GEOTECH TESTING PTY LTD ®
ABN 71 076 676 321

Job No: 9557/1
Our Ref: 9557/1-AA-R3
2 August 2023

Camden Council
PO Box 36
WICKHAM NSW 2293
Email: Salina.Lama@facs.nsw.gov.au

Attention: Mrs S Lama

Dear Madam

re: **Proposed Twelve Boarding House**
3-5 Kelloway Avenue, Camden (Lot 17 & 18 DP 219782)
Preliminary Geotechnical Investigation

This letter report provides the results of a geotechnical investigation and inspection at the above site. The work was carried out on 30 May 2023 and was carried out in general accordance with Australian Standard AS1726 (Reference 1).

We understand the following:

- The proposed development at the above site includes future development of a boarding house, which would require excavation. Prior to investigation a site plan showing the proposed works of the boarding house was provided in preparation of this report.
- A geological investigation is required to assess subsurface conditions across the proposed location of boarding house, car park and site features and provide geotechnical recommendations for excavation condition, suitability of foundation on design of floors slabs and footings and soil bearing capacities.
- Designs provided for the proposed development indicates fill up to 1.5m and cuts up to 2.0m along with site preparation procedures.

Review of Available Information
Reference of the Geological Map of Wollongong (scale 1:250,000) indicates that bedrock at the site is likely to be Wianamatta Group shale, dark grey siltstones, calcareous claystone, laminate, lithic sandstone, and rare coals.

Reference to Soil Landscape Map indicates that the landscape of the site gently undulating rises on Wianamatta Group shale. Local relief to 30m with slopes usually <5% and occasionally up to 10%. Broad rounded crests and ridges with gently inclined slopes. Almost completely cleared eucalypt woodland, open-forest and tall open forest.

Reference to the Map of Salinity Potential in Western Sydney (scale approximately 1:140,000) indicates landscape in most part of the site has moderate salinity potential.

Geotech Testing Pty Ltd (Geotech Testing) has completed a preliminary site investigation (PSI) for the site and submitted a report (Reference 1). Review of PSI report indicates that a total of 4 test pits were excavated across the site and the sub-surface profile across the site comprises a sequence of topsoil underlain by natural soils and bedrock within the excavation depth. Localised fill may be present in some portions of the site but was not encountered at the time.

Topsoil is silty clay of low plasticity with gravel and rootlets, residual soils include silty clay of low to medium plasticity and traces of gravels.

Field Works

The following work was completed on the 30 May 2023 and consisted of the following:

- Review of geological and geotechnical information relevant to the site.
- A walk over survey to assess existing site conditions and reviewing services plans obtained from "Dial Before You Dig" to assess existing services across the site.
- Scanning test pit locations for underground services so that drilling would not damage the services. We engaged a specialist services locator for this purpose.
- Excavate four (4) test pits at the locations shown on the attached Drawing No 9557/1-AA1. Test pits drilled were terminated at depths of refusal or 2.0m. Engineering logs and explanatory notes are also attached.
- Collecting representative soil samples for visual assessment and laboratory testing.
- Backfilling the test pits with recovered soils after logging and sampling.
- Measure depths of groundwater, if encountered
- Carry out Dynamic Cone Penetrometer (DCP) tests to assess the strength characteristics of the sub-surface soils. DCP tests will be terminated at refusal or depth of about 1.5m. DCP test results are included in the appropriate borehole logs.

Site Locality

The site address is located at 3-5 Kelloway Avenue, Camden off Old Hume Highway and roughly 1296m^2 which is located opposite of residential lots 4 and 6 and in between lots 1 and 7. The site is surrounded by medium to high residential lots with open grass lands and trees to the west along Burragorang Road.

Site Conditions

The site is of irregular rectangle at Kelloway Avenue, Camden. At the time of investigation, vegetation in the boarding house consisted of medium to high density grass coverage with trees along the boundary. No water way was visible from ground level of the site. The topography of the site is relatively flat with undulating ground levels, gentle slopes <3º from south to north.

Sub-surface Conditions

Sub-surface materials encountered in the test pits are detailed in the attached engineering logs and summarised in Table 1 below.

Table 1 – Sub-surface Profiles

Test Pit	Termination Depth (m)	Topsoil/Fill (m)	Residual (m)	Bedrock (m)
1	1.70	0.0-0.1	0.1-1.7	1.7
2	1.20	0.0-0.1	0.1-1.2	1.2
3	1.90	0.0-0.1	0.1-1.9	1.9
4	2.00	0.0-0.1	0.1-2.0	NE

NE: Not encountered to the termination depth

Based on information presented in Table 1, the sub-surface profile across the site is anticipated to comprise a sequence of topsoil/fill and natural soils to depths exceeding 1.5m from existing ground surface. Natural soils are assessed to be residual soils and subsurface materials may in general be described as follows:

Topsoil Silty Clay, low plasticity, brown, with rootlets.

Residual Soil Silty CLAY, high plasticity, brown mottled grey, trace fine to medium sub-angular gravel.
Silty CLAY, high plasticity, red brown mottled grey, trace fine sub-angular gravels.

Bedrock was unable to be confirmed at the time but is likely to consist of low to medium strength sandstone. Groundwater or seepage was not encountered on site at the time of investigation. However, it should be noted that groundwater/seepage level might vary due to rainfall, temperature, and other factors not evident during field work.

Laboratory Testing

A total of two (2) undisturbed 50mm diameter hollow tube (U_{50}) and one (1) disturbed sample were recovered from the site, aimed at determining the reactivity of the material to variations in moisture changes. The test conducted determines shrink/swell index and Atterberg Limits values.

Table 2 – Shrink/swell Index and Atterberg Limit Values

Test Pit	Depth (m)	Material Description	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Shrink/Swell Index (%/pF)
1	0.4-0.6	Silty CLAY, high plasticity, red-brown, trace fine sub-angular gravels	-	-	-	4.7
3	0.4-0.6	Silty CLAY, high plasticity, brown, trace fine to medium sub-angular gravels	-	-	-	4.2
4	0.6-0.8	Silty CLAY, high plasticity, brown mottled grey, trace fine sub-angular gravels	71	42	18.5	-

Site Classification

Based on information from two (2) test pits, the foundation materials within the footprint of the proposed boarding house are anticipated to be clayey fill of similar in nature. Therefore, the result of the shrink swell index test on a representative sample is considered to be indicative for the fill materials across the building footprint.

Based on shrink swell index value of 4.2%/pF to 4.7%/pF, the ground surface movement during moisture variation is estimated to be in the range of 45mm to 55mm. Therefore, the site for the proposed boarding house is assessed as Class H1, in accordance with Australian Standard AS2870 (Reference 4). This site classification is applicable at the time of conducting the investigation, being May 2023, and is based on the following assumptions:

- The recommendations for site maintenance set out with accordance to AS2870 are followed.
- The performance expectations set out with accordance to AS2870 are acceptable.

Floor Slabs and Footings

It is our understanding that existing topsoil/fill will be removed or replaced with controlled fill. Therefore, ground floor slabs for the proposed boarding house may be designed and constructed as ground bearing slabs or suspended slabs supported by footings designed in accordance with recommendations provided in this report.

Ground floor slabs bearing on controlled fill or natural soils may be designed for a Class “H1” site in accordance with Australian Standard AS287-2011. Alternatively, ground bearing slabs on controlled fill or natural soils may be designed for a recommended Modulus of Subgrade Reaction value of 20kPa/mm.

