



GEOTECHNICAL REPORT

Hakone Road and Woongarra Road, Woongarra NSW 2259

Woolworths Pty Ltd – June 2024



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GEOTECHNICAL REPORT

262 Hakone Road,
Woongarra NSW 2259

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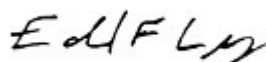
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1. INTRODUCTION

Geo-Logix Pty Ltd (Geo-Logix) was commissioned by Woolworths Group Ltd (Woolworths) to conduct a geotechnical investigation of the property located at 262 Hakone Road, Woongarah NSW 2259 (Figure 1).

Geo-Logix understands that a Preliminary Geotechnical Investigation report for the Warnervale Town Centre was prepared by RCA Australia in November 2005 (Ref: 5191-001/0). In order to facilitate Woolworths' proposed development of the site as a supermarket with specialty shops and on-grade car parking Geo-Logix has undertaken the additional geotechnical investigation detailed in this report.

A preliminary plan for the site is presented in Attachment A.

1.1 Objectives and Scope of Work

The objective of the geotechnical investigation was to provide a preliminary assessment of subsurface soil conditions on the site to assist with design and construction of the proposed development.

To satisfy the above objectives Geo-Logix completed the following scope of work:

- Visual appraisal of the site conditions and locality;
- Underground utility location and perform dial before you dig;
- Review of the geological maps for the area;
- Drilling 6 test bores by solid stem auger to a maximum depth of 4.5 mbg or prior refusal on bedrock;
- Performance of Standard Penetration Test (SPT) testing to determine the consistency/density of in situ soils in each boring;
- Logging of boreholes in accordance with the Unified Soil Classification System (USCS);
- Collection of representative soil samples for selective geotechnical and chemical laboratory testing;
- Backfilling of boreholes with onsite soils and compacted on completion; and
- Provision of this report detailing the results of the above investigation, recommendations for design and construction of the proposed extension.

The Geo-Logix field investigation was conducted on 2 June 2023.

2. SITE INFORMATION

Site Information	Details
Address	262 Hakone Road, Woongarrah NSW
Lot and Deposited Plan (DP)	Part Lot 5211 DP1200804
Approximate Area	4 ha
Coordinates	Lat: 33.238°S Long: 151.461°E
Site Description	The site is a generally square shaped lot that is currently vacant and unfenced. The site appears to have been subject to quarrying with excavated benches present in the northern portion of the site. Three dams exist in the central of the site, the most central dam having walls of approximately 3m in height on the southern side. The southern portion of the site remains generally untouched, whilst the northern portion of the site is subject to illegal dumping of household and construction wastes (bedframes, car parts, plastic, glass, concrete and potential asbestos fragments). A vapour well was noted approximately 10m to the southeast of the central dam.
Topography and Elevation	The site is situated in the saddle region between two hills. The site is located on the southwest side of the eastern hill, with a slope across the site southwest from 54 metres Australian Height Datum (AHD) to 32 mAHD. Topographic slope from the site continues south.
Geology	Northeast half: Grey to green grey laminite, to red-brown claystone and siltstone, interbedded with fine- to medium grained green grey sandstone (Patonga Claystone). Southwest half: Red-brown claystone and siltstone, light green-grey fine grained sandstone (Tuggerah Formation).
Regional Hydrogeology	Groundwater is expected to follow regional topography and flow south-southwest. The aquifer type beneath the site is identified as "porous, extensive aquifers of low to moderate productivity".

3. METHOD OF INVESTIGATION

3.1 Investigation Methods

Geotechnical fieldwork was undertaken on 2 June 2023.

Prior to drilling of boreholes, each location was scanned for underground services and utilities by an independent utility locator and cross-checked with the results of a 'Dial Before You Dig' (DBYD) search.

All boreholes were completed utilising a ute mounted drill rig equipped with a solid flight auger. Initially, drilling was advance using a hardened steel V-Bit until refusal. Drilling was then using a winged tungsten carbide drill bit (TC-Bit) until refusal or the targeted depth of the investigation at 4.5 mbg.

In each borehole, SPT testing was completed from 1.0 mbg and every 1.5mbg thereafter until the depth of the investigation.

Encountered soils were logged in accordance with the Unified Soil Classification System (USCS). The borehole and SPT results, are presented in Attachment B.

Representative soil samples were submitted to Eurofins Environment Testing Australia Pty Ltd (Eurofins) and Macquarie Geotech for selective characterisation and chemical tests.

4. SITE GEOLOGY AND HYDROGEOLOGY

4.1 Surface and Subsurface Conditions

The following sections contain a summarised account of the site surface and subsurface. For detailed descriptions of individual locations please refer to the attached boring logs.

Filling

Limited filling was encountered during the site investigation. Fill soils were encountered to a depth of 1 mbg in BH1 and consisted of medium plasticity, pink / moderate orange pink gravelly clay gravelly clay.

Soils

Native on-site soil typically comprised light red / moderate reddish orange firm sandy clay of medium plasticity overlying sandstone bedrock.

Bedrock

Refusal on sandstone bedrock was encountered at 1.5 mbg in BH1, 2.4 mbg in BH4, 0.5 mbg in BH5 and 3.2 mbg in BH6.

Groundwater

Groundwater was not encountered during investigation.

5. LABORATORY RESULTS

Representative samples of soil were collected during the fieldwork and submitted to Eurofins and Macquarie Geotech for laboratory testing. Tests included:

- Atterberg Limits and Linear Shrinkage tests to assess the plasticity and reactivity of specific soil samples to assist with classification and description;
- Standard Maximum Dry Density (MDD), Optimum Moisture Content (OMC) and California Bearing Ratio (CBR) testing to assist with pavement and slab design;
- Aggressivity testing (electrical conductivity, sulphate, chloride and pH) to assess the exposure classification of the soil with respect to buried structural concrete and/or exposed steel; and
- Unconfined Compressive Strength (UCS) and Point Load Strength tests to assist with the determination of rock strength and rippability.

The laboratory test results are presented in Attachment C. A summary of the results is provided in the following sections.

5.1 USCS Classification Testing

Soil samples were collected from locations BH2 and BH3 at depths of 2.6 and 1.0m respectively and submitted for laboratory analysis to Macquarie Geotech for NATA accredited Atterberg Limits and Linear Shrinkage tests. The samples were selected to confirm the USCS field classification of fill and natural soils across the site. Linear Shrinkage testing was completed to facilitate calculation of the free surface movement of the onsite soils for site classification in accordance with AS2870-2011. A summary of the results is provided in the following table.

Location/ Depth (m)	Laboratory Sample Description	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Material Finer than 4.75 mm (%)	Material Finer than 425 μ m (%)	Material Finer than 75 μ m (%)
BH2/2.6-2.8	Sandy Clay	41	27	8.5	100	100	75
BH3/1.0-1.5	Sandy Clay with gravel	42	29	11.5	85	69	36

Under the USCS material larger than 4.75 mm in size is considered Gravel, material between 4.75-75 μ m in size is considered Sand and material finer than 75 μ m in size is considered Silt or Clay. The Atterberg Limit test results indicate whether the fine-grained component of the samples is classified as Silt or Clay as well as the reactivity of the material. The potential for surface movement based on the reactivity of the soil to changes in moisture is discussed in Section 6.6.

5.2 Californian Bearing Ratio (CBR)

Bulk soil samples were collected from locations BH1/BH2 (composite) and BH4/BH6 (composite) and submitted for laboratory analysis to determine a CBR value for use in pavement design. These samples were submitted to Macquarie Geotech for NATA accredited testing of the CBR.

The CBR samples were remoulded in the laboratory and compacted to 100% standard maximum dry density (SMDD) at optimum moisture content (OMC). Prior to testing, the samples were soaked for four days under a surcharge load of 4.5 kg. The soaked CBR values are provided in the following table.

Location/ Depth (m)	Laboratory Sample Description	SMDD (t/m ³)	OMC (%)	CBR Value (%)	Swell After Soaking (%)
BH1/1.0-1.5 and BH2/0.2-2.0	Gravelly Sandy Clay	1.84	14.8	4.5	0.8
BH4/0.2-1.5 and BH6/1.0-2.0	Sandy Silty Clay	1.72	16.2	2.0	5.0

Pavement design based on these CBR results is discussed in Section 6.8.

5.3 Exposure Classification Tests

Selected soil profile samples were submitted to Eurofins for NATA accredited testing of pH, sulphate, chloride and electrical conductivity to determine the exposure classification (or aggressiveness/corrosiveness potential of the soil) with respect to buried steel and/or concrete. The samples were selected as representative of onsite soils in which foundations were expected.

To determine the aggressiveness of the soil and water environment on concrete or steel, the chemical test results are compared to Tables 6.1 and 6.3 from Section 6 of the Australian Standard AS2159 – 2009. This section provides assessment criteria to assess the 'exposure classification' for a concrete or steel pile. The Standard has two classes of soil conditions:

- Type A – high permeability soils below groundwater; and
- Type B – low permeability soils and all soils above groundwater.

Based on the chemical testing results, the Standard provides a range of 'exposure classifications' from non-aggressive to very severe. For the range of chemical conditions in the soil surrounding the structure, the condition leading to the most severe aggressive conditions is adopted. A summary of the soil results is provided in the following table.

Location/ Depth (m)	Soil Condition	Electrical Conductivity (EC) (dS/m)	Soil Texture Factor	Extract Electrical Conductivity (EC _e) (dS/m)	Electrical Resistivity (Ω·cm)	pH	Chloride (mg/kg)	Sulphate (mg/kg)
BH2/1.1-1.4	B	0.023	6	0.14	43,478	5.2	< 10	< 10
BH2/4.0-4.15	B	0.025	6	0.15	40,000	5.8	< 10	< 10
BH6/1.0-1.5	B	0.069	6	0.41	14,493	5.5	< 10	<10
BH6/2.5-3.0	B	0.160	6	0.96	6,250	4.9	18	<10

The potential aggressivity of an environment towards concrete and steel is dependent on the sulphate, chloride and pH levels of the soil. Soil aggressivity is discussed in Section 6.9. Site Salinity is discussed in Section 6.10.

6. DISCUSSION

6.1 Earthworks

The subject site should be prepared in accordance with AS 3798-2007 Section 6.1 and filled in accordance with AS 3798-2007 Section 6.2.

