Douglas PARTNERS

GROUNDED EXPERTISE

Report on Geotechnical Investigation

Sports and Aquatic Centre

84, 86 and 90-98 The Boulevarde, Strathfield NSW

Prepared for Santa Sabina College

DP Project No. 224188.00

SEARs Application No. SSD-68054209

August 2024

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

Signature	Date
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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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Report on Geotechnical Investigation
Sports Centre Development
84, 86 and 90-98 The Boulevarde, Strathfield NSW

1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed Sports and Aquatic Centre within the Santa Sabina College (SSC) – Senior Campus, at 84, 86 and 90-98 The Boulevarde, Strathfield NSW. The investigation was commissioned in an email dated 25 September 2023 by Ryan Kang of Stantec Australia Pty Ltd and was undertaken in accordance with Douglas Partners' proposal 224188.00.P.001.Rev1 dated 19 September 2023.

Douglas has been commissioned by Santa Sabina College to prepare this report in accordance with the following technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD-68054209) for the proposed Sport and Aquatic Centre at Santa Sabina Senior School, 84, 86 and 90-98 The Boulevarde, Strathfield:

- ***Ground Conditions (SEARs item 12): "Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site, including soil erosion, salinity and acid sulfate soils."*** This report considers soil and rock conditions on the development site as relevant to the proposed development. Data and comments relating to this item are provided in Sections 3 to 8, as relevant; and
- ***Ground and Water Conditions (SEARS item 12): "Provide a Surface and Groundwater Impact Assessment that assesses potential impacts on surface water resources (quality and quantity) including related infrastructure, hydrology, dependent ecosystems, drainage lines, downstream assets and watercourses, and groundwater resources in accordance with the Groundwater Guidelines."*** This report does not address the surface water assessment. It is understood that Stantec's Stormwater Management Plan will address surface water impacts. Data and comments in relation to groundwater with respect to the proposed development are provided in Sections 3 to 8, as relevant. Water quality data is presented in Douglas' report on contamination assessment (Ref. 224188.01.R.002.Rev3 dated August 2024).

The investigation included the drilling of fifteen boreholes, the excavation of two test pits, installation of three groundwater monitoring wells, in situ testing and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on design and construction practice, for the current proposed development.

The investigation was undertaken in conjunction with a contamination assessment of the development site which is reported separately in Douglas Report 224188.01.R.002.Rev3 dated August 2024.

2. Project Understanding

Douglas understand that the project comprises demolition and enabling works as well as the construction of a sport and aquatic centre, basement car parking, landscaping and services. The proposed sport and aquatic centre to the west of the existing oval comprises the following:

- Demolition of the existing outdoor courts, changing rooms, pool and car park to the north of the maintenance shed;
- Construction of a new sports centre, of 2,775 m^2 ground floor area (GFA) building and aquatic centre (213 m^2 GFA) including:
  - Main entrance and foyer area;
  - 3 x indoor multipurpose sports courts / hall;
  - Covered promenade to the south of the sports centre, connecting the 1967 Centenary building;
  - Lift and stairs from the car park level;
  - Sports offices;
  - Staff bathrooms;
  - Student amenities - bathrooms / changerooms;
  - Gym;
  - Sports offices;
  - Storage and building services;
  - Basement car park including 77 car spaces, accessible from the existing vehicle entry/exit on Jersey Road. It is understood that the proposed building sits on gently sloping ground that needs be retained by the basement carpark structure. The basement level is understood to have a finished floor level of RL 16.6 m, relative to the Australian Height Datum (AHD), where maximum basement excavation depths will be approximately 3 m. Further excavation will likely be required for footings, service pits, lift pits etc.;
  - Heated outdoor swimming pool with seating areas. It is understood the existing pool will be demolished and re-oriented. It is expected that the area will require localised backfilling following demolition of the existing pool, and excavation for the new pool. The proposed pool is understood to have a finished level of RL 18.18 (AHD), where maximum excavation depths will be approximately 2.8 m ;
  - Changing areas and amenities; and
  - Landscaping works.
- Demolition of the existing Siena Hall is also proposed as the facility is no longer fit for purpose. The demolition will also open up the view lines and setting of the 1927 building to the south. Landscaping works are proposed where the hall is removed.

3. Site Description

The site is located at 84, 86 and 90-98 The Boulevarde, Strathfield, within the Burwood Local Government Area (LGA). The site comprises multiple parcels of land and is legally described as:

- Lots 1 and 2 DP 456966;
- Lots 1 and 2 DP 2791;
- Lot A DP 388128;
- Lot 10, 11 and 12 DP1297911;
- Lot 1 DP 938889; and
- Lot 1 DP 307088.

'The site' refers to the broader Santa Sabina College (SSC) land described as Lots 1 and 2 in DP2791, Lot 1 & 2 in DP456966, Lot A in DP 388128, Lot 10, 11 & 12 in DP1297911, Lot 1 in DP938889 and Lot 1 in DP307088. The street address is 84, 86 and 90-98 The Boulevarde, Strathfield.

The 'Development site' comprises the land whereby all works that form part of the SSDA are proposed and is confined to two areas of the site. The development site is bounded by the blue outline in Figure 1 below. The relevant legal description for the development site is Lot A DP388128, Lot 12 DP1297911 and Lot 2 DP2791.

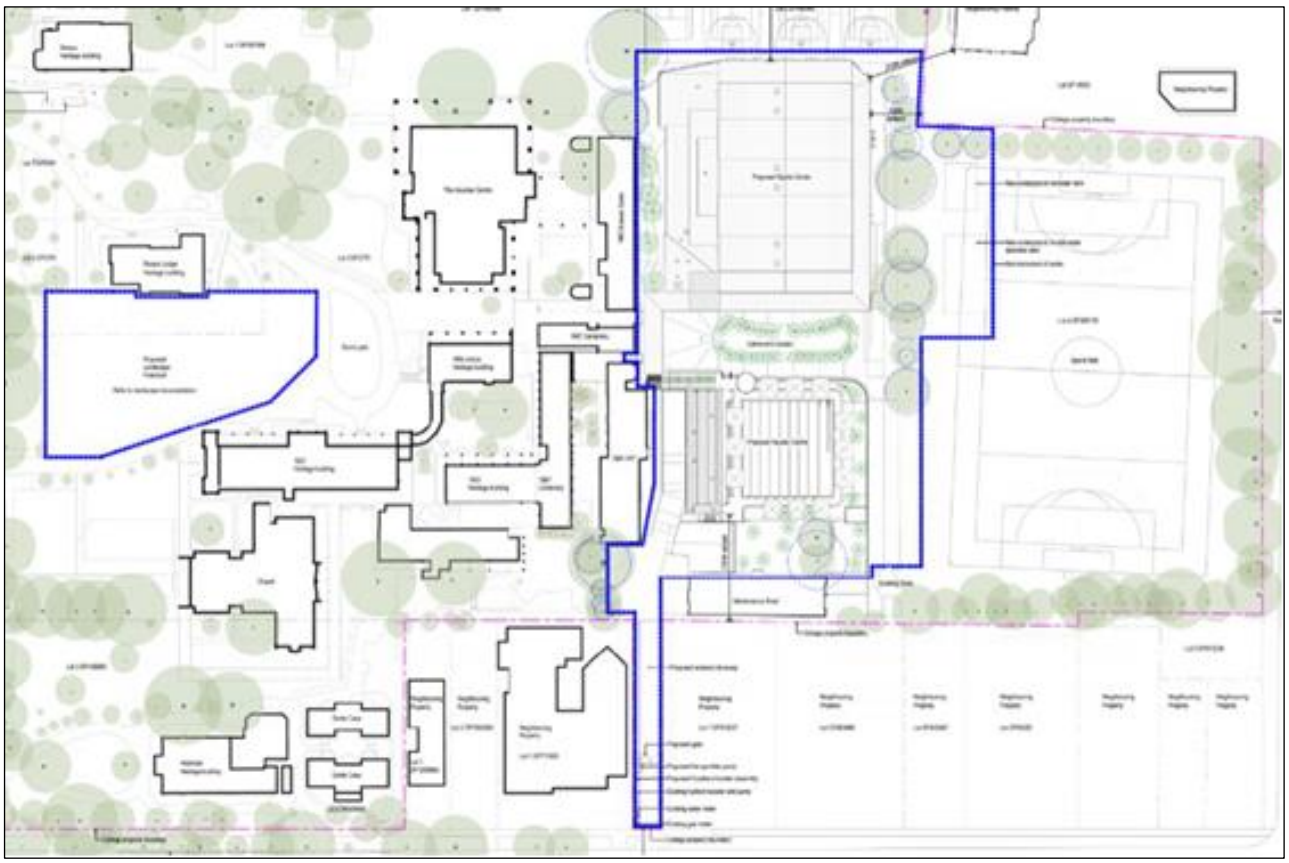

Figure 1: The proposed development site (Source: Pier Property Corporation)

Key Features of the site are as follows:

- Given its use as an existing school, the site itself is relatively level with a slight fall to the north. The proposed aquatic and sports centre is currently higher than the ovals to the east and north;
- The site accommodates the existing Santa Sabina College Senior Campus which includes year 7 to 12 students with the northern portion of the site accommodating year 5 and 6 students. Given its existing land use as a school, the site is highly urbanised with a number of existing buildings and facilities to enable the functioning of the school;
- Pedestrian access to the site is via the main entrance on The Boulevarde and from the pedestrian entrance on Jersey Road. Goods delivery and staff vehicle access to the site is via the laneway accessible via Jersey Road;
- The entire site (apart from the two lots at 84-86 The Boulevarde) is a local heritage item (No. I205), named: *Santa Sabina Convent ("Holyrood" Former Bank Façade, Main Convent Building and Grounds)*; and
- The site contains multiple existing trees predominately around the perimeter of the site, however some substantial trees are located more centralised on school ground.

Key features of the locality:

- The site is located approximately 15 km west of the Sydney Central Business District and 15 km east of the Parramatta Central Business district. The site is also approximately 500 m to the south of the Strathfield town centre, within easy walking distance; and
- The site is adjacent to regular bus services on The Boulevarde and approximately 600 m from Strathfield railway station.

The surrounding locality is described as follows:

- North: The site is bounded by Russell Lane and medium density residential apartments to the north.
- East: Immediately east of the site is Wentworth Road. To the east of Westworth Road is predominately medium density housing (3 storey walk ups.). A multi storey (~8 storeys) residential building is located to the north of the oval in the east of the site and is the tallest element immediately adjoining the site.
- South: Goondee Aged Care is located directly adjacent to the south of the site with Jersey Road and a number of residential dwellings located further south. Jersey Road also contains the Campus' drop off and pick car spaces.
- West: The Boulevarde is located immediately west of the site. Further west are a number of low-medium density residential dwellings to the west and south. To the north west of the site is the Santa Sabina Junior Campus.

The ground surface across the development site gently slopes downwards in a north to north-easterly direction, with levels typically ranging between about RL 18 m and RL 16 m AHD. There are several abrupt changes in slope associated with retaining walls and batter slopes across the site to accommodate changes in levels around the existing buildings. Typical conditions of the development site are shown in Figure 3 below.

Figure 2: View of the development site, looking north

The development site was accessible via an asphalt driveway that connects to Jersey Road on the southern side of the school. To the south of the investigation area, within the school property, was a swimming pool with change room and brick building. The south-eastern section of the investigation area was occupied by an on-grade carpark and two small buildings. The northern portion of the investigation area was occupied by an open space playing field and tennis courts. These areas are relatively level which may indicate previous cut and fill to create a level surface. The existing school buildings are typically one to two storeys and are constructed of brick. The 1994 VAT building comprises a lower-level basement. The recent investigations confirmed the presence of fill in these areas.

4. Regional Mapping

4.1 Geology

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the development site is underlain by Ashfield Shale. The Ashfield Shale typically comprises dark grey shale, laminite and siltstone which usually weathers to form a moderately deep residual clay profile. The predominantly shaly rock is typically closely bedded and contains an orthogonal pair of steeply dipping (70° to 90°) joint sets typically striking NNE and ESE and spaced at 0.5 m to 5 m. Randomly oriented, 30° to 45° dipping slickensided joints are also ubiquitous.

The results of the recent field work for the present investigation were consistent with the published geological mapping.

4.2 Soil Landscape

Reference to the Sydney 1:100,000 Soils Landscape Sheet indicates that bedrock at the development site is overlain by residual soils of the Blacktown group. These typically comprise shallow to moderately deep, moderately reactive clay soils. The results of the field work indicated that filling is present across much of the development site, with natural clay soils present between the filling and bedrock, at the borehole locations.

4.3 Hydrogeology

No registered groundwater bores are located within 1 km of the development site. The nearest bores are for monitoring purposes. The nearest surface water body is Powells Creek, parts of which are culverted. Powells Creek is located approximately 650 m north-west of the development site and connects to the Parramatta River at Homebush Bay. Based on the geology and topography of the development site, surface and groundwater are expected to flow in a northerly direction, possibly toward Powells Creek.

The geology and topography of the development site suggests that the regional groundwater table is in the underlying rock. Ephemeral seepage from perched water would be expected from along the top of bedrock and through joints and bedding planes within the rock itself. Seepage volume would be expected to be low and vary with climatic events.

4.4 Groundwater Dependant Ecosystems (GDEs)

A review of the Bureau of Meteorology Groundwater Dependant Ecosystems Atlas indicates that there are no aquatic, subterranean or terrestrial GDEs within 1 km of the development site. The closest GDE to the development site is approximately 5 km west which comprises a moderate potential for terrestrial GDE (Cumberland Shale Plains Woodland, vegetation).

4.5 Acid Sulfate Soils

Reference to the 1:25,000 Acid Sulfate Soils (ASS) Risk map indicates that the development site is within an area of no known occurrence of acid sulfate soils. The nearest mapped 'high probability of occurrence' of ASS is in Powells Creek, which is approximately 2.6 km north-west of the development site. Given the elevation (RL 20 m) and the known geology of the development site, it is expected that acid sulfate soils are not present on the development site.

The development site is also mapped as being Class 5 with reference to the Burwood Local Environmental Plan 2012 Acid Sulfate Soil maps. Reference to the NSW Planning and Environmental portal, indicates that acid sulfate soils are not typically found in Class 5 category areas.

Additionally, acid sulfate soils typically do not form above RL 5 m.

4.6 Salinity

Regional mapping of salinity potential in Western Sydney was undertaken in 2002 by the former Department of Infrastructure, Planning and Natural Resources, now the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW). The development site is located outside the mapped area of salinity potential.

Reference to the NSW DCCEEW information system eSPADE[1], indicates that soils in the surrounding area have shown 'no salting evident' within available soil profiles.

5. Field Work

5.1 Field Work Methods

The field investigations were conducted on 3 to 6 October 2023 in the presence of a geotechnical engineer from Douglas. The investigations included a combined fifteen geotechnical and environmental boreholes (Bores 02 – 16) and two test pits to expose existing footings of nearby buildings. BH01 was excluded from the investigation due to access limitations and the proximity of existing underground services.

Ground Penetrating Radar (GPR) and electronic scanning for buried services were carried out prior to drilling. Due to the proximity to existing services, several boreholes were limited to non-destructive drilling and the use of hand tools only.

Non-destructive drilling (NDD) methods were carried out at Bores 2 to 5 and Test Pits 1 and 2. Coring was initially undertaken using a 150 mm diameter 'Diacore' barrel to penetrate through the asphalt and concrete surface at each test location. Disturbed sampling was carried out at various depth intervals using a hand auger. The boreholes were taken to a termination depth of between 1.3 m and 1.7 m to refusal on concrete fill. Test Pits 1 and 2 were terminated at depths of 0.95 m and 1.0 m, respectively.

Eight boreholes (Bores 07 to 09 and 12 to 16) were drilled using a truck mounted drilling rig. The boreholes were drilled to the top of very low strength rock at depths in the range of 2.65 m to 3.6 m using solid flight augers and rotary wash-boring techniques.

During auger drilling, Standard Penetration Tests (SPTs) were carried out at regular depth intervals within Bores 07 to 09 and 12 to 16 to assess the in situ strength of the soil material. Soil samples were recovered from SPT split tubes and auger cuttings for subsequent laboratory testing. Three dynamic cone penetrometer (DCP) tests were also conducted in Bores 2, 6 and 10. In these tests a cone tipped steel rod was driven into the ground using a standard weight hammer dropping a standard distance. The number of blows required to drive the rod each 150 mm into the ground was recorded and used to assess the in situ strength of the soils. The DCPs were terminated at depths in the range of 1.4 m to 1.8 m. Refusal will occur on the top of rock but may also occur on gravel or boulders within the soil profile, so gives an indication of the depth of rock but does not prove it.

Bores 12 to 14 and 16 were then continued into the underlying rock using NMLC diamond core drilling techniques to obtain continuous core samples of the rock to depths in the range of 7.8 m to 12.6 m. The rock cores recovered from the boreholes were returned to the Douglas office where they were photographed and Point Load Strength Index ($Is_{(50)}$) tests were carried out on selected samples. The results of the Point Load Strength Index tests are presented on the accompanying logs.

[1] https://www.environment.nsw.gov.au/eSpade2Webapp/

Groundwater monitoring wells were installed in Bores 12, 13 and 16, following the completion of drilling to depths in the range of 9 m to 12.6 m. The wells were constructed using 50 mm diameter machine slotted Class 18 uPVC screen and casing. The wells were completed with a flush mount "Gatic" cover. Construction details of the standpipe piezometers and initial water level readings are included in the attached borehole logs in Appendix C. Following installation, the wells were purged dry of drilling fluids using a bailer and left to recharge.

A follow-up visit was undertaken to obtain groundwater levels at each standpipe location and to perform rising head permeability tests, which involve either artificially dropping (e.g. by pumping) water levels within the standpipe and measuring the time for water levels to return to near original levels. Low flow groundwater sampling was also undertaken at Bores 12 and 16 for subsequent groundwater quality testing purposes.