Loading conditions for the proposed development are not known at this stage. However, we consider that appropriate footings would comprise shallow footings (pad and strip footings) founded on controlled fill and/or natural soil. The recommended allowable bearing pressures for design of shallow footings are as follows:

- Recommended allowable bearing pressure for footings founded in controlled fill is 150kPa.
- Recommended allowable bearing pressure for footings founded in residual soils at depths up to 1.0m is 150kPa.
- Recommended allowable bearing pressure for footings founded in residual soils at depths of 1.0m to 2.0m is 200kPa.

For footings founded in controlled fill and natural soils the total settlements of footings under the recommended allowable bearing pressures are estimated to be approximately 2.0% of the minimum dimension of footings. The differential settlements are estimated to be about half the estimated total settlements.

As actual nature of existing fill may vary across the proposed site depths the recommended allowable bearing pressures could also vary across the site. Therefore, an experienced Geotechnical Engineer, on the basis of assessment made during footing excavation or pier hole drilling, should confirm founding levels and recommended allowable bearing pressure during construction.

Soil Salinity

Salinity refers to the presence of excess salt in the environment, either in soil or water. Salinity is a serious problem for any development due to the many environmental, economic and social impacts. Main impacts attributed to soil salinity and relevant to the proposed residential development include damage to houses, roads, highways and other structures, caused by the deterioration of brick, mortar, concrete, bitumen and asphalt, and corrosion of metal (pipes, cables) etc.

Soil salinity is generally assessed by measuring Electrical Conductivity (EC) of a soil sample made up of 1:5 soil water suspension. Thus determined Electrical Conductivity (EC) is multiplied by a factor varying from 6 to 17, based on the texture of the soil sample, to obtain Corrected Electrical Conductivity designated as EC_e (Reference 3). Alternatively, EC_e may be directly measured in soil saturation extract. Soils are classified as saline if Electrical Conductivity (EC_e) of the saturated extracts exceeds 4dS/m or 4mS/cm. The criteria for assessment of soil salinity classes are shown in the following Table 6 (Reference 6).

Table 3 - The Criteria for Assessment of Soil Salinity Classes

Classification	EC_e (dS/m)	Exposure Classification AS2870-2011	Comment
Non saline	<2	A1	Salinity effects mostly negligible
Slightly saline	2 – 4		Yields of very sensitive crops may be affected
Moderately saline	4 – 8	A2	Yields of many crops affected
Very saline	8 – 16	B1	Only tolerant crops yield satisfactorily
Highly saline	>16	B2	Only a few tolerant crops yield satisfactorily

Note 1 μS/cm=1000xdS/m

Measurements of EC for 8 representative soil samples from the site are presented in Table 3. For clayey soils encountered across the site, it is our assessment that the appropriate multiplying factor is about 6 to 8. Based on site observation, a multiplication factor of 6 was used for the soil encountered during field work.

For assumed factor of 6, EC_e values of representative samples are assessed to vary from 0.50 dS/m to 3.6 dS/m, with average of 1.51 dS/m. Out of the 8 representative soil samples, none of the representative soil samples taken exceeds 4dS/m. Table 3 also shows that the EC_e values of soils samples fluctuate irrespective of the depth.

Thus, it is our assessment that the soils across the site are non to slightly saline up to depths of about 1.5m from existing ground surface. Therefore, it is our assessment that the earthworks involving excavation and disturbance of soils are carried out in accordance with construction plans from Cardno.

Acidity (pH) testing was also conducted to determine the aggressivity of the soils to steel and concrete. The various classes of aggressive soils are defined as follows according to AS2870-2011.

Table 4 - The Criteria for Assessment of Soil Salinity Classes

Classification	pH	Exposure Classification AS2870-2011
Non-aggressive	>5.5	A1
Mild	4.5-5.5	A2
Moderate	4.0-4.5	B1
Severe	<4.0	B2

Based on the results, it is assessed that soils at the site are generally slightly saline and non-aggressive to steel and concrete. Therefore, based on the procedures described in AS2870-2011 the exposure classification for the proposed lots is in table 5.

Table 5: Laboratory Test Results

Test Pit	Depth (m)	PH	EC (µS/cm)	soil description	MF	ECe (dS/m)	Exposure Classification
TP1	0.4-0.5	5.9	120	high plasticity silty clay	6	0.72	A1
TP1	1.0-1.1	5.9	410	high plasticity silty clay	6	2.46	A1
TP2	0.4-0.5	7.1	170	high plasticity silty clay	6	1.02	A1
TP2	1.0-1.1	8	600	high plasticity silty clay	6	3.6	A1
TP3	0.4-0.5	6.8	120	high plasticity silty clay	6	0.72	A1
TP3	1.0-1.1	8.6	420	high plasticity silty clay	6	2.52	A1
TP4	0.4-0.5	6.1	86	high plasticity silty clay	6	0.516	A1
TP4	1.0-1.1	5.9	83	high plasticity silty clay	6	0.498	A1

Conclusion

Based on the procedures described in AS2870-2011 the exposure classifications for the proposed boarding house are classified as '**A2**'.

Based on the results of the post site works salinity assessment, the site is suitable for the boarding house development. The construction requirements for **A2** classifications are shown below (AS2870-2011, Table 5.3).

Classification	Minimum Design Characteristic Strength	Minimum Initial Curing
A2	25 MPa	3 days

Pavement Testing for Proposed Internal Roads

Proposed boarding house is understood to include construction of some internal roads for car park. Pavement design for these roads depends on anticipated traffic loading and subgrade conditions.

It is our understanding that the proposed internal roads within the site will be classified as Local Streets in accordance with Camden Council. The council recommended traffic loadings for design of pavements of Local Streets and Collector Roads are 5.0 x 10^5 Equivalent Standard Axle (ESA).

Laboratory tests on representative samples from subgrade materials along internal roads and carpark is listed below on table 5.

Table 5 – Shrink/swell Index and Atterberg Limit Values

Test Pit	Depth (m)	Sample Summary Description	MDD (t/m^3)	OMC (%)	FMC (%)	Variation (%)	Swell (%)	CBR (%)
TP1	0.6-0.9	Silty CLAY, high plasticity, brown mottled grey, trace fine to medium sub-angular gravels	1.49	27.0	24.7	2.3 dry	3.5	1.0
TP2	0.2-0.5	Silty CLAY, high plasticity, brown mottled grey, trace fine sub-angular gravels	1.49	26.5	23.7	2.8 dry	3.5	1.5

MDD: Maximum Dry Density, FMC: Field Moisture Content, OMC: Optimum Moisture Content, Variation from OMC, CBR: California Bearing Ratio

Foregoing results indicate the following:

CBR values of 1.0% to 1.5% with the high swell greater than 3.0%. Soils with CBR values of less than 3.0% are generally considered to be unsuitable as road pavement.

We recommend subgrade replacement due to the low CBR and high swell values. The road pavement should be constructed only after the subgrade is improved using one of the following methods:

Method 1: Replace upper 300mm of existing subgrade with crushed sandstone (minimum of CBR≥20%) compacted to achieve a Dry Density Ratio of at least 100% Standard at about Optimum Moisture Content.

Method 2: Stabilise upper 300mm of subgrade materials with lime and compact to achieve a Dry Density Ratio of at least 100% Standard at about Optimum Moisture Content. Actual proportions of lime to be used for stabilisation will have to be determined by conducting compaction and CBR tests on lime stabilised subgrade samples. However, for preliminary budgeting purposes we suggest allowing 3.0% to 5.0% of lime by weight.

