GROUNDED
EXPERTISE

Report on Salinity Investigation and Management Plan

The Gables New Primary School

Fontana Drive, Gables NSW

Prepared for School Infrastructure NSW

Project 216255.02

15 November 2024

Douglas Partners
GROUNDED EXPERTISE

Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
96 Hermitage Road, West Ryde, NSW 2114
(02) 9809 0666

Document History

Details

Project No.	216255.02
Document Title	Report on Salinity Investigation and Management Plan
Site Address	Fontana Drive, Gables NSW
Report Prepared For	School Infrastructure NSW
Filename	216255.02.R.001.Rev1

Status and Review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Lucinda Lau	Ray Blinman	3 October 2024
Revision 1	Lucinda Lau	Ray Blinman	15 November 2024

Distribution of Copies

Status	Issued to
Revision 0	Sumit Kusare, School Infrastructure NSW
Revision 1	Sumit Kusare, School Infrastructure NSW

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

Signature		Date
Author	pp	15 November 2024
Reviewer	pp	15 November 2024

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Report on Salinity Investigation and Management Plan
The Gables New Primary School
Fontana Drive, Gables NSW

1. Introduction

1.1 General

This report has been prepared by Douglas Partners Pty Ltd (Douglas), on behalf of the NSW Department of Education (the Applicant), to assess the potential environmental impacts that could arise from the development of The Gables New Primary School, at Lot 301 DP 1287967 on Fontana Drive, Gables (the site).

This report has been prepared to present the results of a salinity investigation undertaken by Douglas and to provide a salinity management plan for the site.

This report accompanies a Review of Environment Factors (REF) that seeks approval for the construction and operation of a new primary school at the site, which involves the following works:

- Construction of school buildings, including learning hubs, a school hall and an administration and library building;
- Construction and operation of a public preschool;
- Delivery of a sports court and fields;
- Construction of car parking, waste storage and loading area;
- Associated site landscaping and open space improvements; and
- Associated off-site infrastructure works to support the school, including (but not limited to) services, driveways and pedestrian crossings.

For a detailed project description, refer to the Review of Environmental Factors prepared by Ethos Urban.

The salinity investigation and management plan was carried out under the Standard Form Agreement SINSW03210-22 dated 12 July 2022 and was undertaken in accordance with Douglas' proposal 216255.00.P.001.Rev1 dated 16/08/2024.

The investigation included the drilling of four (4) boreholes and laboratory testing of selected samples for aggressivity, salinity, sodicity and dispersion characteristics. The details of the field work are presented in this report, together with a salinity management plan for the proposed development.

Douglas has previously undertaken geotechnical and contamination investigations at the site (ref: Report on Geotechnical Investigation, 216255.00.R.002; Report on Preliminary Site Investigation (Contamination), 216255.01.R.001; and Report on Detailed Site Investigation (Contamination), 216255.01.R.002).

1.2 Statement of Significance

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed development, it is determined that:

- The extent and nature of potential impacts from the proposed development are low and will not have significant adverse effects on the locality, community and the environment in relation to salinity if the recommendations in this report are followed.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community by following the recommendations in this report.

1.3 REF Requirements

The REF requirement relevant to this report is summarised in Table 1.

Table 1: Summary of Relevant REF Requirements

Item	REF Requirement	Relevant Section of Report
33	Salinity Management Plan, where a site has Salinity potential.	Section 9

2. Site Description

The site of the proposed The Gables New Primary School (GPS) is located on Cataract Road, Gables, within The Hills Local Government Area (LGA), approximately 50 km northwest of the Sydney CBD and 10 km north of the Rouse Hill Town Centre. It comprises one lot, legally described as Lot 301 DP 1287967, that measures approximately 2.2 ha in area. The site is bounded by Pennant Way to the north, Cataract Road to the east, Fontana Drive to the west and a vacant lot to the south.

An aerial image of the site is shown in Figure 1 (following page).

The site is located on gently sloping terrain, with existing surface levels of approximately RL 39 m in the northwest and RL 35 m in the southeast (reduced levels relative to the Australian height datum, AHD). The site slopes down towards the southeast, with surface runoff appearing to collect to the east of the site (a previous creek tributary) and drains northwards to Cattai Creek.

Historical aerial imagery reveals that the site and surrounds were previously occupied by low density residential properties for small garden farms and agriculture with multiple farm dams. Bulk earthworks filling operations were undertaken at the site between 2016 and 2020. The site appears relatively unchanged since the completion of earthworks in 2020 and is currently unoccupied with grass cover across the site.

Figure 1: Site aerial imagery (Source: Nearmap, dated 9 Dec 2023, edits by Ethos Urban)

3. Previous Geotechnical Investigation

The previous geotechnical investigation undertaken at the site by Douglas in 2022 encountered the following subsurface profile:

- **Fill**, reportedly controlled under Level 1 earthworks testing, typically comprising clay, sand, and sandstone gravel, cobbles and boulders to depths of between 2.3 m and 7.2 m. The fill is understood to have been placed to achieve subdivisional design finished surface levels and was likely sourced from nearby earthworks. The fill was generally deeper in the northern portion of the site.
- **Residual Clay** beneath the fill, which is derived from the weathering of the parent Ashfield Shale and Hawkesbury Sandstone formations (refer Section 4.1) and had a thickness ranging between 0.3 m and 5.7 m.
- **Shale and Sandstone** bedrock beneath the residual clay at depths of between 5 m and 8.5 m.

Further details on the geotechnical conditions at the site are available in the Report on Geotechnical Investigation (ref: 216255.00.R.002).

4. Published Data

4.1 Soil Landscape and Geology

Reference to the Penrith 1:100,000 Soils Landscape Series Sheet indicates that the site is underlain by the Blacktown Soils Group, which is characterised by shallow to moderately deep red and brown podzolic soils on crests, upper slopes and well drained areas; and deep yellow podzolic soils and soloths on lower sloped and in areas of poor drainage. It is noted that the site has previously undergone earthworks operations and there are areas with substantial depths of fill.

Reference to the Sydney 1:100,000 Geological Series map indicates that the site is underlain by Ashfield Shale, typically comprising of grey to dark grey shale and laminite (finely interbedded sandstone and siltstone) part of the Wianamatta Group. The Ashfield Shale formation overlies the Hawkesbury Sandstone formation which is mapped approximately 800 m to the east of the site. An extract of the geological map is shown below in Figure **2**.

Figure 2: NSW Seamless Geology map with approximate site location

4.2 Acid Sulphate Soils

Reference to the 1:25,000 Acid Sulphate Soils (ASS) Risk map indicates that the site is in an area of no known occurrence of acid sulphate soils. Given the location of the site and the underlying geology, the risk of ASS occurring on the site is considered to be very low.