All boreholes and test pits were backfilled with spoil upon completion and reinstated with fill, asphalt, or concrete (where required). Wells were completed with a flush mount "Gatic" cover. The locations of the boreholes and wells are shown on Drawing 1 in Appendix B. The coordinates and surface levels at the test locations were determined using a dGPS which is typically accurate to within 0.1 m.

5.2 Field Work Results

Details of the subsurface conditions encountered are given in the borehole logs in Appendix C. Notes explaining descriptive terms and classification methods used are given in Appendix A.

Based on the results of the geotechnical investigation, the sequence of subsurface materials encountered at the development site, in increasing depth order, is summarised below.

- FILL: gravelly/silty/clayey sand, silty clay and clay varying in depths of between 0.4 m and 1.7 m with varying proportions of rootlets, ash and sandstone gravel. It should be noted that refusal occurred within fill (on concrete) at locations BH03 to BH05, possibly due to encased services;
- RESIDUAL: stiff to hard silty clay/clay to depths of between 1.2 m and 2.5 m; and
- BEDROCK: generally very low to low strength shale becoming low to medium strength below depths of between 5.5 m and 5.8 m. Medium strength, slightly fractured, slightly weathered to fresh shale was typically encountered from depths of between 6.3 m and 8.0 m to the base of the boreholes.

5.3 Existing Footings

Douglas excavated two test pits (TP01 and TP02) on the western side of the existing pool building. The work was conducted in the presence of a geotechnical engineer on 3 October 2023. Reference should be made to the footing exposure drawings (Drawings 3 and 4) provided in Appendix B. A summary of the observations made during the footing exposures is provided in Table 1 below.

It should be noted that Douglas has not assessed the structural capacity of the existing footings. If the existing footings are required to carry additional loading then the structural engineer would need to assess the load carrying capacity of the existing footings and associated settlement and differential settlements as results of the additional loads. Douglas can assist with this if required.

Table 1: Summary of Footing Exposures

Test Pit ID	Inferred Footing Type	Depth to Base of Footing Below Surface (m)	Apparent Footing Condition	Material Exposed Below the Base of Footing
TP01	Strip Footing	0.50	No visible signs of damage observed	Fill (gravel/cobbles), over Clay
TP02	Strip Footing	0.55	No visible signs of damage observed	Clay, apparently in a stiff condition

The footing exposed in TP01 appeared to comprise a concrete footing founded on a layer of gravel (cobbles). It is possible that this filling may be weak concrete.

5.4 Groundwater

No free groundwater was encountered during auger drilling through the soil profile of the boreholes. The use of water for rotary drilling and coring prevented observations of groundwater within the rock at BH12 to BH14 and BH16. No major water loss was noted during rock drilling.

The groundwater monitoring wells installed within BH12, BH13 and BH16 were purged immediately after installation, and the groundwater levels measured at the completion of the investigation. Notably BH13 was dry following purging. A summary of the measured groundwater levels from this investigation and the previous investigation are provided in Table 2.

Table 2: Summary of Groundwater Measurements

Borehole	Surface RL (AHD)	Screen Depths (m)	Screened Lithology	Date of Reading	Measured Groundwater Depth (m)	Approximate Groundwater RL (AHD)
BH12[(1)(2)(3)]	17.2	1.5-5.0	Clay and Shale	31 October 2023	3.37	13.83
BH13[(1)(3)]	17.1	1.5-5.0	Clay and Shale	31 October 2023	-	-
BH16[(1)(2)(3)]	20.6	2.5-6.0	Clay and Shale	31 October 2023	2.76	17.84

Notes to Table:

(1) Well was purged on 25 October 2023

(2) Rising head test carried out on 31 October 2023

(3) Standing water levels were measured using a data logger, following purging

It is expected that the regional groundwater table is relatively deep in the underlying rock. Seepage from perched groundwater is, however, expected to occur along the soil and rock interface and may also occur through fractured zones and joints in the rock. Seepage is likely to increase following periods of extended wet weather. It should be noted that groundwater levels are transient and water levels are likely to fluctuate following periods of extended wet weather.

5.5 Permeability Testing

Rising head permeability tests were carried out in the wells of BH12 and BH16 on 31 October 2023. This was carried out by purging the well then measuring the rise in water level at regular time intervals using a data logger. Permeability results are presented in Table 3. The detailed results of the permeability tests are attached in Appendix C.

Table 3: Interpreted Permeability Results

Well ID	Material Types within Screen Interval	Calculated Permeability (m/s)
BH12	Clay and underlying weathered shale	2.2×10^{-7}
BH16	Clay and underlying weathered shale	7.1×10^{-9}

6. Laboratory Testing

6.1 Laboratory Methods

Laboratory testing on soil samples was undertaken to determine:

- Soil salinity and aggressiveness for exposure classification of buried concrete and steel elements;
- Atterberg Limits, Linear Shrinkage, and Moisture Content for site classification;
- Shrink-swell testing for assessment of soil reactivity;
- Particle Size Distribution for soil classification;
- Emerson Aggregate Test and Exchangeable Sodium Percentage (ESP) for determination of erosion potential; and
- California Bearing Ratio testing for assessment of pavement subgrade strength.

6.2 Soil Laboratory Test Results

The results of the chemical and geotechnical laboratory testing are presented in Tables 4 to 8, respectively. The detailed laboratory test reports are given in Appendix D.

Table 4: Summary of ESP, Aggressivity, EC and pH Results

BH ID	Depth (m)	Material[1]	pH	EC (µs/cm)	Cl (mg/kg)	SO_4 (mg/kg)	Resistivity (ohm.cm)[2]	ESP (%)
BH02	0.3-0.5	Fill/Silty Clay	7.5	210	20	20	4,762	<1%
BH02	0.9-1.1	Fill/Silty Clay	4.6	120	-	-	-	-
BH03	0.5-0.7	Fill/Silty Clay	6.7	440	-	-	-	-
BH05	1.0-1.2	Fill/Silty Clay	4.6	390	340	310	2,564	17.0
BH08	0.7-0.9	Fill/Silty Clay	6.2	60	10	25	16,667	1.0
BH08	1.5-1.7	Silty Clay	4.5	150	-	-	-	-
BH12	0.8-1.0	Silty Clay	4.7	120	-	-	-	-
BH12	1.5-1.7	Silty Clay	4.6	210	47	350	4,762	18.0
BH15	0.8-1.0	Silty Clay	4.4	190	-	-		-
BH16	0.8-1.0	Silty Clay	4.9	56	<10	<10	17,857	3.0

Notes to table:

(1) Soil condition B – low permeability soils or all soils above groundwater (Refer to Table 6.4.2 (C) and 6.5.2 (C) in AS2159-2009)

(2) Calculated Resistivity by inversion of EC(1:5) = (1/EC)x(1x106)

EC = Electrical conductivity;

Cl = Chloride ion concentration;

S04 = Sulphate ion concentration

ESP – exchangeable Sodium Percentage

" – " denotes not analysed

Table 5: Results of Plasticity Characteristics Results

BH ID	Depth (m)	Material	LL (%)	PL (%)	PI (%)	LS (%)	Iss (%)
BH02	1.0-1.2	Silty Clay	73	26	47	18.0	-
BH05	1.0-1.2	Fill / Clay	62	27	35	15.5	-
BH08	1.5-1.7	Clay	70	27	43	17.5	-
BH12	0.7-2.0	Silty Clay	80	27	53	18.0	2.9
BH13	0.7-2.0	Clay	67	23	44	18.0	2.7
BH13	2.5-2.9	Clay	38	19	19	11.0	-
BH14	1.0-1.45	Clay	74	29	45	18.0	-
BH15	1.0-1.45	Clay	69	26	43	16.5	-
BH16	0.5-2.5	Clay	52	22	30	14.0	1.4

Notes:

LL = Liquid Limit

PL = Plastic Limited

PI = Plasticity Index

LS = Linear Shrinkage

Iss = Shrink Swell Index

Table 6: Results of Particle Size Distribution Tests

BH ID	Depth (m)	Material	Percentage Passing Nominated Sieves (%)		
			Gravel Fraction	Sand Fraction	Silt and Clay Fraction
BH02	0.4-0.6	Fill / Silty Clay	100	91	82
BH12	0.7-2.0	Silty Clay	100	92	85
BH13	0.7-2.0	Clay	100	91	83
BH16	0.5-2.5	Clay	100	83	64

Table 7: Results of Emerson Aggregate Tests

BH ID	Depth (m)	Material	Emerson Class
BH02	1.0-1.2	Silty Clay	6
BH05	1.0-1.2	Fill / Clay	2
BH12	0.7-2.0	Silty Clay	2
BH13	0.7-2.0	Silty Clay	2
BH14	1.0-1.45	Clay	6
BH16	0.5-2.5	Clay	2

Table 8: Summary of CBR Results

BH ID	Depth (m)	Material	CBR (%)	SMDD (t/m^3)	OMC (%)	FMC (%)	Swell (%)
BH12	0.7-2.0	Silty Clay	3.0	1.57	24.0	22.5	3.5
BH13	0.7-2.0	Clay	2.5	1.64	22.0	22.1	1.0
BH16	0.5-2.5	Clay	4.5	1.70	19.5	20.6	1.5

6.3 Rock Laboratory Test Results

Selected samples of the rock core obtained from BH12 to BH14 and BH16 were tested in the laboratory to determine the Point Load Strength Index ($Is_{(50)}$) values to assist with the rock strength classification. The results of the testing are shown on the borehole logs at the corresponding depths.

The $Is_{(50)}$ values for the rock have been used to estimate the Unconfined Compressive Strength (UCS) based on a UCS:$Is_{(50)}$ ratio of 20:1. It is noted that point load tests are not readily carried out on very low strength rock or highly fractured rock and hence strength classification of the weaker rock is based on visual/tactile assessments of the rock core only.

The $Is_{(50)}$ values of the rock cores from the investigation typically ranged from 0.08 MPa to 1.5 MPa, corresponding to a very low to high strength classification (inferred UCS ranging from 1.6 MPa to 30 MPa).

7. Proposed Development

Douglas understand that the project comprises demolition and enabling works as well as the construction of a sport and aquatic centre, basement car parking, landscaping and services. The proposed sport and aquatic centre to the west of the existing oval comprising the following:

- Demolition of the existing outdoor courts, changing rooms, pool and car park to the north of the maintenance shed;
- Construction of a new sports centre, of 2,775 m^2 ground floor area (GFA) building and aquatic centre (213 m^2 GFA) including:
  - Main entrance and foyer area;
  - 3 x indoor multipurpose sports courts/hall;
  - Covered promenade to the south of the sports centre, connecting the 1967 Centenary building;
  - Lift and stairs from the car park level;
  - Sports offices;
  - Staff bathrooms;
  - Student amenities - bathrooms/changerooms;
  - Gym;
  - Sports offices;
  - Storage and building services;
  - Basement car park including 77 car spaces, accessible from the existing vehicle entry/exit on Jersey Road. It is understood that the proposed building sits on gently sloping ground that needs be retained by the basement carpark structure. The basement level is understood to have a finished floor level of RL 16.6 m, relative to the Australian Height Datum (AHD), where maximum basement excavation depths will be approximately 3 m. Further excavation will likely be required for footings, service pits, lift pits etc.;
  - Heated outdoor swimming pool with seating areas. The existing pool will be demolished and re-oriented. It is expected that the area will require localised backfilling following demolition of the existing pool, and excavation for the new pool. The proposed pool is understood to have a finished level of RL 18.18 (AHD), where maximum excavation depths will be approximately 2.8 m ;
  - Changing areas and amenities; and
  - Landscaping works.
- Demolition of the existing Siena Hall is also proposed as the facility is no longer fit for purpose. The demolition will also open up the view lines and setting of the 1927 building to the south. Landscaping works are proposed where the hall is removed.

During excavation of the proposed sports centre basement, excavations are likely to be near or adjacent to existing services, infrastructure and/or structures.

No structural loads were provided at the time of preparing this report. Load carrying capacity of nearby footings did not form part of this assessment but will need to be confirmed as part of future investigations.

It is considered that from a geotechnical perspective the proposed excavation and development is feasible provided the recommendations outlined within this report are implemented, the project is appropriately designed, and sound engineering/construction practices are adopted.

8. Geotechnical Model

The investigated subsurface profile can be grouped into five geotechnical units. The interpreted depth and RLs at the top of the various units at each test location are shown in Table 9. Reference should be made to the borehole logs for more detailed information. It should be noted that the boreholes (BH02 to BH05) along the existing road alignment refused on concrete (i.e. possibly fill or an encased service line). These have been excluded from the geotechnical model.

Table 9: Summary of the Geotechnical Model

Stratum	Depth (m) to Top of Stratum (AHD)										
	BH06	BH07	BH08	BH09	BH10	BH11	BH12	BH13	BH14	BH15	BH16
Unit 1: Fill (Surface)	0 (18.2)	0 (16.9)	0 (17.4)	0 (18.2)	0 (20.7)	0 (21.3)	0 (17.2)	0 (16.8)	0 (18.9)	0 (18.1)	0 (20.6)
Unit 2: Residual Clay	0.3 (17.9)	0.4 (16.5)	1.3 (16.1)	0.7 (17.5)	N.E	1.0 (20.3)	0.7 (16.5)	1.0 (15.8)	0.7 (18.2)	0.4 (17.7)	0.4 (20.2)
Unit 3: Class V Shale	N.E.	2.6 (14.3)	2.7 (14.7)	2.7 (15.5)	N.E.	N.E.	2.7 (14.5)	2.8 (14.0)	2.6 (16.3)	2.6 (15.5)	2.7 (17.9)
Unit 4: Class IV Shale	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.	6.0 (10.8)	N.E.	N.E.	N.E.
Unit 5: Class III Shale (or better)	N.E.	N.E.	N.E.	N.E.	N.E.	N.E.	5.7 (11.5)	6.5 (10.3)	5.4 (13.5)	N.E.	7.0 (13.6)
Base of Borehole	0.8 (17.4)	2.7 (14.2)	2.8 (14.6)	2.8 (15.4)	1.6 (19.1)	1.2 (20.1)	10.4 (6.8)	9.0 (7.8)	7.8 (11.1)	2.7 (15.4)	12.6 (8.0)

Notes to Table:

N.E. = not encountered

A geotechnical cross-section (Section A-A') showing the interpreted subsurface profile is provided on Drawing 2 in Appendix B. The section shows the interpreted geotechnical divisions of the underlying fill, soil and rock, together with the current ground surface. It should be noted that the interpreted unit boundaries shown on the section are accurate at the borehole locations only.

Reference should be made to the borehole logs for more detailed information and descriptions of the soil and rock.

Groundwater was encountered at depths of 3.37 m (RL 13.83 m) and 2.76 m (RL 17.84 m) below surface levels in the monitoring wells BH12 and BH16, respectively. Notably, BH13 was dry following purging. The hydrogeology at the development site can be characterised by the following:

- Ephemeral seepage or 'perched' groundwater, expected to occur within the fill, higher permeability layers within the natural soils (e.g. clayey sand), and along the top of rock, particularly following periods of rainfall or due to human influences such as stormwater runoff and irrigation. Some ephemeral seepage may also migrate through defects within the rock; and
- Groundwater sources at the subject site are considered to be from water flowing downslope through the shale from areas of higher topography. These sources are expected to respond to climatic and weather variations, which would be expected to be reflected by natural fluctuations in groundwater levels.

The groundwater encountered at varying depths across the development site suggests the presence of temporary 'perched' groundwater, rather than a regional groundwater table. It should be noted that groundwater levels are transient and can fluctuate over time due to seasonal and climatic factors.

9. Comments

9.1 Site Preparation

The following site preparation measures are recommended in areas where filling to finished site levels is proposed:

- Excavate and remove any vegetation, oversize pieces (>100 mm), organic rich topsoil, existing fill and other building materials (e.g. brick and glass);
- Proof roll the exposed surface using a minimum 10 tonne smooth drum roller (preferable) in non-vibration mode. The subgrade should be rolled a minimum of six times with the last two passes observed by an experienced geotechnical engineer to detect any soft spots;
- After approval of testing, place approved fill such as site won clays in uniform layers not exceeding 300 mm loose thickness and compact each layer to a dry density ratio of at least 98% Standard, increasing to 100% Standard within the upper 0.3 m of the subgrade. Ensure each fill layer is appropriately tested by the geotechnical consultant to verify the required compaction criterion has been achieved;
- Some moisture conditioning (i.e. drying or wetting) may be required when reusing site won high plasticity clays for filling;
- The residual clays on site are derived from shale and are expected to be moderately to highly reactive to changes in moisture content. It is therefore important, when compacting site won clayey fill, to provide an upper limit on compaction and to keep the moisture content close to optimum (OMC) to limit the risk of future swelling;
- Testing should be undertaken in accordance with AS3798 (2007) "Guidelines on Earthworks for Commercial and Residential Structures"; and

- 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, particularly during and following periods of wet weather.

Complete removal and replacement of fill might not be a viable option for the project, although this approach would reduce the risk of unacceptable settlements of the fill.

If fill is imported to the development site then the engineering properties (e.g. plasticity, reactivity, CBR, etc.) should ideally be equivalent, or superior, to the existing materials on site.

From a geotechnical perspective, the existing predominantly clay fill (only) 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. Reference should be made to the contamination report (224188.01.R.002.Rev3 dated August 2024). All material re-use should be subject to the requirements of the contamination report.

9.2 Preliminary Site Classification

Controlled fill is defined in AS3798 (2007) "Guidelines on Earthworks for Commercial and Residential Structures" as fill inspected and tested by a GITA (Geotechnical Inspection and Testing Authority") to a Level 1 (full-time) standard so that "the GITA is able to express an opinion that the works (as far as it has been able to determine) comply with the specification and drawings". The current fill on site has no inspection or testing results and therefore cannot be considered controlled fill. Therefore, the existing fill on site is considered uncontrolled and should not be relied upon to support new structural loads.

