GEOTECHNIQUE® PTY LTD

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Job No: 14947/1
Our Ref: 14947/1-AA
24 August 2021

Legacy Property Pty Ltd
MLC Centre, Level 45, 25 Martin Place
SYDNEY NSW 2000

Attention: Mr T Kent

Dear Sir

re: **Proposed Residential Development**
89-115 O'Connell Street, Caddens
Geotechnical Investigation

This report provides the results of a geotechnical investigation carried out at 89-115 O'Connell Street, Caddens, hereafter referred to as the site. This investigation was carried out in general accordance with Australian Standard AS1726 (Reference 1).

We understand that Legacy Property has entered into a contract to purchase the above site and the site is proposed to be subdivided for residential development. The details on the proposed subdivision were not provided, but earthworks for construction of building platforms and internal roads for the subdivision are anticipated to involve up to about 2.0m deep excavation and some fill placement.

A geotechnical investigation is required to assess subsurface profile across the site in order to provide geotechnical recommendations on earthworks and preliminary design of future dwellings and internal road pavements.

Review of Available Information

Reference to the Geological Map of Penrith (scale 1:100,000) indicates that the bedrock at the site is Bringelly Shale, belonging to the Wianamatta Group of rocks and comprising shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone, and rare coal.

Reference to the Soil Landscape Map of Penrith (scale 1:100,000) indicates that the landscape at the site belongs to Luddenham Group, which is characterised by undulating to rolling low hills on Wianamatta Group shale, often associated with Minchinbury sandstone, with local relief of 50m to 80m, ground surface slopes of 5% to 20%, narrow ridges, hillcrests and valley. Soil in this group is likely to be up to 1.5m deep, highly plastic, moderately reactive, locally impermeable and susceptible to high erosion hazards.

Reference to Map showing Salinity Potential in Western Sydney (Scale Approximate 1:143,000) prepared by Department of Infrastructures, Planning and Natural Resources (2002) indicates moderate salinity potential at the site.

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Field Work

Field works for the geotechnical investigation were carried out on 6 and 10 August 2021 and consisted of the following:

- Reviewing geological map, soil landscape map and salinity potential map relevant to the site.
- Reviewing services plans obtained from "Dial Before You Dig" to locate existing services across the site.
- Carrying out a walkover survey to assess existing site conditions and nominate test pit locations.
- Scanning proposed test pit locations with aim of avoiding damages to existing underground services during test pit excavation. We engaged a specialist services locator for this purpose.
- Excavating 16 test pits (designated as TP1 to TP16) using a backhoe. Test pits were uniformly distributed across the site and terminated at backhoe refusal in bedrock at depths of about 2.5m from existing ground surface. Approximate locations of test pits are indicated on the attached Drawing No 14947/1-AA1. Excavation logs are also attached.
- Conducting Dynamic Cone Penetrometer (DCP) tests adjacent to test pits to assess strength characteristics of subsurface soils. DCP tests were terminated due to refusal at depths of about 0.5m to 1.0m. DCP test results are included in appropriate excavation logs.
- Measuring depths to groundwater level or seepage in test pits, where encountered.
- Collecting representative soil samples for visual assessment and laboratory testing.
- Backfilling the test pits with excavated materials after logging and sampling.

Field work was supervised by a Field Engineer from this company, responsible for nominating the test locations, conducting DCP tests, sampling, and preparation of field logs.

Site Conditions

The site is of approximately of rectangular shape, measuring about 290.0m by 275.0m in plan. The following observations were made during field works:

- This site is bound by O'Connell Street, Caddens to the north, O'Connell Lane to the west and existing residential developments in two remaining sides.
- There is an existing dwelling and a commercial building with associated driveway, shed etc in the north eastern portion of the site. Vacant portions of the site are grass covered.
- In general, ground surface across the site dips gently towards west and south from the north eastern portion of the site.
- There is a drainage depression originated in the south eastern portion of the site and dipping in about north westerly direction.

Sub-surface profiles encountered in thirteen test pits are detailed in the attached excavation logs, and summarised below in Table 1.

Table 1 – Sub-surface Profiles encountered in Test Pits

Test Pit No	Termination Depth* (m)	Depth Range for Topsoil (m)	Depth Range for Residual Soil (m)	Depth to Bedrock (m)
TP1	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP2	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP3	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP4	1.8	0.0-0.4	0.4-1.8	1.8
TP5	2.0	0.0-0.3	0.3-2.0	2.0
TP6	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP7	2.5	0.0-0.3	0.2->2.5	Not Encountered
TP8	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP9	2.5	0.0-0.3	0.2->2.5	Not Encountered
TP10	2.5	0.0-0.3	0.2->2.5	Not Encountered
TP11	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP12	2.5	0.0-0.2	0.2->2.5	Not Encountered
TP13	2.5	0.0-0.4	0.2->2.5	Not Encountered
TP14	2.5	0.0-0.4	0.2->2.5	Not Encountered
TP15	2.5	0.0-0.3	0.2->2.5	Not Encountered
TP16	2.5	0.0-0.3	0.2->2.5	Not Encountered

* Approximate only

Based on information presented in Table 1, we anticipate that the subsurface profile across the site comprises a sequence of topsoil and residual soils underlain by bedrock. Bedrock was encountered in only two test pits at depths of 1.8m to 2.0m but remaining test pits did not encounter bedrock up to their termination depth of about 2.5m from existing ground surface.

Topsoil is sandy silty clay of low plasticity with some grass roots. Residual soils include localised silty sandy clay of low plasticity and widespread silty clay of medium to high plasticity at moisture content lower than plastic limit with some ironstone and siltstone gravels. Residual soils are assessed to be stiff to hard. Bedrock encountered in two test pits is extremely weathered siltstone/sandstone of very low to low strength.

Groundwater was not encountered to test pit termination depths of 1.8m to 2.0m from existing ground surface. Therefore, it is anticipated that the depth to groundwater level across the site is more than 2.5m under normal conditions. It should however be noted that the groundwater levels might vary due to rainfall and other factors not evident during field work.

Laboratory Testing

Representative soil samples recovered from the test pits were tested in the NATA accredited laboratory of SGS Environmental Services and Geotech Testing Pty Ltd, in accordance with relevant Australian Standards, to determine the following properties:

- Chemical properties including Exchangeable Sodium Percentage (ESP), Electrical Conductivity (EC), pH and Sulphate.
- Physical properties including shrink swell index, Atterberg Limits, maximum dry density, optimum moisture content, and California Bearing Ratio (CBR).

Detailed laboratory test results are attached, and summaries are presented in Tables 2, 3 and 4.

Table 2 – Results of Chemical Properties Tests

Test Pit	Sample Depth (m)	EC (µS/cm)	pH	Chloride (ppm)	Sulphate (ppm)	Resistivity (ohm-cm)	Exchangeable Sodium Percentage (%)
TP1	0.5-0.6	520	6.8	710	8.5	970	19.5
TP1	1.5-1.6	720	9.1	410	38	1000	18.0
TP2	0.8-0.9	400	-	-	-	-	-
TP2	1.6-1.7	760	-	-	-	-	-
TP3	1.0-1.1	25	-	-	-	-	-
TP3	2.0-2.1	19	-	-	-	-	-
TP4	0.5-0.6	58	6.6	4.2	44	10000	5.1
TP4	1.5-1.6	21	5.6	9.0	16	24000	10.1
TP5	0.9-1.0	960	-	-	-	-	-
TP5	1.4-1.5	240	-	-	-	-	-
TP6	1.0-1.0	1300	-	-	-	-	-
TP6	2.0-2.1	1200	-	-	-	-	-
TP7	0.9-1.0	41	6.5	12	26	12000	5.8
TP7	2.0-2.1	94	7.7	12	44	5200	10.0
TP8	1.0-1.1	770	-	-	-	-	-
TP8	1.9-2.0	1100	-	-	-	-	-
TP9	0.5-0.6	190	-	-	-	-	-
TP9	1.5-1.6	98	-	-	-	-	-
TP10	1.0-1.1	1000	4.3	1500	130	500	50.3
TP10	20.-2.1	1000	4.3	950	110	470	49.1
TP11	1.0-1.1	340	-	-	-	-	-
TP11	2.0-2.1	110	-	-	-	-	-
TP12	1.0-1.1	180	-	-	-	-	-
TP12	2.0-2.1	210	-	-	-	-	-
TP13	1.5-1.6	210	7.8	100	41	2800	5.0
TP13	2.0-2.1	550	8.7	460	30	1000	12.8
TP14	0.5-0.6	400	-	-	-	-	-
TP14	1.5-1.6	1500	-	-	-	-	-
TP15	1.0-1.1	390	-	-	-	-	-
TP15	2.0-2.1	760	-	-	-	-	-
TP16	1.0-1.1	760	8.5	150	65	1900	8.3
TP16	2.0-2.1	970	8.0	1300	100	540	26.3

Table 3 – Results of Physical Shrink Swell and Atterberg Limits Tests

Test Pit	Sample Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Shrink Swell Index (%/pF)
TP1	2.0 - 2.1	42.0	17.0	25.0	15.0	
TP2	0.3 - 0.6	-	-	-	-	2.6
TP4	1.0 - 1.1	41.0	21.0	20.0	8.5	
TP4	0.4 - 0.7	-	-	-	-	3.0
TP5	0.4 - 0.7	-	-	-	-	0.9
TP6	0.5 - 0.6	69.0	22.0	47.0	15.5	
TP7	0.4-0.7	-	-	-	-	1.0
TP8	0.3 - 0.4	73.0	25.0	48.0	18.0	
TP9	0.4 - 0.7	-	-	-	-	4.1
TP10	0.3 - 0.4	67.0	23.0	44.0	17.5	
TP11	0.3 - 0.5	49.0	17.0	32.0	14.0	
TP12	0.3 - 0.4	65.0	22.0	43.0	17.0	
TP13	0.4 - 0.5	52.0	21.0	31.0	17.5	
TP13	0.4 - 0.7	-	-	-	-	2.7
TP15	0.5 - 0.6	63.0	23.0	40.0	15.0	
TP16	0.3 - 0.6	-	-	-	-	3.9

Table 4 – Results of Compaction and California Bearing Ratio Tests

Test Pit	Sample Depth (m)	Natural Moisture Content (%)	Maximum Dry Density (t/m^3)	Optimum Moisture Content (%)	California Bearing Ratio (%)
TP3	0.3-0.6	24.5	1.57	22.8	6
TP7	0.4-0.7	22.3	1.70	19.5	6
TP12	0.3-0.6	14.2	1.75	16.3	4
TP15	0.3-0.6	20.8	1.7	18.5	2

DISCUSSION AND RECOMMENDATIONS

Soil Erodibility

Erosion is the detachment and movement of soil materials. Soil erodibility (or dispersivity) is generally assessed by conducting chemical tests such as Exchangeable Sodium Percentage (ESP) and Sodium Absorption Ratio (SAR), and physical tests such as Emerson Class and Dispersion Percentage. It should however be noted that assessment of soil dispersibility based on these methods might differ from each other.

For the proposed investigation, ESP values for representative soil samples were determined. Soils with ESP values of 10% or more are considered sodic, and susceptible to excessive erosion (Reference 2). However, soils with ESP of more than 5% are potentially dispersive.

