Geotechnical Investigation Report

Project

Ausgrid Underground Cable Project
Waterloo to Surry Hills

Prepared for

Ausgrid

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alliance
geotechnical & environmental solutions

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Appendices

1 INTRODUCTION

This report presents the findings of a geotechnical investigation carried out by Alliance Geotechnical Pty Ltd (Alliance) for Ausgrid (the Client) for the Ausgrid Underground Cable Project from Waterloo to Surry Hills. The investigation was commissioned on 25 February 2022 by Matthew Faferko of Ausgrid. The geotechnical investigation was undertaken in accordance with Alliance's fee proposal Quote No. 14777, dated 14 March 2022.

Alliance has been supplied with the following documents to aid this geotechnical investigation:

- Request for Quotations, Underground Cable Geotechnical Investigations (prepared by: Ausgrid; Ref: 01 – A2K, W2SH _NS Cable Project, Dated: 25/02/22).
- Annexure A of the RFQ – A2K, W2SH & NS Cable Project – Geotechnical Investigation Requirements (WBS no. SJ-00234 and SH-10045, Dated 23/02/2022).
- Old Structural/Route Plans (prepared by: The Electricity Commission of New South Wales; Ref: G-300xxx; Dated: 14/6/1988).

Based on the provided documents and information received from the Client, it is understood that a geotechnical assessment is required to be carried out for a new underground 132kV ductline route that is extending from Waterloo to Surry Hills. Alliance understands that the cable installation will involve trenching and Horizontal Directional Drilling (HDD).

The objective of this Geotechnical Investigation Report is to address the subsurface conditions encountered, field and laboratory testing results, and provide comments and recommendations regarding:

- Existing subsurface profile and groundwater conditions including inflows.
- Advice on benching/shoring for excavation of the in-situ materials.
- Excavation conditions.
- Advice on Horizontal Directional Drilling (HDD).
- Thermal resistivity characteristics of the soil and rock.

2 PROPOSED DEVELOPMENT

Alliance understands that the proposed alignment consists of a new cable route that stretches from Zetland Zone Substation through Surry Hills Substation. It is understood that the proposed alignment installation includes the following:

- The excavation of new cable trenches similar to trench section 'A1' (from Annexure A provided by the Client) for the installation of high-voltage cables.
- Standard depth of cover will vary from 750mm within a Council road up to 1.0m in a state classified road. Non-standard depths of cover may be required if underground obstructions are encountered which may vary from 500mm (with additional steel plate protection) to 2.5m.
- Horizontal Directional Drilling (HDD) with depths anticipated to be between 3m and 6m under Cleveland St. Two separate bores will be made between 650mm and 700mm in diameter with depth of cover varying between the send and receive holes.

Alliance understands that a geotechnical investigation is required to inform the expected underboring conditions, and subsurface parameters for which Ausgrid designers can use to determine the cable size, cable system design, and cable rating calculations.

3 SITE DESCRIPTION AND REGIONAL GEOLOGY

The proposed alignment has a general NNE-SSW orientation and spans from Zetland Zone Substation (DP78101) in the corner of Allen Street and George Street in Waterloo through Surry Hills Substation (DP88921) in the corner of Little Albion Street and Wade Place in Surry Hills in the City of Sydney local government area (LGA). The site location relative to the surrounding features is shown in Figure 1 below. The alignment primarily extends across urban areas, requiring underbores across major road crossings. The proposed alignment does not intersect any creeks or water crossings.

The proposed alignment traverses varying topographies, ascending and descending across its entirety. Based on the survey data gathered from the GNSS Rover, site elevations range between Reduced Level (RL) 19.34m and 41.35m Australian Height Datum (AHD).

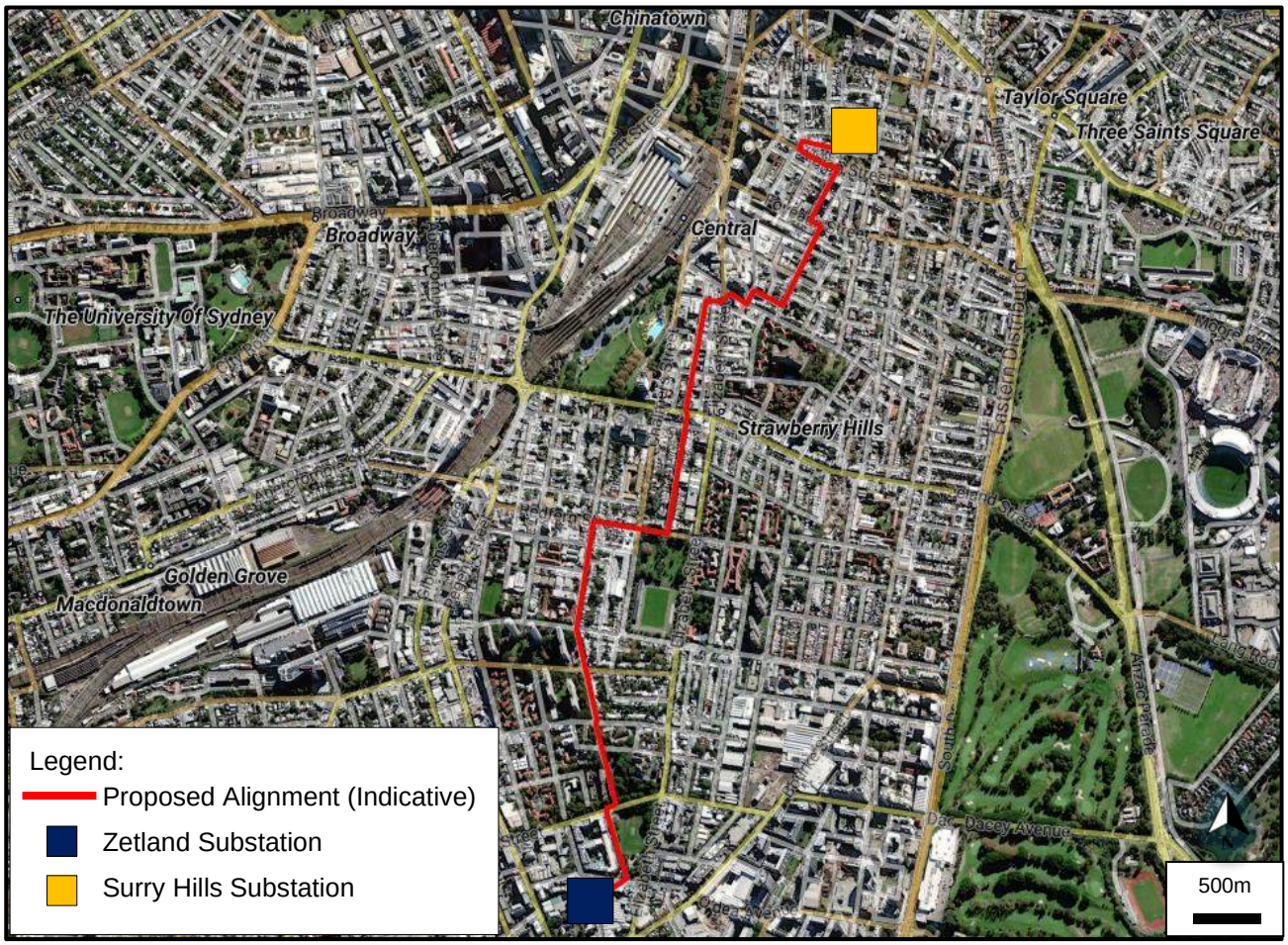

Figure 1 - The Alignment Location & Aerial Image (extracted from MinView)

The New South Wales Seamless Geology dataset, version 2.1 [Digital Dataset] published by the Geological Survey of New South Wales indicates that the southern extend of the site is underlain by Coastal deposits – dune facies which may contain *marine-deposited and aeolian-reworked coastal sand dunes.* Northern extend of the site is underlain by the Ashfield Shale of the Wianamatta Group characterised by *black to light grey shale and laminite.*

The site overlaying NSW Seamless Geology map with 10m contours are presented in Figure 2 below.

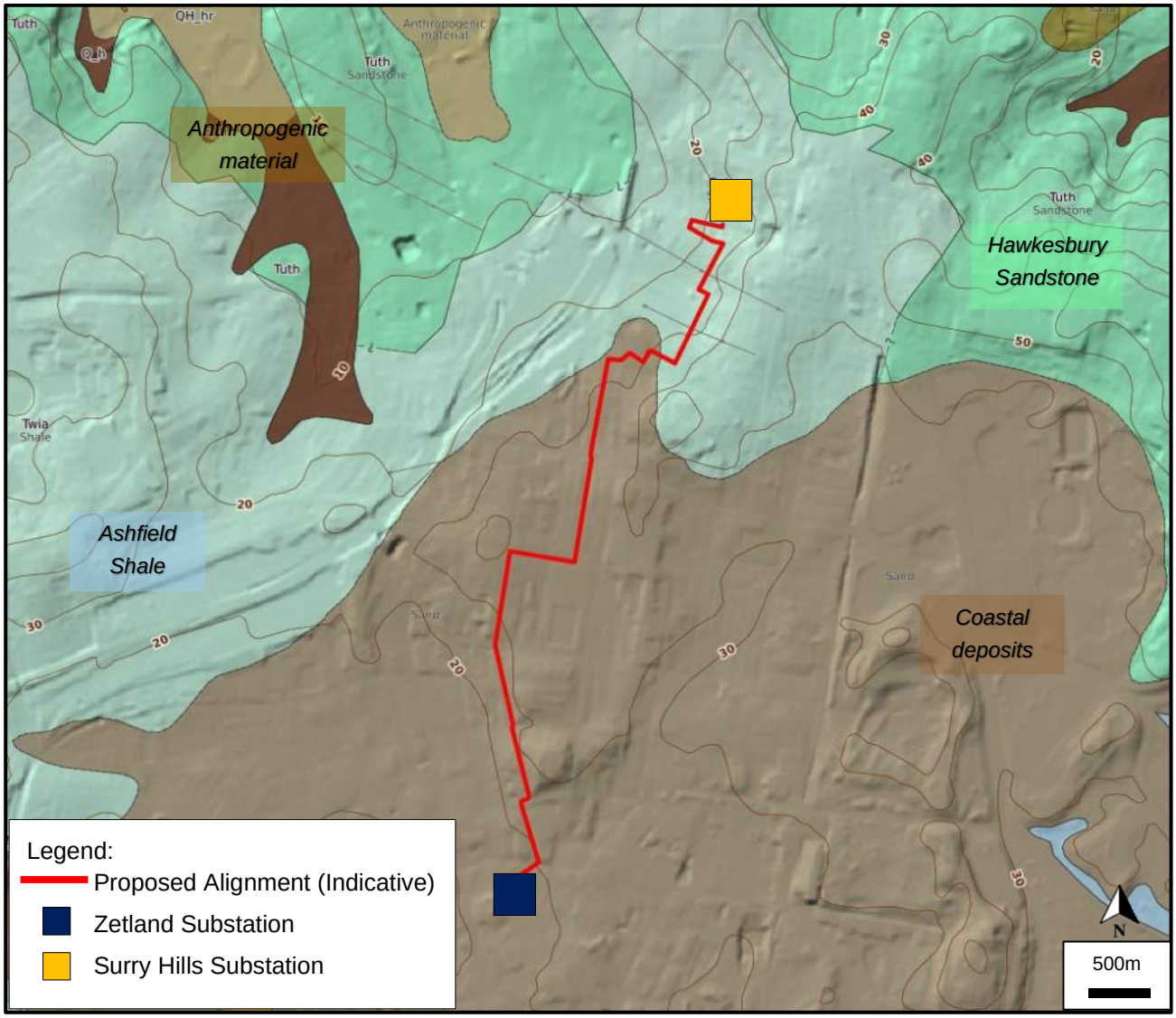

Figure 2 - The M2SH Alignment with NSW Seamless Geology and 10m Contours

4 FIELDWORK

The geotechnical investigation was undertaken as per the details outlined in the geotechnical scope provided by the client. The methods and results are discussed in detail in the following.

4.1 Methods

The geotechnical investigation was undertaken by Alliance between 16 May to 13 July 2022. Selected site photographs taken during the fieldwork are presented in Appendix A.

Alliance undertook the drilling of fifteen (15) boreholes and dynamic cone penetrometer testing aligned to the geotechnical scope. Borehole locations were cleared of underground services by an accredited service locator prior to drilling. Initial borehole locations were provided by the client, and final locations were confirmed on site before drilling/testing.

During the field investigation, the boreholes were drilled using a ute-mounted drilling rig operated by an Alliance engineering geologist and a track-mounted drilling rig operated by BG Drilling and Stratacore Drilling. The boreholes were advanced in the overburden soils using 110mm diameter solid flight augers fitted with a tungsten carbide (TC)-bit.

Standard Penetration Tests (SPT) were undertaken at 1.5m intervals starting at 1.5m bgl to assess the soil consistency at depth. Dynamic Cone Penetrometer Tests (DCP) were undertaken adjacent to the borehole locations to a target depth of 1.5m or prior refusal to determine the near-surface soil consistency.

The encountered soil profiles were documented by an experienced geotechnical engineer from Alliance generally in accordance with AS 1726 - 2017 Geotechnical Site Investigation. Recovered samples were transported to Alliance's NATA accredited materials testing laboratory and a subcontracted NATA accredited testing laboratory for further testing and storage.

A summary of the geotechnical site investigation scope at each site and approximate borehole coordinates are presented in Table 1.

Table 1 - Summary of the Geotechnical Site Investigation Scope of Work

ID	Easting (m MGA20)	Northing (m MGA20)	RLs m AHD	Termination Depth	
				m bgl	m AHD
W2SH-BH01	334005	6247191	19.94	2.00	17.94
W2SH-BH02	333980	6247372	22.63	2.00	20.63
W2SH-BH03	333985	6247458	28.18	4.85	23.33
W2SH-BH04	333921	6247725	28.01	2.00	26.01
W2SH-BH05	333883	6248025	33.77	2.00	31.77
W2SH-BH06	333995	6248267	33.52	2.10	31.42
W2SH-BH07	334170	6248430	41.35	2.00	39.35
W2SH-BH08	334187	6248533	35.45	6.00	29.45

W2SH-BH09	334199	6248643	32.23	6.00	26.23
W2SH-BH10	334249	6248970	28.27	2.00	26.27
W2SH-BH11	334476	6248939	40.22	2.00	38.22
W2SH-BH12	334582	6249255	38.33	2.10	36.23
W2SH-BH13	334534	6249437	21.80	1.57	20.23
W2SH-BH14	334578	6249473	19.34	2.00	17.34
W2SH-BH15	334195	6248584	34.98	6.00	28.98

The approximate borehole locations are indicated on the Geotechnical Investigation Plan (Drawing 14777-GR-1-1-A) in Appendix B. The coordinate values provided should be used for reference only and a registered surveyor must be engaged for design and/or construction purposes.

On completion, the boreholes were backfilled with drilling spoils and made flush with the surrounding surface. A dilapidation survey was carried out 3 weeks after the completion of the fieldworks to ensure the borehole locations were reinstated as close to its original condition as possible.

4.2 Results

4.2.1 Soils

The borehole logs with DCP test results can be found in Appendix C. These results should be read in conjunction with the attached Explanatory Note which explains the terms, abbreviations, and symbols used, together with the interpretation and limitation of the logging procedure.

A summary of the generalised subsurface conditions encountered in the boreholes has been provided in Table 2, Table 3, and Table 4 below. For ease of reference, the subsurface profiles were systematically grouped into three according to the borehole location proximity and method of proposed installation (open trench or HDD).

Table 2 - Summary of the Subsurface Profiles Encountered (W2SH-BH01 – W2SH-BH07)

Ground Profile	Consistency/ Density	Depth to top of unit (m)	Thickness (m)
Pavement Asphaltic Concrete/Concrete	-	0.0	0.05 – 0.45
Fill Gravelly SAND/Clayey SAND	-	0.05 – 0.45	0.09 – 0.45
Coastal Deposits SAND/Clayey SAND/Silty SAND	Medium Dense to Very Dense	0.25 – 0.6	0.75 - 4.35
Coastal Deposits/Residual Silty CLAY/Sandy CLAY	Soft to Firm	1.35 – 1.60	not penetrated
Coastal Deposits/Residual Silty CLAY	Stiff to Hard	0.55 – 1.65	0.35 – not penetrated
Note: **The depths and unit thicknesses are based on the information from the test locations only and do not necessarily represent the maximum and minimum values across the site.**			

The site subsurface profile for boreholes W2SH-BH01 to W2SH-BH07 generally comprises an Asphaltic Concrete pavement of thickness varying from 0.05 to 0.45m, which is underlain by uncontrolled fill (up to 0.45m thick) consisting of well graded Gravelly Sand (road base) and/or Sandy Gravel (ballast). The fill is underlain by medium dense to very dense granular coastal deposits (up to 4.35m thick). Stiff to hard residual clay underlies the coastal deposits. Soft to firm coastal deposits/residual clays were also encountered at some borehole locations.

Table 3 - Summary of the Subsurface Profiles encountered for the Cleaveland St HDD crossing (W2SH-BH08, BH09, & BH15)

Ground Profile	Consistency/ Density	Depth to top of unit (m)	Thickness (m)
Pavement Asphaltic Concrete/Concrete	-	0.0	0.05 – 0.22
Fill Sandy GRAVEL/Silty Clay	-	0.05 – 0.22	0.45 – 0.70
Coastal Deposits SAND	Loose	0.60	1.50
Residual CLAY/Silty CLAY	Stiff to hard	0.50 – 2.10	2.60 – not penetrated
Extremely Weathered to Highly Weathered Shale (Class V and IV)	Very Low to Low Strength	3.05 – 3.10	not penetrated

Note:
The depths and unit thicknesses are based on the information from the test locations only and do not necessarily represent the maximum and minimum values across the site.
Rock classification to Pells, P.J.N., Mostyn, G. & Walker, B.F., Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, December 1998.

The site subsurface profile for boreholes W2SH-BH08, W2SH-BH09, and W2SH-BH15 generally comprises an Asphaltic Concrete pavement of thickness varying from 0.05m to 0.22m, which is underlain by uncontrolled fill (up to 0.70m thick). The fill is underlain by loose granular coastal deposits (up to 1.50m thick). Stiff to hard residual clay underlies the coastal deposits. Very low to low strength Shale inferred to be a member of Ashfield Shale formation was encountered below the residual clay at some borehole locations.

Table 4 - Summary of the Subsurface Profiles Encountered (W2SH-BH10 – W2SH-BH14)

Ground Profile	Consistency/ Density	Depth to top of unit (m)	Thickness (m)
Pavement Asphaltic Concrete/Concrete	-	0.0	0.03 – 0.25
Fill Sandy GRAVEL/Gravelly SAND/Sandy CLAY	-	0.03 – 0.25	0.45 – 1.50
Coastal Deposits/Residual Silty SAND/Clayey SAND/SAND	Loose to Medium Dense	0.50 – 1.50	1.15 – not penetrated
Coastal Deposits/Residual CLAY	Very Soft to Soft	1.60 – 1.65	not penetrated
Residual CLAY/Silty CLAY	Stiff to Very Stiff	0.9	0.6

Extremely Weathered SHALE (Class V)	Very Low	1.5	not penetrated

Note:
The depths and unit thicknesses are based on the information from the test locations only and do not necessarily represent the maximum and minimum values across the site
Rock classification to Pells, P.J.N., Mostyn, G. & Walker, B.F., Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, December 1998.

The site subsurface profile for boreholes W2SH-BH10 to W2SH-BH14 generally comprises an Asphaltic Concrete pavement of thickness varying from 0.03 to 0.25m. which is underlain by uncontrolled fill (up to 1.50m thick). Fill is underlain by loose to medium dense granular coastal deposits. Stiff to hard residual clay underlies the coastal deposits. Very low strength Shale inferred to be a member of Ashfield Shale formation was encountered below the residual clay at some borehole locations. Very soft to soft coastal deposits/residual clays were also encountered at some borehole locations.

4.2.2 Groundwater

Groundwater was encountered in boreholes at depths shown in Table 3 during the geotechnical investigation.

Table 5 - Groundwater Levels Encountered at Each Borehole

Borehole	Existing Ground Surface Level (m AHD)	Groundwater level	
		m bgl	m AHD
W2SH-BH01	19.94	1.80	18.14
W2SH-BH11	40.22	1.50	38.72
W2SH-BH14	19.34	0.90	18.44

Groundwater seepage may still occur at the interface of residual soils and bedrock and also through the bedrock joints/defects. It should be noted that groundwater conditions are subject to seasonal variations and major weather events (i.e. prolonged rainfall). It is noted that the groundwater observation may have been made before water levels had stabilised. No long-term groundwater monitoring was carried out.

5 LABORATORY TESTING

5.1 Classification Testing

Laboratory tests were carried out on selected soil samples collected from the boreholes during the site investigation. The following tests were carried out on selected soil samples in Alliance's NATA-accredited soil laboratory:

- Atterberg Limits and Linear Shrinkage
- Particle Size Distribution
- Moisture Content

The laboratory tests certificates are provided in Appendix D.

5.1.1 Moisture Content, Particle Size Distribution, Atterberg Limits, and Linear Shrinkage

Particle Size Distribution and Atterberg Limit tests were conducted on selected samples in accordance with AS1289 by Alliance NATA accredited laboratory. The results are summarised in Table 6 and Table 7 below and the detailed results are presented in Appendix D.

Table 6 - Summary of Particle Size Distribution

Sample Source	Soil Description	Moisture Content (%)	Particle Size Distribution Passing (%)	
			75 µm	2.36 mm
W2SH-BH01 0.6 – 0.9m	Clayey SAND	7.0	17	98
W2SH-BH02 0.7 – 0.9m	SAND	3.8	5	98
W2SH-BH03 2.5 – 2.7m	SAND	2.5	1	100
W2SH-BH03 2.9 – 3.2m	SAND	3.0	2	97
W2SH-BH04 1.4 – 1.6m	Clayey SAND	10.7	25	99
W2SH-BH05 1.2 – 1.5m	Clayey SAND	3.1	31	91
W2SH-BH10 1.8 – 2.0m	Sandy CLAY	7.7	36	99
W2SH-BH11 1.2 – 1.5m	SAND	5.6	9	98
W2SH-BH12 1.6 – 2.1m	Clayey SAND	13.3	32	99

Table 7 - Summary of Atterberg Limits and Linear Shrinkage

Sample Source	Soil Description	Moisture Content (%)	Atterberg Limits (%)			Linear Shrinkage (%)
			Liquid Limit	Plastic Limit	Plasticity Index	
W2SH-BH06 1.3 – 1.5m	Sandy CLAY	22.3	21	11	10	4.5
W2SH-BH07 0.8 – 0.9m	Silty CLAY	23.8	70	29	41	6.5
W2SH-BH08 2.9 – 3.2m	Silty CLAY	10.8	55	23	32	12.0
W2SH-BH09 4.0 – 4.5m	CLAY	22.7	68	26	42	17.0
W2SH-BH10 1.8 – 2.0m	Sandy CLAY	7.7	14	9	5	3.0
W2SH-BH13 1.3 – 1.5m	Sandy CLAY	5.6	36	19	17	9.0
W2SH-BH14 1.0 – 1.5m	Clayey SAND	29.1	26	19	7	4.0
W2SH-BH15 2.9 – 3.2m	CLAY	13.7	43	18	25	10.5

5.2 Thermal Resistivity Testing

Thermal Resistivity (TR) were carried out on selected bulk samples. The laboratory test certificates are presented in Appendix D. A summary of the TR test results is summarised in Table 8 below:

Table 8 - Summary of Thermal Resistivity Testing Results

Test Location	Depth below ESL (m)	Material Description	Field Moisture Content (%)	Field Moisture Thermal Resistivity (mK/W)	0% Moisture Thermal Resistivity (mK/W)	3% Moisture Thermal Resistivity (mK/W)
W2SH-BH01	0.9 – 1.2	Clayey SAND	16.2	0.50	1.85	1.22
W2SH-BH02	0.9 – 1.2	SAND	2.8	1.13	2.56	1.05*
W2SH-BH03	0.9 – 1.2	SAND	2.6	1.52	3.03	1.37*
W2SH-BH04	0.9 – 1.2	SAND	3.5	1.14	2.38	1.35
W2SH-BH05	0.9 – 1.2	Clayey SAND	3.1	1.01	2.17	1.03
W2SH-BH06	0.9 – 1.2	SAND	21.4	0.64	1.74	1.39

W2SH-BH07	0.9 – 1.2	Silty CLAY	15.8	0.90	2.63	1.98
W2SH-BH08	0.9 – 1.2	Silty CLAY	14.7	0.98	2.18	1.62
W2SH-BH09	0.9 – 1.2	Clayey SAND	15.7	0.57	1.61	1.37
W2SH-BH09	2.9 – 3.2	CLAY	21.3	0.65	1.83	1.55
W2SH-BH09	4.9 – 5.2	CLAY	19.7	0.80	2.19	1.76
W2SH-BH10	0.9 – 1.2	Clayey SAND	3.8	0.71	2.13	0.98
W2SH-BH11	0.9 – 1.2	SAND	4.9	0.89	1.82	1.11
W2SH-BH12	0.9 – 1.2	Sandy CLAY	8.0	0.76	1.75	1.23
W2SH-BH13	0.9 – 1.5	Sandy CLAY	11.3	0.57	1.75	1.00
W2SH-BH14	0.9 – 1.2	Sandy CLAY	18.9	0.82	2.27	1.75
W2SH-BH15	0.9 – 1.2	CLAY	18.7	0.69	1.72	1.50
W2SH-BH15	2.9 – 3.2	CLAY	13.7	0.68	1.57	1.14
*Values have been extrapolated as insitu moisture content was <3%.						

6 COMMENTS AND RECOMMENDATIONS

6.1 Open Trench Excavation

6.1.1 Groundwater conditions including inflows

Most of the cable trenches will be constructed in granular fill, coastal deposit sands, natural clays and extremely weathered shale. As such significant groundwater management of open excavations is not anticipated, beyond the use of sump pump dewatering with potentially some exception in sections of the alignment where the groundwater level can be encountered above the base of the proposed trench excavations, where sheet piles (or other cut-off wall options) might be required to manage groundwater inflow into the trench.

Significant groundwater inflow may occur where the trench excavations intersect with granular fill material surrounding or at the surface of existing services. Groundwater encountered in such circumstances may be contaminated and require specialist treatment for disposal.

Optimal solutions (gravity drainage controls, cut-off walls, active dewatering) will depend on the nature and duration of groundwater control required. Equipment such as temporary sump pumps should be made available during construction to manage potential groundwater ingress and similarly provision should be made for additional shoring that may be required due to potential groundwater induced instability.

6.1.2 Excavation conditions

The expected depth of excavation for trenched sections of the alignment will be between 1.2 to 3m below the existing road surface level. The subsurface profiles prepared in 4.2.1 indicate that the proposed open trench excavations are anticipated through road pavement, well compacted fill, coastal deposit sands, natural clays and extremely weathered Shale.

Excavation through road pavement, fill, coastal deposit sands, natural clays and extremely weathered bedrock is expected to be readily achievable using conventional earthwork equipment such as a tracked excavator with tiger-tooth bucket. The construction related vibrations are expected to be negligible. Generally, the peak particle velocity during any demolition, excavation, and construction should be limited to 5mm/s.

A dilapidation survey of structures within the zone of influence which is generally a horizontal distance of 2H from the edge of the excavation with H being the depth of the excavation is recommended to be undertaken by a structural engineer prior to the commencement of any site excavations. The report should include precise measurements of the existing defects and cracks presented with relevant photos. Impact of the proposed excavation on existing utilities is not covered in this geotechnical report but should be taken into consideration.

6.1.3 Impact on utilities in the area

In areas where the open trench will intersect or run adjacent to sensitive utilities such as gas or other fuel pipes, the pipe should be service located and, where necessary should undergo non-destructive digging to expose the utilities before excavating the trenches. The use of sheet piles for trench support may be required to reduce the risk of ground movements affecting movement sensitive existing utilities.

6.1.4 Soft Soils

Soft soils are susceptible to consolidation settlement under loads over time. It is understood that the proposed cables will be installed within conduits, which are encased with concrete. The conduit joints are generally sensitive to movement therefore settlements in soft soils can lead to issues. It is recommended that the soft soil areas are over excavated, compacted and replaced with engineered fill prior to laying of the cables. Based on the provided alignment invert levels and the ground investigation findings, it is anticipated that some trenched cables will be laid above potential soft zones. As the cable invert levels are determined at detailed design stage, consideration should be given to the presence of these soil conditions.