Site classification, in accordance with AS2870 (2011) "Residential Slabs and Footings", indicates that areas with greater than 0.4 m of clayey fill are assigned a "P" classification, however, "a site with controlled fill and classified P may be given an alternative site classification if assessed in accordance with engineering principles".

If the fill is removed and replaced with controlled fill placed under Level 1 (full-time) testing conditions in accordance with the requirements of AS3798 then reclassification to "H2" classification is considered feasible in accordance with AS2870. See also site preparation advice in Section 8.1.

9.3 Excavation Conditions

It is understood bulk excavation for the basement is planned to be approximately RL 16.3 m AHD. The finished level for the pool is understood to be RL 18.18 (AHD). Excavations are expected to encounter concrete structures, fill and clay soils (Units 1 and 2), and possibly the upper part of Class V Shale (Unit 3). Based on the conditions encountered in the bores, it is expected that excavation should be readily achievable by hydraulic excavator. Excavation of the very low to low strength rock (Unit 3) should be achievable by rock bucket, assisted by light rock-breaking using hydraulic rock hammers. Excavation of medium strength shale (or stronger), if encountered, will require medium to heavy rock breaking and ripping equipment.

The use of rock breaking equipment will generally cause dust, noise and vibration that has the potential to affect adjacent sensitive infrastructure (i.e. services, existing structures) as well as pedestrians and occupants of nearby buildings.

Prior to excavation of the ramp, pool and basement, it will be necessary to determine the type, thickness and founding conditions of existing structures as well as footings and walls adjacent to the excavation (where required). This process is critical as demolition and excavation could potentially destabilise the walls and footings. Adjacent footings, depending on their founding level and foundation material, may require underpinning. If reliable and accurate records of the existing structure and adjacent footing types and foundation conditions are available, these records would assist in the preliminary assessment. It will also be necessary to determine if any services might be affected by the excavation.

Based on the current groundwater information, it is anticipated that seepage will generally occur from along the soil/rock interface and from bedding planes within the bedrock, where exposed. Seepage volumes are expected to be low but will vary with rainfall. During construction, any seepage should be readily controlled by the use of sump and pumps (or tremie pipes in pile excavations).

9.4 Trafficability

The exposed surface after excavation is expected to comprise either clayey fill/soil and or shale. These materials quickly deteriorate when they become wet and therefore do not provide a good working surface. Working platforms should be provided over the clay and shale and could comprise granular materials such as DGB, recycled concrete or ripped sandstone.

9.5 Disposal of Excavated Material

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the *Waste Classification Guidelines* (EPA, 2014) and recommendations carried out in the Douglas contamination report 224188.01.R.002.Rev3 dated August 2024.

9.6 Dilapidation Surveys

Dilapidation surveys (existing building condition) should be carried out on surrounding buildings close to the existing basement as well as footpaths, roads and any critical services adjacent to the development site boundaries. The dilapidation surveys should be undertaken before commencement of any demolition or excavation work in order to document any existing defects so that any claims for damage due to construction related activities can be accurately assessed.

9.7 Ground-borne Vibration

During demolition, it will be necessary to use appropriate methods and equipment to keep ground-borne vibration at adjacent buildings and structures within acceptable limits. For buildings, the level of acceptable vibration is dependent on various factors including the type of structure (e.g. reinforced concrete or brick structures etc.), its structural condition, the frequency range of vibration produced by the construction equipment, the natural frequency of the structure and the vibration transmitting medium.

Ground-borne vibration can be strongly perceptible to humans at levels above 2.5 mm/s vector sum peak particle velocity (VSPPV). This is generally much lower than the vibration levels required to cause structural damage to buildings. The Australian Standard AS2670.2 (1990) "Evaluation of human exposure to whole-body vibrations – continuous and shock induced vibrations in buildings (1-80 Hz)" indicates an acceptable day time limit of 8 mm/s VSPPV for human comfort.

Based on the experience of Douglas in Sydney and reference to AS2670.2, it is suggested that a maximum component PPVi of 8 mm/s be employed at this site for the adjacent buildings which are in good condition in order to reduce the risk of architectural damage and to address human comfort levels. This vibration limit should be reduced to a maximum component PPVi of 3 mm/s in the vicinity of the sensitive structures or buildings with sensitive equipment therein. The vibration limit is applicable at the foundation level of existing buildings/structures and may need to be modified following review of dilapidation surveys, vibration trials and/or proposed plant.

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial be undertaken at the commencement of demolition. The trial may indicate that smaller or different types of equipment should be used.

9.8 Groundwater

Water levels within the wells have been observed at depths of between 2.76 m (RL 17.84 m) and 3.37 m (RL 13.83 m) in the monitoring wells installed during the recent investigation. These readings are likely to represent perched water, which is commonly present at the soil/rock interface after periods of prolonged wet weather. It is expected that the regional groundwater table will be below the proposed bulk excavation. It is expected that the seepage from perched groundwater will occur along the top of the soil and rock interface and through joints and along bedding planes within the rock exposed in the basement floor and walls, particularly after wet weather.

Seepage volumes are expected to be low but will vary with rainfall. Seepage will be present both during excavation and for the life of the structure. Based on the footprint and depth of the two excavations, yearly seepage is unlikely to exceed 3 ML (seepage analysis will be required to predict the amount of inflow). On this basis, a drained basement may be considered for this site. It is recommended , however, that approval is obtained from Water NSW prior to designing and constructing a drained basement. The volume of groundwater ingress to the basement should be further assessed by additional investigation, groundwater monitoring and numerical modelling.

During construction, it is anticipated that seepage into the excavations (basement and aquatic centre) should be readily controlled by temporary perimeter drains, connected to a 'sump-and-pump' system. A drained basement will require permanent sub-floor drainage below the basement floor slab to direct seepage to a pump out system and into the stormwater drainage system, subject to Council approval.

The design of a drained basement will need to make provision for sub-floor drainage below the basement floor level to prevent hydrostatic pressures developing on the underside of the basement slab (and walls), and to direct seepage to the drainage system. This could comprise a minimum 100 mm thick, durable, open-graded, crushed rock with subsurface drains and sumps.

Previous experience in the area suggests that seepage will likely contain relatively high levels of soluble iron that will form a precipitate in the form of a gelatinous 'sludge' when exposed to oxygen. This 'sludge' has the potential to block sub-slab (gravel) drains and damage pumps. Therefore, detailing of sub-floor drains, sumps and pumps should incorporate provision for regular maintenance such as flushing and 'rodding' of drains and/or 'baffle' pits.

It is imperative that excavations for drainage trenches and sumps are not located within the zone of influence of foundations.

9.9 Excavation Support

Battering of the sides of the excavation is unlikely to be feasible where close to services or existing buildings with shallow footings etc. Batter slopes could be possible away from these locations but may be restricted.

9.9.1 Batter Slopes

Suggested temporary and permanent batter slopes for unsupported excavations up to a maximum height of 3 m, above the water table and without surcharge loads, are shown in Table 10. Batter slopes higher than 3 m will require analysis of each slope. If surcharge loads are applied near the crest of the slope, then analysis will be required and probably flatter batters or support may be required.

Table 10: Recommended Batter Slopes for Exposed Material

Material	Excavation Height (m)	Maximum Temporary Batter Slope (H : V)	Maximum Permanent Batter Slope (H : V)
Unit 1: Fill	≤ 3	1.5 : 1	2.5 : 1(1)
Unit 2: Residual Clay(2)	≤ 3	1 : 1	2 : 1(1)
Unit 3 and 4: Class IV/V Shale	≤ 3	0.75 : 1(3)	1 : 1(3)
Class III Shale	≤ 3	Vertical(3)	0.25 : 1(3)

Notes to Table:

(1) Permanent batters in fill and soil may need to be reduced to 3H: 1V to facilitate maintenance of grassed slopes, if required.

(2) Very stiff to hard clays are often fissured. Flatter slopes may be necessary in such clays and measures such as topsoiling and vegetating may also be necessary to resist erosion.

(3) Subject to jointing assessment by experienced Geotechnical Engineer/Engineering Geologist

Temporary batters should be protected in the short term from erosion caused by heavy rain. Shotcrete with dowels and weepholes or strip drains may be considered to protect the slope face. This will have to be investigated further during detailed design. Any temporary slopes should be inspected for signs of instability on a regular basis by a geotechnical engineer. Steeper slopes reinforced with soil nails and a structural facing may be considered where there are space constraints.

Shale/siltstone is expected to deteriorate and breakdown if left exposed to weather. Any rock faces exposed over the long term should be covered with mesh reinforced shotcrete pinned to the face with dowels.

9.9.2 Retaining/Shoring Systems

Where temporary batter slopes cannot be adopted, excavations will require temporary support through construction of an anchored, propped, or cantilevered pile shoring wall using soldier piles with infill panels or contiguous piles. Permanent support should be provided by the building structure.

Design pressures for retaining walls should consider the requirement to limit movement of the surrounding ground and adjacent structures and to ensure an adequate factor of safety is maintained against failure (for temporary and permanent retaining walls).

The design of cantilevered shoring systems (or shoring systems with one row of restraint (i.e. ground anchors or props) may be based on a triangular earth pressure distribution using the parameters presented in Table 11. 'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable. 'At rest' earth pressure coefficient (K_o) values should be used where wall movement needs to be limited (i.e. adjacent to existing structures or utilities). Note that cantilevered walls are generally associated with relatively high lateral deflections or movements in towards the excavation and should not be used where wall movement needs to be limited or for the support of excavations more than 3 m deep.

Table 11: Recommended Design Parameters for Shoring Systems

Unit	Material	Unit Weight (kN/m³)	Earth Pressure Coefficient			Effective Cohesion c' (kPa)	Effective Friction Angle (Degrees)
			Active (K_a)	At Rest (K_o)	Passive (K_p)		
1	Fill	20	0.4	0.6	-	2	25
2	Residual Soil	20	0.3	0.45	3.3	5	25
3/4	Class IV/V Shale	21	0.2	0.3	400^	10	28
5	Class III Shale	22	0*	0*	2000*^	20	28

Notes:

The values above assume a level surface behind the wall.

* It is assumed that the rock mass is free of adverse dipping joints and seams.

^ Ultimate passive pressure

The design of the shoring should allow for all surcharge loads applied as a rectangular earth pressure distribution, including existing (or future) building footings, inclined slopes behind the wall, traffic, site sheds, and construction related loads.

The earth pressure loading described above does not include either earthquake loads or hydrostatic pressures. Unless positive drainage measures are incorporated to prevent water pressure build-up behind the walls, full hydrostatic head should be allowed for in design.

Detailed design of shoring walls should be undertaken using a computer program such as WALLAP, FLAC or PLAXIS to model soil-structure interactions during different phases of construction.

Passive resistance for piles founded in rock below the base of the bulk excavation (including allowance for services or footings) may be based on an ultimate passive pressure equal to the values indicated in Table 11 above. A factor of safety must be applied to these ultimate values to limit wall movement that is required to mobilise the passive resistance. The top 0.5 m of the rock socket below bulk excavation level should be ignored due to possible disturbance (i.e. over excavation) and tolerance effects. The minimum socket depth should be equal to the greater of one pile diameter or 1.0 m below the lowest level of any nearby excavation (including any detailed excavations), but subject to analysis. Staged excavation and inspection by a suitably qualified geotechnical engineer will therefore be required to confirm that the rock in front of the piles is not adversely affected by discontinuities, especially where passive resistance is relied upon.

9.9.3 Ground Anchors

Pre-stressed ground anchors, rock bolts and dowels (support elements) can be used to laterally support existing walls, new shoring, underpinning works or unstable rock masses. These support elements should be bonded into the stronger rock, inclined as required, but preferably not steeper than 30° below the horizontal. Table 12 provides allowable bond stresses for estimating purposes.

Table 12: Allowable Bond Stress for Ground Anchor Design

Material Description	Allowable Bond Stress (kPa)
Residual Clays (Stiff or stronger)	30
Class IV/V Shale	70
Class III Shale (or better)	150

These values should be confirmed by pull-out tests, carried out prior to installation of support elements. Ultimately, it is the anchoring contractor's responsibility to ensure that the correct design values (specific to the support system and method of installation) are used and that the support element holes are carefully cleaned prior to grouting.

The parameters given in Table 11 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind an imaginary line drawn up at 45 degrees from the base of the excavation, and 'lift-off' tests should be carried out to confirm the anchor capacities.

After support elements have been installed, it is recommended that they are tested to 125% of their nominal working load and locked-off at about 80% of the nominal working load. Where movement of the shoring is expected, it is recommended that the support elements are locked-off at a lower value, as required to accommodate the additional movement and subsequent increase in stress in the support elements. Checks should be carried out to confirm that the load in the support elements is maintained and that losses due to creep or other causes do not occur.

Care should be exercised to ensure that anchors are installed progressively during excavation and stressed prior to excavation of the next drop to ensure that stability is maintained at all times.

The use of permanent anchors, if required, would need careful attention to corrosion protection for which further geotechnical advice should be sought.

9.10 Foundations

The most appropriate type of foundation system will depend on the magnitude of the proposed column loads and ground profile below each building footprint.

In all cases, structural loads should be transferred to a uniform founding stratum. For heavily loaded columns, pile foundations socketed into the underlying bedrock are considered the most appropriate foundation system.

Bored piles may be considered however the potential for collapse of the filling overlying the bedrock may occur. Bored piles with temporary casing to support the filling could be considered. Continuous Flight Auger (CFA) piles could be a suitable option to avoid problems associated with collapsing filling and groundwater seepage. Large piling rigs with high torque capacity will be required to penetrate the medium and high strength bedrock, if required. The piling contractor should be made aware of the ground conditions and should make their own assessment of the type of equipment required to carry out the piling works.

Table 13: Recommended Design Parameters for Foundation Design (after Pells et al[1])

Unit	Founding Stratum	Allowable Pressure (Serviceability)		Ultimate Pressure (Ultimate)		Field Young's Modulus, E (MPa)
		End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	End Bearing (kPa)^	Shaft Adhesion (Compression) (kPa)^	
2	Residual Soil Stiff to Very Stiff Clay or Stronger	150	-	450	-	25
3	Class V Shale	700	50	2000	100	50
4	Class IV Shale	1000	100	3000	150	100
5	Class III Shale (or better)	3500	300	10,000	500	250

Notes to Table:

(1) Design Values for Foundations on Sandstone and Shale in the Sydney Region, Pells Mostyn and Walker. Australian Geomechanics December 1998.

^ Ultimate values occur at large settlements, typically >5% of minimum footing dimension

Foundations proportioned on the basis of the allowable bearing pressures in Table 13 would be expected to experience total settlements of less than 1% of the footing width/pile diameter under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

Footings designed using ultimate values and Limit State Design will need to consider serviceability which usually governs the design in this case. For pile design, a basic geotechnical strength reduction factor, Φ_{gb}, of about 0.4 (or possibly higher) calculated from Table 4.3.2 (A, B, and C) of AS2159 (2009) "Piling Design and Installation", is considered feasible. However, the structural engineer will need to make their own assessment with the final (Φ_{gb}) number being dependent on the design and installation method (and associated risk rating) adopted by the structural engineer.

All foundations should be inspected by a geotechnical engineer or engineering geologist prior to placing concrete.

9.11 Seismic Design

In accordance with the Earthquake Loading Standard, AS1170.4 (2007), the development site has a hazard factor (z) of 0.08 and a site sub-soil class of shallow soil (C_e).

9.12 Pavements

The result of the investigation indicates subgrade conditions will comprise typically natural clay and clay fill soils over weathered shale.

Laboratory testing of bulk soil samples returned soaked CBR values in the range of 2.5% to 4.5%. This is considered to be in the typical range expected for medium to high plasticity clay soils in the general area.

The design of pavements will depend on the type of subgrade material. If pavements are to be placed over the natural clay, some subgrade replacement or treatment may be required to provide a suitable subgrade for the pavement construction. Based on experience in the region with similar clay soils, it is recommended that a design CBR of 3% be adopted for any pavement design at the development site. This design CBR assumes that the subgrade is appropriately prepared, and that adequate surface and subsurface drainage is provided and maintained.

9.13 Aggressivity

The results of the aggressivity testing compared to the values presented in AS2159 (2009) "Piling – Design and installation" indicate that the soil conditions are 'moderate' for buried concrete and 'non-aggressive' for buried steel. Recommendations are presented in AS2159 for appropriate minimum concrete strengths and minimum cover to reinforcing steel for various exposure classifications.

9.14 Salinity

The development site is outside of the Salinity Potential in Western Sydney mapping and is not in an area generally associated with saline soils. Some layers within the Blacktown Residual landscape are associated with localised salinity but are not considered likely to be present in significant volumes on this site. Notwithstanding the aforementioned, soil salinity is typically assessed with respect to electrical conductivity of a 1:5 (soil:water) extract ($EC_{1:5}$). This value can be converted to ECe (electrical conductivity of a saturated extract) by multiplication with a factor dependent of soil texture ranging from 6 for heavy clays to 17 for sands. Richards (1954, Ref 4) and Hazelton and Murphy (1992, Ref 5) classify soil salinity on the basis of ECe. Based on the testing

undertaken, and using a multiplication factor of 8 (for conservatism) the results indicate that non-saline to slightly-saline (<4 dS/m) conditions can generally be expected across the development site. Based on the aforementioned, a salinity management plan is considered unnecessary for the development site.

9.15 Erosion

The results of the ESP testing (refer to Table 4) indicate that the samples tested have ESPs ranging from 'non-sodic' to 'highly-sodic'. Additionally, Emerson crumb tests returned numbers of 2 and 6 (refer to Table 7). The results of the Emerson testing therefore implies a medium to high potential for erosion for the clay soils tested.

