coke, trace of shell and glass			1.0				
36	2			A	1.9		PID<1		2
	2.0				2.0				
	2.2	FILL: pale grey sand fill with ash		A	2.3		PID<1		
					2.4				
35	2.6	FILL: yellow brown sand fill with trace of ash							
	3			A	2.9		PID<1		3
					3.0				
34	3.5	SAND: pale yellow fine to medium sand							
	4			A	3.9		PID<1		4
					4.0				
33	4.5	SANDSTONE: apparently extremely low to low strength, pale grey sandstone							
	5			A	4.9		PID<1		5
	5.0	Bore discontinued at 5.0m Refusal on sandstone bedrock, target stratum encountered			5.0				
32	6								6
31	7								7
30	8								8
29	9								9
28	10								10

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 5.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.6 AHD
EASTING: 335801
NORTHING: 6248026
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 86724.00
DATE: 7/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.15	CONCRETE SLAB		A	0.15		PID<1		
	0.2	FILL: dark yellow slightly clayey sand fill		A	0.2		PID<1		
	0.5	CONCRETE		A	0.4		PID<1		
		FILL: yellow white sand fill with trace of ash		A	0.5		PID<1		
	1			A	0.9		PID<1		
	1.5	FILL: dark brown sand fill with trace of tiles and glass		A	1.0		PID<1		
36				A	1.9		PID<1		
	2			A	2.0		PID<1		
				A	2.9		PID<1		
35	3			A	3.0		PID<1		
	3.0	FILL: yellow and orange-brown sand fill with trace of gravel		A	3.4		PID<1		
	3.6	SANDSTONE: apparently extremely low to very low strength, pale grey and pink sandstone with some medium and high strength ironstone bands		A	3.5		PID<1		
34	4	4.0m-4.2m: ironstone band		A	3.9		PID<1		
				A	4.0		PID<1		
		4.4m: becoming apparently low to medium strength		A	4.1		PID<1		
33				A	4.4		PID<1		
	5			A*	4.5		PID<1		
	5.0	Bore discontinued at 5.0m Refusal on sandstone bedrock, target stratum encountered			4.9 5.0				
32	6								
31	7								
30	8								
29	9								
28	10								

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 5.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD1/20190307 taken from 4.9-5.0m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.7 AHD
EASTING: 335819
NORTHING: 6248052
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 86724.00
DATE: 7/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.18	CONCRETE SLAB							
	0.4	CONCRETE							
	0.6	FILL: yellow-brown medium sand fill with trace of gravel, ash and coke		A	0.4 0.5		PID<1		
	1	SANDSTONE: apparently very low to low strength, pale grey-white sandstone		A	0.9 1.0		PID<1		
	1.4	Bore discontinued at 1.4m Refusal on sandstone bedrock, target stratum encountered							
36	2								
35	3								
34	4								
33	5								
32	6								
31	7								
30	8								
29	9								
28	10								

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 1.4m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.6 AHD
EASTING: 335807
NORTHING: 6248094
DIP/AZIMUTH: 90°/--

BORE No: 106
PROJECT No: 86724.00
DATE: 7/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.15	CONCRETE SLAB							
	0.3	FILL: dark yellow sand fill with some clay and trace of siltstone and clay		A	0.2–0.3		PID<1		
				A	0.4		PID<1		
		FILL: dark brown slightly clayey sand fill with trace of siltstone gravel, plastic, charcoal, coke and glass			0.5				
	1				0.9				1
36	1.6	FILL: grey sand fill with some coke and ash		A			PID<1		
	2			A	1.9–2.0		PID<1		2
	2.2	SANDSTONE: apparently very low to low strength, pale grey-white sandstone							
35	2.5	Bore discontinued at 2.5m Refusal on sandstone bedrock, target stratum encountered		A	2.4–2.5		PID<1		
	3								3
34	4								4
33	5								5
32	6								6
31	7								7
30	8								8
29	9								9
28	10								10

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.7 AHD
EASTING: 335818
NORTHING: 6248069
DIP/AZIMUTH: 90°/--

BORE No: 107
PROJECT No: 86724.00
DATE: 7/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.15	CONCRETE SLAB							
	0.3	FILL: brown, clayey fine sand fill with sandstone gravel, trace of glass, ceramic and clay		A	0.2 0.3		PID<1		
	0.6	CONCRETE							
	1	SANDSTONE: apparently extremely low to very low strength, pale yellow sandstone 1.1m: becoming brown		A*	0.9 1.0		PID<1		1
	1.5	SANDSTONE: apparently very low to low strength, yellow sandstone		A	1.4 1.5		PID<1		
36	2			A	1.9 2.0		PID<1		2
		2.2m: becoming apparently low to medium strength and pale yellow-white							
35	3			A	2.9 3.0		PID<1		3
	3.2	Bore discontinued at 3.2m Refusal on sandstone bedrock, target stratum encountered							
34	4								4
33	5								5
32	6								6
31	7								7
30	8								8
29	9								9
28	10								10

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.15m, solid flight auger to 3.2m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD2/20190307 taken from 0.9-1.0m.

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.3 AHD
EASTING: 335830
NORTHING: 6247983
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 86724.00
DATE: 7/3/2019
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
37	0.18	CONCRETE SLAB										
		FILL: brown sand fill with some sandstone and igneous gravel, and clay with trace of glass, plastic and ceramic fragments - dark brown from 0.5m							A			PID<1
36	1.1	SAND: pale yellow medium to coarse sand							A			PID<1
	1.5	SANDSTONE: apparently extremely low to very low strength, pale yellow sandstone 2.1m: becoming apparently very low to low strength							A*			PID<1
35	2.8					11-03-19			A			PID<1
34		SANDSTONE: low to medium and medium strength, moderately and slightly weathered, fractured and slightly fractured, orange brown and purple brown, medium grained sandstone						3.4-4.4m: B(x4),0°,pl,ro,fe/cly 1mm 4.47-4.70m: cs(x3), 20mm	C	100	88	PL(A) = 0.36 PL(A) = 0.56 PL(A) = 0.64
33	4.7	SANDSTONE: medium and medium to high strength, slightly weathered and fresh, unbroken, grey brown, medium grained sandstone 5.60-6.15m: low to medium strength band							C	100	100	PL(A) = 0.28 PL(A) = 0.61 PL(A) = 1.1 PL(A) = 1
28	10.06	Bore discontinued at 10.06m Target depth reached							C	100	100	PL(A) = 0.89