6.1.5 Temporary support of excavations

Given that the proposed trenched sections of the cabling alignment runs along existing roads, temporary batters are considered unfeasible for the trench excavations and the excavation should be supported by a properly designed shoring system. Shoring systems can take the form of sheet piles, trench boxes, time shorting or a combination of them. Any temporary earth retaining structures should be designed by a structural engineer in accordance with AS4678-2002 Earth Retaining Structures. They should withstand the applied lateral pressures exerted by soil and hydrostatic pressures applied by groundwater, together with any existing or live surcharge loads imposed within the zone of influence which is generally a horizontal distance of 2H from the edge of the excavation with H being the depth of the excavation. The selection of an appropriate shoring system is a design matter which needs to consider several geotechnical and non-geotechnical factors.

For the design of retaining structures where some lateral movement is acceptable, an ‘active’ lateral earth pressure coefficient (K_a) is recommended. If it is critical to limit horizontal deformations, the ‘at rest’ (K_0) earth pressure coefficient is recommended. Note that designing the wall using K_0 does not in and of itself limit deformations, which are highly dependent on other design elements as well as construction sequence. Based

on the findings of the geotechnical investigation, retaining walls or temporary shoring can be designed using the recommended geotechnical design parameters provided in Table 9 below.

Table 9 Typical Material Properties for Retention Design

Geotechnical Units	c' (kPa)	$\emptyset'$ (degrees)	γ (kN/m^3)	K_a	K_p	K_o	E' (MPa)	ϑ'
Fill **Gravelly SAND/ Clayey SAND** (uncontrolled)	0	28	17	0.36	2.77	0.53	4	0.3
Coastal Deposits SAND **(loose to medium dense)**	0	28	18	0.36	2.77	0.53	20	0.3
Coastal Deposits **Silty SAND/ Clayey SAND/ SAND (medium dense to very dense)**	0	35	20	0.27	3.69	0.5	60	0.3
Residual Silty CLAY/Sandy CLAY **(very soft to soft)**	0	21	15	0.47	2.12	0.64	2	0.3
Residual **Silty CLAY/Sandy CLAY (soft to firm)**	1	23	16	0.44	2.28	0.61	5	0.3
Residual **Silty CLAY (stiff to hard)**	5	27	19	0.38	2.66	0.55	20	0.3
Extremely Weathered to Highly Weathered Shale (Class V and IV)	30	28	23	0.36	2.77	0.53	50	0.25

Legend:
$\emptyset'$: Effective Friction Angle
c': Effective Cohesion
γ: Bulk Unit Weight
K_a: Active earth pressure
K_o: Earth pressure at rest
Kp: Passive earth pressure
E': Elasticity Modulus
ϑ': Poisson's Ratio

An assessment of the stability of an excavation during construction can be provided by Alliance if requested. We recommend this particularly if any part of the excavation face is to be unsupported.

6.1.6 Foundations

The existing fill material is not considered to be a suitable foundation strata and joint bays (precast/ insitu) should be taken to found on the underlying natural clays. The proposed structure may be supported at the ground level by shallow pad or strip footings founded on firm to stiff clay or medium dense to dense sand. Design parameters for shallow footing design in residual clay are presented in Table 10.

Table 10 Preliminary Geotechnical Design Parameters for Shallow Foundations

Description	Allowable Bearing Pressure (kPa)	Youngs Modulus (Mpa)
Coastal Deposits SAND (loose to medium dense)	160*	20

Coastal Deposits Silty SAND/ Clayey SAND/ SAND (Medium Dense to Very Dense)	450*	60
Residual Silty CLAY (Stiff to Hard)	200*	20
Extremely Weathered SHALE **(Class V)**	700*	50
*** Based on a 1.0m square pad footing, 1.0m deep. Separate settlement assessment should be undertaken to ensure that the footing settlements are within the tolerable range.**		

6.2 Trenchless Crossings

Based on the information provided an underbore using Horizontal Directional Drilling (HDD) techniques will be carried out across Cleveland Street. The underbore depth is anticipated to be between 3m – 6m below Cleveland Street.

6.2.1 Excavation conditions

Based on the information provided, the expected depth of excavation for the HDD section across Cleveland Street of the alignment will be between 3m to 6m below the existing road surface level. The subsurface profiles prepared in Table 3 indicate that the proposed HDD are anticipated to be installed through fill, stiff to very stiff clays and very low to low strength shale.

6.2.2 Groundwater conditions

No groundwater was encountered during the site investigations in the HDD section across Cleveland Street. However, groundwater seepage may still occur at the interface of residual soils and bedrock and also through the bedrock joints/defects. It should be noted that groundwater conditions are subject to seasonal variations and major weather events (i.e. prolonged rainfall). It is noted that the groundwater observation may have been made before water levels had stabilised. No long-term groundwater monitoring was carried out.

6.2.3 Impact on utilities and structures in the area

Consideration needs to be given to any existing utilities that the proposed underbore may cross during construction to ensure that the underbore construction doesn't intersect with any existing utility trenches, thereby causing damage to the utility.

An impact assessment including a include the review of accurate survey data including distances to the existing utilities should be carried out. A settlement assessment of nearby structures and utilities is recommended to be undertaken to understand the impact of the proposed HDD on Cleveland Street and nearby structures. A ground deformation monitoring plan may also be required to a monitor the impact of the HDD on existing utilities during construction.

6.2.4 Thermal resistivity characteristics of the soil and rock

Thermal resistivity at 0% moisture ranges for subsurface materials based on the soil laboratory test results are presented in Table 11.

Table 11 Thermal resistivity range for subsurface materials

Material	0% Moisture Thermal Resistivity (mK/W)
Fill **Silty SAND/Clayey SAND/SAND**	1.75 – 2.27
Coastal Deposits/Residual **Silty CLAY/Clayey SAND/SAND**	1.74 - 3.03
SHALE (Class V and IV)	Not tested

Undisturbed sampling was carried out at all borehole locations between 0.9m and 1.2m bgl. Undisturbed samples were also collected from the rock core at W2SH-BH15. However due to the fractures and brittle nature of shale, the samples were damaged during preparation for testing and no testing was carried out. Furthermore, dry out curves cannot be produced in Shale as the samples crumble when dried.

Generally as thermal resistivity is predominately influenced by a material's air void content, bedrock with its higher density and lower void ratio has lower thermal resistivity properties. Alliance has previously carried out thermal resistivity with dry out curves in shale with a thermal resistivity value ranging from 0.5 to 0.8mK/W at 0% moisture. Based on Alliance's experience and with reference to the available guidelines, the indicative design Thermal Resistivity values for conduit being placed within very low strength and low strength Shale is 0.9mK/W at 0% moisture.

7 LIMITATIONS

Alliance Geotechnical Pty Ltd (Alliance) has prepared this report for the Ausgrid Underground Cable Project along Waterloo NSW 2017 to Surry Hills NSW 2010 in accordance with Alliance's fee proposal and Terms of Engagement. This geotechnical report has been prepared for Ausgrid for this project and for the purposes outlined in this report. This report cannot be relied upon for other projects, other parties on this site or any other site. The comments and recommendations provided in this report are based on the assumption that the geotechnical recommendations contained in this report will be fully complied with during the design and construction of the proposed site development.

The borehole investigation and dynamic cone penetrometer test results provided in this report are indicative of the subsurface conditions at the site only at the specific sampling and testing locations, and to the depths drilled at the time of the investigation. Subsurface conditions can change significantly due to geological and human processes. Where variations in conditions are encountered further geotechnical advice should be sought from Alliance.

APPENDIX A – Site Photograph

Photo 1 – Borehole W2SH-BH09 drill rig set up

Photo 2 – W2SH-BH05 site reinstated

APPENDIX B – Geotechnical Investigation Plan (Drawing 14777-GR-1-1-A)

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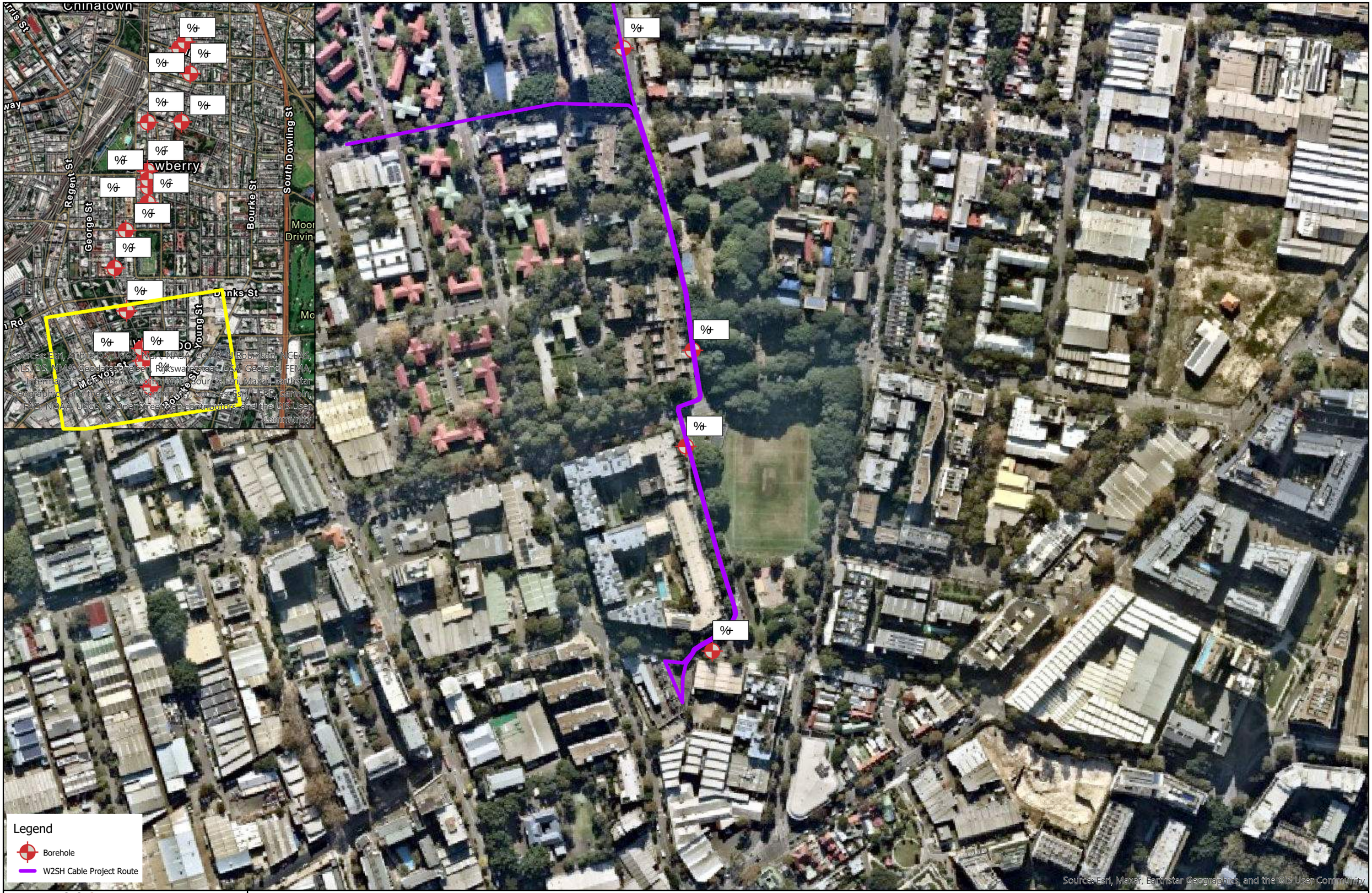
Site Plan Scale 1:6,000 on A3

Client Name:	Ausgrid	Figure Number:	14777-GR-1-1-A
Project Name:	Underground Cable Projects	Figure/Drawing Date:	04/08/2022
Project Location	Waterloo to Surry Hills	Report Number:	14777-GR-1-1

0 120
Meters



Site Plan Scale 1:3,000 on A3

Client Name:	Ausgrid	Figure Number:	14777-GR-1-1-A1
Project Name:	Underground Cable Projects	Figure/Drawing Date:	04/08/2022
Project Location	Waterloo to Surry Hills	Report Number:	14777-GR-1-1

0 80 Meters

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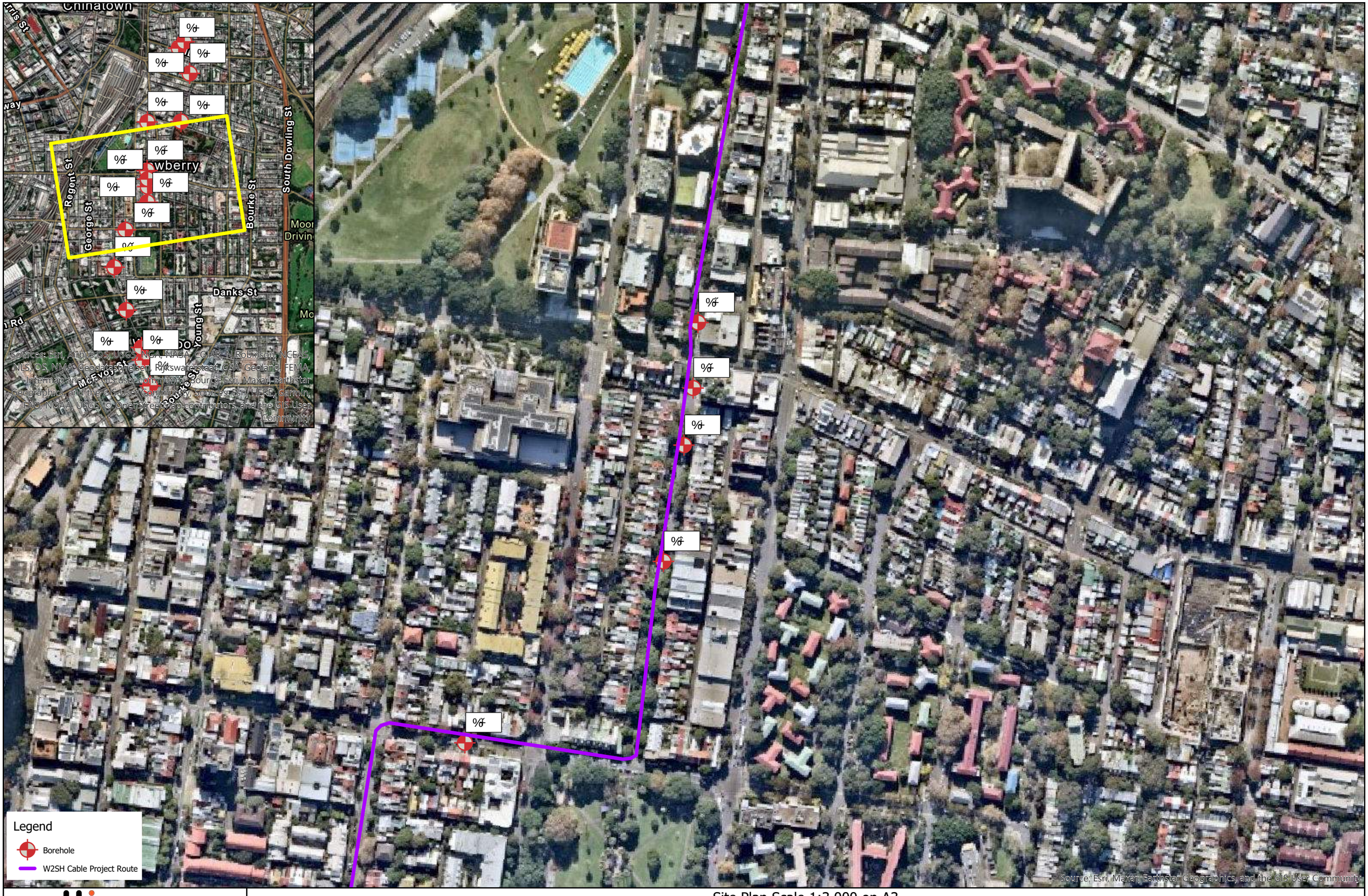
Site Plan Scale 1:3,000 on A3

Client Name:	Ausgrid	Figure Number:	14777-GR-1-1-A1
Project Name:	Underground Cable Projects	Figure/Drawing Date:	04/08/2022
Project Location	Waterloo to Surry Hills	Report Number:	14777-GR-1-1

0 80
Meters



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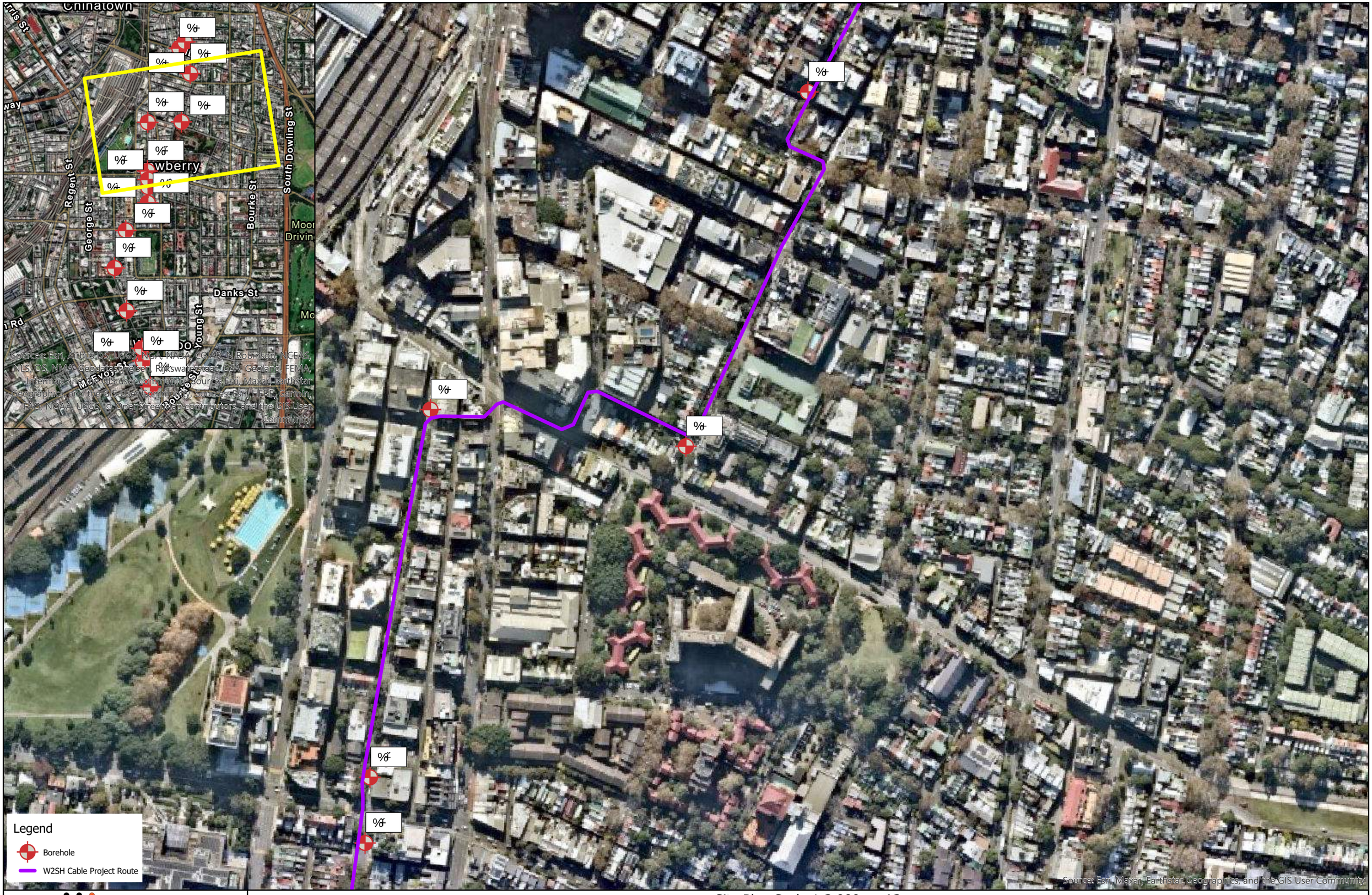
Site Plan Scale 1:3,000 on A3

Client Name:	Ausgrid	Figure Number:	14777-GR-1-1-A1
Project Name:	Underground Cable Projects	Figure/Drawing Date:	04/08/2022
Project Location	Waterloo to Surry Hills	Report Number:	14777-GR-1-1

0 80 Meters



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Site Plan Scale 1:3,000 on A3

Client Name:	Ausgrid	Figure Number:	14777-GR-1-1-A1
Project Name:	Underground Cable Projects	Figure/Drawing Date:	04/08/2022
Project Location	Waterloo to Surry Hills	Report Number:	14777-GR-1-1

0 80
Meters

alliance geotechnical & environmental solutions	Site Plan Scale 1:3,000 on A3				
	Client Name:	Ausgrid	0 80 Meters	Figure Number:	14777-GR-1-1-A1
	Project Name:	Underground Cable Projects		Figure/Drawing Date:	04/08/2022
	Project Location	Waterloo to Surry Hills		Report Number:	14777-GR-1-1

APPENDIX C – Explanatory Notes, Borehole Logs with DCP

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Explanatory Notes
Drill & Excavation Logs

General

Information obtained from site investigations is recorded on log sheets. Soils and very low strength rock are commonly drilled using a combination of solid-flight augers with a Tungsten-Carbide (TC) bit. Descriptions of these materials presented on the “Borehole Log” are based on a combination of regular sampling and in-situ testing. Rock coring techniques commences once material is encountered that cannot be penetrated using a combination of solid-flight augers and Tungsten-carbide bit. The "Cored Borehole Log" presents data from drilling where a core barrel has been used to recover material - commonly rock.

The "Excavation – Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits or trenches.

The heading of the log sheets contains information on Project Identification, Hole or Test Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The scale is presented in the depth column as metres below ground level.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is included in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures, and geological unit. Material description and classifications are based on Australian Standard Geotechnical Site Investigations: AS 1726 - 2017 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

Drilling

Drilling, Casing and Excavating

Drilling methods deployed are abbreviated as follows

Abbreviation	Method
AS	Auger Screwing
ADV	Auger Drilling with V-Bit
ADT	Auger Drilling with TC Bit
BH	Backhoe
E	Excavator
HA	Hand Auger
HQ	HQ core barrel (~63.5 mm diameter core) *
HMLC	HMLC core barrel (~63.5 mm diameter core) *
NMLC	NMLC core barrel (~51.9 mm diameter core) *
NQ	NQ core barrel (~47.6 mm diameter core) *
RR	Rock Roller
WB	Wash-bore drilling

* Core diameters are approximate and vary due to the strength of material being drilled.

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage. It is introduced to assist with the drill process, in particular, when core drilling. The introduction of drill fluid/water does not allow for accurate identification of water seepages.

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

Abbreviation	Description
VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Date of measurement is shown.


Standing water level measured in completed borehole


Level taken during or immediately after drilling


Groundwater inflow water level

Samples/Tests

Samples collected and testing undertaken are abbreviated as follows

Abbreviation	Test
ES	Environmental Sample
DS	Disturbed Sample
BS	Bulk Sample
U50	Undisturbed (50 mm diameter)
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (*sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Device
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test
HB	Hammer Bouncing

Excavation Logs

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added. Photos are recommended.

Material Description – Soil

Material Description - In accordance with AS 1726-2017

Classification Symbol - In accordance with the Unified Classification System (AS 1726-2017).

Abbreviation	Typical Name
GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
GM	Silty gravels, gravel-sand-silt mixtures.
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well graded sands, gravelly sands, little or no fines.
SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
SM	Silty sand, sand-silt mixtures.
SC	Clayey sands, sand-clay mixtures.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity. *
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity, organic silts. *
Pt	Peat and other highly organic soils. *

* Additional details may be provided in accordance with the Von Post classification system (1922).

Organic Soils – Identification using laboratory testing:

Material	Organic Content - % of dry mass
Inorganic	<2
Organic Soil	<2 ≤ 25
Peat	> 25

Organic Soils – Descriptive terms for the degree of decomposition of peat:

Term	Decomposition	Remains	Squeeze
Fibrous	Little or none	Clearly recognizable	Only water No solid
Pseudo-fibrous	Moderate	Mixture of fibrous and amorphous	Turbid water < 50% solids
Amorphous	Full	Not recognizable	Paste > 50% solids

Particle Characteristics – Definitions are as follows:

Fraction	Component (& subdivision)		Size (mm)
Oversize	**Boulders**		> 200
	Cobbles		> 63 ≤ 200
Coarse grained soils	**Gravel**	Coarse	> 19 ≤ 63
		Medium	> 6.7 ≤ 19
		Fine	> 2.36 ≤ 6.7
	Sand	Coarse	> 0.6 ≤ 2.36
		Medium	> 0.2 ≤ 0.6
		Fine	> 0.075 ≤ 0.21
Fine grained soils	**Silt**		0.002 ≤ 0.075
	Clay		< 0.002

Secondary and minor soil components

In coarse grained soils – The proportions of secondary and minor components are generally estimated from a visual and tactile assessment of the soils. Descriptions for secondary and minor soil components in coarse grained soils are as follows.

Designation of components	Percentage fines	Terminology (as applicable)	Percentage accessory coarse fraction	Terminology (as applicable)
Minor	≤ 5	Trace clay / silt	≤ 5	Trace sand / gravel
	> 5 ≤12	With clay / silt	> 5 ≤12	With sand / gravel
Secondary	> 12	Silty or clayey	> 30	Sandy or gravelly

Descriptions for secondary and minor soil components in fine grained soils are as follows.

Designation of components	Percentage coarse grained soils	Terminology (as applicable)
Minor	≤ 5	Trace sand / gravel / silt / clay
	> 5 ≤12	With sand / gravel / silt / clay
Secondary	> 30	Sandy / gravelly / silty / clayey

Plasticity Terms - Definitions for fine grained soils are as follows:

Descriptive Term	Range of Liquid Limit for silt	Range of Liquid Limit for clay
Low Plasticity	≤ 50	≤ 35
Medium Plasticity	N/A	> 35 ≤50
High Plasticity	> 50	> 50

Particle Characteristics

Particle shape and angularity are estimated from a visual assessment of coarse-grained soil particle characteristics. Terminology used includes the following:

Particle shape – spherical, platy, elongated,

Particle angularity – angular, sub-angular, sub-rounded, rounded.

Moisture Condition – Abbreviations are as follows:

D	Dry, looks and feels dry.
M	Moist, No free water on remoulding.
W	Wet, free water on remoulding.

Moisture content of fine-grained soils is based on judgement of the soils moisture content relative to the plastic and liquid limit as follows:

MC < PL	Moist, dry of plastic limit.
MC ≈ PL	Moist, near plastic limit.
MC > PL	Moist, wet of plastic limit.
MC ≈ LL	Wet, near liquid limit.
MC > LL	Wet of liquid limit.

Consistency - of cohesive soils in accordance with AS 1726-2017, Table 11 are abbreviated as follows:

Consistency Term	Abbreviation	Indicative Undrained Shear Strength Range (kPa)
Very Soft	**VS**	< 12
Soft	**S**	12 ≤ 25
Firm	**F**	25 ≤ 50
Stiff	**St**	50 ≤ 100
Very Stiff	**VSt**	100 ≤ 200
Hard	**H**	≥ 200
Friable	**Fr**	-

Density Index (%) of granular soils is estimated or is based on SPT results. Abbreviations are as follows:

Description	Abbreviation	Relative Density	SPT N
Very Loose	**VL**	< 15%	0 - 4
Loose	**L**	15 - 35%	4 - 10
Medium Dense	**MD**	35 - 65%	10 - 30
Dense	**D**	65 - 85%	30 - 50
Very Dense	**VD**	> 85%	> 50

Structures – Fissuring and other defects are described in accordance with AS 1726-2017 using the terminology for rock defects

Origin – Where practicable an assessment is provided of the probable origin of the soil, e.g. fill, topsoil, alluvium, colluvium, residual soil.

MATERIAL DESCRIPTION - ROCK

Material Description – In accordance with AS 1726-2017

Rock Naming – Where possible conventional geological names are used within the logs. Engineering properties cannot be inferred directly from the rock names in the table, but the use of a particular name provides an indicative range of characteristics to the reader. Lithological identification of rock is provided to appreciate the geology of an area, to correlate geological profiles seen in boreholes or to distinguish boulders from bedrock.

Grain Size – Grain size is done in accordance with AS1726-2017 as follows:

For sedimentary rock:

Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mmto 0.6mm
Fine grained	Mainly 0.06mm to 0.2mm

For igneous and metamorphic rock:

Coarse grained	Mainly greater than 2 mm
Medium grained	Mainly 0.6mm to 2mm
Fine grained	Mainly less than 2mm

Colour - Rock colour is described in the moist condition.