Existing Fills and Quarrying

Geo-Logix understands that the site has historically been used as a quarry and may contain areas of uncontrolled filling associated with the adjacent landfill. Any areas of uncontrolled fill encountered should be fully excavated during initial site preparation. Quarried areas which have been filled with water should be emptied and any soft sediments mucked out.

Initial Site Preparation

Initially surface features including observed illegally dumped rubbish and building foundations should be stripped from the site, in an area extending at least 1.5 m laterally beyond any planned structures or improvements.

Utilities should be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed or filled with grout. Utility trench excavations must be cut to competent bearing soils and backfilled with properly compacted structural fill.

Structural Filling

Where the above site preparation procedures create excavations below the proposed final grade, the excavations should be backfilled with properly compacted structural fill. Materials selected for use as structural fill should not contain organic matter, waste construction debris, or deleterious materials. Fill materials should be granular material or should be of low or medium plasticity. Existing onsite soils and fill meeting the above criteria may be re-used as structural fill. Under no circumstances should topsoil or other organic-laden soils be placed as fill beneath or within 1.5 horizontal metres of buildings, pavements or other structural areas.

Once final grade is reached in cut areas, and prior to fill placement in areas of the site that will receive new fill, the subgrade should be evaluated by a geotechnical engineer or their representative. Following subgrade evaluation, the exposed subgrade should be test-rolled in accordance with AS 3798-2009. Any unstable areas failing the evaluation or test-roll should be excavated to the depth of competent bearing material and filled in accordance with the general site fill placement methodology outlined below.

Fill materials should be placed in individual lifts of 300 mm or less loose measurement and compacted using a sheep's foot roller for cohesive soils and a smooth drum roller for cohesionless soils. Fill should be compacted to a minimum of 98% of standard compaction with a moisture content within $\pm 2\%$ of the optimum moisture content.

Test rolling and fill placement is to be undertaken under Level 1 Supervision or Level 2 Inspection and Testing.

6.2 Excavations

It is expected that on-site soils and weathered sandstone within the top 2.0 mbg (4.5 mbg in the northeastern corner of the site) will generally be excavatable using medium sized excavation equipment. Excavation beyond this depth is expected to require large equipment (i.e., excavators greater than 25 tonne) and/or localised assistance by ripping or rock hammer may be required during excavation. Groundwater management, batter and shoring of excavations are discussed in the following sections.

6.3 Groundwater Inflow

Groundwater was not encountered during investigation. Groundwater inflow to excavations may occur after periods of heavy rains. It is expected that this inflow and associated surface water flows may be managed by sump and pump methods.

6.4 Batter Slopes and Shoring

Excavations must be designed and constructed in a stable manner. The sides of the excavation should be shored or battered so as to maintain stability of both the excavation sides and bottom. Assuming that excavations are undertaken prior to any other construction works, and provided all surcharge loads, including plant and stockpiled material are kept well clear of the top of the batters, minimum batter slopes are recommended as 1H:1V for temporary batters and 2H:1V for permanent batters. In the on-site sandstone bedrock, near vertical batter slopes may be appropriate for temporary batters, subject to inspection by a suitably qualified person.

Permanent batters should be protected from erosion by vegetation or other measures and designed with adequate surface and subsurface drainage. For batters taller than 2 m, localised assessment of batter slopes is recommended.

Stormwater runoff should be directed away from the tops of batters by use of berm drains. Where runoff must be directed down the face of a batter, the batter drains/chutes should be lined to prevent erosion. Properly installed silt fence should be used at the base of batter slopes to prevent offsite migration of sediment. Scouring of excavation faces due to runoff should be repaired prior to further works within the excavation(s). All permanent batters should be protected from erosion by vegetation or other measures and designed with adequate surface and subsurface drainage.

The contractor is solely responsible for temporary excavation design and should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench depth, exceed those specified in local, state, and national safety regulations.

The following earth pressure coefficients are recommended for use in design of temporary and permanent retaining structures:

Retained Material	Bulk Density (kN/m ³)	Earth Pressure Coefficients		
		At rest (K_0)	Active (K_a)	Passive (K_p)
Onsite Clayey Sand (SC) and Sandy Clay (CL)	21	0.80	0.40	2.5
Weathered Sandstone (Class IV/V)	25	0.43	0.27	3.7

The 'at rest' earth pressure coefficient (K_0) is suitable for retaining structures where anchors or other methods restrain retaining wall movement or where significant movements cannot be tolerated (rigid wall). A uniform or trapezoidal earth pressure distribution should be adopted. It should be noted that shoring which is designed for this 'at rest' coefficient will still undergo some lateral movements.

The active earth pressure coefficient (K_a) is suitable for retaining structures allowing movement of the top such as cantilevered pile walls. For these structures the pressure acting on the wall can be estimated on the basis of a triangular earth pressure distribution.

The passive earth pressure coefficient (K_p) is suitable for the calculation of resisting forces at the toe of concrete, reinforced stone, or masonry walls.

Any surcharge affecting the walls (e.g., traffic, construction loads, adjacent footings, inclined backfill surface, etc.) should be allowed in the design using the appropriate earth pressure coefficient from above.

Design of all retaining structures should be undertaken in accordance with AS4678-2002. Furthermore, the design of any retaining structures should make allowance for all applicable surcharge loadings including construction activities around the perimeter of the excavation, traffic loadings and adjacent buildings. Consideration should be given to the possibility of a hydrostatic pressure due to build-up of water behind the wall (e.g. from broken services), unless permanent subsurface drainage can be provided.

6.5 Construction Induced Vibrations

Based on the shallow depths of TC-Bit refusal, on-site sandstone may require the assistance of a ripper, rock hammer or rock saw for excavation.

If percussive excavation equipment (e.g. rock hammer) is used, consideration must be given to possible construction induced ground vibration. Construction induced ground vibration is unlikely to be an issue at the site unless heavy impact tools are required for excavation. The use of other techniques which do not involve impact (e.g. rock saws), although less productive, would reduce or possibly eliminate risks of damage due to vibrations.

If adopting a rock hammer or similar, on-site guidance by a vibration specialist is recommended during the early part of excavation. This should include vibration characterisation trials that are used to define vibration levels for the selected equipment.

Peak Particle Velocity (PPV) is usually the adopted measure of ground vibration and the safe limits depend on the sensitivity of the adjoining structures and services. There are a number of Australian and overseas publications that provide vibration velocity guideline levels (or safe limits) including:

- Australian Standard AS2187.2-2006 Explosives - Storage and use - Use of explosives - Appendix J: Ground Vibrations and Airblast Overpressure;
- DIN 4150 – Part 3 – 1999. Effects of Vibration on Structures;
- Department of Environment and Conservation NSW, 2006. Assessing Vibration: a technical guideline;
- British Standard BS 7385-1:1990. Evaluation and measurement for vibration in buildings. Guide for measurement of vibrations and evaluation of their effects on buildings;
- British Standard BS 7385-2:1993. Evaluation and measurement for vibration in buildings. Guide to damage levels from ground borne vibration.

The most appropriate guidelines levels for the proposed excavation work are provided in AS2187.2-2006, which refers to guideline values from BS7385-2 for the prevention of minor or cosmetic damage occurring in structures from ground vibration. Additionally, the guideline levels provided in DIN 4150 Part 3 is considered an appropriate source for guideline levels.

Ideally, safe limits should be determined by a specialist vibration consultant. However, as a preliminary guide, and considering the above guidelines and the type of adjoining structures present, Geo-Logix recommend a maximum PPV of 10 mm/sec (measured at the foundations of adjoining structures) to prevent cosmetic and structural damage.

The PPV limits of 10 mm/sec are expected to be achievable if rock breaker equipment or other excavation methods are restricted as indicated in the following table:

Distance from Adjoining structure (m)	Maximum Peak Particle Velocity 10 mm/sec*	
	Equipment	Operating Limit (% of Maximum Capacity)
1.5 to 2.5	300 kg rock hammer	50
2.5 to 5.0	300 kg rock hammer	100
	or 600 kg rock hammer	50
5.0 to 10.0	600 kg rock hammer	100
	Or 900 kg rock hammer	50

Geo-Logix notes human discomfort levels caused by vibration are typically less than the levels that are likely to cause cosmetic or structural damage to structures. Therefore, neighbours may lodge complaints before any cosmetic or structural damage occurs.

Regardless of excavation, retention or foundation methods, Geo-Logix recommends dilapidation surveys be carried out on neighbouring buildings prior to construction to confirm that the construction works are not causing damage. These surveys should be agreed to, and the report signed, by the owners of the adjacent building prior to work commencing.

6.6 Site Classification

Based on Linear Shrinkage testing results, for structures with foundations in the onsite natural soils, the appropriate site classification is considered to be equivalent to Class 'M' with a characteristic free surface movement (ys) of 20-40 mm with changes in moisture (AS2870-2011).

Where foundations on sandstone bedrock are proposed, little or no ground movement from changes in moisture is expected.

Geo-Logix notes that this site classification has not included the effects of trees, poor site drainage, leaking plumbing, and exceptionally wet or dry moisture conditions.

6.7 Foundations

Geo-Logix recommends that footings be founded on a consistent medium to minimise any potential differential settlements. However, depending on the building loads and whether the structures are designed to be relatively flexible, this may not be significant. Existing on-site fill is not generally considered to be a suitable founding medium.

Provided new structural fill is placed in a controlled manner as advised in Section 6.1, native on-site soils and structural fill are expected to be capable of supporting shallow footings. Assuming an allowable settlement of 25 mm shallow footings in soil may be designed based on an allowable bearing capacity of 200 kPa. Shallow footings bearing on weathered sandstone may be designed based on an allowable bearing capacity of 1,000 kPa.

Geo-Logix recommend that foundation subgrade surfaces be observed and tested by a geotechnical engineer using Dynamic Cone Penetrometer (DCP) testing equipment or other satisfactory methods prior to steel or concrete placement. Any unsatisfactory soil detected during this evaluation should be undercut as directed by the geotechnical engineer. Footing excavations should be protected from surface water run-

off; if water is allowed to accumulate within a footing excavation and soften the bearing soils, the deficient soils should be removed from the excavation prior to concrete placement.

Allowable bearing pressure and adhesion for deep foundations including bored piers founded on rock are summarised in the following table.