4.3 Salinity

Reference to the Map of Salinity Potential in Western Sydney (2002), indicates that the site is located within an area of 'moderate salinity potential', where "saline areas may occur which may have not yet been identified".

5. Field Work

5.1 Field Work Methods

Field investigations were undertaken on 10 September 2024 under the supervision of an engineering geologist. The field work included the drilling of four (4) boreholes (BH201 to BH204) to depths between 2.8 m and 3.1 m using a small truck mounted drilling rig fitted with 110 mm diameter solid flight augers. BH202 to BH204 were terminated at the target depth of 3.1 m and BH201 was terminated at 2.8 m depth due to auger refusal on an inferred sandstone boulder within the fill material.

Engineering logs detailing the subsurface profiles encountered within the bores were prepared by an engineering geologist who also collected representative samples for strata identification and subsequent laboratory testing purposes.

Coordinates and elevations of borehole locations were recorded by Douglas using a differential GPS. The surface coordinates are presented on the engineering logs and were measured relative to MGA Zone 56 and GDA2020. The surface elevations measured relative to AHD. The borehole locations are shown on Drawing 1 in Appendix B.

5.2 Field Work Results

The detailed subsurface conditions encountered at each borehole are presented in the borehole logs in Appendix C, together with notes defining descriptive terms and classification methods.

The general subsurface profile encountered at the borehole locations may be summarised as:

- **FILL / Sandy Clay & Clay**: Encountered within all boreholes from the surface to the base of the boreholes. The fill typically comprised medium and medium to high plasticity sandy clay and clay with fine to medium sand and varying portions of silt. The material included varying amounts of sandstone, shale and ironstone gravel ranging from fine to coarse as well as inclusions of cobbles and boulders.
- **FILL / Clayey Sand**: Encountered in BH201 from 0.2 m to 0.7 m depth comprising pale brown, fine to medium sand.

Free groundwater was not observed during drilling in any of the boreholes. It is noted, however, that groundwater levels can fluctuate due to seasonal and rainfall variations.

6. Laboratory Test Results

Laboratory testing at NATA accredited laboratories was undertaken on soil samples retrieved during the field work. The detailed test reports are presented in Appendix D and the testing included:

- Testing for aggressivity on 16 samples (pH, chloride, sulphate and electrical conductivity (EC)) to assess the exposure classification to buried steel and concrete elements in accordance with the provisions of AS2159–2009 “Piling – Design and Installation”, which are summarised in Table 2.
- Testing for salinity on 16 samples (EC, soil textural class, EC_e and salinity classification) presented in Table 3. It is noted that soil salinity values (EC_e) have been calculated using the methods of the “Site Investigations for Urban Salinity” booklet, prepared by the Department of Land and Water Conservation (DLWC, 2002). The soil samples were classified as per soil textural classification methods to determine the multiplication factors (M) for the samples and resultant calculated soil salinity values ($EC_e = M \times EC_{1:5}$).
- Testing for sodicity and dispersion on four (4) disturbed samples (exchangeable sodium, cation exchange capacity (CEC), exchangeable sodium percentage (ESP) and Emerson class

number) presented in Table 4. The sodicity classification is based on DLWC, 2002 and the dispersion is based on AS 1289.3.8.1 – 2007.

Table 2: Analytical Results for Aggressivity in Soil

Borehole	Depth (m)	Material	pH	Chloride (mg/kg)	Sulphate (mg/kg)	EC (µS/cm)	Aggressivity	
							To Concrete	To Steel
BH201	0.5-0.6	FILL/Clayey SAND	7.8	42	43	110	Non-Aggressive	Non-Aggressive
BH201	1.0-1.1	FILL/Sandy CLAY	5.0	350	180	350	Mild	Non-Aggressive
BH201	2.0-2.1	FILL/Sandy CLAY	5.6	320	99	280	Non-Aggressive	Non-Aggressive
BH201	2.7-2.8	FILL/Sandy CLAY	5.8	150	120	190	Non-Aggressive	Non-Aggressive
BH202	0.5-0.6	FILL/ CLAY	5.5	340	260	380	Mild	Non-Aggressive
BH202	1.0-1.1	FILL/ CLAY	5.4	590	130	510	Mild	Mild
BH202	2.0-2.1	FILL/Sandy CLAY	5.5	350	61	290	Mild	Non-Aggressive
BH202	3.0-3.1	FILL/Sandy CLAY	6.5	290	110	280	Non-Aggressive	Non-Aggressive
BH203	0.5-0.6	FILL/Sandy CLAY	5.0	270	120	270	Mild	Non-Aggressive
BH203	1.0-1.1	FILL/ CLAY	6.3	230	190	270	Non-Aggressive	Non-Aggressive
BH203	2.0-2.1	FILL/ CLAY	5.9	170	60	170	Non-Aggressive	Non-Aggressive
BH203	3.0-3.1	FILL/ CLAY	5.4	940	230	830	Mild	Mild
BH204	0.5-0.6	FILL/Sandy CLAY	6.3	330	270	370	Non-Aggressive	Non-Aggressive
BH204	1.0-1.1	FILL/Sandy CLAY	5.5	440	97	400	Mild	Non-Aggressive
BH204	2.0-2.1	FILL/Silty Sandy CLAY	6.6	510	160	490	Non-Aggressive	Non-Aggressive
BH204	3.0-3.1	FILL/Silty Sandy CLAY	5.1	610	280	610	Mild	Mild

Notes: EC = electrical conductivity; samples mixed with 1:5 soil:water.
Aggressivity Classification per Tables 6.4.2(C) and 6.5.2(C) of AS 2159 – 2009

Table 3: Summary of Test Results for Salinity

Borehole	Depth (m)	Material	Soil Texture	MF	EC (µS/cm)	EC_e (dS/m)	Classification
BH201	0.5-0.6	FILL/Clayey SAND	Sandy Loam	14	110	<2	Non-Saline
BH201	1.0-1.1	FILL/Sandy CLAY	Light Medium Clay	8	350	2.8	Slightly Saline
BH201	2.0-2.1	FILL/Sandy CLAY	Medium Clay	7	280	<2	Non-Saline
BH201	2.7-2.8	FILL/Sandy CLAY	Medium Clay	7	190	<2	Non-Saline
BH202	0.5-0.6	FILL/ CLAY	Clay Loam	9	380	3.5	Slightly Saline
BH202	1.0-1.1	FILL/ CLAY	Clay Loam	9	510	4.6	Moderately Saline
BH202	2.0-2.1	FILL/Sandy CLAY	Medium Clay	7	290	2.0	Slightly Saline
BH202	3.0-3.1	FILL/Sandy CLAY	Clay Loam	9	280	2.5	Slightly Saline
BH203	0.5-0.6	FILL/Sandy CLAY	Clay Loam	9	270	2.4	Slightly Saline
BH203	1.0-1.1	FILL/ CLAY	Medium Clay	7	270	<2	Non-Saline
BH203	2.0-2.1	FILL/ CLAY	Medium Clay	7	170	<2	Non-Saline
BH203	3.0-3.1	FILL/ CLAY	Medium Clay	7	830	5.8	Moderately Saline
BH204	0.5-0.6	FILL/Sandy CLAY	Medium Clay	7	370	2.6	Slightly Saline
BH204	1.0-1.1	FILL/Sandy CLAY	Medium Clay	7	400	2.8	Slightly Saline
BH204	2.0-2.1	FILL/Silty Sandy CLAY	Clay Loam	9	490	4.4	Moderately Saline
BH204	3.0-3.1	FILL/Silty Sandy CLAY	Medium Clay	7	610	4.3	Moderately Saline