Texture and Fabric

Frequently used terms:

Sedimentary Rock	Metamorphic Rock	Igneous
Bedded	Banded	Amorphous
Cross-bedded	Cleaved	Crystalline
Folded	Folded	Flow banded
Graded	Foliated	Folded
Interbedded	Gneissose	Lineated
Laminated	Lineated	Massive
Massive	Schistose	Porphyritic

Bedding and fabric:

Description	Spacing
Very Thickly Bedded	> 2m
Thickly Bedded	0.6m to 2m
Medium Bedded	0.2m to 0.6m
Thinly Bedded	60mm to 200mm
Very Thinly Bedded	20mm to 60mm
Thickly Laminated	6mm to 20mm
Thinly Laminated	< 6mm

Degree of development:

Massive	No layering or fabric. Rock is homogeneous.
Indistinct	Layering or fabric just visible, There is little effect on strength properties.
Distinct	Layering or fabric obvious. The rock may break more easily parallel to the fabric.

Features, inclusions, and minor components - Features, inclusions and minor components within the rock material shall be described where those features could be significant such as gas bubbles, mineral veins, carbonaceous material, salts, swelling minerals, mineral inclusions, ironstone or carbonate bands, cross-stratification, or minerals the readily oxidise upon atmospheric exposure.

Moisture content - Where possible descriptions are made by the feel and appearance of the rock using one according to following terms:

Dry	Looks and feels dry.
Moist	Feels cool, darkened in colour, but no water is visible on the surface.
Wet	Feels cool, darkened in colour, water film or droplets visible on the surface.

The moisture content of rock cored with water may not be representative of its in-situ condition.

Durability – Descriptions of the materials durability such as tendency to develop cracks, break into smaller pieces or disintegrate upon exposure to air or in contact with water are provided where observed.

Rock Material Strength – The strength of the rock material is based on uniaxial compressive strength (UCS). The following terms are used:

Term / Abbreviation		Description	UCS (MPa)	Point Load Strength Index (MPa)
Very Low	**VL**	Crumbles under firm blow with sharp end of pick, can be peeled with a knife; too hard to cut a triaxial by hand; 30mm pieces can be broken by hand.	0.6 – 2	0.03 – 0.1
Low	**L**	Easily scored with a knifed; indentations 1-3mm show with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	2 – 6	0.1 – 0.3
Medium	**M**	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.	6 – 20	0.3 – 1
High	**H**	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.	20 – 60	1 – 3
Very High	**VH**	Hand specimen breaks with pick after more than one blow; rock rings under hammer.	60 – 200	3 – 10
Extremely High	**EH**	Specimen requires many blows with geological pick to break into intact materials; rock rings under hammer.	> 200	> 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical logs as follows:

D	Diametral Point Load Test
A	Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown. Point Load Strength Index test results are presented as $I_{s\,(50)}$ values in MPa.

Weathering – Weathering classification assists in identification but does not imply engineering properties. Descriptions are as follows:

Term / Abbreviation		Description
Residual Soil	**RS**	Material has soil properties. Mass structure and material texture and fabric of original rock not visible, but the soil has not been significantly transported.
Extremely Weathered	**EW**	Material has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	**HW**	Material is completely discoloured, significant decrease in strength from fresh rock.
Moderately Weathered	**MW**	Material is `completely discoloured, little or no change of strength from fresh rock.
Slightly Weathered	**SW**	Partly stained or discoloured, little or no change to strength from fresh rock.
Fresh	**FR**	No signs of mineral decomposition or colour change.

Alteration – Physical and chemical changes of the rock material due to geological processes by fluids at depth at pressures and temperatures above atmospheric conditions. Unlike weathering, alteration shows no relationship to topography and may occur at any depth. When altered materials are recognized, the following terms are used:

Term / Abbreviation				Description
Extremely Altered		**XA**		Material has soil properties. Structure, texture, and fabric of original rock are still visible. The rock name is replaced with the name of the parent material, e.g., Extremely Altered basalt. Soil descriptive terms are used.
Highly Altered	**Distinctly altered**	**HA**	**DA**	The whole of the rock material is discoloured. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be higher or lower due to loss of minerals or precipitation of secondary minerals in pores.
Moderately Altered	**Distinctly altered**	**MA**	**DA**	The whole of the rock material is discoloured. Little or no change of strength from fresh rock. The term 'Distinctly Altered' is used where it is not practicable to distinguish between 'Highly Altered' and 'Moderately Altered'. Distinctly Altered is defined as follows: - The rock may be highly discoloured; - Porosity may be higher due to mineral loss; or may be lower due to precipitation of secondary minerals in pores; and - Some change of rock strength.
Slightly Altered		**S**		Rock is slightly discoloured. Little or no change of strength from fresh rock.

Alteration is only described in the context of the project where it has relevance to the civil and structural design.

Defect Descriptions

General and Detailed Descriptions – Defect descriptions are provided to suit project requirements. Generalized descriptions are used for some projects where it is unnecessary to describe each individual defect in a rock mass, or where multiple similar defects are present which are too numerous to log individually. The part of the rock mass to which this applies is delineated.

Detailed descriptions are given of defects judged to be particularly significant in the context of the project. For example, crushed seams in an apparently unstable slope. As a minimum, general descriptions outlining the number of defect sets within the rock mass and their broad characteristics are provided where it is possible to do so.

Defect Type – Defect abbreviations are as follows:

BP	Bedding parting	**SSM**	Sheared seam	**DB**	Drilling break
JT	Joint	**CS**	Crushed seam	**HB**	Handling break
SS	Shear surface	**SM**	Infilled seam		
SZ	Sheared zone	**EWS**	Extremely weathered seam		

Sheared surfaces, sheared zones, sheared seams, and crushed seams are generally faults in geological terms.

Defect Orientation

For oriented core: The dip and dip direction are recorded as a two-digit and three-digit number separated by a slash, are collected e.g., 50°/240° and there is not core loss that could obscure core orientation. If alternative measurements are made, such as dip and strike or dip direction relative to magnetic north this shall be documented.

For non-oriented core: The dip is recorded as a two-digit number, e.g., 10°. In vertical boreholes the dip is generally measured relative to the horizontal plan. If the borehole is inclined the dip is generally measured from the core axis.

Surface Roughness – Defect surface roughness is described as follows:

VR	**Very rough**	Many large surface irregularities with amplitude generally more than 1 mm.
RO	**Rough**	Many small surface irregularities with amplitude generally less than 1 mm.
SO	**Smooth**	Smooth to touch. Few or no surface irregularities.
PO	**Polished**	Shiny smooth surface
SK	**Slickensided**	Grooved or striated surface, usually polished.

Surface Shape – Defect surface roughness is described as follows:

PL	**Planar**	The defect does not vary in orientation.
CU	**Curved**	The defect has a gradual change in orientation
UN	**Undulating**	The defect has a wavy surface.
ST	**Stepped**	The defect has one or more well defined steps
IR	**Irregular**	The defect has many sharp changes of orientation

Defect Infilling – Common abbreviation as follows:

Ca	Calcite	**Fe**	Iron Oxide	**Qz**	Quartz
Cy	Clay	**MS**	Secondary mineral	**X**	Carbonaceous

Defect Coatings and Seam Composition - Coatings are described using the following terms:

CN	**Clean**	No visible coating.
SN	**Stained**	No visible coating but surfaces are discoloured.
VN	**Veneered**	A visible coating of soil or mineral, too thin to measure; may ne patchy.
CO	**Coating**	A visible coating up to 1 mm thick. Soil in-fill greater than 1 mm shall be described using defect terms (e.g., infilled seam). Defects greater than 1 mm aperture containing rock material great described as a vein.

Defect Spacing, Length, Openness and Thickness – Described directly in millimetres and metres. In general descriptions, half order of magnitude categories is used, e.g. joint spacing typically 100 mm to 300 mm, sheared zones 1m to 3m thick.

Depending on project requirements and the scale of observation, spacing may be described as the mean spacing within a set of defects, or as the spacing between all defects within the rock mass. Where spacing is measured within a specific set of defects, measurements shall be made perpendicular to the defect set.

Where significant, the nature of the defect end condition is recorded in the context of the scale of the exposure.

Block Shape – Where it is considered significant, block shape should be described using terms given in Table 23, AS 1725:2017.

Stratigraphic Unit – Geological maps related to the project are used for the designation of lithological formation name and, where possible geological unit name, e.g., Bringelly Shale, Potts Hill Sandstone Member.

Core Loss – Core loss occurs when material is lost during the drilling process It is shown at the bottom of the run unless otherwise indicated where core loss is known.

Total Core Recovery – The percentage of rock recovered excluding core loss per core run.

Defect Spacing – The spacing of successive defects or the mean spacing for relatively broken core.

Fracture Index – Which is the number defects per metre of core.

Rock Quality Designation (RQD) – The percentage of sound core pieces of 100mm or greater per core run and is calculated using Deere et al. (1989) method.

Rock Classification System – For design purpose, Sydney Rock Mass Classification System (Pells et al. 1998, 2019) is adopted.

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BH No: W2SH-BH01
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 11 Allen St, Waterloo
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 27/05/2022
Finished: 27/05/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 334005E, 6247191N
Driller: CC
Logged: AH
RL Surface: 19.94m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT / ADT						-	Asphaltic CONCRETE, 35mm.			-	-	PAVEMENT
						-	CONCRETE, 150mm, aggregate, 10-30mm.					
						-	FILL: Sandy GRAVEL, medium sub-angular igneous gravel, brown, fine to mediumg grained sand, trace clay and silt, well graded, appears well compacted.			M		FILL
			19.5	0.5		SM	Clayey SAND, fine to medium grained, brown, trace silt, poorly graded.	6 17 14 12	ES		D - VD	COASTAL DEPOSITS
									ES, PSD: 0.6-0.9			
			19.0	1.0					ES			
									TR			
			18.5	1.5					ES			
	▼					CI-CH	Silty CLAY, medium to high plasticity, grey mottled, brown-yellow, trace fine grained sand.		SPT 0, 0, 1 N=1		S	
			18.0	2.0								
							Target depth. Borehole W2SH-BH01 terminated at 2m					
			17.5	2.5								
			17.0	3.0								

A. AUGERED BOREHOLE + LOCATION CHANGE 14777.GPJ GINT STD AUSTRALIA.GDT 19/8/22

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BH No: W2SH-BH02
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 34 Pitt St, Waterloo
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 23/06/2022
Finished: 23/06/2022
Borehole Size: 250 mm

Rig Type: TDLR690
Hole Coordinates 333980E, 6247372N
Driller: CC
Logged: AH
RL Surface: 22.63m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT	Not Encountered	22.5			-	Asphaltic CONCRETE, 140mm.			-	-	PAVEMENT
ADT					-	CONCRETE PAVEMENT, 130mm.			-	-	
					-	FILL: Sandy GRAVEL, medium sub-angular igneous gravel, grey, fine to medium grained sand, well cemented, poorly to moderately compacted, poorly graded.			-	-	FILL
			0.5		-	FILL: Sandy GRAVEL, medium sub-angular igneous gravel, grey, fine to medium grained sand, appears well comapcted.		ES	-	-	
					-	FILL: SAND, fine grained, grey-brown, with silt, poorly graded.			-	-	
		22.0			SP	SAND, fine to medium grained, orange-yellow, with clay and silt, poorly graded.			-	MD	COASTAL DEPOSITS
								ES, PSD			
			1.0					TR			
		21.5									
						1.4m: pale brown-yellow.		ES			
			1.5								
		21.0						SPT 3, 4, 5 N=9			
			2.0								
						Target Depth Borehole W2SH-BH02 terminated at 2m					
		20.5									
			2.5								
		20.0									
			3.0								

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BH No: W2SH-BH03
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 250 Pitt St, Waterloo
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 27/05/2022
Finished: 27/05/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 333985E, 6247458N
Driller: CC
Logged: AH
RL Surface: 28.18m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT						-	Asphaltic CONCRETE, 35mm.			-	-	PAVEMENT
			28.0			-	FILL: Gravelly SAND, fine to medium grained, grey, well graded, fine to medium sub-angular igneous gravel, with silt, appears well compacted.	20		M		FILL
								27	ES			
				0.5				25				
ADT	Not Encountered					SM	Silty SAND, fine grained, dark grey-brown, trace gravel.		ES		VD	COASTAL DEPOSITS
			27.5									
						SP	SAND, fine grained, grey-brown-yellow, trace clay and silt.		ES, PSD			
				1.0					TR			
			27.0						PSD			
				1.5								
			26.5						SPT 2, 4, 6 N=10			
						SP	SAND, fine to medium grained, pale brown-yellow, trace silt.				MD	
				2.0								
			26.0									
				2.5					PSD			
			25.5									
				3.0					TR			
			25.0									
				3.5								
			24.5									
				4.0								
			24.0									
				4.5							MD - D	
			23.5						SPT 7, 18, - N = R			
				5.0			Target Depth Borehole W2SH-BH03 terminated at 4.85m					

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BH No: W2SH-BH04
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 241 Pitt St, Waterloo
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 27/05/2022
Finished: 27/05/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 333921E, 6247725N
Driller: CC
Logged: AH
RL Surface: 28.01m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT						-	Asphaltic CONCRETE, 110mm.			-	-	PAVEMENT
ADT	Not Encountered					-	FILL: Sandy GRAVEL, medium sub-angular igneous gravel, grey, fine to medium sand, poorly graded (ballast), appears well compacted.			M		FILL
						-	FILL: Gravelly SAND, fine to medium grained, pale brown, fine to medium sub-angular sandstone gravel, appears well compacted.		ES			
			27.5	0.5		SP	SAND, fine grained, orange-pale brown, trace low plasticity clay, poorly graded.	3 14 13 13	ES, PSD		MD	COASTAL DEPOSITS
			27.0	1.0					TR-U75			
						SC	Clayey SAND, fine to medium grained, orange-pale brown, low plasticity, trace silt, poorly graded.		ES			
			26.5	1.5		CI-CH	Silty CLAY, medium to high plasticity, brown mottled red, trace ironstone gravel.		SPT 3, 5, 7 N=12 PSD: 1.4-1.6 & 1.6-1.95		St	COASTAL DEPOSITS/RESIDUAL
			26.0	2.0			Target Depth Borehole W2SH-BH04 terminated at 2m					
			25.5	2.5								
				3.0								

DCP per 150mm: 2 4 9 18

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BH No: W2SH-BH05
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 171 Pitt St, Waterloo
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 24/06/2022
Finished: 24/06/2022
Borehole Size: 200 mm

Rig Type: TDLR690
Hole Coordinates 333883E, 6248025N
Driller: CC
Logged: AH
RL Surface: 33.77m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT	Not Encountered					-	Asphaltic CONCRETE, 110mm.			-	-	PAVEMENT
ADT						-	FILL: Sandy GRAVEL, medium sub-angular gravel, grey, fine to medium sand, poorly graded (ballast), appears well compacted.		ES	D	-	FILL
						-	FILL: Gravelly SAND, fine to medium grained, grey, fine sub-angular igneous gravel, appears well compacted.		ES	D	-	
			33.5			-	FILL: Clayey SAND, fine to medium grained, pale brown, medium plasticity clay, trace sand and gravel and inferred boulders/cobbles, appears well compacted.			M	-	
				0.5		SP	Clayey SAND, fine grained, pale brown-orange, poorly graded.	7 8		M	MD	COASTAL DEPOSITS
			33.0									
				1.0					TR-U75			
			32.5						ES/PSD/PI			
				1.5		CI	Silty CLAY, medium plasticity, brown mottled red, with fine rounded ironstone gravel.		SPT 2, 4, 6 N=10	MC > PL	St	COASTAL DEPOSITS/RESIDUAL
			32.0									
				2.0			Target Depth Borehole W2SH-BH05 terminated at 2m					
			31.5									
				2.5								
			31.0									
				3.0								

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BH No: W2SH-BH06
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 83 Redfern St, Waterloo
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 24/06/2022
Finished: 24/06/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 333995E, 6248267N
Driller: CC
Logged: AH
RL Surface: 33.52m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT DT	Not Encountered					-	Asphaltic CONCRETE, 55mm.			-	-	PAVEMENT
						-	CONCRETE, 140mm.					
						-	CONCRETE, 255mm.					
			33.0	0.5		-	FILL: Sandy GRAVEL, medium angular igneous gravel, grey, fine to medium grained sand, poorly graded (ballast), appears well compacted.		ES	W	-	FILL
						-				W	-	
						SM	FILL: Gravelly SAND, fine to medium grained, grey, fine sub-angular igneous gravel, appears well compacted. Silty SAND, fine to medium grained, grey, well graded, with clay, trace angular ironstone gravel.		ES	W	MD	COASTAL DEPOSITS
			32.5	1.0		SP	SAND, fine to medium grained, pale brown, with silt, trace clay.		ES/PSD	MC > PL	MD	
									TR-U75			
			32.0	1.5		CL	Sandy CLAY, low plasticity, grey mottled orange-brown, fine to medium grained sand.		PSD/PI	MC > PL	S	COASTAL DEPOSITS/RESIDUAL
			31.5	2.0		CI-CH	Silty CLAY, medium to high plasticity, orange brown and grey (SPT colour profile split vertically), trace fine to medium sub-angular ironstone/shale gravel. 1.7m: high plasticity.		SPT 3, 2, 3 N=5	MC >> PL	S	
											F	
											S	
			31.0	2.5			Target Depth Borehole W2SH-BH06 terminated at 2.1m					
				3.0								

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BH No: W2SH-BH07
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 53 Great Buckingham St, Redfern
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 8/06/2022
Finished: 8/06/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 334170E, 6248430N
Driller: CC
Logged: AH
RL Surface: 41.35m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT	Not Encountered					-	Asphaltic CONCRETE, 180m.			-	-	PAVEMENT
ADT			41.0			-	FILL: Sandy GRAVEL, fine to medium sub-angular igneous gravel, grey, fine to medium grained sand, well graded, appears well compacted.		ES	D	-	FILL
								9	ES			
				0.5		-	FILL: SAND, fine gravel, pale brown, poorly graded.	10		-	-	
						CI-CH	Silty CLAY, high plasticity, grey mottled orange-brown, trace fine sub-angular ironstone gravel.	9		-	St	COASTAL DEPOSITS/RESIDUAL
			40.5						ES			
									PI			
				1.0					TR-U75			
			40.0									
				1.5								
							1.6m: trace fine to medium grained sand/silt and organics (wood).		SPT 5, 9, 13 N=22		VSt	
			39.5									
				2.0								
							Target Depth Borehole W2SH-BH07 terminated at 2m					
			39.0									
				2.5								
			38.5									
				3.0								

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BH No: W2SH-BH08
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 1-5 Buckingham St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 11/07/2022
Finished: 11/07/2022
Borehole Size: 110 mm

Rig Type: CE180
Hole Coordinates 334187E, 6248533N
Driller: DR
Logged: AH
RL Surface: 35.45m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT DT	Not Encountered					-	Asphaltic CONCRETE, 50mm.			-	-	PAVEMENT
						-	FILL: Gravelly SAND, fine to medium grained, grey, fine to medium sub-angular igneous gravel.	6		-	-	FILL
			35			-	FILL: Silty CLAY, medium plasticity, brown, with fine to medium grained sand and fine sub-angular igneous gravel.	8	ES	D	-	
								7	SPT 6, 9, 9 N=18			
				1		CI-CH	Silty CLAY, medium to high plasticity, grey mottled red, with fine sub-angular ironstone gravel.		ES TR	D	VSt	RESIDUAL
			34									
									SPT 5, 12, 23 N=35			
				2			1.8m: ironstone gravels.				H	
			33			CI	Silty CLAY, high plasticity, orange-brown, with fine to medium sub-angular shale gravel.			D	H	
				3					TR			
									SPT 6, 10, 19 N=29 PSD/PI			
			32			-	SHALE, extremely weathered, very low strength, grey with iron staining, recovered as CLAY, medium to high plasticity, grey, with ironstone gravel.			-	-	WEATHERED SHALE
				4								
			31			-	SHALE, highly weathered, low strength, grey-brown.			-	-	BEDROCK
				5								
			30									
				6								
							Target Depth Borehole W2SH-BH08 terminated at 6m					
			29									
				7								
			28									
				8								

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BH No: W2SH-BH09
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Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 2 Buckingham St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 13/07/2022
Finished: 13/07/2022
Borehole Size: 110 mm

Rig Type: CE180
Hole Coordinates 334199E, 6248643N
Driller: DR
Logged: AH
RL Surface: 32.23m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	Not Encountered		32			-	Asphaltic CONCRETE, 100mm.			-	-	PAVEMENT
						-	Concrete Pavement/Stabilized Roadbase, fine to medium sub-angular igneous gravel.			-	-	
						-	FILL: Gravelly SAND, fine grained, grey, angular gravel, appears well compacted.	5		W	-	FILL
						-	FILL: Clayey SAND, fine grained, dark brown, appears poorly to moderately compacted.	6	SPT 3, 3, 2 N=5 ES: 0.7 & 0.9	M	-	
						SP	SAND, fine grained, grey-brown, with silt.			M	L	COASTAL DEPOSITS
				1					TR			
			31				1.3m: pale brown and grey.		ES			
						SC	Clayey SAND, fine to medium grained, pale grey, medium plasticity clay. 1.7m: orange mottled red.		SPT 1, 1, 3 N=4	M	L	
				2								
			30			CI-CH	CLAY, medium to high plasticity, red-brown, with silt.			MC > PL	St	RESIDUAL
				3					TR/PI			
						CH	CLAY, high plasticity, grey mottled brown-red, with fine to coarse ironstone and shale gravel.		SPT 6, 11, 15 N=26	MC > PL	VSt	
			29									
				4					PI			
			28						SPT 6, 9, 13 N=22			
				5					TR			
			27									
				6								
			26				Target Depth Borehole W2SH-BH09 terminated at 6m					
				7								
			25									
				8								

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BH No: W2SH-BH10
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Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 1 Little Buckingham St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 24/06/2022
Finished: 24/06/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 334249E, 6248970N
Driller: CC
Logged: AH
RL Surface: 28.27m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT	Not Encountered					-	Asphaltic CONCRETE, 110mm.			-	-	PAVEMENT
ADT						-	FILL: Sandy GRAVEL, fine to medium sub-angular igneous gravel, grey, fine to medium sand, appears well graded (ballast), appears well compacted.			M	-	FILL
			28.0			-	FILL: Gravelly SAND, fine to medium grained, grey, fine to medium sub-angular crushed sandstone gravel, well graded, appears well compacted.		ES	M	-	
				0.5		SM	Silty SAND, fine grained, grey-brown, trace fine gravel.	7 9	ES	D - M	MD	COASTAL DEPOSITS/RESIDUAL
			27.5			SC	Clayey SAND, fine grained, brown, low to medium plasticity clay, with organics.	9	PSD	M	MD	
				1.0					TR/ES			
			27.0			SP	SAND, fine to medium grained, grey-pale brown, trace silt.			M	L - MD	
				1.5					SPT 8, 6, 4 N=10			
			26.5			CL-CI	Clayey SAND, fine grained, grey, low plasticity.		PI	MC > PL	F - St	
				2.0			Target Depth Borehole W2SH-BH10 terminated at 2m					
			26.0									
				2.5								
			25.5									
				3.0								

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BH No: W2SH-BH11
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 56 Waterloo St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 24/06/2022
Finished: 24/06/2022
Borehole Size: 110 mm

Rig Type: TDLR690
Hole Coordinates 334476E, 6248939N
Driller: CC
Logged: AH
RL Surface: 40.22m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT ADT						-	Asphaltic CONCRETE, 50mm.			-	-	PAVEMENT
			40.0			-	FILL: Sandy GRAVEL, fine to medium sub-angular igneous gravel, grey-pale grey, fine to medium grained sand, with sandstone cobbles, appears well compacted.			D	-	FILL
						-	FILL: SAND, fine to medium grained, grey, with silt.	5 5	ES	M	-	
				0.5		SP	SAND, fine grained, brown, with silt and clay.	4		M	L - MD	COASTAL DEPOSITS
			39.5						ES			
				1.0					TR			
			39.0						PSD/ES			
	▼ GW @ 1.5m			1.5								
						SP	SAND, fine to medium grained, orange-brown, trace clay.			S	L	
			38.5			CI-CH	CLAY, medium to high plasticity, grey-brown, with silt.		SPT 1, 2, 1 N=3	MC > PL	S	COASTAL DEPOSITS/RESIDUAL
				2.0			Target Depth Borehole W2SH-BH11 terminated at 2m					
			38.0									
				2.5								
			37.5									
				3.0								

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BH No: W2SH-BH12
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 43 Bellevue St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 23/06/2022
Finished: 23/06/2022
Borehole Size: 250 mm

Rig Type: TDLR690
Hole Coordinates 334582E, 6249255N
Driller: CC
Logged: AH
RL Surface: 38.33m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT	Not Encountered					-	Asphaltic CONCRETE, 110mm.			-	-	PAVEMENT
ADT						-	FILL: Sandy GRAVEL, fine to medium sub-angular igneous gravel, grey-brown, fine to medium grained sand, well graded, appears well compacted (road base).		ES	M	-	FILL
						-	FILL: Gravelly SAND, fine to medium grained sand, pale brown, fine to medium sub-angular crushed sandstone gravel, trace clay.		ES	M	-	
			38.0									
				0.5		-	FILL: Sandy CLAY, low to medium plasticity, orange-red, with fine sub-angular ironstone gravel, appears moderately compacted.	6		M	-	
							0.6m: pale brown-orange.	20	ES			
								9				
			37.5			-	FILL: Gravelly SAND, fine to medium grained sand, pale brown, fine to medium sub-angular crushed sandstone gravel, trace clay.			M	-	
				1.0		-	FILL: Sandy CLAY, low to medium plasticity, brown, fine to medium grained sand, trace fine to medium angular sandstone gravel.		TR-U75	M	-	
			37.0						ES			
				1.5		Cl	Clayey SAND, fine grained, orange-brown, low to medium plasticity.		SPT 2, 3, 3 N=6	MC ~ PL	L	COASTAL DEPOSITS/RESIDUAL
			36.5									
				2.0					PSD			
							2.1m: orange-brown mottled red.					
			36.0									
				2.5			Target Depth Borehole W2SH-BH12 terminated at 2.4m					
			35.5									
				3.0								

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BH No: W2SH-BH13
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 6 Commonwealth St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 13/07/2022
Finished: 13/07/2022
Borehole Size: 100 mm

Rig Type: Ute Rig
Hole Coordinates 334534E, 6249437N
Driller: Carlos
Logged: AS
RL Surface: 21.8m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: JA

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
PC	Not Encountered		21.8	0.0		-	Asphaltic Concrete, 250mm.	2 4 9 18		D	-	PAVEMENT
			21.5			-	CONCRETE PAVEMENT, 100mm.					
ADT						-	FILL: Gravelly SAND, fine to coarse grained, brown, fine to coarse grained angular igneous gravel.					FILL
				0.5				20				
			21.0						ES			
				1.0		CL-CI	Sandy CLAY, low to medium plasticity, orange-brown, fine grained sand.		U75	MC < PL	VSt	RESIDUAL
			20.5						ES			
									PI			
				1.5		-	SHALE, extremely weathered, grey brown, recovered as CLAY, high plasticity.		SPT 25/75mm N=R		-	EXTREMELY WEATHERED SHALE
							Refusal on EW Bedrock Borehole W2SH-BH13 terminated at 1.57m					
			20.0	2.0								
			19.5	2.5								
			19.0	3.0								

A. AUGERED BOREHOLE + LOCATION CHANGE 14777.GPJ GINT STD AUSTRALIA.GDT 19/8/22

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BH No: W2SH-BH14
Sheet: 1 of 1
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 19 Ann St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 13/07/2022
Finished: 13/07/2022
Borehole Size: 100 mm

Rig Type: Ute Rig
Hole Coordinates 334578E, 6249473N
Driller: Carlos
Logged: AS
RL Surface: 19.34m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: JA

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						-	Asphaltic CONCRETE, 100mm.			D	-	PAVEMENT
			19.0	0.5		-	FILL: Sandy GRAVEL, fine to medium, sub-angular igneous, brown, fine to coarse grained sand, with clay, moderately compacted.	7 9 5	ES			FILL
			18.5			-	FILL: Gravelly SAND, fine to coarse grained, dark grey, fine to coarse sub-angular igneous gravel, with rootlets and organics, moderately compacted.	5	ES			
	GW @ 0.9m			1.0		-	FILL: Clayey SAND, fine to medium grained, grey, low plasticity clay,moderately compacted.	3	TR-U75	W	-	
			18.0						PI			
			17.5	1.5		CH	CLAY, high plasticity, grey brown.		SPT 0, 1, 0 N=1	St	VS	RESIDUAL
			17.0	2.0			Target Depth Borehole W2SH-BH14 terminated at 2m					
			16.5	2.5								
				3.0								

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BH No: W2SH-BH15
PAGE 1 OF 2
Job No: 14777

Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 1A Great Buckingham St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 13/07/2022
Finished: 13/07/2022
Borehole Size: 110 mm