Bearing Stratum	Allowable Bearing Pressure (MPa)	Allowable Adhesion (kPa)*	Young's Modulus, Es (MPa)	Estimated Settlement
Class IV-V Sandstone	1,000	50	100	1% of Footing Width or Pier Base

*For pier foundations only, not applicable for footings. Assumes a clean socket of roughness R2 or better.

The bearing stratum should be verified prior to the placement of rebar or concrete. Pier borings should be filled on the same day as drilling. Pier borings should be dewatered immediately prior to placement of concrete. If required dewatering for pier borings may be accomplished by sump pump.

All footing systems should be designed and constructed in accordance with the recommendations contained in AS 2870-2011 and/or AS 2159-2009 by a suitably qualified and experienced structural engineer.

6.8 Ground Slabs and Pavements

Slab and pavement designs are based on the California Bearing Ratio (CBR) and modulus of the subgrade materials encountered after any excavation or re-grading has taken place. The principal aim of the subgrade preparation is to provide a uniform foundation over the entire slab/pavement formation which will not give rise to unevenness in the slab/pavement surface under the design loads. The final subgrade, following the earthworks recommended in Section 9.1, may comprise natural soil or well compacted structural fill or weathered shale provided the material performs satisfactorily under test-rolling as detailed in AS3798-2007. Other than current pavement subgrades, existing on-site fill is not considered suitable for use as pavement subgrade unless excavated and reinstated as new structural fill.

Based on Laboratory results and Geo-Logix's experience with similar soil and provided the final subgrade performs under test-rolling and is compacted to at least 98% standard compaction, design of pavements and slabs-on-grade placed on onsite residual soils may be based on a CBR of 2%.

In order to provide uniform support beneath any proposed floor slab-on-grade, Geo-Logix recommends that floor slabs be underlain by a minimum of 100 mm of free-draining (a maximum particle size of 19 mm with less than 5 percent material passing the 75 μ m sieve), well graded gravel or crushed rock base course.

6.9 Aggressivity/Exposure Classification

Based on the preliminary exposure classification test results, and in accordance with AS3600-2009 and AS2159-2009, steel and concrete structures in contact with fill, natural soils and rock above the water table should be designed based on no less than non-aggressive, A2, exposure.

6.10 Salinity Risk

Soil salinity risk is based on extract electrical conductivity (EC_e). Based on laboratory testing of the selected samples, on-site soils do not appear to be saline (Department of Land and Water Conservation NSW, 2002).

6.11 Earthquake Design

Structural design for earthquake loads should be carried out in accordance with the relevant provisions in AS1170.4–2007. Based on the subsurface profile encountered at the base elevation of the proposed excavation, and with reference to Tables 3.2 and 4.1 of AS1170.4, the site subsoil class is considered to be C_e (shallow soil site) with a hazard factor (Z) of 0.10.

7. LIMITATIONS

This report should be read in full, and no executive summary, conclusion or other section of the report may be used or relied on in isolation or taken as representative of the report as a whole. No responsibility is accepted by Geo-Logix, and any duty of care that may arise but for this statement is excluded, in relation to any use of any part of this report other than on this basis.

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This report is based on the available project information and the subsurface information obtained by Geo-Logix. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Geo-Logix should be notified immediately to determine if there are consequences to the recommendations provided in this report. If Geo-Logix is not retained to perform these functions, Geo-Logix cannot be responsible for the impact of those conditions on the performance of the project.

Unless otherwise expressly stated, Geo-Logix has assumed that the information and data contained in previous reports carried out by others and reviewed in preparation of this report are completely accurate and has not sought independently to verify the accuracy of the information or data.

Where laboratory tests have been carried out by others on Geo-Logix' behalf, the tests are reproduced in this report on the assumption that the tests are accurate. Geo-Logix has not sought independently to verify the accuracy of those tests and assumes no responsibility in respect of them.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area at the time of this report. No other warranties are implied or expressed.

This report has been prepared for the specific application to the proposed development as described in the report. After the plans and specifications for the project are more complete the geotechnical engineer should be provided with the opportunity to review the final design plans and specifications to assess whether our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations.

8. REFERENCES

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- Pells et al (1998) Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Society, 1998.

FIGURES





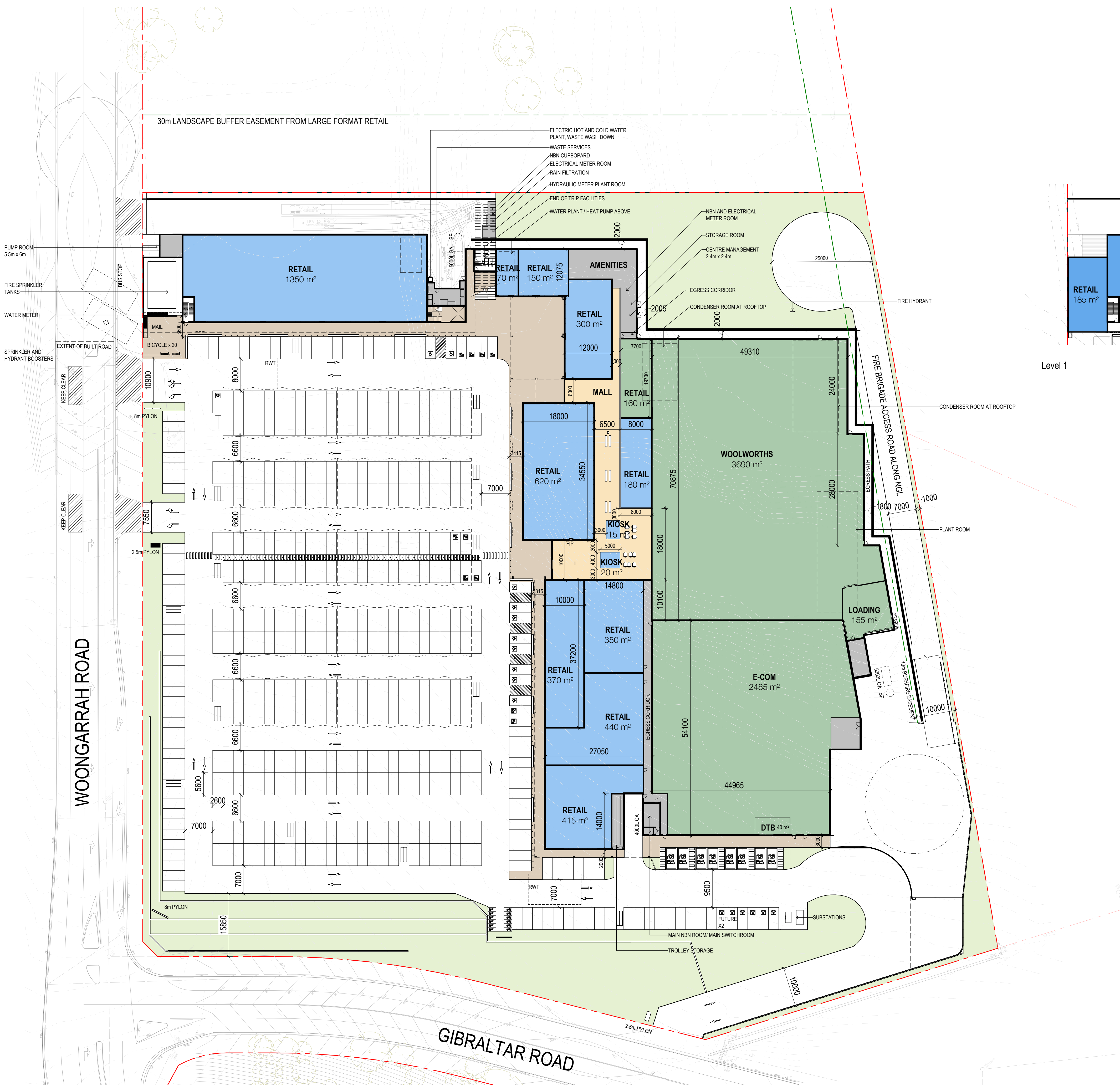
Key

Site Boundary

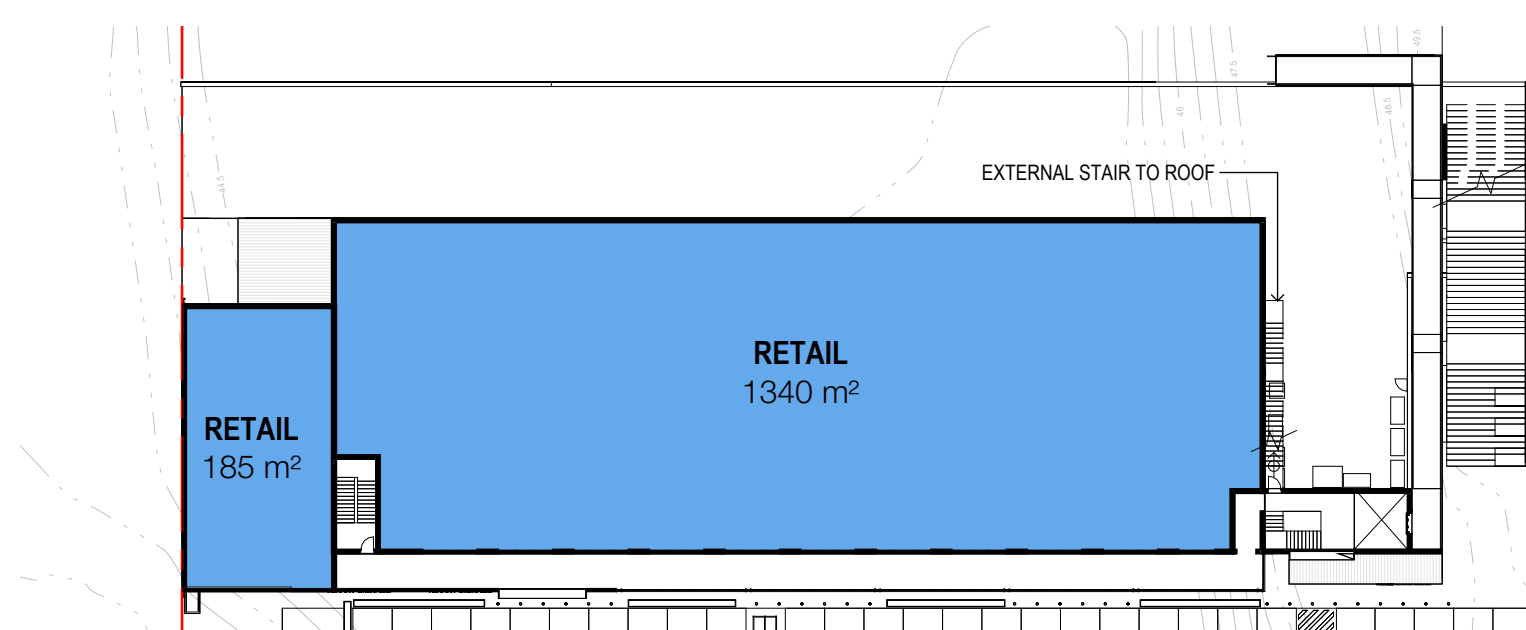
Borehole Locations

0 30 60 90 120

ATTACHMENT A



Ground Floor



Level 1

- Legend - Site
- SETOUT POINT
 - FOOTPATH
 - RAISED PEDESTRIAN CROSSING
 - GARDEN BEDS
 - EXISTING TREE
 - PROPOSED TREE
REFER TO LANDSCAPE ARCHITECTS DRAWINGS
 - EX 79.40 EXISTING LEVEL
 - RL 79.40 RELATIVE LEVEL
 - FFL 79.40 FLOOR LEVEL
 - DENOTES DEMOLISHED ITEMS