Notes: MF = multiplication factor based on textural classification; ECe = salinity value (calculated value);
Salinity Classification per DLWC (2002), using the criteria of Richards (1954)

Table 4: Summary of Test Results for Sodicity and Dispersion

Borehole	Depth (m)	Exchangeable Sodium (meq/100g)	CEC (meq/100g)	ESP (%)	Emerson Class	Sodicity Class, Dispersion
BH202	0.5-0.6	1.2	8.9	14	2	Sodic, Some Dispersion
BH202	1.0-1.1	1.1	8.6	13	2	Sodic, Some Dispersion
BH203	0.5-0.6	1.1	5.9	18	2	Highly Sodic, Some Dispersion
BH203	1.0-1.1	1.2	8.3	15	2	Sodic, Some Dispersion

Notes: Sodicity Classification per DLWC (2002); Dispersion per AS 1289.3.8.1 – 2017

7. Comments on Test Results

7.1 Aggressivity

The laboratory test results indicate 'non-aggressive' and 'mildly' aggressive conditions for buried concrete, and generally 'non-aggressive' conditions for buried steel elements with one occurrence of 'mildly' aggressive conditions for buried steel, as outlined in AS 2159 – 2009. The results are consistent with the testing previously undertaken during Douglas' geotechnical investigation in 2022.

7.2 Salinity

Figure 3 presents the variations of salinity with depth, based on salinity (EC_e) profiles, together with the salinity classifications (Richards, 1954). There does not appear to be a correlation between salinity and depth, which is consistent with the nature of fill material.

The test results indicate that 31% (5 out of 16) of tested soil samples were non-saline, 44% (7 out of 16) were slightly saline and 25% (4 out of 16) were moderately saline. The moderately saline soils were found in samples from BH202 at 1 m depth, BH203 at 3 m depth and BH204 at 2 m and 3 m depth.

Based on the results of salinity testing on fill material present at the site, it is considered necessary to undertake salinity management measures for the proposed development. A salinity management plan is provided in Section 9 of this report.

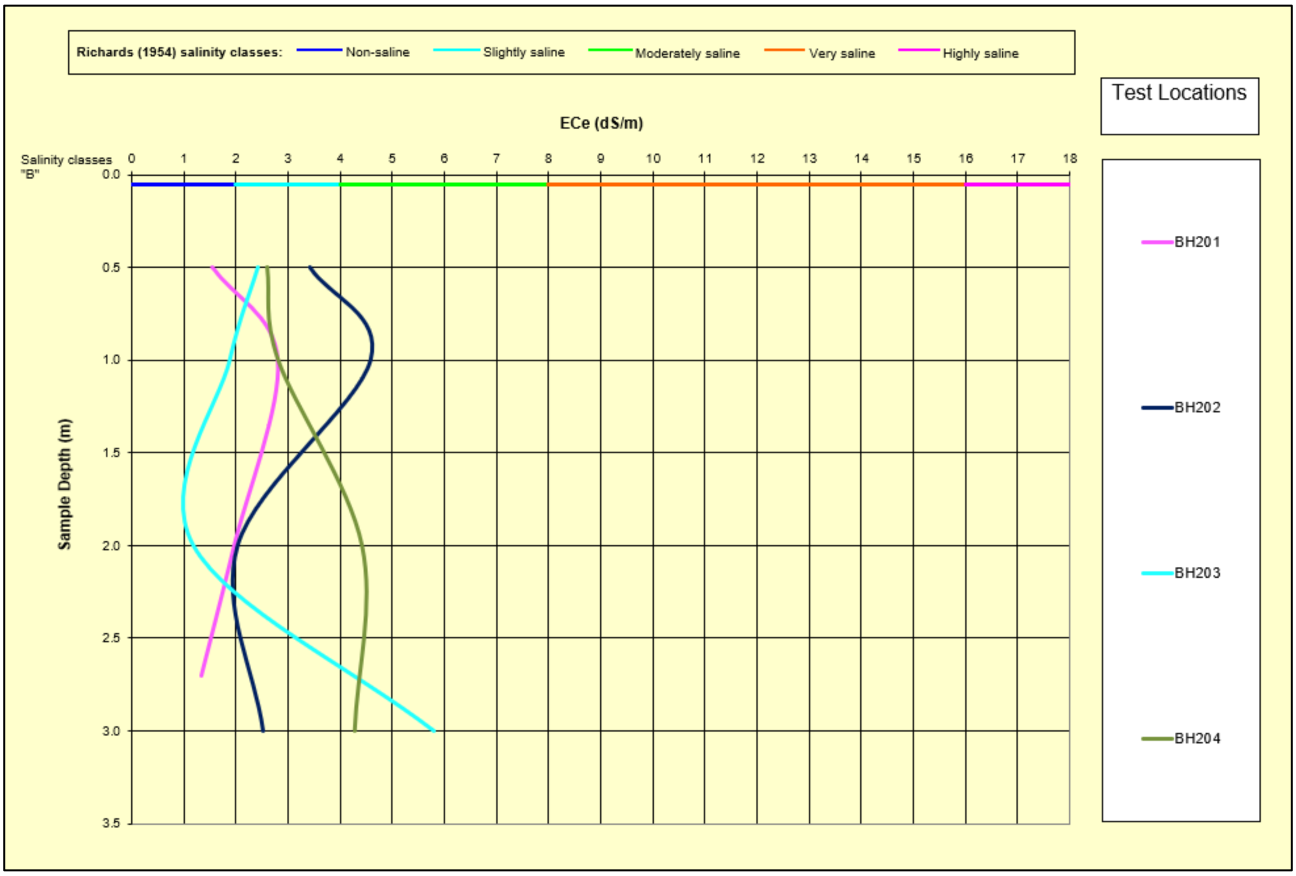

Figure 3: Vertical Salinity Profiles and Salinity Classes

7.3 Sodicity and Dispersion

The sodicity tests indicated that three samples were sodic, and one sample was highly sodic. Dispersion potential by the Emerson class number test indicated Class 2 material (some dispersion). Emerson Class 2 clay soils are considered to be associated with a high potential for erosion. The presence of sodic and highly sodic, and dispersible soils will need to be considered for the proposed development. Further comments are provided in the salinity management plan in Section 9 of this report.

8. Impacts on the Proposed Development

It is understood that the proposed development will include construction of three-storey school buildings, including learning hubs, a school hall and an administration and library building; construction and operation of a public preschool; delivery of a sports court and fields; construction of car parking, waste storage and loading area; associated site landscaping and open space improvements; and associated off-site infrastructure works to support the school, including (but not limited to) services, driveways and pedestrian crossings.

Below ground basement structures are not currently proposed for the development, however, limited excavation may be necessary for foundations, localised leveling, landscaping and for the installation of buried services.

The non-aggressive and mildly aggressive soil conditions, the presence of moderately saline soils, the sodic and highly sodic soils, and dispersible soils are not considered significant impediments to the proposed development, provided appropriate management techniques are employed.

Salinity and aggressivity affects the durability of concrete and steel by causing premature breakdown of concrete and corrosion of steel. This has impacts on the longevity of structures in contact with these materials. As a result, management will be required, which is discussed further in Section 9.

Sodic soils have a low permeability due to infilling of interstices with fine clay particles during the weathering process, restricting infiltration of surface water and potentially creating perched water tables, seepage in cut faces or ponding water in flat open areas. In addition, sodic and dispersive soils tend to erode when exposed. Management of the sodic and dispersive soils will be required, which is discussed further in Section 9.

9. Salinity Management Plan

The salinity investigation indicates that material within the site is non-saline to moderately saline. Testing of other parameters associated with salinity indicates that the materials are non-aggressive to mildly aggressive to concrete and non-aggressive to mildly aggressive to steel (AS 2159, 2009). It would be prudent to assume that all soils encountered within the site are possibly moderately saline, mildly aggressive to steel and mildly aggressive to concrete. In addition, shallow material encountered within the site were found to be sodic and highly sodic, and dispersive.

The following management strategies are recommended, which are confined to the management of those factors with a potential impact on the development.

- Management should focus on capping the upper surface of the sodic and dispersive soils, both exposed by excavation and placed as fill, with a more permeable material to prevent ponding, to reduce capillary rise, to act as a drainage layer and to reduce the potential for erosion.
- With respect to imported fill material, testing should be undertaken prior to importation, to determine the salinity characteristics of the material, which should be non-aggressive and non-saline where possible, but in any case, not more aggressive or more saline than the material on which it is to be placed.
- Sodic and dispersive soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. The addition of organic matter, gypsum and lime can also be considered where appropriate. After gypsum addition, reduction of sodicity levels may require some time for sufficient infiltration and leaching of sodium into the subsoils, however capping of exposed sodic material should remain the primary management method. Topsoil added at the completion of bulk earthworks is, in effect, also adding organic matter which may help infiltration and leaching of sodium.
- Avoid water collecting in low lying areas, in depressions, or behind fill. This can lead to waterlogging of the soils, evaporation and increased concentration of salts, and eventual breakdown in the soil structure resulting in accelerated erosion.
- Pavements should be designed to be well drained of surface water. There should not be excessive concentrations of runoff or ponding that would lead to waterlogging of the

pavement or additional recharge to the groundwater through any more permeable zones in the underlying filling material.

- Surface drains should generally be provided along the top of any batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.
- Salt tolerant grasses and trees should be considered for landscaping, to reduce soil erosion and to maintain the existing evapo-transpiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist.

The following additional strategies are recommended for the completion of subsurface structures and service installation, including but not limited to, roads, drainage, services, piles, slabs and footings. These strategies should be complementary to standard good building practices recommended within the Building Code of Australia, including cover to reinforcement within concrete.

- For soils that are mildly aggressive to concrete, piles should have a minimum strength of 32 MPa and a minimum cover to reinforcement of 60 mm (as per AS 2159) to limit the corrosive effects of the surrounding materials (in accordance with AS 2159).
- With regard to concrete structures, for moderately saline soils (with salinities of 4 – 8 dS/m) and mildly aggressive to concrete (AS 3600 – A1), slabs and foundations should have a minimum strength of 25 MPa, a minimum cover of reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS 3600) to limit the corrosive effects of the surrounding soils.
- Wet cast concrete pipes and spun concrete pipes are understood to have estimated compressive strengths of 50 MPa and 60 MPa to 70 MPa, respectively, in excess of the requirements for mass concrete, as above. Reference to the maximum and minimum test results of Table 2 (refer to Section 6 of this report), and to Tables E1 and 3.1 of AS 4058 – 2007 'Precast concrete pipes' indicates that the site falls within the AS 4058 Clay/Stagnant (low sulphate) soil type (where chlorides <= 20,000 ppm, pH >= 4.5, and sulphates <= 1,000 ppm) and (in the absence of tidal water flow) falls within the AS 4058 Normal durability environment. Under these conditions, AS 4058 compliant reinforced concrete pipes of General Purpose (GP) Portland cement, with a minimum cover to reinforcement of 10 mm, are expected to have a design life in excess of 100 years.

  Hence, any concrete pipes installed within the site should employ AS 4058 (2007) compliant steel reinforced pipes of GP Portland cement, with minimum cover to reinforcement of 10 mm, or should be fibre reinforced.
- For soils that are mildly aggressive to steel a corrosion allowance (as per AS2159 – 2009) of 0.01 – 0.02 mm/year should be taken into account by the designer. In instances where a corrosion protection coating is applied, if the design life of the structure is greater than the design life of the coating, consideration must be given to corrosion of the structure in accordance with the above allowance.

10. REF Risk Mitigation Measures

The salinity risk mitigation measures relevant to the REF requirements for the proposed development at the site, as discussed in previous sections of this report, are summarised in Table 5.

Table 5: Summary of REF Salinity Risk Mitigation Measures

Project Stage Design (D) Construction (C) Operation (O)	Mitigation Measures	Relevant Section of Report
D	Assuming moderately saline, mildly aggressive to steel and mildly aggressive to concrete conditions at the site, as per Section 9.	Section 9
D, C & O	Management of mildly aggressive, moderately saline, sodic and dispersive soils as per the recommendations in Section 9.	Section 9

11. References

AS 2159. (2009). *Piling - Design and Installation.* Standards Australia.

AS 3600. (2018). *Concrete Structures.* including Amendment 1:2018 and Amendment 2:2021: Standard Australia.

AS 4058. (2007). *Precast Concrete Pipe (Pressure and Non-Pressure).* Australian Standard.

NSW DPI. (2014). *Salinity Training Manual: Salinity Identification, Causes and Management.* JTN 12832 06/14, June 2014: NSW Department of Primary Industries.

Richards, L. A. (1954). *Diagnosis of Saline and Alkaline Soils.* Washington D.C: US Department of Agriculture.

12. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at Fontana Drive, Gables NSW in line with Douglas' proposal 216255.00.P001.Rev1, dated 16/08/2024 and acceptance received from School Infrastructure NSW. The work was carried out under contract SINSW0310-22. This report is provided for the exclusive use of School Infrastructure NSW 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 Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and their agents.

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

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the 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 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. Douglas 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 Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this specific report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the 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. Further details on contamination at the site are available in the Report on Preliminary Site Investigation (Contamination) (ref: 216255.01.R.001) and the Report on Detailed Site Investigation (Contamination) (ref: 216255.01.R.002).

Appendix A

Notes About This Report

About this Report

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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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

continued next page

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.

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Appendix B

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Test Location Plan	20.09.2024	LL

SCALE:
0 10 20 30 40 50 m
1:1000 @ A3

N

Douglas PARTNERS

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

CLIENT:
School Infrastructure NSW

NOTE:
1: Basemap from MetroMap (Dated 04.09.2024)
2: Base Survey Plan from Architectus Sydney, Reference AR-SD2000, Revision 0 (Dated 06.09.2024)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
The Gables New Primary School

PROJECT ADRESS:
Fontana Drive, Gables, NSW 2765

DRAWING TITLE:
Test Location Plan

PROJECT NO:
216255.02

DRAWING NO:
01

REVISION:
00

Appendix C

Terminology, Symbols and Abbreviations

Soil Descriptions

Sampling, Testing and Excavation Methodology

Borehole Logs

Terminology, Symbols and Abbreviations

November 2020

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style `XW`. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	`KL`
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	`UK`
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	`ND`
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	`NA`

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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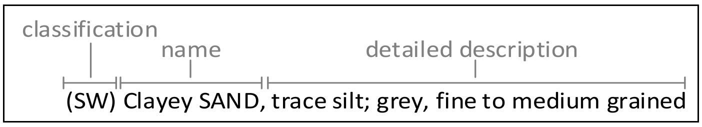
Soil Descriptions

Terminology
Symbols
Abbreviations

November 2020

Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:



The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence it's behaviour. The detailed description presents more information about the soil's composition, condition, structure, and origin.

Classification, naming and description of soils requires the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Fraction	**Particle Size (mm)**	**Behaviour Model**	
		Behaviour	**Approximate Dry Mass**
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soils behaviour.

Component Proportion Designation	**Definition[1]**	**Relative Proportion**	
		In Fine Grained Soil	**In Coarse Grained Soil**
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to it's engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub categories. Refer "identification of minor components" below

Composite Materials

In certain situations a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example "INTERBEDDED Silty CLAY AND SAND".

Classification

The soil classification comprises a two character group symbol. The first symbol identifies the primary component. The second symbol identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component[1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters `(?)`, with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description.

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterize due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

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

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular particle size with the range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

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Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	`<PL`
	Near plastic limit	Can be moulded	`≈PL`
	Wet of plastic limit	Water residue remains on hands when handling	`>PL`
	Near liquid limit	"oozes" when agitated	`≈LL`
	Wet of liquid limit	"oozes"	`>LL`
Coarse	Dry	Non-cohesive and free running	`D`
	Moist	Feels cool, darkened in colour, particles may stick together	`M`
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	`W`

The abbreviation code `NDF`, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Rock

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered rock origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description

Quantitative engineering performance of these materials may be determined by laboratory testing, or estimated by correlated field tests (for example penetration or shear vane testing). In some cases performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example `(VS)`.

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	`VS`
Soft	Mouldable with light finger pressure	>12 - ≤25	`S`
Firm	Mouldable with strong finger pressure	>25 - ≤50	`F`
Stiff	Cannot be moulded by fingers	>50 - ≤100	`ST`
Very stiff	Indented by thumbnail	>100 - ≤200	`VST`
Hard	Indented by thumbnail with difficulty	>200	`H`
Friable	Easily crumbled or broken into small pieces by hand	-	`FR`

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	`VL`
Loose	>15-≤35	`L`
Medium dense	>35-≤65	`MD`
Dense	>65-≤85	`D`
Very dense	>85	`VD`

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	`WC`
Poorly compacted	`PC`
Moderately compacted	`MC`
Variably compacted	`VC`

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	`MCE`
Weakly cemented	`WKCE`
Cemented	`CE`
Strongly bound	`SB`
Weakly bound	`WB`
Unbound	`UB`

Extremely Weathered Rock

AS1726-2017 considers weathered rock material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. very low strength rock). These materials may be identified as “extremely weathered rock” in reports and by the abbreviation code `XWR` on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	`RES`
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than ‘very low’ as per as1726 but retains the structure or fabric of the parent rock.	`XWM`
Alluvial	Deposited by streams and rivers	`ALV`
Estuarine	Deposited in coastal estuaries	`EST`
Marine	Deposited in a marine environment	`MAR`
Lacustrine	Deposited in freshwater lakes	`LCS`
Aeolian	Carried and deposited by wind	`AEO`
Colluvial	Soil and rock debris transported down slopes by gravity	`COL`
Topsoil	Mantle of surface soil, often with high levels of organic material	`TOP`
Fill	Any material which has been moved by man	`FILL`
Littoral	Deposited on the lake or sea shore	`LIT`
Unidentifiable	Not able to be identified	`UID`

Cobbles and Boulders

The presence of particles considered to be “oversize” may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with “MIXTURE OF”.

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Rock Descriptions

Terminology
Symbols
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November 2021

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

[1] Assumes a ratio of 20:1 for UCS to $I_{s(50)}$. It should be noted that the UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site.

On investigation logs only, the following data contiguity codes may be in rock strength tables for layers or seams of material “within rock”, but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the “Description of Strata” and soil properties columns.	`SOIL`
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	`SEAM`

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil[1,2]	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.	`RS`
Extremely weathered[1,2]	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	`XW`
Highly weathered	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.	`HW`
Moderately weathered	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.	`MW`
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	`SW`
Fresh	No signs of decomposition or staining.	`FR`
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	`DW`

[1] AS1726-2017 6.1.9 provides similar definitions for “residual soil” and “extremely weathered material” as soil origins. Generally, the soil origin terms would be used above the depth at which very low strength or stronger rock material is first encountered, while both soil origin and weathering should may be stated for soil encountered below the first contact with rock material, where appropriate.
[2] The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	`XA`
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching, or may be decreased due to precipitation of secondary materials in pores.	`HA`
Moderately altered	The whole of the rock material is discoloured, usually by 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.	`MA`
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	`SA`
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching, or may be decreased due to precipitation of secondary minerals in pores.	`DA`

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

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:

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

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

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

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

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Clay seam	CS
Cleavage	CV
Crushed zone	CZ
Decomposed seam	DS
Fault	F
Joint	J
Lamination	LAM
Parting	PT
Sheared zone	SZ
Vein	VN
Drilling/handling break	DB , HB
Fracture	FCT

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CLN
Coating	CO
Healed	HE
Infilled	INF
Stained	STN
Tight	TI
Veneer	VEN

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLY
Iron oxide	FE
Manganese	MN
Silty	SLT

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Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Irregular	IR
Planar	PL
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RO
Slickensided	SL
Smooth	SM
Very rough	VR

Other Rock Defect Attributes

Term	Abbreviation Code
Fragmented	FG
Band	BND
Quartz	QTZ

Defect Orientation

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

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Sampling, Testing and Excavation Methodology

Terminology
Symbols
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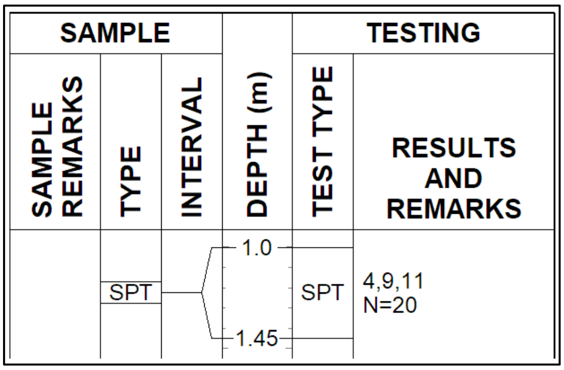
November 2020

Sampling and Testing

A record of samples retained and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Sample from SPT test	SPT
Environmental sample	E
Gas sample	G
Jar sample	J
Undisturbed tube sample	U[1]
Water sample	W
Piston sample	P
Core sample for unconfined compressive strength testing	UCS

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =*x* blows for *y* mm penetration HB = hammer bouncing	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	Observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Excavator/backhoe bucket	B[1]
Toothed bucket	TB[1]
Mud/blade bucket	MB[1]
Ripping tyne/ripper	RT
Rock breaker/hydraulic hammer	RB
Hand auger	HA[1]
NMLC series coring	NMLC
HMLC series coring	HMLC
NQ coring	NQ
HQ coring	HQ
PQ coring	PQ
Push tube	PT [1]
Rock roller	RR[1]
Solid flight auger. Suffixes: (TC) = tungsten carbide tip, (V) = v-shaped tip	SFA[1]
Sonic drilling	SON[1]
Vibrocore	VC[1]
Wash bore (unspecified bit type)	WB[1]
Existing exposure	X
Hand tools (unspecified)	HT
Predrilled	PD
Specialised bit (refer report)	SPEC[1]
Diatube	DT[1]
Hollow flight auger	HFA[1]
Vacuum excavation	VE

[1] – numeric suffixes indicate tool diameter/width in mm

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Tha Gables New Primary School
LOCATION: Fontana Drive, Gables, NSW 2765

SURFACE LEVEL: 38.9 AHD
COORDINATE: E:305778.2, N:6277168.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH201
PROJECT No: 216255.02
DATE: 10/09/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) ▩ DENSITY.(*) ▨	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
10/09/24 No free groundwater observed whilst augering			FILL / Sandy CLAY, trace rootlets, trace gravel: dark brown; medium plasticity; fine to medium sand; fine to medium, sandstone gravel.	▨	FILL		w<PL						
		0.20	FILL / Clayey SAND: pale brown; fine to medium.	▨	FILL		D to M		A		0.50 0.60		
	38	0.70 1	FILL / Sandy CLAY, trace rootlets, trace gravel: pale brown mottled red brown; medium to high plasticity; fine to medium sand; fine, sandstone, pale grey gravel.	▨	FILL		w=PL		A		1.00 1.10		
			From 1.60m: Higher Auger Resistance	▨	FILL								
	37	2		▨			w<PL to w=PL		A		2.00 2.10		
			From 2.70m: sandstone boulder	▨			D		A		2.70		
	36	3	Borehole discontinued at 2.80m depth. Auger refusal.										
	35	4											
	34												

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: GT-10
METHOD: AD to 2.8m
REMARKS:

OPERATOR: Ground Test (TK)

LOGGED: L.Lau
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Tha Gables New Primary School
LOCATION: Fontana Drive, Gables, NSW 2765

SURFACE LEVEL: 35.0 AHD
COORDINATE: E:305879.7, N:6277091.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH202
PROJECT No: 216255.02
DATE: 10/09/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) ▨ DENSITY.(*) ▨	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
10/09/24 No free groundwater observed whilst augering	35 34	1	FILL / CLAY, with sand, trace gravel: brown mottled yellow-brown; medium plasticity; fine sand; fine to coarse, sandstone gravel; trace charcoal. 0.20m: sandstone cobble ~200 mm	▨	FILL		w<PL to w=PL		A A		0.50 0.60 1.00 1.10		
	33 32	1.60 2 3	FILL / Sandy CLAY, with gravel: brown mottled pale grey; medium to high plasticity; fine to medium sand; fine to medium, sandstone and ironstone gravel; one fragment of ceramic. From 2.50m: with fine to medium sandstone and shale, ironstone gravel	▨	FILL		w=PL		A A		2.00 2.10 3.00		

Borehole discontinued at 3.10m depth.
Target depth reached.

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: GT-10
METHOD: AD to 3.1m
REMARKS:

OPERATOR: Ground Test (TK)

LOGGED: L.Lau
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Tha Gables New Primary School
LOCATION: Fontana Drive, Gables, NSW 2765

SURFACE LEVEL: 37.5 AHD
COORDINATE: E:305765.1, N:6277038.5
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH203
PROJECT No: 216255.02
DATE: 10/09/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] ▨ DENSITY.[*] ▨	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
10/09/24 No free groundwater observed whilst augering	37		FILL / Sandy CLAY, trace rootlets: brown; medium plasticity; fine to medium sand.	▨	FILL		w<PL		A		0.50 0.60		
	36	0.80 1	FILL / CLAY, trace sand, trace gravel: brown mottled pale grey and orange-brown; medium to high plasticity; fine sand; sandstone and ironstone gravel.	▨	FILL		w=PL		A		1.00 1.10		
		2	1.80m-2.10m: sandstone boulder				D		A		2.00 2.10		
	35	2.10 3	FILL / CLAY, trace sand, trace gravel: brown mottled dark brown; medium to high plasticity; fine sand; fine to medium, sandstone and ironstone gravel.	▨	FILL		w=PL		A		3.00		
	34 33	4	Borehole discontinued at 3.10m depth. Target depth reached.										

Generated with CORE-GS by Geroc - Soil Log

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: GT-10
METHOD: AD to 3.1m
REMARKS:

OPERATOR: Ground Test (TK)

LOGGED: L.Lau
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Tha Gables New Primary School
LOCATION: Fontana Drive, Gables, NSW 2765

SURFACE LEVEL: 35.6 AHD
COORDINATE: E:305827.7, N:6277002.9
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH204
PROJECT No: 216255.02
DATE: 10/09/24
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
10/09/24 No free groundwater observed whilst augering			FILL / Sandy CLAY, trace gravel: brown mottled orange-brown; medium plasticity; fine to medium sand; fine to coarse, sandstone gravel.		FILL		w<PL						
									A		0.50 0.60		
		0.70	FILL / Silty Sandy CLAY, trace gravel: orange-brown mottled pale grey-brown; medium plasticity; fine to medium sand; fine to medium, sandstone and ironstone gravel.		FILL		w=PL						
									A		1.00 1.10		
									A		2.00 2.10		
			From 2.50m: high plasticity										
									A		3.00		
			Borehole discontinued at 3.10m depth. Target depth reached.										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: GT-10
METHOD: AD to 3.1m
REMARKS:

OPERATOR: Ground Test (TK)

LOGGED: L.Lau
CASING: Uncased

Refer to explanatory notes for symbol and abbreviation definitions

Appendix D

Laboratory Certificates of Results

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 361504

Client Details

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

Sample Details

Your Reference	**216255.02 Gables**
Number of Samples	16 Soil
Date samples received	11/09/2024
Date completed instructions received	11/09/2024

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	18/09/2024
Date of Issue	19/09/2024
Reissue Details	This report replaces R00 created on 18/09/2024 due to: result entry error-Texture for sample1 amended.

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

Results Approved By
Diego Bigolin, Inorganics Supervisor
Jenny He, Senior Chemist
Loren Bardwell, Development Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Client Reference: 216255.02 Gables

ESP/CEC					
Our Reference	UNITS	361504-5	361504-6	361504-9	361504-10
Your Reference		BH202	BH202	BH203	BH203
Depth		0.5-0.6	1-1.1	0.5-0.6	1-1.1
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/09/2024	17/09/2024	17/09/2024	17/09/2024
Date analysed	-	17/09/2024	17/09/2024	17/09/2024	17/09/2024
Exchangeable Ca	meq/100g	1.8	2.0	0.4	2.2
Exchangeable K	meq/100g	0.2	0.2	0.2	0.2
Exchangeable Mg	meq/100g	5.7	5.3	4.2	4.7
Exchangeable Na	meq/100g	1.2	1.1	1.1	1.2
Cation Exchange Capacity	meq/100g	8.9	8.6	5.9	8.3
ESP	%	14	13	18	15

Misc Inorg - Soil						
Our Reference		361504-1	361504-2	361504-3	361504-4	361504-5
Your Reference	UNITS	BH201	BH201	BH201	BH201	BH202
Depth		0.5-0.6	1-1.1	2-2.1	2.7-2.8	0.5-0.6
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2024	13/09/2024	13/09/2024	13/09/2024	13/09/2024
Date analysed	-	13/09/2024	13/09/2024	13/09/2024	13/09/2024	13/09/2024
pH 1:5 soil:water	pH Units	7.8	5.0	5.6	5.8	5.5
Chloride, Cl 1:5 soil:water	mg/kg	42	350	320	150	340
Sulphate, SO4 1:5 soil:water	mg/kg	43	180	99	120	260

Misc Inorg - Soil						
Our Reference		361504-6	361504-7	361504-8	361504-9	361504-10
Your Reference	UNITS	BH202	BH202	BH202	BH203	BH203
Depth		1-1.1	2-2.1	3-3.1	0.5-0.6	1-1.1
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2024	13/09/2024	13/09/2024	13/09/2024	13/09/2024
Date analysed	-	13/09/2024	13/09/2024	13/09/2024	13/09/2024	13/09/2024
pH 1:5 soil:water	pH Units	5.4	5.5	6.5	5.0	6.3
Chloride, Cl 1:5 soil:water	mg/kg	590	350	290	270	230
Sulphate, SO4 1:5 soil:water	mg/kg	130	61	110	120	190

Misc Inorg - Soil						
Our Reference		361504-11	361504-12	361504-13	361504-14	361504-15
Your Reference	UNITS	BH203	BH203	BH204	BH204	BH204
Depth		2-2.1	3-3.1	0.5-0.6	1-1.1	2-2.1
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	13/09/2024	13/09/2024	13/09/2024	13/09/2024	13/09/2024
Date analysed	-	13/09/2024	13/09/2024	13/09/2024	13/09/2024	13/09/2024
pH 1:5 soil:water	pH Units	5.9	5.4	6.3	5.5	6.6
Chloride, Cl 1:5 soil:water	mg/kg	170	940	330	440	510
Sulphate, SO4 1:5 soil:water	mg/kg	60	230	270	97	160

Misc Inorg - Soil		
Our Reference		361504-16
Your Reference	UNITS	BH204
Depth		3-3.1
Date Sampled		10/09/2024
Type of sample		Soil
Date prepared	-	13/09/2024
Date analysed	-	13/09/2024
pH 1:5 soil:water	pH Units	5.1
Chloride, Cl 1:5 soil:water	mg/kg	610
Sulphate, SO4 1:5 soil:water	mg/kg	280

Client Reference: 216255.02 Gables

Texture and Salinity*						
Our Reference		361504-1	361504-2	361504-3	361504-4	361504-5
Your Reference	UNITS	BH201	BH201	BH201	BH201	BH202
Depth		0.5-0.6	1-1.1	2-2.1	2.7-2.8	0.5-0.6
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
Date analysed	-	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
Electrical Conductivity 1:5 soil:water	µS/cm	110	350	280	190	380
Texture Value	-	14	8.0	7.0	7.0	9.0
Texture	-	SANDY LOAM	LIGHT MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	CLAY LOAM
ECe	dS/m	<2	2.8	<2	<2	3.5
Class	-	NON SALINE	SLIGHTLY SALINE	NON SALINE	NON SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		361504-6	361504-7	361504-8	361504-9	361504-10
Your Reference	UNITS	BH202	BH202	BH202	BH203	BH203
Depth		1-1.1	2-2.1	3-3.1	0.5-0.6	1-1.1
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
Date analysed	-	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
Electrical Conductivity 1:5 soil:water	µS/cm	510	290	280	270	270
Texture Value	-	9.0	7.0	9.0	9.0	7.0
Texture	-	CLAY LOAM	MEDIUM CLAY	CLAY LOAM	CLAY LOAM	MEDIUM CLAY
ECe	dS/m	4.6	2.0	2.5	2.4	<2
Class	-	MODERATELY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	NON SALINE

Client Reference: 216255.02 Gables

Texture and Salinity*						
Our Reference		361504-11	361504-12	361504-13	361504-14	361504-15
Your Reference	UNITS	BH203	BH203	BH204	BH204	BH204
Depth		2-2.1	3-3.1	0.5-0.6	1-1.1	2-2.1
Date Sampled		10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
Date analysed	-	12/09/2024	12/09/2024	12/09/2024	12/09/2024	12/09/2024
Electrical Conductivity 1:5 soil:water	μS/cm	170	830	370	400	490
Texture Value	-	7.0	7.0	7.0	7.0	9.0
Texture	-	MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	CLAY LOAM
ECe	dS/m	<2	5.8	2.6	2.8	4.4
Class	-	NON SALINE	MODERATELY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE	MODERATELY SALINE

Texture and Salinity*		
Our Reference		361504-16
Your Reference	UNITS	BH204
Depth		3-3.1
Date Sampled		10/09/2024
Type of sample		Soil
Date prepared	-	12/09/2024
Date analysed	-	12/09/2024
Electrical Conductivity 1:5 soil:water	μS/cm	610
Texture Value	-	7.0
Texture	-	MEDIUM CLAY
ECe	dS/m	4.3
Class	-	MODERATELY SALINE

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. 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.
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.
INORG-123	Determined using a "Texture by Feel" method.
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-1	[NT]
Date prepared	-			17/09/2024	10	17/09/2024	17/09/2024		17/09/2024	[NT]
Date analysed	-			17/09/2024	10	17/09/2024	17/09/2024		17/09/2024	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	10	2.2	2.1	5	124	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	10	0.2	0.2	0	126	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	10	4.7	4.4	7	124	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	10	1.2	1.2	0	121	[NT]
ESP	%	1	Metals-020	[NT]	10	15	15	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	361504-2
Date prepared	-			13/09/2024	1	13/09/2024	13/09/2024		13/09/2024	13/09/2024
Date analysed	-			13/09/2024	1	13/09/2024	13/09/2024		13/09/2024	13/09/2024
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	7.8	[NT]		100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	42	40	5	105	#
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	43	42	2	100	#

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	7	13/09/2024	13/09/2024		[NT]	[NT]
Date analysed	-			[NT]	7	13/09/2024	13/09/2024		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	7	5.5	5.5	0	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	7	350	320	9	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	7	61	60	2	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	13	13/09/2024	13/09/2024		[NT]	[NT]
Date analysed	-			[NT]	13	13/09/2024	13/09/2024		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	13	6.3	6.4	2	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	13	330	[NT]		[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	13	270	[NT]		[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			12/09/2024	7	12/09/2024	12/09/2024		12/09/2024	[NT]
Date analysed	-			12/09/2024	7	12/09/2024	12/09/2024		12/09/2024	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	7	290	260	11	97	[NT]
Texture Value	-		INORG-123	[NT]	7	7.0	7.0	0	[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	13	12/09/2024	12/09/2024		[NT]	[NT]
Date analysed	-			[NT]	13	12/09/2024	12/09/2024		[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	13	370	360	3	[NT]	[NT]
Texture Value	-		INORG-123	[NT]	13	7.0	7.0	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

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.

Material Test Report

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

Report Number: **216255.02-1**
Issue Number: 1
Date Issued: 16/09/2024
Client: School Infrastructure NSW
Level 8, SYDNEY NSW
Contact: Richard Moyle
Project Number: 216255.02
Project Name: Box Hill (The Gables) New Public School
Project Location: 7 Red Gables Rd, Gables NSW
Work Request: 11780
Sample Number: SY-11780A
Date Sampled: 10/09/2024
Dates Tested: 11/09/2024 - 16/09/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH202 (0.5-0.6m)**
Material: FILL/CLAY: brown mottled pale yellow-brown

Accredited for compliance with ISO/IEC 17025 - Testing

Lujia Wu

Approved Signatory: Lujia Wu
Soil Technician
Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	FILL/CLAY: brown mottled pale yellow-brown		
Nature of Water	Demineralised		
Temperature of Water (^{o}C)	22		

Material Test Report

Report Number: **216255.02-1**
Issue Number: 1
Date Issued: 16/09/2024
Client: School Infrastructure NSW
Level 8, SYDNEY NSW
Contact: Richard Moyle
Project Number: 216255.02
Project Name: Box Hill (The Gables) New Public School
Project Location: 7 Red Gables Rd, Gables NSW
Work Request: 11780
Sample Number: SY-11780B
Date Sampled: 10/09/2024
Dates Tested: 11/09/2024 - 16/09/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH202 (1.0-1.1m)**
Material: FILL/CLAY: brown mottled pale yellow-brown

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Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Email: lujia.wu@douglaspartners.com.au

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Lujia Wu

Approved Signatory: Lujia Wu
Soil Technician
Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	FILL/CLAY: brown mottled pale yellow-brown		
Nature of Water	Demineralised		
Temperature of Water (^{o}C)	22		

Material Test Report

Report Number: **216255.02-1**
Issue Number: 1
Date Issued: 16/09/2024
Client: School Infrastructure NSW
Level 8, SYDNEY NSW
Contact: Richard Moyle
Project Number: 216255.02
Project Name: Box Hill (The Gables) New Public School
Project Location: 7 Red Gables Rd, Gables NSW
Work Request: 11780
Sample Number: SY-11780C
Date Sampled: 10/09/2024
Dates Tested: 11/09/2024 - 16/09/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH203 (0.5-0.6m)**
Material: FILL/Sandy CLAY: brown

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

Accredited for compliance with ISO/IEC 17025 - Testing

Lujia Wu

Approved Signatory: Lujia Wu
Soil Technician
Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description	FILL/Sandy CLAY: brown		
Nature of Water	Demineralised		
Temperature of Water (^{o}C)	22		

Material Test Report

Report Number: **216255.02-1**
Issue Number: 1
Date Issued: 16/09/2024
Client: School Infrastructure NSW
Level 8, SYDNEY NSW
Contact: Richard Moyle
Project Number: 216255.02
Project Name: Box Hill (The Gables) New Public School
Project Location: 7 Red Gables Rd, Gables NSW
Work Request: 11780
Sample Number: SY-11780D
Date Sampled: 10/09/2024
Dates Tested: 11/09/2024 - 16/09/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH203 (1.0-1.1m)**
Material: FILL/CLAY: brown mottled pale grey and orange-brown

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

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Lujia Wu

Approved Signatory: Lujia Wu
Soil Technician
Laboratory Accreditation Number: 828

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