Rig Type: BG Drilling
Hole Coordinates 334195E, 6248584N
Driller: DR
Logged: AH
RL Surface: 34.98m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
DT ADT	Not Encountered					-	Asphaltic CONCRETE, 50mm.			-	-	PAVEMENT
						-	FILL: Sandy GRAVEL, fine to medium sub-angular igneous gravel,grey, fine to medium grained sand, appears well compacted.			M	-	FILL
						-			ES	M	-	
						CI-CH	FILL: Gravelly SAND, medium to coarse grained, grey, fine to medium sub-angular igneous gravel, with silt, appears well compacted.	10 9 9	SPT 5, 7, 10 N=17	MC > PL	VSt	RESIDUAL
			34	1			CLAY, medium plasticity, grey mottled red, with gravel, trace sand.		TR			
							1.5m: ironstone shale gravel, trace fine to medium grained sand.		SPT 4, 14, 12 N=26		H	
			33	2								
			32	3					TR/PI			
						-	SHALE, highly weathered, very low strength, orange-brown.		SPT HB	-	-	BEDROCK
			31	4			Borehole W2SH-BH15 continued as cored hole					
			30	5								
			29	6								
			28	7								
			27	8								

DCP per 150mm: 2 4 9 18

A. AUGERED BOREHOLE + LOCATION CHANGE 14777.GPJ GINT STD AUSTRALIA.GDT 19/8/22

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Cored Borehole Log

Client: Ausgrid
Project: Ausgrid Cable Project
Location: 1A Great Buckingham St, Surry Hills
Hole Location: Refer to drawing 14777-GR-1-1-A
Started: 13/07/2022
Finished: 13/07/2022
Borehole Size: 110 mm

Rig Type: BG Drilling
Hole Coordinates 334195E, 6248584N
Driller: DR
Logged: AH
RL Surface: 34.98m
Contractor: Alliance Geotechnical
Bearing: ---
Checked: AS

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (● - Axial, ○ - Diametral) EL -0.03 VL -0.1 L -0.3 M -1 H -3 VH -10 EH	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Additional Data
			34	1								
			33	2								
			32	3								
						Continued from non-cored borehole						
NMLC			31	4		Core Loss, 100mm.	-					4.02 - BP, 0°, PL, RO, CN.
						SHALE, brown, distinctly laminated at 0°.	HW		D A 0.11 0.04			4.03 - BP, 0°, PL, RO, CN.
												4.04 - BP, 0°, PL, RO, Cy VN.
												4.08 - BP, 0°, PL, RO, Cy VN.
												4.13 - BP, 0°, PL, RO, CN.
												4.16 - BP, 0°, PL, RO, Fe SN.
												4.21 - BP, 0°, PL, RO, CN.
												4.28 - BP, 0°, PL, RO, CN.
												4.35 - BP, 0°, PL, RO, CN.
												4.45 - BP, 0°, PL, RO, CN.
			30	5		Core Loss, 150mm.	-			8		4.53 - BP, 0°, PL, RO, CN.
						SHALE, brown, distinctly laminated at 0°.	HW					4.66 - BP, 5°, PL, RO, CN.
						SHALE, grey, distinctly laminated at 0°.						4.78 - BP, 5-10°, PL, RO, Cy CO.
												5.04 - BP, 0°, PL, RO, CN.
												5.07-5.14 - CS, Cy, 140mm.
						Core Loss, 100mm.	-					5.22 - BP, 0°, PL, RO, Cy VN.
						SHALE, grey, distinctly laminated at 0°.	HW					5.30 - BP, 0°, PL, RO, CN.
												5.3-5.4 - CS, Cy, 100mm.
			29	6		Core Loss, 50mm.	-					5.625 - JT, 90°, PL, RO, Cy VN.
						SHALE, grey, distinctly laminated at 0°.	HW					5.75-5.85 - CS, Cy, 100mm.
						Target Depth						End of Borehole
						W2SH-BH15 terminated at 6m						
			28	7								
			27	8								

W2S – BH15 – Core Box 1/1

Client Name	Ausgrid	Photo Number	-
Project Name	Ausgrid Cable Project	Photo Date	13/7/22
Project Location	1A Great Buckingham St, Surry Hills	Report Number	14777-GR-1-1

APPENDIX D – Laboratory Test Certificates

Material Test Report

Report Number: **14777-1**
Issue Number: 1
Date Issued: 12/07/2022
Client: Alliance Geotechnical
10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Alexandria, Surry Hills & Waterloo
Contractor: Ausgrid
Work Request: 19419
Date Sampled: 29/05/2022
Dates Tested: 31/05/2022 - 30/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received

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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
22-19419A	A2KBH2, Depth: 0.8-1.0m	14.6 %	Clayey SAND, with gravel, brown
22-19419B	A2KBH2, Depth: 0.9-1.2m	16.5 %	Clayey Gravelly SAND, dark brown
22-19419C	A2KBH5, Depth: 0.8-1.0m	2.9 %	SAND, trace clay/silt, trace gravel, brown
22-19419D	A2KBH5, Depth: 0.9-1.2m	2.9 %	SAND, trace gravel, brown
22-19419E	A2KBH6, Depth: 0.6-0.8m	9.7 %	SAND, trace clay/silt, brown
22-19419F	A2KBH6, Depth: 0.9-1.2m	3.4 %	SAND, trace gravel, brown yellow
22-19419G	A2KBH7, Depth: 0.9-1.2m	19.4 %	SAND, trace gravel, trace clay/silt, brown
22-19419H	A2KBH7, Depth: 1.6-1.8m	71.0 %	Sandy CLAY, dark brown
22-19419I	A2KBH8, Depth: 0.6-0.8m	2.2 %	SAND, trace clay/silt, brown
22-19419J	A2KBH8, Depth: 0.9-1.2m	2.4 %	SAND, yellow
22-19419K	A2KBH9, Depth: 0.9-1.2m	8.0 %	SAND, trace clay/silt, grey brown
22-19419L	A2KBH9, Depth: 0.9-1.2m	1.9 %	SAND, trace gravel, brown
22-19419M	A2KBH14, Depth: 0.7-0.9m	2.1 %	SAND, with clay/silt, grey
22-19419N	A2KBH14, Depth: 0.9-1.2m	1.4 %	SAND, trace gravel, brown yellow
22-19419O	A2KBH15, Depth: 1.5-1.6m	4.9 %	SAND, trace clay/silt, grey
22-19419P	A2KBH15, Depth: 0.9-1.2m	0.4 %	SAND, brown
22-19419Q	A2KBH16, Depth: 0.9-1.2m	2.6 %	SAND, trace gravel, light brown-brown
22-19419R	A2KBH16, Depth: 1.2-1.5m	3.6 %	SAND, trace clay/silt, brown
22-19419S	A2KBH18, Depth: 0.9-1.2m	9.0 %	Gravelly SAND, brown
22-19419T	A2KBH18, Depth: 1.6-2.0m	3.2 %	SAND, trace clay/silt, grey
22-19419U	A2KBH19, Depth: 0.6-0.8m	5.8 %	SAND, trace clay/silt, brown grey
22-19419V	A2KBH19, Depth: 0.9-1.2m	3.5 %	SAND, trace gravel, yellow brown
22-19419W	W2SBH1, Depth: 0.6-0.9m	7.0 %	Clayey SAND, trace gravel, brown
22-19419X	W2SBH1, Depth: 0.9-1.2m	16.1 %	Clayey SAND, grey brown
22-19419Y	W2SBH3, Depth: 2.5-2.7m	2.5 %	SAND, trace clay/silt, yellow
22-19419Z	W2SBH3, Depth: 0.9-1.2m	2.5 %	SAND, trace clay/silt, brown
22-19419AA	W2SBH3, Depth: 2.9-3.2m	3.0 %	SAND, trace clay/silt, trace gravel, yellow brown
22-19419AB	W2SBH4, Depth: 1.4-1.6m	10.7 %	Clayey SAND, trace gravel, brown
22-19419AC	W2SBH4, Depth: 0.9-1.2m	3.8 %	SAND, trace clay/silt, brown

Material Test Report

Report Number: **14777-2**
Issue Number: 1
Date Issued: 12/07/2022
Client: Alliance Geotechnical
10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Alexandria, Surry Hills & Waterloo
Contractor: Ausgrid
Work Request: 19739
Date Sampled: 10/06/2022
Dates Tested: 20/06/2022 - 30/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received

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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
22-19739A	A2KBH13, Depth: 0.9-1.2m	2.2 %	SAND, trace gravel, light brown
22-19739B	A2KBH13, Depth: 2.5-3.2m	1.2 %	SAND, trace gravel, brown yellow
22-19739C	A2KBH13, Depth: 4.5-5.0m	1.1 %	SAND, yellow
22-19739D	A2KBH13, Depth: 6.9-7.2m	1.1 %	SAND, yellow
22-19739E	A2KBH13, Depth: 8.9-9.2m	5.4 %	SAND, yellow
22-19739F	A2KBH17, Depth: 0.9-1.2m	3.3 %	SAND, light brown and brown
22-19739H	A2KBH20, Depth: 0.9-1.2m	1.3 %	SAND, light brown
22-19739I	A2KBH20, Depth: 2.8-3.2m	1.7 %	SAND, trace gravel, light brown
22-19739J	A2KBH20, Depth: 4.0-4.5m	1.5 %	SAND, yellow
22-19739K	A2KBH20, Depth: 5.5-6.0m	8.9 %	SAND, yellow brown
22-19739L	A2KBH21, Depth: 0.9-1.2m	1.3 %	SAND, trace gravel, light brown
22-19739M	A2KBH21, Depth: 2.9-3.3m	2.2 %	SAND, yellow
22-19739N	A2KBH21, Depth: 4.9-5.2m	4.2 %	SAND, trace gravel, yellow

Material Test Report

Report Number: **14777-3**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Alexandria, Surry Hills & Waterloo
Contractor: Ausgrid
Work Request: 19742
Date Sampled: 08/06/2022
Dates Tested: 20/06/2022 - 05/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received

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Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
22-19742A	W2SBH7, Depth: 0.8-0.9m	23.8 %	Silty CLAY, high plasticity, grey mottled brown-red, trace ironstone gravel
22-19742B	W2SBH7, Depth: 0.9-1.2m	14.3 %	Silty CLAY, high plasticity, grey mottled brown-red, trace ironstone gravel
22-19742C	NSBH5, Depth: 0.9-1.2m	17.4 %	Silty CLAY, low plasticity, brown, trace gravel
22-19742D	NSBH5, Depth: 1.2-1.4m	12.9 %	Silty CLAY, low plasticity, brown, trace gravel
22-19742E	NSBH6, Depth: 0.7-0.9m	27.1 %	Silty CLAY, medium plasticity, dark grey-brown, trace sand
22-19742F	NSBH6, Depth: 0.9-1.2m	29.3 %	Silty CLAY, medium plasticity, dark grey-brown, trace sand
22-19742G	NSBH7, Depth: 0.8-0.9m	21.9 %	SAND, with gravel, brown
22-19742H	NSBH7, Depth: 0.9-1.2m	26.6 %	Silty CLAY, medium plasticity, brown, trace gravel
22-19742I	NSBH8, Depth: 0.6-0.8m	25.3 %	Silty CLAY, high plasticity, dark brown
22-19742J	NSBH8, Depth: 0.9-1.2m	21.8 %	Silty CLAY, medium to high plasticity, red-brown

Material Test Report

Report Number: **14777-4**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Alexandria, Surry Hills & Waterloo
Contractor: Ausgrid
Work Request: 19954
Date Sampled: 24/06/2022
Dates Tested: 01/07/2022 - 11/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample dates between 21/06/2022 to 24/06/2022

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Approved Signatory: Brett Bellingham
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NATA Accredited Laboratory Number: 15100

Moisture Content AS 1289 2.1.1

Sample Number	Sample Location	Moisture Content (%)	Material
22-19954A	A2KBH01, Depth: 0.9-1.2m	28.2 %	Sandy CLAY, low to medium plasticity, dark grey, fine to medium grained sand, with silt
22-19954A	A2KBH01, Depth: 0.9-1.2m	24.9 %	Sandy CLAY, low to medium plasticity, dark grey, fine to medium grained sand, with silt
22-19954B	A2KBH01 (2.6-3.0m)	46.1 %	Clayey SAND, low plasticity, dark grey, trace gravel
22-19954C	A2KBH01, Depth: 2.9-3.2m	43.0 %	Clayey SAND, low plasticity, dark grey, trace gravel
22-19954C	A2KBH01, Depth: 2.9-3.2m	29.6 %	Clayey SAND, low plasticity, dark grey, trace gravel
22-19954D	A2KBH10, Depth: 0.1-0.5m	13.2 %	SAND, fine to medium grained, trace gravel, trace clay/silt, brown
22-19954E	A2KBH10, Depth: 0.9-1.2m	6.6 %	SAND, fine to medium grained, yellow-pale brown, trace silt
22-19954F	W2SBH2, Depth: 0.7-0.9m	3.8 %	SAND, trace gravel, trace clay/silt, grey-brown
22-19954G	W2SBH2, Depth: 0.9-1.2m	2.8 %	SAND, fine to medium grained, orange-yellow
22-19954H	W2SBH2, Depth: 0.9-1.5m	3.2 %	SAND, fine to medium grained, orange-yellow
22-19954J	W2SBH5, Depth: 0.9-1.2m	3.1 %	Clayey SAND, low plasticity, fine to medium grained, trace gravel, pale brown-orange
22-19954K	W2SBH5, Depth: 0.9-1.2m	2.9 %	Clayey SAND, low plasticity, fine to medium grained, trace gravel, pale brown-orange
22-19954L	W2SBH6, Depth: 1.0-1.4m	21.4 %	SAND, fine to medium grained, pale brown, with silt, trace clay
22-19954M	W2SBH6, Depth: 1.3-1.5m	22.3 %	Sandy CLAY, Low Plasticity, grey mottled orange-brown, fine to medium grained sand
22-19954N	W2SBH10, Depth: 0.9-1.2m	3.8 %	Clayey SAND, fine grained, low to medium plasticity, brown
22-19954O	W2SBH10 (1.8-2.0m)	7.7 %	Sandy CLAY, low plasticity, trace gravel, grey
22-19954P	W2SBH11, Depth: 1.2-1.5m	5.6 %	SAND, with clay/silt, trace gravel, brown
22-19954Q	W2SBH11, Depth: 0.9-1.2m	4.9 %	SAND, with clay/silt, trace gravel, brown
22-19954R	W2SBH12, Depth: 0.9-1.2m	8.0 %	Sandy CLAY, low to medium plasticity, with ironstone gravel, pale brown-orange
22-19954S	W2SBH12, Depth: 1.6-2.1m	13.3 %	Clayey SAND, low to medium plasticity, orange-brown
22-19954T	NSBH2, Depth: 1.2-1.5m	25.1 %	Sandy CLAY. medium plasticity, with silt, brown
22-19954U	NSBH2, Depth: 0.9-1.2m	11.5 %	Gravelly CLAY, medium plasticity, grey-brown

Material Test Report

Report Number: **14777-5**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Alexandria, Surry Hills & Waterloo
Contractor: Ausgrid
Work Request: 20102
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 20/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022

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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
22-20102A	W2SBH14, Depth: 1.0-1.5m	29.1 %	Clayey SAND, low plasticity, grey
22-20102B	W2SBH14, Depth: 0.9-1.2m	18.9 %	Clayey SAND, low plasticity, grey
22-20102C	NSBH3, Depth: 0.3-0.6m	26.2 %	CLAY, medium to high plasticity, with silt, brown
22-20102D	NSBH3, Depth: 0.9-1.2m	26.7 %	CLAY, medium to high plasticity, grey mottled pale brown, with silt, trace shale gravel
22-20102E	NSBH4, Depth: 0.9-1.2m	24.1 %	CLAY, medium plasticity, orange mottled pale grey-brown
22-20102G	NSBH1, Depth: 3.5-3.7m	21.8 %	Silty CLAY, high plasticity, red-brown & grey
22-20102H	NSBH1, Depth: 0.9-1.2m	19.1 %	Sandy CLAY, medium plasticity, dark grey, with gravel

Material Test Report

Report Number: **14777-6**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Alexandria, Surry Hills & Waterloo
Contractor: Ausgrid
Work Request: 20103
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 20/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022

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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
22-20103A	A2KBH11, Depth: 0.9-1.2m	6.8 %	Silty SAND, grey brown
22-20103B	A2KBH11, Depth: 2.9-3.2m	22.4 %	SAND, trace silt, orane-brown
22-20103C	A2KBH11, Depth: 4.9-5.2m	21.0 %	SAND, with silt, wih gravel, pale brown-yellow
22-20103E	A2KBH12, Depth: 0.9-1.2m	5.0 %	SAND, trace silt, pale brown-orange
22-20103F	A2KBH12, Depth: 3.9-4.2m	4.4 %	SAND, trace silt, pale brown
22-20103G	A2KBH12, Depth: 5.9-6.2m	13.1 %	SAND, trace silt, pale brown
22-20103H	A2KBH12, Depth: 7.9-8.2m	17.4 %	SAND, trace silt, grey-brown
22-20103I	A2KBH12, Depth: 9.9-10.0m	20.7 %	SAND, trace silt, grey-brown
22-20103K	A2KBH22, Depth: 0.9-1.2m	8.7 %	Silty SAND, brown
22-20103L	A2KBH22, Depth: 2.9-3.2m	6.5 %	SAND, brown
22-20103M	A2KBH22, Depth: 4.9-5.2m	5.6 %	SAND, brown
22-20103N	A2KBH22, Depth: 6.9-7.2m	20.5 %	SAND, pale grey
22-20103O	A2KBH22, Depth: 8.9-9.2m	19.2 %	SAND, pale grey
22-20103Q	W2SBH08, Depth: 0.9-1.2m	14.7 %	Silty CLAY, medium to high plasticity, with gravel, grey mottled red
22-20103R	W2SBH08, Depth: 2.9-3.2m	10.8 %	Silty CLAY, medium to high plasticity, with shale gravel, orange-brown
22-20103S	W2SBH09, Depth: 0.9-1.2m	15.7 %	SAND, with silt, grey-brown
22-20103T	W2SBH09, Depth: 2.9-3.2m	21.3 %	CLAY, medium to high plasticity, with silt, red-brown
22-20103U	W2SBH09, Depth: 4.9-5.2m	19.7 %	CLAY, high plasticity, with gravel, grey mottled brown-red
22-20103V	W2SBH09, Depth: 4.0-4.5m	22.7 %	CLAY, high plasticiity, with gravel, grey mottled brown-red
22-20103W	W2SBH15, Depth: 0.9-1.2m	18.7 %	CLAY, medium to high plasticity, grey mottled red
22-20103X	W2SBH15, Depth: 2.9-3.2m	13.7 %	CLAY, medium to high plasticity, with gravel, trace sand, grey mottled red
22-20103Z	W2SBH13, Depth: 0.9-1.5m	11.3 %	Sandy CLAY, low to medium plasticity, orange-brown

Material Test Report

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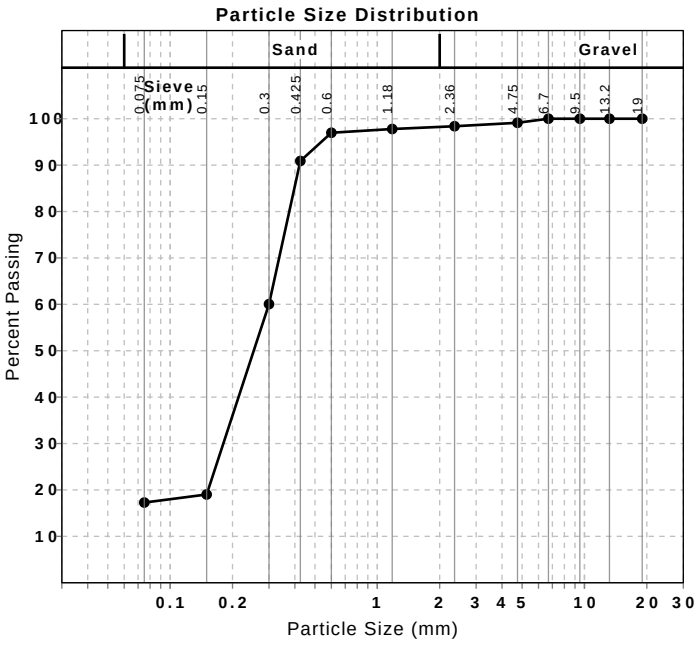
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-1**
Issue Number: 1
Date Issued: 12/07/2022
Client: Alliance Geotechnical
10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19419
Sample Number: 22-19419W
Date Sampled: 29/05/2022
Dates Tested: 31/05/2022 - 07/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **W2SHBH1, Depth: 0.6-0.9m**
Material: Clayey SAND, trace gravel, brown

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**99**		
2.36 mm	**98**		
1.18 mm	**98**		
0.6 mm	**97**		
0.425 mm	**91**		
0.3 mm	**60**		
0.15 mm	**19**		
0.075 mm	**17**		



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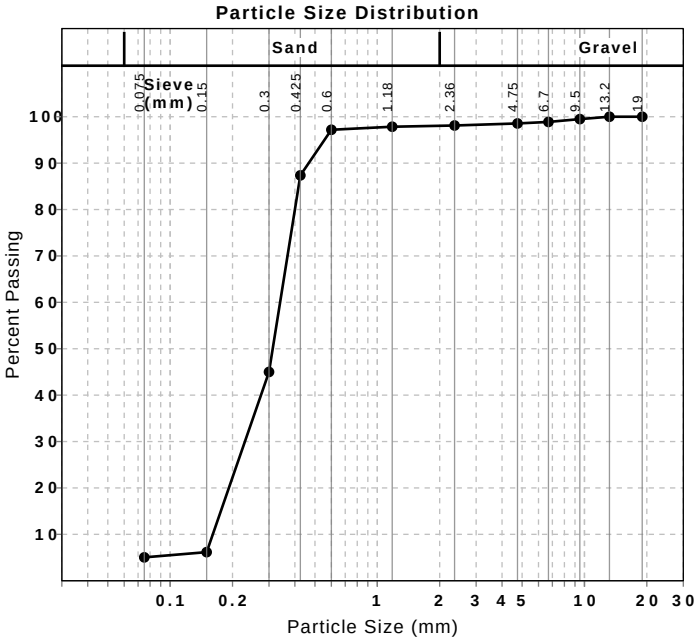
Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-4**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19954
Sample Number: 22-19954F
Date Sampled: 24/06/2022
Dates Tested: 01/07/2022 - 06/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample dates between 21/06/2022 to 24/06/2022
Sample Location: **W2SHBH2, Depth: 0.7-0.9m**
Material: SAND, trace gravel, trace clay/silt, grey-brown

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**99**		
6.7 mm	**99**		
4.75 mm	**99**		
2.36 mm	**98**		
1.18 mm	**98**		
0.6 mm	**97**		
0.425 mm	**87**		
0.3 mm	**45**		
0.15 mm	**6**		
0.075 mm	**5**		



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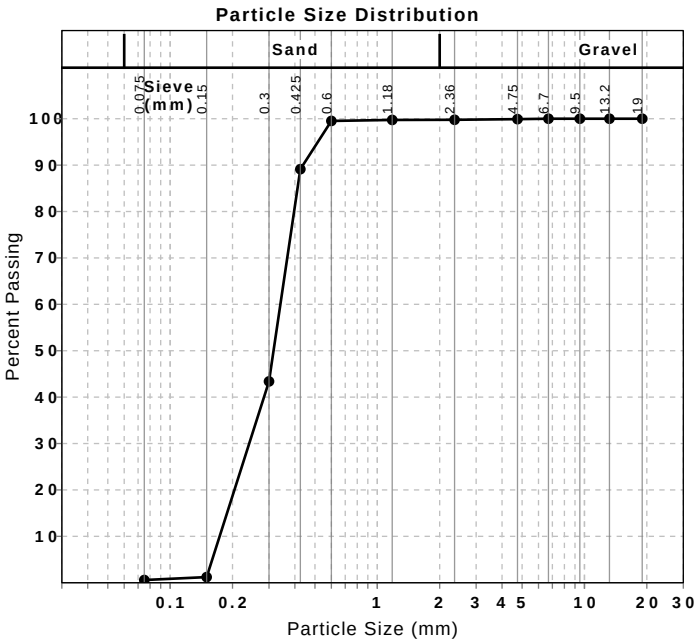
NATA Accredited Laboratory Number: 15100

Report Number: **14777-1**
Issue Number: 1
Date Issued: 12/07/2022
Client: Alliance Geotechnical
10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19419
Sample Number: 22-19419Y
Date Sampled: 29/05/2022
Dates Tested: 31/05/2022 - 07/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **W2SHBH3, Depth: 2.5-2.7m**
Material: SAND, trace clay/silt, yellow

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**100**		
2.36 mm	**100**		
1.18 mm	**100**		
0.6 mm	**100**		
0.425 mm	**89**		
0.3 mm	**43**		
0.15 mm	**1**		
0.075 mm	**1**		



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Approved Signatory: Brett Bellingham
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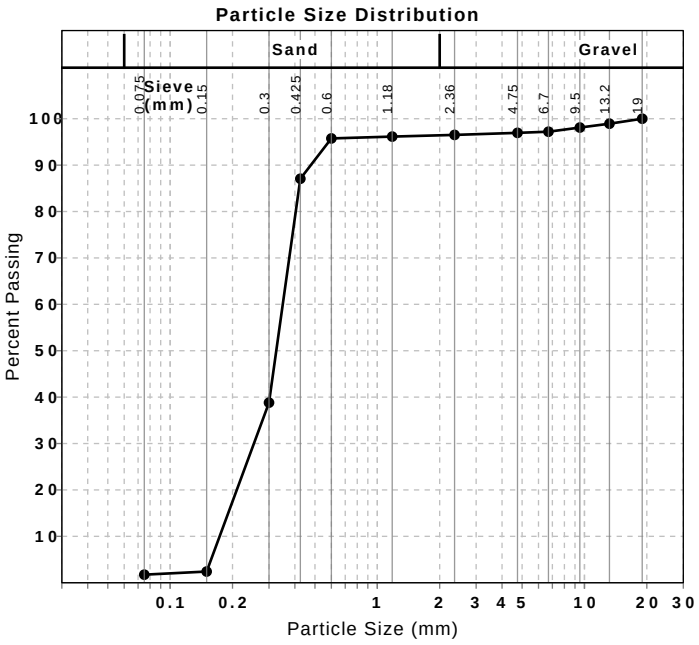
NATA Accredited Laboratory Number: 15100

Report Number: **14777-1**
Issue Number: 1
Date Issued: 12/07/2022
Client: Alliance Geotechnical
10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19419
Sample Number: 22-19419AA
Date Sampled: 29/05/2022
Dates Tested: 31/05/2022 - 07/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **W2SHBH3, Depth: 2.9-3.2m**
Material: SAND, trace clay/silt, trace gravel, yellow brown

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**99**		
9.5 mm	**98**		
6.7 mm	**97**		
4.75 mm	**97**		
2.36 mm	**97**		
1.18 mm	**96**		
0.6 mm	**96**		
0.425 mm	**87**		
0.3 mm	**39**		
0.15 mm	**2**		
0.075 mm	**2**		



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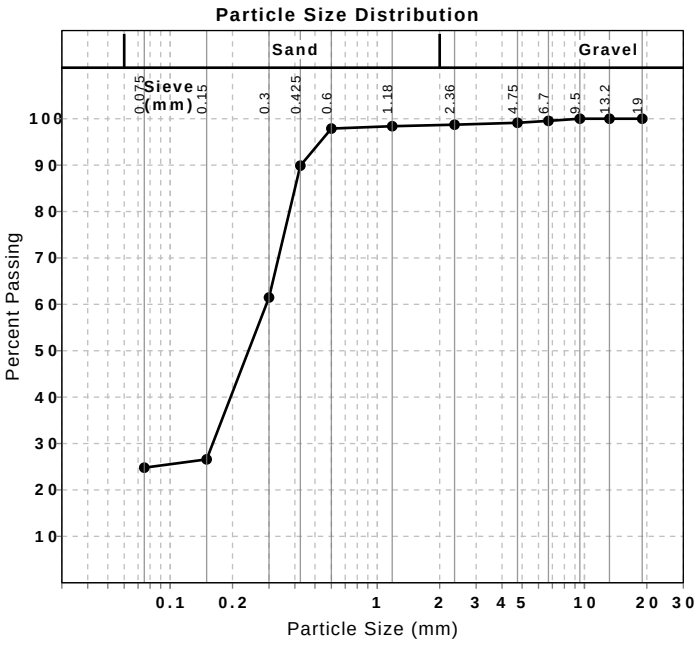
NATA Accredited Laboratory Number: 15100

Report Number: **14777-1**
Issue Number: 1
Date Issued: 12/07/2022
Client: Alliance Geotechnical
10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19419
Sample Number: 22-19419AB
Date Sampled: 29/05/2022
Dates Tested: 31/05/2022 - 07/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **W2SHBH4, Depth: 1.4-1.6m**
Material: Clayey SAND, trace gravel, brown