GLA	
RETAIL	
WOOLWORTHS	3690 m ²
RETAIL	4405 m ²
KIOSK	35 m ²
DTB	40 m ²
	8170 m ²
MALL	
MALL	635 m ²
	635 m ²
LFR/COMMERCIAL	
RETAIL	1525 m ²
	1525 m ²
E-COM (INCLUDES DTB AND HOME DELIVERY)	
E-COM	2485 m ²
	2485 m ²
AMENITIES	
AMENITIES	200 m ²
	200 m ²
Grand total	13015 m ²

PARKING SCHEDULE		
RETAIL	5/100	410
LFR / COMMERCIAL	3/100	46
E-COM	2/100	50
TOTAL REQUIRED		506
TOTAL PROVIDED		485
TOTAL MOTORCYCLE REQUIRED (1/50 PARKING SPACES)		10
TOTAL MOTORCYCLE PROVIDED		10

ClarkeHopkinsClarke

www.chc.com.au | studio@chc.com.au | 03 9419 4340

NSW Nominated Architect: Jordan Curran (10259)

Job No. 20230057

WOOLWORTHS WARNERVALE

262 HAKONE ROAD, WOONGARRAH

Scale 1:500 @ A1

Scale 1:1000 @ A3

015m

ATTACHMENT B



Geo-Logix
environment · geotech

Geo-Logix Pty Ltd
Building Q2, Level 3
Unit 2309 / 4 Daydream Street
Warriewood NSW 2102
www.geo-logix.com.au

Project Number: **2301027**
Hole Depth: **1.50 m**
Date Started: **02/06/2023**
Date Completed: **02/06/2023**

Project Name: **Geotechnical Investigation**
Location / Site: **Part of 262 Hakone Road, Woongarra NSW**
Client: **Woolworths Group Pty Ltd**
Contractor: **Fico Group Pty Limited**
Method: **Solid Flight Auger (Ute mounted)**

Method	Water Level	Depth (mBGL)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
SFA (V-bit)	0.20		D	Z	BH1/0.2	Fill	F		FILL- dusky brown (5YR 2/2), 60% clay, 40% gravel, moderately compacted.	damp		240mm recovery. V-bit refusal at 1.4m, switch to TC-bit.
									FILL- pink / moderate orange pink (5YR 8/4), 70% clay, 30% gravel, moderately compacted.	damp		
									Light red / moderate reddish orange (10R 6/6) at 0.5m.	moist		
SFA	1.00		B	Z	BH1/0.2-2.0 (& 1.0-1.5) BH1/1.0-1.5	Natural	CL		CLAY with Sand- light red / moderate reddish orange (10R 6/6), 80% clay, 20% sand, medium plasticity, firm.	damp	2,5,3 N=8	
									Terminated at 1.500 m TC-bit refusal on Bedrock.			

Abbreviations:

Hydrocarbon Odour
H High
M Medium
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed
B Bulk
R Representative
C Continuous
J Jar
Asb Asbestos

Strength Testing
SPT Standard Penetration Test
DCP Dynamic Cone Penetrometer
PP Pocket Penetrometer

Water Levels
Encountered Groundwater
Stabilised Groundwater

Abandonment Method: Backfill with soil and compact.

Additional Comments: SPT hammer type: Donut hammer.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: Tiffany Mabbott
Checked By: Ted Lilly

Date: 02/06/2023
Date: 29/06/2023

GLLOG2023 2301027 WOONGARRAH V2.GPJ GL.GDT 6/30/23 2:15:48 PM - drawn by laurie white at www.reumad.com.au



Project Name: **Geotechnical Investigation**
Location / Site: **Part of 262 Hakone Road, Woongarrah NSW**
Client: **Woolworths Group Pty Ltd**
Contractor: **Fico Group Pty Limited**
Method: **Solid Flight Auger (Ute mounted)**

Method	Water Level	Depth (mBGL)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments		
											SPT			
SFA (V-bit)	SFA (TC-bit)		R	Z	BH2/1.1-1.4	Natural	CL		CLAY with Sand - moderate red (5R 4/6), 80% clay, 20% sand, low plasticity, stiff.	damp		V-bit refusal at 0.4m, switch to TC-bit. 465mm recovery.		
		1.40							Light red / moderate reddish orange (10R 6/6) at 1.0m.	7,11,7 N=18				
		2.20							CLAY - moderate red (5R 4/6), 90% clay, 10% sand, low plasticity, stiff.	damp				
		2.50							CLAY - very pale brown / very pale orange (10YR 8/2) and very light grey (N8), 90% clay, 10% sand, medium plasticity, very stiff.	damp				
		3	R	Z	BH2/2.6-2.8	Natural	CL		CLAY - very light grey (N8), 100% clay, medium plasticity, very stiff.	damp	4,7,10 N=17	480mm recovery.		
		4												
					R	Z	BH2/4.0-4.15	Natural	CL				5,16	390mm recovery, double bounce (x3).
								Terminated at 4.500 m Target depth.						

Abbreviations:

Abbreviations:
Hydrocarbon Odour
H High
M Medium
L Low
Z Zero

Sample Type

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U Undisturbed
B Bulk
R Representative
C Continuous
J Jar
Asb Asbestos

Strength Testing

SPT Standard Penetration Test
DCP Dynamic Cone Penetrometer
PP Pocket Penetrometer

Water Levels

 Encountered Groundwater
 Stabilised Groundwater

Abandonment Method: Backfill with soil and compact.

Additional Comments: SPT hammer type: Donut hammer.
Approximately 2-3m higher in elevation from BH1.

GLLOG2023 2301027 WOONGARRAH V2.GPJ GL.GDT 6/30/23 2:15:51 PM - drawn by laurie white at www.reumad.com.au

REUMAD

Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tiffany Mabbott**
Checked By: **Ted Lilly**

Date: 02/06/2023
Date: 29/06/2023



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Building Q2, Level 3
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Warriewood NSW 2102
www.geo-logix.com.au

Project Number: **2301027**
Hole Depth: **3.90 m**
Date Started: **02/06/2023**
Date Completed: **02/06/2023**

Project Name: **Geotechnical Investigation**
Location / Site: **Part of 262 Hakone Road, Woongarra NSW**
Client: **Woolworths Group Pty Ltd**
Contractor: **Fico Group Pty Limited**
Method: **Solid Flight Auger (Ute mounted)**

Method	Water Level	Depth (mBGL)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
		0.10										
		1										
		2	D	Z	BH3/1.0-1.5	Natural	CL		CLAY with Silt- dusky brown (5YR 2/2), 80% clay, 20% silt, firm. CLAY- very pale brown / greyish orange (10YR 7/4), 90% clay, 10% sand, medium plasticity, stiff. Very light grey (N8) and 1.0m.	damp moist	3,4,4 N=8	360mm recovery.
		3	D	Z	BH3/2.5-3.0						7,6,9 N=15	400mm recovery.
		3.50										
		4					CL		CLAY- brownish yellow / dark yellowish orange (10YR 6/6) and very light grey (N8), 90% clay, 10% sand, medium plasticity, very stiff.	damp		V-bit refusal at 3.7m, switch to TC-bit.
		5							Terminated at 3.900 m TC-bit refusal.			

Abbreviations:

Hydrocarbon Odour
H High
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Sample Type

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C Continuous
J Jar
Asb Asbestos

Strength Testing

SPT Standard Penetration Test
DCP Dynamic Cone Penetrometer
PP Pocket Penetrometer

Water Levels

Encountered Groundwater
Stabilised Groundwater

Abandonment Method: Backfill with soil and compact.

Additional Comments: SPT hammer type: Donut hammer.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: Tiffany Mabbott
Checked By: Ted Lilly

Date: 02/06/2023
Date: 29/06/2023

GLLOG2023 2301027 WOONGARRAH V2.GPJ GL.GDT 6/30/23 2:15:55 PM - drawn by laurie white at www.reumad.com.au



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www.geo-logix.com.au

Project Number: **2301027**
Hole Depth: **2.40 m**
Date Started: **02/06/2023**
Date Completed: **02/06/2023**

Project Name: **Geotechnical Investigation**
Location / Site: **Part of 262 Hakone Road, Woongarra NSW**
Client: **Woolworths Group Pty Ltd**
Contractor: **Fico Group Pty Limited**
Method: **Solid Flight Auger (Ute mounted)**

Method	Water Level	Depth (mBGL)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
SFA (V-bit)		0.20				Fill			FILL - Topsoil, reddish grey / pale brown (5YR 5/2), 10% silt, 60% sand, 30% gravel, moderately compacted.	damp		
		1				CL			CLAY with Sand - yellow / pale yellowish orange (10YR 8/6) and very light grey (N8), 80% clay, 20% sand, medium plasticity, stiff.	damp		
SFA (TC-bit)		1.50	R	Z	BH4/1.0-1.5	Natural					10,8,16 N=24	V-bit refusal at 1.0m, switch to TC-bit. 400mm recovery.
		2				CL			CLAY - yellow / pale yellowish orange (10YR 8/6) and very light grey (N8), 90% clay, 10% sand, very stiff, weathered sandstone.	damp		
		3							Terminated at 2.400 m TC-bit refusal on Bedrock.			
		4										
		5										

Abbreviations:

Hydrocarbon Odour
H High
M Medium
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Z Zero

Sample Type
D Disturbed
U Undisturbed
B Bulk
R Representative
C Continuous
J Jar
Asb Asbestos

Strength Testing
SPT Standard Penetration Test
DCP Dynamic Cone Penetrometer
PP Pocket Penetrometer

Water Levels
Encountered Groundwater
Stabilised Groundwater

Abandonment Method: Backfill with soil and compact.