ESP values for 12 representative soil samples presented in Table 2 indicate that the ESP values vary from 5.0% to 50.3%. All samples have ESP of more than 5.0% and 8 out of 12 samples show ESP value of more than 10.0%. Therefore, it is our assessment that most of the soils likely to be disturbed or excavated during proposed development works are likely to be dispersive and susceptible to excessive erosion.

Therefore, we recommend that the earthworks for the proposed development works should be carried out in accordance with an appropriate Soil Management Plan to manage the impacts from the erosive soils. We recommend that the Soil Management Plan be developed in accordance with Department of Housing Guidelines (Reference 3).

Soil Salinity

Soil salinity is generally assessed by measuring EC of a soil sample made up of 1:5 soil water suspension. Thus, determined EC is multiplied by a factor varying from 6 to 23, based on the texture of the soil sample, to obtain Corrected Electrical Conductivity designated as ECe (Reference 4). Alternatively, ECe may be directly measured in soil saturation extracts. Soils are classified as saline if ECe of the saturated extracts exceed 4.0dS/m. The criteria for assessment of soil salinity classes are shown in the following Table 5 (Reference 4).

Table 5 – Criteria for Soil Salinity Classification

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

Electrical conductivity (EC) values for 32 representative soil samples are summarised in Table 2. For clayey soils encountered across the site, appropriate multiplying factor is assumed to vary from 9 to 10. For these factors, ECe for representative soil samples are estimated to vary from about 2.0dS/m to 15.0dS/m. Soils with ECe of less than 4.0dS/m are assessed to be localised and minor. Therefore, it is our assessment that the soils likely to be disturbed or excavated during proposed development works should be considered saline. Therefore earthworks for the proposed development works may be carried out in accordance with a Saline Soils Management Plan (SSMP). Recommended SSMP is presented below in this report.

Exposure Classification

Australian Standard AS2870 (Reference 5) provides guidelines to assess Exposure Classification for saline and sulphate soils. Table 6 below provides salinity and Exposure Classifications based on EC_e, and Table 7 provides Exposure Classification for sulphate soils.

Table 6 – Exposure Classifications for Saline Soils

Electrical Conductivity, EC_e (dS/m)	Exposure Classification	Salinity Classification
<2	A1	Non-saline
2 – 4	A1	Slightly saline
4 – 8	A2	Moderately saline
8 – 16	B1	Very saline
>16	B2	Highly saline

Table 7 – Exposure Classifications for Sulphate Soils

Sulphate expressed as SO_3		pH	Exposure Classification*	
In Soil (ppm)	In Groundwater (ppm)		Soil Condition A	Soil Condition B
<5000	<1000	>5.5	A2	A1
5000-10000	1000-3000	4.5-5.5	B1	A2
10000-20000	3000-10000	4.0-4.5	B2	B1
>20000	>10000	<4.0	C2	B2

Approximately 100ppm of SO_4 = 80ppm of SO_3
*Soil Condition A = high permeability soils (e.g. sands and gravels) which are below groundwater
*Soil Condition B = low permeability soils (e.g. silts and clays) and all soils above groundwater

Soils across the site are clayey and therefore appropriate Soil Condition is "Condition B". Therefore, based on laboratory test results presented in Tables 2 and guidelines on Exposure Classifications presented in Tables 6 and 7, the following are our assessments:

- Based on ECe, the Exposure Classifications for soils across site belong to Class A1 to A2.
- Based on pH, the Exposure Classifications for soils across site belong to Class A1 to B1.
- Based on sulphate, the Exposure Classifications for soils across site belong to Class A1.

Therefore, we recommend that the proposed subdivision development use construction materials (such as concrete, bricks) and construction methods appropriate for Exposure Class B1. However, Exposure Classification for individual lot should be reassessed after post earthworks salinity assessment.

Aggressivity Classification

Australian Standard AS2159 (Reference 6) provides guidelines to assess Aggressivity Classification for soils and groundwater. Table 8 below provides Aggressivity Classifications applicable to iron and steel and Table 8 provides Aggressivity Classifications applicable to concrete.

Table 8 – Aggressivity Classification for Steel/Iron

Chloride		pH	Resistivity (ohm cm)	Soil Condition A*	Soil Condition B#
In Soil (ppm)	In Water (ppm)				
<5000	<1000	>5.0	>5000	Non-aggressive	Non-aggressive
5000-20000	1000-10000	4.0-5.0	2000-5000	Mild	Non-aggressive
20000-50000	10000-20000	3.0-4.0	1000-2000	Moderate	Mild
>50000	>20000	<3.0	<1000	Severe	Moderate

*Soil Condition A = high permeability soils (e.g. sands and gravels) which are below groundwater
#Soil Condition B = low permeability soils (e.g. silts and clays) and all soils above groundwater

Table 9 – Aggressivity Classification for Concrete

Sulphate expressed as SO_4		pH	Chloride in Water (ppm)	Soil Condition A	Soil Condition B
In Soil (ppm)	In Groundwater (ppm)				
<5000	<1000	>5.5	<6000	Mild	Non-aggressive
5000-10000	1000-3000	4.5-5.5	6000-12000	Moderate	Mild
10000-20000	3000-1000	4.0-4.5	12000-30000	Severe	Moderate
>20000	>10000	<4.0	>30000	Very Severe	Severe

Approximately 100ppm of SO_4 = 80ppm of SO_3

As indicated above, appropriate Soil Condition is "Condition B". Therefore, based on laboratory test results presented in Tables 2 and guidelines on Aggressivity Classifications presented in Tables 8 and 9, the following are our assessments:

- Based on pH, soils across site are assessed to be Non-aggressive to steel/iron but Non to Moderately Aggressive to concrete.
- Based on chloride content, soils across site are assessed to be Non-aggressive to steel/iron as well as concrete.
- Based on sulphate content, soils across site are assessed to be Non-aggressive to concrete.
- Based on resistivity, soils across site are assessed to be Non-aggressive to Moderately Aggressive to steel/iron as well as concrete.

Therefore, we recommend that the proposed subdivision development use construction materials (such as concrete, bricks) and construction methods appropriate Moderately Aggressive site.

Soil Reactivity

Test pits indicate that the residual soils are predominantly silty clay and silty sandy clay, visually assessed to be of low to medium plasticity at moisture content lower than plastic limit with some ironstone and siltstone gravels. Laboratory tests in representative soil samples to assess reactivity of soils indicate the following:

Liquid Limit	= 41.0% to 73.0%
Plastic Limit	= 17.0% to 25.0%
Plasticity Index	= 2.0% to 48.0%
Linear Shrinkage	= 9.0% to 18.0%
Shrink Swell Index	= 0.9%/pF to 4.1%/pF

Therefore, it is our assessment that the soils likely to be disturbed and excavated during proposed development works are predominantly medium to high plasticity clay.

Excavation Conditions

The details on the proposed subdivision were not provided, but earthworks for construction of building platforms and internal roads for the subdivision are anticipated to involve up to about 2.0m deep excavation and some fill placement. Therefore, the materials to be excavated are anticipated to comprise topsoil, residual soils and bedrock (siltstone/sandstone). However, bedrock encountered to depth of about 2.0m is anticipated to be localised and of very low to low strength.

It is our assessment that the excavation of topsoil, residual soils and bedrocks of very low to low strength can be achieved using conventional earthmoving equipment such as excavators and dozers. Therefore, we anticipate that the excavation works for the proposed subdivision development can be completed with conventional earthmoving equipment provided slow production rate is acceptable while excavating into bedrock.

Ground vibration during excavation works is generally represented by maximum peak particle velocity. Houses and buildings, similar to those currently existing in the vicinity of the site, are anticipated to tolerate ground vibration of about 5.0mm/s to 10.0mm/s. We anticipate that excavations into soils and very low to low strength bedrock will result in ground vibrations that are likely to be within tolerable limits for stability of existing structures in the vicinity of the site.

Based on site observation during field works, we do not anticipate significant groundwater inflow during excavations to about 2.0m. Minor groundwater inflow, if any, could be managed by a conventional sump and pump method. However, trafficability problems could arise locally during wet weather or if water is allowed to pond at the site.

However, if depth of excavation exceeds 3.0m, bedrocks of medium to high strength sandstone may be encountered necessitating use of larger equipment (such as a rock saw, Caterpillar D9 or equivalent). Selection of rock cutting equipment is based on site access, desired smoothness of the excavated rock surface and acceptable ground vibration during rock excavation.

Fill Placement

Proposed subdivision development is anticipated to involve placement of fill during construction of building platforms and preparation of subgrades for internal road constructions. The fill should be placed in a controlled manner and we recommend the following procedures for placement of controlled fill.

- Strip existing topsoil and stockpile separately for possible future uses or dispose off the site. Topsoil may be used in landscaping.
- Undertake proof rolling (using an 8 to 10 tonnes roller) of the exposed residual 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 further proof rolling, this office should be contacted for additional recommendations, which may include stripping additional soft soils and replacing with granular materials with or without geogrid reinforcement.
- Place suitable fill materials on proof rolled surface of residual soil 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). However, the upper 500mm of controlled fill forming subgrade for internal roads should be compacted to a MDDR of 100% Standard, at moisture content within 2% of 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 residual soils and bedrock obtained from excavations within the site may also be selectively used in controlled fill, after crushing to sizes finer than 75mm, moisture conditioning, and removal of unsuitable materials.
- 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 (Reference 7). It should be noted that a Geotechnical Inspection and Testing Authority will generally provide certification on quality of entire compacted fill only if Level 1 supervision and testing is carried out.

Batter Slopes and Retaining Structures

As described above, site preparation for the proposed subdivision development involves cut and fill operations. Cuts are anticipated to be limited in residual soil. No significant rock excavation is anticipated. The cut and fill slopes should be battered for stability or retained by engineered retaining structures.

If cut and fill slopes are to be battered for stability, we recommend the following batter slopes:

- For short-term stability in controlled fill and residual soils = 1 vertical to 1 horizontal
- For long-term stability in controlled fill and residual soils = 1 vertical to 2.5 horizontal

It is also recommended that batter slopes are provided with adequate surface and sub-surface drainage, and the crest of the batter slope is at least 1.0m away from the property boundary.

However, 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 subdivision are anticipated to include gravity walls and cantilever 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, an active earth pressure coefficient (k_a) is recommended. However, if it is critical to limit the horizontal deformation, use of an earth pressure coefficient at rest (k_0) is recommended. Recommended earth pressure coefficients for the design of retaining structures are presented in the following Table 10.

Table 10 – Recommended earth pressure coefficients

Retained Material	Unit Weight (kN/m^3)	Active Earth Pressure Coefficient, K_a	At Rest Earth Pressure Coefficient, K_0	Ultimate Passive Earth Pressure (kPa)
Controlled Fill	18.5	0.35	0.55	Ignore
Residual Soil	18.0	0.30	0.50	200.0

The above coefficients are based on the assumption that ground level behind the retaining structure is horizontal and the retained material is effectively drained. Additional earth pressures resulting from surcharge load (buildings, infrastructures, etc) on retained materials and groundwater pressure, if any should also be allowed for in design of retaining structures. The design of any retaining structure should also be checked for bearing capacity, overturning, sliding and overall stability of the slope.