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**99**		
2.36 mm	**99**		
1.18 mm	**98**		
0.6 mm	**98**		
0.425 mm	**90**		
0.3 mm	**61**		
0.15 mm	**27**		
0.075 mm	**25**		



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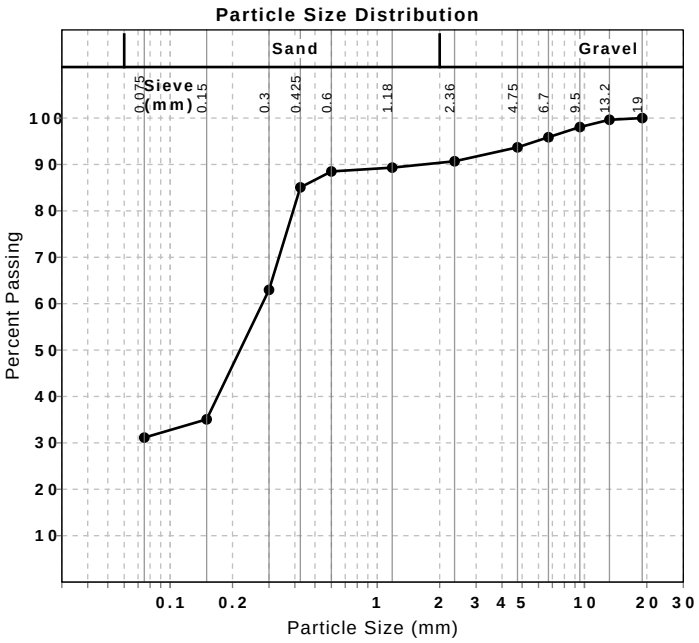
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-4**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19954
Sample Number: 22-19954I
Date Sampled: 24/06/2022
Dates Tested: 01/07/2022 - 06/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample dates between 21/06/2022 to 24/06/2022
Sample Location: **W2SHBH5, Depth: 1.2-1.5m**
Material: Clayey SAND, low plasticity, fine to medium grained, trace gravel, pale brown-orange

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**98**		
6.7 mm	**96**		
4.75 mm	**94**		
2.36 mm	**91**		
1.18 mm	**89**		
0.6 mm	**88**		
0.425 mm	**85**		
0.3 mm	**63**		
0.15 mm	**35**		
0.075 mm	**31**		



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Approved Signatory: Brett Bellingham
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NATA Accredited Laboratory Number: 15100

Report Number: **14777-4**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19954
Sample Number: 22-19954M
Date Sampled: 24/06/2022
Dates Tested: 01/07/2022 - 07/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample dates between 21/06/2022 to 24/06/2022
Sample Location: **W2SHBH6, Depth: 1.3-1.5m**
Material: Sandy CLAY, Low Plasticity, grey mottled orange-brown, fine to medium grained sand

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	21		
Plastic Limit (%)	11		
Plasticity Index (%)	**10**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	4.5		
Cracking Crumbling Curling	Cracking		

Material Test Report

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Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-3**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19742
Sample Number: 22-19742A
Date Sampled: 08/06/2022
Dates Tested: 20/06/2022 - 30/06/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **W2SHBH7, Depth: 0.8-0.9m**
Material: Silty CLAY, high plasticity, grey mottled brown-red, trace ironstone gravel

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	70		
Plastic Limit (%)	29		
Plasticity Index (%)	**41**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	6.5		
Cracking Crumbling Curling	Curling		

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Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-6**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 20103
Sample Number: 22-20103R
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 21/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022
Sample Location: **W2SHBH08, Depth: 2.9-3.2m**
Material: Silty CLAY, medium to high plasticity, with shale gravel, orange-brown

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	55		
Plastic Limit (%)	23		
Plasticity Index (%)	**32**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	12.0		
Cracking Crumbling Curling	None		

Material Test Report

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Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-6**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 20103
Sample Number: 22-20103V
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 21/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022
Sample Location: **W2SHBH09, Depth: 4.0-4.5m**
Material: CLAY, high plasticiity, with gravel, grey mottled brown-red

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	68		
Plastic Limit (%)	26		
Plasticity Index (%)	**42**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	17.0		
Cracking Crumbling Curling	Cracking		

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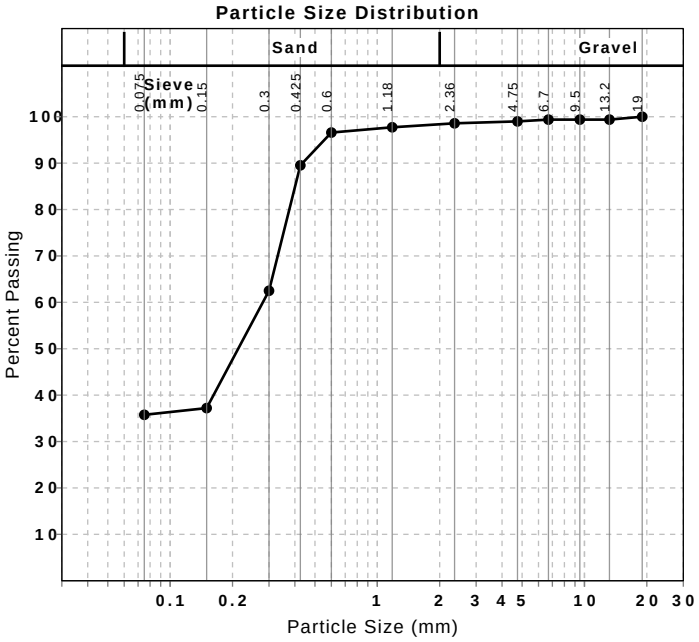
Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-4**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19954
Sample Number: 22-19954O
Date Sampled: 24/06/2022
Dates Tested: 01/07/2022 - 07/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample dates between 21/06/2022 to 24/06/2022
Sample Location: **W2SHBH10 (1.8-2.0m)**
Material: Sandy CLAY, low plasticity, trace gravel, grey

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**99**		
9.5 mm	**99**		
6.7 mm	**99**		
4.75 mm	**99**		
2.36 mm	**99**		
1.18 mm	**98**		
0.6 mm	**97**		
0.425 mm	**90**		
0.3 mm	**62**		
0.15 mm	**37**		
0.075 mm	**36**		

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	14		
Plastic Limit (%)	9		
Plasticity Index (%)	**5**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	3.0		
Cracking Crumbling Curling	None		



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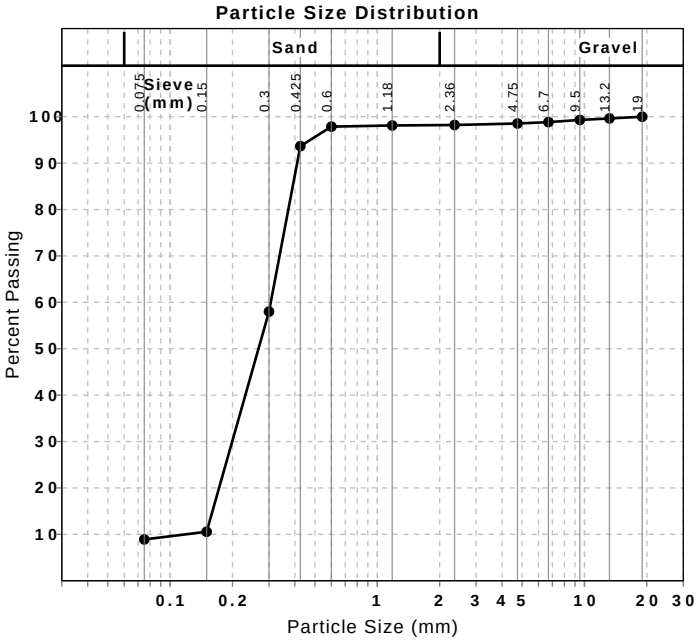
NATA Accredited Laboratory Number: 15100

Report Number: **14777-4**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 19954
Sample Number: 22-19954P
Date Sampled: 24/06/2022
Dates Tested: 01/07/2022 - 06/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sample dates between 21/06/2022 to 24/06/2022
Sample Location: **W2SHBH11, Depth: 1.2-1.5m**
Material: SAND, with clay/silt, trace gravel, brown

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**99**		
6.7 mm	**99**		
4.75 mm	**99**		
2.36 mm	**98**		
1.18 mm	**98**		
0.6 mm	**98**		
0.425 mm	**94**		
0.3 mm	**58**		
0.15 mm	**11**		
0.075 mm	**9**		



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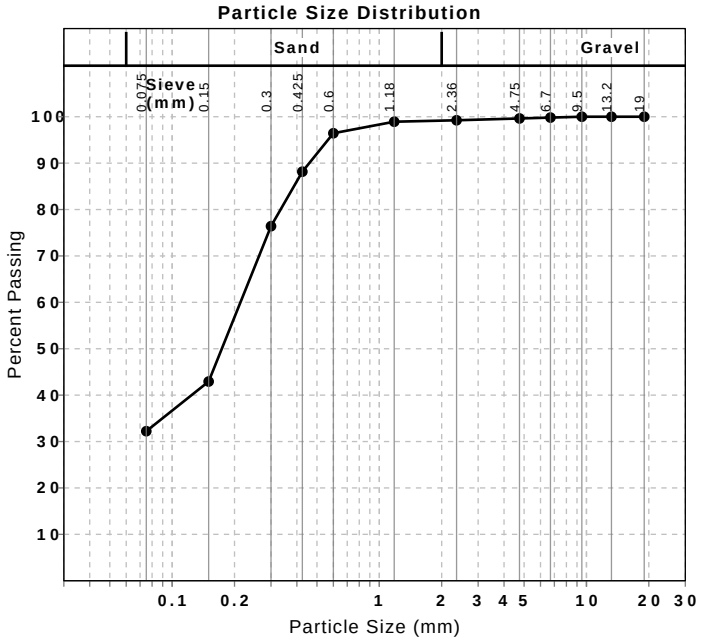
Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number:	**14777-4**
Issue Number:	1
Date Issued:	29/07/2022
Client:	Alliance Geotechnical Pty Ltd 8-10 Welder Road, Seven Hills NSW 2147
Contact:	Aaron Hong
Project Number:	14777
Project Name:	Ausgrid Cable Project
Project Location:	Waterloo to Surry Hills Cable Project
Contractor:	Ausgrid
Work Request:	19954
Sample Number:	22-19954S
Date Sampled:	24/06/2022
Dates Tested:	01/07/2022 - 06/07/2022
Sampling Method:	Sampled by Client *The results apply to the sample as received*
Remarks:	Sample dates between 21/06/2022 to 24/06/2022
Sample Location:	**W2SHBH12, Depth: 1.6-2.1m**
Material:	Clayey SAND, low to medium plasticity, orange-brown

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**100**		
2.36 mm	**99**		
1.18 mm	**99**		
0.6 mm	**96**		
0.425 mm	**88**		
0.3 mm	**76**		
0.15 mm	**43**		
0.075 mm	**32**		



Material Test Report

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Approved Signatory: Brett Bellingham
Conformance Testing Manager
NATA Accredited Laboratory Number: 15100

Report Number: **14777-6**
Issue Number: 2 - *This version supersedes all previous issues*
Reissue Reason: *Retest PI - Sample Y*
Date Issued: 16/08/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location:
Contractor: Ausgrid
Work Request: 20103
Sample Number: 22-20103Y
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 15/08/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022
Sample Location: **W2SH BH13, Depth: 1.3-1.5m**
Material: Sandy CLAY, low to medium plasticity, orange brown

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	36		
Plastic Limit (%)	19		
Plasticity Index (%)	**17**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	9.0		
Cracking Crumbling Curling	None		

Material Test Report

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Report Number: **14777-5**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 20102
Sample Number: 22-20102A
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 22/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022
Sample Location: **W2SHBH14, Depth: 1.0-1.5m**
Material: Clayey SAND, low plasticity, grey

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	26		
Plastic Limit (%)	19		
Plasticity Index (%)	**7**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	4.0		
Cracking Crumbling Curling	None		

Material Test Report

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Report Number: **14777-6**
Issue Number: 1
Date Issued: 29/07/2022
Client: Alliance Geotechnical Pty Ltd
8-10 Welder Road, Seven Hills NSW 2147
Contact: Aaron Hong
Project Number: 14777
Project Name: Ausgrid Cable Project
Project Location: Waterloo to Surry Hills Cable Project
Contractor: Ausgrid
Work Request: 20103
Sample Number: 22-20103X
Date Sampled: 07/07/2022
Dates Tested: 18/07/2022 - 21/07/2022
Sampling Method: Sampled by Client
The results apply to the sample as received
Remarks: Sampled between 07/07/2022 and 13/07/2022
Sample Location: **W2SHBH15, Depth: 2.9-3.2m**
Material: CLAY, medium to high plasticity, with gravel, trace sand, grey mottled red

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	43		
Plastic Limit (%)	18		
Plasticity Index (%)	**25**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	10.5		
Cracking Crumbling Curling	None		

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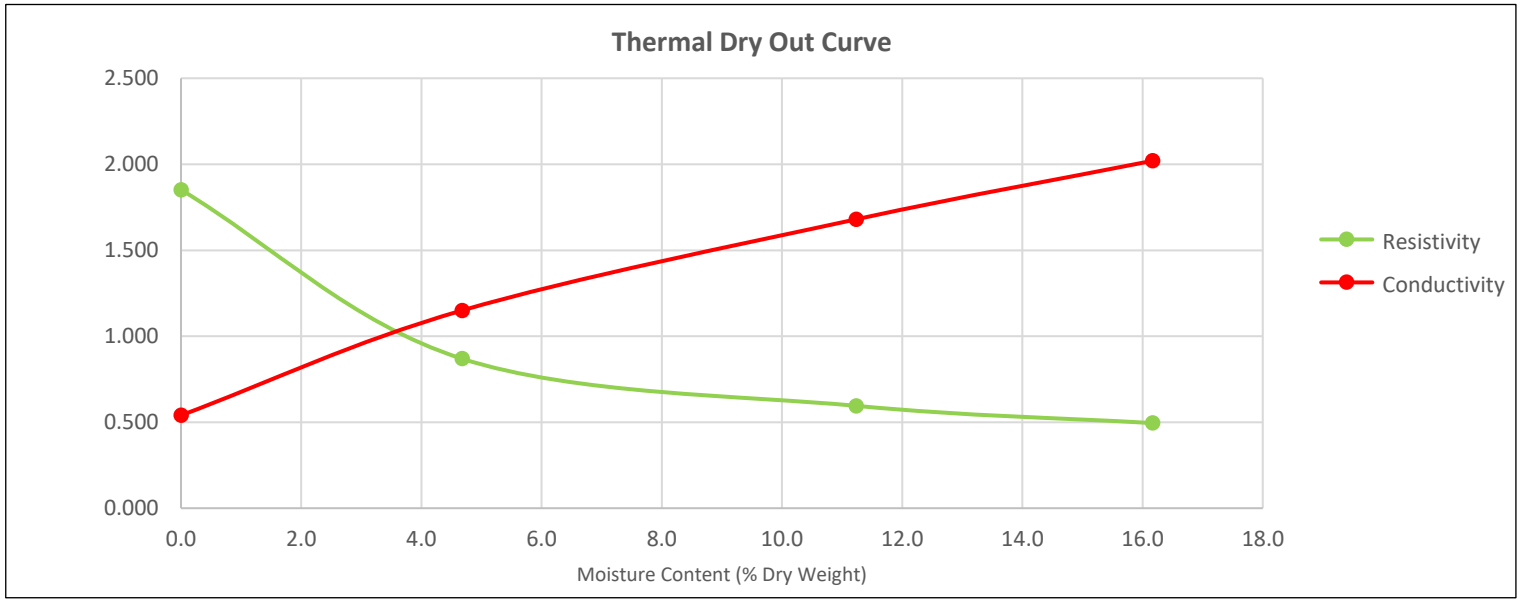
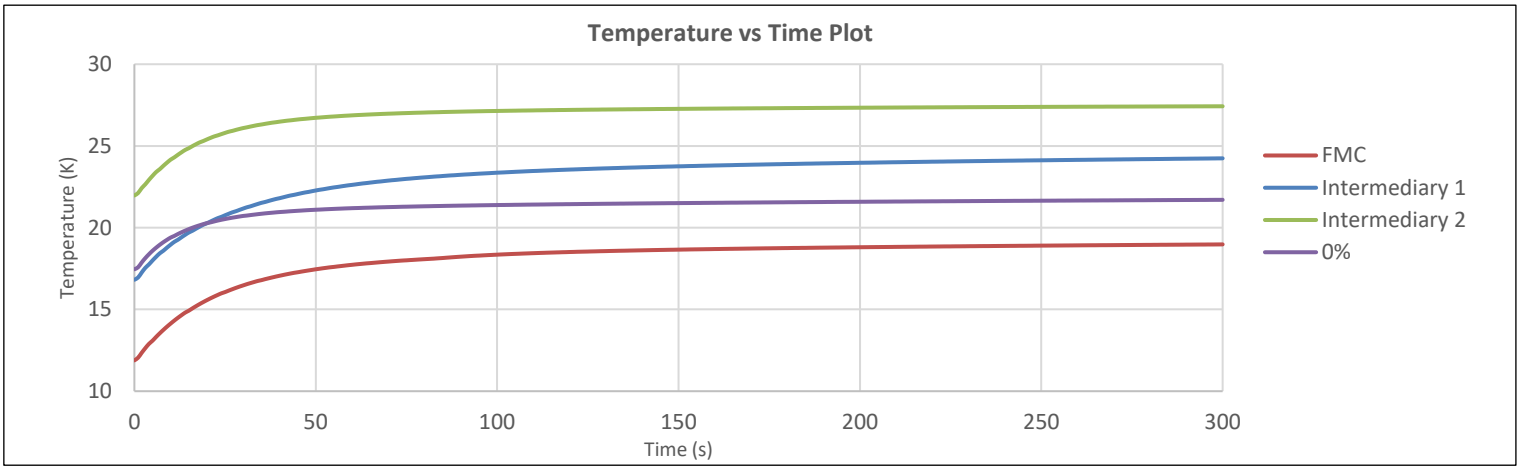
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-12 rev1	Report Date :	15/07/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH01, Depth 0.9-1.2m
Sample Number :	19419X	Date Sampled :	25-29/05/2022
Material Description :	Clayey SAND, grey brown	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	07/12/2022

Moisture Content:	(% Dry Weight)	16.2	11.2	4.7	0.0
Wet Density:	(t/m3)	1.90	1.82	1.72	1.64
Starting Temperature:	(°C)	11.89	16.82	21.97	17.46
Resistivity:	(mK/W)	0.50	0.60	0.87	1.85





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Authorised By:	Brett Bellingham
Date:	15/07/2022

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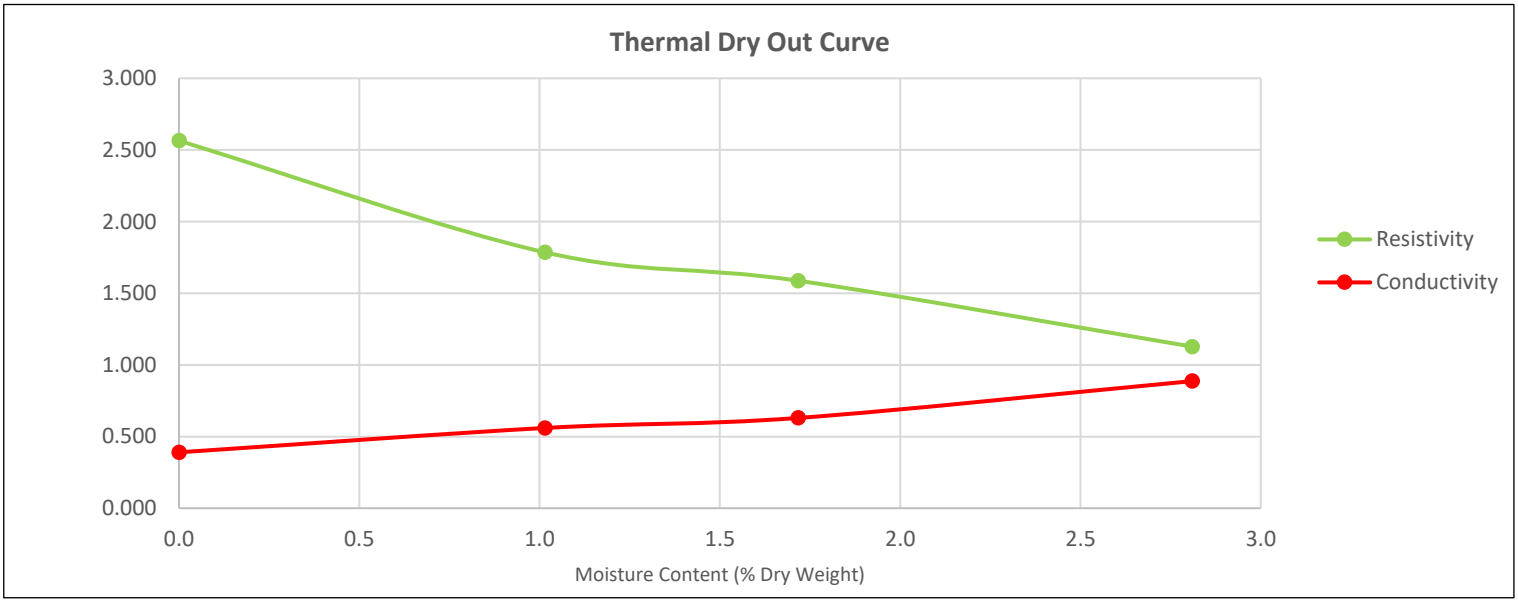
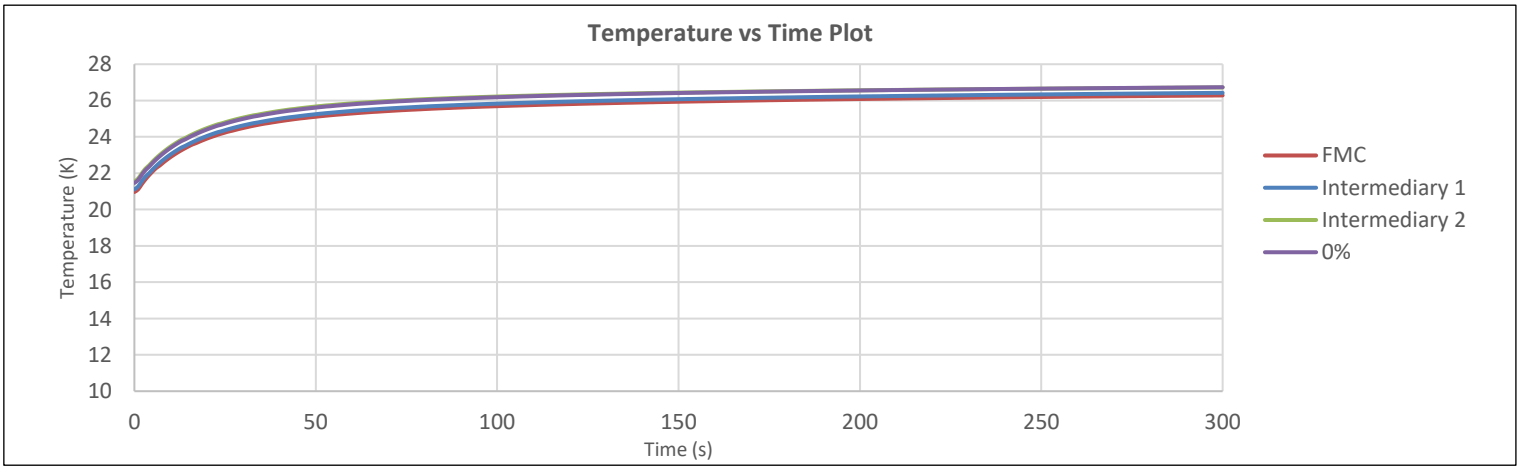
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-36	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH02, Depth 0.9-1.2m
Sample Number :	19954G	Date Sampled :	21/06 to 24/06/2022
Material Description :	SAND	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	2.8	1.7	1.0	0.0
Wet Density:	(t/m3)	1.60	1.58	1.57	1.55
Starting Temperature:	(°C)	20.97	21.11	21.54	21.47
Resistivity:	(mK/W)	1.13	1.59	1.79	2.56





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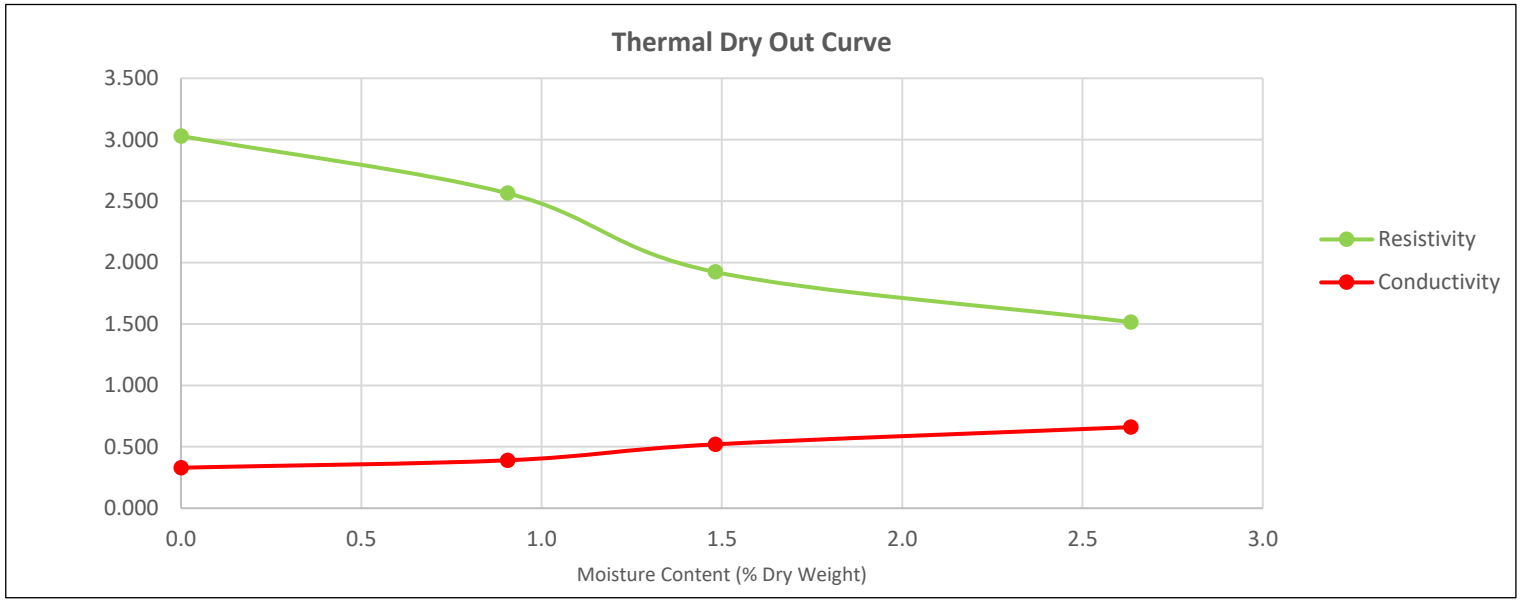
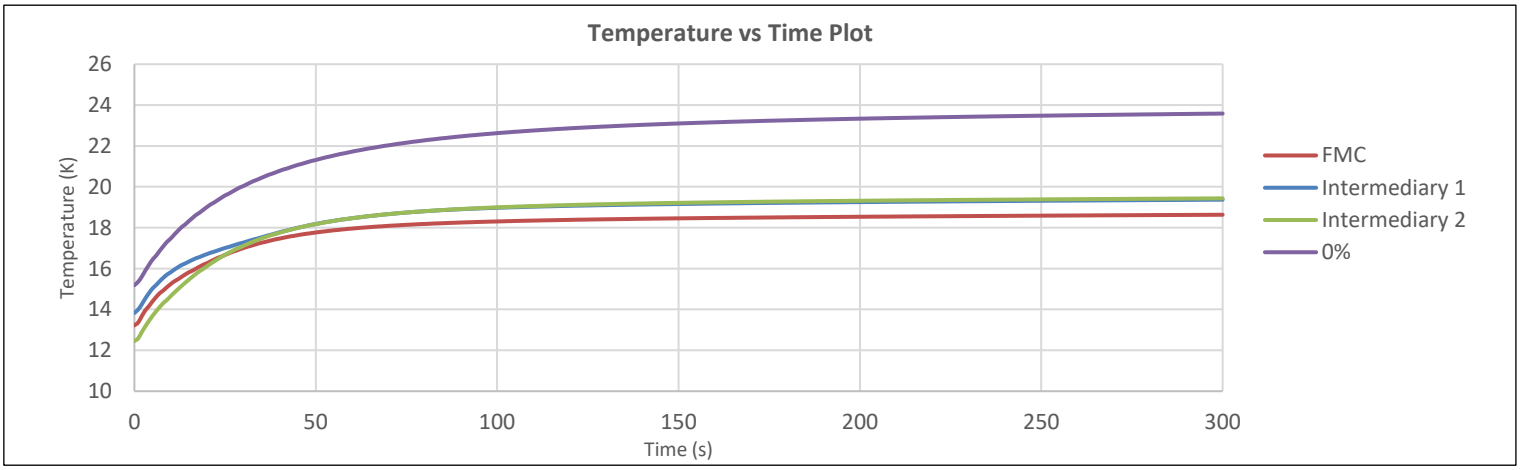
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-13	Report Date :	15/07/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH03, Depth 0.9-1.2m
Sample Number :	19419Z	Date Sampled :	25-29/05/2022
Material Description :	SAND, trace gravel, brown	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	11/07/2022