Additional Comments: SPT hammer type: Donut hammer.
Upgradient from BH6.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tiffany Mabbott**
Checked By: **Ted Lilly**

Date: **02/06/2023**
Date: **29/06/2023**



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Project Number: **2301027**
Hole Depth: **1.00 m**
Date Started: **02/06/2023**
Date Completed: **02/06/2023**

Project Name: **Geotechnical Investigation**
Location / Site: **Part of 262 Hakone Road, Woongarra NSW**
Client: **Woolworths Group Pty Ltd**
Contractor: **Fico Group Pty Limited**
Method: **Solid Flight Auger (Ute mounted)**

Method	Water Level	Depth (mBGL)	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Observations / Comments
SFA (V-bit)		0.20	CL			CLAY with Silt - dusky brown (5YR 2/2), 80% clay, 20% silt, low plasticity, firm.	moist	
SFA (TC-bit)		0.50	CL			CLAY - very pale brown / greyish orange (10YR 7/4), 90% clay, 10% sand, medium plasticity, stiff.	damp	
		1	Natural			Weathered SANDSTONE - yellow / pale yellowish orange (10YR 8/6).	dry	V-bit refusal at 0.5m, switch to TC-bit.
		2				Terminated at 1.000 m TC-bit refusal.		
		3						
		4						
		5						

Abbreviations:
Hydrocarbon Odour
H High
M Medium
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed
B Bulk
R Representative
C Continuous
J Jar
Asb Asbestos

Strength Testing
SPT Standard Penetration Test
DCP Dynamic Cone Penetrometer
PP Pocket Penetrometer

Water Levels
▽ Encountered Groundwater
▼ Stabilised Groundwater

Abandonment Method: Backfill with soil and compact.
Additional Comments:



Log Drawn By: **Laurie White**
Contact: laurie.white@reumad.com.au

Logged By: **Tiffany Mabbott**
Checked By: **Ted Lilly**

Date: **02/06/2023**
Date: **29/06/2023**

GLLOG2023 2301027 WOONGARRAH V2.GPJ GL.GDT 6/30/23 2:16:01 PM - drawn by laurie white at www.reumad.com.au



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Unit 2309 / 4 Daydream Street
Warriewood NSW 2102
www.geo-logix.com.au

Project Number: **2301027**
Hole Depth: **3.20 m**
Date Started: **02/06/2023**
Date Completed: **02/06/2023**

Project Name: **Geotechnical Investigation**
Location / Site: **Part of 262 Hakone Road, Woongarra NSW**
Client: **Woolworths Group Pty Ltd**
Contractor: **Fico Group Pty Limited**
Method: **Solid Flight Auger (Ute mounted)**

Method	Water Level	Depth (mBGL)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
		0.70				Fill			FILL - Topsoil, reddish grey / pale brown (5YR 5/2), 10% silt, 60% sand, 30% gravel, moderately compacted.	damp		
		1	R	Z	BH6/1.0-1.5							
			B	Z	BH6/1.0-2.0 (& 0.2-1.5)	CL			CLAY with Sand - yellow / pale yellowish orange (10YR 8/6), 80% clay, 20% sand, medium plasticity, stiff.	damp	2,4,7 N=11	280mm recovery.
		2.00				Natural						
			R	Z	BH6/2.5-3.0	CL			CLAY - yellow / pale yellowish orange (10YR 8/6), 90% clay, 10% sand, stiff, extremely weathered sandstone.	damp	1,17,12 N=29	310mm recovery.
		3										Switch to TC-bit at 2.95m.
		4							Terminated at 3.200 m TC-bit refusal on Bedrock.			
		5										

Abbreviations:

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H High
M Medium
L Low
Z Zero

Sample Type

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R Representative
C Continuous
J Jar
Asb Asbestos

Strength Testing

SPT Standard Penetration Test
DCP Dynamic Cone Penetrometer
PP Pocket Penetrometer

Water Levels

Encountered Groundwater
Stabilised Groundwater

Abandonment Method: Backfill with soil and compact.

Additional Comments: SPT hammer type: Donut hammer.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Tiffany Mabbott**
Checked By: **Ted Lilly**

Date: **02/06/2023**
Date: **29/06/2023**

ATTACHMENT C

Geo-Logix P/L
Bld Q2 Level 3, 2309/4 Daydream St
Warriewood
NSW 2102



NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: **Ted Lilly**

Report **996101-S**
Project name **WOONGARRAH**
Project ID **2301027**
Received Date **Jun 05, 2023**

Client Sample ID			BH2/1.1-1.4	BH2/4.0-4.15	BH6/1.0-1.5	BH6/2.5-3.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S23-Jn0010711	S23-Jn0010712	S23-Jn0010713	S23-Jn0010714
Date Sampled			Jun 02, 2023	Jun 02, 2023	Jun 02, 2023	Jun 02, 2023
Test/Reference	LOR	Unit				
Chloride	10	mg/kg	< 10	< 10	< 10	18
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	23	25	69	160
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	5.2	5.8	5.5	4.9
Resistivity*	0.5	ohm.m	430	400	150	62
Sulphate (as SO4)	10	mg/kg	< 10	< 10	< 10	< 10
Sample Properties						
% Moisture	1	%	9.9	16	20	9.1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chloride - Method: LTM-INO-4270 Anions by Ion Chromatography	Sydney	Jun 11, 2023	28 Days
Conductivity (1:5 aqueous extract at 25 °C as rec.) - Method: LTM-INO-4030 Conductivity	Sydney	Jun 11, 2023	7 Days
pH (1:5 Aqueous extract at 25 °C as rec.) - Method: LTM-GEN-7090 pH by ISE	Sydney	Jun 11, 2023	7 Days
Sulphate (as SO ₄) - Method: In-house method LTM-INO-4270 Sulphate by Ion Chromatograph	Sydney	Jun 11, 2023	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Sydney	Jun 05, 2023	14 Days



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VIC 3175
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NATA# 1261 Site# 1254

Geelong
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Grovedale
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NATA# 1261 Site# 25403

Sydney
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NATA# 1261 Site# 20794

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Mayfield West NSW 2304
Tel: +61 2 4968 8448
NATA# 1261
Site# 25079 & 25289

Perth
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Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377 Site# 2370

Auckland
35 O'Rorke Road
Penrose,
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Tel: +64 9 526 4551
IANZ# 1327

Christchurch
43 Detroit Drive
Rolleston,
Christchurch 7675
Tel: +64 3 343 5201
IANZ# 1290

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Company Name: Geo-Logix P/L
Address: Bld Q2 Level 3, 2309/4 Daydream St
Warriewood
NSW 2102

Project Name: WOONGARRAH
Project ID: 2301027

Order No.: P05963TM
Report #: 996101
Phone: 02 9979 1722
Fax: 02 9979 1222

Received: Jun 5, 2023 2:43 PM
Due: Jun 13, 2023
Priority: 5 Day
Contact Name: Ted Lilly

Eurofins Analytical Services Manager : Asim Khan

Sample Detail

HOLD

Aggressivity Soil Set

Moisture Set

Sydney Laboratory - NATA # 1261 Site # 18217

External Laboratory

No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID			
1	BH2/1.1-1.4	Jun 02, 2023		Soil	S23-Jn0010711		X	X
2	BH2/4.0-4.15	Jun 02, 2023		Soil	S23-Jn0010712		X	X
3	BH6/1.0-1.5	Jun 02, 2023		Soil	S23-Jn0010713		X	X
4	BH6/2.5-3.0	Jun 02, 2023		Soil	S23-Jn0010714		X	X
5	BH3/1.0-1.5	Jun 02, 2023		Soil	S23-Jn0010715	X		
6	BH3/2.5-3.0	Jun 02, 2023		Soil	S23-Jn0010716	X		
7	BH4/1.0-1.5	Jun 02, 2023		Soil	S23-Jn0010717	X		

Test Counts

3

4

4

Internal Quality Control Review and Glossary

General

- Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
- All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
- All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
- Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
- Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
- SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- Samples were analysed on an 'as received' basis.
- Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
- This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	µg/L: micrograms per litre
ppm: parts per million	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

- Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
- For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
- Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test				Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank										
Chloride				mg/kg	< 10			10	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)				uS/cm	< 10			10	Pass	
Sulphate (as SO4)				mg/kg	< 10			10	Pass	
LCS - % Recovery										
Chloride				%	99			70-130	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)				%	100			70-130	Pass	
Resistivity*				%	100			70-130	Pass	
Sulphate (as SO4)				%	96			70-130	Pass	
Test	Lab Sample ID	QA Source		Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate										
					Result 1	Result 2	RPD			
Chloride	S23-Jn0020165	NCP		mg/kg	< 10	< 10	<1	30%	Pass	
Sulphate (as SO4)	S23-Jn0020165	NCP		mg/kg	18	18	1.9	30%	Pass	
Duplicate										
Sample Properties					Result 1	Result 2	RPD			
% Moisture	S23-Jn0010239	NCP		%	6.1	7.5	21	30%	Pass	
Duplicate										
					Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	S23-Jn0010712	CP		uS/cm	25	25	<1	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	S23-Jn0010712	CP		pH Units	5.8	5.8	<1	30%	Pass	
Resistivity*	S23-Jn0010712	CP		ohm.m	400	400	<1	30%	Pass	

Comments
Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Asim Khan
Ryan Phillips

Analytical Services Manager
Senior Analyst-Inorganic



Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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Eurofins Environment Testing Australia Pty Ltd

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Sample Receipt Advice

Company name:	Geo-Logix P/L
Contact name:	Ted Lilly
Project name:	WOONGARRAH
Project ID:	2301027
Turnaround time:	5 Day
Date/Time received	Jun 5, 2023 2:43 PM
Eurofins reference	996101

Sample Information

- ✓ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ✓ Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : -1 degrees Celsius.
- ✓ All samples have been received as described on the above COC.
- ✓ COC has been completed correctly.
- ✓ Attempt to chill was evident.
- ✓ Appropriately preserved sample containers have been used.
- ✓ All samples were received in good condition.
- ✓ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ✓ Appropriate sample containers have been used.
- ✓ Sample containers for volatile analysis received with zero headspace.
- ✗ Split sample sent to requested external lab.
- ✗ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Asim Khan on phone : or by email: AsimKhan@eurofins.com

Results will be delivered electronically via email to Ted Lilly - tlilly@geo-logix.com.au.