Once subgrade improvement is placed for the internal roads is completed in accordance with one of the above methods, we recommend that the pavement for all internal roads be designed for indicative CBR value of 4.0%.

Basecourse and sub-base materials should satisfy RMS Specifications for DGB20 and DGS40 respectively (Reference 8). The pavement design is valid only if the subgrade and pavement materials are compacted to the following Minimum Dry Density Ratios:

Basecourse	98% Modified
Sub-basecourse	95% Modified
Subgrade	100% Standard

This pavement design assumes the provision of adequate surface and sub-surface drainage of the pavement and adjacent areas.

DISCUSSION AND RECOMMENDATIONS

Nature of Existing Fill

Test pits indicate that the site is underlain by about 0.1m thick topsoil. Although fill was not encountered at the time of investigation, it should be noted that fill may be at various locations. If fill is to be encountered the fill is likely to be well compacted the presence of topsoil means that the fill is unlikely to be controlled fill. In addition, we do not have information on how the existing fill was placed. Therefore, unless there is evidence (such as density test results) certifying that the fill is controlled; the fill should be considered uncontrolled in nature and unsuitable as a load bearing foundation for the proposed development.

If evidence indicating that the fill is controlled is not available, we recommend that suitability of the existing fill as foundation material for the proposed boarding house is confirmed by proof rolling and insitu density tests. If proof rolling shows significant movement and insitu density tests indicate highly variable degrees of compaction and/or poor compaction (dry density ratio less than 95% Standard) the fill will be considered "uncontrolled" and unsuitable as load bearing foundation material.

Site Preparation

We anticipate that earthworks will involve some cut and fill operations of depths up to 2.0m from existing ground surface. Therefore, materials to be excavated are expected to comprise topsoil and residual soil underlain with bedrock. Excavation of these materials can be achieved using conventional earthmoving equipment such as excavators and dozers.

We do not anticipate significant groundwater inflow during excavation to about 2.0m. However, it should be noted that fluctuations in the level of groundwater and/seepage might occur due to variations in rainfall and/or other factors and trafficability problems could arise locally during wet weather or if water is allowed to pond at the site.

We recommend the following procedures for placement of controlled fill during site preparation:

- Strip existing fill/topsoil and stockpile separately for possible future use. Topsoil may be used in landscaping. Existing fill may be used in controlled fill after moisture conditioning, removal of unsuitable materials and environmental validation.
- Undertake proof rolling (using an 8 to 10 tonnes roller) of the exposed natural soils to detect potentially weak spots (ground heave). Excavate areas of localised heaving to a depth of about 300mm and replace with granular fill compacted as described below.
- Undertake proof rolling of soft spots backfilled with granular fill, as described above. If the backfilled area shows movement during proof rolling, this office should be contacted for further recommendations.
- Place fill in horizontal layers of 200mm to 250mm maximum loose thickness and compact to a Minimum Dry Density Ratio (MDDR) of 95% Standard, at moisture content within 2% of Optimum Moisture Content (OMC). Controlled fill should preferably comprise non-reactive fill (e.g. crushed sandstone) with a maximum particle size not exceeding 75mm, or low plasticity clay. The fill materials and residual soil obtained from excavations within the site may be selectively used in controlled fill after environmental validation, moisture conditioning and removal of unsuitable materials (construction materials etc).

Fill placement should be supervised to ensure that material quality, layer thickness, testing frequency and compaction criteria conform to the specifications. We recommend "Level 2" or better supervision, in accordance with AS3798-2007 (Reference 1). It should be noted that a Geotechnical Inspection and Testing Authority will generally provide certification on quality of compacted fill only if Level 1 supervision and testing is carried out.

Batter Slope and Retaining Structures

Cut and fill slopes during and after site preparation works should be battered for stability or retained by engineered retaining structures. Recommended batter slopes in controlled fill and natural soils for short-term (temporary) and long-term (permanent) stability, are presented below:

- Short-term stability = 1 vertical to 1 horizontal
- Long-term stability = 1 vertical to 2.5 horizontal

The above batter slopes are appropriate the cut and fill slopes located at least 1.0m away from load bearing structures and the slopes are protected from surface and sub-surface water flow.

If cut and fill slopes steeper than those recommended above are required for whatever reason, these slopes should be retained by engineered retaining structures. Appropriate retaining structures for the proposed excavation would comprise cantilever walls and gravity walls. The pressure distribution on such walls is assumed to be triangular in shape and estimated as follows:

$$p_h = \gamma k H$$

Where,

p_h = Horizontal pressure (kN/m^2)
γ = Total unit weights of retained materials (kN/m^3)
k = Coefficient of earth pressure (k_a or k_o)
H = Retained height (m)

For design of flexible retaining structures where some lateral movement is acceptable use an active earth pressure coefficient (ka) of 0.35 is recommended. However, if it is critical to limit the horizontal deformation, use of an earth pressure coefficient at rest (ko) of 0.55 is recommended. These coefficients are based on the assumptions that the ground level behind the retaining structure is horizontal and the retained material is effectively drained. Additional earth pressures resulting from surcharge loads (buildings, infrastructures, etc) on retained materials and groundwater pressure, if any, should also be allowed for in design of retaining structures.

Limitations

As the recommendations presented in this report are based on information from four (4) excavated test pits, laboratory testing on a representative soil sample and site observations, actual sub-surface conditions across the site might differ from those expected (interpreted). If such differences are encountered during construction, we recommend that this office is contacted for further advice. This can also occur with groundwater conditions, especially after climatic changes.

If you have any questions, please do not hesitate to contact the undersigned.