Moisture Content:	(% Dry Weight)	2.6	1.5	0.9	0.0
Wet Density:	(t/m3)	1.62	1.60	1.59	1.58
Starting Temperature:	(°C)	13.23	13.83	12.45	15.19
Resistivity:	(mK/W)	1.52	1.92	2.56	3.03





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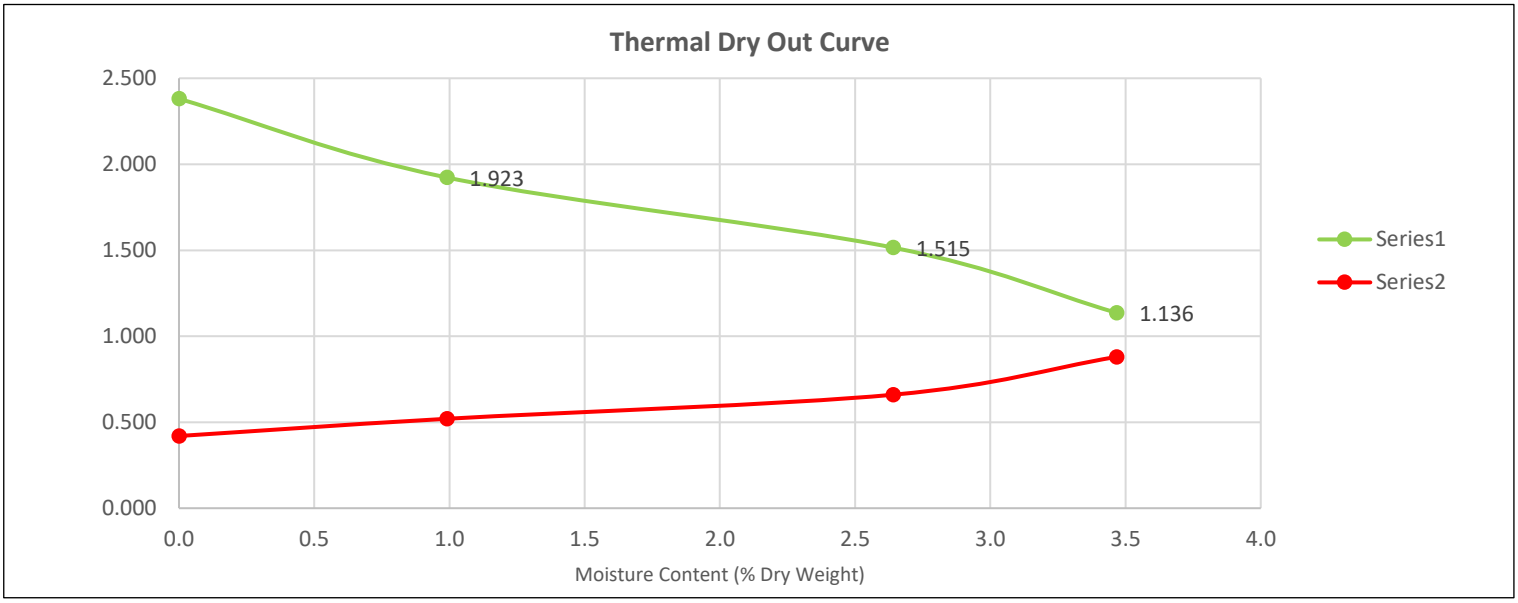
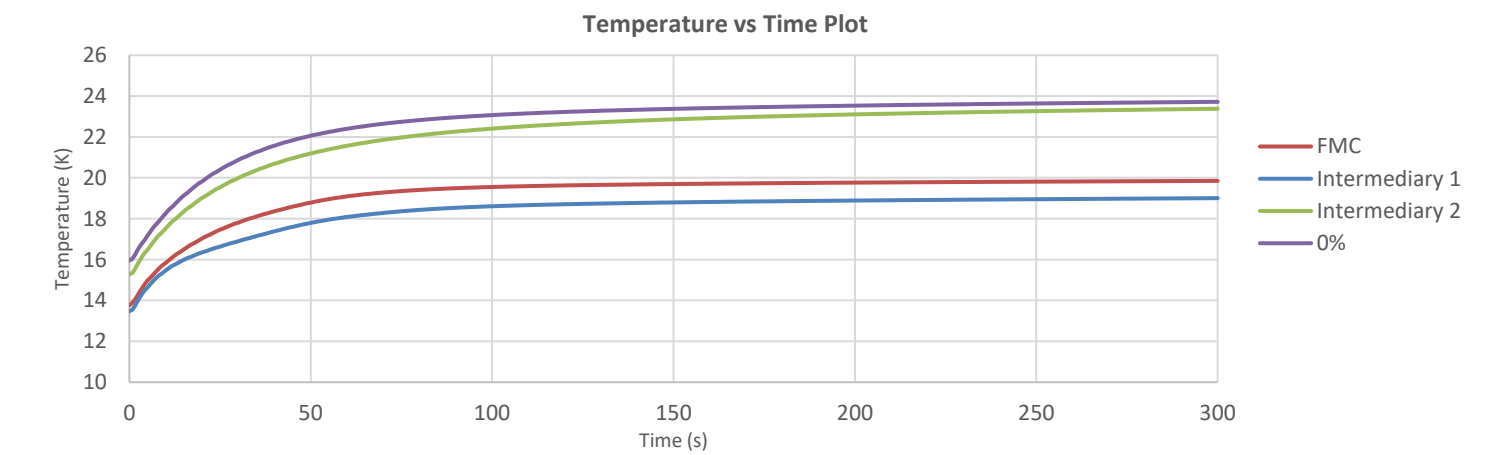
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-14	Report Date :	15/07/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH04, Depth 0.9-1.2m
Sample Number :	19419AC	Date Sampled :	25-29/05/2022
Material Description :	SAND, trace gravel, trace clay/silt, brown	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	

Moisture Content:	(% Dry Weight)	3.5	2.6	1.0	0.0
Wet Density:	(t/m3)	1.63	1.62	1.59	1.57
Starting Temperature:	(°C)	13.76	13.47	15.28	15.95
Resistivity:	(mK/W)	1.14	1.52	1.92	2.38





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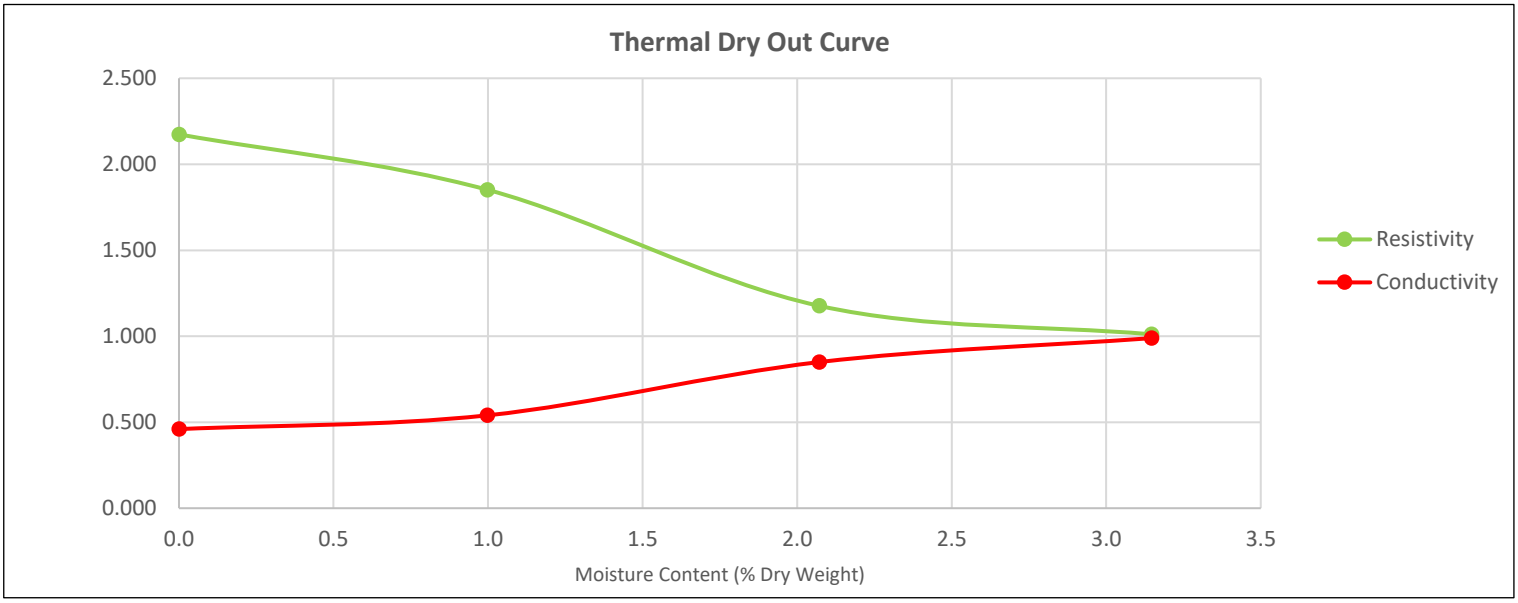
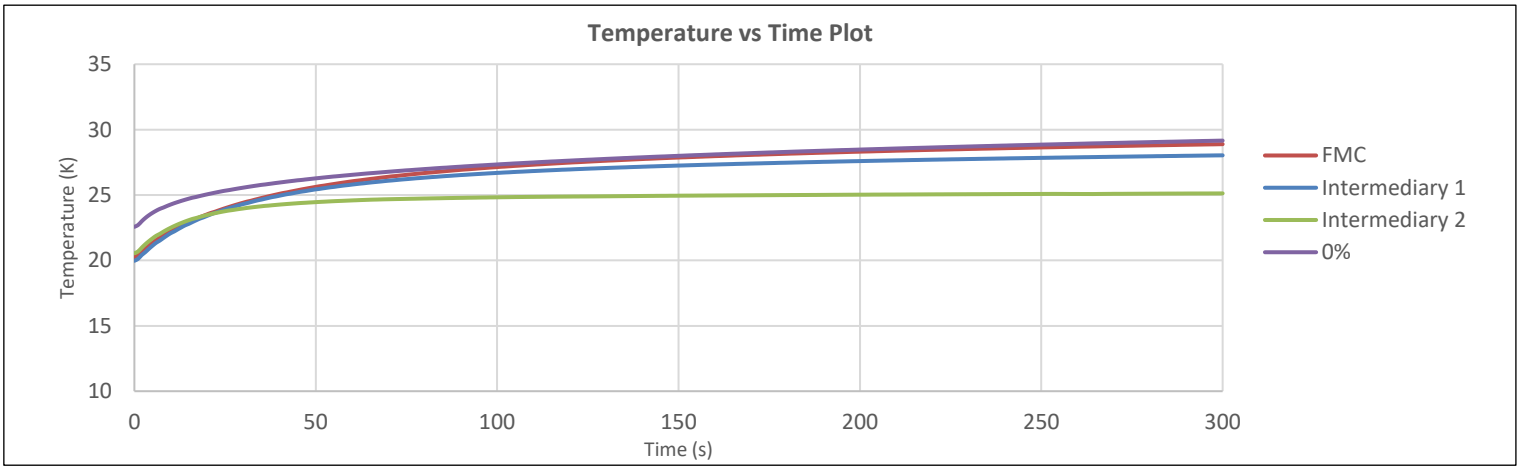
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-38	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH05, Depth 0.9-1.2m
Sample Number :	19954J	Date Sampled :	21/06 to 24/06/2022
Material Description :	Clayey SAND	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	3.1	2.1	1.0	0.0
Wet Density:	(t/m3)	1.63	1.61	1.59	1.58
Starting Temperature:	(°C)	20.25	19.98	20.55	22.57
Resistivity:	(mK/W)	1.01	1.18	1.85	2.17





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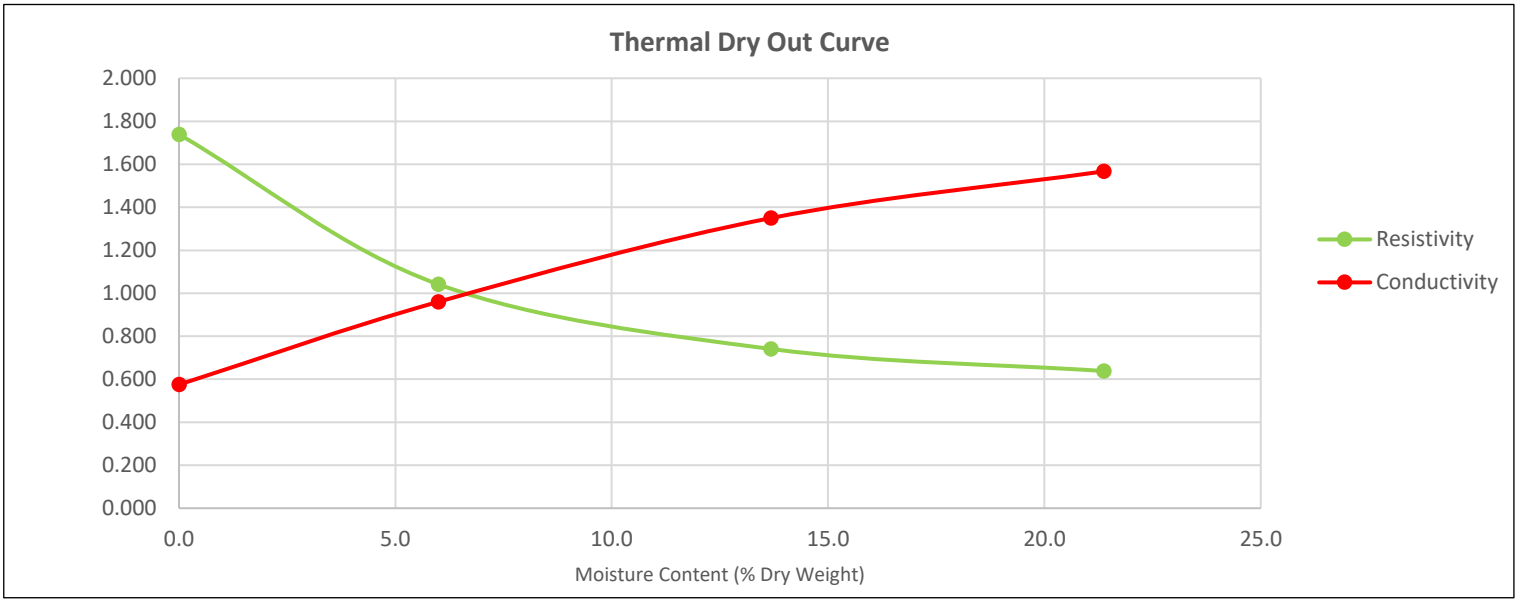
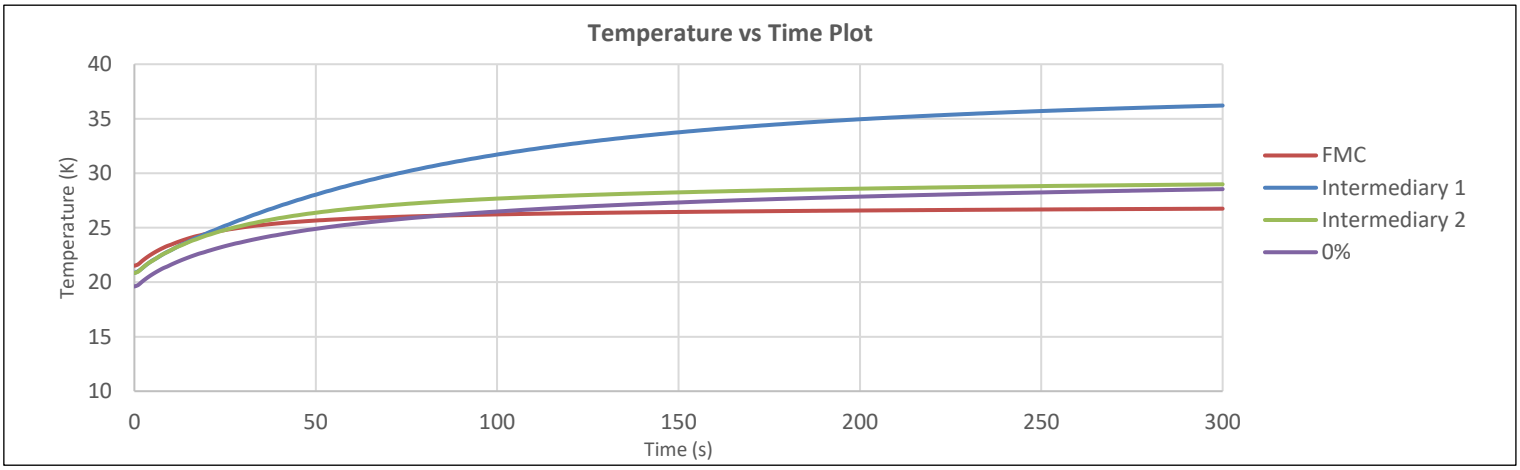
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-40	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH06 Depth 0.9-1.2m
Sample Number :	19954L	Date Sampled :	21/06 to 24/06/2022
Material Description :	SAND, trace silt, trace clay	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	21.4	13.7	6.0	0.0
Wet Density:	(t/m3)	1.86	1.74	1.63	1.53
Starting Temperature:	(°C)	21.51	20.85	20.85	19.61
Resistivity:	(mK/W)	0.64	0.74	1.04	1.74





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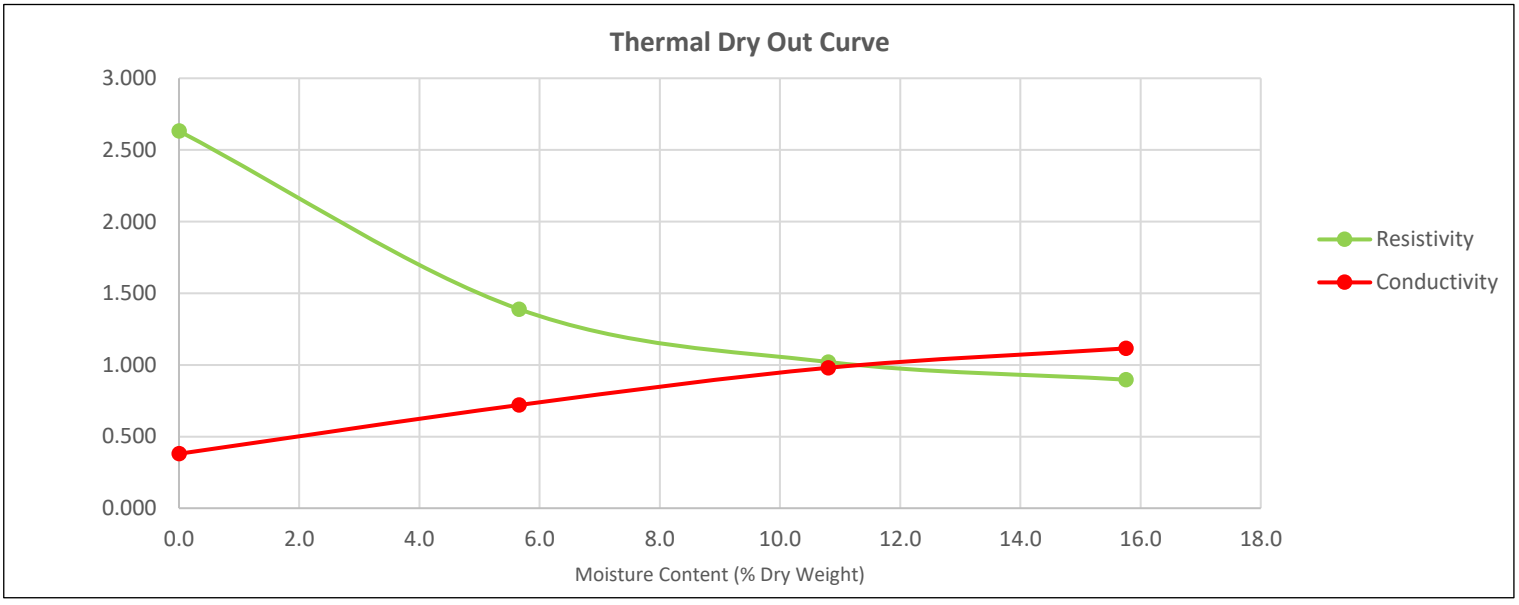
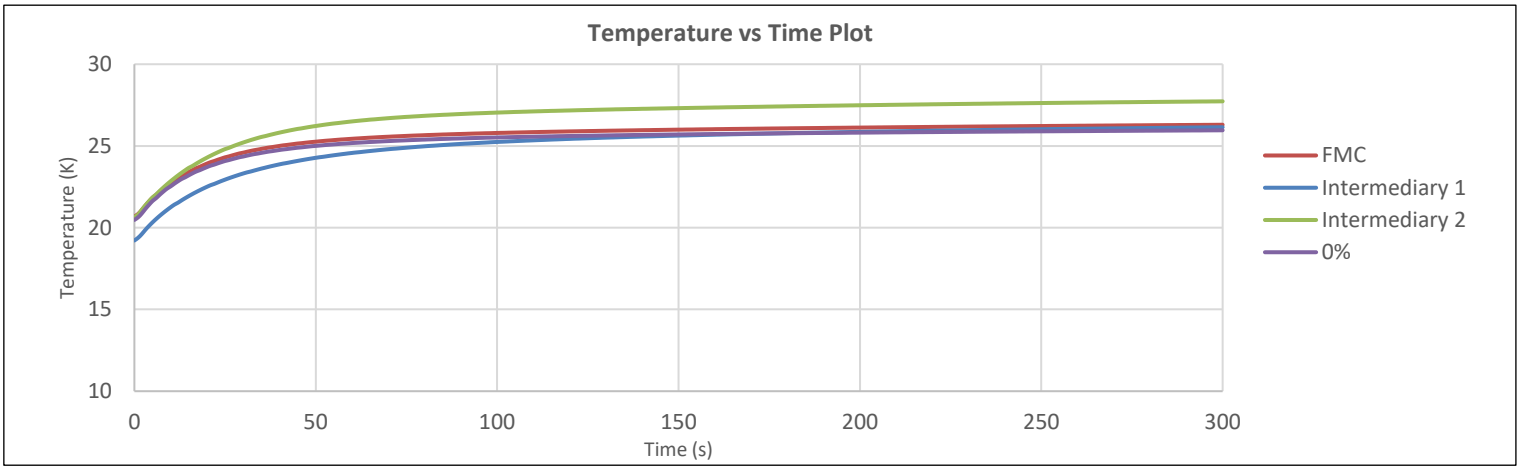
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-28	Report Date :	02/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH07, Depth 0.9-1.2m
Sample Number :	19742B	Date Sampled :	08/06/2022
Material Description :	Silty CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	15.8	10.8	5.7	0.0
Wet Density:	(t/m3)	2.13	2.04	1.94	1.84
Starting Temperature:	(°C)	20.69	19.22	20.66	20.48
Resistivity:	(mK/W)	0.90	1.02	1.39	2.63





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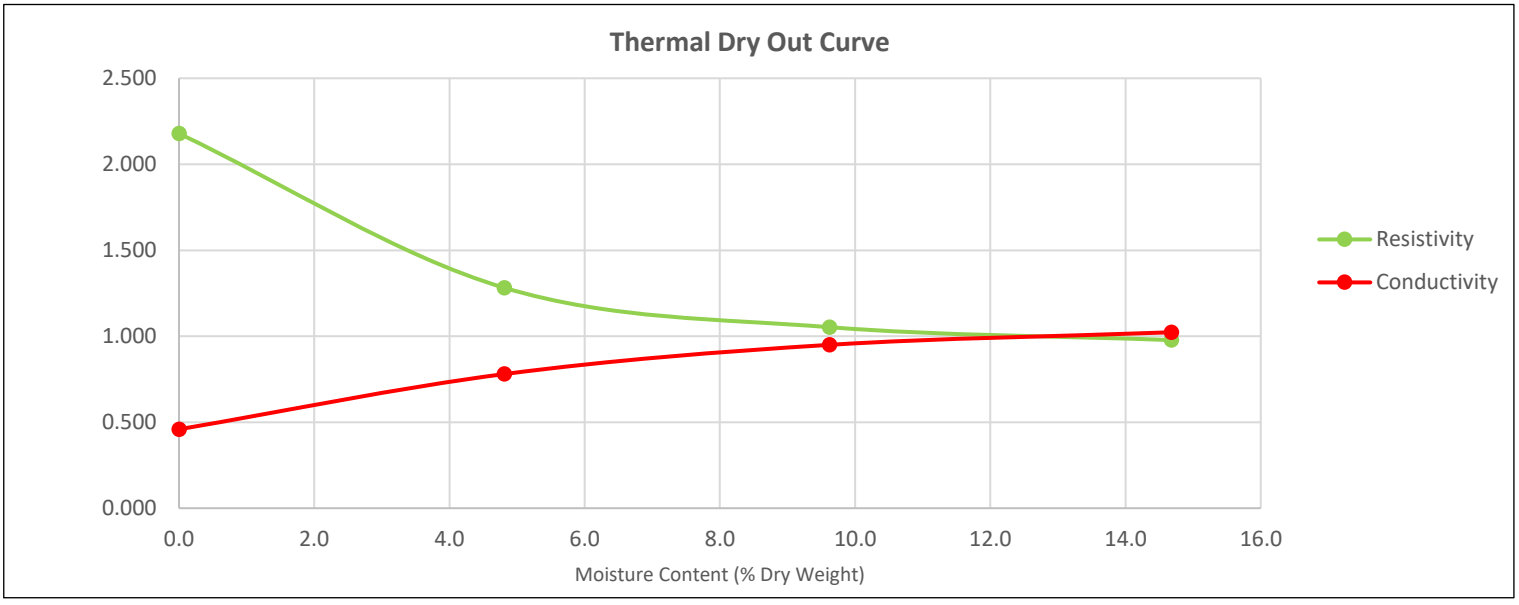
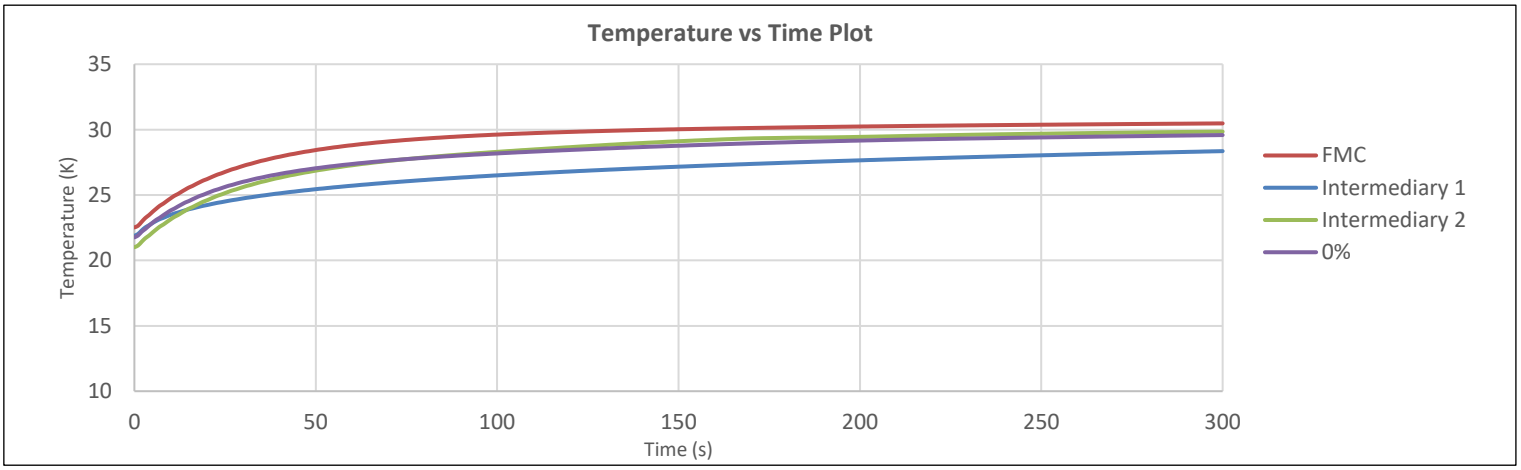
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-63	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH08, Depth 0.9-1.2m
Sample Number :	20103Q	Date Sampled :	07/07 to 13/07/2022
Material Description :	Silty CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	14.7	9.6	4.8	0.0
Wet Density:	(t/m3)	1.93	1.85	1.76	1.68
Starting Temperature:	(°C)	22.52	21.89	21.01	21.76
Resistivity:	(mK/W)	0.98	1.05	1.28	2.18