Site Classification

Australian Standard AS2870 (Reference 4) recommends building sites are classified based on thickness of clayey foundation soils and reactivity (shrink swell movements) of foundation soils. Site preparation for the proposed subdivision development involves cut and fill operations. Therefore, the thickness of clayey foundation soils, including thickness and nature of controlled fill, in each building lot at the completion of earthworks is not known at this stage. Therefore, this report provides only preliminary site classifications.

At completion of cut and fill operations, when building platforms are ready for construction of residences, sub-surface profiles within the residential lots are anticipated to belong to one of two types listed below:

- Type 1 – Profile comprising residual soil underlain by bedrock
- Type 2 – Profile comprising a sequence of control fill and residual soil underlain by bedrock

It is anticipated that all unsuitable materials will be removed and replaced with controlled fill placed in accordance with recommendations provided in this report. Controlled fill is anticipated to comprise residual soil and/or crushed bedrock obtained from excavations within the site. That means reactivity of fill material is anticipated to be similar or better than that of residual soils.

Therefore, based on the nature and thickness of residual soil and controlled fill likely to be encountered across the site, future residential lots are anticipated to belong to Class "A" or "S" or "M" or "H1", in accordance with Australian Standard AS2870 (Reference 4). Thickness of soil (residual soil and controlled fill combined) may vary across the site, which might indicate two or more site classes for a single residential lot. Under such circumstances, we suggest that the worst site class should be considered appropriate for that lot. The general definitions of site classes provided in Australian Standard AS2870 (Reference 4) are reproduced below in Table 11.

Table 11 – Definitions of Site Classifications

Site Classification	Soils Thickness* (m)	Foundation Conditions	Ground Movement (mm)
Class A	Bedrock Exposed	Most sand and rock sites with little or no ground movement from moisture changes	Not Applicable
Class S	Less than 0.6	Slightly reactive sites, which might experience only slight ground movement from moisture changes	Less than 20
Class M	0.6-1.8	Moderately reactive clay or silt sites, which might experience moderate ground movement from moisture changes	20.0 to 40.0
Class H1	More than 1.8	Highly reactive clay sites, which might experience extreme ground movement from moisture changes	40.0 to 60.0

* Total thickness of controlled fill and residual soil combined

The above classifications should be considered preliminary only and site classification for individual lot for final design should be confirmed by sampling and testing of foundation soils after construction of building platforms is completed.

Floor Slabs and Footings

We anticipate foundation materials at ground floor levels of future residences will include controlled fill or residual soils or bedrock. Under such circumstances, ground floor slabs for the future residences 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 bearing floor slabs may be designed for assessed site classifications in accordance with Australian Standard AS2870 (Reference 4. Alternatively, we recommend a Modulus of Subgrade Reaction value of 20kPa/mm, 25kPa/mm and 35.0kPa for design of ground-bearing slabs on controlled fill, residual soils and bedrock respectively.

Loading conditions for the future residences are not known at this stage. However, depending on whether construction of building platforms involves cut or fill, we consider that appropriate footings would comprise shallow footings (pad and strip footings) founded on controlled fill, residual soils or bedrock or deep footings (bored piers or screw piles) founded on bedrock. Deep footings would also be preferable where footings are required to withstand significant lateral and uplift pressures. The recommended allowable bearing pressures for design of shallow and deep footings are presented in the following Table 12.

Table 12 – Recommended Allowable Bearing Pressures

Founding Material	Founding Depth *(m)	Allowable Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)
Controlled Fill/Residual Soil	0.0-1.0	125.0	Ignore
Bedrock	2.0->2.5	700.0	50.0

* Approximate from existing ground surface

Allowable shaft adhesion value presented in Table 12 is for compressive load. Recommended shaft adhesion value for uplift pressure is half that presented in Table 12.

As depths to residual soils and bedrock with the recommended allowable bearing pressures could vary across the site (especially due to cut and fill operations) the founding depths of footings to be constructed will also vary. The founding depths presented in Table 12 are measured at test pit locations during geotechnical investigation and should be considered as indicative only. Therefore, an experienced Geotechnical Engineer should confirm founding levels during construction, on the basis of assessment made during footing excavation or pier hole drilling. The engineer should ensure that the design strength of bedrock is achieved.

For footings founded in controlled fill and residual soils, the total settlements of footings under the recommended allowable bearing pressures are estimated to be about 2.0% of the minimum dimension of footings. However, for footings founded in bedrock, total settlements under the recommended allowable bearing pressures are estimated to be 1.0% of footing width or pier diameter. The differential settlements are estimated to be about half the estimated total settlements.

Pavement Design

Design of road pavement depends on strength of subgrade, which is usually represented by CBR value and traffic load.

Results of CBR tests presented in Table 4 indicate CBR values of residual soils across the site vary from 2.0% to 6.0%. It is noted, subsurface materials with CBR value of less than 3.0% is likely to be localised.

Subgrade with CBR values of less than 3.0% are considered to be weak and generally not acceptable as subgrade for construction of road pavement. If road pavements are to be constructed on subgrade with CBR of less than 3.0%, we recommend that the subgrade is improved using one of the following options.

- Replace upper 300mm of natural clay with crushed sandstone compacted to Minimum Dry Density Ratio (MDDR) of 100% Standard, at moisture content within 2% of Optimum Moisture Content (OMC). The crushed sandstone will have to be placed and compacted in two layers to achieve desired compaction level.

- Stabilise upper 300mm of natural soil with lime and compact to MDDR of 100% Standard, at moisture content within 2% of OMC. Although exact proportion of lime may have to be determined after conducting laboratory tests on lime stabilised subgrade materials, we suggest 4.0% by weight for preliminary budgeting purposes. It is preferable that the mixing of lime with excavated natural soil is carried out using a rotary hoe or similar equipment outside the road reserve and lime stabilised natural soil is placed and compacted in two layers.

Subgrade improvement is required in only those sections of road where subgrade CBR is assessed to be less than 3.0%. It is reiterated that the subgrade with CBR of less than 3.0% is anticipated to be localised and therefore roads may not pass through subgrade requiring improvement.

Once section of subgrade with CBR values of less than 3.0% is improved using one of the abovementioned method (if required), entire internal road pavement for proposed subdivision may be designed for an indicative subgrade CBR value of 3.0%.

Penrith City Council (Reference 8) recommends a design traffic load of 5.0×10^5 Equivalent Standard Axle (ESA) for design of streets with likely bus routes and this traffic is deemed appropriate for internal road in the proposed subdivision development.

For recommended indicative design subgrade CBR value and design traffic loading, the recommended flexible pavement designs for internal roads in the proposed subdivision, in accordance with Penrith City Council and Austroads (References 8 and 9) is presented in the following Table 13.

Table 13 – Recommended Pavement Design

Pavement Materials	Internal Roads
Asphaltic Concrete	50mm
Basecourse Material (DGB20)	150mm
Sub-base Material (DGS40)	275mm

Recommended pavement thicknesses presented in Table 13 are valid only if the subgrade and pavement materials are compacted to the following Minimum Dry Density Ratios.

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

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

It should be noted that the pavement design may change if subgrade conditions and actual traffic load differs from those assumed in preparation of this report. Therefore, we recommend that the subgrade testing is carried out to confirm subgrade CBR value after completion of subgrade conditions.

Saline Soil Management Plan (SSMP)

Soils encountered across the site are anticipated to be saline as well as dispersive and therefore susceptible to excessive erosion. Therefore, earthworks for the proposed subdivision development should be carried out in accordance with a Saline Soil Management Plan (SSMP). The objective of this SSMP is to minimise the impact of saline and dispersive soils on the proposed development and minimise the impact of the proposed development on the existing salinity and hydrology. More specifically, this SSMP aims to address the following:

- Minimise the disruption to natural surface water drainage
- Minimise the potential for waterlogging or surface water pooling
- Minimise the potential for raising the water table beneath the site
- Minimise the potential for cyclic wetting and drying areas
- Minimise the potential for excessive soil erosion
- Minimise the degradation of building products (masonry, concrete, steel) in the presence of aggressive and/or saline soils

The following are recommended for adoption as part of SSMP during the earthworks for the proposed subdivision development:

- Erosion and Sediment Control Plans must be developed and implemented in accordance with the NSW Department of Housing document "Managing Urban Stormwater: Soils and Construction" (Reference 3). All sediment and erosion controls proposed by the Erosion and Sediment Control Plan are to be installed prior to commencement of any earthwork.
- Utilise native and deep-rooted plants (salt tolerant) in order to minimise soil erosion. Western Sydney soils are generally prone to dispersion and erosion, therefore where vegetation cover is not adequate to control erosion, improve soil resistance to erosion by stabilising dispersive soils with hydrated lime and gypsum.
- Cut and fill batters are provided with secured turf overlay to guard against erosion. Construction of a V-drain behind the crest of any slope, to divert water away from the slope, is also recommended.
- Map the current primary drainage lines and incorporate these into the surface water drainage system for the subdivision. Do not fill in or block these drainage lines unless appropriate alternative drainage is provided.
- Develop the best use of the existing topography in order to minimise cut and fill operations. Excavation depths of less than 1.0m are preferable, if possible.
- Where the creation of individual building platforms would require substantial cut and/or fill (i.e. on relatively steep slopes) consider the use of tiered housing and/or house slabs suspended on piers. This will minimise the obstruction of the natural surface water flow.
- Minimise the use of retaining structures; use safely inclined slopes, with grass and plant cover as an alternative. Gabion walls are also a better alternative as they are free draining.
- Reduce groundwater recharge through appropriate land use and land management practices including the following;
    - Minimising deep infiltration and by maximising vegetation cover, planting deep-rooted trees and the use of salt tolerant plants
    - Preventing water ponding against the walls of any new structures

- Providing appropriate slope to surrounding paths to drain water away from any external walls
- Providing appropriate downpipes to divert water away from structures and prevent cyclic wetting and drying
- Preventing use of unlined on-site water detention basins. Lined basins, relying solely on evaporation should be used as an alternative
- Ensuring finished ground surface in each lot after completion of earthworks are provided with adequate fall to the street or stormwater manholes to allow run-off of water and prevent water ponding, waterlogging and infiltration of rainwater
- Monitor water pipes for leaks and repair any damaged pipes as soon as possible after detection

- Ensure that earthworks and construction activities do not affect the natural flow of groundwater. Where groundwater is intercepted during development works/excavation, the flow should be diverted to stormwater drains or creeks by providing appropriate surface and sub-surface drainage. We do not anticipate that the proposed earthworks will affect the natural flow of groundwater.
- For slab on ground construction, a layer of bedding sand of at least 30mm thickness under the slab should be provided. This will permit free drainage of water beneath the slab, minimising the possibility of pooling or trapping water that might potentially carry salts.
- A high impact waterproof membrane, not just a vapour proof membrane, must be laid under any ground-bearing slab. For masonry building construction, the damp proof course must consist of polyethylene or polyethylene coated metal.
- Ground levels immediately adjacent to masonry walls must be kept below the damp-proof course.
- Use construction materials (concrete, steel, brick, mortar etc) and methods suitable for Exposure Class B1 and Moderately Aggressive site (References 5 and 6).
- Ensure all underground services are provided with adequate corrosion protection, including sheaths to power and telecommunication cables.

Limitations

Based on anticipated surface and subsurface conditions as well as properties of subsurface soils likely to be disturbed or excavated during the proposed subdivision development, it is our assessment that geotechnical conditions will not impose any constraints on the proposed development. Therefore, it is also our assessment that the site is suitable for proposed subdivision development provided earthworks and design of future residences and roads are carried out in accordance with recommendation provided in this report.