Note: A copy of these results will also be delivered to the general Geo-Logix P/L email address.

Geo-Logix Pty Ltd

Building Q2, Level 3
2309/4 Daydream St
Warriewood, NSW 2102

CHAIN OF CUSTODY

Project Manager: Ted Lilly
Contact email: tlilly@geo-logix.com.au
Project Name: Wonggarah
Project Number: 230 0217 Date Submitted: 5/6/23

Page 1 of 1
Purchase Order No: P05963TM

Quote Reference:
Send invoice to: accounts@geo-logix.com.au
TAT required: Standard

Quote Reference:

Send Invoice to:

TAT required:

ANALYSIS REQUIRED

[illegible]

Metals (circle)** As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Cr⁶⁺, Cr³⁺, Fe²⁺, Fe³⁺, Be, B, Al, V, Mn, Fe, Co, Se, Sr, Sn, Mo, Ag, Ba, Ti, Bi, Sb

Chain of Custody

Relinquished by: Tiffany M Date/Time: 5/6/03 Signature: [Signature]

Received by: R.H. Date: 1/2/2000

Date/Time: 5/6/23 Signature: [Signature]

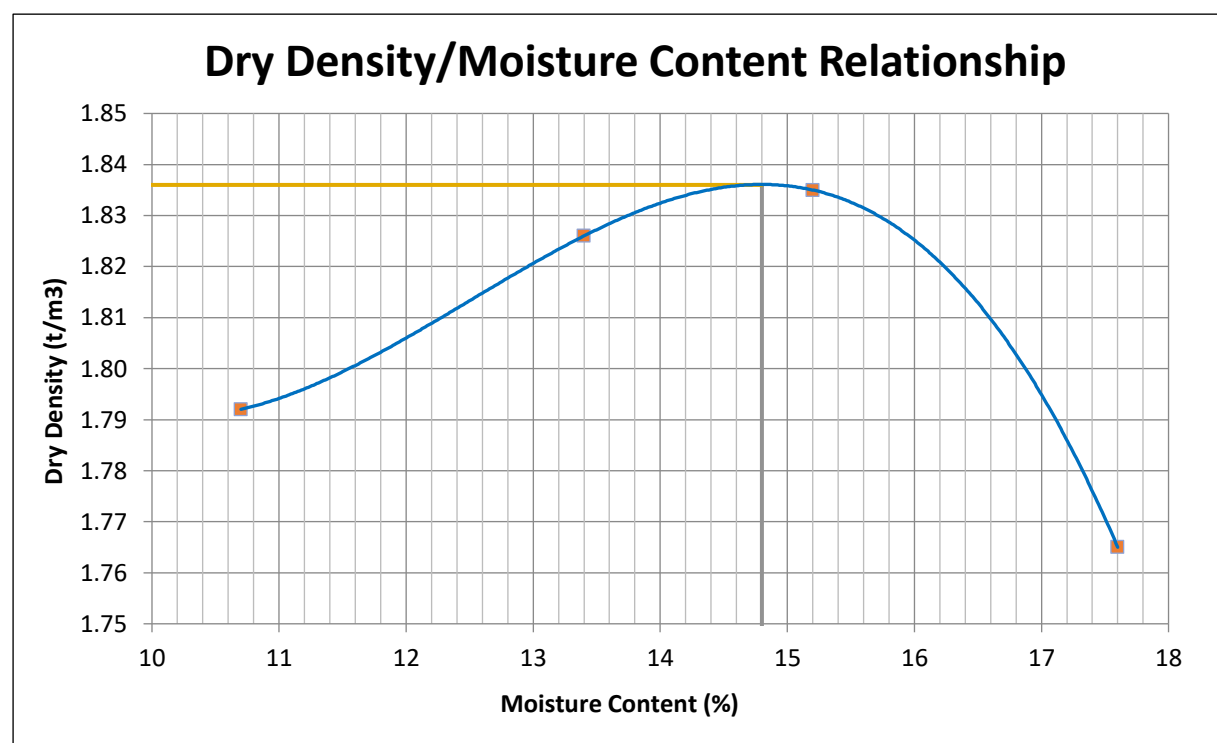
996101
-1.00/

CALIFORNIA BEARING RATIO REPORT				
Client	Geo-Logix Pty Ltd		Source	BH1 1.00-1.50m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102		Sample Description	Gravelly Sandy CLAY
Project	Woongarrah (2301027)		Report No.	S86413-CBR
Job No.	S23221-1		Sample No.	S86413
Test Procedure	☒ AS 1289.6.1.1 ☐ RMS T117 ☒ AS 1289.5.1.1 ☐ RMS T111 ☐ AS 1289.5.2.1 ☐ RMS T112 ☒ AS 1289.2.1.1 ☐ RMS T120		California Bearing Ratio Dry Density / Moisture Content Relationship - Standard Compaction Dry Density / Moisture Content Relationship - Modified Compaction Moisture Content - Oven Drying Method (Standard Method)	
Sampling	Sampled by Client - results apply to the sample as received		Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method		Date Tested	15/06/2023
Load (kN) Penetration (mm)				
Preparation & Specification			Density & Moisture	
Retained on 19.0mm Sieve (%)	0	Lab Moisture Ratio - LMR (%)	Achieved	Target
Method of Establishing Plasticity Level	Technician Assessment	Lab Density Ratio - LDR (%)	103.0	100.0
Sample Curing Time (hrs)	142 hrs	Dry Density - At Compaction (t/m³)	100.0	100.0
Compaction Hammer Used	Standard	Dry Density - After Soaking (t/m³)	1.83	1.84
Surcharge Mass Applied (kg)	4.5	Specimen Swell (%)	1.82	
Period of Soaking (Days)	4	Moisture Content - At Compaction (%)	0.8	
Maximum Dry Density - MDD (t/m³)	1.84	Moisture Content - Top 30mm (%)	15.2	
Optimum Moisture Content - OMC (%)	14.8	Moisture Content - Remainder (%)	17.1	
			16.9	
Material CBR Value (%): 4.5 at a penetration of 2.5 mm				
Notes				
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NATA Accredited Laboratory Number: 14874		Jacob Lloyd Date:		
MACQUARIE GEO TECH		Macquarie Geotechnical 14 Carter St Lidcombe NSW 2141		

DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client	Geo-Logix Pty Ltd	Source	BH1 1.00-1.50m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102	Sample Description	Gravelly Sandy CLAY
Project	Woongarra (2301027)	Report No	S86413-MDD
Job No	S23221-1	Sample No	S86413

Test Procedure	☒ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction		
	☒ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)		
Sampling	Sampled by Client - results apply to the sample as received	Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method	Date Tested	8/06/2023



Maximum Dry Density (t/m ³)	1.84
Optimum Moisture Content (%)	14.8
Oversize Retained on 19mm sieve (%)	0
Oversize Retained on 37.5mm sieve (%)	0
Curing Time	48 hrs
Liquid Limit Determination	Technician Assessment

Notes



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Authorised Signatory:

Jacob Lloyd

29/06/2023

Date:



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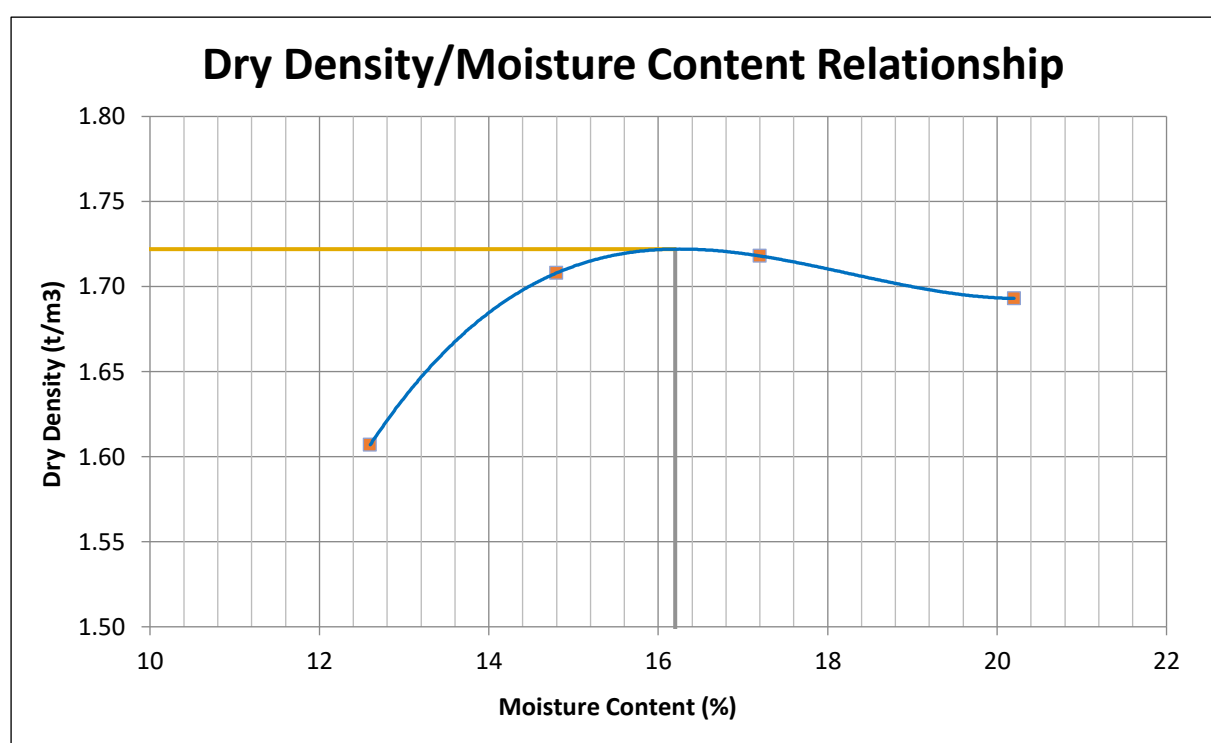
CALIFORNIA BEARING RATIO REPORT				
Client	Geo-Logix Pty Ltd		Source	BH6 0.20-1.50m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102		Sample Description	Sandy Silty CLAY
Project	Woongarra (2301027)		Report No.	S86414-CBR
Job No.	S23221-1		Sample No.	S86414
Test Procedure	☒ AS 1289.6.1.1 ☐ RMS T117 ☒ AS 1289.5.1.1 ☐ RMS T111 ☐ AS 1289.5.2.1 ☐ RMS T112 ☒ AS 1289.2.1.1 ☐ RMS T120			