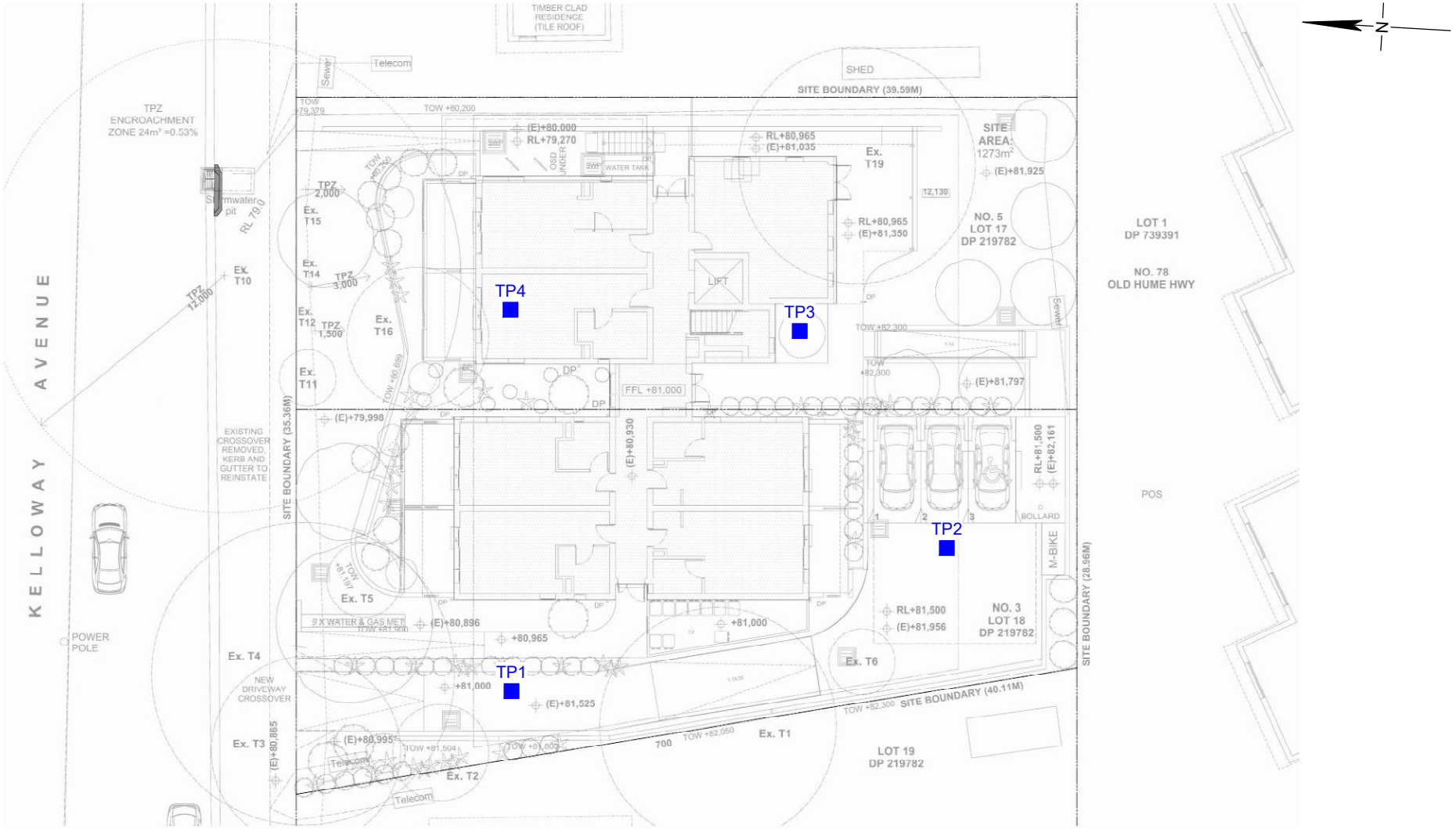
Yours faithfully
GEOTECH TESTING PTY LTD

JOE CHEN
Geotechnical Engineer

Reviewed by

EMGED RIZKALLA
Director

Attached Drawing No 9557/1-AA1 – Test Pit Locations
Excavation Logs and Explanatory Notes
9557/1 – Laboratory Test Results



LEGEND

■ Test Pit

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NOTES

1. Site features are indicative and are not to scale.
2. This drawing has been produced using a base plan provided by others to which additional information e.g test pits, borehole locations or notes have been added. Some or all of the plan may not be relevant at the time of producing this drawing

NSW Land & Housing Corporation
3-5 Kelloway Avenue
Camden

Test Pit Locations

Drawing No: 9557/1-AA1
Job No: 9557/1
Drawn By: MH
Date: 31 May 2023
Checked By: JC

File No: 9557-1
Layers: 0, AA1

Test Pit LOG

TP ID: TP1

Location	3-5 Kelloway Avenue, Camden			**Started**	30 May 2023		
Client	NSW Land & Housing Corporation			**Completed**	30 May 2023		
Job No.	9557/1			**Logged By**	JC	**Date**	30 May 2023
Sheets	1 of 1			**Review By**	JC	**Date**	01 June 2023
Drilling Contractor	Matvel Excavations	**Surface RL**	-	**Latitude**	-		
Plant	Yanmar vio5-5	**Inclination**	90°	**Longtitude**	-		

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	DCP BLOWS	MATERIAL ORIGIN & OBSERVATIONS
EX	GWNE	TP1_0.40-0.50 TP1_0.40-0.60 TP1_0.60-0.90 TP1_1.00-1.10		0 0.00 0.10 0.60 1 2 3 4 5			TOPSOIL: Silty CLAY: low plasticity, dark brown, trace rootlets Silty CLAY: high plasticity, red brown, trace fine sub-angular gravels Silty CLAY: high plasticity, brown mottled grey, trace fine to medium sub-angular gravels Terminated at 1.70m. Refusal on bedrock.	M < PL	St - VSt VSt - H	12 9 9 9 9 7 7 7 8 5 9 11 13/50mm	TOPSOIL RESIDUAL SOIL RESIDUAL SOIL

This log should be read in conjunction with EI Australia's accompanying explanatory notes.

Test Pit LOG

TP ID: TP2

Location	3-5 Kelloway Avenue, Camden		**Started**	30 May 2023	
Client	NSW Land & Housing Corporation		**Completed**	30 May 2023	
Job No.	9557/1		**Logged By**	JC	**Date** 30 May 2023
Sheets	1 of 1		**Review By**	JC	**Date** 01 June 2023
Drilling Contractor	Matvel Excavations	**Surface RL** -	**Latitude**	-	
Plant	Yanmar vio5-5	**Inclination** 90°	**Longtitude**	-	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	DCP BLOWS	MATERIAL ORIGIN & OBSERVATIONS
EX	GWNE	TP2_0.20-0.50 TP2_0.40-0.50 TP2_1.00-1.10		0.00 0.10 0.60 1 2 3 4 5			TOPSOIL: Silty CLAY: low plasticity, dark brown, with rootlets Silty CLAY: high plasticity, brown mottled grey, trace fine sub-angular gravels Silty CLAY: high plasticity, red brown mottled grey, trace fine sub-angular gravels Terminated at 1.20m. Refusal on bedrock.	M < PL	St - VSt	0 5 10 15 20 25 30 5 3 5 5 6 8 7 12 12	TOPSOIL RESIDUAL SOIL RESIDUAL SOIL

Test Pit LOG

TP ID: TP3

Location	3-5 Kelloway Avenue, Camden	**Started**	30 May 2023
Client	NSW Land & Housing Corporation	**Completed**	30 May 2023
Job No.	9557/1	**Logged By**	JC **Date** 30 May 2023
Sheets	1 of 1	**Review By**	JC **Date** 01 June 2023
Drilling Contractor	Matvel Excavations	**Surface RL**	- **Latitude** -
Plant	Yanmar vio5-5	**Inclination**	90° **Longtitude** -

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	DCP BLOWS	MATERIAL ORIGIN & OBSERVATIONS
EX	GWNE	TP3_0.40-0.50 TP3_0.40-0.60		0 0.00 0.10 1 2 3 4 5			TOPSOIL: Silty CLAY: low plasticity, Silty CLAY: high plasticity, brown, trace fine to medium sub-angular gravels	M < PL - M ≈ PL	St - VSt	0 5 10 15 20 25 30 5 5 6 5 5 5 5 6 7 7 5 5 6 6 8	TOPSOIL RESIDUAL SOIL
							Terminated at 1.90m. Refusal on bedrock.				