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT/LS **CASING:** HW to 3.0m; HQ to 10.0m

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 3.0m, NMLC to 10.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering, groundwater measured at 2.64 m depth in standpipe on 11/03/19

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD3/20190307 taken from 1.9-2.0m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.3 AHD
EASTING: 335830
NORTHING: 6247983
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 86724.00
DATE: 7/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.18	CONCRETE SLAB							Well Plug and Flush Gatic Cover Concrete
		FILL: brown sand fill with some sandstone and igneous gravel, and clay with trace of glass, plastic and ceramic fragments		A	0.4 0.5		PID<1		
		- dark brown from 0.5m		A	0.9 1.0		PID<1		
36	1.1	SAND: pale yellow medium to coarse sand							Backfill
	1.5	SANDSTONE: apparently extremely low to very low strength, pale yellow sandstone		A*	1.9 2.0		PID<1		Blank PVC
35		2.1m: becoming apparently very low to low strength						▼ 11-03-19	
	2.8			A	2.7 2.8 2.9		PID<1 PL(A) = 0.36		Bentonite
34		SANDSTONE: low to medium and medium strength, moderately and slightly weathered, fractured and slightly fractured, orange brown and purple brown, medium grained sandstone		C	3.83		PL(A) = 0.56		
33	4.7	SANDSTONE: medium and medium to high strength, slightly weathered and fresh, unbroken, grey brown, medium grained sandstone			4.9		PL(A) = 0.64		
32		5.60-6.15m: low to medium strength band			5.55 5.87		PL(A) = 0.28		
31				C	6.91		PL(A) = 0.61		Gravel Machine Slotted PVC Screen
30					7.51		PL(A) = 1.1		
29					8.5 8.6		PL(A) = 1		
28				C	9.24		PL(A) = 0.89		
	10.06	Bore discontinued at 10.06m Target depth reached			10.06				End Cap

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT/LS **CASING:** HW to 3.0m; HQ to 10.0m

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 3.0m, NMLC to 10.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering, groundwater measured at 2.64 m depth in standpipe on 11/03/19

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD3/20190307 taken from 1.9-2.0m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 108 PROJECT: MOORE PARK (86724.00) MARCH 2019

2.80 – 7.00m

BORE: 108 PROJECT: MOORE PARK (86724.00) MARCH 2019

7.00 – 10.06m

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.3 AHD
EASTING: 335798
NORTHING: 6247992
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 86724.00
DATE: 11/3/2019
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)	Type	Core Rec. %	RQD %	Test Results & Comments
37	0.18	CONCRETE SLAB										
		FILL: pale grey clayey sand fill with some sandstone gravel, metal and trace of coke							A			PID<1
		- pale grey pink from 0.6m										
36	1	- mottled brown grey from 1.0m							A			PID<1
35	2								A			PID<1
	2.0	FILL: dark brown clayey sand fill with trace clay and glass fragments										
34	3								A			PID<1
	3.0	CLAYEY SAND: yellow brown mottled grey clayey sand with trace root fibres, damp (possibly extremely low strength sandstone)							A*			PID<1
	3.6	SANDSTONE: apparently very low to low strength, yellow sandstone							A			PID<1
33	4											
	4.3	SANDSTONE: medium and high strength, slightly weathered, slightly fractured and unbroken, yellow brown and light grey, medium grained sandstone						4.72m: B,0°,pl,ro,cly 1mm 4.78m: J,30°-40°,un,ro,cly vn 5.34m-5.4m: cs, 60mm				PL(A) = 0.42
32	5								C	100	96	PL(A) = 0.58
31	6					11-03-19						PL(A) = 0.66
30	7											PL(A) = 1.3
29	8							7.90-7.96m: B(x2),0°,pl,ro,cly 1mm 8m: J,45°&20°, st,ro,fe 8.05-9.73m: B(x4),0°,pl,ro,cly 1-7mm	C	100	92	PL(A) = 1.5
28	9											PL(A) = 0.86
	10	Bore discontinued at 10.0m Target depth reached						9.73-9.81m: B(x2) B,0°,pl,ro,cly 1-4mm				
	10.0											

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT/LS **CASING:** HW to 4.3m; HQ to 10.0m

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 4.3m, NMLC to 10.06m

WATER OBSERVATIONS: No free groundwater observed whilst augering, groundwater measured at 6.03 m depth in standpipe on 11/03/19

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD1/20190308 taken from 3.4-3.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.3 AHD
EASTING: 335798
NORTHING: 6247992
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 86724.00
DATE: 11/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.18	CONCRETE SLAB							Well Plug and Flush Gatic Cover Concrete
		FILL: pale grey clayey sand fill with some sandstone gravel, metal and trace of coke		A	0.4 0.5		PID<1		
		- pale grey pink from 0.6m							
1				A	0.9 1.0		PID<1		1
36		- mottled brown grey from 1.0m							Backfill
				A	1.9 2.0		PID<1		
2	2.0	FILL: dark brown clayey sand fill with trace clay and glass fragments							2 Blank PVC
35				A	2.9 3.0		PID<1		
3	3.0	CLAYEY SAND: yellow brown mottled grey clayey sand with trace root fibres, damp (possibly extremely low strength sandstone)		A*	3.4 3.5		PID<1		3 Bentonite
34	3.6	SANDSTONE: apparently very low to low strength, yellow sandstone		A	3.9 4.0		PID<1		
4	4.3	SANDSTONE: medium and high strength, slightly weathered, slightly fractured and unbroken, yellow brown and light grey, medium grained sandstone			4.3 4.53		PL(A) = 0.42		4
33									
5				C	5.75		PL(A) = 0.58		5
32									
6					6.42		PL(A) = 0.66	▼ 11-03-19	6
31									Gravel
7					7.2				7 Machine Slotted PVC Screen
30					7.47		PL(A) = 1.3		
8									8
29				C	8.62		PL(A) = 1.5		
9									9
28					9.25		PL(A) = 0.86		
10	10.0	Bore discontinued at 10.0m Target depth reached			10.0				10 End Cap

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT/LS **CASING:** HW to 4.3m; HQ to 10.0m

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 4.3m, NMLC to 10.06m

WATER OBSERVATIONS: No free groundwater observed whilst augering, groundwater measured at 6.03 m depth in standpipe on 11/03/19

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD1/20190308 taken from 3.4-3.5m.