The existing fill and clay soils may have exhibited some erosion characteristics, however, the proposed works will largely comprise paved surfaces over the existing ground surface and are not expected to expose soils to erosion conditions. Batters should consider erosion protection in their design, in the short-term and long-term. In addition, it is recommended that the invert and sides of any proposed drains or across bare unprotected soils, where concentrated stormwater flows are anticipated, be protected from erosion by promotion of the vegetation growth, and/or adoption of other erosion/scour protection measures.

9.16 Acid Sulfate Soils

No ASS testing has been carried out as part of this investigation. This section of the report provides only preliminary comments based on observed geological and topographical indicators at the development site.

In general, ASS are predominately formed with Holocene-aged (i.e. less than approximately 10,000 years old) marine deposits, typically below RL 5 m AHD.

The development site elevation is around RL 16 m to RL 20 m AHD, and the published geology indicates the natural soils at the development site are residual in origin (Blacktown residual landscape). No physical indicators of ASS (i.e. presence of jarosite, degradation of concrete, etc) were observed at the development site.

Given the above, management of ASS is considered unnecessary.

10. Limitations

Douglas Partners (DP) has prepared this report for this project at 84, 86 and 90-98 The Boulevarde, Strathfield NSW in accordance with DP's proposal dated 19 September 2023 and acceptance received from Ryan Kang dated 25 September 2023. The work was carried out under DP's Engagement Terms. This report is provided for the exclusive use of Santa Sabina College for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical and groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.
This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

The scope of work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the development site. 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.

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

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

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

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Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Appendix B

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	12.08.2024	MN/EC

SCALE: 0 15 30 45 60 75 m

1:1500 @ A3

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02)9809 0666

CLIENT:
Santa Sabina College

NOTE:
1: Basemap from metromap (Dated 19.11.2023)
2: Proposed outlines from M3architecture, Drawing No's. 22009/sd A-200001/1 & 23009/dd A-040001/2(Dated 26.06.2023 & 10.12.2023)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Sports and Aquatic Centre

PROJECT ADRESS:
84, 86 and 90-98 The Boulevarde, Strathfield

DRAWING TITLE:
TEST LOCATION PLAN

PROJECT NO: **224188.00**
DRAWING NO: **1**
REVISION: **0**

A

A'

ELEVATION (AHD)

APPROXIMATE SITE BOUNDARY

APPROXIMATE SITE BOUNDARY

BH13
Offset 0.9m

BH09
Offset - 1.7m

BH14
Offset - 2.1m

BH16
Offset - 5.1m

FILL

BASEMENT FFL
RL 16.6 m

PROPOSED AQUATIC CENTRE(POOL)
RL 18.18

REFUSAL

CLASS V SHALE

CLASS IV SHALE

CLASS III SHALE (OR BETTER)

BH13: N = 11; refusal; VL; VL; VL-L; VL; VL; M; M; ?; L-M; M; L-M; VL; M; VL; L-M; M
Bottom Depth 9 m

BH09: N = 22; refusal
Bottom Depth 2.8 m

BH14: N = 4; refusal; L; VL; L; VL; L-M; M
Bottom Depth 7.8 m

BH16: N = 11; refusal; VL-L; L; M; M-H
Bottom Depth 12.62 m

DISTANCE ALONG PROFILE (m)

LEGEND

- Core Loss
- Asphaltic Concrete
- Concrete
- Filling
- Shale
- Silty Clay

TESTS / OTHER

- N - Standard penetration test value
- — ? — — - Interpreted geotechnical boundary
- ⊻ - Water level

ROCK STRENGTH

- VL- Very Low
- L - Low
- M - Medium
- H - High

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	13.05.2024	EC/MN

SCALE: 0 5 10 15 20 30 40
1:800 @ A3
Vertical Exaggeration = 10.0

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02) 9809 0666

CLIENT:
Santa Sabina College

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

PROJECT NAME:
Sports and Aquatic Centre

PROJECT ADDRESS:
84, 86 and 90-98 The Boulevarde, Strathfield

DRAWING TITLE:
INTERPRETED GEOTECHNICAL CROSS SECTION A-A'

PROJECT No: **224188.00**
DRAWING No: **2**
REVISION: **0**

Appendix C

Results of the Investigation

Sampling Methods

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Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Description and Classification Methods

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

The soil group symbol classifications are given as follows based on two major soil divisions:

- Coarse-grained soils
- Fine-grained soils

Major Divisions				Description	
				Group Symbol*	Typical Name
COARSE-GRAINED SOILS	More than 65% by dry mass, (excluding that larger than 63 mm) is greater than 0.075 mm	GRAVEL	More than 50% of coarse grains are greater than 2.36 mm	GW	Well graded gravels and gravel-sand mixtures, little or no fines.
				GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
		GRAVELLY SOILS		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clay gravels, gravel-sand-clay mixtures.
		SAND	More than 50% of coarse grains are less than 2.36 mm	SW	Well graded sands and gravelly sands, little or no fines.
				SP	Poorly graded sands and gravelly sands, little or no fines.
		SANDY SOILS		SM	Silty sand, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.

* For coarse grained soils where the fines content is between 5% and 12%, the soil shall be given a dual classification eg GP-GM.

FINE-GRAINED SOILS	More than 35% by dry mass, (excluding that larger than 63 mm) is less than 0.075 mm	Liquid Limit less than 35%	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity
		35% <LL< 50%	CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Liquid Limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
			Pt	Peat muck and other highly organic soils.

Soil Descriptions

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Soil Types

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

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

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

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

Definitions of grading terms used are:

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

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

In fine grained soils (>35% fines)

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

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

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

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

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

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

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Origin

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

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

Moisture Condition – Coarse Grained Soils

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

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

Moisture Condition – Fine Grained Soils

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

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

Rock Strength

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

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Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

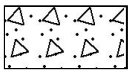
Symbols & Abbreviations

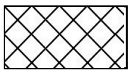
Graphic Symbols for Soil and Rock

General

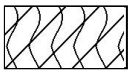

Asphalt

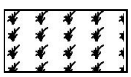

Road base

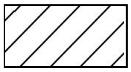

Concrete

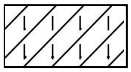

Filling

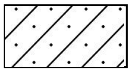
Soils


Topsoil

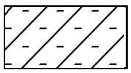

Peat

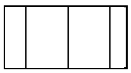

Clay

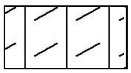

Silty clay

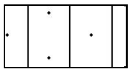

Sandy clay

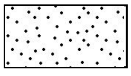

Gravelly clay

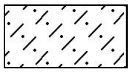

Shaly clay

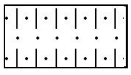

Silt


Clayey silt


Sandy silt

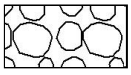

Sand

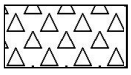

Clayey sand


Silty sand


Gravel

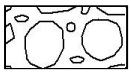

Sandy gravel


Cobbles, boulders

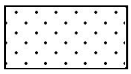

Talus

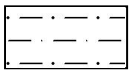
Sedimentary Rocks

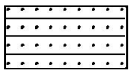

Boulder conglomerate

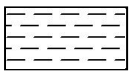

Conglomerate


Conglomeratic sandstone

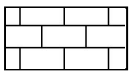

Sandstone


Siltstone

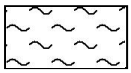

Laminite

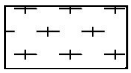

Mudstone, claystone, shale

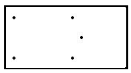

Coal


Limestone

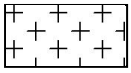
Metamorphic Rocks

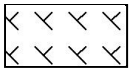

Slate, phyllite, schist

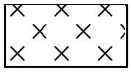

Gneiss

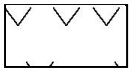

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 22.5 AHD
EASTING: 323840
NORTHING: 6249730
DIP/AZIMUTH: 90°/--

BORE No: 02
PROJECT No: 224188.00
DATE: 5/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
22	0.0	FILL/Sandy Silty CLAY: low plasticity, dark grey, trace fine igneous gravel, w~PL, generally in a firm condition		E/A	0.0		PID 2.1 ppm		
	0.2	FILL/Silty CLAY: medium to high plasticity, dark brown, trace fine to medium ironstone gravel and rootlets, generally in a firm to stiff condition, w~PL			0.2				
					0.3				
				E/A	0.4		PID 1.2 ppm		
				E/A	0.5		PID 1 ppm		
					0.6				
	0.7	Silty CLAY CI-CH: medium to high plasticity, brown mottled grey-brown, w~PL, stiff to very stiff, residual							
					0.9				
1		Below 1.0 m: red-brown mottled grey, w>PL		E/A			PID <1 ppm		1
					1.1				
				A			PID 1.1 ppm		
	1.3	Bore discontinued at 1.3m Auger refusal in stiff clay			1.3				
21									
									2
20									
									3
19									
									4
18									

RIG: Hand tools **DRILLER:** NW **LOGGED:** NW **CASING:** None

TYPE OF BORING: Hand auger to 1.3 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 21.0 AHD
EASTING: 323843
NORTHING: 6249764
DIP/AZIMUTH: 90°/--

BORE No: 03
PROJECT No: 224188.00
DATE: 3/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
21	0.06	ASPHALTIC CONCRETE							
		FILL/Silty SAND and GRAVEL: grey-brown, fine to coarse sand, fine to medium igneous gravel, moist, roadbase		E/A	0.1 0.2		PID <1 ppm		
	0.26	FILL/Silty CLAY: medium to high plasticity, orange-brown, pale grey and brown, w~PL							
		At 0.5 m: tree root (30mm)		E/A	0.5 0.7		PID 1 ppm		
		At 0.85 m: cobble sized asphaltic inclusion							
20	1	Below 1.0 m: with sand pockets, trace fine to medium igneous gravel and river pebbles		E/A	1.0 1.2		PID 1 ppm		1
				E/A	1.5		PID 2 ppm		
	1.7	Bore discontinued at 1.7m Auger refusal on inferred concrete subslab			1.7				
19	2								2
18	3								3
17	4								4

RIG: Hand tools **DRILLER:** ZW/AH **LOGGED:** ZW/AH **CASING:** None
TYPE OF BORING: Hand auger to 1.7 m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.0 AHD
EASTING: 323846
NORTHING: 6249783
DIP/AZIMUTH: 90°/--

BORE No: 04
PROJECT No: 224188.00
DATE: 3/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
20	0.11	ASPHALTIC CONCRETE							
		FILL/Silty SAND and GRAVEL: grey-brown, fine to coarse sand, fine to medium igneous gravel, roadbase		E/A	0.15 0.25		PID 1.3 ppm		
	0.35	FILL/Silty CLAY: medium to high plasticity, brown, orange and pale grey, trace sand and brick fragments, w~PL		E/A*	0.4 0.6		PID <1 ppm		
19	1	Below 0.85 m: red-brown and and grey		E/A	0.8 1.0		PID <1 ppm		1
				E/A	1.4		PID <1 ppm		
	1.7	Bore discontinued at 1.7m Auger refusal on inferred concrete subslab			1.7				
18	2								2
17	3								3
16	4								4

RIG: Hand tools **DRILLER:** ZW/AH **LOGGED:** ZW/AH **CASING:** None

TYPE OF BORING: Hand auger to 1.7 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Replicate sample BD2/231003 taken from 0.4 to 0.6 m

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 19.0 AHD
EASTING: 323849
NORTHING: 6249808
DIP/AZIMUTH: 90°/--

BORE No: 05
PROJECT No: 224188.00
DATE: 3/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
19	0.06	ASPHALTIC CONCRETE							
		FILL/Silty SAND and GRAVEL: grey-brown, fine to coarse sand, fine to medium igneous gravel, moist, roadbase		E/A	0.1 0.2		PID 2 ppm		
	0.26	FILL/Silty CLAY: medium to high plasticity, orange and pale grey, trace sand and charcoal like inclusion, w~PL		E/A*	0.3 0.5		PID 1 ppm		
18	1			E/A	1.0 1.2		PID 2 ppm		1
	1.3	Bore discontinued at 1.3m Auger refusal on inferred concrete subslab							
17	2								2
16	3								3
15	4								4

RIG: Hand tools **DRILLER:** ZW **LOGGED:** ZW **CASING:** None

TYPE OF BORING: Hand auger to 1.3 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Replicate sample BD1/231003 taken from 0.3 to 0.5 m

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 18.2 AHD
EASTING: 323859
NORTHING: 6249821
DIP/AZIMUTH: 90°/--

BORE No: 06
PROJECT No: 224188.00
DATE: 5/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
18	0.0	FILL/Silty CLAY: low to medium plasticity, dark brown, trace rootlets, w<PL, generally in a firm condition, sporadic brick fragments		E/A	0.0		PID 2.1 ppm		
	0.2				0.2				
	0.3	Silty CLAY CI-CH: medium to high plasticity, pale brown mottled grey, trace ironstone gravel and rootlets, firm to stiff, residual			0.4				
				E/A			PID <1 ppm		
		Below 0.6m: becoming very stiff			0.6				
				E/A			PID <1 ppm		
	0.8	Bore discontinued at 0.8m			0.8				
		Auger refusal in stiff clay							
17	1								1
16	2								2
15	3								3
14	4								4

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Hand tools **DRILLER:** NW **LOGGED:** NW **CASING:** None

TYPE OF BORING: Hand auger to 0.8 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 16.9 AHD
EASTING: 323887
NORTHING: 6249839
DIP/AZIMUTH: 90°/--

BORE No: 07
PROJECT No: 224188.00
DATE: 4/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
16.9	0.0	FILL/Silty CLAY: low to medium plasticity, dark brown, with fine to medium siltstone gravel and rootlets, trace igneous gravel, glass and charcoal fragments, w~PL, topsoil		E/A	0.0		PID 2 ppm		
					0.2				
16.5	0.4	Silty CLAY CI-CH: medium to high plasticity, orange-brown, trace ironstone gravel and rootetls, w~PL, stiff to very stiff, residual		E/A	0.4		PID <1 ppm		
					0.6				
15.9	1	Below 1.0 m: pale grey mottled orange		S	1.0		4,6,9 N = 15 PID <1 ppm		1
					1.45				
15	2	Below 1.9 m: pale grey, with siltstone gravel/bands, w<PL, increasing auger resistance, grading into extremely weathered siltstone							2
				S	2.5		23B refusal		
14.25	2.65	Bore discontinued at 2.65m Target depth reached			2.65				
14	3								3
13	4								4
12									

RIG: Scout 4 **DRILLER:** Ground test **LOGGED:** ZW **CASING:** None

TYPE OF BORING: Solid flight auger to 2.5 m, standard penetration test to 2.65 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 17.4 AHD
EASTING: 323905
NORTHING: 6249822
DIP/AZIMUTH: 90°/--

BORE No: 08
PROJECT No: 224188.00
DATE: 4/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
		FILL/Silty CLAY: low to medium plasticity, brown, trace siltstone gravel and rootlets, w~PL		E/A	0.0		PID <1 ppm		
					0.2				
		Below 0.7m: dark brown, trace inclusions of clinker, glass and brick fragments		E/A	0.7		PID 2 ppm		
					0.9				
	1			E/S	1.0		3,2,3 N = 5 PID <1 ppm		1
		At 1.2 m: possible inclusions of ash							
	1.3	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled orange, trace ironstone gravel, stiff, w~PL, residual		S	1.3		PID <1 ppm		
					1.45				
				E/A	1.5		PID <1 ppm		
					1.7				
	2	Below 1.9 m: pale grey, with siltstone gravel/bands, w<PL, increasing auger resistance, grading into extremely weathered siltstone							2
				S	2.5		10,25B refusal PID <1 ppm		
	2.8	Bore discontinued at 2.8m Target depth reached			2.8				
	3								3
	4								4

RIG: Scout 4 **DRILLER:** Ground test **LOGGED:** ZW **CASING:** None

TYPE OF BORING: Solid flight auger to 2.5 m, standard penetration test to 2.8 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 18.2 AHD
EASTING: 323902
NORTHING: 6249793
DIP/AZIMUTH: 90°/--

BORE No: 09
PROJECT No: 224188.00
DATE: 4/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
18	0.06	ASPHALTIC CONCRETE							
	0.25	FILL/Silty SAND and GRAVEL: grey-brown, fine to coarse sand, fine to medium igneous gravel and crushed brick fragments, dry, apparently well compacted, roadbase		E/A	0.1 0.2		PID 1 ppm		
		FILL/Silty CLAY: medium to high plasticity, grey-brown, trace charcoal like inclusions, w~PL		E/A	0.3 0.5		PID 1 ppm		
	0.7	Silty CLAY CI-CH: medium to high plasticity, orange mottled grey-brown, trace ironstone gravel and rootetls, w~PL, very stiff, residual		E/A*	0.7 0.9		PID <1 ppm		
17	1	Below 1.2 m: w<PL		S	1.0		5,9,13 N = 22 PID <1 ppm		1
					1.45				
				E	1.5 1.7		PID <1 ppm		
16	2	Below 2.0 m: pale grey, with siltstone and ironstone gravel/bands, w<PL, increasing auger resistance, grading into extremely weathered siltstone							2
				S	2.5		13,25B refusal PID <1 ppm		
	2.8	Bore discontinued at 2.8m Target depth reached			2.8				
15	3								3
14	4								4

RIG: Scout 4 **DRILLER:** Ground test **LOGGED:** ZW **CASING:** None

TYPE OF BORING: Solid flight auger to 2.5 m, standard penetration test to 2.8 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Replicate sample BD1/231004 taken from 0.7 to 0.9 m