Test Pit LOG

TP ID: TP4

Location	3-5 Kelloway Avenue, Camden			**Started**	30 May 2023	
Client	NSW Land & Housing Corporation			**Completed**	30 May 2023	
Job No.	9557/1			**Logged By**	JC/KK	**Date**	30 May 2023
Sheets	1 of 1			**Review By**	JC	**Date**	01 June 2023
Drilling Contractor	Matvel Excavations	**Surface RL**	-	**Latitude**	-	
Plant	Yanmar vio5-5	**Inclination**	90°	**Longtitude**	-	

METHOD	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	SAMPLE RECOVERY	DEPTH (m)	GRAPHIC LOG	RL (m AHD)	MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / REL. DENSITY	DCP BLOWS	MATERIAL ORIGIN & OBSERVATIONS
EX	GWNE	9557/1-TP4_0.40-0.50 9557/1-TP4_0.60-0.80 9557/1-TP4_1.00-1.10		0 0.00 0.10 1 2 3 4 5			TOPSOIL: Silty CLAY: low plasticity, Silty CLAY: high plasticity, brown mottled grey, trace fine sub-angular gravels Terminated at 2.00m. Target Depth Reached.	M > PL	St VSt - H	0 5 10 15 20 25 30 3 3 4 3 5 6 7 11 9/60mm	TOPSOIL RESIDUAL SOIL

Log Symbols & Abbreviations (Non-cored Borehole Log)

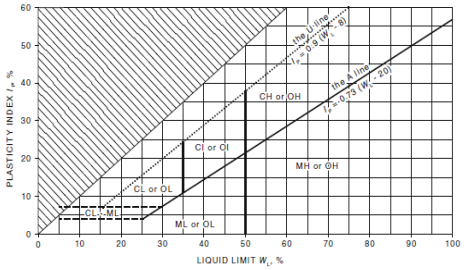
Log Column	Symbol/Value		Description
Drilling Method	V-bit		Hardened steel 'V' shaped bit attached to auger
	TC-bit		Tungsten Carbide bit attached to auger
	RR		Tricone (Rock Roller) bit
	DB		Drag bit
	BB		Blade bit
Groundwater	Dry		Groundwater not encountered to the drilled or auger refusal depth
			Groundwater level at depths shown on log
			Groundwater seepage at depths shown on log
Environment Sample	GP		Glass bottle and plastic bag sample over depths shown on log
	G		Glass bottle sample over depths shown on log
	P		Plastic bag sample over depths shown on log
PID Reading	100		PID reading in ppm
Geotechnical Sample	DS		Disturbed Small bag sample over depths shown on log
	DB		Disturbed Bulk sample over depths shown on log
	U_{50}		Undisturbed 50mm tube sample over depths shown on log
Field Test	N=10 3,5,5		Standard Penetration Test (SPT) 'N' value. Individual numbers indicate blows per 150mm penetration.
	N=R 10,15/100		'R' represents refusal to penetration in hard/very dense soils or in cobbles or boulders. The first number represents10 blows for 150mm penetration whereas the second number represents 15 blows for 100mm penetration where SPT met refusal
	DCP/PSP	5 6 R/10	Dynamic Cone Penetration (DCP) or Perth Sand Penetrometer (PSP). Each number represents blows per 100mm penetration. 'R/10' represents refusal after 10mm penetration in hard/very dense soils or in gravels or boulders.
Classification	GP		Poorly Graded GRAVEL
	GW		Well graded GRAVEL
	GM		Silty GRAVEL
	GC		Clayey GRAVEL
	SP		Poorly graded SAND
	SW		Well graded SAND
	SM		Silty SAND
	SC		Clayey SAND
	ML		SILT / Sandy SILT / clayey SILT, low plasticity
	MI		SILT / Sandy SILT / clayey SILT, medium plasticity
	MH		SILT / Sandy SILT / clayey SILT, high plasticity
	CL		CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, low plasticity
	CI		CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, medium plasticity
	CH		CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, high plasticity
Moisture Condition Cohesive soils	M<PL		Moisture content less than Plastic Limit
	M=PL		Moisture content equal to Plastic Limit
	M>PL		Moisture content to be greater than Plastic Limit
Cohesionless soils	D		Dry - Runs freely through hand
	M		Moist - Tends to cohere
	W		Wet - Tends to cohere

Consistency Cohesive soils		Term	Undrained shear strength, C_u (kPa)	Hand Penetrometer (Qu)
	VS	Very Soft	≤12	<25
	S	Soft	>12 & ≤25	25 – 50
	F	Firm	>25 & ≤50	50 – 100
	St	Stiff	>50 & ≤100	100 – 200
	VSt	Very Stiff	>100 & ≤200	200 – 400
	H	Hard	>200	>400

Density Index Cohesionless soils		Term	Density Index, I_D (%)	SPT 'N' (blows/300mm)
	VL	Very Loose	≤15	≤5
	L	Loose	>15 & ≤35	>5 & ≤10
	M	Medium Dense	>35 & ≤65	>10 & ≤30
	D	Dense	>65 & ≤85	>30 & ≤50
	VD	Very Dense	>85	>50

Hand Penetrometer	100 200	Unconfined compressive strength (q_u) in kPa determined using pocket penetrometer, at depths shown on log
Remarks		Geological origin of soils
	Residual	Residual soils above bedrock
	Alluvium	River deposited Alluvial soils
	Colluvial	Gravity deposited Colluvial soils
	Aeolian	Wind deposited Aeolian soils
	Marine	Marine Soils

AS1726 : 2017– Unified Soil Classification System

Major Divisions		Particle size (mm)	Group Symbol	Typical Names	Field Identifications Sand and Gravels			Use the gradation of material passing 63mm for classification of fractions according to the criteria given in 'Major Division's'	Laboratory classification				
									% Fines (2)	Plasticity of Fine Fraction	$C_u = D_{60}/D_{10}$	$C_c = (D_{30})^2/(D_{10}D_{60})$	Notes
OVERSIZE	BOULDERS	>200											
	COBBLES	63											
COARSE GRAINED SOIL (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm)	Coarse 19	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength				≤5	-	>4	between 1 and 3	1. Identify lines by the method given for fine grained soils 2. Borderline classifications occur when the percentage of fines (fraction smaller than 0.075mm size) is greater than 5% and less than 12%. Borderline classifications require the use of dual symbols e.g. SP-SM, GW-GC
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength				≤5	-	Fails to comply with above		
		Medium 6.7	GM	Silty gravels, gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength				≥12	Below 'A' line or I_p<4	-	-	
		Fine 2.36	GC	Clayey gravels, gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength				≥12	Above 'A' line or I_p>7	-	-	
	SAND (more than half of coarse fraction is smaller than 2.36mm)	Coarse 0.6	SW	Well-graded sands, gravelly sands, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength				≤5	-	>6	between 1 and 3	
		Medium 0.21	SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength				≤5	-	Fails to comply with above		
		Fine 0.075	SM	Silty sands, sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength				≥12	Below 'A' line or I_p<4	-	-	
			SC	Clayey sand, sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength				≥12	Above 'A' line of I_p>7	-	-	
FINE GRAINED SOIL (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT (0.075mm to 0.002mm) & CLAY (<0.002mm) Liquid Limit<50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	**Dry Strength**	**Dilatancy**	**Toughness**		More than 35% passing 0.075mm	Below 'A' line			
					None to low	Slow to rapid	Low						
			CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium to high	None to very slow	Medium			Above 'A' line			
			OL	Organic silts and organic silty clays of low plasticity	Low to medium	Slow	Low			Below 'A' line			
	SILT (0.075mm to 0.002mm) & CLAY (<0.002mm) Liquid Limit>50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Low to medium	None to slow	Low to medium			Below 'A' line			
			CH	Inorganic clays of medium to high plasticity, fat clays	High to very high	None	High			Above 'A' line			
			OH (1)	Organic clays of medium to high plasticity, organic silts	Medium to high	None to very slow	Low to medium			Below 'A' line			
	HIGHLY ORGANIC SOILS		Pt (1)	Peat and highly organic soils	Identified by colour, odour, spongy feel and generally by fibrous texture				Effervesces with H_2O_2				

Log Symbols & Abbreviations (Cored Borehole Log)