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: 109 PROJECT: MOORE PARK (86724.00) MARCH 2019

4.30 – 9.00m

BORE: 109 PROJECT: MOORE PARK (86724.00) MARCH 2019

9.00 – 10.00m

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.3 AHD
EASTING: 335854
NORTHING: 6248031
DIP/AZIMUTH: 90°/--

BORE No: 110
PROJECT No: 86724.00
DATE: 8/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.05	ASPHALTIC CONCRETE							
	0.1	FILL: yellow-brown sand fill, humid		A	0.4				
	0.5	FILL: yellow, fine to medium gravelly sand fill, sandstone gravel, humid			0.5				
	1	SANDSTONE: apparently very low to low strength, yellow sandstone		A	0.9				
36	1.1	Bore discontinued at 1.1m Refusal on sandstone bedrock, target stratum encountered			1.0				
35	2								
34	3								
33	4								
32	5								
31	6								
30	7								
29	8								
28	9								
	10								

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 1.1m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.4 AHD
EASTING: 335852
NORTHING: 6248049
DIP/AZIMUTH: 90°/--

BORE No: 111
PROJECT No: 86724.00
DATE: 8/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.02	ASPHALTIC CONCRETE		A	0.05		PID<1		
	0.25	FILL: brown, gravelly sand fill, 5-15mm igneous and sandstone gravel, humid		A	0.1				
	0.5	FILL: yellow, fine to medium gravelly sand fill, sandstone gravel, humid		A	0.2 0.4 0.5		PID<1		
36	1			A	0.9 1.0		PID<1		
	1.1	SANDSTONE: apparently very low to low strength, yellow sandstone							
		Bore discontinued at 1.1m Refusal on sandstone bedrock, target stratum encountered							
35	2								
34	3								
33	4								
32	5								
31	6								
30	7								
29	8								
28	9								
	10								

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 1.1m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.4 AHD
EASTING: 335850
NORTHING: 6248065
DIP/AZIMUTH: 90°/--

BORE No: 112
PROJECT No: 86724.00
DATE: 8/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.02	ASPHALTIC CONCRETE		A	0.05		PID<1		
	0.15	FILL: dark grey-black sandy gravel fill with some silt, 5-20mm igneous and sandstone gravel		A*	0.1–0.4		PID<1		
	0.5	FILL: yellow, fine to medium gravelly sand fill, sandstone gravel, humid		A	0.5–0.9		PID<1		
36	1.0	SANDSTONE: apparently very low to low strength, white and pale grey sandstone			1.0				
		Bore discontinued at 1.0m Refusal on sandstone bedrock, target stratum encountered							
35	2								
34	3								
33	4								
32	5								
31	6								
30	7								
29	8								
28	9								
	10								

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 1.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD2/20190308 taken at 0.4-0.5m.

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.5 AHD
EASTING: 335847
NORTHING: 6248086
DIP/AZIMUTH: 90°/--

BORE No: 113
PROJECT No: 86724.00
DATE: 8/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.02	ASPHALTIC CONCRETE							
	0.2	FILL: dark grey-black, sandy gravel fill with some silt, 5-20mm igneous and sandstone gravel		A	0.4 0.5		PID<1		
	0.5	FILL: yellow, fine to medium gravelly sand fill, sandstone gravel, humid		A	0.8 0.9		PID<1		
	0.9	SANDSTONE: apparently very low to low strength, white sandstone							
		Bore discontinued at 0.9m Refusal on sandstone bedrock, target stratum encountered							

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 0.9m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.2 AHD
EASTING: 335849
NORTHING: 6248003
DIP/AZIMUTH: 90°/--

BORE No: 114
PROJECT No: 86724.00
DATE: 8/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.02	ASPHALTIC CONCRETE							
		FILL: dark brown-grey sand fill with some clay, igneous gravel, moist		A	0.4 0.5		PID<1		
	0.7	SANDSTONE: apparently extremely low to very low strength, grey sandstone		A	0.9 1.0		PID<1		
36	1	1.0m: becoming apparently very low to low strength and pale yellow-brown		A	1.4 1.5		PID<1		
	1.5	Bore discontinued at 1.5m Refusal on sandstone bedrock, target stratum encountered							
35	2								
34	3								
33	4								
32	5								
31	6								
30	7								
29	8								
28	9								
	10								

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 1.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.4 AHD
EASTING: 335832
NORTHING: 6248003
DIP/AZIMUTH: 90°/--

BORE No: 115
PROJECT No: 86724.00
DATE: 11/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.18	CONCRETE SLAB							
		FILL: dark brown, clayey sand fill with igneous and sandstone gravel, moist		A	0.4 0.5		PID<1		
	1			A	0.9 1.0		PID<1		1
36	1.3	FILL: grey, fine to medium sand fill with some coal, moist		A	1.4 1.5		PID<1		
	1.5	SANDSTONE: apparently extremely low to very low strength, yellow-brown sandstone		A*	1.7 1.8		PID<1		
	2	1.9m: becoming apparently low strength		A	1.9 2.0		PID<1		2
35	2.1	Bore discontinued at 2.1m Refusal on sandstone bedrock, target stratum encountered							
	3								3
34									
	4								4
33									
	5								5
32									
	6								6
31									
	7								7
30									
	8								8
29									
	9								9
28									
	10								10

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 2.1m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery. *Blind replicate sample BD1/20190311 taken from 1.7-1.8m.