The assessments and recommendations presented in this report are based on site observations and information from a limited number of test pits. Although we believe that the sub-surface profiles encountered in the test pits and presented in this report are indicative of the general nature of soils and bedrock across the site, it is possible that the soils across the site could differ from those encountered in the test pits. We recommend that this company is contacted for further advice if subsurface conditions encountered during earthworks differ from those presented in this report. Furthermore, it should be noted that the recommendations on site classifications and design of footings and pavements provided in this report are preliminary in nature and should be confirmed after completion of earthworks and subgrade preparation works, which may alter the existing site conditions.

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

Yours faithfully
GEOTECHNIQUE PTY LTD

INDRA JWORCHAN
MIEAust CPEng NER APEC Engineer IntPE(Aust)
Principal Geotechnical Engineer

Attached — Drawing No 14947/1-AA1 - Test Pit Locations
Excavation Logs
Laboratory Test Results

References

1. Australian Standard AS1726-2017, Geotechnical Site Investigation 2017.
2. Fell, R., MacGregor, P, Stapledon, D., Bell, G. and Foster, M., Geotechnical Engineering of Embankment Dams, Second Edition, 2017.
3. NSW Department of Housing, Managing Urban Stormwater, Soils and Construction, 1998.
4. Lillicrap, A and McGhie, S., Site Investigation for Urban Salinity, Department of Land and Water Conservation, 2002.
5. Australian Standard AS2870-2011, Residential Slabs and Footings, 2011.
6. Australian Standard AS2159-2009, Piling – Design and Installation, 2009.
7. Australian Standard AS3798-2007, Guidelines on Earthworks for Commercial and Residential Developments, 2007.
8. Penrith City Council, Design Guidelines for Engineering Works for Subdivisions and Developments, 2013.
9. Austroads, Guide to Pavement Technology, Pavement Structural Design, February 2010.

LEGEND

Test Pit

Imagery ©2021 NearMap.com

0 30 60 90 120 150m

Scale 1:3000

GEOTECHNIQUE® PTY LTD

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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

Legacy Property Pty Ltd
Proposed Residential Development
89-115 O'Connell Street
Caddens

Test Pit Locations

Drawing No: 14947/1-AA1
Job No: 14947/1
Drawn By: MH
Date: 23 August 2021
Checked By: IJ

File No: 14947-1
Layers: 0, AA1

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP1
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 46.424
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry			DS	CONE 9,6,4,4,3,3,4,4,5,5,4,6,5,4,5,6	0			TOPSOIL: Silty Sandy Clay. low plasticity, dark brown, with grass roots				
							CH	Silty CLAY, high plasticity, brown	M<PL	F-St		Residual
			DS		0.5							
					1		CI-CH	Silty CLAY, medium to high plasticity, brown	M<PL	St		
			DS		1.5							
			DS		2		CH	Silty CLAY, high plasticity, red-brown mottled grey, with ironstone gravel	M<PL	VSt-H		
					2.5			Test Pit TP1 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP2
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 50.537
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				C O N E 8 7 5 4 3 3 5 4	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
			U_{50}		0.5		CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
			DS	4 5 5 6 9	1		CH	Silty CLAY, high plasticity, grey	M<PL	St		
			DS	8 9	1.5		CI	Silty CLAY, medium plasticity, grey, with siltstone gravel	M<PL	VSt		
					2		CL-CI	Silty CLAY, low to medium plasticity, grey and brown, with siltstone gravel	M<PL	H		
					2.5			Test Pit TP2 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP3
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 56.638
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				C O N E 7	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
				6								
				5			CH	Silty CLAY, high plasticity, red-brown	M<PL	St		Residual
				3								
			DB	4	0.5							
				3								
				4								
				4								
				4								
				5								
			DS	7	1		CI	Silty Sandy CLAY, medium plasticity, brown	M<PL	St-VSt		
				6								
				6								
				7								
				7	1.5							
			DS		2		CL-CI	Silty Sandy CLAY, low to medium plasticity, brown	M<PL	VSt		
					2.5			Test Pit TP3 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP4
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 62.982
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				CONE 8	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
				6								
				4								
				4								
				5			CH	Silty CLAY, high plasticity, red-brown	M<PL	St		Residual
		U_{50}	DS	4	0.5							
				4								
				5								
				6								
				7								
			DS	8	1		CI	Silty Sandy CLAY, medium plasticity, brown, with ironstained sandstone gravel	M<PL	VSt		
				8								
				9								
				9								
				11								
			DS		1.5		CL-CI	Silty Sandy CLAY, low to medium plasticity, brown mottled grey, with sandstone and siltstone gravel	M<PL	VSt		
								Test Pit TP4 terminated at 1.8m due to refusal on sandstone/siltstone bedrock				Bedrock
					2							
					2.5							
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP5
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 55.963
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				COVER 7	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
				7			CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
				47								
				5								
			U_{50}	4	0.5		CH	Silty CLAY, high plasticity, orange-brown mottled grey	M<PL	St		
				3								
				4								
				4								
				4								
			DS	5	1							
				6			CI	Silty Sandy CLAY, medium plasticity, brown	M<PL	St-VSt		
				5								
				6								
				7								
			DS	6	1.5		CI	Silty Sandy CLAY, medium plasticity, brown, with siltstone and sandstone gravel	M<PL	H		
Dry					2			Test Pit TP5 terminated at 2.0m due to refusal on sandstone/siltstone bedrock				Bedrock
					2.5							
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP6
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 50.864
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				CONE 10	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
				8			CH	Silty CLAY, high plasticity, pale brown	M<PL	St		Residual
				5								
				4								
				4								
			DS	5	0.5							
				5								
				4								
				4								
				3								
			DS	5	1		CH	Silty CLAY, high plasticity, grey	M<PL	St		
				4								
				5								
				5								
				6	1.5							
Dry							CI	Silty CLAY, medium plasticity, grey mottled brown, with ironstained siltstone gravel	M<PL	VSt-H		
			DS		2							
					2.5			Test Pit TP6 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP7
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 48.044
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				COZE 8 6 4	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
				4			CH	Silty CLAY, high plasticity, brown mottled grey	M<PL	St		Residual
		DB	U_{50}	3 3 3 4 4	0.5							
			DS	4 3 5 4 5 5	1							
					1.5		CI-CH	Silty CLAY, medium to high plasticity, red-brown	M<PL	VSt		
Dry			DS		2							
					2.5			Test Pit TP7 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP8
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 48.537
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				CONE 8	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
				6			CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
			DS	5								
				4	0.5							
				4								
				5								
				5								
				6								
				7			CH	Silty CLAY, high plasticity, brown, with ironstone gravel	M<PL	VSt		
				7	1							
			DS	8								
				8								
				7								
				11	1.5							
				10								
			DS									
					2		CH	Silty CLAY, high plasticity, grey mottled brown, with gravel	M<PL	VSt-H		
					2.5			Test Pit TP8 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP9
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 49.750
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				C O N E 8 6 5 4	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
				4 4			CH	Silty CLAY, high plasticity, red-brown	M<PL	St		Residual
		U_{50}	DS	4 4	0.5							
				5 3			CH	Silty CLAY, high plasticity, brown	M<PL	St		
				4 5 6 7 7 7	1							
			DS		1.5							
							CI-CH	Silty CLAY, medium to high plasticity, brown, with ironstone gravel	M<PL	VSt		
Dry					2							
					2.5			Test Pit TP9 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP10
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 51.921
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				COVER 8	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
			DS	6 5 4 4 3 3 3	0.5		CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
			DS	4 5 4 5 6 6	1		CH	Silty CLAY, high plasticity, grey and red-brown	M<PL	St-VSt		
Dry			DS		1.5							
					2							
					2.5			Test Pit TP10 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP11
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 53.743
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				COVER 9 7 6 5 4 4 5 5 4 3 3 4 4 5 5	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
			U_{50}		0.5		CI-CH	Silty CLAY, medium to high plasticity, red-brown	M<PL	St		Residual
			DS		1							
					1.5		CH	Silty CLAY, high plasticity, red-brown	M<PL	St		
			DS		2		CI	Silty Sandy CLAY, medium plasticity, brown mottled grey	M<PL	St-VSt		
					2.5			Test Pit TP11 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

GEOTECHNIQUE
PTY LTD

engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP12
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 56.392
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				CONE 8	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
				6			CI-CH	Silty Sandy CLAY, medium to high plasticity, brown	M<PL	St		Residual
		DS		3								
			DB	4	0.5							
				4								
				5								
				4								
				4								
				5								
				5	1							
			DS	6								
				6								
				7								
				8								
				8	1.5		CI-CH	Silty Sandy CLAY, medium to high plasticity, red-brown, with ironstone gravel	M<PL	VSt		
			DS		2		CH	Silty CLAY, high plasticity, red-brown mottled grey	M<PL	VSt		
					2.5			Test Pit TP12 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP13
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 56.105
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				COVER 8	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
		U_{50}	DS	4	0.5		CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
				3								
				3								
				4								
				3								
				4	1							
				3								
				3								
				3								
				4								
			DS	4	1.5							
				5								
				5								
Dry							CI-CH	Silty CLAY, medium to high plasticity, brown grey, with siltstone gravel	M<PL	St-VSt		
			DS		2							
					2.5			Test Pit TP13 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP14
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 54.704
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				COVER 7	0			TOPSOIL: Silty Sandy Clay, low to medium plasticity, dark brown, with grass roots				
			DS	6 3 3 4 4 5	0.5		CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
				4 5 6 5 5	1		CH	Silty CLAY, high plasticity, brown and grey	M<PL	St		
			DS		1.5							
					2		CH	Silty CLAY, high plasticity, grey	M<PL	St-VSt		
					2.5			Test Pit TP14 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP15
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 53.211
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
Dry				CONE 9, 6, 5	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
			DB	3, 4	0.5		CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
		DS		4, 5								
			DS	3, 4, 4, 5	1							
				5, 7, 7, 9	1.5		CH	Silty CLAY, high plasticity, brown mottled grey, with ironstone gravel	M<PL	VSt		
			DS	8	2		CI	Silty CLAY, medium plasticity, grey-brown, with siltstone gravel	M<PL	VSt-H		
					2.5			Test Pit TP15 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

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engineering log - excavation

Client : Legacy Property Pty Ltd
Project : Proposed Residential Subdivision
Location : 89-115 O'Connell Street, Caddens

Job No : 14947/1
Pit No : TP16
Date : 06/08/2021
Logged/Checked by: NK/IJ

Equipment type and model: 5 Tonne Excavator
R.L. surface : 50.036
Excavation dimensions : 2.0 **m long** 0.4 **m wide**
datum : AHD

groundwater	env samples	PID reading (ppm)	geo samples	field tests	depth or R.L. in meters	graphic log	classification symbol	MATERIAL DESCRIPTION soil type, plasticity or particle characteristic, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	Remarks and additional observations
				COVER	0			TOPSOIL: Silty Sandy Clay, low plasticity, dark brown, with grass roots				
			U_{50}	7 5 4 3 3 4 4 8 9	0.5		CH	Silty CLAY, high plasticity, brown	M<PL	St		Residual
			DS	9 9 13/R	1		CH	Silty CLAY, high plasticity, brown and grey, with ironstone gravel	M<PL	VSt-H		
Dry			DS		2		CI	Silty CLAY, medium plasticity, grey and brown, with siltstone gravel	M<PL	VSt-H		
					2.5			Test Pit TP16 terminated at 2.5m				
					3							
					3.5							
					4							
					4.5							