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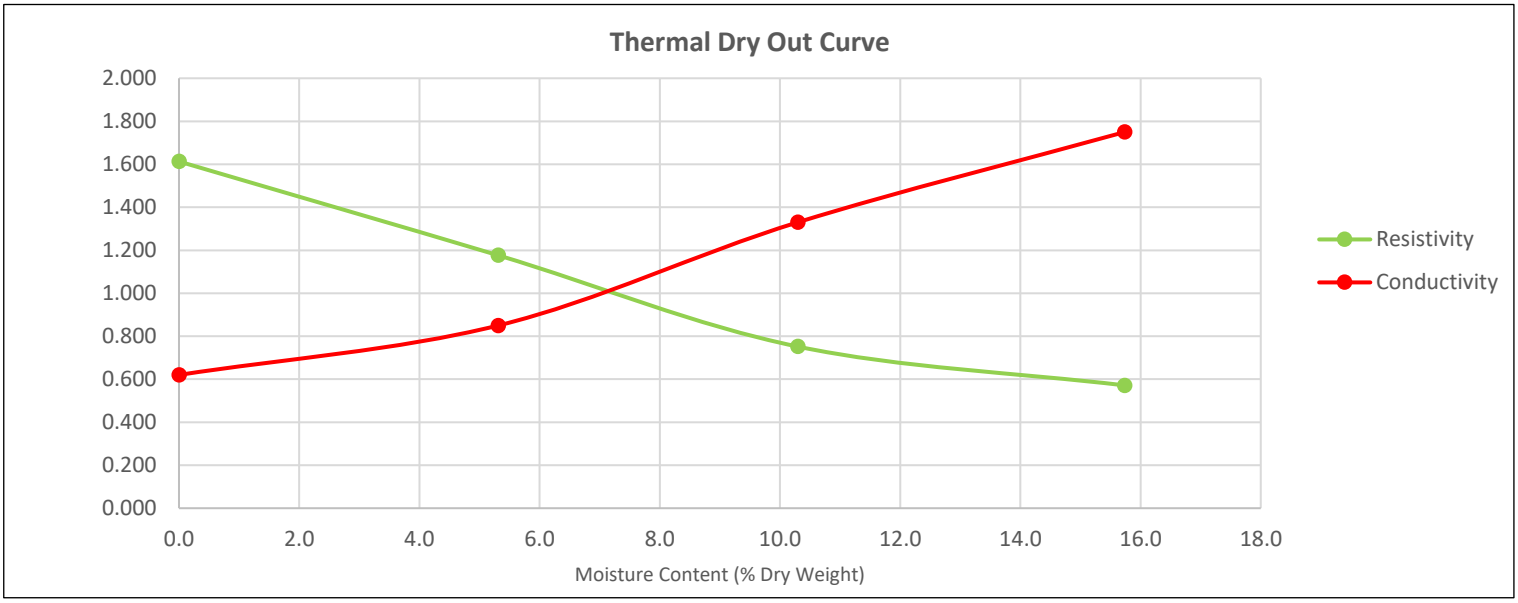
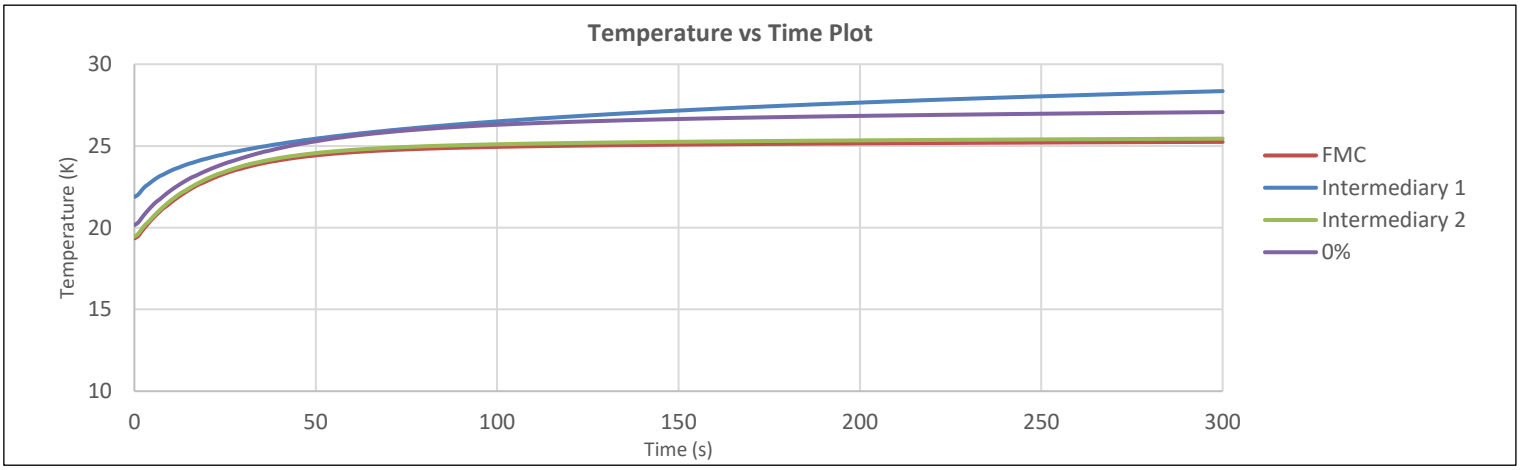
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-64	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH09, Depth 0.9-1.2m
Sample Number :	20103S	Date Sampled :	07/07 to 13/07/2022
Material Description :	Clayey SAND	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	15.7	10.3	5.3	0.0
Wet Density:	(t/m3)	2.10	2.00	1.91	1.81
Starting Temperature:	(°C)	19.35	21.89	19.46	20.17
Resistivity:	(mK/W)	0.57	0.75	1.18	1.61





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Date:	4/08/2022

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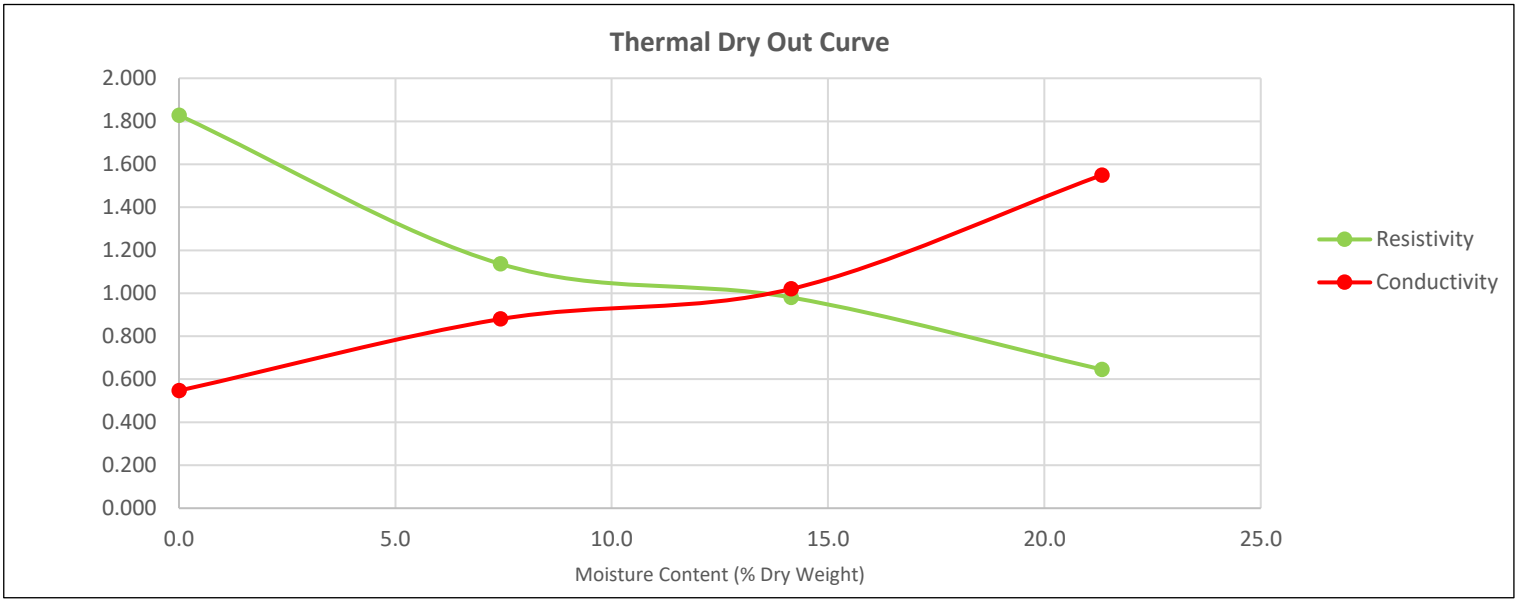
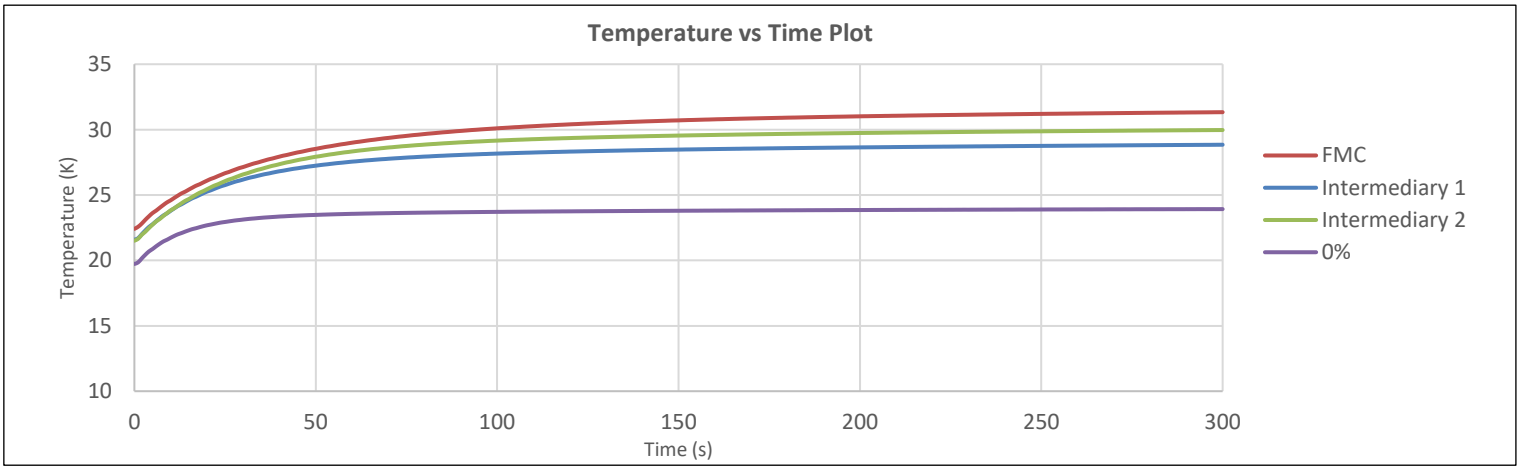
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-65	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH09, Depth 2.9-3.2m
Sample Number :	20103T	Date Sampled :	07/07 to 13/07/2022
Material Description :	CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	21.3	14.1	7.4	0.0
Wet Density:	(t/m3)	2.02	1.90	1.78	1.66
Starting Temperature:	(°C)	22.41	21.58	21.51	19.73
Resistivity:	(mK/W)	0.65	0.98	1.14	1.83





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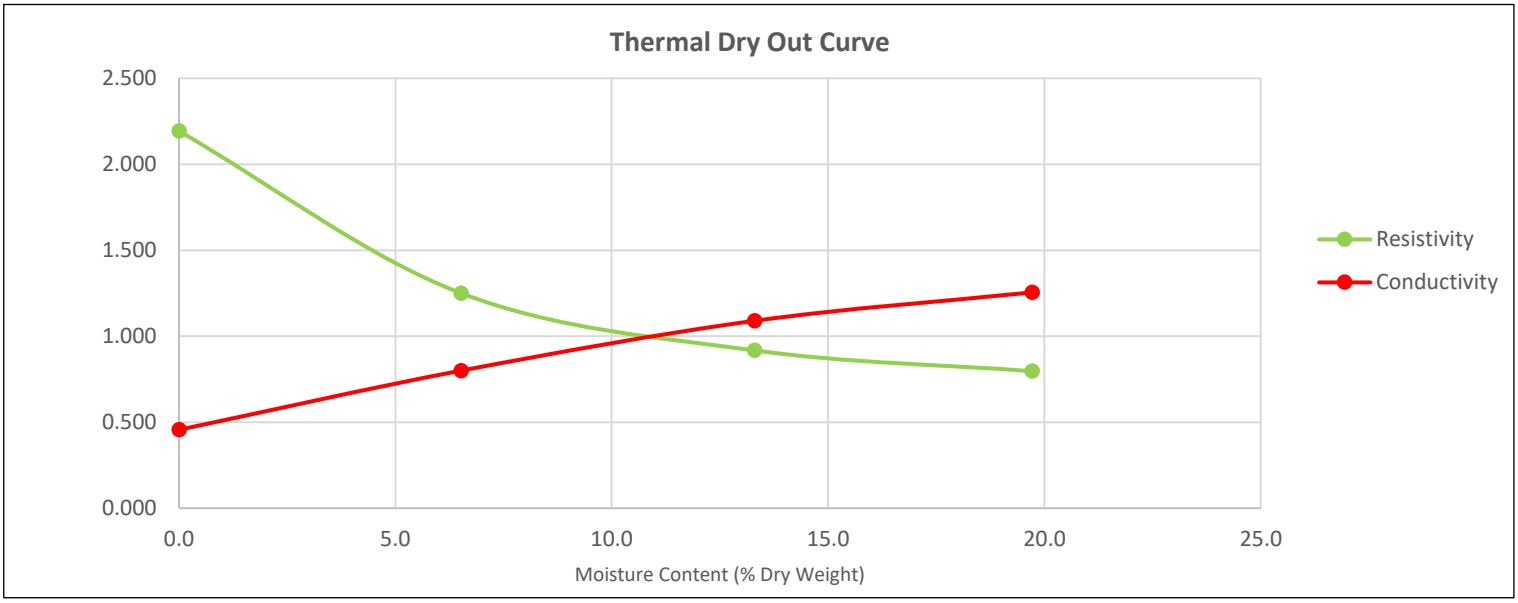
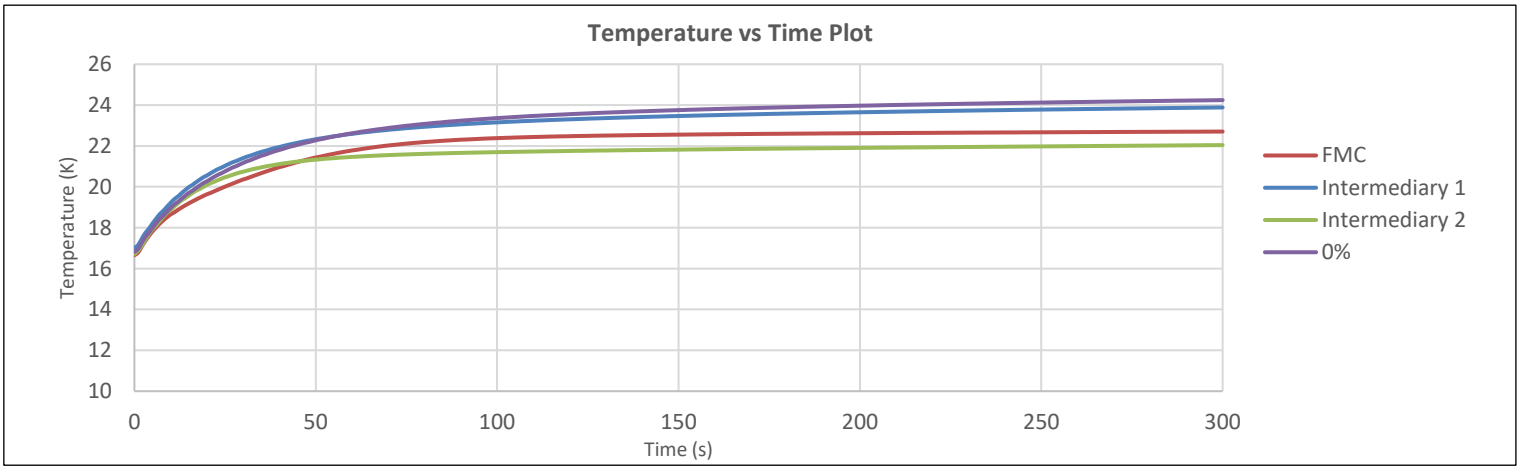
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-66	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH09, Depth 4.9-5.2m
Sample Number :	20103U	Date Sampled :	07/07 to 13/07/2022
Material Description :	CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	19.7	13.3	6.5	0.0
Wet Density:	(t/m3)	1.88	1.78	1.68	1.57
Starting Temperature:	(°C)	16.66	17.01	16.71	16.82
Resistivity:	(mK/W)	0.80	0.92	1.25	2.19





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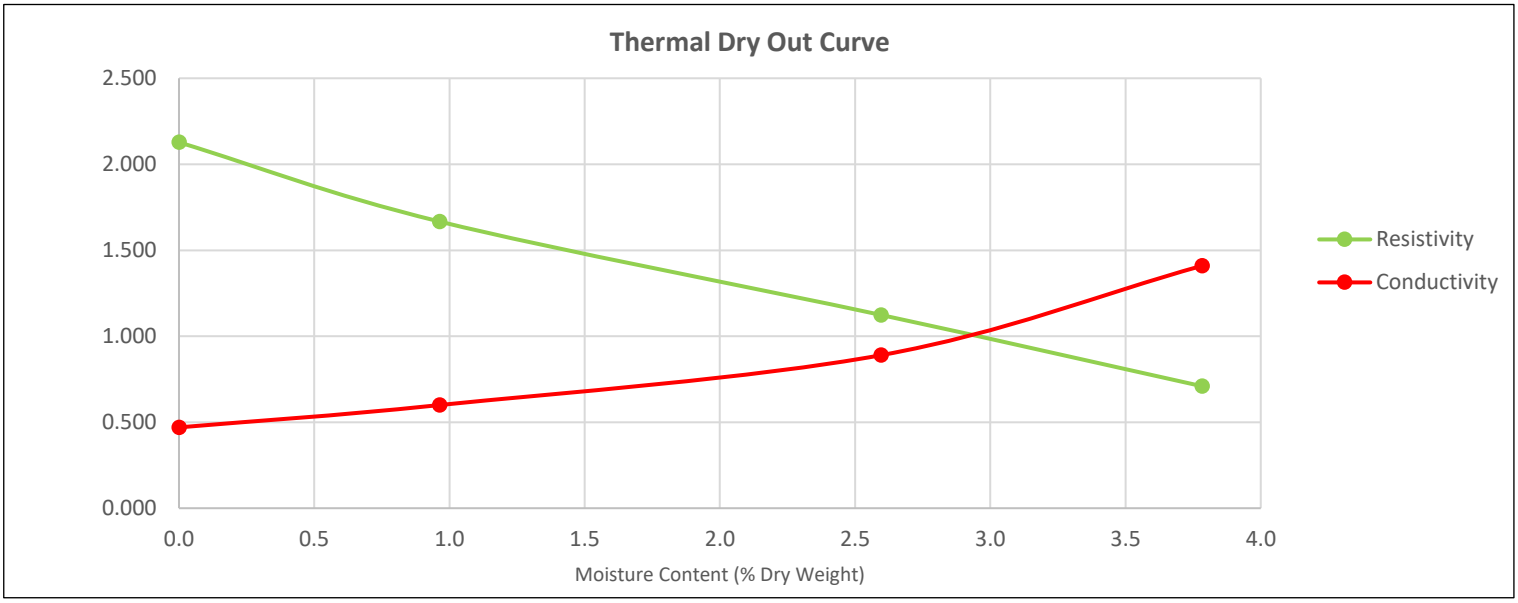
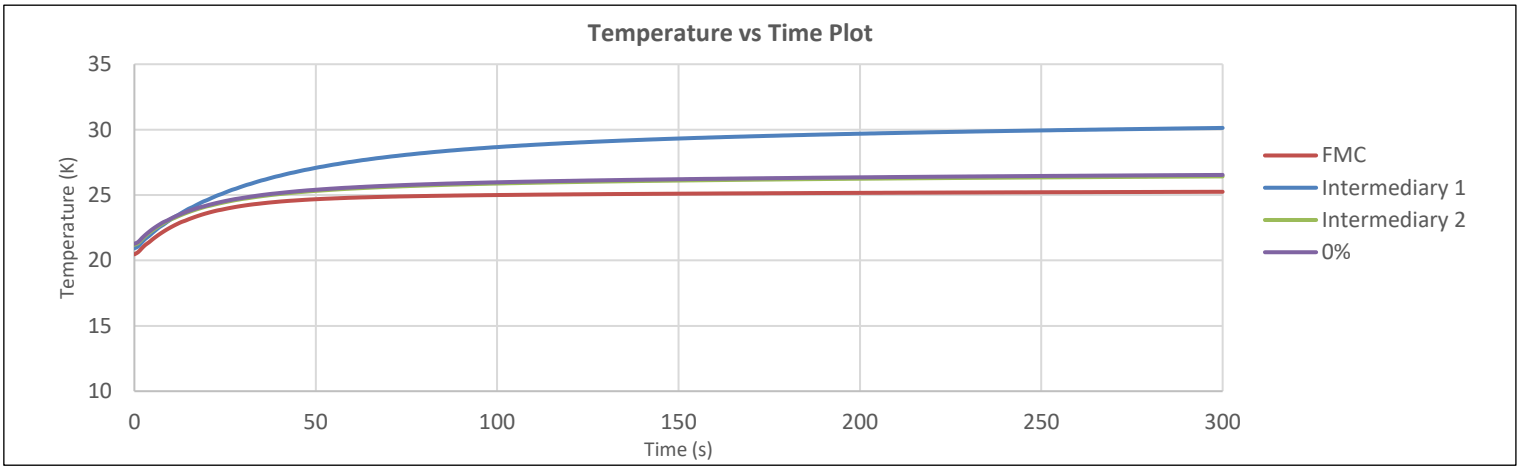
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-41	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH10, Depth 0.9-1.2m
Sample Number :	19954N	Date Sampled :	21/06 to 24/06/2022
Material Description :	Clayey SAND	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	3.8	2.6	1.0	0.0
Wet Density:	(t/m3)	1.69	1.68	1.65	1.63
Starting Temperature:	(°C)	20.47	20.93	21.20	21.28
Resistivity:	(mK/W)	0.71	1.12	1.67	2.13





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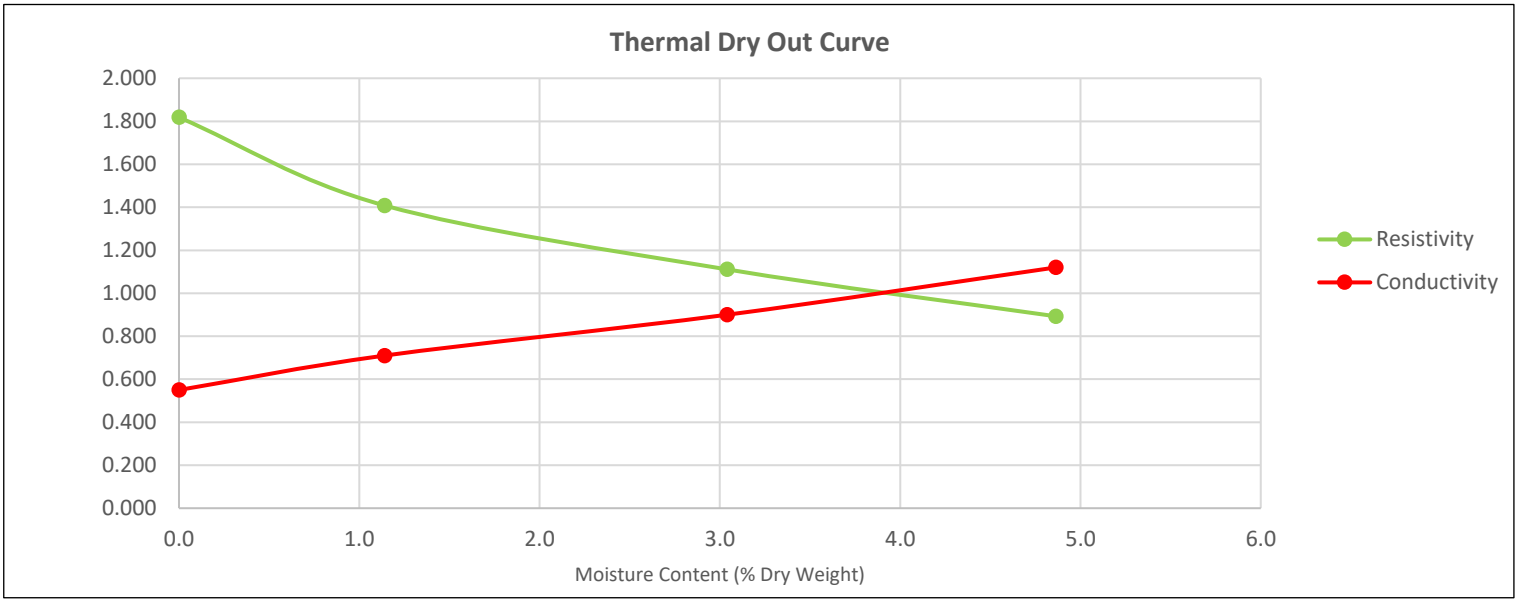
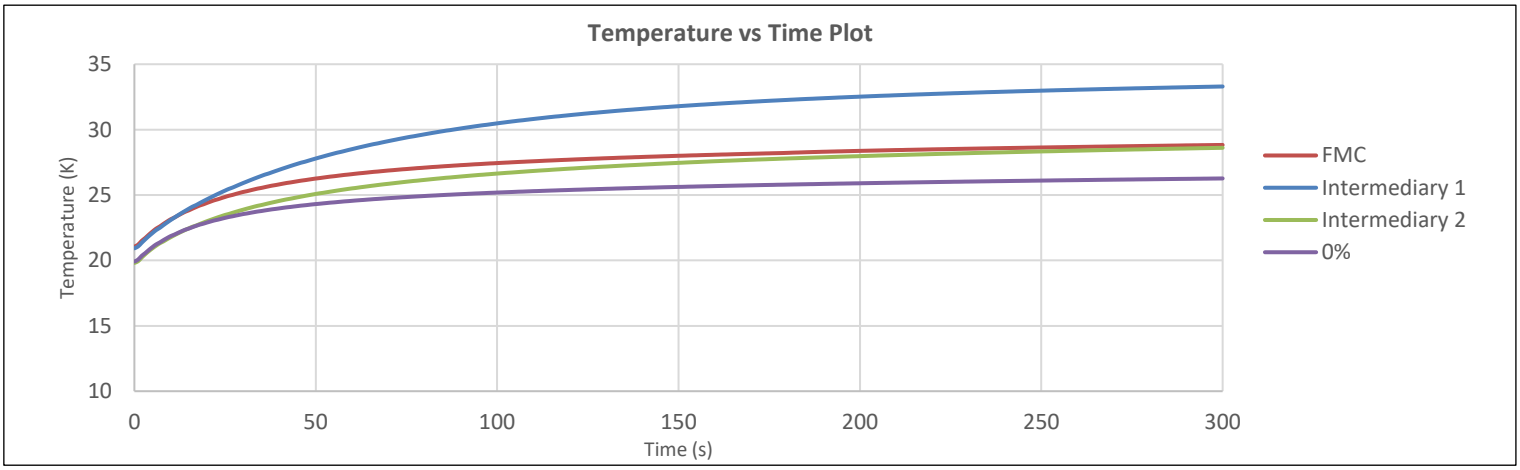
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-42	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH11, Depth 0.9-1.2m
Sample Number :	19954Q	Date Sampled :	21/06 to 24/06/2022
Material Description :	SAND, with clay/silt	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	4.9	3.0	1.1	0.0
Wet Density:	(t/m3)	1.76	1.73	1.70	1.68
Starting Temperature:	(°C)	21.05	20.93	19.81	19.92
Resistivity:	(mK/W)	0.89	1.11	1.41	1.82