California Bearing Ratio
Dry Density / Moisture Content Relationship - Standard Compaction
Dry Density / Moisture Content Relationship - Modified Compaction
Moisture Content - Oven Drying Method (Standard Method)

DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

Client	Geo-Logix Pty Ltd	Source	BH6 0.20-1.50m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102	Sample Description	Sandy Silty CLAY
Project	Woongarra (2301027)	Report No	S86414-MDD
Job No	S23221-1	Sample No	S86414

Test Procedure	☒ AS1289.5.1.1 Dry Density / Moisture Content Relationship - Standard Compaction		
	☒ AS1289.2.1.1 Moisture Content - Oven Drying Method (Standard Method)		
Sampling	Sampled by Client - results apply to the sample as received	Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method	Date Tested	8/06/2023



Maximum Dry Density (t/m³)	1.72
Optimum Moisture Content (%)	16.2
Oversize Retained on 19mm sieve (%)	0
Oversize Retained on 37.5mm sieve (%)	0
Curing Time	48 hrs
Liquid Limit Determination	Technician Assessment

Notes



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20/06/2023

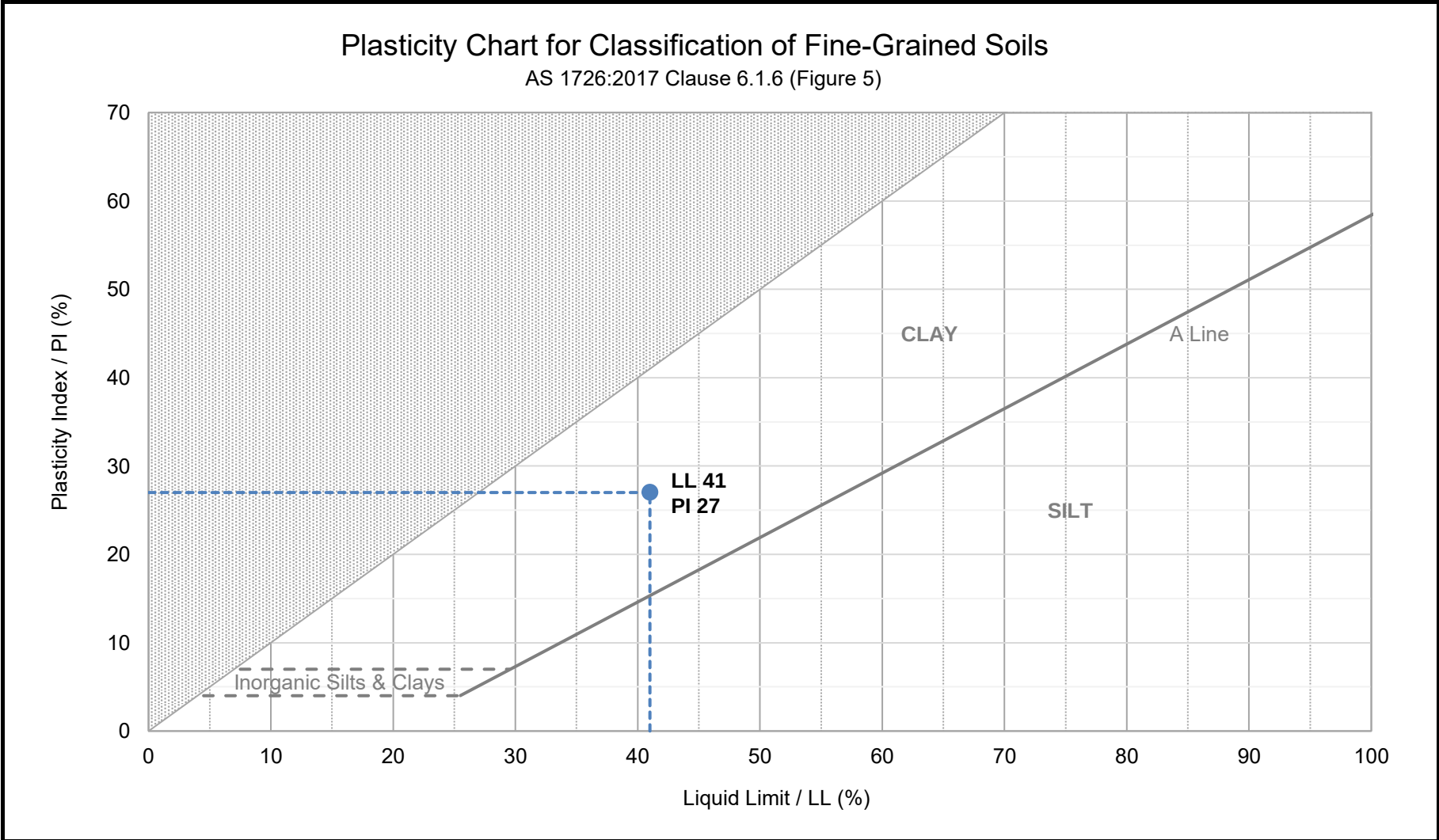
Date:



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SOIL CLASSIFICATION REPORT

Client	Geo-Logix Pty Ltd	Source	BH2 2.60-2.80m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102	Sample Description	Sandy CLAY
Project	Woongarra (2301027)	Report No.	S86415-PI
Job No.	S23221-1	Lab No.	S86415
Test Procedure	☒ AS1289 3.1.1 ☐ AS1289 3.1.2 ☒ AS1289 3.2.1 ☒ AS1289 3.3.1 ☒ AS1289 3.4.1 Liquid Limit - Four point Casagrande method Liquid Limit - One point Casagrande method Plastic Limit - Standard method Calculation of the Plasticity Index Linear Shrinkage - Standard method		
Sampling	Sampled by Client - results apply to the sample as received	Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method	Date Tested	13/06/2023



Preparation	Results
Method of Preparation	Liquid Limit / LL (%)
History of the Sample	Plastic Limit (%)
	Plasticity Index / PI (%)
	Linear Shrinkage (%)
	Condition upon Drying

Notes



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Date: 19/06/2023

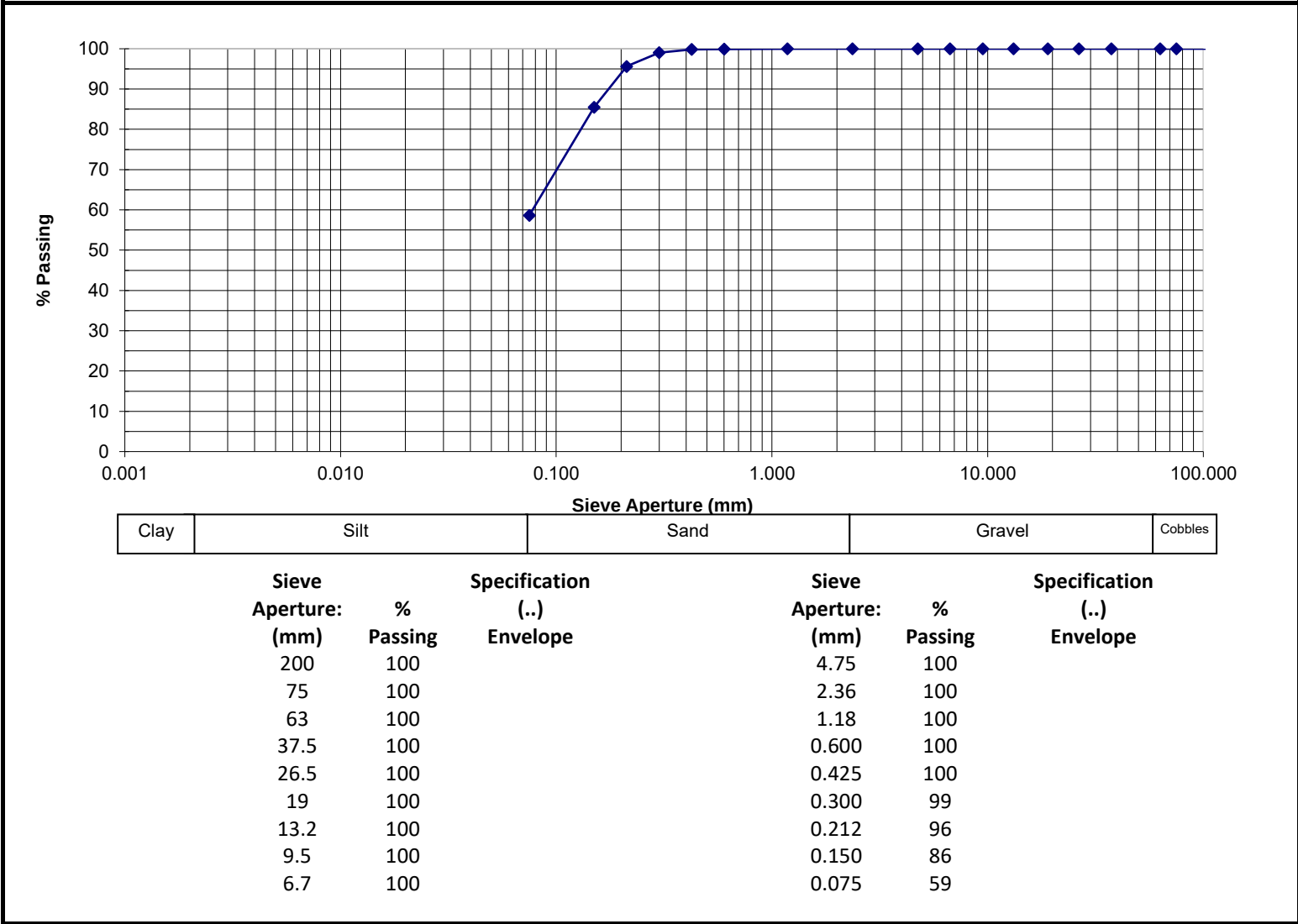


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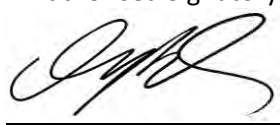
Particle Size Distribution Report