Log Symbols & Abbreviations (Non-cored Borehole Log)

Log Column	Symbol/Value	Description
Drilling Method	V-bit TC-bit RR DB BB	Hardened steel 'V' shaped bit attached to auger Tungsten Carbide bit attached to auger Tricone (Rock Roller) bit Drag bit 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 G P	Glass bottle and plastic bag sample over depths shown on log Glass bottle sample over depths shown on log Plastic bag sample over depths shown on log
PID Reading	100	PID reading in ppm
Geotechnical Sample	DS DB U_{50}	Disturbed Small bag sample over depths shown on log Disturbed Bulk sample over depths shown on log Undisturbed 50mm tube sample over depths shown on log
Field Test	N=10 3,5,5 N=R 10,15/100	Standard Penetration Test (SPT) 'N' value. Individual numbers indicate blows per 150mm penetration. '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 GW GM GC SP SW SM SC ML MI MH CL CI CH	Poorly Graded GRAVEL Well graded GRAVEL Silty GRAVEL Clayey GRAVEL Poorly graded SAND Well graded SAND Silty SAND Clayey SAND SILT / Sandy SILT / clayey SILT, low plasticity SILT / Sandy SILT / clayey SILT, medium plasticity SILT / Sandy SILT / clayey SILT, high plasticity CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, low plasticity CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, medium plasticity CLAY / Silty CLAY / Sandy CLAY / Gravelly CLAY, high plasticity
Moisture Condition Cohesive soils Cohesionless soils	 M<PL M=PL M>PL D M W	 Moisture content less than Plastic Limit Moisture content equal to Plastic Limit Moisture content to be greater than Plastic Limit Dry - Runs freely through hand Moist - Tends to cohere Wet - Tends to cohere
Consistency Cohesive soils	 VS S F St VSt H	**Term** / **Undrained shear strength, C_u (kPa)** / **Hand Penetrometer (Qu)** Very Soft / ≤12 / <25 Soft / >12 & ≤25 / 25 – 50 Firm / >25 & ≤50 / 50 – 100 Stiff / >50 & ≤100 / 100 – 200 Very Stiff / >100 & ≤200 / 200 – 400 Hard / >200 / >400
Density Index Cohesionless soils	 VL L M D VD	**Term** / **Density Index, I_D (%)** / **SPT 'N' (blows/300mm)** Very Loose / ≤15 / ≤5 Loose / >15 & ≤35 / >5 & ≤10 Medium Dense / >35 & ≤65 / >10 & ≤30 Dense / >65 & ≤85 / >30 & ≤50 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	 Residual Alluvium Colluvial Aeolian Marine	Geological origin of soils Residual soils above bedrock River deposited Alluvial soils Gravity deposited Colluvial soils Wind deposited Aeolian soils Marine Soils

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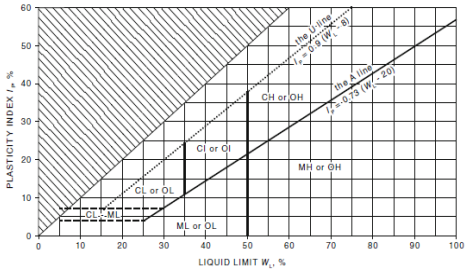
AS1726 : 2017– Unified Soil Classification System

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 Divisions'	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	

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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 VOLCANIC BRECCIA	Halite
	2								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	Fine-grained TUFF	
	Less than 0.002			SHALE Fissile	CLAYSTONE Mostly clay		Calcilutite	Very fine-grained TUFF	
							CHALK		
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					

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Indra Jworchan
Client	Geotechnique
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Telephone	02 4722 2700
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Project	**14947/1 95-119 OConnell Street, Caddens**
Order Number	(Not specified)
Samples	32

LABORATORY DETAILS

Manager	Huong Crawford
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SGS Reference	**SE222421 R0**
Date Received	9/8/2021
Date Reported	16/8/2021

COMMENTS

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

SIGNATORIES

Bennet LO
Senior Organic Chemist/Metals Chemist

Dong LIANG
Metals/Inorganics Team Leader

Huong CRAWFORD
Production Manager

Shane MCDERMOTT
Inorganic/Metals Chemist

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography [AN245] Tested: 16/8/2021

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.6 9/8/2021 SE222421.001	TP1 SOIL 1.5-1.6 9/8/2021 SE222421.002	TP4 SOIL 0.5-0.6 9/8/2021 SE222421.007	TP4 SOIL 1.5-1.6 9/8/2021 SE222421.008	TP7 SOIL 0.9-1.0 9/8/2021 SE222421.013
Chloride	mg/kg	0.25	710	410	4.2	9.0	12
Sulfate	mg/kg	0.5	8.5	38	44	16	26

PARAMETER	UOM	LOR	TP7 SOIL 2.0-2.1 9/8/2021 SE222421.014	TP10 SOIL 1.0-1.1 9/8/2021 SE222421.019	TP10 SOIL 2.0-2.1 9/8/2021 SE222421.020	TP13 SOIL 1.5-1.6 9/8/2021 SE222421.025	TP13 SOIL 2.0-2.1 9/8/2021 SE222421.026
Chloride	mg/kg	0.25	12	1500	950	100	460
Sulfate	mg/kg	0.5	44	130	110	41	30

PARAMETER	UOM	LOR	TP16 SOIL 1.0-1.1 9/8/2021 SE222421.031	TP16 SOIL 2.0-2.1 9/8/2021 SE222421.032
Chloride	mg/kg	0.25	150	1300
Sulfate	mg/kg	0.5	65	100

pH in soil (1:2) [AN101] Tested: 16/8/2021

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.6 9/8/2021 SE222421.001	TP1 SOIL 1.5-1.6 9/8/2021 SE222421.002	TP4 SOIL 0.5-0.6 9/8/2021 SE222421.007	TP4 SOIL 1.5-1.6 9/8/2021 SE222421.008	TP7 SOIL 0.9-1.0 9/8/2021 SE222421.013
pH (1:2)	pH Units	-	6.8	9.1	6.6	5.6	6.5

PARAMETER	UOM	LOR	TP7 SOIL 2.0-2.1 9/8/2021 SE222421.014	TP10 SOIL 1.0-1.1 9/8/2021 SE222421.019	TP10 SOIL 2.0-2.1 9/8/2021 SE222421.020	TP13 SOIL 1.5-1.6 9/8/2021 SE222421.025	TP13 SOIL 2.0-2.1 9/8/2021 SE222421.026
pH (1:2)	pH Units	-	7.7	4.3	4.3	7.8	8.7

PARAMETER	UOM	LOR	TP16 SOIL 1.0-1.1 9/8/2021 SE222421.031	TP16 SOIL 2.0-2.1 9/8/2021 SE222421.032
pH (1:2)	pH Units	-	8.5	8.0

Conductivity (1:2) in soil [AN106] Tested: 16/8/2021

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.6 9/8/2021 SE222421.001	TP1 SOIL 1.5-1.6 9/8/2021 SE222421.002	TP4 SOIL 0.5-0.6 9/8/2021 SE222421.007	TP4 SOIL 1.5-1.6 9/8/2021 SE222421.008	TP7 SOIL 0.9-1.0 9/8/2021 SE222421.013
Conductivity (1:2) @25 C*	µS/cm	1	1000	990	98	42	84
Resistivity (1:2)*	ohm cm	-	970	1000	10000	24000	12000

PARAMETER	UOM	LOR	TP7 SOIL 2.0-2.1 9/8/2021 SE222421.014	TP10 SOIL 1.0-1.1 9/8/2021 SE222421.019	TP10 SOIL 2.0-2.1 9/8/2021 SE222421.020	TP13 SOIL 1.5-1.6 9/8/2021 SE222421.025	TP13 SOIL 2.0-2.1 9/8/2021 SE222421.026
Conductivity (1:2) @25 C*	µS/cm	1	190	2000	2100	360	960
Resistivity (1:2)*	ohm cm	-	5200	500	470	2800	1000

PARAMETER	UOM	LOR	TP16 SOIL 1.0-1.1 9/8/2021 SE222421.031	TP16 SOIL 2.0-2.1 9/8/2021 SE222421.032
Conductivity (1:2) @25 C*	µS/cm	1	530	1800
Resistivity (1:2)*	ohm cm	-	1900	540

Conductivity and TDS by Calculation - Soil [AN106] Tested: 16/8/2021

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.6 9/8/2021 SE222421.001	TP1 SOIL 1.5-1.6 9/8/2021 SE222421.002	TP2 SOIL 0.8-0.9 9/8/2021 SE222421.003	TP2 SOIL 1.6-1.7 9/8/2021 SE222421.004	TP3 SOIL 1.0-1.1 9/8/2021 SE222421.005
Conductivity of Extract (1:5 as received)	µS/cm	1	520	720	400	760	25
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	660	850	500	890	30

PARAMETER	UOM	LOR	TP3 SOIL 2.0-2.1 9/8/2021 SE222421.006	TP4 SOIL 0.5-0.6 9/8/2021 SE222421.007	TP4 SOIL 1.5-1.6 9/8/2021 SE222421.008	TP5 SOIL 0.9-1.0 9/8/2021 SE222421.009	TP5 SOIL 1.4-1.5 9/8/2021 SE222421.010
Conductivity of Extract (1:5 as received)	µS/cm	1	19	58	21	960	240
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	22	73	24	1200	270

PARAMETER	UOM	LOR	TP6 SOIL 1.0-1.0 9/8/2021 SE222421.011	TP6 SOIL 2.0-2.1 9/8/2021 SE222421.012	TP7 SOIL 0.9-1.0 9/8/2021 SE222421.013	TP7 SOIL 2.0-2.1 9/8/2021 SE222421.014	TP8 SOIL 1.0-1.1 9/8/2021 SE222421.015
Conductivity of Extract (1:5 as received)	µS/cm	1	1300	1200	41	94	770
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	1600	1300	50	95	920

PARAMETER	UOM	LOR	TP8 SOIL 1.9-2.0 9/8/2021 SE222421.016	TP9 SOIL 0.5-0.6 9/8/2021 SE222421.017	TP9 SOIL 1.5-1.6 9/8/2021 SE222421.018	TP10 SOIL 1.0-1.1 9/8/2021 SE222421.019	TP10 SOIL 2.0-2.1 9/8/2021 SE222421.020
Conductivity of Extract (1:5 as received)	µS/cm	1	1100	190	98	1000	1000
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	1400	230	120	1400	1000

PARAMETER	UOM	LOR	TP11 SOIL 1.0-1.1 9/8/2021 SE222421.021	TP11 SOIL 2.0-2.1 9/8/2021 SE222421.022	TP12 SOIL 1.0-1.1 9/8/2021 SE222421.023	TP12 SOIL 2.0-2.1 9/8/2021 SE222421.024	TP13 SOIL 1.5-1.6 9/8/2021 SE222421.025
Conductivity of Extract (1:5 as received)	µS/cm	1	340	110	180	210	210
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	410	130	200	260	290