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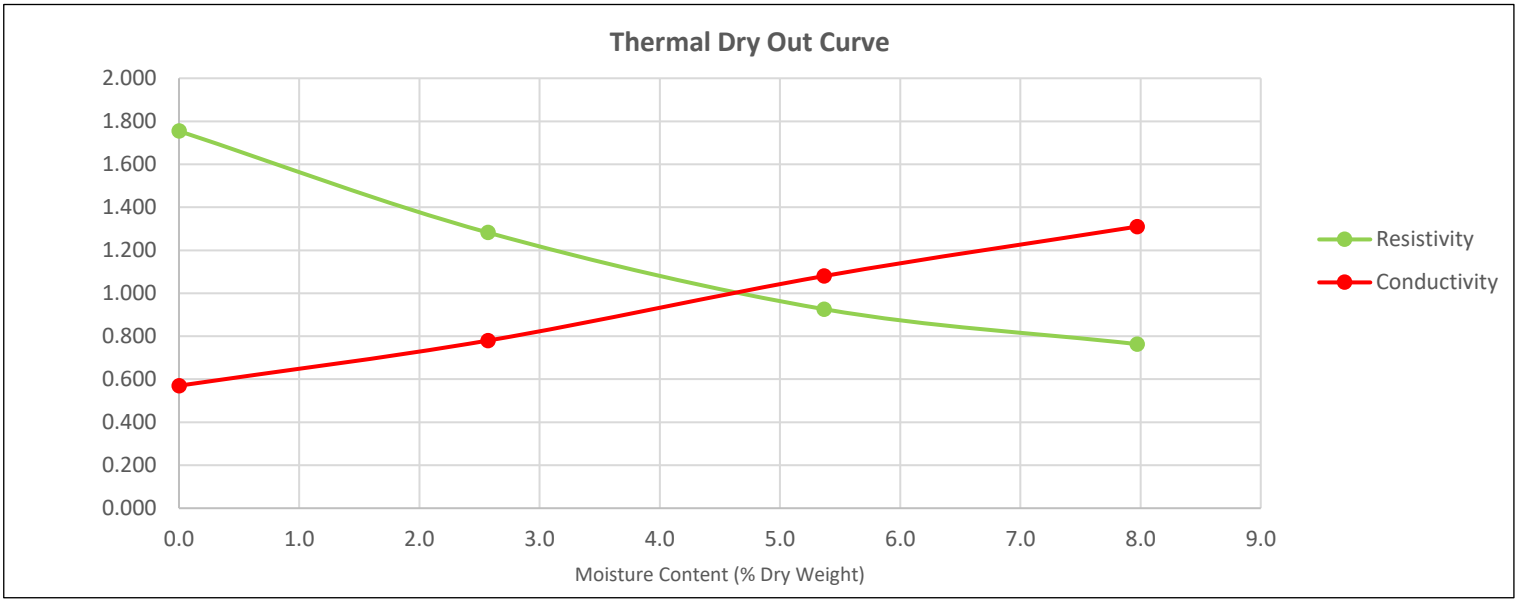
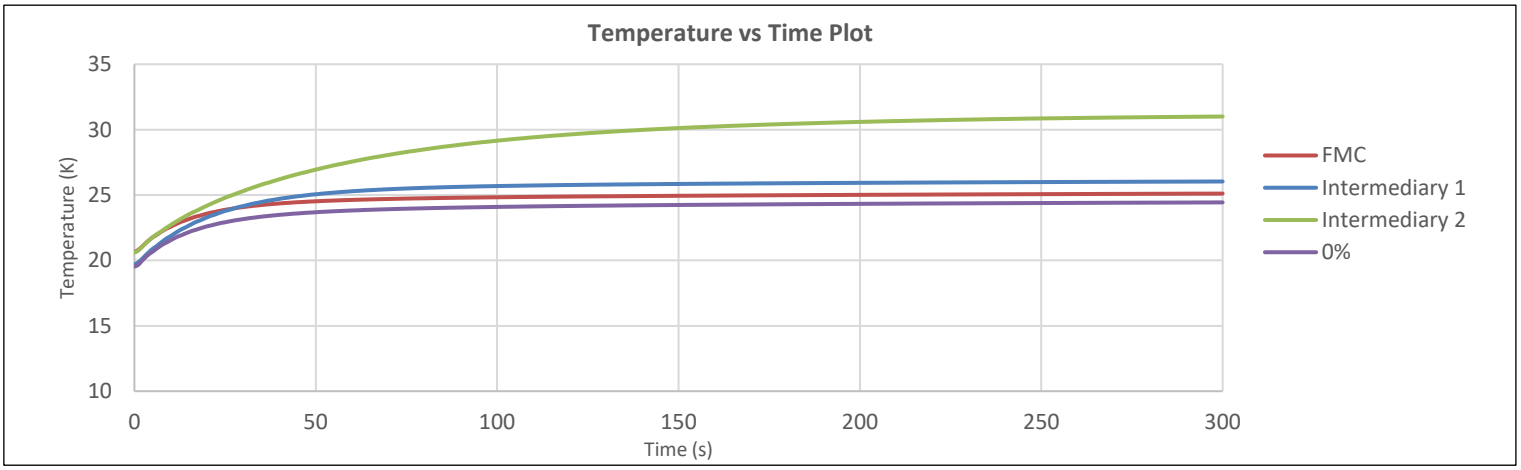
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-43	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH12, Depth 0.9-1.2m
Sample Number :	19954R	Date Sampled :	21/06 to 24/06/2022
Material Description :	Sandy CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	8.0	5.4	2.6	0.0
Wet Density:	(t/m3)	2.04	1.99	1.93	1.89
Starting Temperature:	(°C)	20.64	19.69	20.61	19.53
Resistivity:	(mK/W)	0.76	0.93	1.28	1.75





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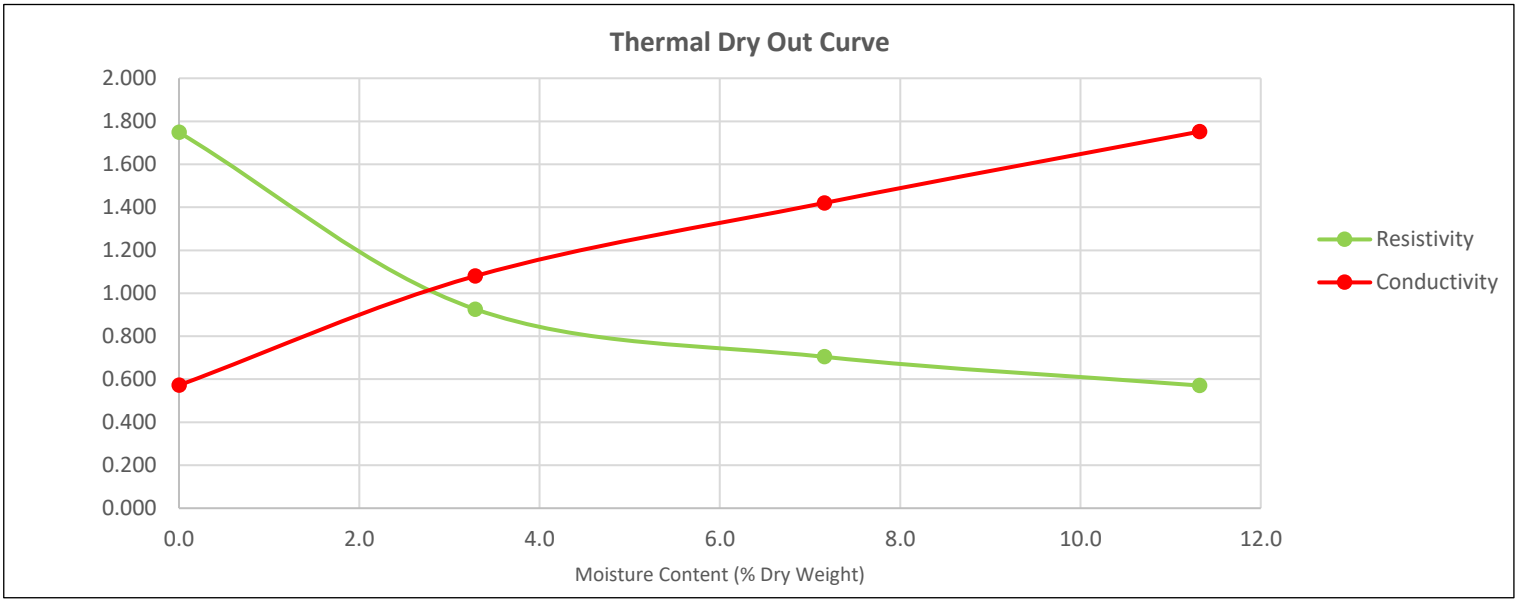
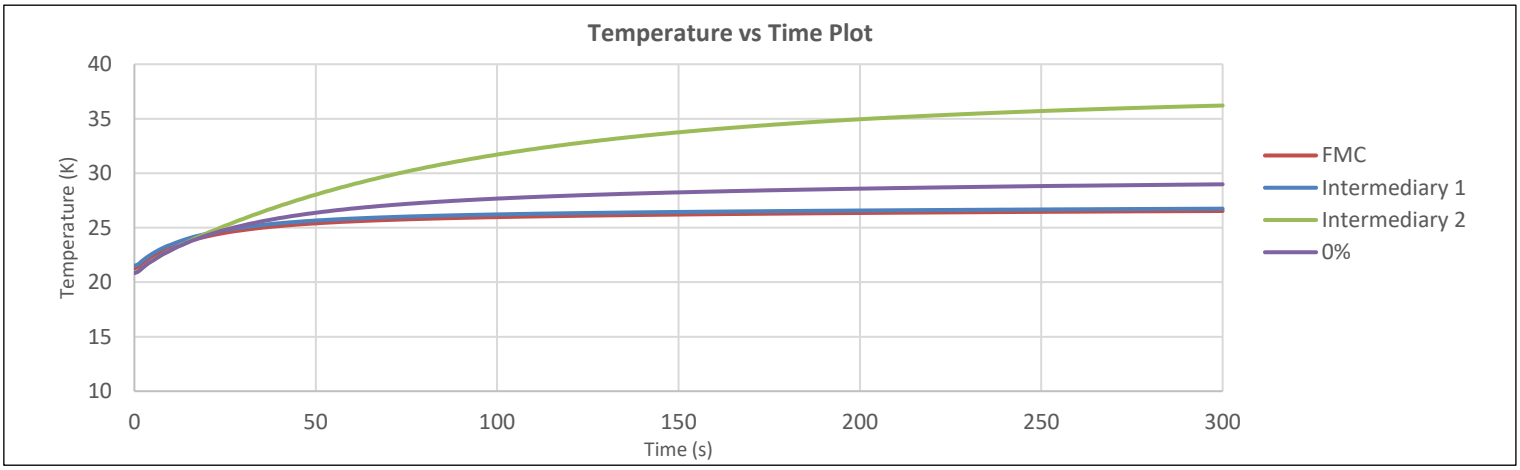
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-69	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH13, Depth 0.9-1.5m
Sample Number :	20103Z	Date Sampled :	07/07 to 13/07/2022
Material Description :	Sandy CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	11.3	7.2	3.3	0.0
Wet Density:	(t/m3)	1.74	1.68	1.62	1.56
Starting Temperature:	(°C)	21.28	21.51	20.85	20.85
Resistivity:	(mK/W)	0.57	0.70	0.93	1.75





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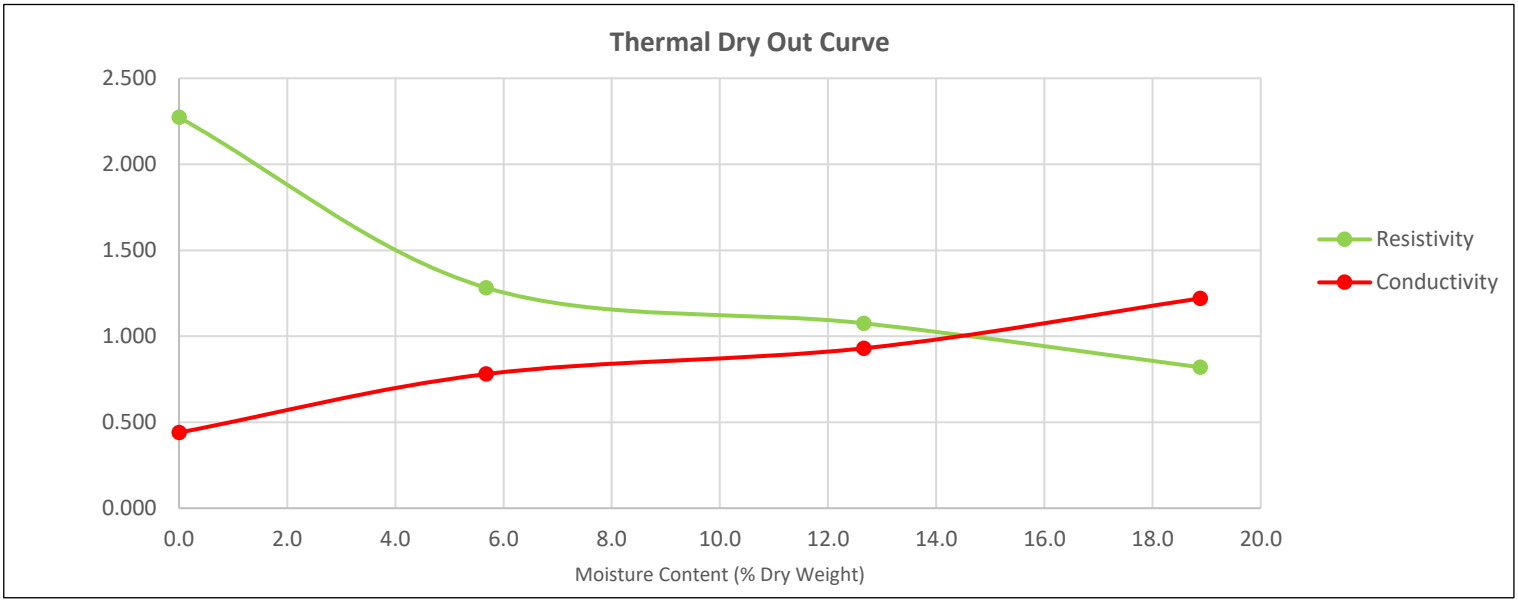
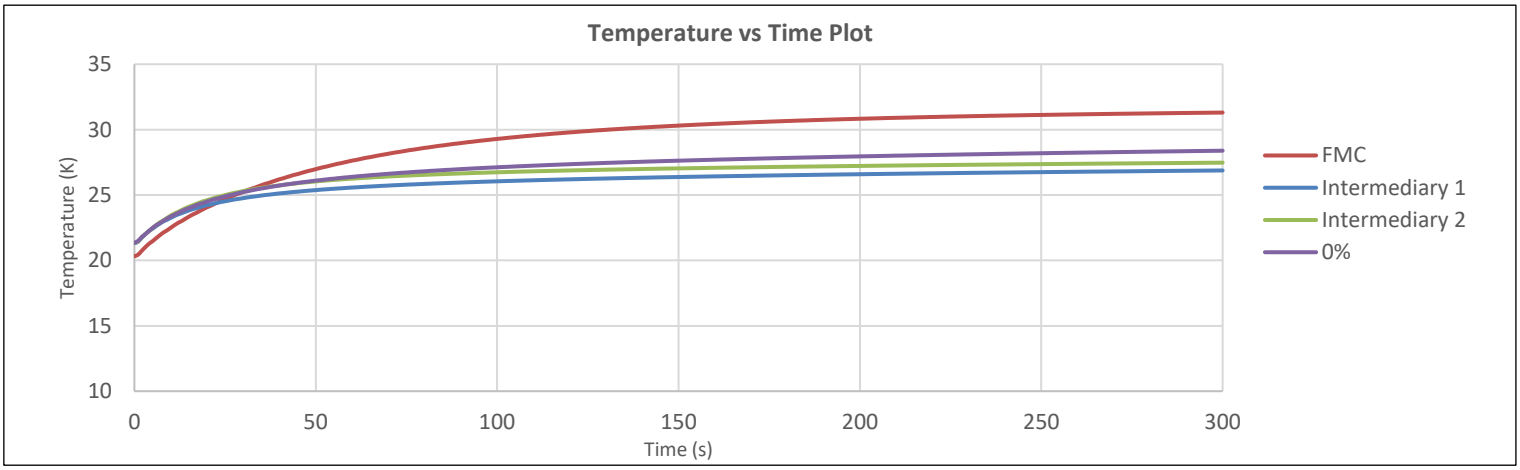
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-46	Report Date :	03/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH14, Depth 0.9-1.2m
Sample Number :	20102B	Date Sampled :	07/07 to 13/07/2022
Material Description :	Sandy CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	01/08/2022

Moisture Content:	(% Dry Weight)	18.9	12.7	5.7	0.0
Wet Density:	(t/m3)	1.85	1.75	1.64	1.55
Starting Temperature:	(°C)	20.32	21.32	21.33	21.35
Resistivity:	(mK/W)	0.82	1.08	1.28	2.27





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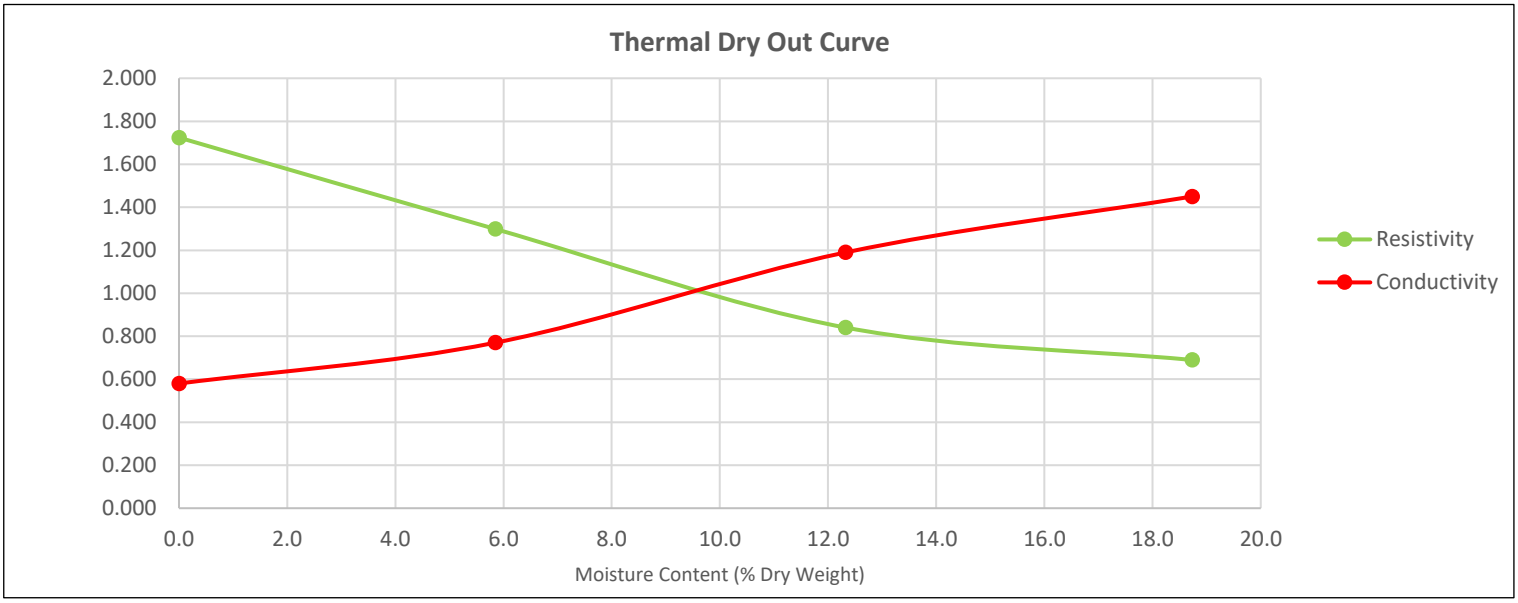
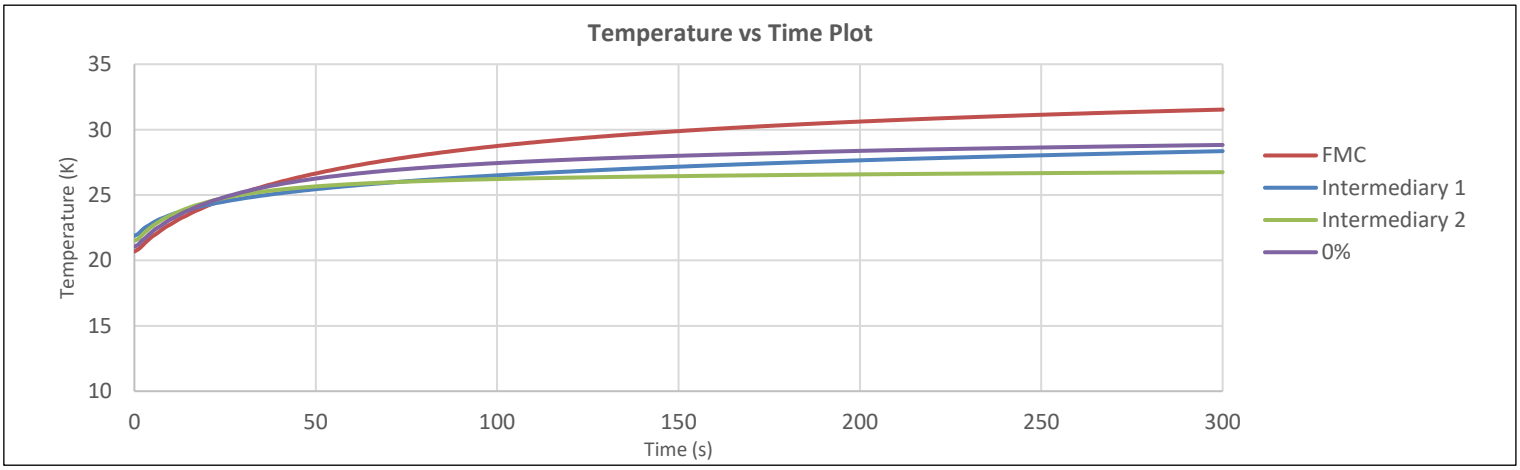
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-67	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SHBH15, Depth 0.9-1.2m
Sample Number :	20103W	Date Sampled :	07/07 to 13/07/2022
Material Description :	CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	18.7	12.3	5.8	0.0
Wet Density:	(t/m3)	2.03	1.92	1.81	1.71
Starting Temperature:	(°C)	20.68	21.89	21.51	21.05
Resistivity:	(mK/W)	0.69	0.84	1.30	1.72





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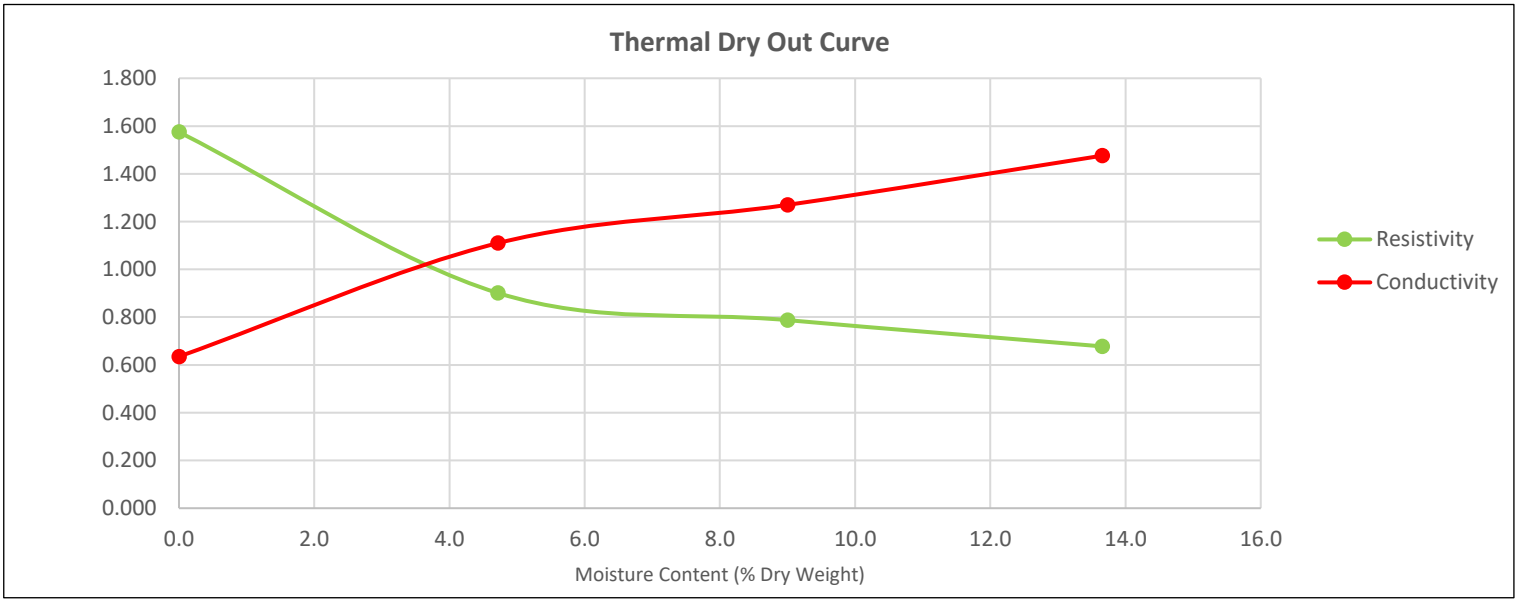
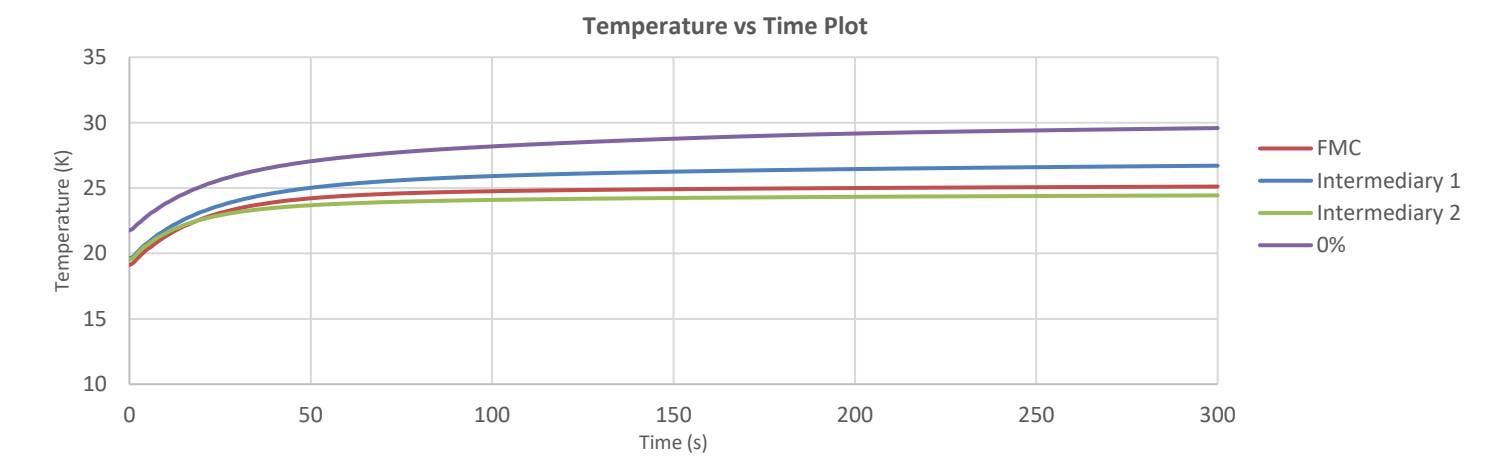
Thermal Resistivity with Dry Out Curve - 4 Point Tube Sample

Report Number :	14777-68	Report Date :	04/08/2022
Project Name :	Ausgrid Cable Project		Page 1 of 1
Client Name :	Alliance Geotechnical Pty Ltd		
Project Location :	Waterloo to Surry Hills Cable Project	Sample Location:	W2SBH15, Depth 2.9-3.2m
Sample Number :	20103X	Date Sampled :	07/07 to 13/07/2022
Material Description :	CLAY	Test Method:	ASTM D5334-14
Sampling Method :	Sampled by client		
Tested By:	BB/HM	Date Tested:	02/08/2022

Moisture Content:	(% Dry Weight)	13.7	9.0	4.7	0.0
Wet Density:	(t/m3)	2.02	1.94	1.86	1.78
Starting Temperature:	(°C)	19.12	19.63	19.53	21.76
Resistivity:	(mK/W)	0.68	0.79	0.90	1.57





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