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Sydney Swans Limited
PROJECT: Sydney Swans HQ & Community Centre
LOCATION: Royal Hall of Industries, 1 Driver Avenue, Moore Park

SURFACE LEVEL: 37.4 AHD
EASTING: 335813
NORTHING: 6248000
DIP/AZIMUTH: 90°/--

BORE No: 116
PROJECT No: 86724.00
DATE: 11/3/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.18	CONCRETE SLAB							
	0.3	FILL: dark brown clayey sand fill with igneous and sandstone gravel, moist		A	0.2		PID<1		
				A	0.3		PID<1		
	0.5	FILL: grey mottled dark brown, clayey sand fill, moist		A	0.4				
					0.5				
36	1	FILL: dark brown, fine sand with some clay, igneous, ironstone and sandstone gravel, trace of coke/charcoal/coal, moist		A	0.9		PID<1		1
					1.0				
35	2			A	1.9		PID<1		2
					2.0				
	2.8	SANDSTONE: apparently very low to low strength, pale yellow and grey-white sandstone		A	2.9		PID<1		
	3				3.0				3
34		Bore discontinued at 3.0m Refusal on sandstone bedrock, target stratum encountered							
33	4								4
32	5								5
31	6								6
30	7								7
29	8								8
28	9								9
	10								10

RIG: Hanjin DB8 **DRILLER:** BG Drilling **LOGGED:** LT **CASING:** Uncased

TYPE OF BORING: Diacore to 0.18m, solid flight auger to 3.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface level interpolated from survey drawing by Veris Australia Pty Ltd, Ref:201062A. 12/12/18. Location coordinates are in MGA94 Zone 56 and were estimated from aerial imagery.

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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Appendix D