Log Column	Symbol / Abbreviation	Description	
Core Size		Nominal Core Size (mm)	
	NQ	47	
	NMLC	52	
	HQ	63	
Water Loss	◀	Complete water loss	
	◁	Partial water loss	
Weathering (AS1726:2017)	RS	Residual Soil	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
	XW	Extremely Weathered	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
	HW	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 recognizable. 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.
	MW	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 recognizable, but shows little or no change of strength from fresh rock
	SW	Slightly Weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change in strength from fresh rock
	FR	Fresh	Rock shows no sign of decomposition of individual minerals or colour changes
		Note : Where it is not possible to distinguish between HW and MW rock the term Distinctly Weathered (DW) may be used. DW is defined as 'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased by deposition of weathering products in pores'	

Strength (AS1726:2017)		**Term**	**Point Load Strength Index (I_{s50}, MPa)**	
	VL	Very Low	≥0.03	≤0.1
	L	Low	>0.1	≤0.3
	M	Medium	>0.3	≤1
	H	High	>1	≤3
	VH	Very High	>3	≤10
	EH	Extremely High	>10	

Defect Spacing	**Description**	**Spacing (mm)**
	Extremely closely spaced	<20
	Very closely spaced	20 to 60
	Closely spaced	60 to 200
	Medium spaced	200 to 600
	Widely spaced	600 to 2000
	Very widely spaced	2000 to 6000
	Extremely widely spaced	>6000

Defect Description (AS1726:2017) Type		
	Pt	Parting
	Jo	Joint
	Sh	Sheared Surface
	Sz	Sheared Zone
	Ss	Sheared Seam
	Cs	Crushed Seam
	Is	Infilled Seam
	Ews	Extremely Weathered Seam
Macro-surface geometry	St	Stepped
	Cu	Curved
	Un	Undulating
	Ir	Irregular
	Pl	Planar
Micro-surface geometry	Vro	Very Rough
	Ro	Rough
	Sm	Smooth
	Po	Polished
	Sl	Slickensided
Coating or infilling	cn	clean
	sn	stained
	vn	veneer
	cg	coating

AS1726 – Identification of Sedimentary Rocks for Engineering Purposes

Grain Size mm		Bedded rocks (mostly sedimentary)									
More than 20	20	Grain Size Description		CONGLOMERATE Rounded boulders, cobbles and gravel cemented in a finer matrix		At least 50% of grains are of carbonate				At least 50% of grains are of fine-grained volcanic rock	
	6	RUDACEOUS				LIMESTONE and DOLOMITE (undifferentiated)		Calcirudite		Fragments of volcanic ejecta in a finer matrix	SALINE ROCKS
				Breccia Irregular rock fragments in a finer matrix						Rounded grains AGGLOMERATE Angular grains	Halite
	2									VOLCANIC BRECCIA	Anhydrite
	0.6	ARENACEOUS	Coarse	SANDSTONE Angular or rounded grains, commonly cemented by clay, calcite or iron minerals				Calcarenite		Cemented volcanic ash	Gypsum
			Medium	Quartzite Quartz grains and siliceous cement						TUFF	
	0.2										
			Fine	Arkose Many feldspar grains Greywacke Many rock chips							
	0.06										
	0.002	ARGILLACEOUS		MUDSTONE	SILTSTONE Mostly silt	Calcareous Mudstone		Calcisiltite	CHALK	Fine-grained TUFF	
	Less than 0.002			SHALE Fissile	CLAYSTONE Mostly clay			Calcilutite		Very fine-grained TUFF	
Amorphous or crypto-crystalline				Flint: occurs as hands of nodules in the chalk Chert: occurs as nodules and beds in limestone and calcareous sandstone							COAL LIGNITE
				Granular cemented – except amorphous rocks							
				SILICEOUS		CALCAREOUS				SILICEOUS	CARBONACEOUS
				SEDIMENTARY ROCKS Granular cemented rocks vary greatly in strength, some sandstones are stronger than many Igneous rocks. Bedding may not show in hand specimens and is best seen in outcrop. Only sedimentary rocks, and some metamorphic rocks derived from them, contain fossils Calcareous rocks contain calcite (calcium carbonate) which effervesces with dilute hydrochloric acid						

AS1726 – Identification of Metamorphic and Igneous Rocks for Engineering Purposes

Obviously foliated rocks (mostly metamorphic)		Rocks with massive structure and crystalline texture (mostly igneous)						Grain size (mm)
Grain size description			Grain size description	Pegmatite			Pyrosenite	More than 20
		MARBLE						20
COARSE	GNEISS Well developed but often widely spaced foliation sometimes with schistose bands	QUARTZITE	COARSE	GRANITE	Diorite	GABBRO	Peridorite	6
		Granulite		These rocks are sometimes phorphyritic and are then described, for example, as porphyritic granite				
	Migmatite Irregularly foliated: mixed schists and gneisses	HORNFELS						2
MEDIUM	SCHIST Well developed undulose foliation; generally much mica	Amphibolite	MEDIUM	Micorgranite	Microdiorite	Dolerite		0.6
		Serpentine		These rocks are sometimes phorphyritic and are then described as porphyries				0.2
								0.06
FINE	PHYLLITE Slightly undulose foliation; sometimes 'spotted'		FINE	RHYOLITE	ANDESITE	BASALT		0.002
	SLATE Well developed plane cleavage (foliation)			These rocks are sometimes phorphyritic and are then described as porphyries				Less than 0.002
	Mylonite Found in fault zones, mainly in igneous and metamorphic areas			Obsidian	Volcanic glass			Amorphous or cryptocrystalline
CRYSTALLINE				Pale<----------->Dark				
SILICEOUS		Mainly SILICEOUS		ACID Much quartz	INTERMEDIATE Some quartz	BASIC Little or no quartz	ULTRA BASIC	
METAMORPHIC ROCKS Most metamorphic rocks are distinguished by foliation which may impart fissility. Foliation in gneisses is best observed in outcrop. Non-foliated metamorphics are difficult to recognize except by association. Any rock baked by contact metamorphism is described as 'hornfels' and is generally somewhat stronger than the parent rock Most fresh metamorphic rocks are strong although perhaps fissile			IGNEOUS ROCKS Composed of closely interlocking mineral grains. Strong when fresh; not porous Mode of occurrence : 1 Batholith; 2 Laccoliths; 3 Sills; 4 Dykes; 5 Lava Flows; 6 Veins					

GEOTECH TESTING PTY LTD®
ABN 71 076 676 321

TEST RESULTS - SHRINK / SWELL INDEX

NSW LAND & HOUSING CORPORATION
LEVEL 4, PARRAMATTA SQUARE, 12 DARCY STREET
PARRAMATTA NSW 2150

Laboratory: Prestons
Job No: 9557/1

LIMITED SITE INVESTIGATION
3-5 KELLOWAY AVENUE, CAMDEN

Test Procedure: AS 1289 7.1.1				
Test Pit No.	1	3		
Depth (m)	0.4-0.6	0.4-0.6		
Laboratory Number	9557/1-1	9557/1-2		
Date Tested:	08/06/23	08/06/23		
Tested By:	DP	DP		
Checked By:	MM	MM		
Test Description				
Moisture Content				
Initial %	17.1	21.4		
Final %	23.5	28.8		
Swell %	9.5	6.1		
Shrinkage %	3.8	4.6		
Shrink/Swell Index $\%/_pF$	4.7	4.2		
Material Description	Silty CLAY, high plasticity, red-brown, traces of gravel	Silty CLAY, high plasticity, brown, traces of gravel.		