PARAMETER	UOM	LOR	TP13 SOIL 2.0-2.1 9/8/2021 SE222421.026	TP14 SOIL 0.5-0.6 9/8/2021 SE222421.027	TP14 SOIL 1.5-1.6 9/8/2021 SE222421.028	TP15 SOIL 1.0-1.1 9/8/2021 SE222421.029	TP15 SOIL 2.0-2.1 9/8/2021 SE222421.030
Conductivity of Extract (1:5 as received)	µS/cm	1	550	400	1500	390	760
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	620	490	1800	470	850

PARAMETER	UOM	LOR	TP16 SOIL 1.0-1.1 9/8/2021 SE222421.031	TP16 SOIL 2.0-2.1 9/8/2021 SE222421.032
Conductivity of Extract (1:5 as received)	µS/cm	1	760	970
Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	950	1100

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) [AN122] Tested: 16/8/2021

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.6 9/8/2021 SE222421.001	TP1 SOIL 1.5-1.6 9/8/2021 SE222421.002	TP4 SOIL 0.5-0.6 9/8/2021 SE222421.007	TP4 SOIL 1.5-1.6 9/8/2021 SE222421.008	TP7 SOIL 0.9-1.0 9/8/2021 SE222421.013
Exchangeable Calcium, Ca	mg/kg	2	1300	4800	2700	1900	1900
Exchangeable Calcium, Ca	meq/100g	0.01	6.5	24	14	9.3	9.6
Exchangeable Calcium Percentage*	%	0.1	28.6	65.7	61.7	53.1	67.5
Exchangeable Potassium, K	mg/kg	2	200	140	200	110	120
Exchangeable Potassium, K	meq/100g	0.01	0.51	0.35	0.52	0.28	0.31
Exchangeable Potassium Percentage*	%	0.1	2.2	1.0	2.3	1.6	2.2
Exchangeable Magnesium, Mg	mg/kg	2	1400	680	840	750	430
Exchangeable Magnesium, Mg	meq/100g	0.02	11	5.5	6.9	6.2	3.5
Exchangeable Magnesium Percentage*	%	0.1	49.8	15.3	30.8	35.3	24.5
Exchangeable Sodium, Na	mg/kg	2	1000	1500	260	400	190
Exchangeable Sodium, Na	meq/100g	0.01	4.5	6.5	1.1	1.8	0.83
Exchangeable Sodium Percentage*	%	0.1	19.5	18.0	5.1	10.1	5.8
Cation Exchange Capacity	meq/100g	0.02	23	36	22	17	14

PARAMETER	UOM	LOR	TP7 SOIL 2.0-2.1 9/8/2021 SE222421.014	TP10 SOIL 1.0-1.1 9/8/2021 SE222421.019	TP10 SOIL 2.0-2.1 9/8/2021 SE222421.020	TP13 SOIL 1.5-1.6 9/8/2021 SE222421.025	TP13 SOIL 2.0-2.1 9/8/2021 SE222421.026
Exchangeable Calcium, Ca	mg/kg	2	1300	54	37	5200	4000
Exchangeable Calcium, Ca	meq/100g	0.01	6.4	0.27	0.19	26	20
Exchangeable Calcium Percentage*	%	0.1	41.4	1.2	1.0	70.9	56.3
Exchangeable Potassium, K	mg/kg	2	140	140	120	190	200
Exchangeable Potassium, K	meq/100g	0.01	0.35	0.35	0.31	0.49	0.51
Exchangeable Potassium Percentage*	%	0.1	2.2	1.5	1.6	1.3	1.4
Exchangeable Magnesium, Mg	mg/kg	2	870	1300	1100	1000	1300
Exchangeable Magnesium, Mg	meq/100g	0.02	7.1	10	9.4	8.4	11
Exchangeable Magnesium Percentage*	%	0.1	46.3	46.9	48.4	22.8	29.5
Exchangeable Sodium, Na	mg/kg	2	360	2600	2200	420	1000
Exchangeable Sodium, Na	meq/100g	0.01	1.5	11	9.5	1.8	4.6
Exchangeable Sodium Percentage*	%	0.1	10.0	50.3	49.1	5.0	12.8
Cation Exchange Capacity	meq/100g	0.02	15	22	19	37	36

PARAMETER	UOM	LOR	TP16 SOIL 1.0-1.1 9/8/2021 SE222421.031	TP16 SOIL 2.0-2.1 9/8/2021 SE222421.032
Exchangeable Calcium, Ca	mg/kg	2	7200	1500
Exchangeable Calcium, Ca	meq/100g	0.01	36	7.3
Exchangeable Calcium Percentage*	%	0.1	66.6	26.4
Exchangeable Potassium, K	mg/kg	2	230	240
Exchangeable Potassium, K	meq/100g	0.01	0.60	0.61
Exchangeable Potassium Percentage*	%	0.1	1.1	2.2
Exchangeable Magnesium, Mg	mg/kg	2	1600	1500
Exchangeable Magnesium, Mg	meq/100g	0.02	13	13
Exchangeable Magnesium Percentage*	%	0.1	24.0	45.1
Exchangeable Sodium, Na	mg/kg	2	1000	1700
Exchangeable Sodium, Na	meq/100g	0.01	4.5	7.3
Exchangeable Sodium Percentage*	%	0.1	8.3	26.3
Cation Exchange Capacity	meq/100g	0.02	54	28

Moisture Content [AN002] Tested: 16/8/2021

PARAMETER	UOM	LOR	TP1 SOIL 0.5-0.6 9/8/2021 SE222421.001	TP1 SOIL 1.5-1.6 9/8/2021 SE222421.002	TP2 SOIL 0.8-0.9 9/8/2021 SE222421.003	TP2 SOIL 1.6-1.7 9/8/2021 SE222421.004	TP3 SOIL 1.0-1.1 9/8/2021 SE222421.005
% Moisture	%w/w	1	21.1	15.2	19.8	13.9	16.6

PARAMETER	UOM	LOR	TP3 SOIL 2.0-2.1 9/8/2021 SE222421.006	TP4 SOIL 0.5-0.6 9/8/2021 SE222421.007	TP4 SOIL 1.5-1.6 9/8/2021 SE222421.008	TP5 SOIL 0.9-1.0 9/8/2021 SE222421.009	TP5 SOIL 1.4-1.5 9/8/2021 SE222421.010
% Moisture	%w/w	1	14.3	20.9	13.6	18.9	13.9

PARAMETER	UOM	LOR	TP6 SOIL 1.0-1.0 9/8/2021 SE222421.011	TP6 SOIL 2.0-2.1 9/8/2021 SE222421.012	TP7 SOIL 0.9-1.0 9/8/2021 SE222421.013	TP7 SOIL 2.0-2.1 9/8/2021 SE222421.014	TP8 SOIL 1.0-1.1 9/8/2021 SE222421.015
% Moisture	%w/w	1	17.8	13.9	16.6	1.6	16.6

PARAMETER	UOM	LOR	TP8 SOIL 1.9-2.0 9/8/2021 SE222421.016	TP9 SOIL 0.5-0.6 9/8/2021 SE222421.017	TP9 SOIL 1.5-1.6 9/8/2021 SE222421.018	TP10 SOIL 1.0-1.1 9/8/2021 SE222421.019	TP10 SOIL 2.0-2.1 9/8/2021 SE222421.020
% Moisture	%w/w	1	17.3	18.9	20.4	25.0	<1.0

PARAMETER	UOM	LOR	TP11 SOIL 1.0-1.1 9/8/2021 SE222421.021	TP11 SOIL 2.0-2.1 9/8/2021 SE222421.022	TP12 SOIL 1.0-1.1 9/8/2021 SE222421.023	TP12 SOIL 2.0-2.1 9/8/2021 SE222421.024	TP13 SOIL 1.5-1.6 9/8/2021 SE222421.025
% Moisture	%w/w	1	17.3	15.4	13.1	19.2	29.3

PARAMETER	UOM	LOR	TP13 SOIL 2.0-2.1 9/8/2021 SE222421.026	TP14 SOIL 0.5-0.6 9/8/2021 SE222421.027	TP14 SOIL 1.5-1.6 9/8/2021 SE222421.028	TP15 SOIL 1.0-1.1 9/8/2021 SE222421.029	TP15 SOIL 2.0-2.1 9/8/2021 SE222421.030
% Moisture	%w/w	1	11.2	18.3	19.5	16.2	11.0

PARAMETER	UOM	LOR	TP16 SOIL 1.0-1.1 9/8/2021 SE222421.031	TP16 SOIL 2.0-2.1 9/8/2021 SE222421.032
% Moisture	%w/w	1	20.6	14.2

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, an extract with water is made at a ratio of 1:2 and the pH determined and reported on the extract after 1 hour extraction (pH 1:2) or after 1 hour extraction and overnight aging (pH (1:2) aged). 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.
AN106	Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.
AN122	Exchangeable Cations, CEC and ESP: Soil sample is extracted in 1M Ammonium Acetate at pH=7 (or 1M Ammonium Chloride at pH=7) with cations (Na, K, Ca & Mg) then determined by ICP OES/ICP MS and reported as Exchangeable Cations. For saline soils, these results can be corrected for water soluble cations and reported as Exchangeable cations in meq/100g or soil can be pre-treated (aqueous ethanol/aqueous glycerol) prior to extraction. Cation Exchange Capacity (CEC) is the sum of the exchangeable cations in meq/100g.
AN122	The Exchangeable Sodium Percentage (ESP) is calculated as the exchangeable sodium divided by the CEC (all in meq/100g) times 100. ESP can be used to categorise the sodicity of the soil as below: ESP < 6% non-sodic ESP 6-15% sodic ESP >15% strongly sodic Method is referenced to Rayment and Lyons, 2011, sections 15D3 and 15N1.-
AN245	Anions by Ion Chromatography: A water sample or extract is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 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.