Results of Previous Investigations

CONE PENETRATION TEST

CLIENT HUGHES TRUEMAN REINHOLD PTY LTD

PROJECT HORDERN PAVILION/RHI

LOCATION DRIVER AVENUE, MOORE PARK

PROJECT No 24967

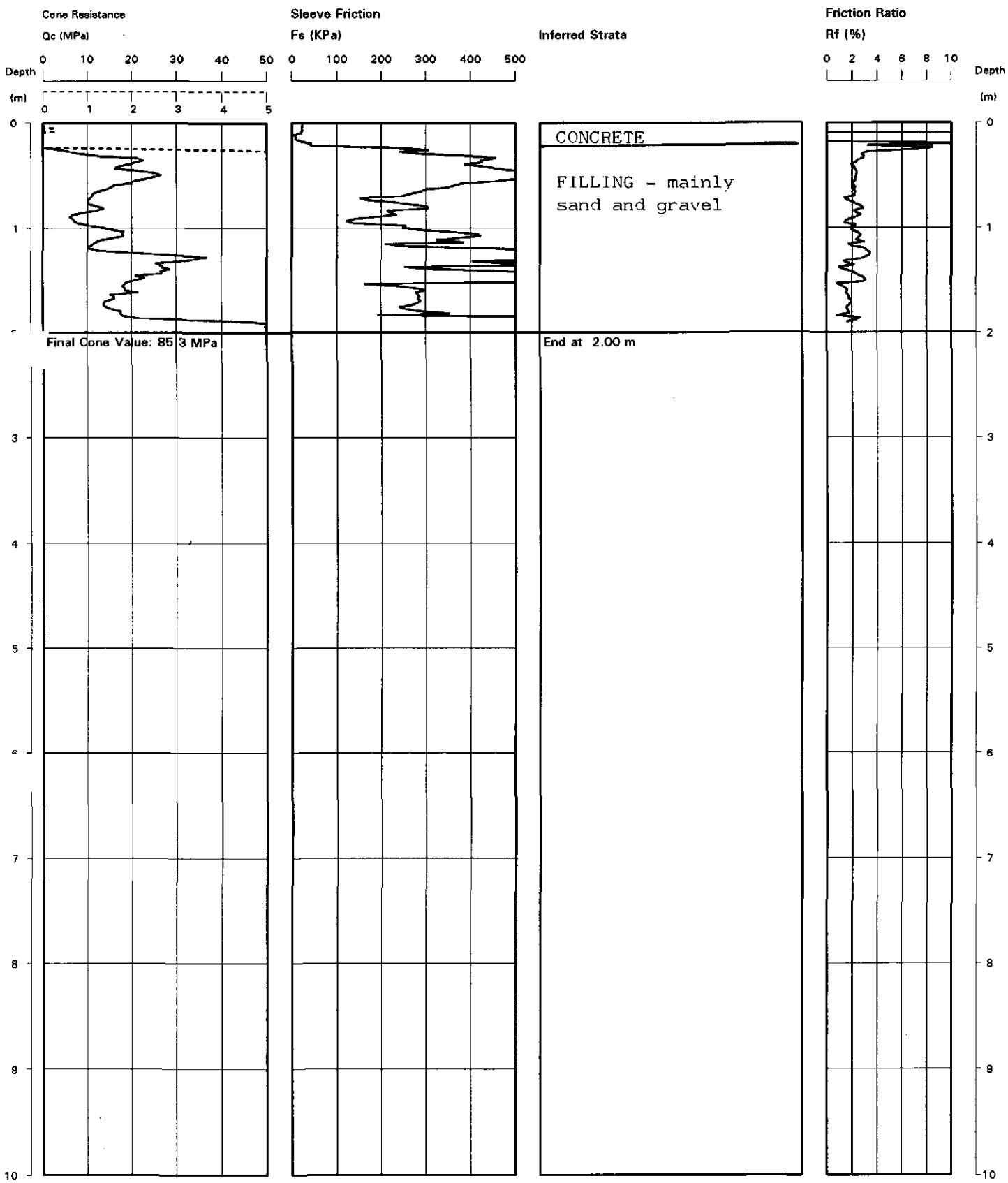
CPT 6

Page 1 of 1

DATE 6 MAR 1998

37.5

SURFACE RL



REMARKS: HOLE COLLAPSE AT 1.9 METRES DEPTH
REFUSAL ON OBSTRUCTION

File: A:\24967-06.CPT
Cone ID: CONE-903 **Type:** Standard

Date	7-98
Plotted	GAK
Checked	

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CONE PENETRATION TEST

CLIENT HUGHES TRUEMAN REINHOLD

PROJECT HORDERN PAVILION/RHI

LOCATION DRIVER AVENUE, MOORE PARK

PROJECT No 24967

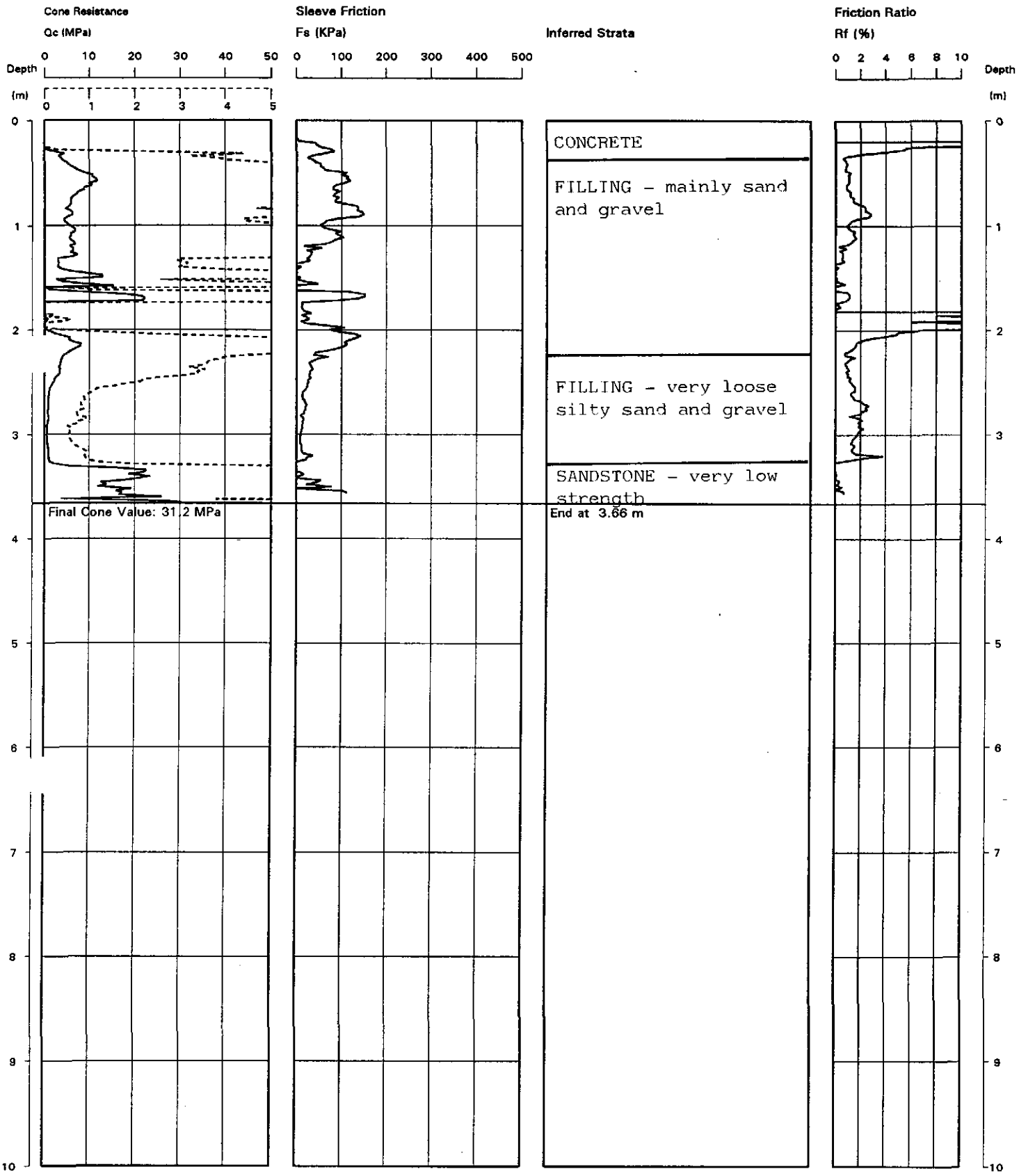
CPT 6A

Page 1 of 1

DATE 17 MAR 1998

37.5

SURFACE RL



REMARKS: HOLE COLLAPSE AT 2.7 METRES DEPTH
DUMMY CONE FROM 1.7-2.2 METRES DEPTH

File: A:\24967-6A.CPT
Cone ID: CONE1010 Type: Standard

Date	3-98
Plotted	GAK
Checked	AM

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TEST BORE REPORT

BORE No: 1

CLIENT: HUGHES TRUEMAN REINHOLD
PROJECT No: 24967
DATE: 13 JULY 98

PROJECT: ROYAL HALL OF INDUSTRIES
SURFACE LEVEL:
SHEET 1 **OF** 1

LOCATION: DRIVER AVE, MOORE PARK
DIP OF HOLE: 90°
AZIMUTH:

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)	Discontinuities (B – Bedding, J – Joint, S – Shear, D – Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	CONCRETE									
0.25	FILLING – dark brown sand and gravel (Drillers' description)									
1.5	SANDY CLAY – dark, grey sandy clay (Drillers' description)									
1.6										
1.81	SANDSTONE – very low to low strength, extremely to highly weathered, grey brown, medium grained sandstone				1.82m,2.8m, & 2.95m B 0° planar smooth					PL (A)=0.5MPa
2					2.5m:B 20° planar smooth					
3	SANDSTONE – medium strength, moderately weathered, slightly fractured to unbroken, grey brown, medium to coarse grained sandstone				2.95m:90mm extremely low to low strength band		C	100	97	PL (A)=0.5MPa
	– below 3.04m unbroken									
	– below 3.6m coarse grained									
4										PL (A)=0.5MPa
4.7	TEST BORE DISCONTINUED AT 4.7 METRES									
5										
6										
7										
8										
9										
10										

RIG: SCOUT **DRILLER:** DRIVER **LOGGED:** HOLY **CASING:** NW TO 1.7m

TYPE OF BORING: ROLLER BIT – 0.25m, SFA – 1.7m, NMLC CORING – 4.7m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:
Initials:
Date:

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DOUGLAS PARTNERS PTY LTD
ROYAL HALL OF INDUSTRIES - MOORE PARK
BORE 1 PROJ NO 24 967 JULY 1998
MOORE PARK 24967
BH 1
START 1.7m
END AT 4.7m
1.70 - 4.70 M

TEST BORE REPORT

BORE No: 2

CLIENT: HUGHES TRUEMAN REINHOLD | **PROJECT No:** 24967 | **DATE:** 13 JULY 98

PROJECT: ROYAL HALL OF INDUSTRIES | **SURFACE LEVEL:** | **SHEET** 1 **OF** 1

LOCATION: DRIVER AVE, MOORE PARK | **DIP OF HOLE:** 90° | **AZIMUTH:**

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)	Discontinuities (B – Bedding, J – Joint, S – Shear, D – Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	CONCRETE									
0.25	FILLING – sand and concrete rubble									
1.5	FILLING – dark grey, clayey sand									
2.1	FILLING – dark grey, clayey sand with gravel									
2.8	SAND – grey sand									
3.4	SAND – light brown sand									
4.1	SANDSTONE – extremely low strength, extremely weathered, grey brown, medium grained sandstone				Core loss 200mm					PL (A)=0.7MPa
4.35					4.58m,4.59m,4.61m,&4.67 B 10–20° planar smooth					
4.4	SANDSTONE – medium strength, moderately weathered, slightly fractured to unbroken, grey, brown, red brown, medium grained sandstone				5.12m:B 0–5° 5–8mm sandy clay 5.16m:B 0° planar smooth		C	93	83	PL (A)=0.7MPa
5.8	SANDSTONE – low strength, highly weathered, slightly fractured to unbroken, grey, brown, red brown, medium grained sandstone				6.5m:110mm extremely low to very low strength 6.67m:B 5° undulating smooth					PL (A)=0.2MPa
7.15	TEST BORE DISCONTINUED AT 7.15METRES									
10										

RIG: SCOUT **DRILLER:** DRIVER **LOGGED:** HOLY **CASING:** NW TO 4.15m

TYPE OF BORING: ROLLER BIT – 0.25m,SFA – 4.15m,NMLC CORING – 7.15m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:

Initials:

Date:

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DOUGLAS PARTNERS PTY LTD
ROYAL HALL OF INDUSTRIES - MOORE PARK
BORE 2 PROJ NO 24 967 JULY 1998
MOORE PARK 24 967 BH 2 START 4.15
CORE LOSS 200 mm
5
6
7
8
END AT 7.15m
4.15 - 7.15 M

TEST BORE REPORT

BORE No: 3

CLIENT: HUGHES TRUEMAN REINHOLD **PROJECT No:** 24967 **DATE:** 29 JUNE 98

PROJECT: ROYAL HALL OF INDUSTRIES **SURFACE LEVEL:** **SHEET** 1 **OF** 1

LOCATION: DRIVER AVE, MOORE PARK **DIP OF HOLE:** 90° **AZIMUTH:**

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)	Discontinuities (B – Bedding, J – Joint, S – Shear, D – Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0										
0.15	CONCRETE									
	FILLING – brown sand with gravel, glass and rubble (Drillers' description)									
2.8	SAND – dark brown, fine to medium grained sand (Drillers' description)									
3.75	SANDSTONE – interbedded very low and low strength, extremely and highly weathered, highly fractured to fractured, grey, brown, medium to coarse grained sandstone									
4.85					Core loss 550mm		C	65	23	
5.4	SANDSTONE – medium strength, moderately weathered, fractured to slightly fractured, grey, brown, red brown, medium to coarse grained sandstone				5.58m & 5.7m B 20° & 25° 1mm clayey sand x2 5.7m & 5.93m B 20° & 0° planar smooth x2					PL (A)=0.4MPa
6.08					Core loss 300mm					
6.38					6.47m:J 45° planar 6.7m, 6.9m & 6.94m B 0–5° 2mm sandy clay x3 7.0m 20mm low strength band 7.0m & 7.05m B 15 & 10° 3 & 1mm sandy clay 7.16m & 7.23m B 20 & 15° 2 & 1mm sandy clay 7.35m:B 0–5° undulating smooth 8.53m: 50mm very low strength band		C	90	84	PL (A)=0.4MPa PL (A)=0.4MPa PL (A)=0.6MPa
8.75	TEST BORE DISCONTINUED AT 8.75 METRES									
10										

RIG: SCOUT **DRILLER:** PACKMAN **LOGGED:** HOLY **CASING:** NW TO 4.2m

TYPE OF BORING: DIA TUBE TO 0.15m,SFA TO 4.2m,NMLC CORING TO 8.75m

WATER OBSERVATIONS: FREE GROUNDWATER OBSERVED AT 3.5–4.0m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:

Initials:

Date:

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DOUGLAS PARTNERS PTY LTD
ROYAL HALL OF INDUSTRIES - MOORE PARK
BORE 3 PROJ NO 24 967 JULY 1998
RHI MOORE PARK BH 3
START CORING 4.20m
5.0
CORE LOSS 0.55 m
6.0
CORE LOSS 0.30m
7.0
8.0
END
8.75m
4.20 - 8.75 M

TEST BORE REPORT

BORE No: 4

CLIENT: HUGHES TRUEMAN REINHOLD **PROJECT No:** 24967 **DATE:** 29 JUNE 98

PROJECT: ROYAL HALL OF INDUSTRIES **SURFACE LEVEL:** **SHEET** 1 **OF** 1

LOCATION: DRIVER AVE, MOORE PARK **DIP OF HOLE:** 90° **AZIMUTH:**

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)	Discontinuities (B – Bedding, J – Joint, S – Shear, D – Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	CONCRETE									
0.175	FILLING – brown sand with gravel, glass and rubble (Drillers' description)									
0.8	SANDSTONE – extremely low to very low strength, extremely to highly weathered, grey brown, medium to coarse grained sandstone									
1.35	SANDSTONE – medium strength, moderately weathered, fractured to slightly fractured, grey brown, medium to coarse grained sandstone				1.42m & 1.61m B 20° planar 2mm clayey sand x2 1.79mB 5–15° undulating 1mm clayey sand 2.16m:B 20° undulating 1mm clayey sand 2.83m:B 5° undulating smooth 3.27m:B 5° 5mm sandy clay 4.28m:B 10° undulating smooth		C	100	95	PL (A)=0.4MPa PL (A)=0.6MPa
4.3	TEST BORE DISCONTINUED AT 4.3 METRES									

RIG: SCOUT **DRILLER:** PACKMAN **LOGGED:** HOLY **CASING:** NW TO 1.3m

TYPE OF BORING: DIA TUBE TO 0.175m,SFA TO 1.3m,NMLC CORING TO 4.3m

WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:

Initials:

Date:

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DOUGLAS PARTNERS PTY LTD
ROYAL HALL OF INDUSTRIES - MOORE PARK
BORE 4 PROJ NO 24 967 JULY 1998
R.H.I. MOORE PARK 24967 BH 4
START CORING 1.30m
2.0
3.0
4.0
5.0
END
4.30
1.30 - 4.30 M

TEST BORE REPORT

CLIENT: HUGHES TRUEMAN REINHOLD
PROJECT: ROYAL HALL OF INDUSTRIES
LOCATION: DRIVE AVE, MOORE PARK

DATE: 14 JULY 98
PROJECT No.: 24967
SURFACE LEVEL:

BORE No. 6
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Test Results	Core Recovery %
0	BITUMINOUS PAVEMENT				
0.1	ROADBASE – sandy crushed rock with maximum particle size 20mm	B	0.3		
0.4	SANDSTONE – extremely low to very low strength, extremely weathered, grey brown, medium grained sandstone	S	0.5	25/100mm ref	
			0.6		
0.8	TEST BORE DISCONTINUED AT 0.8 METRES – auger refusal	A	0.8		
1					
2					

RIG: SCOUT **DRILLER:** DRIVER **LOGGED:** HOLY **CASING:** –

TYPE OF BORING: SPIRAL FLIGHT AUGER TO 0.8m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS: S = STANDARD PENETRATION TEST

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plasitc limit (%)

CHECKED:
Initials: AGS
Date: 7/98

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TEST BORE REPORT

CLIENT: HUGHES TRUEMAN REINHOLD
PROJECT: ROYAL HALL OF INDUSTRIES
LOCATION: DRIVE AVE, MOORE PARK

DATE: 14 JULY 98
PROJECT No.: 24967
SURFACE LEVEL:

BORE No. 7
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Test Results	Core Recovery %
0					
0.04	BITUMINOUS PAVEMENT				
	ROADBASE – sandy crushed rock with maximum particle size 20mm	B	0.3		
0.5	FILLING – grey, brown, gravelly clayey sand		0.5	2,3,3 N=6	
0.6	FILLING – sand, sandy clay, gravel, coke and ash	S			
			0.95		
1		A	1.2		
			1.5	2,25/100mm ref	
		S			
1.7					
1.75	SANDSTONE – extremely low strength, extremely weathered, grey brown sandstone		1.75		
	TEST BORE DISCONTINUED AT 1.75 METRES				
2					

RIG: SCOUT **DRILLER:** DRIVER **LOGGED:** HOLY **CASING:** –

TYPE OF BORING: SPIRAL FLIGHT AUGER TO 1.75m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS: S = STANDARD PENETRATION TEST

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plasitc limit (%)

CHECKED:
Initials: ACT
Date: 7/98

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TEST BORE REPORT

CLIENT: HUGHES TRUEMAN REINHOLD
PROJECT: ROYAL HALL OF INDUSTRIES
LOCATION: DRIVE AVE, MOORE PARK

DATE: 14 JULY 98
PROJECT No.: 24967
SURFACE LEVEL:

BORE No. 8
SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Test Results	Core Recovery %
0					
0.04	BITUMINOUS PAVEMENT				
	ROADBASE – sandy crushed rock with maximum particle size 20mm				
0.2	FILLING – sandy clay, sand, gravel and coke				
0.3	FILLING – crushed sandstone (Drillers' description)	B	0.3		
0.5	FILLING – sandy clay, sand, gravel, ash and glass	S	0.5	4,25/150mm ref	
0.8	SANDSTONE – extremely low to very low strength, extremely weathered, grey brown, medium grained sandstone	A	0.8 1.2		
1					
1.3	TEST BORE DISCONTINUED AT 1.3 METRES				
2					

RIG: SCOUT **DRILLER:** DRIVER **LOGGED:** HOLY **CASING:** –

TYPE OF BORING: SPIRAL FLIGHT AUGER TO 1.3m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS: S = STANDARD PENETRATION TEST

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plasitc limit (%)

CHECKED:
Initials: AGF
Date: 7/98

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TEST BORE REPORT

CLIENT: HUGHES TRUEMAN REINHOLD
PROJECT: ROYAL HALL OF INDUSTRIES
LOCATION: DRIVE AVE, MOORE PARK

DATE: 14 JULY 98
PROJECT No.: 24967
SURFACE LEVEL:

BORE No. 9
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Test Results	Core Recovery %
0	BITUMINOUS PAVEMENT				
0.15	ROADBASE – sandy crushed rock with maximum particle size 20mm	B	0.3		
0.4	FILLING – crushed sandstone (Drillers' description)				
0.5	FILLING – sandy clay/clayey sand, sand, gravel and ash		0.5	4,3,14 N=17	
0.7	SANDSTONE – extremely low strength, extremely weathered, grey, medium grained sandstone	S			
1			0.95		
1.2	TEST BORE DISCONTINUED AT 1.2 METRES – auger refusal				
2					

RIG: SCOUT **DRILLER:** DRIVER **LOGGED:** HOLY **CASING:** –

TYPE OF BORING: SPIRAL FLIGHT AUGER TO 1.2m

GROUND WATER OBSERVATIONS: NO FREE GROUNDWATER OBSERVED

REMARKS: S = STANDARD PENETRATION TEST

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	M Moisture content (%)
B Bulk sample	pp Pocket Penetration (kPa)
D Disturbed sample	Ux x mm dia. tube
HV Hand Vane	Wp Plasitc limit (%)

CHECKED:
Initials: AJT
Date: 7/98

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Borehole Log

Location **TP1**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	20.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 1.6m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.2			Concrete Slab		D		
				Gravelly SAND: Brown/dark brown with inclusions of rock (Gravels)	D	L	0.5 1.0 (A+B)	Filling materials
	1.2							
				SANDSTONE: White/yellow coarse grained, Medium hardness.		D	1.5	Natural Bedrock
	1.6			Refusal 1.6m				

Notes:

Test Pit Log

Location **TP2**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	20.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 4.0m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.2			Concrete Slab				
	0.5			Second Conrete Slab		D		
				SAND: Brown/dark brown		L	0.7	Filling materials
	2				D		2	
				SANDSTONE: White/yellow coarse grained, Medium hardness.		D	2.5 3	Natural Bedrock
	4			Terminated 4.0m				

Notes:

Test Pit Log

Location **TP3**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	20.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 6.0m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.3			Concrete Slab		D		
	0.7			Sandy FILL: Brown		L	0.5	
	5.5			Sandy FILL: Dark brown/black		L	1 2 3 4 5	Filling Materials
	6			SANDSTONE: White/yellow coarse grained, Medium hardness.		D		Natural Bedrock
				Terminated 6.0m				

Notes:

Test Pit Log

Location **TP4**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	20.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 5.5m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.2			Concrete Slab		D		
	0.7			Sandy Gravelly FILL: Brown with inclusions of Brick, Terracotta			0.5	
	1.2			Sandy Gravelly FILL: Dark brown, fine to coarse gravels			1	
	4			SAND: Black with trace amounts of glass, brick, metal	D	L	2 3 4	Filling Materials
	6			SANDSTONE: White/yellow with minor amounts of clay, Harder towards 5.5m		D	5 6	Natural Bedrock
				Terminated 6.0m				

Notes:

Test Pit Log

Location **TP5**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	20.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 2.1m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
	0.15			Concrete Slab		D		
				Sandy Gravelly FILL: Brown with inclusions of Brick, Terracotta	D	L	1	Filling Material
	1.5							
				SAND: Yellow, coarse grained				Natural
	1.8							
				SANDSTONE: White/yellow coarse grained, Medium hardness.		D	2.0 (A+B)	Natural Bedrock
	2.1			Terminated 2.1m				

Notes:

Test Pit Log

Location **TP6**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	20.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 2.0m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.2			Concrete Slab		D		
				Sandy Gravelly FILL: Brown with inclusions of Brick, Terracotta, Fine to coarse gravels	D	L	0.5	Filling Materials
	1.4							
				SAND: Yellow, coarse grained			1.5	Natural
	1.7							
				SANDSTONE: White/yellow coarse grained, Medium hardness.		D		Natural Bedrock
	2						2	
				Terminated 2.0m				

Notes:

Test Pit Log

Location **TP7**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	21.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 2.0m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.2			Concrete Slab	D			
	0.4			Second Concrete Slab				
	0.6			Sandy FILL: Brown			0.5	
	1.1			Sandstone FILL: Yellow/ orange	D	L	1	Filling Materials
	1.5			Sandy FILL: Brown				
	2			SANDSTONE: White/yellow coarse grained, Medium hardness.		D		Natural Bedrock
				Terminated 2.0m				

Notes:

Test Pit Log

Location **TP8**

Client:	Sydney Swans Limited	Job Type:	Land Suitabilty
Project No:	0478061	Address:	1 Driver Avenue, Moore Park
Date:	21.9.2018	Logged By:	AR + MJ
Contractor:	BG Drilling	Method:	100mm Augar
Hole Size	100mm$^{\phi}$ X 5.0m	Co-ordinates:	N/A

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
Solid Flight Auger	0.2			Concrete Slab		D		
				Sandy FILL: Brown	D	L	1 2.0 (A)	Filling Materials
	2.5			Sandy FILL: Brown with inclusions of white sand. Increased amounts of foreign materials			3 4	
	4.5			SANDSTONE: White/yellow coarse grained, Medium hardness.		D	5	Natural Bedrock
	5			Terminated 5.0m				

Notes:

Appendix E

Results of Laboratory Tests

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

CERTIFICATE OF ANALYSIS 213873

Client Details

Client	Douglas Partners Pty Ltd
Attention	Matthew Bennett
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**86724.00, Sydney Swans HQ & Community Centre**
Number of Samples	4 Soil
Date samples received	20/03/2019
Date completed instructions received	20/03/2019

Analysis Details

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

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

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

Report Details

Date results requested by	27/03/2019
Date of Issue	26/03/2019

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

Results Approved By
Nick Sarlamis, Inorganics Supervisor

Authorised By

Jacinta Hurst, Laboratory Manager

Misc Inorg - Soil					
Our Reference		213873-1	213873-2	213873-3	213873-4
Your Reference	UNITS	BH102/4.9-5.0	BH106/0.9-1.0	BH107/1.9-2.0	BH115/1.9-2.0
Date Sampled		06/03/2019	07/03/2019	07/03/2019	11/03/2019
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	22/03/2019	22/03/2019	22/03/2019	22/03/2019
Date analysed	-	22/03/2019	22/03/2019	22/03/2019	22/03/2019
pH 1:5 soil:water	pH Units	5.0	7.4	6.0	7.6
Electrical Conductivity 1:5 soil:water	µS/cm	78	260	50	15
Chloride, Cl 1:5 soil:water	mg/kg	<10	20	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	27	190	36	<10

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

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	213873-3
Date prepared	-			22/03/2019	1	22/03/2019	22/03/2019		22/03/2019	22/03/2019
Date analysed	-			22/03/2019	1	22/03/2019	22/03/2019		22/03/2019	22/03/2019
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	5.0	4.9	2	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	78	91	15	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	10	0	92	99
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	27	29	7	91	129

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.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No: 86724.00	**Suburb:** Moore Park	**To:** ELS	
Project Name: Sydney Swans HQ & Community Centre	**Order Number**		
Project Manager: Matthew Bennett	**Sampler:** LT	**Attn:** Aileen Hie	
Emails: matthew.bennett@douglaspartners.com.au		**Phone:**	
Date Required: Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑		**Email:** Ahie@envirolab.com.au	
Prior Storage: ☑ Esky ☑ Fridge ☑ Shelved	Do samples contain 'potential' HBM? Yes ☐	No ☑ (If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
							Cl	Sulphate	pH	EC				
BH102/4.9-5.0m	1	6/3/19	S	G			X	X	X	X				Sandy clay.
BH106/0.9-1.0m	2	7/3/19	S	G			X	X	X	X				Clayey sand filling
BH107/1.9-2.0m	3	7/3/19	S	G			X	X	X	X				sand
BH115/1.9-2.0m	4	11/3/19	S	G			X	X	X	X				Sandstone.

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

Job No: 213873
Date Received: 20.3.19
Time Received: 13:25
Received by:
Temp: Cool/Ambient 10.3°C
Cooling: Ice/Ice-pack
Security: Intact/Broken/None

PQL (S) mg/kg	**ANZECC PQLs req'd for all water analytes** ☐
PQL = practical quantitation limit. If none given, default to L .	**Lab Report/Reference No:**
Metals to Analyse: 8HM unless specified here:	
Total number of samples in container: 4 **Relinquished by:** MB	**Transported to laboratory by:**
Send Results to: Douglas Partners Pty Ltd **Address:** 96 Hermitage Rd, West Ryde, 2114	**Phone:** 9809 0666 **Fax:** 9809 4095
Signed: **Received by:**	**Date & Time:** 20.3.19 13:25