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.7 AHD
EASTING: 323882
NORTHING: 6249749
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 224188.00
DATE: 5/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
20	0.0	FILL/Silty CLAY: low plasticity, dark-brown, trace sand, igneous gravel, roots and rootlets, w~PL, well compacted		E/A	0.0		PID 6 ppm		
	0.2	Below 0.3m: trace siltstone gravel, generally in a stiff condition			0.2				
	0.5			E/A	0.5		PID <1 ppm		
	0.8	FILL/Silty CLAY: medium to high plasticity, red-brown, with fine to medium ironstone gravel, generally in a stiff condition, w~PL			0.8				
19	1.0			E/A	1.0		PID 2 ppm		
	1.2	Below 1.2 m: grey mottled red-brown			1.2				
	1.4			E/A	1.4		PID <1 ppm		
	1.6	Below 1.5m: generally in a hard condition Bore discontinued at 1.6m Auger refusal in fill			1.6				
18	2								
17	3								
16	4								

RIG: Hand tools **DRILLER:** NW **LOGGED:** NW **CASING:** None

TYPE OF BORING: Hand auger to 1.6 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 21.3 AHD
EASTING: 323880
NORTHING: 6249732
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 224188.00
DATE: 5/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
21	0.0	FILL/Silty CLAY: low to medium plasticity, dark brown, trace roots and rootlets, w<PL, topsoil		E/A	0.0		PID 2 ppm		
					0.2				
	0.45	FILL/Silty CLAY: medium to high plasticity, grey-brown mottled orange, trace rootlets, w~PL, very stiff to hard, possibly natural		E/A	0.5		PID 1 ppm		
					0.8				
	1.0	SILTY CLAY CI-CH: medium to high plasticity, red-brown mottled grey, trace siltstone and ironstone gravel, w<PL, very stiff to hard, residual		E/A	1.0		PID 1 ppm		
	1.2	Bore discontinued at 1.2m Auger refusal in hard clay			1.2				

RIG: Hand tools **DRILLER:** NW **LOGGED:** NW **CASING:** None
TYPE OF BORING: Hand auger to 1.2 m
WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 17.2 AHD
EASTING: 323861
NORTHING: 6249848
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 224188.00
DATE: 5/10/2023
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
17.2	0.0	FILL/Clayey SILT: low plasticity, dark brown, trace igneous gravel, w<PL, apparently in a firm condition, sporadic concrete and brick fragments							E/A			PID <1 ppm
	0.7	Below 0.3 m: grey-brown silty clay, possibly natural							E/A			PID 1 ppm
									E/A*			PID <1 ppm
	1	Silty CLAY CI-CH: medium to high plasticity, orange mottled pale grey, trace ironstone gravel/bands, w~PL, stiff to very stiff, residual							S			3,6,8 N = 14
		Below 1.5 m: grey mottled orange							E			PID <1 ppm
	2											
15.1	2.1	Silty CLAY CI-CH: medium to high plasticity, pale grey, with siltstone gravel/bands, w<PL, grading to extremely weathered siltstone						Unless otherwise stated rock is fractured along planar to undulating rough bedding, dipping 0-10°	S			12,25/140B refusal PID <1 ppm
	3											
						31-10-23						
13.32	3.88	SHALE: brown to grey-brown, with approximately 70% clay and decomposed seams, interbedded low strength iron cemeted bands, very low to low strength, extremely to highly weathered, fragmented, Ashfield Shale						3.98m: Ds, 350mm 4.33m: CORE LOSS: 470mm	C	88	0	PL(A) = 0.36 PL(A) = 0.14
	4.8							4.86m: Ds, 390mm	C	100	10	
	5							5.28-5.46m: J60-80°, un, ro, discontinuous 5.5m: fg, 50mm 5.62m: fg, 60mm 5.89m: Ds, 30mm				
11.5	5.7	SHALE: dark grey, medium strength, slightly weathered, slightly fractured Ashfield Shale						6.15-6.3m: J30-90°, cu, ro, ti 6.32-6.49m: Ds(x3), 30mm 6.75m: Ds, 40mm 6.76-6.84m: J(x2)45°, pl, ro, gvl inf 6.9m: J45°, pl, ro, cly inf, discontinuous 7.03-7.11: Cs(x2), 10mm 7.52-7.71m: Ds(x2), 10mm	C	100	80	PL(A) = 0.34 PL(A) = 0.78 PL(A) = 0.67
	6											
	7											
	8	Below 7.9 m: fresh, unbroken										
	9								C	100	100	PL(A) = 0.78 PL(A) = 0.73
	10											
6.82	10.38	Bore discontinued at 10.38m Target depth reached										PL(A) = 0.82

RIG: Scout 4 **DRILLER:** Ground test **LOGGED:** ZW **CASING:** HW to 2.5 m

TYPE OF BORING: Solid flight auger to 2.5 m, wash bore to 3.1 m, NMLC core to 10.38 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Replicate sample BD1/231005 taken from 0.8 to 1.0 m; refer to well log for groundwater well construction details

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 17.2 AHD
EASTING: 323861
NORTHING: 6249848
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 224188.00
DATE: 5/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
17	0.0	FILL/Clayey SILT: low plasticity, dark brown, trace igneous gravel, w<PL, apparently in a firm condition, sporadic concrete and brick fragments		E/A	0.0		PID <1 ppm		Gatic Cover
					0.2				
		Below 0.3 m: grey-brown silty clay, possibly natural		E/A	0.5		PID 1 ppm		Backfill 0.0-1.0 m
	0.7				0.7				
16		Silty CLAY CI-CH: medium to high plasticity, orange mottled pale grey, trace ironstone gravel/bands, w~PL, stiff to very stiff, residual		E/A*	0.8		PID <1 ppm		
	1				1.0				1 Blank PVC 0.0-2.0 m
				S			3,6,8 N = 14		Bentonite 0.5-2.5 m
					1.45				
		Below 1.5 m: grey mottled orange		E	1.5		PID <1 ppm		
					1.7				
15	2								2
	2.1	Silty CLAY CI-CH: medium to high plasticity, pale grey, with siltstone gravel/bands, w<PL, grading to extremely weathered siltstone							
				S	2.5		12,25/140B refusal		
					2.79		PID <1 ppm		
14	3				3.1				3
								31-10-23	Gravel pack 1.5-5.0 m
									Slotted PVC 1.5-5.0 m
	3.88	SHALE: brown to grey-brown, with approximately 70% clay and decomposed seams, interbedded low strength iron cemeted bands, very low to low strength, extremely to highly weathered, fragmented, Ashfield Shale		C	3.88		PL(A) = 0.36		
13	4				4.17		PL(A) = 0.14		4
	4.8				4.8				
12	5			C					5 End Cap
					5.5				
	5.7	SHALE: dark grey, medium strength, slightly weathered, slightly fractured Ashfield Shale							
11	6				5.95		PL(A) = 0.34		6
				C					
10	7				6.97		PL(A) = 0.78		7
									Bentonite backfill 5.0-10.38 m
					7.84		PL(A) = 0.67		
9	8	Below 7.9 m: fresh, unbroken			8.16				8
					8.95		PL(A) = 0.78		9
8	9			C					
					9.64		PL(A) = 0.73		
7	10								10
	10.38				10.32		PL(A) = 0.82		
		Bore discontinued at 10.38m Target depth reached			10.38				

RIG: Scout 4 **DRILLER:** Ground test **LOGGED:** ZW **CASING:** HW to 2.5 m

TYPE OF BORING: Solid flight auger to 2.5 m, wash bore to 3.1 m, NMLC core to 10.38 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Replicate sample BD1/231005 taken from 0.8 to 1.0 m; refer to well log for groundwater well construction details

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: BH12 PROJECT: STRATHFIELD OCTOBER 2023

3.10 – 8.00m

BORE: BH12 PROJECT: STRATHFIELD OCTOBER 2023

8.00 – 10.38m

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	Santa Sabina College	Project No:	224188.00
Project:	Sports and Aquatic Centre	Test date:	25-Oct-23
Location:	84, 86 and 90 -98 The Boulevarde, Strathfield	Tested by:	AN

Test Location

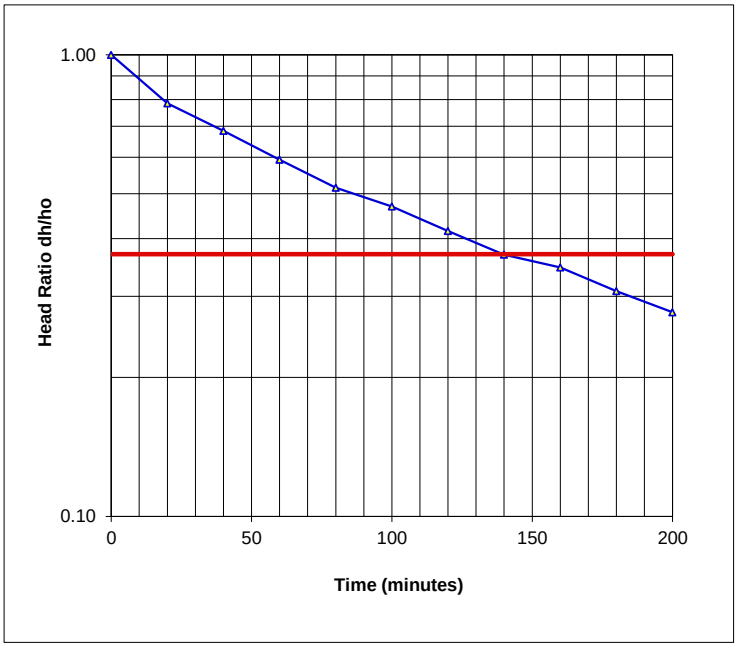
Description:	Standpipe in borehole	**Test No.**	BH12	
Material type:	Sandstone and Interbedded Siltstone and Sandstone	Easting:	323861	m
		Northing	6249848	m
		Surface Level:	17.2	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	3.56	m
borehole diameter (2R)	76	mm	Depth to water at start of test	4.86	m
Effective Length of well screen (Le)	1.44	m	Depth of top of gravel pack	1.50	m
			Depth of base of gravel pack	5.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	4.86	1.30	1.000
20	4.58	1.02	0.785
40	4.45	0.89	0.685
60	4.33	0.77	0.592
80	4.23	0.67	0.515
100	4.17	0.61	0.469
120	4.10	0.54	0.415
140	4.04	0.48	0.369
160	4.01	0.45	0.346
180	3.96	0.40	0.308
200	3.92	0.36	0.277



To = 140 mins
8400 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 2.2E-07** m/sec
= 1.9E-02 m/day

BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 17.1 AHD
EASTING: 323910
NORTHING: 6249837
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 224188.00
DATE: 5/10/2023
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
17	0	FILL/Silty CLAY: low to medium plasticity, dark brown, with fine to medium sandstone, siltstone and igneous gravel, trace clinker, ironstone and rootlets, w<PL, apparently firm to stiff, possible ash inclusions							E			PID1.1 ppm
16	1								E			PID1.6 ppm
	1.0	Below 0.7m: grey-brown, possibly natural							E			PID<1 ppm
		Silty CLAY CI-CH: medium to high plasticity, orange mottled grey-brown, trace rootlets, w~PL, stiff, residual							S			3,5,6 N = 11 PID<1 ppm
15	2	Below 2.0m: pale grey, with interbedded siltstone gravel/bands, trace ironstone gravel/bands							E			PID<1 ppm
									S			4,11,16/100 refusal PID<1 ppm
	2.8	Silty CLAY CI-CH: medium to high plasticity, with approximately 30% ironstone and iron indurated very low to low strength siltstone bands (up to 50mm in thickness), w~PL, generally very stiff to hard, extremely weathered siltstone						Unless otherwise stated, all bedding are planar, smooth to rough, with clay coating or vaneer, dipping at 0-5°				
14	3											
13	4											
	4.25	SHALE: grey-brown, very low to low strength, with approximately 20% clay and decomposed seams, highly weathered, initially fragmented grading to fractured with occasional fragmented segments, Ashfield Shale						4.25-4.31m: J45°, pl, ro, gvl inf 4.35m: DS, 90 mm 4.44m: fg, 60 mm 4.5-4.56 m: J60°, pl, ro, cly inf 4.56m: fg, 180 mm 4.8m: CORE LOSS: 300mm 5.12m: fg, 40 mm 5.16m: Cs, 20mm 5.34m: Ds, 40mm 5.38m: Fg, 60mm 5.54m: Ds, 60mm 5.73m: Cs, 10mm 5.79m: Fg, 50mm 5.89m: Ds, 130mm 6.09m: Ds, 30mm 6.6m: Cs, 30mm 6.63-6.7 m: J30-90°, st, ro, cly inf 6.75-6.8 m: Cs(x3), 20mm 7.02-7.2 m: Cs(x3), 20mm 7.5-7.63 m: J(x2)45°,pl, ro, cly inf 7.71-7.83 m: Ds(x2), 50mm 7.83-8.0 m: DS(x3), 20mm 8.25-8.47 m: Ds(x2), 40mm 8.51-8.57 m: J45°, pl, ro, cly vn, discontinuous 8.9-9.0 m: J(x2)45-60°, pl, ro, cly vn	C	100	0	PL(A) = 0.09
12	5								C	85	20	PL(A) = 0.09 PL(A) = 0.14 PL(A) = 0.31
	5.1											
11	6											
	6.5	SHALE: dark grey, medium strength, with approximately 10% interbedded clay and decomposed seams, generally slightly weathered, generally fractured to slightly fractured, Ashfield Shale							C	100	45	PL(A) = 0.36 PL(A) = 0.53 PL(A) = 0.57 PL(A) = 1.1 PL(A) = 0.74
10	7											
9	8											
	9.0	Bore discontinued at 9.0m Target depth reached										
8	9											

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5 m, wash bore to 3.6 m, NMLC to 9.0 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Bulk sample taken from 0.7-2.0 m; refer to well log for groundwater well construction details

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 17.1 AHD
EASTING: 323910
NORTHING: 6249837
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 224188.00
DATE: 5/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
17		FILL/Silty CLAY: low to medium plasticity, dark brown, with fine to medium sandstone, siltstone and igneous gravel, trace clinker, ironstone and rootlets, w<PL, apparently firm to stiff, possible ash inclusions		E	0.0		PID1.1 ppm		Gatic Cover
					0.2				
				E	0.4		PID1.6 ppm		Backfill 0.0-1.0 m
					0.6				
		Below 0.7m: grey-brown, possibly natural		E	0.8		PID<1 ppm		
16	1 1.0	Silty CLAY CI-CH: medium to high plasticity, orange mottled grey-brown, trace rootlets, w~PL, stiff, residual		S	1.0		3,5,6 N = 11 PID<1 ppm		1 Blank PVC 0.0-2.0 m; Bentonite 0.5-2.5 m
					1.45				
				E	1.5		PID<1 ppm		
15	2	Below 2.0m: pale grey, with interbedded siltstone gravel/bands, trace ironstone gravel/bands			1.7				2
				S	2.5		4,11,16/100 refusal PID<1 ppm		
	2.8	Silty CLAY CI-CH: medium to high plasticity, with approximately 30% ironstone and iron indurated very low to low strength siltstone bands (up to 50mm in thickness), w~PL, generally very stiff to hard, extremely weathered siltstone			2.9				
14	3								3 Gravel pack 1.5-5.0 m; Slotted PVC 1.5-5.0 m
					3.6				
13	4			C					4
	4.25	SHALE: grey-brown, very low to low strength, with approximately 20% clay and decomposed seams, highly weathered, initially fragmented grading to fractured with occasional fragmented segments, Ashfield Shale			4.38		PL(A) = 0.09		
12	5 5.1				4.8				5 End Cap
				C	5.76		PL(A) = 0.09		
11	6				6.26		PL(A) = 0.14		6
	6.5	SHALE: dark grey, medium strength, with approximately 10% interbedded clay and decomposed seams, generally slightly weathered, generally fractured to slightly fractured, Ashfield Shale			6.52		PL(A) = 0.31		
					6.7				
10	7				6.97		PL(A) = 0.36		7 Bentonite backfill 5.0-9.0 m
					7.14		PL(A) = 0.53		
9	8			C	7.83		PL(A) = 0.57		8
					8.47		PL(A) = 1.1		
					8.71		PL(A) = 0.74		
8	9 9.0	Bore discontinued at 9.0m Target depth reached			9.0				9

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Solid flight auger to 2.5 m, wash bore to 3.6 m, NMLC to 9.0 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Bulk sample taken from 0.7-2.0 m; refer to well log for groundwater well construction details

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: BH13 PROJECT: STRATHFIELD OCTOBER 2023

3.60 – 8.00m

BORE: BH13 PROJECT: STRATHFIELD OCTOBER 2023

8.00 – 9.00m

BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 18.9 AHD
EASTING: 323900
NORTHING: 6249779
DIP/AZIMUTH: 90°/--

BORE No: 14
PROJECT No: 224188.00
DATE: 4/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
	0.17	CONCRETE SLAB										
	0.7	FILL/Silty CLAY: medium to high plasticity, grey-brown, trace sand, sandstone and ironstone gravel, charcoal fragments, w~PL, apparently firm to stiff							E			PID<1 ppm
									E/A			PID1.8 ppm
	1.2	Silty CLAY CI: medium plasticity, orange-brown mottled pale grey, w>PL, soft to firm, possibly alluvial, hydrocarbon stained							S			1,1,3 N = 4 PID1.1 ppm
	1.8	Silty CLAY CI-CH: medium to high plasticity, pale grey mottled orange-brown, w~PL, apparently firm to stiff, residual							E/A			PID<1 ppm
		Silty CLAY: medium to high plasticity, with approximately 30% ironstone and iron indurated very low to low strength siltstone bands (up to 50mm in thickness), w~PL, generally very stiff to hard, extremely weathered siltstone						Unless otherwise stated, all bedding are planar, smooth to rough, ironstained to clay veneer, dipping at 0-5°	S			15,18/110 refusal PID<1 ppm
	3.4							3.1m: CORE LOSS: 300mm				
	3.74	SHALE: pale grey and grey-brown, with approximately 15% interbedded ironstone and iron indurated bands, interbedded clay and decomposed seams, very low to low strength, distinctly weathered, generally highly fractured with fragmented beds, Ashfield Shale						3.88-3.95 m: J45°, un, ro, fe stn, cly inf 3.95m: Ds, 70 mm 4.02-4.15 m: J(x3)45°, un, ro, fe stn, he 4.09m: Cs, 20mm 4.15-4.22 m: J30-90°, ir, ro, fe stn, he, discontinuous 4.37-4.45 m: Cs(x2), 20 mm 4.49-4.63 m: Ds(x2), 40 mm 4.5-4.7 m: J(x2)45°, un, ro, fe stn, gvl, cly inf 4.89m: Ds, 60 mm 4.95m: CORE LOSS: 150mm 5.1m: Fg, 290 mm 5.92-6.06 m: J30°, pl, ro, fe stn 6.14-6.3 m: J60°, pl, he	C	84	10	PL(A) = 0.12 PL(A) = 0.29
	5.1											
	5.38	SHALE: dark-grey, medium strength, slightly weathered to fresh, slightly fractured, Ashfield Shale							C	95	85	PL(A) = 0.66 PL(A) = 0.52 PL(A) = 0.65 PL(A) = 0.69
	7.8	Bore discontinued at 7.8m Target depth reached										

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.17 m, Solid flight auger to 2.5 m, wash bore to 3.1m, NMLC to 7.8 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH14 PROJECT: STRATHFIELD OCTOBER 2023

3.10 – 7.80m

BOREHOLE LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 18.1 AHD
EASTING: 323878
NORTHING: 6249813
DIP/AZIMUTH: 90°/--

BORE No: 15
PROJECT No: 224188.00
DATE: 6/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
18	0.0	FILL/Silty CLAY: low to medium plasticity, dark brown, trace siltstone gravel, rootlets and plastic fragments, w~PL, apparently in a firm condition, topsoil		E/A	0.0		PID <1 ppm		
					0.2				
	0.4	Silty CLAY: medium to high plasticity, brown to orange mottled grey-brown, trace ironstone gravel and rootetls, w~PL, stiff to very stiff, residual		E/A	0.4		PID <1 ppm		
					0.6				
				E/A	0.8		PID <1 ppm		
17	1			S	1.0		5,8,9 N = 17 PID <1 ppm		1
		Below 1.5 m: trace siltstone gravel/bands			1.45				
16	2	Below 2.1 m: pale grey, with siltstone gravel/bands, w<PL, increasing auger resistance, grading into extremely weathered siltstone							2
				S	2.5		13,13/50B refusal PID <1 ppm		
	2.7	Bore discontinued at 2.7m Target depth reached			2.7				
15	3								3
14	4								4

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** None

TYPE OF BORING: Solid flight auger to 2.5m, standard penetration test to 2.7 m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: *Replicate sample BD1/231004 taken from 0.7 to 0.9 m

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.6 AHD
EASTING: 323892
NORTHING: 6249738
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 224188.00
DATE: 6/10/2023
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
		CONCRETE SLAB										
	0.2											
	0.4	FILL/Sandy CLAY and COBBLES: medium plasticity, brown, sandstone cobbles, fine to medium sand, with fine to coarse sandstone gravel, moist, apparently well compacted							E/A			PID <1 ppm
									E/A*			PID <1 ppm
20												
	1	Silty CLAY CI-CH: medium to high plasticity, brown to orange-brown mottled grey-brown, w~PL, stiff to very stiff, residual							E			PID <1 ppm
									S			3,4,7 N = 11
19		Below 0.8 m: orange mottled pale grey, trace ironstone gravel										PID <1 ppm
	2	Below 1.5 m: trace siltstone gravel/bands										
	2.0											
18		Silty CLAY CI-CH: medium to high plasticity, pale grey, orange and red-brown, with approximately 30% interbedded low strength ironstone, iron indurated siltstone and siltstone bands (up to 10 mm in thickness), very stiff to hard clay, extremely weathered Siltstone				31-10-23			S			17,8/150 refusal
	3							Unless otherwise stated, all bedding are planar, smooth to rough, ironstained and/or clay veneer, dipping at 0-5°				
17								3.6m: CORE LOSS: 500mm	C	57	0	
	4											
	4.1											
16	4.73	SHALE: grey-brown and dark grey, with approximately 20% interbedded clay and decomposed seams, very low to low strength, highly weathered, initially fragmented grading to fractured, Ashfield Shale						4.73m: Fg, 270 mm				
	5							5m: Cs, 40 mm 5.1m: Fg, 80 mm 5.21m: Cs, 140 mm 5.36m: Fg, 40 mm 5.4m: Ds, 30 mm 5.45m: Ds, 280 mm 5.73m: Fg, 20 mm 5.81m: Fg, 20 mm 5.87-6.0 m: Cs(x3), 20 mm	C	89	15	PL(A) = 0.08 PL(A) = 0.08
15												
	6											
	6.2							6m: CORE LOSS: 200mm 6.24m: Cs, 60 mm				PL(A) = 0.22
14	6.82							6.41-6.61 m: Cs(x4), 30mm 6.7m: CORE LOSS: 120mm 6.82m: Fg, 180 mm 7.18m: B0°, pl, ro, gvl inf 7.22m: Fg, 60 mm 7.51m: B0°, pl, ro, fe stn, gvl inf, 20 mm 7.85-9.34 m: J(x3)45-60°, pl, ro, fe stn	C	96	85	PL(A) = 0.63
	7											
	7.3	SHALE: dark grey, medium strength, slightly weathered to fresh, slightly fractured, Ashfield Shale										
13												PL(A) = 0.63
	8											
12												
	9							9.11m: Ds, 60 mm 9.21m: Cs, 20 mm				
11												PL(A) = 0.44
									C	100	95	PL(A) = 1.1

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.2 m, Solid flight auger to 2.5 m, wash bore to 3.6m, NMLC to 12.62 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Replicate sample BD1/231006 taken from 0.4-0.6 m; bulk sample taken from 0.5-2.5 m; refer to well log for groundwater well construction details

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.6 AHD
EASTING: 323892
NORTHING: 6249738
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 224188.00
DATE: 6/10/2023
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
10	10	Below 9.9 m: medium to high strength, fresh SHALE: dark grey, medium strength, slightly weathered to fresh, slightly fractured, Ashfield Shale *(continued)*	EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	9.89m: B0°, pl, ro, gvl inf 10.53-10.73 m: Ds(x2), 10mm 10.89-11.32 m: J(x2)45°, pl, ro, cly vn				PL(A) = 1.5
11									C	100	95	
12												PL(A) = 0.8
8	12.62	Bore discontinued at 12.62m Target depth reached						12.52m: Ds, 40 mm				PL(A) = 1
13												
7												
14												
6												
15												
5												
16												
4												
17												
3												
18												
2												
19												
1												

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.2 m, Solid flight auger to 2.5 m, wash bore to 3.6m, NMLC to 12.62 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Replicate sample BD1/231006 taken from 0.4-0.6 m; bulk sample taken from 0.5-2.5 m; refer to well log for groundwater well construction details

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.6 AHD
EASTING: 323892
NORTHING: 6249738
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 224188.00
DATE: 6/10/2023
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
	0.2	CONCRETE SLAB			0.2				Gatic Cover
	0.4	FILL/Sandy CLAY and COBBLES: medium plasticity, brown, sandstone cobbles, fine to medium sand, with fine to coarse sandstone gravel, moist, apparently well compacted		E/A	0.4		PID <1 ppm		
				E/A*	0.6		PID <1 ppm		
					0.8				
		Silty CLAY CI-CH: medium to high plasticity, brown to orange-brown mottled grey-brown, w~PL, stiff to very stiff, residual		E	1.0		PID <1 ppm		Backfill 0.0-2.0 m
		Below 0.8 m: orange mottled pale grey, trace ironstone gravel		S			3,4,7 N = 11		Blank PVC 0.0-3.0 m
		Below 1.5 m: trace siltstone gravel/bands			1.45		PID <1 ppm		
	2.0	Silty CLAY CI-CH: medium to high plasticity, pale grey, orange and red-brown, with approximately 30% interbedded low strength ironstone, iron indurated siltstone and siltstone bands (up to 10 mm in thickness), very stiff to hard clay, extremely weathered Siltstone							Bentonite 2.0-2.5 m
				S	2.5		17,8/150 refusal		
					2.7			31-10-23	
					3.6				
	4.1			C					Gravel pack 2.5-6.0 m
	4.73	SHALE: grey-brown and dark grey, with approximately 20% interbedded clay and decomposed seams, very low to low strength, highly weathered, initially fragmented grading to fractured, Ashfield Shale			4.77				Slotted PVC 3.0-6.0 m
					5.3		PL(A) = 0.08		
				C	5.81		PL(A) = 0.08		End Cap
	6.2				6.43		PL(A) = 0.22		
	6.82				6.7				
					7.09		PL(A) = 0.63		
	7.3	SHALE: dark grey, medium strength, slightly weathered to fresh, slightly fractured, Ashfield Shale							
				C					
					8.67		PL(A) = 0.63		
					9.53		PL(A) = 0.44		Bentonite backfill 6.0-12.62 m
					9.7				
				C	9.94		PL(A) = 1.1		

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.2 m, Solid flight auger to 2.5 m, wash bore to 3.6m, NMLC to 12.62 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Replicate sample BD1/231006 taken from 0.4-0.6 m; bulk sample taken from 0.5-2.5 m; refer to well log for groundwater well construction details

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: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.6 AHD
EASTING: 323892
NORTHING: 6249738
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 224188.00
DATE: 6/10/2023
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
		Below 9.9 m: medium to high strength, fresh SHALE: dark grey, medium strength, slightly weathered to fresh, slightly fractured, Ashfield Shale *(continued)*		C	10.84		PL(A) = 1.5		
					11.95		PL(A) = 0.8		
	12.62				12.56		PL(A) = 1		
		Bore discontinued at 12.62m Target depth reached			12.63				

RIG: Scout 4 **DRILLER:** Ground Test **LOGGED:** ZW **CASING:** HW to 2.5m

TYPE OF BORING: Diacore to 0.2 m, Solid flight auger to 2.5 m, wash bore to 3.6m, NMLC to 12.62 m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Replicate sample BD1/231006 taken from 0.4-0.6 m; bulk sample taken from 0.5-2.5 m; refer to well log for groundwater well construction details

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH16 PROJECT: STRATHFIELD OCTOBER 2023

3.60 – 8.00m

BORE: BH16 PROJECT: STRATHFIELD OCTOBER 2023

8.00 – 12.62m

Douglas Partners Pty Ltd
ABN 75 053 980 117
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Permeability Testing - Rising Head Test Report

Client:	Santa Sabina College	Project No:	224188.00
Project:	Sports and Aquatic Centre	Test date:	25-Oct-23
Location:	84, 86 and 90-98 The Boulevarde, Strathfield	Tested by:	AN

Test Location

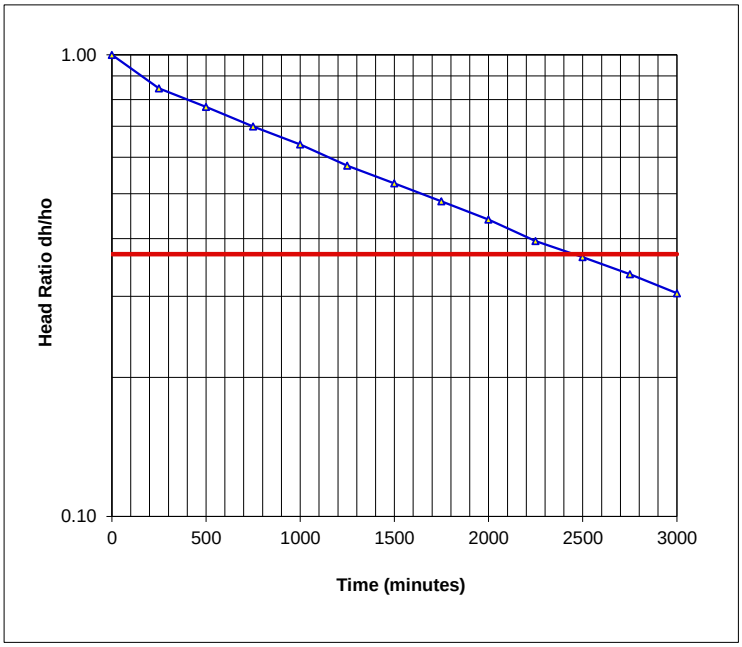
Description:	Standpipe in borehole	**Test No.**	BH16	
Material type:	Sandstone and Interbedded Siltstone and Sandstone	Easting:	3238692	m
		Northing	6249738	m
		Surface Level:	20.6	m AHD

Details of Well Installation

Effective diameter (2re)	76	mm	Depth to water before test	2.78	m
borehole diameter (2R)	76	mm	Depth to water at start of test	5.44	m
Effective Length of well screen (Le)	3.00	m	Depth of top of gravel pack	2.50	m
			Depth of base of gravel pack	6.00	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	5.44	2.66	1.000
250	5.03	2.25	0.846
500	4.83	2.05	0.771
750	4.64	1.86	0.699
1000	4.48	1.70	0.639
1250	4.31	1.53	0.575
1500	4.18	1.40	0.526
1750	4.06	1.28	0.481
2000	3.95	1.17	0.440
2250	3.83	1.05	0.395
2500	3.75	0.97	0.365
2750	3.67	0.89	0.335
3000	3.59	0.81	0.305



To = 2464 mins
147840 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 7.1E-09** m/sec
= 6.1E-04 m/day

TEST PIT LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.6 AHD
EASTING: 323849
NORTHING: 6249761

PIT No: TP01
PROJECT No: 224188.00
DATE: 3/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
20		CONCRETE SLAB							
	0.1	FILL/Silty CLAY: medium to high plasticity, pale brown, with fine to medium sand, igneous, sandstone and siltstone gravel, roots, rootlets, and metal (rebar), w~PL, apparently in a stiff consistancy							
	0.65	Silty CLAY: medium to high plasticity, pale grey mottled red-brown, w~PL, apparently very stiff, residual							
	0.95	Pit discontinued at 0.95m Target depth reached							1
19	1								

RIG: Vacc truck

LOGGED: ZW

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Not applicable

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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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TEST PIT LOG

CLIENT: Santa Sabina College
PROJECT: Sports and Aquatic Centre
LOCATION: 84, 86 and 90-98 The Boulevarde, Strathfield

SURFACE LEVEL: 20.6 AHD
EASTING: 323849
NORTHING: 6249766

PIT No: TP02
PROJECT No: 224188.00
DATE: 3/10/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		CONCRETE SLAB							
	0.2	FILL/Silty CLAY: medium to high plasticity, brown, with fine to medium sand, fine to medium igneous, sandstone and siltstone gravel, trace rootlets, w~PL, apparently in a stiff consistancy							
20									
	1.0	Pit discontinued at 1.0m Target depth reached							1
19									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Vacc truck

LOGGED: ZW

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Not applicable

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

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

Laboratory Reports

Material Test Report

Report Number:	**224188.00-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Amended client details*
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10965
Sample Number:	SY-10965A
Date Sampled:	04/10/2023
Dates Tested:	18/10/2023 - 30/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH102 (0.6-0.8m)**
Material:	FILL/Silty CLAY: red brown mottled pale grey, with sand, trace gravel

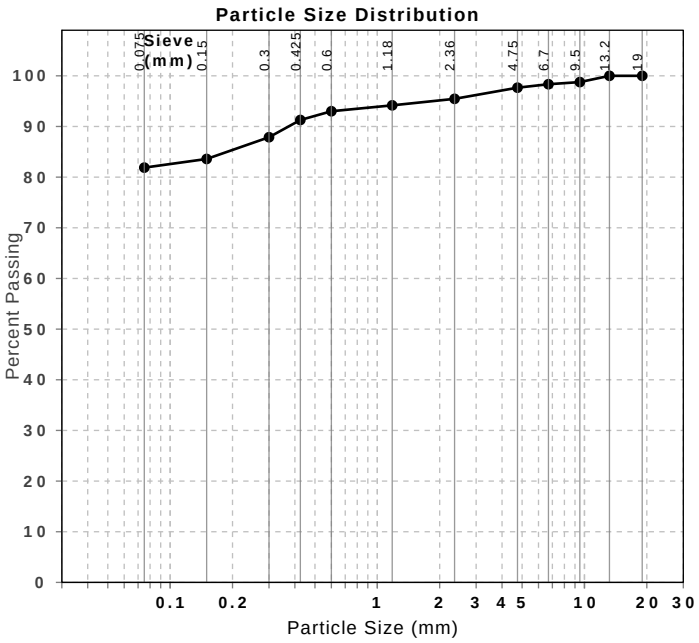
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Email: mick.gref@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Mick Gref
Assistant Laboratory Manager
Laboratory Accreditation Number: 828

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**99**		
6.7 mm	**98**		
4.75 mm	**98**		
2.36 mm	**95**		
1.18 mm	**94**		
0.6 mm	**93**		
0.425 mm	**91**		
0.3 mm	**88**		
0.15 mm	**84**		
0.075 mm	**82**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description	FILL/Silty CLAY: red brown mottled pale grey, with sand, trace gravel		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		



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Report Number:	**224188.00-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Amended client details*
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10965
Sample Number:	SY-10965B
Date Sampled:	04/10/2023
Dates Tested:	18/10/2023 - 26/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH103 (1-1.2m)**
Material:	Silty CLAY: pale grey mottled yellow, with sandstone

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Assistant Laboratory Manager
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Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	55		
Plastic Limit (%)	22		
Plasticity Index (%)	**33**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**15.5**		
Cracking Crumbling Curling	Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	Silty CLAY: pale grey mottled yellow, with sandstone		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