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STATEMENT OF QA/QC PERFORMANCE

SE222421 R0

CLIENT DETAILS		LABORATORY DETAILS	
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Project	**14947/1 95-119 OConnell Street, Caddens**	SGS Reference	**SE222421 R0**
Order Number	(Not specified)	Date Received	09 Aug 2021
Samples	32	Date Reported	16 Aug 2021

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:

Duplicate	Moisture Content	1 item

SAMPLE SUMMARY

HOLDING TIME SUMMARY

SE222421 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

Conductivity (1:2) in soil

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE222421.001	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP1	SE222421.002	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP4	SE222421.007	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP4	SE222421.008	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP7	SE222421.013	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP7	SE222421.014	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP10	SE222421.019	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP10	SE222421.020	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP13	SE222421.025	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP13	SE222421.026	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP16	SE222421.031	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP16	SE222421.032	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021

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	SE222421.001	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP1	SE222421.002	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP2	SE222421.003	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP2	SE222421.004	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP3	SE222421.005	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP3	SE222421.006	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP4	SE222421.007	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP4	SE222421.008	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP5	SE222421.009	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP5	SE222421.010	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP6	SE222421.011	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP6	SE222421.012	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP7	SE222421.013	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP7	SE222421.014	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP8	SE222421.015	LB230616	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP8	SE222421.016	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP9	SE222421.017	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP9	SE222421.018	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP10	SE222421.019	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP10	SE222421.020	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP11	SE222421.021	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP11	SE222421.022	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP12	SE222421.023	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP12	SE222421.024	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP13	SE222421.025	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP13	SE222421.026	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP14	SE222421.027	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP14	SE222421.028	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP15	SE222421.029	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP15	SE222421.030	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP16	SE222421.031	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021
TP16	SE222421.032	LB230620	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021	16 Aug 2021

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE222421.001	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP1	SE222421.002	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP4	SE222421.007	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP4	SE222421.008	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP7	SE222421.013	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP7	SE222421.014	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP10	SE222421.019	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP10	SE222421.020	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP13	SE222421.025	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP13	SE222421.026	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021
TP16	SE222421.031	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021

HOLDING TIME SUMMARY

SE222421 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

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR) (continued)

Method: ME-(AU)-[ENV]AN122

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP16	SE222421.032	LB230619	09 Aug 2021	09 Aug 2021	06 Sep 2021	16 Aug 2021	06 Sep 2021	16 Aug 2021

Moisture Content

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE222421.001	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP1	SE222421.002	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP2	SE222421.003	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP2	SE222421.004	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP3	SE222421.005	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP3	SE222421.006	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP4	SE222421.007	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP4	SE222421.008	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP5	SE222421.009	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP5	SE222421.010	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP6	SE222421.011	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP6	SE222421.012	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP7	SE222421.013	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP7	SE222421.014	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP8	SE222421.015	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP8	SE222421.016	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP9	SE222421.017	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP9	SE222421.018	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP10	SE222421.019	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP10	SE222421.020	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP11	SE222421.021	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP11	SE222421.022	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP12	SE222421.023	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP12	SE222421.024	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP13	SE222421.025	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP13	SE222421.026	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP14	SE222421.027	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP14	SE222421.028	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP15	SE222421.029	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP15	SE222421.030	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP16	SE222421.031	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021
TP16	SE222421.032	LB230670	09 Aug 2021	09 Aug 2021	23 Aug 2021	16 Aug 2021	21 Aug 2021	16 Aug 2021

pH in soil (1:2)

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

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE222421.001	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP1	SE222421.002	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP4	SE222421.007	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP4	SE222421.008	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP7	SE222421.013	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP7	SE222421.014	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP10	SE222421.019	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP10	SE222421.020	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP13	SE222421.025	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP13	SE222421.026	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP16	SE222421.031	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021
TP16	SE222421.032	LB230638	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	17 Aug 2021	16 Aug 2021

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP1	SE222421.001	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP1	SE222421.002	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP4	SE222421.007	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP4	SE222421.008	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP7	SE222421.013	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP7	SE222421.014	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP10	SE222421.019	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021

HOLDING TIME SUMMARY

SE222421 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

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography (continued) — **Method: ME-(AU)-[ENV]AN245**

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
TP10	SE222421.020	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP13	SE222421.025	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP13	SE222421.026	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP16	SE222421.031	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021
TP16	SE222421.032	LB230612	09 Aug 2021	09 Aug 2021	16 Aug 2021	16 Aug 2021	13 Sep 2021	16 Aug 2021

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 (1:2) in soil

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

Sample Number	Parameter	Units	LOR	Result
LB230638.001	Conductivity (1:2) @25 C*	µS/cm	1	<1

Conductivity and TDS by Calculation - Soil

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

Sample Number	Parameter	Units	LOR	Result
LB230616.001	Conductivity of Extract (1:5 as received)	µS/cm	1	<1
	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	0.52
LB230620.001	Conductivity of Extract (1:5 as received)	µS/cm	1	<1
	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	0.83

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result
LB230619.001	Exchangeable Sodium, Na	mg/kg	2	0
	Exchangeable Potassium, K	mg/kg	2	0
	Exchangeable Calcium, Ca	mg/kg	2	0
	Exchangeable Magnesium, Mg	mg/kg	2	0

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result
LB230612.001	Chloride	mg/kg	0.25	<0.25
	Sulfate	mg/kg	0.5	<0.5

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

Conductivity (1:2) in soil

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE222421.026	LB230638.014	Conductivity (1:2) @25 C*	µS/cm	1	960	950	30	1
		Resistivity (1:2)*	ohm cm	-	1000	1100	31	1
SE222421.032	LB230638.017	Conductivity (1:2) @25 C*	µS/cm	1	1800	1700	30	10
		Resistivity (1:2)*	ohm cm	-	540	600	32	10

Conductivity and TDS by Calculation - Soil

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE222421.005	LB230616.014	Conductivity of Extract (1:5 as received)	µS/cm	1	25	26	38	5
		Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	30	31	37	5
SE222421.015	LB230616.025	Conductivity of Extract (1:5 as received)	µS/cm	1	770	780	30	1
		Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	920	930	30	1
SE222421.025	LB230620.014	Conductivity of Extract (1:5 as received)	µS/cm	1	210	200	31	4
		Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	290	280	31	4
SE222421.032	LB230620.022	Conductivity of Extract (1:5 as received)	µS/cm	1	970	840	30	15
		Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	1100	970	30	15

Moisture Content

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE222421.010	LB230670.011	% Moisture	%w/w	1	13.9	13.5	37	3
SE222421.020	LB230670.022	% Moisture	%w/w	1	<1	20.6	39	181 ⓡ
SE222421.030	LB230670.033	% Moisture	%w/w	1	11.0	10.6	39	3
SE222421.032	LB230670.036	% Moisture	%w/w	1	14.2	14.8	37	4

pH in soil (1:2)

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

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE222421.026	LB230638.014	pH (1:2)	pH Units	-	8.7	8.6	31	0
SE222421.032	LB230638.017	pH (1:2)	pH Units	-	8.0	8.0	31	0

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE222421.032	LB230612.017	Chloride	mg/kg	0.25	1300	1300	30	0
		Sulfate	mg/kg	0.5	100	100	32	0

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 (1:2) in soil

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB230638.002	Conductivity (1:2) @25 C*	µS/cm	1	320	303	70 - 130	105

Conductivity and TDS by Calculation - Soil

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB230616.002	Conductivity of Extract (1:5 as received)	µS/cm	1	320	303	85 - 115	105
	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	NA	303	85 - 115	105
LB230620.002	Conductivity of Extract (1:5 as received)	µS/cm	1	320	303	85 - 115	106
	Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	NA	303	85 - 115	106

Exchangeable Cations and Cation Exchange Capacity (CEC/ESP/SAR)

Method: ME-(AU)-[ENV]AN122

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB230619.002	Exchangeable Sodium, Na	meq/100g	0.01	0.21	0.194	80 - 120	108
	Exchangeable Potassium, K	meq/100g	0.01	0.63	0.63	80 - 120	100
	Exchangeable Calcium, Ca	meq/100g	0.01	6.6	6.3	80 - 120	104
	Exchangeable Magnesium, Mg	meq/100g	0.02	1.1	1.11	80 - 120	101

pH in soil (1:2)

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

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB230638.003	pH (1:2)	pH Units	-	7.4	7.415	98 - 102	100

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography

Method: ME-(AU)-[ENV]AN245

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB230612.002	Chloride	mg/kg	0.25	39	40	70 - 130	98
	Sulfate	mg/kg	0.5	38	40	70 - 130	96

MATRIX SPIKES

SE222421 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

SE222421 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

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.

GEOTECHNIQUE 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

TO: SGS ENVIRONMENTAL SERVICES
UNIT 16
33 MADDOX STREET
ALEXANDRIA NSW 2015

PH: 02 8594 0400 FAX: 02 8594 0499
ATTN: Ms Emily Yin

Sampling By: RS
Job No: 14947/1
Project: Proposed Residential Subdivision
Project Manager: IJ
Location: 95-119 O'Connell Street, Caddens

Sampling details — **Results required by: Normal Turnaround**

	Location	Depth	Soil	Water	EC (1:5)	Aggressivity	ESP						Notes	Keep Sample
1	TP1	0.5-0.6	DSP		✓	✓	✓	✓					Aggressivity Test Includes	✓
2	TP1	1.5-1.6	DSP		✓	✓	✓	✓					pH, Chloride, Sulphate and Resistivit	✓
3	TP2	0.8-0.9	DSP		✓									✓
4	TP2	1.6-1.7	DSP		✓								ESP	✓
5	TP3	1.0-1.1	DSP		✓								Exchangeable Sodium Percentage	✓
6	TP3	2.0-2.1	DSP		✓									✓
7	TP4	0.5-0.6	DSP		✓	✓	✓	✓						✓
8	TP4	1.5-1.6	DSP		✓	✓	✓	✓						✓
9	TP5	0.9-1.0	DSP		✓									✓
10	TP5	1.4-1.5	DSP		✓									✓
11	TP6	1.0-1.0	DSP		✓									✓
12	TP6	2.0-2.1	DSP		✓									✓
13	TP7	0.9-1.0	DSP		✓	✓	✓	✓						✓
14	TP7	2.0-2.1	DSP		✓	✓	✓	✓						✓
15	TP8	1.0-1.1	DSP		✓									✓
16	TP8	1.9-2.0	DSP		✓									✓
17	TP9	0.5-0.6	DSP		✓									✓
18	TP9	1.5-1.6	DSP		✓									✓
19	TP10	1.0-1.1	DSP		✓	✓	✓	✓						✓
20	TP10	2.0-2.1	DSP		✓	✓	✓	✓						✓
21	TP11	1.0-1.1	DSP		✓									✓
22	TP11	2.0-2.1	DSP		✓									✓
23	TP12	1.0-1.1	DSP		✓									✓
24	TP12	2.0-2.1	DSP		✓									✓
25	TP13	1.5-1.6	DSP		✓	✓	✓	✓						✓
26	TP13	2.0-2.1	DSP		✓	✓	✓	✓						✓
27	TP14	0.5-0.6	DSP		✓									✓
28	TP14	1.5-1.6	DSP		✓									✓
29	TP15	1.0-1.1	DSP		✓									✓
30	TP15	2.0-2.1	DSP		✓									✓
31	TP16	1.0-1.1	DSP		✓	✓	✓	✓						✓
32	TP16	2.0-2.1	DSP		✓	✓	✓	✓						✓

SGS EHS Sydney COC
SE222421

Excel Geotecg_Geo Required

Name	Signature	Date	Received by Name	Received by Signature	
Indra Jworchan		9/08/2021	George Zhi		9/8/21 12pm

Legend:
WG / WP — USG Undisturbed soil sample (glass ja); DSG Disturbed soil sample (glass jar); DSP Disturbed soil sample (small plastic bag); ✓ Test required; * Purge & Trap; # Geotechnique Screen

Form No 4.7F2-5 SGS

SAMPLE RECEIPT ADVICE

SE222421

CLIENT DETAILS

Contact	Indra Jworchan
Client	Geotechnique
Address	P.O. Box 880 NSW 2751
Telephone	02 4722 2700
Facsimile	02 4722 6161
Project	**14947/1 95-119 O'Connell Street, Caddens**
Order Number	(Not specified)
Samples	32

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
Samples Received	Mon 9/8/2021
Report Due	Mon 16/8/2021
SGS Reference	**SE222421**

SUBMISSION DETAILS

This is to confirm that 32 samples were received on Monday 9/8/2021. Results are expected to be ready by COB Monday 16/8/2021. Please quote SGS reference SE222421 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	None
Samples received in correct containers	Yes	Sample counts by matrix	32 Soil
Date documentation received	9/8/2021	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	19°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

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

SAMPLE RECEIPT ADVICE

SE222421

CLIENT DETAILS

Client Geotechnique

Project 14947/1 95-119 O'Connell Street, Caddens

SUMMARY OF ANALYSIS

No.	Sample ID	Conductivity (1:2) in soil	Conductivity and TDS by Calculation - Soil	Exchangeable Cations and Cation Exchange Capacity	Moisture Content	pH in soil (1:2)	Soluble Anions in Soil from 1:2 DI Extract by Ion
001	TP1 0.5-0.6	2	2	13	1	1	2
002	TP1 1.5-1.6	2	2	13	1	1	2
003	TP2 0.8-0.9	-	2	-	-	-	-
004	TP2 1.6-1.7	-	2	-	-	-	-
005	TP3 1.0-1.1	-	2	-	-	-	-
006	TP3 2.0-2.1	-	2	-	-	-	-
007	TP4 0.5-0.6	2	2	13	1	1	2
008	TP4 1.5-1.6	2	2	13	1	1	2
009	TP5 0.9-1.0	-	2	-	-	-	-
010	TP5 1.4-1.5	-	2	-	-	-	-
011	TP6 1.0-1.0	-	2	-	-	-	-
012	TP6 2.0-2.1	-	2	-	-	-	-
013	TP7 0.9-1.0	2	2	13	1	1	2
014	TP7 2.0-2.1	2	2	13	1	1	2
015	TP8 1.0-1.1	-	2	-	-	-	-
016	TP8 1.9-2.0	-	2	-	-	-	-
017	TP9 0.5-0.6	-	2	-	-	-	-
018	TP9 1.5-1.6	-	2	-	-	-	-
019	TP10 1.0-1.1	2	2	13	1	1	2
020	TP10 2.0-2.1	2	2	13	1	1	2
021	TP11 1.0-1.1	-	2	-	-	-	-
022	TP11 2.0-2.1	-	2	-	-	-	-
023	TP12 1.0-1.1	-	2	-	-	-	-
024	TP12 2.0-2.1	-	2	-	-	-	-

CONTINUED OVERLEAF

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 .

SAMPLE RECEIPT ADVICE

SE222421

CLIENT DETAILS

Client Geotechnique

Project 14947/1 95-119 O'Connell Street, Caddens

SUMMARY OF ANALYSIS

No.	Sample ID	Conductivity (1:2) in soil	Conductivity and TDS by Calculation - Soil	Exchangeable Cations and Cation Exchange Capacity	Moisture Content	pH in soil (1:2)	Soluble Anions in Soil from 1:2 DI Extract by Ion
025	TP13 1.5-1.6	2	2	13	1	1	2
026	TP13 2.0-2.1	2	2	13	1	1	2
027	TP14 0.5-0.6	-	2	-	-	-	-
028	TP14 1.5-1.6	-	2	-	-	-	-
029	TP15 1.0-1.1	-	2	-	-	-	-
030	TP15 2.0-2.1	-	2	-	-	-	-
031	TP16 1.0-1.1	2	2	13	1	1	2
032	TP16 2.0-2.1	2	2	13	1	1	2

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
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GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION, 89-115 O'CONNELL STREET, CADDENS

TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

Job No:	14947/1	Tested By:	BG
Laboratory	Penrith	Checked By:	AK
Date Tested	12/08/2021		

Sample Identification	Test Pit 1	Test Pit 4	Test Pit 6
Laboratory Number	14947/1-1	14947/1-4	14947/1-7
Depth (m)	2.0 - 2.1	1.0 - 1.1	0.5 - 0.6
Test Description			
Liquid Limit (W_L)	42%	41%	69%
Plastic Limit (W_P)	17%	21%	22%
Plastic Index (I_P)	25%	20%	47%
Linear Shrinkage (LS)	15.0%	8.5%	15.5%
Mould Length (mm)	127	127	125
Sample History	Oven Dried Dry Sieved	Oven Dried Dry Sieved	Oven Dried Dry Sieved
Material Description	(CI) Silty CLAY, medium plasticity, red-brown with grey mottling, trace of fine to medium gravel	(CI) Silty sandy CLAY, medium plasticity, brown, trace of fine to medium gravel	(CH) Silty CLAY, high plasticity, pale brown

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A Kench 24/08/2021
Approved Signatory

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PROPOSED RESIDENTIAL SUBDIVISION, 89-115 O'CONNELL STREET, CADDENS

TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

Job No:	14947/1	Tested By:	BG
Laboratory	Penrith	Checked By:	AK
Date Tested	12/08/2021		

Sample Identification	Test Pit 8	Test Pit 10	Test Pit 12
Laboratory Number	14947/1-10	14947/1-12	14947/1-14
Depth (m)	0.3 - 0.4	0.3 - 0.4	0.3 - 0.4
Test Description			
Liquid Limit (W_L)	73%	67%	65%
Plastic Limit (W_P)	25%	23%	22%
Plastic Index (I_P)	48%	44%	43%
Linear Shrinkage (LS)	18.0%	17.5%	17.0%
Mould Length (mm)	125	127	127
Sample History	Oven Dried Dry Sieved	Oven Dried Dry Sieved	Oven Dried Dry Sieved
Material Description	(CH) Silty CLAY, high plasticity, brown	(CH) Silty CLAY, high plasticity, brown	(CH) Silty CLAY, high plasticity, brown

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TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

Job No:	14947/1	Tested By:	BG
Laboratory	Penrith	Checked By:	AK
Date Tested	12/08/2021		

Sample Identification	Test Pit 13	Test Pit 15
Laboratory Number	14947/1-16	14947/1-18
Depth (m)	0.4 - 0.5	0.5 - 0.6
Test Description		
Liquid Limit (W_L)	52%	63%
Plastic Limit (W_P)	21%	23%
Plastic Index (I_P)	31%	40%
Linear Shrinkage (LS)	17.5%	15.0%
Mould Length (mm)	127	125
Sample History	Oven Dried Dry Sieved	Oven Dried Dry Sieved
Material Description	(CI-CH) Silty CLAY, medium to high plasticity, brown	(CH) Silty CLAY, high plasticity, brown

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TEST RESULTS - ATTERBERG LIMITS

Test Procedure AS1289 3.1.1, 3.2.1, 3.3.1, 3.4.1

Job No:	14947/1	Tested By:	BG
Laboratory	Penrith	Checked By:	AK
Date Tested	12/08/2021		

Sample Identification	Test Pit 11
Laboratory Number	14947/1-13
Depth (m)	0.3 - 0.5
Test Description	
Liquid Limit (W_L)	49%
Plastic Limit (W_P)	17%
Plastic Index (I_P)	32%
Linear Shrinkage (LS)	14.0%
Mould Length (mm)	125
Sample History	Oven Dried Dry Sieved
Material Description	(CI-CH) Silty CLAY, medium to high plasticity, red-brown

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Job No:	14947/1
Tested By:	BLG
Checked By:	AK
Date Tested:	12/08/2021
Laboratory	Penrith

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION, 89-115 O'CONNELL STREET, CADDENS

TEST RESULTS - SHRINK / SWELL INDEX

Test Procedure: AS 1289 7.1.1

Sample Identification	Test Pit 2	Test Pit 4	Test Pit 5	Test Pit 7
Depth (m)	0.3 - 0.6	0.4 - 0.7	0.4 - 0.7	0.4 - 0.7
Laboratory Number	14947/1-2	14947/1-5	14947/1-6	14947/1-8
Test Description				
Moisture Content				
Initial %	21.0	19.5	17.8	19.9
Final %	24.7	24.9	21.9	22.9
Swell %	1.8	0.7	1.1	0.3
Shrinkage %	3.9	5.1	1.1	1.7
Shrink/Swell Index $\%/_pF$	2.6	3.0	0.9	1.0
Material Description	(CH) Silty CLAY, high plasticity, brown	(CH) Silty CLAY, high plasticity, red-brown	(CL-CI) Silty CLAY, low to medium plasticity, brown	(CI) Silty CLAY, medium plasticity, brown with grey mottling

Form No R007 Version 12 06/13

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Job No:	14947/1
Tested By:	BLG
Checked By:	AK
Date Tested:	12/08/2021
Laboratory	Penrith

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION, 89-115 O'CONNELL STREET, CADDENS

TEST RESULTS - SHRINK / SWELL INDEX

Test Procedure: AS 1289 7.1.1

Sample Identification	Test Pit 9	Test Pit 13	Test Pit 16	
Depth (m)	0.4 - 0.7	0.4 - 0.7	0.3 - 0.6	
Laboratory Number	14947/1-11	14947/1-17	14947/1-20	
Test Description				
Moisture Content				
Initial %	23.9	22.4	24.1	
Final %	26.4	23.9	28.1	
Swell %	1.6	0.8	3.1	
Shrinkage %	6.7	4.4	5.5	
Shrink/Swell Index $\%/_pF$	4.1	2.7	3.9	
Material Description	(CH) Silty CLAY, high plasticity, red-brown	(CH) Silty CLAY, high plasticity, brown	(CH) Silty CLAY, high plasticity, brown	

Form No R007 Version 12 06/13

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CALIFORNIA BEARING RATIO TEST REPORT

CBR Test Procedure		Laboratory Compaction Method		Sampling Method	Date of Test
AS1289 6.1.1		AS1289 5.1.1		AS1289 1.2.1 Clause 6.5.4	17/08/2021
Job No: 14947/1		Tested By: BG		Checked By: AK	Lab Penrith
Laboratory Number		14947/1-3	14947/1-9	14947/1-15	14947/1-19
Drawing No		Test Pit 3 14947/1-AA1	Test Pit 7 14947/1-AA1	Test Pit 12 14947/1-AA1	Test Pit 15 14947/1-AA1
Sample No		3	9	15	19
Depth (m)		0.3 - 0.6	0.4 - 0.7	0.3 - 0.6	0.3 - 0.6
Date Sampled		06/08/2021	06/08/2021	06/08/2021	06/08/2021
Sample Description		(CH) Silty CLAY, high plasticity, red-brown	(CH) Silty CLAY, high plasticity, brown with grey mottling	(CI) Silty CLAY, medium plasticity, brown	(CI-CH) Silty CLAY, medium to high plasticity, brown
Maximum Dry Density	t/m3	1.57	1.70	1.75	1.70
Optimum Moisture Content	%	22.8	19.5	16.3	18.5
Field Moisture Content	%	24.5	22.3	14.2	20.8
% Retained 19mm		0	0	0	0
Excluded (Yes / No / Not Applicable)		Not Applicable	Not Applicable	Not Applicable	Not Applicable
CBR TEST RESULTS					
Dry Density t/m^3	Before soaking	1.58	1.70	1.79	1.70
	After soaking	1.56	1.68	1.77	1.65
Density Ratio %	Before soaking	100.5	100	102.5	100
Moisture Content %	Before soaking	23.5	19.1	16.3	17.8
	After soaking	27.1	21.0	18.5	22.1
Moisture Ratio %	Before soaking	103	98	100	96
Number of Days Soaked		4	4	4	4
Surcharge	kg	6.75	6.75	6.75	6.75
Moisture Content after test %	Top 30mm	27.3	22.5	20.0	27.0
	Whole Sample	27.1	20.8	18.4	21.9
Swell after soaking	%	1.5	1.0	1.0	3.0
Penetration	mm	2.5	2.5	2.5	2.5
CBR VALUE	%	**6**	**6**	**4**	**2**

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A Kench 23.08/2021
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