Client	Geo-Logix Pty Ltd	Source	BH2 2.60-2.80m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102	Sample Description	Sandy CLAY
Project	Woongarra (2301027)	Report No	S86415-PSD
Job No	S23221-1	Lab No	S86415

Test Procedure	AS 1289.3.6.1 - Particle size distribution of a soil		
Sampling	Sampled by Client - results apply to the sample as received	Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method	Date Tested	12/06/2023

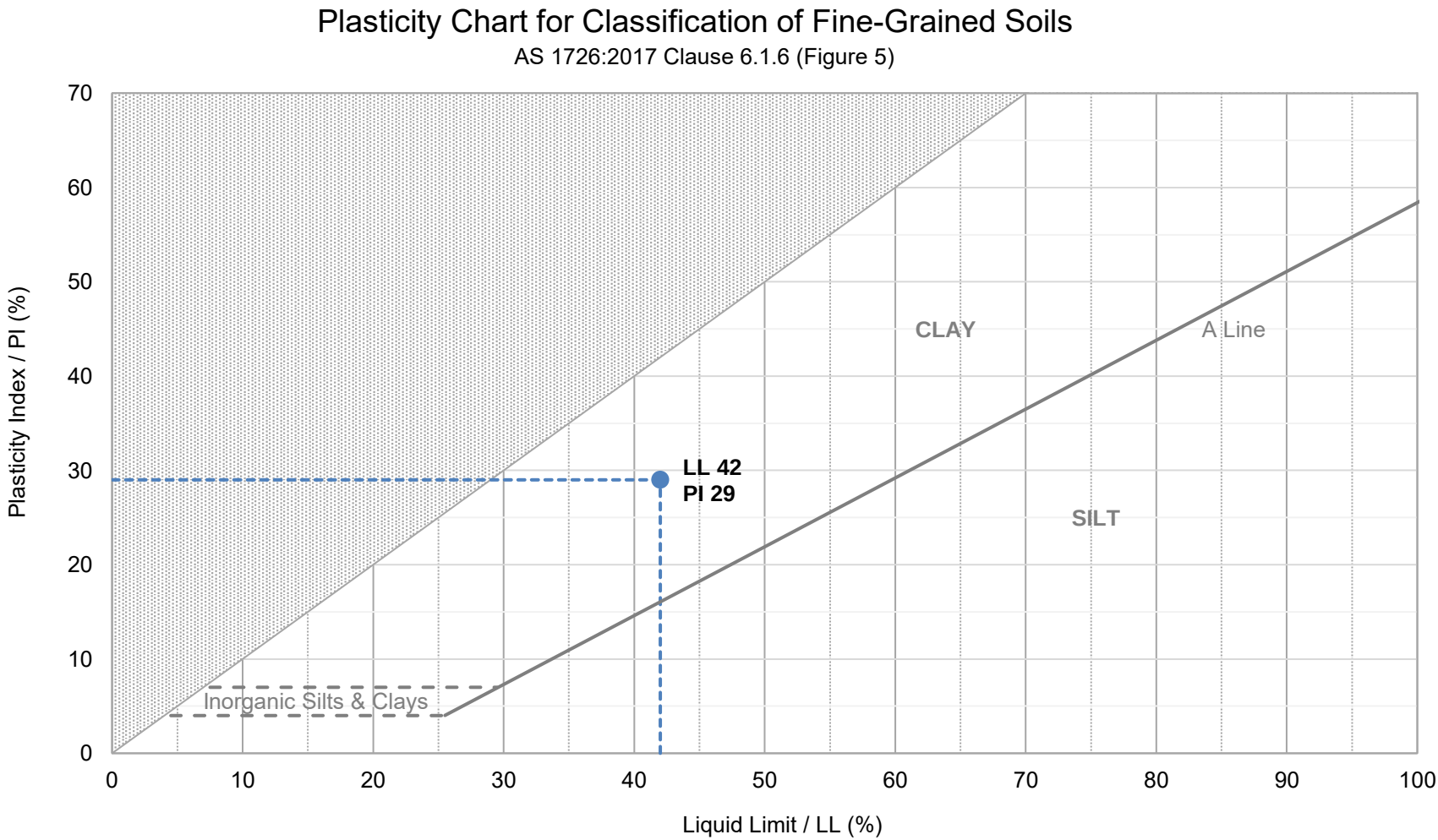


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SOIL CLASSIFICATION REPORT

Client	Geo-Logix Pty Ltd	Source	BH3 1.00-1.50m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102	Sample Description	Sandy CLAY with Gravel
Project	Woongarra (2301027)	Report No.	S86416-PI
Job No.	S23221-1	Lab No.	S86416
Test Procedure	☒ AS1289 3.1.1 ☐ AS1289 3.1.2 ☒ AS1289 3.2.1 ☒ AS1289 3.3.1 ☒ AS1289 3.4.1 Liquid Limit - Four point Casagrande method Liquid Limit - One point Casagrande method Plastic Limit - Standard method Calculation of the Plasticity Index Linear Shrinkage - Standard method		
Sampling	Sampled by Client - results apply to the sample as received	Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method	Date Tested	15/06/2023



Preparation	Results
Method of Preparation	Liquid Limit / LL (%)
History of the Sample	Plastic Limit (%)
	Plasticity Index / PI (%)
	Linear Shrinkage (%)
	Condition upon Drying

Notes



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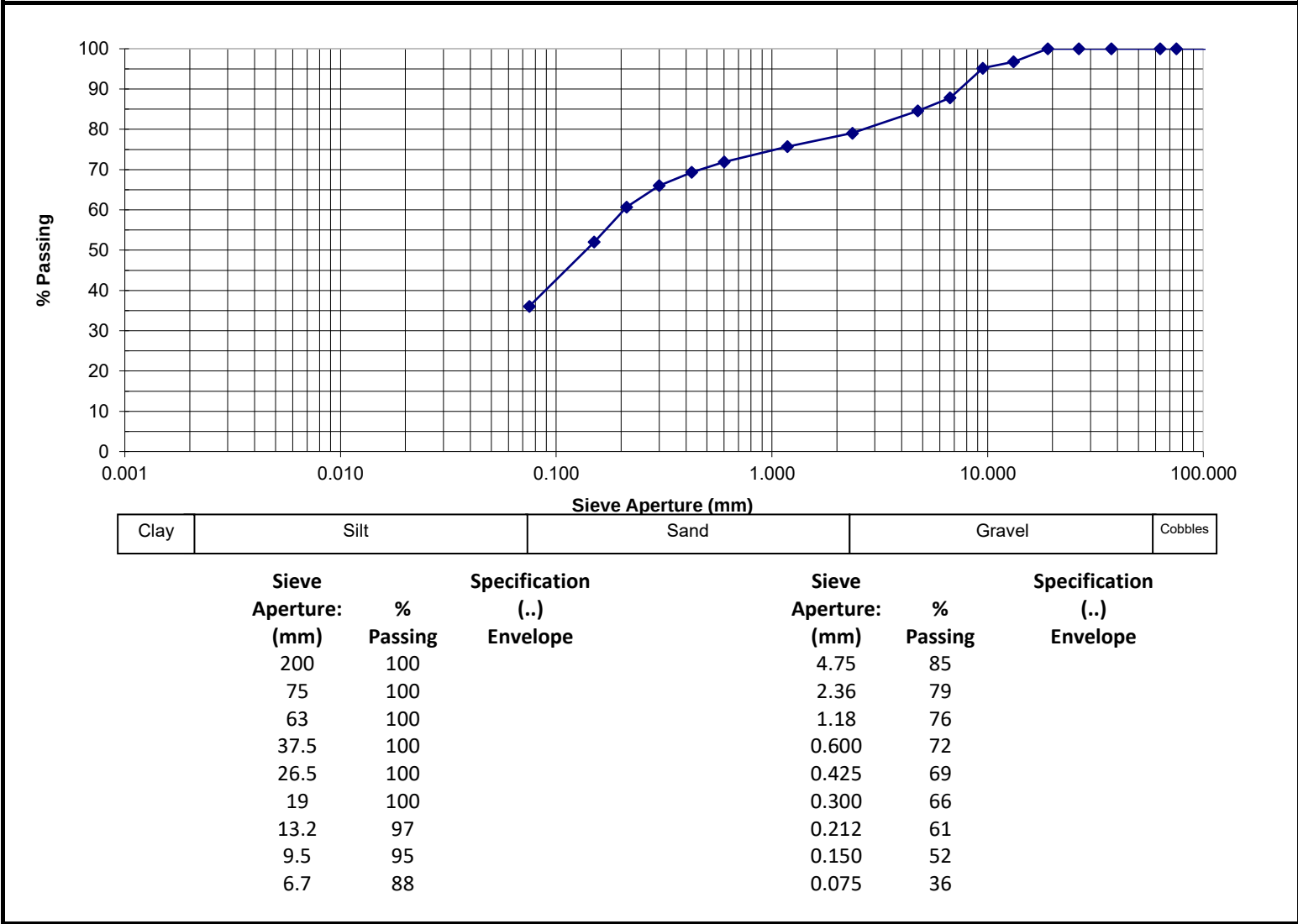


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Particle Size Distribution Report

Client	Geo-Logix Pty Ltd	Source	BH3 1.00-1.50m
Address	Building Q2, Level 3, 2309/4 Daydream St, Warriewood, NSW 2102	Sample Description	Sandy CLAY with Gravel
Project	Woongarra (2301027)	Report No	S86416-PSD
Job No	S23221-1	Lab No	S86416

Test Procedure	AS 1289.3.6.1 - Particle size distribution of a soil		
Sampling	Sampled by Client - results apply to the sample as received	Date Sampled	2/06/2023
Preparation	Prepared in accordance with the test method	Date Tested	15/06/2023



Notes

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	Macquarie Geotechnical 14 Carter St Lidcombe NSW 2141		

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