Form No R007 Version 13 07/21

Report Date
08/06/2023

Accredited for compliance with ISO/IEC 17025 - Testing.

M Morley

Approved Signatory

NATA Accreditation Number 2734
Corporate Site Number 14227

34 Borec Road, Penrith NSW 2750
Telephone: (02) 4722 2744

Unit 4, 18-20 Whyalla Place, Prestons NSW 2170
Telephone: (02) 9607 6111

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GEOTECH TESTING PTY LTD ®
ABN 71 076 676 321

TEST RESULTS - ATTERBERG LIMITS
Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

NSW LAND & HOUSING CORPORATION
LEVEL 4, PARRAMATTA SQUARE, 12 DARCY STREET
PARRAMATTA NSW 2150

Laboratory: Prestons
Job No: 9557/1

PROJECT: LIMITED SITE INVESTIGATION
3-5 KELLOWAY AVENUE, CAMDEN

Date Tested: 7/06/2023
Tested By: DP
Checked By: MM

Test Pit No.	4		
Laboratory Number	95571-3		
Depth (m)	0.6-0.8		
Test Description			
Liquid Limit (W_L)	71%		
Plastic Limit (W_P)	29%		
Plastic Index (I_P)	42%		
Linear Shrinkage (LS)	18.5%		
Mould Length (mm)	250		
Sample History	Oven Dried Dry Sieved	Oven Dried Dry Sieved	Oven Dried Dry Sieved
Material Description	Silty CLAY, High plasticity, brown mottled grey, traces of gravel.		

Form No R004 Version 13 - 07/21 - Issued by ER

Report Date
M Morley 9/06/2023

NATA
Nata Accreditation Number 2734
Corporate Site Number 14227

Accredited for compliance with ISO/IEC 17025 - Testing.

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GEOTECH TESTING PTY LTD®
ABN 71 076 676 321

CALIFORNIA BEARING RATIO TEST REPORT

NSW LAND & HOUSING CORPORATION
LEVEL 4, PARRAMATTA SQUARE, 12 DARCY STREET
PARRAMATTA NSW 2150

Laboratory: Prestons
Job No: 9557/1

PROJECT: LIMITED SITE INVESTIGATION
3-5 KELLOWAY AVENUE, CAMDEN

CBR Test Procedure		Laboratory Compaction Method		Sampling Method	
AS1289 6.1.1		AS1289 5.1.1		AS1289 1.2.1 Clause 6.5.4	
Tested By: DP		Checked By: MM		CBR Test Date: 9/06/2023	
Laboratory Number		9557/1-4	9557/1-5		
Drawing No.		9557/1-AA1	9557/1-AA1		
Test Pit No		1	2		
Depth (m)		0.6-0.9	0.2-0.5		
Date Sampled		30/05/2023	30/05/2023		
Compaction Test Date		2/06/2023	2/06/2023		
Sample Description		Silty CLAY, high plasticity, brown mottled grey	Silty CLAY, high plasticity, brown mottled grey.		
Maximum Dry Density	t/m3	1.49	1.49		
Optimum Moisture Content	%	27.0	26.5		
Field Moisture Content	%	24.7	23.7		
% Retained 19mm		0.0	0.0		
Excluded (Yes / No / Not Applicable)		Yes	Yes		
CBR TEST RESULTS					
Dry Density t/m^3	Before soaking	1.47	1.46		
	After soaking	1.42	1.42		
Density Ratio %	Before soaking	98.5	98.0		
Moisture Content %	Before soaking	27.0	26.5		
	After soaking	32.2	31.4		
Moisture Ratio %	Before soaking	99.5	99.5		
Number of Days Soaked		4	4		
Surcharge	kg	6.75	6.75		
Moisture Content after test %	Top 30mm	41.3	36.5		
	Whole Sample	32.0	31.1		
Swell after soaking	%	3.5	3.5		
Penetration	mm	2.5	2.5		
CBR VALUE	%	**1.0**	**1.5**		

Form No R003 Version 05 07/21 - issued by ER

Report Date
M Morley 16/06/2023

NATA
Nata Accreditation Number 2734
Corporate Site Number 14227

Accredited for compliance with ISO/IEC 17025 - Testing.

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

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Client	Geotech Testing Pty Ltd
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Project	**9557/1 3-5 Kelloway Avenue, Camden**
Order Number	**9557/1**
Samples	8

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
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SGS Reference	**SE248411 R0**
Date Received	31/5/2023
Date Reported	9/6/2023

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Dong LIANG
Metals/Inorganics Team Leader

Huong CRAWFORD
Production Manager

pH in soil (1:5) [AN101] Tested: 9/6/2023

PARAMETER	UOM	LOR	TP1 SOIL 0.4-0.5 31/5/2023 SE248411.001	TP1 SOIL 1.0-1.1 31/5/2023 SE248411.002	TP2 SOIL 0.4-0.5 31/5/2023 SE248411.003	TP2 SOIL 1.0-1.1 31/5/2023 SE248411.004	TP3 SOIL 0.4-0.5 31/5/2023 SE248411.005
pH	pH Units	0.1	**5.9**	**5.9**	**7.1**	**8.0**	**6.8**

PARAMETER	UOM	LOR	TP3 SOIL 1.0-1.1 31/5/2023 SE248411.006	TP4 SOIL 0.4-0.5 31/5/2023 SE248411.007	TP4 SOIL 1.0-1.1 31/5/2023 SE248411.008
pH	pH Units	0.1	**8.6**	**6.1**	**5.9**

Conductivity and TDS by Calculation - Soil [AN106] Tested: 9/6/2023

PARAMETER	UOM	LOR	TP1 SOIL 0.4-0.5 31/5/2023 SE248411.001	TP1 SOIL 1.0-1.1 31/5/2023 SE248411.002	TP2 SOIL 0.4-0.5 31/5/2023 SE248411.003	TP2 SOIL 1.0-1.1 31/5/2023 SE248411.004	TP3 SOIL 0.4-0.5 31/5/2023 SE248411.005
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	120	410	170	600	120

PARAMETER	UOM	LOR	TP3 SOIL 1.0-1.1 31/5/2023 SE248411.006	TP4 SOIL 0.4-0.5 31/5/2023 SE248411.007	TP4 SOIL 1.0-1.1 31/5/2023 SE248411.008
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	420	86	83

Moisture Content [AN002] Tested: 8/6/2023

PARAMETER	UOM	LOR	TP1 SOIL 0.4-0.5 31/5/2023 SE248411.001	TP1 SOIL 1.0-1.1 31/5/2023 SE248411.002	TP2 SOIL 0.4-0.5 31/5/2023 SE248411.003	TP2 SOIL 1.0-1.1 31/5/2023 SE248411.004	TP3 SOIL 0.4-0.5 31/5/2023 SE248411.005
% Moisture	%w/w	1	**17.2**	**20.8**	**14.0**	**12.8**	**21.8**

PARAMETER	UOM	LOR	TP3 SOIL 1.0-1.1 31/5/2023 SE248411.006	TP4 SOIL 0.4-0.5 31/5/2023 SE248411.007	TP4 SOIL 1.0-1.1 31/5/2023 SE248411.008
% Moisture	%w/w	1	**14.1**	**19.2**	**18.5**

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, sediments and sludges, an extract with water (or 0.01M CaCl2) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos /cm or µS/cm @ 25°C. For soils, an extract of as received sample with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2510 B.