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	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10965
Sample Number:	SY-10965C
Date Sampled:	04/10/2023
Dates Tested:	18/10/2023 - 30/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH104 (0.6-0.8m)**
Material:	FILL/Silty CLAY: dark brown, trace gravel and sand

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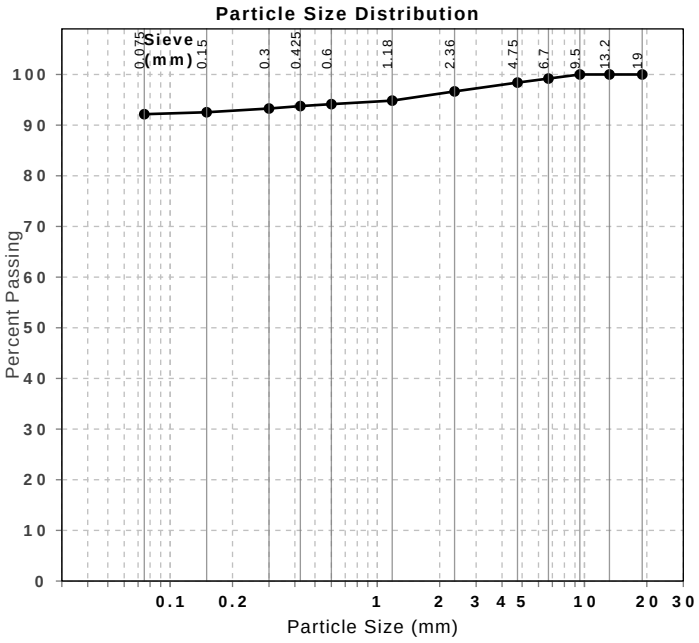
Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**99**		
4.75 mm	**98**		
2.36 mm	**97**		
1.18 mm	**95**		
0.6 mm	**94**		
0.425 mm	**94**		
0.3 mm	**93**		
0.15 mm	**93**		
0.075 mm	**92**		



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Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10965
Sample Number:	SY-10965D
Date Sampled:	04/10/2023
Dates Tested:	18/10/2023 - 26/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH104 (1-1.2m)**
Material:	Silty CLAY: red brown and grey

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	77		
Plastic Limit (%)	28		
Plasticity Index (%)	**49**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**19.0**		
Cracking Crumbling Curling	Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Silty CLAY: red brown and grey		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

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Report Number:	**224188.00-2**
Issue Number:	2 - *This version supersedes all previous issues*
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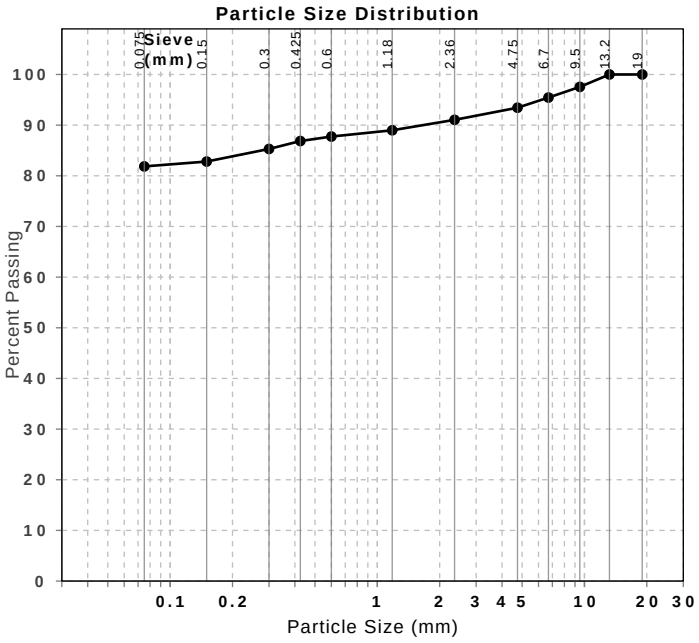
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964A
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 30/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH02 (0.4-0.6m)**
Material:	FILL/Silty CLAY: dark brown, trace sandstone, trace sand

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**98**		
6.7 mm	**95**		
4.75 mm	**93**		
2.36 mm	**91**		
1.18 mm	**89**		
0.6 mm	**88**		
0.425 mm	**87**		
0.3 mm	**85**		
0.15 mm	**83**		
0.075 mm	**82**		



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Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964B
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 13/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH02 (1.0-1.2m)**
Material:	Silty CLAY: red brown mottled grey

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Silty CLAY: red brown mottled grey		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	73		
Plastic Limit (%)	26		
Plasticity Index (%)	**47**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**18.0**		
Cracking Crumbling Curling	None		

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	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964C
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 26/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH05 (1.0-1.2m)**
Material:	FILL/CLAY: brown, orange and pale grey

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	FILL/CLAY: brown, orange and pale grey		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	62		
Plastic Limit (%)	27		
Plasticity Index (%)	**35**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**15.5**		
Cracking Crumbling Curling	None		

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	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964D
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 27/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH08 (1.5-1.7m)**
Material:	CLAY: pale grey mottled orange

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	70		
Plastic Limit (%)	27		
Plasticity Index (%)	**43**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**17.5**		
Cracking Crumbling Curling	None		

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	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964E
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 30/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH12 (0.7-2.0m)**
Material:	Silty CLAY: grey brown and orange brown, trace gravel, trace sand

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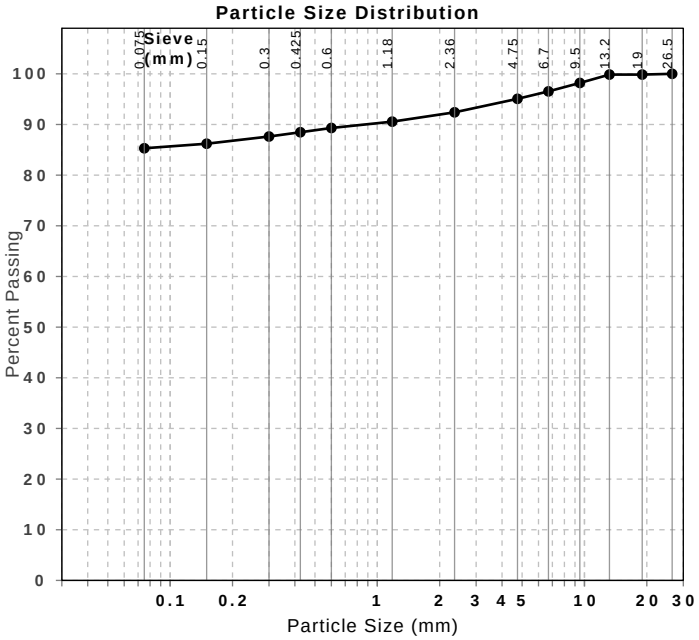
Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
26.5 mm	**100**		
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**98**		
6.7 mm	**97**		
4.75 mm	**95**		
2.36 mm	**92**		
1.18 mm	**91**		
0.6 mm	**89**		
0.425 mm	**88**		
0.3 mm	**88**		
0.15 mm	**86**		
0.075 mm	**85**		



Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	Silty CLAY: grey brown and orange brown, trace gravel, trace sand		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	80		
Plastic Limit (%)	27		
Plasticity Index (%)	**53**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**18.0**		
Cracking Crumbling Curling	None		

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	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964E
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 10/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH12 (0.7-2.0m)**
Material:	Silty CLAY: grey brown and orange brown, trace gravel, trace sand

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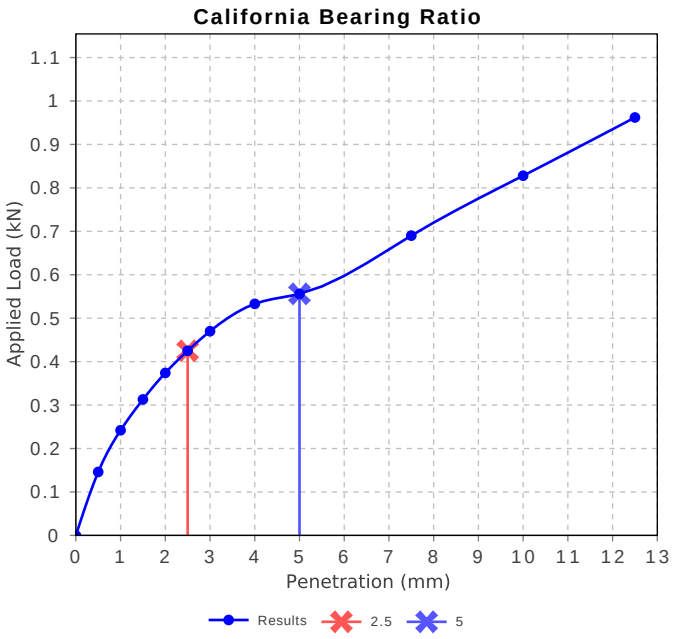
California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**3.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.57		
Optimum Moisture Content (%)	24.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.52		
Field Moisture Content (%)	22.5		
Moisture Content at Placement (%)	24.2		
Moisture Content Top 30mm (%)	29.0		
Moisture Content Rest of Sample (%)	25.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	124.6		
Swell (%)	3.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.1		



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Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964E
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 02/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH12 (0.7-2.0m)**
Material:	Silty CLAY: grey brown and orange brown, trace gravel, trace sand

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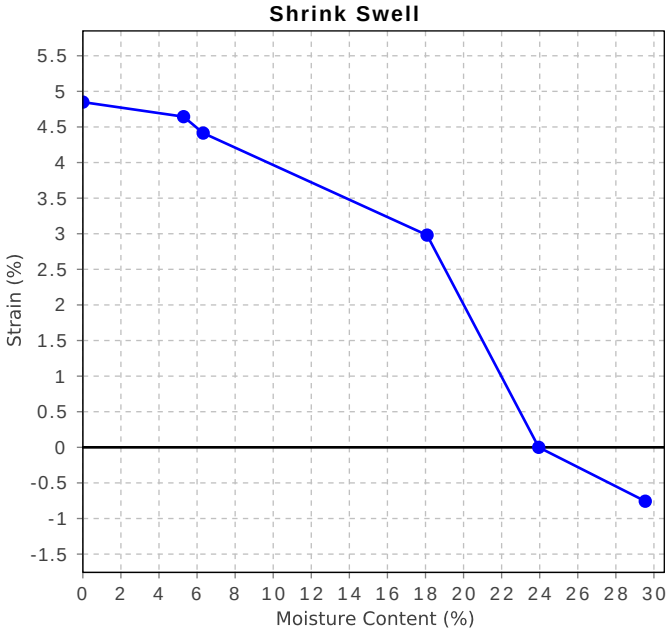
Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.9**
Visual Description	Silty CLAY: grey brown and orange brown, trace gravel, trace sand
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**4.8**
Estimated % by volume of significant inert inclusions	5
Cracking	Uncracked
Crumbling	No
Moisture Content (%)	23.9

Swell Test	
Initial Pocket Penetrometer (kPa)	>400
Final Pocket Penetrometer (kPa)	150
Initial Moisture Content (%)	24.4
Final Moisture Content (%)	29.5
Swell (%)	**0.8**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964F
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 30/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH13 (0.7-2.0m)**
Material:	CLAY: orange brown and grey brown, trace gravel, trace sand

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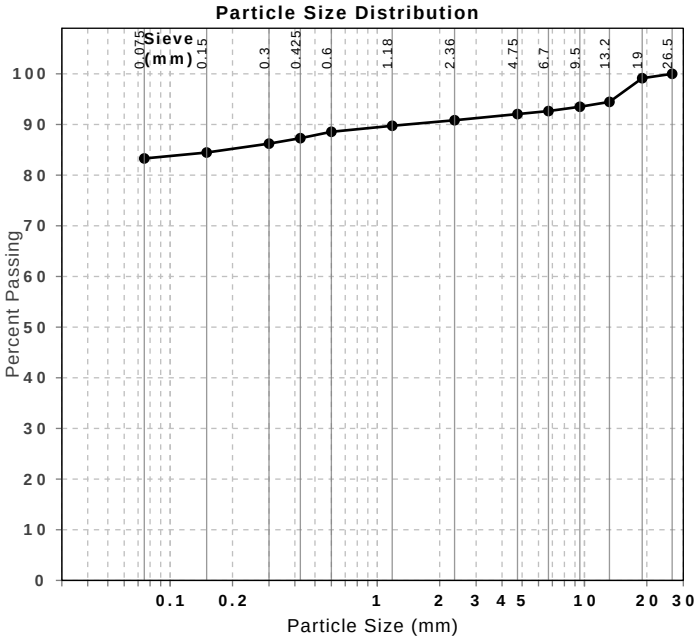
Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
26.5 mm	**100**		
19 mm	**99**		
13.2 mm	**94**		
9.5 mm	**93**		
6.7 mm	**93**		
4.75 mm	**92**		
2.36 mm	**91**		
1.18 mm	**90**		
0.6 mm	**89**		
0.425 mm	**87**		
0.3 mm	**86**		
0.15 mm	**84**		
0.075 mm	**83**		



Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	CLAY: orange brown and grey brown, trace gravel, trace sand		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	67		
Plastic Limit (%)	23		
Plasticity Index (%)	**44**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**18.0**		
Cracking Crumbling Curling	None		

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Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964F
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 07/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH13 (0.7-2.0m)**
Material:	CLAY: orange brown and grey brown, trace gravel, trace sand

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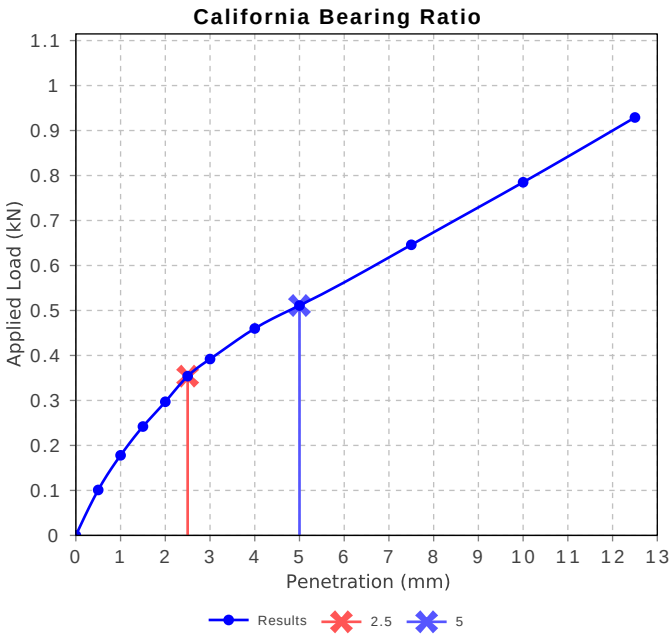
Assistant Laboratory Manager
Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**2.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.64		
Optimum Moisture Content (%)	22.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m^3)	1.63		
Field Moisture Content (%)	22.1		
Moisture Content at Placement (%)	21.7		
Moisture Content Top 30mm (%)	26.5		
Moisture Content Rest of Sample (%)	23.2		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	67.0		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.7		



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Material Test Report

Report Number:	**224188.00-2**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Amended client details*
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964F
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 02/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH13 (0.7-2.0m)**
Material:	CLAY: orange brown and grey brown, trace gravel, trace sand

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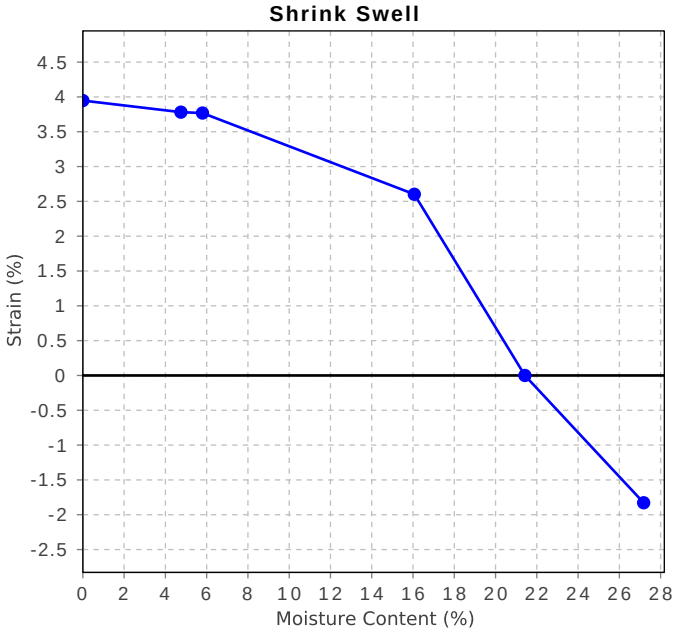
Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.7**
Visual Description	CLAY: orange brown and grey brown, trace gravel, trace sand
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**3.9**
Estimated % by volume of significant inert inclusions	2
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	21.4

Swell Test	
Initial Pocket Penetrometer (kPa)	>400
Final Pocket Penetrometer (kPa)	250
Initial Moisture Content (%)	21.4
Final Moisture Content (%)	27.2
Swell (%)	**1.8**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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Report Number:	**224188.00-2**
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Reissue Reason:	*Amended client details*
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964G
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 07/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH13 (2.5-2.9m)**
Material:	CLAY: pale grey, with trace rootlets

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	38		
Plastic Limit (%)	19		
Plasticity Index (%)	**19**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**11.0**		
Cracking Crumbling Curling	Curling		

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Material Test Report

Report Number:	**224188.00-2**
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Reissue Reason:	*Amended client details*
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964H
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 27/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH14 (1.0-1.45m)**
Material:	CLAY: orange brown mottled pale grey

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	CLAY: orange brown mottled pale grey		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	74		
Plastic Limit (%)	29		
Plasticity Index (%)	**45**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**18.0**		
Cracking Crumbling Curling	None		

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Report Number:	**224188.00-2**
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Reissue Reason:	*Amended client details*
Date Issued:	15/05/2024
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964I
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 27/10/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH15 (1.0-1.45m)**
Material:	CLAY: brown to orange brown mottled grey brown, with trace rootlets

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	69		
Plastic Limit (%)	26		
Plasticity Index (%)	**43**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**16.5**		
Cracking Crumbling Curling	None		

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Report Number:	**224188.00-2**
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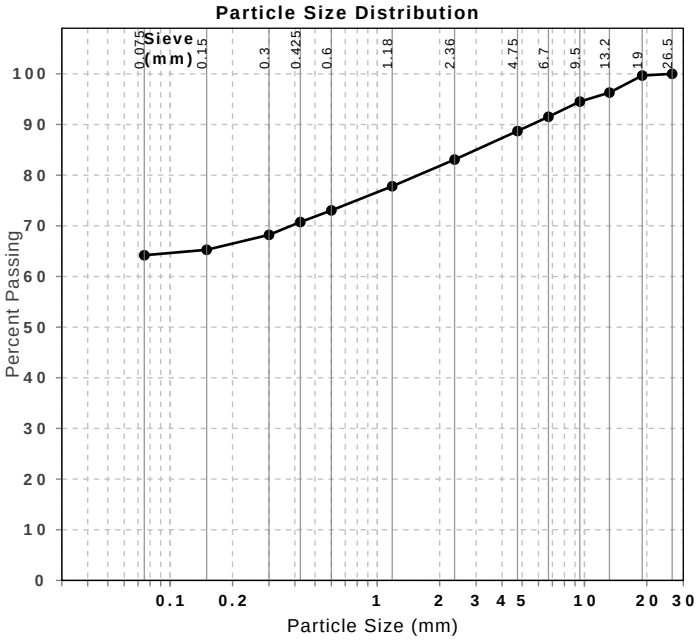
Client:	Santa Sabina College
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964J
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 13/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH16 (0.5-2.5m)**
Material:	CLAY: brown to orange brown mottled grey brown, with gravel and sand

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
26.5 mm	**100**		
19 mm	**100**		
13.2 mm	**96**		
9.5 mm	**95**		
6.7 mm	**92**		
4.75 mm	**89**		
2.36 mm	**83**		
1.18 mm	**78**		
0.6 mm	**73**		
0.425 mm	**71**		
0.3 mm	**68**		
0.15 mm	**65**		
0.075 mm	**64**		



Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	CLAY: brown to orange brown mottled grey brown		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	52		
Plastic Limit (%)	22		
Plasticity Index (%)	**30**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**14.0**		
Cracking Crumbling Curling	None		

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Date Issued:	15/05/2024
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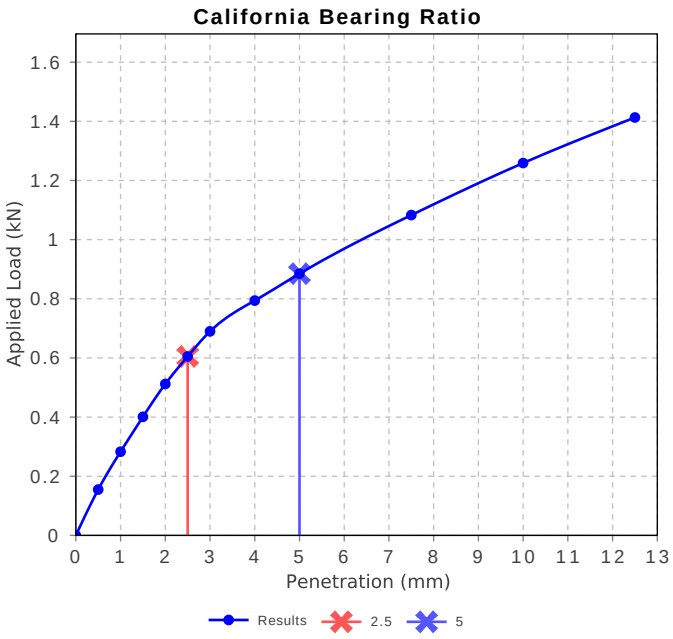
	ABN 88 003 415 450, Strathfield NSW
Contact:	Eleanor Hassell
Project Number:	224188.00
Project Name:	Sports and Aquatic Centre
Project Location:	90 -98 The Boulevarde, Strathfield NSW
Work Request:	10964
Sample Number:	SY-10964J
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 10/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH16 (0.5-2.5m)**
Material:	CLAY: brown to orange brown mottled grey brown, with gravel and sand

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.70		
Optimum Moisture Content (%)	19.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	101.0		
Dry Density after Soaking (t/m^3)	1.68		
Field Moisture Content (%)	20.6		
Moisture Content at Placement (%)	19.7		
Moisture Content Top 30mm (%)	22.8		
Moisture Content Rest of Sample (%)	20.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	124.0		
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.3		



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Report Number:	**224188.00-2**
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Work Request:	10964
Sample Number:	SY-10964J
Date Sampled:	02/10/2023
Dates Tested:	18/10/2023 - 02/11/2023
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Remarks:	125mm linear shrinkage mould used
Sample Location:	**BH16 (0.5-2.5m)**
Material:	CLAY: brown to orange brown mottled grey brown, with gravel and sand

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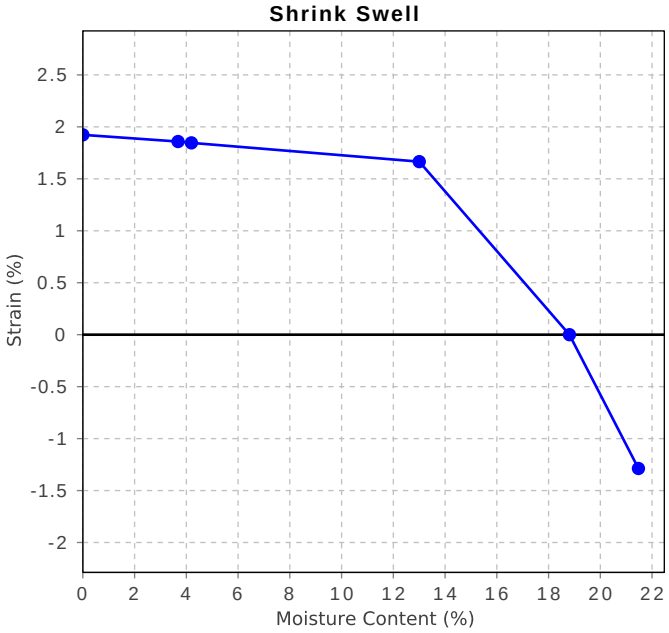
Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**1.4**
Visual Description	CLAY: brown to orange brown mottled grey brown, with gravel and sand
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.9**
Estimated % by volume of significant inert inclusions	3
Cracking	Uncracked
Crumbling	No
Moisture Content (%)	18.8

Swell Test	
Initial Pocket Penetrometer (kPa)	>400
Final Pocket Penetrometer (kPa)	380
Initial Moisture Content (%)	18.8
Final Moisture Content (%)	21.5
Swell (%)	**1.3**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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CERTIFICATE OF ANALYSIS 334992-H

Client Details

Client	Douglas Partners Pty Ltd
Attention	David Smith
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**224188.01 Santa Sabina**
Number of Samples	57 Soil
Date samples received	10/10/2023
Date completed instructions received	09/01/2024

Analysis Details

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

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

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

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

Report Details

Date results requested by	10/01/2024
Date of Issue	10/01/2024

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Results Approved By
Hannah Nguyen, Metals Supervisor

Authorised By
Nancy Zhang, Laboratory Manager

ESP/CEC						
Our Reference		334992-H-2	334992-H-14	334992-H-22	334992-H-39	334992-H-52
Your Reference	UNITS	BH02	BH05	BH08	BH12	BH16
Depth		0.3-0.5	1-1.2	0.7-0.9	1.5-1.7	0.8-1
Date Sampled		5/10/2023	3/10/2023	4/10/2023	5/10/2023	6/10/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/01/2024	10/01/2024	10/01/2024	10/01/2024	10/01/2024
Date analysed	-	10/01/2024	10/01/2024	10/01/2024	10/01/2024	10/01/2024
Exchangeable Ca	meq/100g	6.5	1.0	8.2	0.3	3.6
Exchangeable K	meq/100g	0.2	0.1	0.4	0.1	0.4
Exchangeable Mg	meq/100g	0.6	1.3	2.2	1.3	3.8
Exchangeable Na	meq/100g	<0.1	0.5	0.2	0.4	0.2
Cation Exchange Capacity	meq/100g	7.3	3.0	11	2.1	7.9
ESP	%	[NT]	17	1	18	3

Method ID	Methodology Summary
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	334992-H-14
Date prepared	-			10/01/2024	2	10/01/2024	10/01/2024		10/01/2024	10/01/2024
Date analysed	-			10/01/2024	2	10/01/2024	10/01/2024		10/01/2024	10/01/2024
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	2	6.5	6.8	5	100	102
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	2	0.2	0.2	0	106	103
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	2	0.6	0.7	15	97	101
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	2	<0.1	<0.1	0	112	108

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

ESP: Where the exchangeable Sodium is less than the PQL and CEC is less than 10meq/100g, the ESP cannot be calculated.

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CERTIFICATE OF ANALYSIS 334992-D

Client Details

Client	Douglas Partners Pty Ltd
Attention	Zihan Wang
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**224188.01 Santa Sabina**
Number of Samples	Additional analysis
Date samples received	10/10/2023
Date completed instructions received	18/10/2023

Analysis Details

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

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

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

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

Report Details

Date results requested by	25/10/2023
Date of Issue	25/10/2023

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

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		334992-D-2	334992-D-3	334992-D-5	334992-D-14	334992-D-22
Your Reference	UNITS	BH02	BH02	BH03	BH05	BH08
Depth		0.3-0.5	0.9-1.1	0.5-0.7	1-1.2	0.7-0.9
Date Sampled		5/10/2023	5/10/2023	3/10/2023	3/10/2023	4/10/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	20/10/2023	20/10/2023	20/10/2023	20/10/2023	20/10/2023
Date analysed	-	20/10/2023	20/10/2023	20/10/2023	20/10/2023	20/10/2023
pH 1:5 soil:water	pH Units	7.5	4.6	6.7	4.6	6.2
Electrical Conductivity 1:5 soil:water	µS/cm	210	120	440	390	60
Chloride, Cl 1:5 soil:water	mg/kg	20	[NA]	[NA]	340	10
Sulphate, SO4 1:5 soil:water	mg/kg	20	[NA]	[NA]	310	25

Misc Inorg - Soil						
Our Reference		334992-D-24	334992-D-38	334992-D-39	334992-D-49	334992-D-52
Your Reference	UNITS	BH08	BH12	BH12	BH15	BH16
Depth		1.5-1.7	0.8-1	1.5-1.7	0.8-1	0.8-1
Date Sampled		4/10/2023	5/10/2023	5/10/2023	6/10/2023	6/10/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	20/10/2023	20/10/2023	20/10/2023	20/10/2023	20/10/2023
Date analysed	-	20/10/2023	20/10/2023	20/10/2023	20/10/2023	20/10/2023
pH 1:5 soil:water	pH Units	4.5	4.7	4.6	4.4	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	150	120	210	190	56
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	47	[NA]	<10
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	350	[NA]	<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. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	334992-D-14
Date prepared	-			20/10/2023	2	20/10/2023	20/10/2023		20/10/2023	20/10/2023
Date analysed	-			20/10/2023	2	20/10/2023	20/10/2023		20/10/2023	20/10/2023
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	7.5	7.5	0	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	210	240	13	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	20	21	5	107	#
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	20	20	0	109	#

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Holding time exceedance

MISC_INORG_DRY: # Percent recovery is not applicable due to the high concentration of the analyte/s in the sample/s. However an acceptable recovery was obtained for the LCS.

COC: 18/10/23 1440

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	224188.00	**Suburb:**	Strathfield - Santa Sabina	**To:**	Envirolab Services
Project Manager:	David Smith	**Order Number:**		**Sampler:** ZW	12 Ashley St, Chatswood NSW 2067
Email:	David Smith; Zihan Wang			**Attn:**	Sample Receipt
Turnaround time:	☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day				(02) 9910 6200 samplereceipt@envirolab.com.au
Prior Storage:	☑ Fridge ☐ Freezer ☐ Esky ☐ Shelf	**Do samples contain 'potential' HBM?**	☑ No ☐ Yes		(If YES, then handle, transport and store in accordance with FPM HAZID)

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water M - Material	Container Type: G - glass P - plastic	Analytes: Agresivity	EC	pH								Notes/ Preservation/ Additional Requirements
2	BH02	0.3	0.5	5/10/23	S	G	✓	✓	✓								
3	BH02	0.9	1.1	5/10/23	S	G		✓	✓								
5	BH03	0.5	0.7	3/10/23	S	G		✓	✓								
14	BH05	1	1.2	3/10/23	S	G	✓	✓	✓								
22	BH08	0.7	0.9	4/10/23	S	G	✓	✓	✓								
24	BH08	1.5	1.7	4/10/23	S	G		✓	✓								
38	BH12	0.8	1	5/10/23	S	G		✓	✓								
39	BH12	1.5	1.7	5/10/23	S	G	✓	✓	✓								
49	BH15	0.8	1	6/10/23	S	G		✓	✓								
52	BH16	0.8	1	6/10/23	S	G	✓	✓	✓								

Metals to analyse:		**LAB RECEIPT**	
Number of samples in container:	**Transported to laboratory by:** Courrier	**Lab Ref. No:**	334992-D
Send results to:	Douglas Partners Pty Ltd	**Received by:**	A·BU1
Address:	**Phone:**	**Date & Time:**	18/10/23 1440

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Relinquished by: AN; 10/10/2023	**Date:** 18/10/2023	**Signed:**	**Signed:**

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 334992-E

Client Details

Client	Douglas Partners Pty Ltd
Attention	Kurt Plambeck
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**224188.01 Santa Sabina**
Number of Samples	additional testing
Date samples received	10/10/2023
Date completed instructions received	26/10/2023

Analysis Details

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

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

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

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

Report Details

Date results requested by	03/11/2023
Date of Issue	03/11/2023

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Results Approved By
Loren Bardwell, Development Chemist

Authorised By
Nancy Zhang, Laboratory Manager

CEC					
Our Reference		334992-E-1	334992-E-15	334992-E-29	334992-E-47
Your Reference	UNITS	BH02	BH06	BH10	BH15
Depth		0-0.2	0-0.2	0-0.2	0-0.2
Date Sampled		5/10/2023	5/10/2023	5/10/2023	6/10/2023
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	02/11/2023	02/11/2023	02/11/2023	02/11/2023
Date analysed	-	02/11/2023	02/11/2023	02/11/2023	02/11/2023
Exchangeable Ca	meq/100g	15	14	8.0	12
Exchangeable K	meq/100g	0.4	0.3	0.8	1.0
Exchangeable Mg	meq/100g	1.1	1.9	2.4	2.4
Exchangeable Na	meq/100g	0.2	0.2	<0.1	0.1
Cation Exchange Capacity	meq/100g	17	17	11	15

Method ID	Methodology Summary
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	334992-E-15
Date prepared	-			02/11/2023	1	02/11/2023	02/11/2023		02/11/2023	02/11/2023
Date analysed	-			02/11/2023	1	02/11/2023	02/11/2023		02/11/2023	02/11/2023
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	1	15	16	6	89	#
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	1	0.4	0.4	0	103	109
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	1	1.1	1.1	0	92	107
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	1	0.2	0.2	0	96	98

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Report Comments

CEC - # High spike recovery was obtained for this sample. The sample was re-extracted and re-spiked and the high recovery was confirmed. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.

FW: Results for Registration 334992-B 224188.01 Santa Sabina

Nick Sarlamis <NSarlamis@envirolab.com.au>
Fri 10/27/2023 11:10 AM
To:Customer Service <CustomerService@envirolab.com.au>;Hannah Nguyen <HNguyen@envirolab.com.au>
A job request please.

334992-E

STD TAT

From: Kurt Plambeck <kurt.plambeck@douglaspartners.com.au>
Sent: Thursday, October 26, 2023 12:05 PM
To: Nick Sarlamis <NSarlamis@envirolab.com.au>
Subject: RE: Results for Registration 334992-B 224188.01 Santa Sabina

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi Nick,
Can you please run these 4 samples for CEC 1,15,29,47

Kurt Plambeck | Senior Associate/Environmental Scientist
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
96 Hermitage Road West Ryde NSW 2114 | PO Box 472 West Ryde NSW 1685
P: [http://02+9809+0666]02 9809 0666 | M: +61 402 057 147 | E: kurt.plambeck@douglaspartners.com.au

Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

20 TIMES WINNERS CLIENT CHOICE AWARDS FINALISTS FOR 15 YEARS

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From: Nick Sarlamis <NSarlamis@envirolab.com.au>
Sent: Monday, October 23, 2023 6:27 PM
To: Kurt Plambeck <kurt.plambeck@douglaspartners.com.au>
Subject: Results for Registration 334992-B 224188.01 Santa Sabina

Please refer to attached for:
a copy of the Certificate of Analysis
a copy of the COC/paperwork received from you
ESDAT Extracts
an Excel or .csv file containing the results

Please note that a hard copy will not be posted.

Enquiries should be made directly to:
customerservice@envirolab.com.au

How did we do? Send Feedback

Kind Regards,

Nick Sarlamis | Assistant Operations Manager | Envirolab Services

Great Science. Great Service.

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ENVIROLAB SERVICES

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Latest Update: **We're excited to be attending the AIOH23 Annual Scientific Conference & Exhibition, 2-6 December, Melbourne. Hope to see you there!**

Please consider the environment before printing this email.

Samples will be analysed per our T&C's.