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

STATEMENT OF QA/QC PERFORMANCE

SE248411 R0

CLIENT DETAILS

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Project	**9557/1 3-5 Kelloway Avenue, Camden**
Order Number	**9557/1**
Samples	8

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE248411 R0**
Date Received	31 May 2023
Date Reported	09 Jun 2023

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Conductivity and TDS by Calculation - Soil	8 items
	pH in soil (1:5)	8 items
Analysis Date	Conductivity and TDS by Calculation - Soil	8 items

SAMPLE SUMMARY

Sample counts by matrix	8 Soil	Type of documentation received	COC
Date documentation received	31/5/2023	Samples received in good order	Yes
Samples received without headspace	N/A	Sample temperature upon receipt	18.0°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	None	Samples clearly labelled	Yes
Complete documentation received	Yes	Number of eskies/boxes received	

HOLDING TIME SUMMARY

SE248411 R0

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Conductivity and TDS by Calculation - Soil

Method: ME-(AU)-[ENV]AN106

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE248411.001	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP1	SE248411.002	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP2	SE248411.003	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP2	SE248411.004	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP3	SE248411.005	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP3	SE248411.006	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP4	SE248411.007	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†
TP4	SE248411.008	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	07 Jun 2023	09 Jun 2023†

Moisture Content

Method: ME-(AU)-[ENV]AN002

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE248411.001	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP1	SE248411.002	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP2	SE248411.003	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP2	SE248411.004	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP3	SE248411.005	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP3	SE248411.006	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP4	SE248411.007	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023
TP4	SE248411.008	LB281930	31 May 2023	31 May 2023	14 Jun 2023	08 Jun 2023	13 Jun 2023	09 Jun 2023

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE248411.001	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP1	SE248411.002	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP2	SE248411.003	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP2	SE248411.004	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP3	SE248411.005	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP3	SE248411.006	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP4	SE248411.007	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023
TP4	SE248411.008	LB282041	31 May 2023	31 May 2023	07 Jun 2023	09 Jun 2023†	10 Jun 2023	09 Jun 2023

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Conductivity and TDS by Calculation - Soil — **Method: ME-(AU)-[ENV]AN106**

Sample Number	Parameter	Units	LOR	Result
LB282041.001	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	0.81

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean
The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR
Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may give a different calculated RPD.

Conductivity and TDS by Calculation - Soil

Method: ME-(AU)-[ENV]AN106

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE248456.002	LB282041.014	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	130	150	31	18
SE248521.004	LB282041.019	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	350	380	31	8

Moisture Content

Method: ME-(AU)-[ENV]AN002

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE248411.008	LB281930.011	% Moisture	%w/w	1	18.5	18.5	35	0
SE248456.002	LB281930.014	% Moisture	%w/w	1	11.2	11.2	39	0

pH in soil (1:5)

Method: ME-(AU)-[ENV]AN101

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE248456.002	LB282041.014	pH	pH Units	0.1	6.9	7.5	31	8
SE248521.004	LB282041.019	pH	pH Units	0.1	5.2	5.1	32	2

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Conductivity and TDS by Calculation - Soil — Method: ME-(AU)-[ENV]AN106

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB282041.002	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	NA	303	85 - 115	95

pH in soil (1:5) — Method: ME-(AU)-[ENV]AN101

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB282041.003	pH	pH Units	0.1	7.4	7.415	98 - 102	100

MATRIX SPIKES

SE248411 R0

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub -sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spikes were required for this job.

MATRIX SPIKE DUPLICATES

SE248411 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spike duplicates were required for this job.

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here: https://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
***	Indicates that both * and ** apply.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.
①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

GEOTECH TESTING PTY LTD

Laboratory Test Request / Chain of Custody Record

Lemko Place
PENRITH NSW 2750

P O Box 880
PENRITH NSW 2751

Tel: (02) 4722 2700
Fax: (02) 4722 6161
email: info@geotech.com.au

Page 1 of 1

TO:	**SGS ENVIRONMENTAL SERVICES** **UNIT 16** **33 MADDOX STREET** **ALEXANDRIA NSW 2015**	**Sampling By:** JC	**Job No** 9557/1
			Project: Limited Site Investigation
PH: 02 8594 0400 **FAX:** 02 8594 0499 **ATTN:** Ms Emily Yin		**Project Manager:** JC	**Location:** 3-5 Kelloway Avenue, Camden

Results required by: 9/06/23

	Sampling details													
	Location	Depth	Soil	Water	EC (1:5)	pH	Sulphate	Chloride	ESP				Notes	Keep Sample
1	TP1	0.4-0.5	DSP		✓	✓							ESP=Exchnageable Sodium Percentage	
2		1.0-1.1	DSP		✓	✓								
3	TP2	0.4-0.5	DSP		✓	✓								
4		1.0-1.1	DSP		✓	✓								
5	TP3	0.4-0.5	DSP		✓	✓								
6		1.0-1.1	DSP		✓	✓								
7	TP4	0.4-0.5	DSP		✓	✓								
8		1.0-1.1	DSP		✓	✓								

SGS EHS Sydney COC
SE248411

Please Use Geotechnical Engineering Templete for Reporting

Relinquished by			Received by		
Name	Signature	Date	Name	Signature	
Joe	JC	31/05/2023			31/5/23 @ 14:40

Legend:

WG	USG	Undisturbed soil sample (glass j	DSP	Disturbed soil sample (small plastic bag)	* Purge & Trap
WP	DSG	Disturbed soil sample (glass jar)	✓	Test required	# Geotechnique Screen

Form No 4.7F2-5 SGS

SAMPLE RECEIPT ADVICE

SE248411

CLIENT DETAILS

Contact	Joe Chen
Client	Geotech Testing Pty Ltd
Address	P.O. Box 880 PENRITH NSW 2751
Telephone	02 4722 2700
Facsimile	02 4722 6161
Email	joe@geotech.com.au
Project	**9557/1 3-5 Kelloway Avenue, Camden**
Order Number	**9557/1**
Samples	8

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Wed 31/5/2023
Report Due	Fri 9/6/2023
SGS Reference	**SE248411**

SUBMISSION DETAILS

This is to confirm that 8 samples were received on Wednesday 31/5/2023. Results are expected to be ready by COB Friday 9/6/2023. Please quote SGS reference SE248411 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Sample counts by matrix	8 Soil	Type of documentation received	COC
Date documentation received	31/5/2023	Samples received in good order	Yes
Samples received without headspace	N/A	Sample temperature upon receipt	18.0°C
Sample container provider	SGS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	None	Samples clearly labelled	Yes
Complete documentation received	Yes	Number of eskies/boxes received	

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

Sampling date was not provided. It is assumed to be as date samples were relinquished.

SAMPLE RECEIPT ADVICE

SE248411

CLIENT DETAILS

Client Geotech Testing Pty Ltd

Project 9557/1 3-5 Kelloway Avenue, Camden

SUMMARY OF ANALYSIS

No.	Sample ID	Conductivity and TDS by Calculation - Soil	Moisture Content	pH in soil (1:5)
001	TP1 0.4-0.5	1	1	1
002	TP1 1.0-1.1	1	1	1
003	TP2 0.4-0.5	1	1	1
004	TP2 1.0-1.1	1	1	1
005	TP3 0.4-0.5	1	1	1
006	TP3 1.0-1.1	1	1	1
007	TP4 0.4-0.5	1	1	1
008	TP4 1.0-1.1	1	1	1

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .