Report on Geotechnical Investigation

457-527 Cessnock Road Gillieston Heights

304100964

Prepared for Walker Gillieston Heights Pty Ltd

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Executive Summary

Stantec Australia Pty Ltd (Stantec) have undertaken geotechnical investigation for the proposed residential development located at 457-527 Cessnock Road, Gillieston Heights. The investigation works were undertaken at the request of Zoe Kavanagh on behalf of Walkers Gillieston Heights Pty Ltd (Walkers).

Geotechnical investigation was undertaken in two (2) stages, with the initial investigation undertaken within lots 501-527 Cessnock Road. The initial investigation comprised:

- > A site walkover by a geotechnical consultant from Stantec, including visual appraisal and recording of salient site conditions and features.
- Excavation of 28 test pits and logging of subsurface conditions within the proposed allotment areas, basins and road alignments.
- > Dynamic cone penetrometer tests (DCP) were conducted at all excavated test pits to aid in the assessment of subsurface strength conditions.
- > Disturbed geotechnical/environmental samples of natural materials were collected for subsequent laboratory testing.

Stantec were engaged to undertake additional investigation within lots 457 and 463 Cessnock Road to incorporate the lots within the overall development. The additional investigation comprised:

- > Site walkover of additional lots by a geotechnical consultant from Stantec.
- > Excavation of an additional 12 test pits and DCP testing.
- > Additional sampling and laboratory testing.

Stantec have provided the following recommendations on the following herein for the overall development:

- > Preliminary acid sulfate soil assessment.
- > Preliminary salinity assessment.
- > Earthworks for the development including recommendations on filling operations.
- > Basin construction.
- > Parameters for retaining wall design.
- > Pavement thickness design.
- > Slope stability assessment.

Based on the investigation findings and subsequent recommendations presented in this report, several geotechnical constraints have been identified onsite. However, through the adoption of good engineering practice, and engineering controls recommended in this report, the site would be considered suitable for the proposed development geotechnically.

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1 Introduction

This report presents the results of a geotechnical investigation undertaken by Stantec Pty Ltd (Stantec) for the proposed South Gillieston Heights residential subdivision. The proposed development comprises subdivision of 457, 463, 501, 507 and 527 Cessnock Road, Gillieston Heights. These addresses are legally identified as Lot 1 and Lot 2 DP302745, Lot 1 DP311179, Lot 1 and Lot 2 DP601226, and Lot 3 DP71130. However, Lot 3 DP71130 does not form part of the site as identified in Maitland City Council's DCP Part F - Urban Release Areas South Gillieston Heights - East Precinct Plan and as such, is excluded from this assessment.

Stantec were engaged by Walker Gillieston Heights Pty Ltd to undertake geotechnical investigation to progress civil design for the development.

It should be noted that geotechnical investigation was undertaken on lots 501, 507 and 527 Cessnock Road, and reported under cover 304100964-002.1, dated 5/12/2022. Further investigation was required following the later acquisition of lots 457 and 463 Cessnock Road. The following report revision of the geotechnical investigation report incorporates the additional lots. The revised report also includes slope stability assessment for the overall development. A locality plan has been provided below in Figure 1-1 for context.

 Image: Contract of the contract

Figure 1-1 Overall locality plan.

For the purpose of this report, Stantec were provided with the following documentation:

- Civil Engineering Plans, prepared by Enspire Solutions Pty Ltd (Enspire) (Ref no. 210039-DA, dated 19/05/2023, revision 2) [1].
- > Bulk earthworks plan, prepared by Enspire (Ref no. 210039-DA-C04.01, dated 19/05/2023, revision 2) [2].
- Report on Preliminary Site Investigation and Detailed Site Investigation (Contamination), prepared by Douglas Partners Pty Ltd. (Ref no. 204921.00, dated 20/05/2022, revision 0) [3].

Based on the provided documents prepared by Enspire, it is understood that the proposed subdivision comprises:

- > Creation of 322 residential allotments.
- > Creation of 2 bio-retention basins.
- > Construction of internal pavement roads as shown in Figures 1-3 in Appendix A.
- > Construction of associated civil infrastructure (e.g. in-ground utilities, etc).

The purpose of the investigation was to obtain geotechnical information on subsurface conditions as a basis for the following comments and recommendations:

- > Preliminary acid sulfate soil and salinity assessments.
- > Recommendations for earthwork procedures and guidelines.
- > Commentary on founding conditions for residential structures.
- > Pavement thickness design for the proposed internal road sections.
- > Commentary on basin design and construction procedures.
- > Slope stability assessment (SSA) for the development.

The geotechnical investigation was undertaken in conjunction with a Remedial Strategy which is reported by Stantec under separate cover 304100964-002.2 (June, 2023).

2 Desktop Review

2.1 **Previous Investigations**

2.1.1 Gillieston Heights

Stantec, previously as Cardno have undertaken multiple previous geotechnical investigations within the surrounding area of the development, including multiple stages of the Wallis Creek development that abuts the current development. Geotechnical investigations were undertaken to provide recommendations for pavement design, site classification, founding conditions, earthworks, basin construction, acid sulfate soils and salinity assessments.

Cardno have also facilitated construction testing and provided geotechnical consulting services throughout civil construction of the Wallis Creek development. Experience from inspections and previous investigation have been utilised within recommendations in this report.

Review of previous geotechnical investigations undertaken in proximity to the current proposed development has been undertaken, with relevant data from the following Cardno reports utilised:

- Wallis Creek Stage 10-12 (abuts northern boundary of site): 'Report on Flexible Pavement Design Stage 10-12 Wallis Creek' (ref. CGS3274-002.1, dated 02/03/2018) [4];
- Wallis Creek Stage 10-12 (abuts northern boundary of site): 'Letter Report on Geotechnical Investigation
 Gillieston Heights Subdivision Stage 10-12' (ref. CGS3240, dated 20/01/2017) [5]
- Wallis Creek Stage 3-9 (north of site): 'Report on Preliminary Geotechnical Investigation, Proposed Wallis Creek Subdivision, Stages 3-9, Cessnock Road, Gillieston Heights' (ref. CGS1399-004.1, dated 16/10/2012) [6]; and
- Wallis Creek Stage 13-14 (north of site): 'Report on Geotechnical Investigation, Stage 13 & 14 Wallis Creek, Gillieston Heights' (ref. 81021073-001.2, dated 28/04/2021) [7].

The general subsurface conditions encountered in geotechnical investigations is as follows:

- > FILL: Silty SANDs and Sandy CLAYs
- > TOPSOIL: Silty SANDs with traces of organic components
- > COLLUVIAL: Silty SANDs of grey to brown colour with varying minor components;
- > RESIDUAL: Silty CLAYs of medium to high plasticity and of red-brown colour with grey mottling;
- Extremely Weathered Material (EWM): Silty / Sandy CLAYs with colour mottling of orange and grey/pale grey.
- > WEATHERED ROCK: PEBBLY / SANDSTONE and or SILTSTONE generally of low strength with some areas of higher strength encountered, with an orange and grey or brown colour.

Where relevant I test pit and geotechnical information relevant to the current investigation from previous Cardno reports has been incorporated, with laboratory testing summarised in Table 5-2.

2.1.2 501-527 Cessnock Road Douglas Partners [3]

Douglas Partners (DP) have previously undertaken an assessment of the Site referenced "Report on Preliminary Site Investigation and Detailed Site Investigation (Contamination) – Proposed Residential Subdivision, 501-527 Cessnock Road, Gillieston Heights, Project 204921.00, dated May 2022" [3]. The objective of the PSI and DSI was to identify and investigate the potential for contamination at the Site from the previous and current land uses.

The scope of works comprised desktop review (Site history, published data, NSW EPA data bases, aerial photographs, tittle deeds and council searches), intrusive field investigation, logging of subsurface profile and laboratory analysis of selected soil samples for a range of analytes.

The investigation comprised site walkover, excavation of 58 test pits, and limited laboratory testing. The general subsurface conditions encountered are summarised as follows:

- > FILL: Generally comprising silty soils with foreign materials such as glass, metal and brick;
- Sandy Silt/Clayey Silt/Silty Clay/Silt: Generally comprising grey brown silty soils with varying fractions of clay and sand;
- > Clay: Clay in all test locations likely alluvial clays and or residual clays; and
- > Sandstone: Encountered in the majority of pits, generally extremely weathered and very low strength.

A further seven (7) boreholes were drilled utilising a combination of solid flight augers and coring to depths up to 7 m. Subsurface conditions encountered during drilling works comprised:

- > TOPSOIL Sandy SILT of low plasticity, brown, with varying fractions of sand and gravel encountered to depths of 0.1 m bgl.
- Silty CLAY: high plasticity, red-brown, trace fine to medium grained sand encountered to depths of 0.4-2.1 m bgl.
- > EWM: Sandy CLAY of low plasticity, brown medium to coarse sand to depths of 2.5-5.5 m bgl.
- > WEATHERED ROCK: SANDSTONE brown, fine grained with pebbles, ranging from very low to high strength, encountered to depths of 2.8-7.0 m bgl.

Findings from the previous investigation have been incorporated into this report where considered relevant.

2.2 Published Information

2.2.1 Geological Maps

Reference to the New South Wales Seamless Geology dataset [8] indicates the site is on the border of several geological formations:

- Branxton Formation (Pmtb) of the Maitland Group known to comprise conglomerate, sandstone, siltstone and residual soils derived through the decomposition of the parent rock formations;
- Muree Sandstone (Pmtu) of the Maitland Group known to comprise fine to coarse grained sandstone, conglomerate, minor claystone and residual soils derived through the decomposition of the parent rock formations;
- Mulbring Siltstone (Pmtm) of the Maitland Group known to comprise medium- to dark-grey siltstone, minor claystone, sporadic thin cherty beds (resistant), rare thin sandstone and limestone beds, sporadic marine fossils; and
- > Quaternary aged Alluvial Backswamp Deposits (Q_ab) typically comprising organic-rich mud, peat, silt and clay likely deposited from Wallis Creek.

The approximate site location has been overlaid onto the geological formation in Figure 2-1 below.





2.2.2 Soil Landscape Maps

A review of the NSW Office of Environment and Heritage, eSPADE v2.2 mapping system (eSPADE) [9] indicates that the investigation site is situated within the Bolwarra Heights (9232bh) soil landscape – comprising in situ weathered parent rock from the Branxton Formation of the Maitland Group. These rocks comprise sandstone, siltstone, conglomerate, erratics. The mapping indicates site is prone to minor to moderate sheet and rill erosion where ground cover has been removed along with minor gully erosion.

2.2.3 Acid Sulfate Soil Risk Maps

Review of the Maitland Local Environmental Plan (LEP) 2011 Acid Sulfate Soils Risk Map indicates the Site is situated within Class 5 and Class 2 Acid Sulfate Soils. Class 5 indicates that *"works within 500 metres of adjacent Class 1, 2, 3, or 4 land that is below 5 metres AHD and by which the watertable is likely to be lowered below 1 metres AHD on adjacent Class 1, 2, 3 or 4 land, present an environmental risk".* Class 2 indicates that *"works below the natural ground surface. Works by which the watertable is likely to be lowered.*

The NSW Office of Environment and Heritage, eSPADE v2.2 Acid Sulfate Soils Risk Map Probability indicates the site is situated within H1 (High probability <1m below surface level) and Lm (Low probability, bottom sediments) categories. The approximate site location has been overlaid onto the soil landscape map in Figure 2-2 below.

Given the Acid Sulfate Soil (ASS) risk maps for the Gillieston Heights area indicate that the South Gillieston Heights development extents are located within an area of mapped known occurrence of ASS, further laboratory testing was undertaken. It should be noted however, that no development is proposed in area mapped as having high probability of ASS occurring.

Figure 2-2 Approximate site location over ASS Risk Maps.



3 Site Description

The subject site is identified as 457-527 Cessnock Road, Gillieston Heights . The proposed development incorporates the lots summarised in Table 3-1 below.

Table 3-1 South Gillieston Heights Locality.

Lot & DP	Address
Lot 1 & 2 DP302745	457-463 Cessnock Road, Gillieston Heights
Lot 1 DP 311179	501 Cessnock Road, Gillieston Heights
Lot 1 & 2 DP601226	507-527 Cessnock Road, Gillieston Heights

The site is an irregular shaped parcel of land and is bounded by:

- > Stages 10-12 of the Wallis Creek Residential Development to the north of site;
- Rural parcels of land to the west of site, separated by Main Road/Cessnock Road; >
- Wallis Creek along the eastern boundary of site; and >
- Rural parcels of land to the south. >

Topographically the site is located within a regionally undulating terrain, characterised by a north-south trending ridgeline traversing the northern portion of the site, and adjacent low-lying alluvial flood plains to the south and east.

Slopes within the northern and central portion of site generally fall to the east towards Wallis Creek and to the west from the ridgeline typically in the order of 5-10 degrees. Slopes in the southern portion of the site fall to the south towards Testers Hollow. It is expected surface flows follow this trend with a series of farm dams and channels observed for water retention to the west of the ridgeline. Vegetation across the site at the time of fieldwork comprised large areas of open thick grazing pasture with isolated mature trees. These features have been highlighted on Figure 1 attached in Appendix A.

Observations noted during the investigation for specific lots has been summarised in Table 3-2 below.

able 3-2 Spe	cific lot site observations.
Lot & DP	Observations
Lot 1 & 2 DP302	 Rural residential weatherboard and brick house within the central of site with evidence of animal holding areas. Verdant nature of the pasture, potentially reflecting pasture improvement of fertilizer application. This has the potential to impact trafficability as the surficial soil is more prone to waterlogging. Evidence of localised slumping around upstream edge within existing farm dam within the eastern portion of site. Southern embankment wall appeared to be constructed using localised surplus material from the impoundment area of the basin. A gully line was noted downstream of the farm dam in the eastern portion of the Site, trending south west through Lot 2 DP601226 before discharging offsite via Cessnock Road culvert crossing. Several stockpiles, with several stockpiles noted to contain foreign materials, within the north-western and central portion of site surrounding existing dwellings and sheds. Evidence of localised cut and fill within areas associated with effluent disposal, dams, pavements and structures. Retaining walls observed along northern boundary, abutting Stage 11 & 12 of the Wallis Creek residential development. In-ground concrete pool located within central portion of site, with retaining walls on eastern boundary of pool observed to be failing.
Lot 1 DP 3111	 Rural residential housing within the site with evidence of animal holding areas. Filling noted within driveways/access tracks typically comprised quarry gravel product. Due to presence of livestock it is anticipated the site has been used for grazing.
Lot 1 & 2 DP601	• Rural residential housing within the site with evidence of animal holding areas.

Lot & DP	Observations
Lot 1 & 2 DP601226 (continued)	 Ponded water was observed localised at the base of the north-south trending gully line in the western portion of site due to inclement weather prior and during the initial field investigation. Four gully lines were noted at the Site:
	 A gully line was noted in close proximity to the northern site boundary, trending offsite north-east towards Wallis Creek.
	 A gully line was noted along the central western boundary of the site, trending south- west before discharging offsite via Cessnock Road culvert crossing.
	 A gully was noted in the southern portion of the Site, traversing offsite to the south-west towards Testers Hollow.
	 A gully line was noted within the central eastern portion of site generally trending east- west discharging flows towards Wallis Creek.
	 Surficial softening of the topsoil material was noted through rutting across the site, with trafficability issues encountered at the time of the initial fieldwork.
	 Rock outcropping in the southern portion of site and along the ridgeline on the eastern boundary of site where the break in grade is located.
	 General refuse was noted in both the western and eastern gully, typically comprising scrap metal, masonry units and bricks.
	 A farm dam with general refuse typically comprising scrap metal was noted in central- western portion of site as noted on Figure 1 in Appendix A.
	 Demolition of existing agricultural structures within the southern portion of site with scrap timber and metal sheeting covering site surfaces.
	 Several paddocks cordoning off sections of the central and southern portion of site were noted. Gates and fences for the paddocks were damaged due to livestock with the area likely used for livestock grazing.
	 Vegetation comprised predominately grazing grasses, with an increased density of mature trees noted along the eastern portion of the site associated with steepening slopes along the eastern boundary of the site.
	 The site was noted to slope along the eastern boundary toward a 3 m vertical face.

4 Investigation Methodology

4.1 Site Investigation

Fieldwork for the investigation was undertaken on the 5th and 12th of October 2022 within Lot 1 DP 311179 and Lot 1 & 2 DP601226, with additional investigation undertaken on 19th of April 2023 in Lot 1 & 2 DP302745. It is noted the investigations were undertaken prior to the completion of civil design. The investigations comprised the following:

- > A site walkover by a geotechnical engineer from Stantec, including visual appraisal and recording of salient site conditions and features.
- Excavation of a total of forty (40) test pits and logging of subsurface conditions within the proposed allotment areas, basins and road alignments. Test pits were excavated utilising a 5-tonne excavator with a 600mm toothed bucket to a target depth of 1.5m below existing ground level (bgl). It should be noted deeper cuts are proposed for bulk earthworks for the development, with refusal encountered significantly higher than anticipated bulk earthworks levels.
 - 28 test pits within the original proposed allotments (TP001-TP028) with refusal (including slow progress termination) occurring at test pits TP002, TP004, TP007-TP008, TP010, TP012-TP013, TP024 and TP028.
 - An additional 12 test pits within the additional lots (TP101-TP112) with refusal (including slow progress termination) occurring in test pits TP101-TP104 and TP110-TP112.
- > Dynamic cone penetrometer tests (DCP) were conducted at all excavated test pits to aid in the assessment of subsurface strength conditions.
- > Disturbed geotechnical/environmental samples of natural materials were collected for subsequent laboratory testing.
- > All test pits backfilled with excavated spoil upon completion.

Field investigation including logging of subsurface profiles and collection of samples was carried out by an experienced geotechnical engineer from Stantec. Test pits were located using a kml file generated by overlaying proposed test pits onto the supplied development extents and then outputed to a compatible handheld tablet. It is expected that test pit accuracy would be in the range of +/- 5m.

The location of the test pits is shown on Figures F1-F4, attached in Appendix A. Subsurface conditions are summarised below and detailed in the engineering logs attached in Appendix B with explanatory notes.

4.2 Laboratory Testing

Laboratory testing on selected samples recovered during the site investigation comprised the following:

- > Eight (8) California Bearing Ratio (CBR) tests to assess proposed subgrade strength.
- > Two (2) Emerson Class tests to measure soil dispersion.
- > One (1) Permeability test to determine site soil permeability.
- > Fifteen (15) acid sulfate soil screening tests using the field screening method.
- > Six (6) detailed acid sulfate soil tests using the Chromium Reducible Sulphur (SCr) method.
- > Five (5) Salinity profiling tests, comprising Cation Exchange Capacity (CEC), Exchangeable Sodium Percentage (ESP), chloride, Sulfate, pH, Electrical Conductivity (EC) and resistivity.
- > Ten (10) additional EC tests were undertaken to further aid in soil salinity assessment.

Geotechnical and environmental laboratory testing was conducted at NATA accredited laboratories. Results of laboratory testing are detailed in the report sheets attached in Appendix C and summarised in Section 5.2 below.

5 Investigation Findings

5.1 Subsurface Conditions

The subsurface conditions encountered across the site have been characterised and summarised as follows:

- > FILL: Surficial filling comprising Silty CLAY / Clayey SILT with varying minor components of sand and gravel were encountered within several the test pits to depths in the range of 0-0.5 m BGL.
- > TOPSOIL: Sandy SILT or Silty SAND of low plasticity and fine to medium grain size, dark brown in colour, with varying fractions of gravel encountered to depths in range of 0.1-0.30m below ground level (BGL).
- > COLLUVIUM SOILS: Silty SAND / Sandy SILT / Silty CLAY generally pale brown to brown in colour, encountered in majority of the test locations. Colluvial materials generally ranged from moist to wet (due to inclement weather) and were predominantly loose to medium-dense (based on the results of DCP testing). It should be noted colluvial soils noted in overland flow paths were virtually saturated due to inclement weather at the time of investigation and ranged from soft to stiff (based on the results of DCP testing).
- > RESIDUAL SOILS: Silty / Gravelly / Sandy CLAYs of predominantly a mottling of orange, dark red and brown colour were encountered in all test pits to depths. Residual clays were typically of medium to high plasticity and ranged from firm to hard consistency (based on DCP testing). Moisture condition was observed to range from above to below plastic limit across the site.
- EXTREMELY WEATHERED MATERIAL (EWM): Extremely weathered SANDSTONE / Pebbly SANDSTONE and or SILTSTONE countered at all test locations (excluding TP022, TP024 & TP111). Extremely weathered materials were generally consistent with very stiff to hard Silty / Gravelly / Sandy CLAY and medium dense to very dense Silty / Clayey SAND. EWM clay materials were noted to be low to medium plasticity and predominantly below the plastic limit in moisture condition. Sands were generally observed to be in a dry to moist condition.
- > WEATHERED ROCK: Fine to coarse grained SANDSTONE / Pebbly SANDSTONE, CONGLOMERATE and or SILTSTONE encountered at majority of the test locations (excluding TP003, TP005, TP009, TP011, TP014-TP017, TP019-TP023, TP025, TP027, TP028, TP105-TP107 &TP109). Encountered weathered rock was generally observed to be highly weathered with inferred very low to low strength. Practical bucket refusal on generally low strength (or stronger) rock was encountered at majority of the test locations.

Seepage was encountered in within test pit TP016, associated with perched water within the gravelly fill profile at the time of fieldwork. Potential groundwater seepage was encountered within a heavily fractured siltstone profile in test pit TP111.

It should be noted that initial fieldwork was conducted following an extended period of wet weather with the presence of ponded water in multiple isolated locations across the site. It should be appreciated considering the site topography and material types encountered, groundwater levels are expected to be impacted by prolonged periods of inclement weather in proximity to existing gully lines.

The second portion of the investigation was undertaken following a period of dry weather. Trafficability of the site was easily achieved with a 4x4 vehicle with little to no disturbance of surficial soils.

It should also be noted that following periods of inclement weather, surficial soils may be susceptible to rutting and may cause trafficability issues.

The subsurface conditions are detailed in the engineering logs in Appendix B and summarised in Table 5-1 below.

Test Location	Depth to Base of Fill	Topsoil Thickness (m)	Depth to Base of Colluvium	Depth to Base of Residual	Depth to Base of EWM	Depth of Rock Refusal ⁽¹⁾⁽²⁾
TP001	0.25	-	-	0.85	1.20	1.50 ⁽²⁾
TP002	0.20	-	0.35	0.75	1.20	1.40
TP003	0.15	-	0.30	1.00	1.60	-
TP004	-	0.25	0.45	0.80	1.00	1.30

Table 5-1 Summary of Subsurface Conditions

Test Location	Depth to Base of Fill	Topsoil Thickness (m)	Depth to Base of Colluvium	Depth to Base of Residual	Depth to Base of EWM	Depth of Rock Refusal ⁽¹⁾⁽²⁾
TP005	-	0.10	0.50	0.90	1.50	-
TP006	-	0.15	0.30	1.20	1.45	1.60 ⁽²⁾
TP007	-	0.20	0.35	1.00	1.30	1.40
TP008	-	0.20	0.50	0.90	1.00	1.10
TP009	-	0.20	-	0.90	1.50	-
TP010	0.15	-	0.35	1.05	1.30	1.40
TP011	0.10	-	0.25	0.60	1.50	-
TP012	0.30	-	-	0.90	1.10	1.30
TP013	0.25	-	-	0.95	1.10	1.20
TP014	0.40	-	-	1.40	1.50	-
TP015	0.30	-	-	0.75	1.60	-
TP016	0.45	-	-	1.40	1.70	-
TP017	0.35	-	-	1.10	1.50	-
TP018	0.25	-	-	0.85	1.20	1.50 ⁽²⁾
TP019	0.15	-	0.30	1.30	1.50	-
TP020	0.45	-	-	1.40	1.50	-
TP021	0.25	-	-	1.20	1.50	-
TP022	0.50	-	1.05	1.60	-	-
TP023	0.15	-	-	1.25	1.50	-
TP024	0.20	-	-	0.60	-	0.85
TP025	-	0.20	-	0.80	1.50	-
TP026	-	0.15	0.30	0.80	1.20	1.50 ⁽²⁾
TP027	-	0.15	0.30	1.15	1.60	-
TP028	-	0.15	-	0.70	1.40	-
TP101	-	0.25	0.45	0.65	0.80	0.90
TP102	0.70	-	-	1.00	1.25	-
TP103	0.40	-	-	0.75	1.20	-
TP104	0.25	-	0.40	0.80	1.60	-
TP105	-	0.30	1.00	1.60	2.50 ⁽²⁾	-
TP106	-	0.20	0.35	1.05	2.00 ⁽²⁾	-
TP107	0.60	-	1.30	2.20	2.30 ⁽²⁾	-
TP108	-	0.25	0.80	1.60	1.90	2.20 ⁽²⁾
TP109	-	0.25	-	1.80	2.30 ⁽²⁾	
TP110	-	0.25	-	1.00	1.25	1.40
TP111	0.50	-	-	0.65	-	1.30
TP112	0.25	-	-	0.50	0.90	1.10

Notes to table:

All depths in metres below existing ground levels (m bgl).

(1) Indicates refusal / slow progress refusal with a 5-tonne excavator fitted with a 600mm toothed bucket.

(2) Termination depth of 1.5m bgl or greater where rock refusal not encountered.

(3) Organics predominantly present within top 100-150mm (nominal).

5.2 Laboratory Results

The results of the geotechnical testing undertaken on representative samples are summarised below with the laboratory report sheets attached in Appendix C.

5.2.1 Geotechnical

5.2.1.1 California Bearing Ratio Test Results

The results of the standard compaction CBR testing undertaken on representative samples of the proposed internal road subgrade are summarised below in Table 5-2 with the laboratory report sheets attached in Appendix C.

Table 5-2	Summary of	CBR Test Results					
Pit ID	Depth (m)	Material Description	W (%)	SOMC (%)	SMDD (%)	Swell (%)	CBR (%)
TP002	0.4 - 0.6	RS: Silty CLAY, trace sand	23.5	22.5	1.60	1.5	6.0
TP004	0.5–0.65	RS: Silty Sandy CLAY, trace gravel	22.8	20.0	1.65	0.5	6.0
TP006	1.1 – 1.4	RS: Silty Sandy CLAY	14.9	12.5	1.93	1.0	8.0
TP009	0.3 – 0.6	RS: Silty CLAY, trace sand	32.5	25.5	1.50	1.5	3.0
TP010	0.6 - 0.8	RS: Silty CLAY, trace sand	28.7	26.5	1.51	1.5	3.5
TP011	0.6 - 0.9	EWM: Silty Sandy CLAY	17.1	14.5	1.83	1.0	7.0
TP105	0.5 - 0.8	COL: Silty CLAY	28.1	27.5	1.49	3.0	2.5
TP109	1.8 – 2.0	EWM: Sandy CLAY	15.1	15.5	1.83	1.0	12.0
TP072 ⁽¹⁾	0.4 – 0.7	Silty CLAY, red-grey mottled orange	28.0	23.4	1.58	2.1	4.0
TP079 ⁽¹⁾	0.4 - 0.7	Silty CLAY, brown	24.5	19.1	1.66	2.1	3.0
TB1305 ⁽²⁾	0.4–0.55	Silty CLAY	15.6	18.0	1.71	2.0	3.5
TB1305 ⁽²⁾	0.55–0.7	SILTSTONE	10.2	14.5	1.80	1.0	8.0
TB1402 ⁽²⁾	0.2 – 0.4	Silty CLAY	24.9	25.0	1.53	1.5	5.0

Notes to table:

W: Field Moisture Content

SOMC: Standard Optimum Moisture Content

SMDD: Standard Maximum Dry Density

(1) Test results sourced from previous investigation associated with report CGS3274-002.1 [4]

(2) Test results sourced from previous investigation associated with report 81021073-001.2 [7]

5.2.1.2 Emerson Class Test Results

The result of the Emerson Class test undertaken on a representative sample of the water quality basin material is summarised below in Table 5-3 with the laboratory report sheets attached in Appendix C.

Table 5-3	Summary	of Emerson	Class	Test	Results
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Hole ID	Depth (m)	Soil Type	Emerson Class	Notes
TP014	0.6 – 0.7	Silty CLAY: orange-brown mottled grey	4 ⁽¹⁾	No Dispersion
TP023	0.55 - 0.9	Silty CLAY: brown mottled grey and pale grey	8	No Swelling

Notes to table:

(1): Minerals present: Carbonate and Gypsum

5.2.1.3 Permeability Test Results

The results of the permeability test undertaken on a selected sample of site clay summarised below in Table 5-4.

Table 5-4 Summary of Permeability Te	st Results
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Pit ID	Depth (m)	Soil Type	Sample Compaction (%)	Coefficient of Permeability (m/sec)
TP023	0.55 – 0.90	CLAY, with sand, brown	99	2×10 ⁻¹⁰

5.2.2 Environmental Laboratory Testing

5.2.2.1 Salinity Test Results

Salinity and sodicity assessment results are summarised in Table 5-5 and Table 5-6 below. The assessment results are also detailed in report sheets attached in Appendix C.

Table 5-5	Summary of Sal	linity Results				
Location	Depth (m)	Soil Description	Structure	EC (dS/m)	ECe ^[1] (dS/m)	Salinity Assessment
TP001	1.25-1.30	SANDSTONE	HW. ROCK	0.07	<2	Non-saline
TP002	0.20 - 0.30	Silty SAND	COLLUVIAL	0.02	<2	Non-saline
TP002	1.20 - 1.40	SANDSTONE	HW. ROCK	0.08	<2	Non-saline
TP005	0.20 - 0.40	Sandy SILT	COLLUVIAL	<0.01	<2	Non-saline
TP006	1.20 - 1.30	Silty Sandy CLAY	EWM	0.05	<2	Non-saline
TP007	0.05 - 0.10	Silty SAND	TOPSOIL	0.01	<2	Non-saline
TP007	0.65 - 0.80	Silty Sandy CLAY	RESIDUAL	0.04	<2	Non-saline
TP007	1.30 - 1.40	SILTSTONE	HW. ROCK	0.04	<2	Non-saline
TP014	0.45 - 0.60	Silty CLAY	RESIDUAL	0.03	<2	Non-saline
TP014	0.9 – 1.0	Silty CLAY	RESIDUAL	0.09	<2	Non-saline
TP018	1.2 – 1.3	SILTSTONE	HW. ROCK	0.11	<2	Non-saline
TP022	0.3 – 0.5	Sandy SILT	COLLUVIAL	<0.01	<2	Non-saline
TP022	0.6 - 0.8	Silty CLAY	COLLUVIAL	0.78	4	Slightly Saline
TP028	1.0– 1.2	Clayey SAND	EWM	0.13	<2	Non-saline

Notes to table:

[1] ECe results are EC data multiplied by a conversion factor contained in Table 6.1 of Department of Land Water Conservation NSW, 2002: Site Investigations for urban salinity, based on soil type.

EC: Electrical Conductivity

HW Highly Weathered

EWM Extremely Weathered Material

Table 5-6 Summary of ESP Results

Location	Depth (m)	Soil Description	Structure	ESP	Sodicity Assessment
TP001	1.25 – 1.30	SANDSTONE	HW. ROCK	4.2	Non-sodic
TP006	1.20 – 1.30	Silty Sandy CLAY	EWM	15.0	Sodic
TP014	0.45 – 0.60	Silty CLAY	RESIDUAL	0.2	Non-sodic
TP022	0.60 - 0.80	Silty CLAY	COLLUVIAL	19.0	Highly-sodic
TP028	1.00 – 1.20	Clayey SAND	EWM	3.5	Non-sodic

Notes to table:

ESP EWM Exchangeable Sodium Potential

Extremely Weathered Material

5.2.2.2 Acid Sulfate Soils

Preliminary acid sulfate field screening and detailed results on selected samples, are contained in laboratory report sheets attached in Appendix C and summarised below in Table 5-7.

Table 5-7 Acid Sulfate Soil Test Results

		Date F	Filling (F) /		pH₽	pH _{FOX}	pH _F - pH _{EOY}	Reaction Rate	pH kcl	ТАА		SCr
Location	Depth (m)	Sampled	Natural (N)	Material Description	pH units	pH units	pH units		pH units	mole H+/t	%w/w	mole H+/t
TP004	0.05 - 0.10	5/10/22	N	TS: Silty SAND	6.2	3.3	2.9	Extreme	5.6	8.3	< 0.005	< 3
TP005	0.20 - 0.40	5/10/22	N	ALV: Sandy SILT	6.1	4.4	1.7	Moderate			-	
TP005	0.50 - 0.60	5/10/22	N	RS: Silty Sandy CLAY	6.1	4.5	1.6	Moderate	-		-	-
TP008	0.10 - 0.25	5/10/22	N	TS: Silty SAND	6.2	2.9	3.3	Strong	5	15	< 0.005	< 3
TP011	0.45 - 0.55	5/10/22	N	RS: CLAY	6.1	4.7	1.4	Strong	-	-	-	-
TP014	0.45 - 0.6	12/10/22	N	RS: CLAY	6.7	4.6	2.1	Strong	-	-	-	-
TP014	1.1 - 1.2	12/10/22	N	RS: CLAY	5.2	4.3	0.9	Moderate	-	-	-	-
TP014	1.4 - 1.5	12/10/22	N	EWM: Silty CLAY	5.7	4.5	1.2	No Reaction to Slight	-		-	
TP022	0.3 - 0.5	12/10/22	N	Poss ALV: Sandy SILT	6.5	4.4	2.1	Strong	5.1	12	<0.005	< 3
TP022	0.6 - 0.8	12/10/22	N	ALV: Silty CLAY	5.2	4	1.2	Moderate	4.4	74	< 0.005	< 3
TP022	1.2 - 1.4	12/10/22	N	RS: CLAY	5.4	3.9	1.5	No Reaction to Slight	-		-	
TP024	0.2 - 0.4	12/10/22	N	RS: CLAY	6.2	3.8	2.4	Moderate	4.5	59	< 0.005	< 3
TP028	0.05 - 0.1	12/10/22	N	TS: Sandy SILT	6.1	3.3	2.8	Extreme	6.5	<2	< 0.005	< 3
TP028	0.2-0.35	12/10/22	N	RS: Silty CLAY	6.4	4.6	1.8	Extreme	-	-	-	-
TP028	1.0 - 1.2	12/10/22	N	EWM: Clayey SAND	8.4	8.8	-0.4	Extreme	-	-	-	-
	Gui	deline Value		Eurofins LOR	-	-	-		-	2	0.005	3
ASSMAC (1998) Potenti	al Acid Sulfate	Soil Indicator Valu	e	4 - 5.5 ¹	< 3 3	14				-	-
ASSMAC (1998) Actual	Acid Sulfate So	il Indicator Value		$\leq 4^2$	-	-				-	
ASSMAC (1998) Action	Criteria - Cours	e Soils (1 - 1000 to	onnes) ⁵	-	-	-	-	-	-	0.03	18
ASSMAC (1998) Action	Criteria - Mediu	ım Soils (1 - 1000 t	onnes) ⁶	-	-	-	-			0.06	36
ASSMAC (1998) Action	Criteria - Fine S	Soils (1 - 1000 tonn	es) 7	-	-	-	-	-	-	0.10	62
ASSMAC (1998) Action	Criteria - Cours	e Soils (>1000 ton	nes) ⁵	-	-	-				0.03	18
ASSMAC (1998) Action	Criteria - Mediu	ım Soils (>1000 tor	nnes) ⁶	-	-	-		-	-	0.03	18
ASSMAC (1998) Action	Criteria - Fine S	Soils (>1000 tonne:	\$) ⁷	-	-	-				0.03	18
Notes to Tab	ole:											
1 - pH value	s >4 and <5.5 a	ire acid and may	be the result of some	previous or limited oxidation of sul	lfides, but is	not confirm	atory of act	ual acid sulfate soils				
2 - pH readir	ngs of pH≤4, in	dicates that actua	al acid sulfate soils ar	e present with the sulfides having b	een oxidize	d in the pas	it, resulting i	in acid soils (and soil pore wate	er)			
3 - The lowe	r the final pH _{FO}	x value is, the bet	tter the indication of a	positive result.		and as Mata	and a The s	and the off dense below 2			f - Meter	
» If the pH _{FO} » A pH _{FO} 3:	If the pH _{FOX} < 3 and there was a strong reaction to the peroxide, there is a high level of certainty of a potential acid sulfate soils. The more the pH _{FOX} drops below 3, the more positive the presence of sulfides.											
» For pH _{FOX}	4-5 the test is n	either positive no	or negative. Sulfides r	nay be present either in small quar	tities and b	e poorly rea	ctive under	quick test field conditions.				
» For pH _{FOX}	» For pH _{FOX} >5 and little or no drop in pH from the field value, little net acid generating ability is indicated.											
4 - If the pH;	4 - If the pH _{FOX} value is at least one unit below field pH _F , it may indicate potential acid sulfate soils. The greater the difference between the two measurements, the more indicative the value is of a potential acid sulfate soils.											
5 - Course soils comprise sands to loarny sands - Approximate clay content (% < 0.002mm) ≤ 5%												
6 - Medium soils comprise sandy loams to light clays - Approximate clay content (% < 0.002mm) between 5 and 40%												
7 - Fine soils comprise medium to heavy clays and silty clays - Approximate clay content (% < 0.002mm) ≥ 40%												
Contaminant Exceedance Indicators:												
Bold	Bold Indicates the laboratory result is within the specified range of the ASSMAC (1998) Actual Acid Sulfate Soil Indicator Values											
Italics	Indicates the laboratory result either exceeds or is within the specified range of the ASSMAC (1998) Potential Acid Sulfate Soil Indicator Values											
	Indicates exceedance of the ASSMAC (1998) Action Criteria triggering the need to prepare a ASS Management Plan											
	Indicates the requirement for localised lime treatment of the material, that is, when the laboratory results for SCr (%whw) > 0.03 and the SCr (mole H=/t) > 18											

6 Geotechnical Comments & Recommendations

6.1 Preliminary Acid Sulfate Soil Assessment

Laboratory testing detailed in Section 4.2 comprised preliminary screening of samples from various materials encountered within the subsurface profile across the site.

Following review of preliminary screening results, an additional six (6) detailed chromium suite tests were undertaken with results compared against the Acid Sulfate Soil Action Criteria guidelines [10] as detailed in Section 6.1.1 below.

Acid sulfate test results are detailed in laboratory report sheets contained within Appendix C of this report and summarised in Table 5-7 above.

6.1.1 Acid Sulfate Soil Action Criteria

Review of the New South Wales Planning, Industry & Environment mapping portal 'eSPADE' [11] and Maitland Local Environmental Plan (LEP) 2011 Acid Sulfate Soils Risk Map indicates the Site is situated within Class 5 and Class 2 Acid Sulfate Soils.

The acid sulfate criteria in which the soils were assessed against is described below:

 Table 6-1
 Action Criteria based on Proposed Disturbance - ASSMAC (1998) [10]

Proposed Disturbance	Criteria	Fine Soils ⁽¹⁾	Medium Soils ⁽²⁾	Coarse Soils ⁽³⁾
× 1.000 termes	Sulfur Trail (Spos) %	0.03	0.03	0.03
> 1,000 tonnes	Acid Trail (TPA / TSA) H+/t	18	18	18

Notes to table:

(1) Medium to heavy clays and silty clays - Approximate clay content (%<0.002mm) $\geq 40\%$

(2) Sandy loams to light clays - Approximate clay content (%<0.002mm) > 5% to < 40% $\,$

(3) Sands to loamy sands - Approximate clay content (%<0.002mm) \leq 5%

6.1.2 Preliminary Assessment

The results of the limited laboratory testing indicated minor exceedance of total actual acidity (TAA) following field screening and detailed chromium suite testing, however there was no detection of chromium reducible sulfur. Based on the results of the testing, it's considered that the subsurface soils are naturally acidic but not considered an acid sulfate soil by definition.

6.2 Preliminary Salinity Assessment

The salinity assessment was undertaken in general accordance with Department of Land and Water Conservation – Site Investigations for Urban Salinity [12]. The salinity assessment comprised:

- > A desktop review of available data in the area;
- > Site walkover to inspect for signs of saline and sodic soils; and
- > Intrusive sampling and laboratory testing.

6.2.1 Site Walkover

A site walkover was undertaken by a geotechnical principal from Stantec on 12th October 2022. The site walkover was undertaken to assess for indicators of saline soils across the site in general accordance with the Department of Land and Water Conservation – Site Investigations for Urban Salinity [12]. Observations made during the investigation are presented in Table 6-2 below.

Table 6-2 Potential Saline soil indicators.

Potential Indicator ⁽¹⁾	Site Observation
Bare soil patches	Minor areas around existing dams.
Salt crystals present on surface	Not Observed.
'Puffiness' of soil when dry or greasy when wet	Not Observed.
Black staining on soils	Not Observed.
Presence of indicator vegetation species	Not Observed.
Die back of trees	Not Observed.
Staining of structural foundations	Not Observed.
Erosion paths around existing water bodies	Minor head scape noted on the upstream side of existing farm dams.

Notes to table:

[1] Based on Phase One of Department of Land Water Conservation NSW, 2002: Site Investigations for urban salinity.

The existing site supported well established vegetation comprising open pasture with isolated mature trees. No indication of saline soils were noted during the inspection. Minor indications of erosion were observed around the existing central eastern farm dam in the form of a head scape on the upstream wall. as shown Figure 6-1.



Figure 6-1 Existing Rural Dam

6.2.2 Salinity Assessment Criteria

Salinity assessment criteria adopted from the Department of Land and Water Conservation NSW [12] and assessment results are summarised below Table 6-3 and Table 6-4 respectively. The assessment results are also detailed in report sheets attached in Appendix C.

Class	ECe (dS/m)
Non- saline	<2
Slightly saline	2-4
Moderately saline	4-8
Very saline	8-16
Highly saline	>16

Notes to table:

[1] Based on Table 6.2 of Department of Land Water Conservation NSW, 2002: Site Investigations for urban salinity.

Table 6-4 Sodic Class Assessment Criteria

Class	ESP (%)
Non-sodic	< 5
Sodic	5 - 15
Highly sodic	> 15

Salinity and sodicity laboratory results are summarised in Section 5 above, with laboratory test reports attached in Appendix C.

6.2.3 Preliminary Assessment

Based on laboratory testing and site observations, site soils are generally considered non-saline with the exception of the test from TP022 indicating it is a slightly saline soil. Based on the results and extent of proposed earthworks, it is considered saline soils will not be an issue at the site and therefore will not require remediation.

Based on the above testing, colluvial soils are highly sodic in nature and as such prone to erosion. As a result, depending on proposed use of soils, amelioration of exposed soils may be required by the treatment of gypsum. Where sodic soils are buried at depth in fill areas, treatment may not be required. This would be subject to inspection by suitably qualified geotechnical consultant and further confirmatory laboratory testing undertaken during construction.

Where required, it is anticipated soil sodicity can be managed by the application of gypsum at a typical nominal rate of 2kg per/m². Validation testing following preliminary excavation and dosing would be required to confirm application rates.

It should be noted that where the general site soils are protected by topsoiling and revegetation, no specific treatment would be required.

6.3 Earthworks

At the time of reporting, preliminary regrade plans for a staged development application of the whole site were supplied to Stantec [2]. Based on the supplied documentation, earthworks for the proposed development are expected to comprise:

- Regrade to all allotments, with maximum cut depths generally ranging from 1.0 to 6.0m below existing ground level (bgl) and localised areas of cutting in excess of 7.0m.
- > Filling in the order of 0.5 to 3.0 m above existing ground level to achieve design levels and form residential allotments. It is anticipated filling within low lying areas of site, gulleys and decommissioning existing rural dams will exceed 5.0m.
- > A combination of cutting and filling to portions of all the proposed internal road pavements to depths typically in the order of 1.0 to 2.0m bgl (incl. allowance for subgrade boxout), which includes isolated areas of deeper cut to approximately 3.0 to 4.0 m bgl around the eastern portion of site.
- Based on the provided plans there are two (2) permanent basins proposed across the residential development, with two temporary sediment basins proposed within the future footprints of the temporary basins.

Recommendations regarding earthworks for the development are provided below and should be referenced for construction.

During the investigation, refusal was generally encountered at depths of 1.5 m bgl in the weathered rock profile. It should be noted this is significantly shallower than some areas of proposed excavations. Reference to previous boreholes reported in the DP Report [3] indicate higher strength rock has been encountered in portions of the site at depths ranging from 2.8-7.0 m bgl. As such, it is likely higher strength rock will be encountered during excavation.

6.3.1 Topsoil Stripping

Topsoil was encountered in most test pits at thickness ranging from 0.1-0.3 m. All topsoil should be stripped and stockpiled onsite during bulk earthworks. Topsoil impacted by vegetation can not be used as general fill and should be subject to relevant testing for re-use as site topsoil. Topsoil re-use would be subject to inspection by a suitable qualified geotechnical consultant.

6.3.2 Uncontrolled Filling

Uncontrolled filling was encountered during the investigation associated with existing sheds, private service trenches, effluent beds, driveways/access track and within existing farm dams and drainage channels. Uncontrolled filling encountered during the investigation generally comprised:

- > Filling typically consistent with encountered subsurface conditions within service trenches and drainage channels. It is therefore anticipated filling associated with service trenching and drainage channels comprised site won fill.
- > Filling noted within driveways/access tracks typically comprised quarry gravel product.
- > Foreign materials such as bricks, masonry blocks and scrap metal, noted within farms dams and existing drainage channels.

Based on conditions encountered during the investigation, it is expected the uncontrolled fill could be excavated, assessed, reconditioned and used onsite as general fill. This would be subject to inspection by a suitably qualified geotechnical engineer. The inclusion of foreign material could be sorted during bulk earthworks and either recycled or disposed offsite as waste once classified.

Areas of uncontrolled fill are noted on Figure F1 attached in Appendix A.

6.3.3 Colluvial Soils within Filling Areas

Colluvial soils were encountered in most test pits across the site to depths ranging from 0.25-1.3 m bgl. During stripping, where colluvial soils are encountered in areas of proposed filling and minimal cuts, further stripping of colluvial soils may be required, particularly where colluvial materials are encountered during stripping on slopes greater than 8 degrees.

Stripping extents would be subject to final bulk earthworks design levels, and inspection by a suitably qualified geotechnical consultant.

6.3.4 Excavations

Design excavations across the site are anticipated to reach depths in the order of 7.0 m. This may increase where deeper service trenching is proposed.

6.3.4.1 Excavatability

Based on anticipated depths of cut and encountered subsurface conditions at the test pit locations, excavations are expected to be undertaken within the alluvium, colluvium, residual soils, extremely weathered soils and weathered rock profile. Excavations into the colluvial and residual soils are expected to be readily undertaken utilising conventional earthmoving equipment, such as backhoes and small excavators.

Considering the likely excavation depths, bedrock is expected to be encountered during construction particularly in areas of deeper cut for proposed in ground services excavation and road box out. Although machine refusal was not encountered at all test locations, it should be noted the weathered rock profile was encountered at majority of the test pit locations at depths ranging from 0.6 to 1.0m bgl. Excavation progression within the weathered rock profile was generally observed to be slow, and should be considered with respect to plant selection.

Considering the anticipated cutting depths and rock depth encountered at the test locations across site, it would be considered prudent to make allowance for hydraulic rock hammer excavation, the use of large capacity excavators with a single ripper attachment, or large plant with rock ripping capabilities. This is particularly necessary where excavations are expected to extend significantly into the weathered rock, and in particular, confined service trenching proposed within weathered rock.

As refusal was encountered prior to anticipated excavations depths, it may be considered prudent to undertake further investigation in the form of test pitting with larger machines or drilling within areas of proposed deeper excavation. This would be recommended to gather information on deeper rock excavatability, strength, and inform on potential plant selection.

6.3.4.2 Stability of Excavations

Excavations or trenches in the alluvium, colluvium soils, residual stiff or better soils and the weathered rock profile could be expected to stand close to vertical in the short-term. Unsupported excavations into the natural site soils will likely be subject to local slumping if elevated groundwater conditions exist and seepage occurs (e.g. after sustained periods of wet weather). Particular care should be made where virtually saturated topsoil and colluvium materials are encountered. Should areas of instability or significant groundwater flows be encountered during excavation, a suitably qualified geotechnical engineer should inspect the excavations with respect to stability.

Where personnel are to enter excavations, options for short-term excavations include benching or battering back of the excavations at 1H:1V or the support of excavations within the residual soil and extremely weathered rock profile. Short-term excavations within the more competent rock may be battered at steeper than 1H:1V and may not require support, however this would be subject to specific geotechnical assessment.

It is recommended that long-term excavations should be either battered at 2H:1V or flatter and protected against erosion or be supported by engineer designed and suitably constructed retaining walls. Excavations may be battered steeper than 2H:1V in rock materials, subject to specific geotechnical assessment.

6.3.4.3 Basin Materials

Where suitable site-won residual/colluvial clay is available for construction of the clay core associated with the proposed basins, appropriate care should be taken during excavations to ensure sufficient suitable material is sourced. This would include a multistage excavation process to avoid blending with colluvium and weathered rock material generally including:

- (1) Stripping of surficial topsoil and or fill materials;
- (2) Excavation/removal of colluvium material until the residual/colluvial clay layer is exposed; and
- (3) Excavation of suitable clay and placement into a separate stockpile. Excavations should be to design invert level or to the transition into weathered rock material (whatever is encountered first). Weathered rock material should not be excavated and mixed with the clay material.

Where insufficient suitable material is able to be sourced through in areas of proposed basin construction, utilisation of a clay borrow area may be necessary subject to guidance by an experienced geotechnical

consultant. Material proposed to be used within the clay core should be subject to inspection by a suitably qualified geotechnical consultant.

6.3.5 Filling & Batter Slopes

Fill should be placed and compacted in accordance with AS 3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments* [13].

It is expected that construction of fill platforms during bulk earthworks, which would be suitable to support structural loads associated with residential developments, would comprise the following:

- Removal of any existing uncontrolled fill (if present), stockpiles (if present), topsoil, slopewash, alluvium, colluvium or deleterious materials from the areas where fill is to be placed. Any unsuitable material including foreign matter must be removed from the fill areas.
- > Breaching and draining of any ponded water within the existing farm dam as soon as practical to allow any sediment to dry as much as possible prior to construction/removal.
- Stripping within the existing rural farm dam and gully line footprints. It should be noted that the removal of all sediment as well as the existing dam wall from the development area is required.
- > The fill materials must be free of vegetation including tree stumps, roots, root fibres or other organic matter. Silts or material with high silt portions such as the colluvium material must be blended with other site soils to be used as fill.
- > Fill should not comprise material with particle sizes of greater than 200mm or 2/3 of the compacted layer thickness. On-site ripped rock may need to be treated to allow the reuse in road alignments and for general filling during bulk earthworks.
- > Benching of the slopes where fill is to be placed with slopes steeper than 8H:1V will be required.
- > Placement of fill below 2m total proposed depth should comprise placement in uniform horizontal layers with compaction of each layer to a minimum dry density ratio of 95% standard Compaction (AS 1289-5.5.1) at moisture contents in the order of 85-115% of SOMC or ±2% but generally as close to SOMC as practical. Over compaction should be avoided.
- > Placement of fill in exceedance of 2m in height is recommended to have compaction of each uniform layer to a minimum dry density ratio of 98% Standard Compaction (AS 1289-5.5.1).
- > Within the road alignment, subgrade formation should be in accordance with Section 7.3.1 and the moisture specification will need to be maintain at -2 to 0% of OMC.

Where high reactivity material is used as fill, it should be placed a suitable distance from the surface to avoid the material impacting negatively on-site classifications. It is suggested that this material only be used in lots requiring filling of >1.0m, where the top 1.0m of filling consists of lower reactivity material such as weathered rock.

All fill should be battered at a slope of 2H:1V or preferably flatter and temporary erosion control should be provided. To prevent erosion in the long term, provision of protection by vegetation and with the provision of adequate drainage is also required. Where a batter of 2H:1V is not possible, the fill should be supported by an engineer designed and suitably constructed retaining walls.

Where filling is expected to exceed 2.0 m, consideration to consolidation of the fill material should be made. This may comprise revision of compaction effort, preliminary settlement analysis, and/or the application of geogrids within pavement embankments.

It should also be noted that where deeper service trenching is proposed within areas of deep fill, consideration should be made to backfill operations to prevent vertical joints in pavements and abrupt changes in subgrade conditions. This may require the application of geogrids to reduce differential movement.

6.3.5.1 Material Suitability

Fill materials are expected to comprise:

> Site won colluvial/residual clays and overlying colluvium materials: Generally, soils excavated on site with the exception of topsoil and high silt content soils are considered suitable for reuse as engineering fill. All vegetation including tree stumps, roots, root fibres or other foreign material should be removed from the site won materials.

- Existing filling: Existing filling is considered generally suitable for re-use from a geotechnical perspective however should be subject to excavation, recondition and removal of any significant component of foreign material. This would be subject to inspection by a suitably qualified geotechnical consultant.
- Site won ripped weathered rock: Generally, all site won ripped rock would be suitable for re-use following reconditioning and grading for particle size requirements. It is recommended to use sandstone material at levels close to road subgrade and towards the surface in residential lot filling.

6.3.6 Drainage

Given virtually saturated soils were encountered during the investigation, it is expected poor drainage conditions may result in trafficability issues during construction. Temporary drainage measures should be implemented to intercept and direct overland flows to protect earthworks during construction.

Due to the anticipated excavation depths, fracturing in the weathered rock may be observed close to design levels. Where seepage is observed through fracturing in the weathered rock, application of drainage blankets may be required. This is to be determined onsite during construction by a suitably qualified geotechnical engineer.

The soils encountered at the site should be protected from erosion by vegetation (or similar) together with the provision of adequate drainage where exposed. Appropriate surface drainage should be installed to intercept up-slope overland surface flows and to restrict overland surface flows from flowing onto residential allotments.

All collected stormwater run-off should be appropriately detained on site, or where required; directed to appropriate discharge points within the site in a controlled manner.

6.3.7 Existing Dam Decommissioning

It is noted that there are several existing rural farm dams and gully lines which are to be decommissioned/filled as part of the bulk earthworks. Decommissioning of the dams and drainage lines are expected to comprise the following:

- > Breaching and draining of any ponded water within the existing dams as soon as practical to allow any sediment to dry as much as possible prior to removal.
- Removal of any existing fill (dam wall), stockpiles, topsoil, slope-wash / colluvium, over-wet, silt, organic or deleterious materials from the areas where fill is to be placed.
- Stripping within the existing dam footprints. It should be noted that the removal of the dam wall and all sediment from the development area is required.
- Inspection of all stripped surfaces should be undertaken by an experienced geotechnical consultant to confirm removal of all deleterious material and suitable foundation materials prior to placement of fill, with fill operations undertaken as detailed in Section 6.3.5.

6.4 Basin Construction

Based on the supplied plans [2] two (2) bio-retention basins are to be constructed within the central-western, and southern portions of site.

6.4.1 Proposed Basin Earthworks

Bulk earthworks plans [2] provided at the time of investigation were preliminary in nature, however based on the current landform and proposed development, likely earthworks for the proposed basins are summarised below.

6.4.1.1 Basin 'A' – Bio-Retention

Review of the supplied plans [1] indicates Basin A proposed to be a bioretention basin situated within the southern portion of the site. Based on the design plans provided, earthworks for the proposed basin are expected to comprise:

- > Filling in the order of 1.0-2.0m to create the eastern and western basin walls. Given the site topography, deeper filling is expected on the southern wall in excess of 2.0m. Filling materials required for the basins shall meet the requirements outlined in Table 6-5.
- > A combination of cutting and filling in the order of 1.0m is proposed for the northern embankment wall. Cutting in the basin impoundment area is expected to grade to an assumed maximum of 2.0m within the deepest portion of the basin. Deeper cuts are expected within the impoundment area when considering the biofiltration media.

The basin involves two headwalls, comprised of one inlet along the northern side of the basin and an outlet on the south side discharging flows to the generally south trending towards Wallis Creek. The basin also comprises a high flow spillway discharging to the south, with all discharge points proposed to comprise appropriate scour protection.

Test pits TP014 & TP015 were excavated within the vicinity of the footprint of the proposed Basin A. Encountered subsurface conditions comprised a surficial coverage of fill overlying, residual stiff to very stiff Silty CLAYs of medium to high plasticity with varying minor components of fine sand and gravel, overlying extremely weathered Silty / Sandy CLAY of low to medium plasticity and hard consistency.

6.4.1.2 Basin "B" – Bio-Retention

Review of the supplied plans [1] indicates Basin B is situated within the central-eastern portion of the Site immediately adjacent to Cessnock Road. Located within the footprint of the proposed basin is an existing gully directing surface flows south-west to the Cessnock Road culvert crossing. Basin B also encompasses the footprint of an existing farm dam. It is anticipated that the basin comprises one smaller biofiltration basin to the south that gradually discharges into the larger On-Site Detention (OSD) basin to the north. Based on the design plans provided, earthworks for the proposed basin are expected to comprise:

- The biofiltration basin is predominantly constructed within cutting, in the order of 1.0-2.0m for the embankment walls. Deeper cuts in the order of 2.0-3.0m are expected within the impoundment area when considering the biofiltration media.
- > A combination of cutting and filling in the order of 1.0-2.0m to create the eastern and western embankment walls is proposed. Deeper filling associated with the removal of the existing dam wall and gully line is expected on the northern wall in the order of 3.0-4.0m. Filling materials required for the basins shall meet the requirements outlined in Table 6-5.
- > Given the site topography sloping north-west towards the existing gully line, deeper cutting is proposed in the eastern portion of the permanent basin impoundment area to grade to a maximum of 4.0m bgl.

The biofiltration basin is expected to comprise one headwall with one inlet at the eastern side and an outlet on the northern side discharging flows into the OSD basin. The basin also comprises a high flow spillway into the OSD basin.

The OSD basin is expected to comprise two headwalls with two inlets at the southern and eastern side, with an outlet on the western side discharging flows to the generally west trending existing gully line beyond Main Road. All discharge points are expected to comprise appropriate scour protection.

Test pit TP023 was excavated within the footprint of the proposed Basin B. Encountered subsurface conditions comprised a surficial coverage of fill overlying, a highly plastic residual CLAY with a consistency ranging from stiff to hard with depth. Residual CLAY was encountered to a depth of 1.25m, overlying an extremely weathered Silty Sandy CLAY of low to medium plasticity with a hard consistency to a target depth of 1.50m. Test pit TP022 was conducted within close proximity of Basin B and comprised similar subsurface conditions, however, the inclusion of a highly plastic colluvial Silty CLAY layer was overlying the residual clay layer. It should be noted weathered rock profiles were not encountered in either TP022 or TP023 to target depths of 1.50 and 1.60m bgl respectively, however are likely to be encountered based on anticipated excavation depths and encountered subsurface conditions across the site.

6.4.2 Embankment Requirements

Table 6-5 below provides general material requirements and compaction specifications for the construction of a zoned embankment for temporary and permanent basins.

Table 6-5 Embankment Material Specification

Specifications	Zone 1 – Clay Core Material	Zone 2 – Embankment Fill	
Material Property			
Material Description	CLAY / S	lilty CLAY	
Plasticity Index	10-5	50%	
Permeability	< 10 ⁻⁹ m/s	N/A	
Emerson Class	Minimum Class 4	Minimum Class 2	
Maximum particle Size	50mm	200mm or 2/3 of the compacted layer	
Percentage Fine Content (Material Passing 0.075mm)	> 25%	> 20%	
Compaction Requirements			
Compaction (Standard Relative Density AS1289 5.7.1)	Minimum 98%	Minimum 95%	
Moisture Content	-1 to +2 of SOMC	-1 to +2 of SOMC	

Notes to table:

SOMC: Standard Optimum Moisture Content N/A: Not applicable

Based on the results of the laboratory testing and observations made during the investigation, suitable site clays were encountered across the site. Clays excavated from a deeper profile are more likely to be viable for clay core construction. Highly plastic clays are only permitted for use as embankment filling materials. Clays proposed to be used for basin construction should be inspected by an experience geotechnical consultant during construction to confirm suitability and/or provide further guidance on treatment/conditioning.

Based on the supplied civil plans the foundation for the clay core would comprise residual soils and weathered rock. All batter slopes within the impoundment area should be 5H:1V or flatter. All batter slopes for external walls should be graded at 3H:1V or flatter. Where this cannot be achieved, engineered retaining walls may be required.

Basins A and B will require a retention system as insufficient geometric area is available for formation. Review of the supplied plans indicated masonry infilled blockwork retaining walls are proposed and will be founded on piles. It is recommended that buoyancy or uplift be considered for the design of these walls.

6.4.3 Embankment Foundation Treatment

Based on the subsurface conditions encountered during the investigation and review of the proposed basin plans, embankment foundation conditions are expected to be within residual clay and weathered rock profile (after removal of any unsuitable colluvium and topsoil). Where virtually saturated materials are encountered within the proposed keyway, over excavation and replacement may be required. Deeper filling within the existing gully line to create the north-eastern embankment wall of Basin B will require unsuitable material is to be removed as a part of the bulk earthworks.

The following general foundation preparation requirements must be adopted:

- > Removal of topsoil and colluvium soils.
- Static proof-rolling of the exposed foundation area under the embankment with a heavy (minimum 10 tonne) roller. Soft or weak areas detected during the proof rolling shall be excavated and replaced with compacted fill comprising low permeability clay meeting the requirements of Zone 1 material.
- > Protection of the prepared foundation to prevent excessive wetting or drying prior to placement of embankment fill material. Trafficking of the exposed foundation should be limited (or avoided where possible) to prevent permanent deformation.

- > Embankment clay core to have a minimum 500 mm key into the residual clay (assumed foundation material) targeted at a depth below the basin invert.
- > Inspection by an experienced geotechnical consultant shall be conducted to confirm foundation suitability.

6.4.4 Impoundment Area

Excavations form the foundation of the proposed Basin A and Basin B impoundment areas would be expected to be founded within residual clay and EWM profiles. The civil plans, indicate deeper cut depths into the existing natural profile to be in the order of 2.0-4.0 m bgl within the deepest portion of the proposed basins. Where excavations within these basins expose the underlying weathered rock and sandy EWM, the application of a clay liner may be required and inspection of the exposed subsurface profile within impoundment area would be required to assess any defects of the soil and or rock profile. This would be subject to inspection by a suitably qualified geotechnical consultant.

Excavations form the foundation of the proposed Basin C impoundment areas would be expected to predominantly comprise filling given the existing site slopes. Inspection should be undertaken by a suitably qualified geotechnical consultant to ensure appropriate material is utilised as filling within the impoundment area.

All batter slopes within the impoundment area should be 5H:1V or flatter.

6.4.5 Stormwater Outlets & Seepage Collars

A seepage collar will be required to be constructed along the stormwater pipes traversing the proposed basin embankments to increase the length of the percolation path and reduce the risk of piping developing around the stormwater pipes.

Seepage collars are generally made of concrete with a required width depending on pipe diameter but are typically three times the pipe diameter.

6.4.6 Surface Erosion Control

Topsoil shall be spread over the exposed surfaces of the embankment to a depth of at least 150mm and sown with pasture grass to establish a good cover as soon as practical. Jute mat is recommended over the topsoil to encourage the grass development and reduce topsoil/seed loss at early stages.

Appropriate management of the sodic residual clays through the application of gypsum treatment is required for any surface area of exposed clay material within the basin walls and impoundment area. This may not be necessary where turf is placed within the impoundment area (subject to inspection) however the clay core will need to be treated.

Large vegetation shall not be allowed to become established on or near the embankment. Tree roots (especially eucalyptus tree roots) can cause the core to crack and encourage piping development, resulting in the failure of the dam wall.

All trees and shrubs shall be restricted to a minimum distance of 1.5 times the height of the tree away from the embankment of the dam.

6.4.7 Embankment Construction & Upstream Batters

Following the preparation of the embankment foundations, formation of the embankment must be undertaken from foundation to the crown using the compaction requirements specified in Table 6-5. Compaction of the embankment material must be undertaken using pad foot rollers.

Upstream batters of the basin should be graded at 5H:1V or flatter, with diversion drains/bunds to divert any surface flows towards the specified inlet discharge points to limit erosion of the batter faces. Where this can not be achieved, additional advice should be sought from a suitably qualified geotechnical engineer.

6.5 Retaining Structures

Detailed in the supplied civil [1] set is the inclusion of retaining structures, to establish level building platforms for the residential structures and support basin design, particularly in areas of increased site grades.

All retaining structures greater than 1.0m in height are to be designed by a suitably qualified engineer. Design of retaining structures should consider the following;

> Surcharge loading from slopes and structures above the wall;

- Account for loading from any proposed compaction or fill behind the wall; >
- Provide adequate surface and subsurface drainage behind all retaining walls including a free draining >granular backfill to prevent the build-up of hydrostatic pore pressures behind the wall;
- Utilise materials that are not susceptible to deterioration; and >
- > Ensure all walls are founded in materials appropriate for the loading conditions.

Footings for the proposed retaining walls should be founded below any topsoil, uncontrolled filling, or deleterious materials within the natural residual / extremely weathered soils or underlying weathered rock profile.

Review of proposed retaining structures within detention basins would be required and the parameters below would only be appropriate for walls that aren't subject to inundation.

It should be noted that the retaining wall parameters provided in Table 6-6 below are typical, and could be refined on a wall by wall basis.

Parameter	Very Stiff (or better) EWM CLAYs and Controlled CLAY FILLING	Weathered Rock – SANDSTONE OR SILTSTONE
Bulk Unit Weight (kN/m ³)	20	22
Effective Friction Angle, ¢'	26°	-
Effective Cohesion, c'	2 kPa	-
Undrained Shear Strength, Su	75kPa	-
Active Earth Pressure Coefficient, $K_{\!A}$	0.39	0.1
Passive Earth Pressure Coefficient, K_P	2.56	-
Notes to table:		

Retaining Wall Design Parameters Table 6-6

N/A: Not applicable

7 Pavement Thickness Design

Pavement thickness design has been undertaken based on the findings of the geotechnical investigation and Maitland City Council (MCC) requirements. The following guidelines have been adopted for the design of the internal roads:

- > Pavement thicknesses for flexible pavements in accordance with mechanistic procedure presented in Austroads Guide to Pavement Technology, Part 2: Pavement Structural Design [14]; and
- > Maitland City Council (MCC) Manual of Engineering Standards, Chapter 5: Road Pavement Design [15].

7.1 Design Parameters

7.1.1 Design Traffic Loading

Design traffic loading for the internal roads has been adopted from MCC Engineering Manual, Chapter 4: Road Design [16] and Chapter 5: Pavement Design [15] based on the road type designations specified by lot serviceability. Table 7-1 below provides a summary of the proposed internal road traffic loading.

Table 7-1	Design Traffic	Loading	Roads	1-10
	2001g.1.10.110	g		

Road ⁽¹⁾	Road Designation	Design Equivalent Standard Axles (DESA)
Road 2-6,8 ⁽⁴⁾ ,9-11	Local - Secondary	2 × 10 ⁵
Road 1	Collector – Primary	1.5 × 10 ⁶
Bus Route ⁽⁵⁾	Public Route	5 × 10 ⁶
Road 7	Sub-Arterial	1 × 10 ⁷

Notes to table:

(2) Increased DESA for industrial vehicle access to sewerage pumping station - most southern road of site.

(3) Road adjoining Main Road and Aspen Street, extending along the eastern boundary of site.

(4) Specific roundabout pavement design will be required.

(5) To be utilised where bus route proposed.

A public bus route design has been included where bus routes are proposed for the development. The design traffic loading above is consistent with previous stages of the Wallis Creek development abutting pavement designs.

Where the road designation differs from those presented in Table 7-1 above, additional consultation with Stantec would be required.

7.1.1.2 Reactive Clays

Where pavements are founded on highly reactive soils, significant loss of pavement shape and potential damage to pavements due to volume change can occur as a result of moisture variations. Where expansive soils are encountered at subgrade, potential for volume change should be minimised by adopting some, or all, of the strategies outlined in clause 5.3.5 of Austroads [14]. The specific considerations in relation to highly reactive soils should include, but not be limited to:

- > Specification of a moisture content range which is maintained for preparation of the subgrade until subbase is placed
- > The need for subsoil drainage to not be located in the expansive soils
- > The need for a low permeability lower subbase / select layer
- > Recommendation for sealed shoulders and impermeable verge material
- > Recommend appropriate construction techniques
- > Reduction of the volume expansion potential of the expansive soils by lime stabilisation.

Swell testing conducted during CBR testing indicates the natural clay materials generally have a moderate swell potential as defined in Table 5.2 of Austroads [14] with swell readings in the range of 0.5 to 1.5%. Observations made during the conducted test pits and previous experience in surrounding areas has indicated the presence of clays of high reactivity at the site, particularly in the top portion (<1.0 m) of the

⁽¹⁾ Roads are unnamed on supplied plans.

subsurface profiles and as such a select material is proposed to negate expansive cracking in areas identified as having highly reactive clays.

Given that the site clay testing is low to highly reactive clays no specific treatment of reactivity other than good subgrade preparations would be required. However, assessment of the reactivity of subgrade materials will to be undertaken during the construction phase by an on-site experienced geotechnical consultant/engineer. Where highly reactive clays are exposed at subgrade level, suitable measures should be undertaken in order to mitigate the potential for volume change including those abovementioned.

It is considered that given the proposed earthworks required to reach geometric design levels, control of the bulk earthworks can achieve a subgrade that places any highly reactive material at depth and ensures coverage with a low reactive material.

Typical earthworks would be conducted such that where any highly reactive clay is encountered at subgrade level during construction, over excavation of an additional 300 mm and replace with site-won, weathered "ripped" rock.

It should also be ensured that any over-excavated reactive clays to be utilised as fill are placed lower where possible in road alignments or lots.

It is understood that, over excavation and placement of a 300 mm imported, low reactive select fill layer (min 15% CBR) is a minimum requirement of Maitland City Council for construction on reactive clays.

7.1.1.3 Design CBR

The results of the CBR test undertaken on potential subgrade materials indicate that CBR values for the sites natural clay soils and weathered rock encountered within the test pits and in previous investigations produced CBR values range from 3% to 8% respectively. It should be noted that test pits were not extended to design subgrade where deeper areas of excavations are proposed due to refusal on weathered rock. It should be noted however that representative samples of proposed subgrade material were taken where weathered rock was encountered at other shallower locations within the site for laboratory testing and as such assumptions for subgrade design can be readily undertaken.

For the purpose of design, and to allow for variability in clay CBR values, a design CBR of 3.0% has been adopted for residual clays and a design CBR of 8% adopted for site-won weathered rock. However, it is suggested that confirmatory testing on clay subgrade and weathered "ripped" rock during construction is conducted to confirm design CBR values.

It is recommended pavements founded on reactive clays in transition zones between cut and fill areas would require over excavation to a minimum depth of 0.3 m and replaced with suitable low reactive weathered "ripped" rock material. It is further recommended that filling from a depth of 0.5 m below top of subgrade be of low reactive weathered "ripped" rock material.

Allowance for a minimum 300 mm select layer with CBR≥15% can increase overall CBR value to 8% which has also been added as an option.

7.2 Flexible Pavement Thickness Design

Based on the subsurface conditions present at the time of investigation and the results of the CBR testing, flexible unbound granular pavement would be the most cost-effective option for the construction of the internal roads.

Pavement compositions associated with a design CBR of 8% should only be used for design purposes under direction from an experienced geotechnical consultant who has inspected and confirmed the material type present at design subgrade level. It is understood the preference of MCC where reactive soils are encountered within pavement subgrade is the application of a 300 mm select layer. This has been included in pavement design.

Additional sampling and testing of proposed subgrade materials should be carried out during pavement construction to confirm design CBR values.

Pavement design thicknesses calculated for the Internal Roads are summarised below in Table 7-2, Table 7-3, Table 7-5 and Table 7-5 below. It should be noted layer thicknesses are minimum thickness regardless of construction tolerances.

Table 7-2	Pavement	Thickness	Design f	for Road	2-6, 8	, 9-11	- DESA =	= 2x10 ⁵ (Local	- Secondary)
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	Thickne	Recommended Material Type ⁽¹⁾		
Wearing Course	30mm	30mm	AC10 with C450 binder	
	(7 mm primer seal)	(7 mm primer seal)		
Base Course (2)	160mm	160mm	DGB, GMB or NGB	
Subbase Course	125mm ⁽³⁾	125mm ⁽³⁾	DGS, GMS or NGS	
Select Material	Min 300mm	-	CBR ≥ 15%	
Total Thickness	615mm ⁽⁴⁾	315mm ⁽⁴⁾	-	
Subgrade Material	SELECT FILL overlying Silty CLAY	WEATHERED ROCK	-	
Subgrade CBR	3%	8%	-	
Design traffic	2 × 10 ⁵ DESA			
Design Life	30 years			

Notes to table:

(1) Refer to Section 7.3.2 for material specifications.

(2) 160mm basecourse has been selected for tie in with 190mm kerb and gutter. Minimum 140mm base material as per Figure 8.4 of Austroads [14] has been neglected for constructability purposes.

(3) Minimum subbase thickness of 125mm as per MCC Guidelines.

(4) Minimum pavement thickness of 300mm as per MCC Guidelines has been increased to 315mm to facilitate tie in with 190mm kerb and gutter.

Table 7-3Pavement Thickness Design for Road 1 - DESA = 1.5×10^6 (Collector – Primary)

	Thic	Recommended Material Type ⁽¹⁾		
Wearing Course	30mm	30mm	AC10 with C450 binder	
	(7 mm primer seal)	(7 mm primer seal)		
Base Course (2)	160mm	160mm	DGB or GMB	
Subbase Course	125mm ⁽³⁾	125mm ⁽³⁾	DGS or GMS	
Select Material	Min 300mm	-	CBR ≥ 15%	
Total Thickness (4)	615mm	315mm	-	
Subgrade Material	SELECT FILL overlying Silty CLAY	WEATHERED ROCK	-	
Subgrade CBR	3%	8%	-	
Design traffic	1.5 × 10 ⁶ DESA			
Design Life	30 years			

Notes to table:

(1) Refer to Section 7.3.2 for material specifications.

(2) 160mm basecourse has been selected for tie in with 190mm kerb and gutter. Minimum 140mm base material as per Figure 8.4 of Austroads [14] has been neglected for constructability purposes.

(3) Minimum subbase thickness of 125mm as per MCC Guidelines.

(4) Includes select layer where applicable.

Table 7-4Pavement Thickness Design for Bus Route - DESA = $5x10^6$ (Public Route)

	Thic	Recommended Material Type ⁽¹⁾		
Wearing Course	40mm	40mm	AC14 with C450 binder	
	(7 mm primer seal)	(7 mm primer seal)		
Base Course	160mm	160mm	DGB or GMB	
Subbase Course	150mm	150mm	DGS or GMS	
Select Material	Min 300mm	-	CBR ≥ 15%	
Total Thickness (2)	650mm	350mm	-	
Subgrade Material	SELECT FILL overlying Silty CLAY	WEATHERED ROCK	-	
Subgrade CBR	3%	8%	-	
Design traffic	5 × 10 ⁶ DESA			
Design Life	30 years			

Notes to table:

(1) Refer to Section 7.3.2 for material specifications.

(2) Includes select layer where applicable.

Table 7-5Pavement Thickness Design for Road 7 - DESA = 1×10^7 (Sub-Arterial)

	Thic	Recommended Material Type ⁽¹⁾		
Wearing Course	40mm	40mm	AC14 with C450 binder	
	(7 mm primer seal)	(7 mm primer seal)		
Base Course	170mm	170mm	DGB or GMB	
Subbase Course	175mm	175mm	DGS or GMS	
Select Material	Min 300mm	-	CBR ≥ 15%	
Total Thickness (2)	685mm	385mm	-	
Subgrade Material	SELECT FILL overlying Silty CLAY	WEATHERED ROCK	-	
Subgrade CBR	3%	8%	-	
Design traffic	1 × 10 ⁷ DESA			
Design Life	30 years			

Notes to table:

(1) Refer to Section 7.3.2 for material specifications.

(2) Includes select layer where applicable.

Select material thicknesses in above tables are minimum only and previous experience in the area indicates additional site won or select fill may be required, subject to inspection by a suitably qualified geotechnical engineer.

During boxing out of subgrade levels, where thin clay layers are present in locations such as transitions between bedrock and subgrade fill, over-excavation may be required to remove these thin layers and replacement with select material would be required.

Inspection of the finished subgrade by a geotechnical engineer during boxing is required to assess subgrade conditions, over-excavation and select subgrade quality.

MCC Pavement Design Specifications [15] Chapter 5.1 states that AC wearing course for flexible pavements may be included in total pavement thickness. This has been included by reducing the subbase thickness where possible to limit pavement depths. Where additional pavements (to those specified) are required to facilitate a bus route, Stantec should be notified and amendments to design may be required.

7.3 Construction Notes

7.3.1 Subgrade Preparation

Prior to and following the investigation, significant rainfalls have occurred within and the surrounding area of the site, which may cause fluctuations of the in-situ moisture contents. Elevated moisture contents are likely to occur within the low-lying gully lines to the south and central portion of the site that flow into the existing rural dams.

Options to ameliorate the subgrade conditions may include:

- > Removal and replacement of the materials significantly wet of SOMC;
- Moisture re-conditioning and blending of site won granular material with cohesive materials to improve structure and ability to support the proposed pavements. It should be appreciated that moisture reconditioning will need to allow sufficient time for the materials to 'dry back' and will extend the construction program; or
- > Reconditioning including the addition of lime to the subgrade to reduce moisture content only.

The most efficient and cost-effective treatment would be best determined at construction as soil moisture levels and the final design levels will impact on suitable treatment options.

Based on the preliminary civil plans [1], large diameter stormwater pipes are proposed under roads with deeper backfilling required. Care should be taken where backfilling of deeper service trenching is noted within areas of significant excavation, particularly where service trenching is located within pavement subgrade. Over-excavation and replacement or additional drainage measures may be required to prevent sudden changes in subgrade conditions and impact on pavement from preferential flow paths.

It is noted the investigation was undertaken prior to bulk earthworks plans being issued, and test pitting to design level has not been undertaken in all areas of deeper cuts. As such, confirmatory CBR testing may be required during subgrade preparation to confirm design assumptions made in the pavement thickness design.

Where construction of a new pavement is proposed, subgrade preparation should be in general accordance with the relevant council construction specifications and the following procedures.

- Removal of topsoil, colluvium, uncontrolled fill, and deleterious to subgrade formation level, with the spoiling of any deleterious or over wet material to either allow reconditioning and reuse or offsite disposal;
- Where highly reactive materials are identified at subgrade level by an experienced geotechnical consultant during construction, strategies outlined in clause 5.3.5 of Austroads [14] should be adopted to minimise the potential for volume change to occur as discussed in Section 7.1.1.2.
- > Excavation of loose and oversize filling and elimination of abrupt changes between subgrade conditions, such from rock to soil, and from granular fill to fine grained natural soils.
- > All subgrade surfaces in cut shall be ripped, loosened and compacted to a minimum depth of 150mm below the design subgrade, including up to 150mm behind the back of the kerb.
- Subgrades in rock are to be thoroughly ripped to a minimum of 300mm below the design subgrade level and to extend to the sides of the formation to provide drainage away from the pavement. Ripped material is to conform to the particle size characteristics described for fill material and is to be compacted to form the subgrade construction layer unless the ripped material is deemed unsuitable for subgrade purposes.
- > Fill material to be used as subgrade shall conform to the appropriate specifications as detailed in this report and MCC Specifications.
- Static proof-rolling of the exposed subgrade using a heavy (minimum 10 tonne) roller under the direction of an experienced geotechnical consultant. Loose or yielding areas should be excavated and replaced with compacted select fill or suitable subgrade replacement comprising of material of similar consistency to the subgrade.
- Compaction of the subgrade filling or select should be to at least 100% of SMDD in layers of not greater than 300 mm compacted thickness at a ratio of less than 100% of SOMC.
- > Protection of the subgrade to prevent any excessive wetting or drying.
- > Formation of the pavement in accordance with the below recommendations and specifications.
Following satisfactory preparation of the subgrade, the pavement should be placed in accordance with the requirements of the appropriate section of this report, depending on the proposed pavement type.

7.3.2 Specification & Compaction Requirements

Pavement materials and compaction requirements for the new pavement construction should conform to Maitland City Council design and construction specifications [15] [17], and the following requirements.

 Table 7-6
 Pavement Material Specification and Compaction Requirements

Pavement Course	Material Specification	Compaction Requirements	
Internal Roads (Flexible Paver	nents)		
Wearing Course Asphalt or Sprayed Seal	Material complying with MCC's Engineering Requirements for Development (MCC requirements) [15] [17]	Material complying with MCC's Engineering Requirements for Development [15] [17]	
Base Course Quality crushed rock	Material complying with MCC requirements [17] [15] and a CBR > 80%, PT <6%	Min 98% Modified (AS 1289 5.2.1) or 102% Standard (AS1289.5.1.1)	
Subbase Crushed rock or gravel	Material complying with MCC requirements [17] [15] and a CBR > 30%, PT <12%	Min 95% Modified (AS 1289 5.2.1) or 100% Standard (AS1289.5.1.1)	
Select Crushed rock or gravel	CBR ≥ 15%	Min 100% Standard (AS 1289 5.1.1)	
Subgrade or replacement	Minimum CBR 8% Select fill and weathered rock	Min 100% Standard (AS 1289 5.1.1)	

All granular pavement material quality should be in general accordance with MCC Construction Specifications [17] for relevant design traffic. The selection of appropriate construction materials that are durable and insensitive to moisture change is essential in areas subject to periodic inundation and/or wet ground conditions.

Minimum testing on all potential imported pavement materials should be to RMS QA Specification 3051 [18] including a four-day soaked CBR, Atterberg Limits, Particle Size Distribution analysis and Wet/Dry strength determination. Pre-treatment of material prior to testing would be advisable for materials subject to breakdown.

7.3.3 Wearing Course

Wearing courses should be in accordance with Maitland City Council specifications [15] with consideration to TfNSW QA Specifications R116 [19] and Austroads AGPT04B-07 Guide to Pavement Technology, Part 4B: Asphalt [20].

The design and construction of wearing courses should be in in consultation with the preferred supplier taking into account traffic volume and type. All pavement surfaces should be primed or primer sealed prior to the application of bituminous sprayed seal.

7.3.4 Drainage

The moisture regime associated with a pavement has a major influence on the performance considering the stiffness/strength of the pavement materials is dependent on the moisture content of the material used. Accordingly, to protect the pavement materials from wetting up and softening, particular care would be required to provide a waterproof seal for the pavement materials, together with adequate surface and sub-surface drainage of the pavement and adjacent areas.

Owing to the potential for cracking along the interface where new pavements are joined to existing pavements, it is suggested that an intra-pavement drain should be provided at the interface between any section of new and existing pavements.

Following investigation and observation of the present geotechnical conditions, it is recommended that subsoil drainage be installed at subgrade level on both sides of the road. Detailing of subsoil drainage should be in accordance with Austroads 2017 [14] taking into consideration the presence of moderately to highly expansive soils. The subgrade should be constructed with sufficient cross fall (in general 3%) to assist in reducing retention time for moisture entering the pavement. The subsoil drains should be located below or behind the kerb to intercept any moisture ingress from outside and within the roadway. The drains will require flush-out points and regular maintenance to ensure their correct operation, and detailing should take

into account the presence of moderately to highly expansive soils where encountered. Provision of adequate cross fall to direct runoff from the pavement to drainage lines should be achieved.

The pavement thickness designs presented above assume drained pavement conditions. The selection, construction and maintenance of appropriate drainage mechanisms would be required for adequate performance. The selection of appropriate construction materials that are relatively insensitive to moisture change is also essential in area subject to periodic inundation, even if for a relatively short period of time.

7.3.5 Pavement Compaction

Difficulty obtaining specified compaction requirements can be expected in areas of low strength subgrade which are evident in areas where the road is to be constructed in fill and firm clays near surface are expected and subgrade replacement is not undertaken. Vibratory compaction can lead to potential problems with the development of excess pore pressures and permanent deformation of the subgrade. Large capacity oscillating rollers are better suited to deep lift compaction. Static or low amplitude rolling may be appropriate in conjunction with thinner layers in poor subgrade areas.

It is essential to ensure that compaction is achieved though the full thickness of any pavement layers. A rough interface and bond is required between all pavement layers, generally achieved through scarification of the first layer prior to placement and compaction of the second and subsequent pavement layers.

7.3.6 Pavement Interface and Tie-in

Where new pavement construction abuts an existing pavement, care should be exercised to bench into the base course layer for a minimum of 0.5m for the entire pavement width.

Adequate compaction of the subgrade and pavements in this area is essential to maximise performance of the pavement. It is noted that where variable pavements are abutted, the potential for localised failure is generally greater. Consideration should be given to sealing any cracks that may develop between existing and new pavements. The use of a strain alleviating membranes at the interface may also be appropriate. It may also be prudent to install intra-pavement drainage at subgrade level at interfaces of variable existing and new pavements.

7.3.7 Inspections

The subgrade will require inspection by an experienced geotechnical consultant after boxing out or filling to design subgrade level. The purpose of inspections is to confirm design parameters, assess the suitability of the subgrade to support the pavement, and delineate areas which may require subgrade replacement or remedial treatment prior to construction.

7.3.8 References

All works and materials used in construction should be designed and constructed in accordance with Maitland City Council Specifications or as specified in this report. Where discrepancies may occur, clarification should be sought from Council.

Earthworks and testing should generally be undertaken in accordance with AS 3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments* [13] where not otherwise specified.

8 Slope Stability Assessment

Stantec have undertaken a slope stability assessment (SSA) of the site as part of the additional investigation works. The following assessment for the proposed subdivision has been undertaken in general accordance with the principles outlined in Australian Geotech Society (AGS) Landslide Taskforce paper referenced "Practice Note Guidelines for Landslide Risk Management 2007c," *Journal and News of the Australian Geomechsanics Society*, vol. 42, no. 1, pp. 63-114, 2007c [21].

8.1 Definitions

Definitions utilised in the SSA have been outline below.

- Hazard: A condition with the potential for causing an undesirable consequence. A particular hazard may be severe, but it may or may not pose a high risk to persons or property. For the purpose of this study, a hazard is defined as a condition with the potential for causing an undesirable consequence.
- > Undesirable consequence: Injury or loss of life to persons or damage to property.
- > **Risk:** The measure of the probability and the severity of an adverse effect (undesirable consequence) to health, property or environment *from a hazard*.
- Tolerable risk: A risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible [21].
- Acceptable risk: A level of risk for which for the purpose of life or work we as a society are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable [21].

8.2 Method

The analysis for this study is focused on estimation of future risk to property based on the proposed draft development layout (ignoring regrade and any other remedial measures including rock pitching) together with consideration of the existing conditions observed at the time of the investigation.

The risk assessment procedure adopted herein is in general accordance with the principles outlined AGS 2007c [21]. Stantec have assessed the risk to property using the qualitative assessment matrices of the AGS 2007 Guidelines.

This comprises utilisation of risk matrices/tables that comprise qualitative descriptions for levels of consequence and likelihood of occurrence.

Assessment of landslide hazards includes an assessment of the likelihood of occurrence. Likelihood has been assessed based on the site-specific models derived from the geological mapping and observations, anecdotal evidence, the relationship between geomorphology and geology combined with judgement and experience have been used to estimate likelihood of failure for the current condition.

Likelihood (Table 8-1) and consequence (Table 8-2) are combined in the matrix shown in Table 8-3, resulting in risk level that can range from very low (VL) to very high (VH). The standard definition of the risk levels from AGS 2007c are presented in Table 8-4.

Level	Descriptor	Description	Approximate Annual Probability
А	ALMOST CERTAIN	The event is expected to occur over the design life	10 ⁻¹
В	LIKELY	The event will probably occur under adverse conditions over the design life	10-2
С	POSSIBLE	The event could occur under adverse conditions over the design life	10 ⁻³
D	UNLIKELY	The event might occur under very adverse circumstances over the design life	10 ⁻⁴

Table 8-1 Qualitative Measures of Likelihood

Level	Descriptor	Description	Approximate Annual Probability
E	RARE	The event is conceivable but only under exceptional circumstances over the design life	10 ⁻⁵
F	BARELY CREDIBLE	The event is inconceivable or fanciful over the design life	10 ⁻⁶
Table 8-2	Qualitative Measures of Co	onsequences to Property	
Level	Descriptor	Description	
1	CATASTROPHIC	Structure(s) completely destroyed and/or large-scal engineering works for stabilisation. Could cause at l major consequence damage.	e damage requiring major east one adjacent property
2	MAJOR	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	
3	MEDIUM	Moderate damage to some of structure, and/or sign large stabilisation works. Could cause at least one a consequence damage.	ificant part of site requiring adjacent property minor

4MINORLimited damage to part of structure, and/or part of site requiring reinstatement
stabilisation works.5INSIGNIFICANTLittle damage.

Table 8-3 Qualitative Risk Analysis Matrix

Likelihood		Consequence to Property				
	Approx. Annual Probability	1: 200% Catastrophic	2: 60% Major	3: 20% Medium	4: 5% Minor	5: 0.5% Insignificant
A – Almost Certain	10 ⁻¹	VH	VH	VH	н	M/L
B - Likely	10 ⁻²	VH	VH	н	М	L
C - Possible	10 ⁻³	VH	н	М	М	L
D - Unlikely	10-4	н	М	L	L	VL
E - Rare	10 ⁻⁵	М	L	L	VL	VL
F - Barely Credible	10 ⁻⁶	L	VL	VL	VL	VL

Table 8-4 Risk Level Implications

Risk Level		Example Implications			
VH	Very High Unacceptable without treatment. Extensive detailed investigation and research, planning implementation of treatment options essential to reduce risk to Low; may be too expensiv practical. Work will likely cost more than the value of the property				
н	High	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.			
М	Moderate	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce risk to Low.			
L Low		Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.			
VL	Very Low	Acceptable. Manage by normal slope maintenance procedures.			

8.3 Hazard Assessment

Hazard assessment is a part of the risk assessment process and includes identification of hazards and assessment of the likelihood that the hazard will impact the elements most at risk.

Assessment of landslide hazards involves identification of failure mechanism(s) and an assessment of the likelihood that identified mechanism(s) will result in a failure. Likelihood of occurrence is generally a product of the probability of detachment multiplied by the probability that the detached material once mobilised, will impact the element / area at risk.

The scope of this hazard assessment has been based on geotechnical investigation.

8.3.1 Mechanism

The primary slope stability hazards identified at the site were observed along the eastern boundary of the site, associated with the vertical rock face bordering the riparian zone. Sections showing the approximate slopes along the eastern boundary are shown on Figures 4-6 attached in Appendix A.

Hazards and mechanisms associated with the eastern border include:

- > Overland flow paths eroding rock seams in the exposed vertical rockface causing block failure.
- > Creep of surficial soils (colluvial deposits).
- > Root Jacking of rock joints in the exposed vertical rockface causing isolated falls.
- > Concentrated overland flows causing erosion on slopes.
- > Global stability failure of vertical rock face due to underlying geological units.

8.3.2 Likelihood / Frequency of Occurrence (P_h)

Assessment of landslide hazards (landslips and rock falls) includes an assessment of the likelihood of occurrence within a given period of time, or a frequency analysis. Likelihood of Occurrence is estimated based on the probability of detachment combined with the probability that the detached object / material, once mobilised, will reach or affect the element at risk. The likelihood of occurrence has been inferred from Table 8-1 based on observed site conditions, a review of published data and past experience in the area.

The likelihood of failure for a specific mechanism at a specific location cannot be accurately calculated without detailed analysis of the lithology and geometry for that particular location. Detailed stability analysis is applicable to site-specific investigations that address specific subject areas. The stability analyses as a part of this report have been generalised and are broadly applicable to the subdivision area on which the analysis is based.

Table 8-5 below outlines indicative probability parameters adopted for the assessment for the site in its existing condition without considering remediation measures.

Table 8-5	Risk Assessment Adopted Parameters for the site in Existing Condi	tion

Hazard	Estimated Approximate Annual Probability (P _h)
Overland flow paths eroding rock seams causing block failure.	10 ⁻²
Creep of Surficial Soils (colluvium deposits).	10 ⁻³
Root Jacking of rock joints causing isolated falls.	10 ⁻³
Concentrated overland flows causing erosion along slopes.	10 ⁻²
Global stability failure due to underlying geological units.	10 ⁻⁵

8.4 Risk Assessment

8.4.1 Risk Acceptance Criteria

An <u>acceptable</u> risk is a risk for which for the purpose of life or work we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable [21].

A <u>tolerable</u> risk is a risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible [21].

The regulator is the appropriate authority to set the standards for tolerable risk which may relate not only to perceived safety in relation to other risks, but also to government policy [21]. Implementation of a tolerable risk level has implications for the community at large, both in terms of relative risks or safety, but also in terms of economic impact.

AGS [21] suggests that a risk of 'very low' or 'low' is an appropriate acceptance criterion for tolerable risk for *developments* near or on existing slopes. Regulators usually adopt this risk level as the measure to gauge risk for existing developments.

When considering risk, it should be noted that:

- > Estimations of risk are approximate and the acceptance criteria / tolerable risk level should not be considered absolute values. Variations of up to one order of magnitude may be appropriate for the acceptance criteria for particular circumstances.
- > Risk estimation is only one input into the decision process. Owners, society and regulators need to also consider political, social, and legal issues in their assessments and may consult the public affected by the hazard.
- > The risk can change with time because of natural processes and development, e.g. removal of vegetation by fire or other natural process, **or new construction/development**.
- It is ultimately up to Council to set its standard for tolerable risk criteria for loss to property. For assessment of risk to property, AGS suggests that a qualitative risk level of 'Low' or 'Very Low' is an appropriate acceptance criteria [21].

8.4.2 Slope Risk Assessment

The table shown below presents the risk based on the AGS 2007 guidelines for landslide risk. The risk to loss of property is predominately a desktop assessment, with limited inspection and risk assessment primarily based on available information and existing site conditions.

Risk assessment has been provided based on current site conditions and has been performed as generalised across the site based on worst case or with reference to the element most at risk i.e. closest proposed building envelope etc.

Risk	Risk to Property
Overland flow paths eroding rock seams causing block failure.	Moderate
Creep of Surficial Soils (colluvium deposits).	Moderate
Root Jacking of rock joints causing isolated falls.	Moderate
Concentrated overland flows causing erosion along slopes.	Moderate
Global stability failure due to underlying geological units.	Moderate

Table 8-6 Slope stability risk assessment

Commentary regarding possible slope stability risks and remediation measures are presented below.

8.5 Slope Stability Controls and Residual Risk

Based on the above risk assessment, remediation recommendations that should be implemented to prevent destabilisation along the eastern border of the site are presented in Table 8-7, along with residual risk to the site following implementation.

Table 8-7 Slope stability controls and residual risk.

Risk	Controls	Risk to Property
Overland flow paths eroding rock seams causing block failure.	 Maintain 10 m offset to vertical rockface for proposed infrastructure. Minimise disturbance of mature vegetation is proposed along the eastern boundary of the site. No concentrated stormwater discharge is to be directed to the eastern slope. 	Low
Creep of Surficial Soils (colluvium deposits).	 Minimise disturbance of mature vegetation is proposed along the eastern boundary of the site. Colluvial soils are proposed to be removed based on bulk earthworks plans. This may require additional stripping during bulk earthworks in areas of filling or reduced cut. No concentrated stormwater discharge is to be directed to the eastern slope. 	Low
Root Jacking of rock joints causing isolated falls.	Maintain 10 m offset to vertical rockface for proposed infrastructure.Relatively minor isolated falls.	Low
Concentrated overland flows causing erosion along slopes.	 Minimise disturbance of mature vegetation is proposed along the eastern boundary of the site. No concentrated stormwater discharge is to be directed to the eastern slope. 	Low
Global stability failure due to underlying geological units.	 Maintain 10 m offset to vertical rockface for proposed infrastructure. No observations of deep seeded instability have been observed onsite. 	Low

Areas identified as having potential slope stability risks are predominately situated along the eastern boundary of the site within the riparian corridor upslope of Wallis Creek. Supplied bulk earthworks plans [2] indicate extensive cuts in the order of 5m are proposed to the broad crested ridgeline to accommodate the north-south trending road alignment.

Given the proposed earthworks, the extent of development, offset of the vertical slope to the proposed infrastructure, and distance from the riparian corridor, where the above controls are implemented for the proposed development, the development would be considered low risk with regards to slope stability.

Consideration of the Australian Geoguide (LR8) Hillside Construction Practice document should also be made for the development (attached to this report as Appendix D).

9 Limitations

Stantec has performed investigation and consulting services for this project in general accordance with current professional and industry standards. The extent of testing was limited to discrete test locations and variations in ground conditions can occur between test locations that cannot be inferred or predicted.

A geotechnical consultant or qualified engineer shall provide inspections during construction to confirm assumed conditions in this assessment. If subsurface conditions encountered during construction differ from those given in this report, further advice shall be sought without delay.

Stantec, or any other reputable consultant, cannot provide unqualified warranties nor does it assume any liability for the site conditions not observed or accessible during the investigations. Site conditions may also change subsequent to the investigations and assessment due to ongoing use.

This report and associated documentation was undertaken for the specific purpose described in the report and shall not be relied on for other purposes. This report was prepared solely for the use by Walker Gillieston Heights Pty Ltd and any reliance assumed by other parties on this report shall be at such parties own risk.

10 References

- [1] Enspire Solutions Pty Ltd, "South Gillieston Heights Civil Engineering Works Development Application," 19/05/2023.
- [2] Enspire Solutions Pty Ltd, "Preliminary Cut Fill Plan- (210039-DA-C04.01, revision 2)," 19 May 2023.
- [3] Douglas Partners Pty Ltd, "Report on Preliminary Site Investigation and Detailed Site Investigation (Contamination) 204921.00," 20/05/2022.
- [4] Cardno Geotech Solutions (CGS) Pty Ltd, "Report on Flexible Pavement Design Stage 10-12 Wallis Creek - CGS3274-002.1," March 2018.
- [5] Cardno Geotech Solutions (CGS) Pty Ltd, "Letter Report on Geotechnical Investigation Gillieston Heights Subdivision Stage 10-12 - CGS3240," January 2017.
- [6] Cardno Geotech Solutions (CGS) Pty Ltd, "Report on Preliminary Geotechnical Investigation, Proposed Wallis Creek Subdivision, Stages 3-9, Cessnock Road, Gillieston Heights - CGS1399-004.1," October 2012.
- [7] Cardno (NSW/ACT) Pty Ltd, "Report on Geotechnical Investigation, Stage 13 & 14 Wallis Creek, Gillieston Heights - 81021073-001.2," April 2021.
- [8] NSW Department of Planning, Industry & Environment, "MinView," 2019. [Online]. Available: https://minview.geoscience.nsw.gov.au/. [Accessed August 2020].
- [9] NSW office of Environment and Heritage, "eSPADE v2.1," 2016.
- [10] ASSMAC, "Acid Sulfate Soil Manual, New South Wales," Acid Sulfate Soil Management Advisory Committee, August 1998.
- [11] State of NSW and Department of Planning, Industry & Environment 2022, "eSPADE," 2022.
- [12] Department of Land and Water Conservation, Site Investigations for Urban Salinity, Sydney, 2002.
- [13] Australian Standard AS3798-2007, "Guidelines on Earthworks for Commercial and Residential Structures," Standards Australia, 2007.
- [14] Austroads AGPT02-17, "Guide to Pavement Technology Part 2: Pavement Structural Design," Austroads Ltd, 2017.
- [15] Maitland City Council, "Manual of Engineering Standards: Chapter 5 Pavement Design," Maitland City Council, 2014.
- [16] Maitland City Council, "Manual of Engineering Standards; Chatper 4 Road Design," Maitland City Council, 2014.
- [17] Maitland City Council, "Manual of Engineering Standards Construction: Roads, Drainage, Concrete," 2014.
- [18] RMS QA Specification 3051 (Ed 6 Rev 2), "Granular Base and Subbase Materials for Surfaced Road Pavements," Roads and Maritime Services, April 2011.

- [19] RMS QA Specification R116 (Ed 8 Rev 2), "Heavy Duty Dense Graded Asphalt," Roads and Maritime Services, January 2012.
- [20] Austroads AGPT04B-07, Guide to Pavement Technology Part 4B: Asphalt, Austroads Ltd, May 2007.
- [21] AGS Landslide Taskforce, "Practice Note Guidelines for Landslide Risk Management 2007c," *Journal and News of the Australian Geomechsanics Society*, vol. 42, no. 1, pp. 63-114, 2007c.

APPENDIX



FIGURES







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Sections cut from LiDAR dated 2019. Given limitation of LiDAR due to dense tree coverage on eastern boundary of site, sub-vertical elevation changes have been inferred from site observations and denoted on sections below.









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APPENDIX

ENGINEERING LOGS







Explanatory Notes

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. Material descriptions are deduced from field observation or engineering examination, and may be appended or confirmed by in situ or laboratory testing. The information is dependent on the scope of investigation, the extent of sampling and testing, and the inherent variability of the conditions encountered.

Subsurface investigation may be conducted by one or a combination of the following methods.

Method		
Test Pitting: ex	cavation/trench	
BH	BH Backhoe bucket	
EX Excavator bucket		
R	Ripper	
Н	Hydraulic Hammer	
Х	Existing excavation	
Ν	Natural exposure	
Manual drilling	: hand operated tools	
HA	Hand Auger	
Continuous sa	mple drilling	
PT	Push tube	
PS	Percussion sampling	
SON	Sonic drilling	
Hammer drillin	g	
AH	Air hammer	
AT	Air track	
Spiral flight au	ger drilling	
AS	Auger screwing	
AD/V	Continuous flight auger: V-bit	
AD/T	Continuous spiral flight auger: TC-Bit	
HFA	Continuous hollow flight auger	
Rotary non-co	re drilling	
WB	Washbore drilling	
RR	Rock roller	
Rotary core dr	illing	
PQ	85mm core (wire line core barrel)	
HQ	63.5mm core (wire line core barrel)	
NMLC	51.94mm core (conventional core barrel)	
NQ	47.6mm core (wire line core barrel)	
DT	Diatube (concrete coring)	

Sampling is conducted to facilitate further assessment of selected materials encountered.

Sampling method			
Soil sampling			
В	Bulk disturbed sample		
D	Disturbed sample		
С	Core sample		
ES	Environmental soil sample		
SPT	Standard Penetration Test sample		
U	Thin wall tube 'undisturbed' sample		
Water sampling			
WS	Environmental water sample		

Field testing may be conducted as a means of assessment of the in situ conditions of materials.

Field testing	
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SPT	Standard Penetration Test		
HP/PP	Hand/Pocket Penetrometer		
Dynamic P	enetromet	ters (blows per noted increment)	
	DCP	Dynamic Cone Penetrometer	
	PSP	Perth Sand Penetrometer	
MC	Moisture	Content	
VS	Vane Shear		
PBT	Plate Bearing Test		
IMP	Borehole Impression Test		
PID	Photo Ionization Detector		

If encountered, refusal (R), virtual refusal (VR) or hammer bouncing (HB) of penetrometers may be noted.

The quality of the rock can be assessed by the degree of natural defects/fractures and the following.

Rock q	Rock quality description				
TCR	Total Core Recovery (%)				
	(length of core recovered divided by the length of core run)				
RQD	Rock Quality Designation (%)				
	(sum of axial lengths of core greater than 100mm long divided by the length of core run)				

Notes on groundwater conditions encountered may include.

Groundwater	
Not Encountered	Excavation is dry in the short term
Not Observed	Water level observation not possible
Seepage	Water seeping into hole
Inflow	Water flowing/flooding into hole

Perched groundwater may result in a misleading indication of the depth to the true water table. Groundwater levels are also likely to fluctuate with variations in climatic and site conditions.

Notes on the stability of excavations may include.

Excavation conditions			
Stable	No obvious/gross short term instability noted		
Spalling	Material falling into excavation (minor/major)		
Unstable	Collapse of the majority, or one or more face of the excavation		



Explanatory Notes: General Soil Description

The methods of description and classification of soils used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, a material is described as a soil if it can be remoulded by hand in its field condition or in water. The dominant component is shown in upper case, with secondary components in lower case. In general descriptions cover: soil type, plasticity or particle size/shape, colour, strength or density, moisture and inclusions.

In general, soil types are classified according to the dominant particle on the basis of the following particle sizes.

Soil Classification		Particle Size (mm)	
CLAY		< 0.002	
SILT		0.002 0.075	
SAND	fine	0.075 to 0.21	
	medium	0.21 to 0.6	
	coarse	0.6 to 2.36	
GRAVEL	fine	2.36 to 6.7	
	medium	6.7 to 19	
	coarse	19 to 63	
COBBLES		63 to 200	
BOULDERS		> 200	

Soil types may be qualified by the presence of minor components on the basis of field examination methods and/or the soil grading.

Terminology	In coarse	In fine soils	
reminology	% fines	% coarse	% coarse
Trace	≤5	≤15	≤15
With	>5, ≤12	>15, ≤30	>15, ≤30

The strength of cohesive soils is classified by engineering assessment or field/lab testing as follows.

Strength	Symbol	Undrained shear strength
Very Soft	VS	≤12kPa
Soft	S	12kPa to ≤25kPa
Firm	F	25kPa to ≤50kPa
Stiff	St	50kPa to ≤100kPa
Very Stiff	VSt	100kPa to ≤200kPa
Hard	Н	>200kPa

Cohesionless soils are classified on the basis of relative density as follows.

Relative Density	Symbol	Density Index	
Very Loose	VL	<15%	
Loose	L	15% to ≤35%	
Medium Dense	MD	35% to ≤65%	
Dense	D	65% to ≤85%	
Very Dense	VD	>85%	

The plasticity of cohesive soils is defined by the Liquid Limit (LL) as follows.

Plasticity	Silt LL	Clay LL
Low plasticity	≤ 35%	≤ 35%
Medium plasticity	N/A	> 35% ≤ 50%
High plasticity	> 50%	> 50%

The moisture condition of soil (*w*) is described by appearance and feel and may be described in relation to the Plastic Limit (PL), Liquid Limit (LL) or Optimum Moisture Content (OMC).

Moisture condition and description		
Dry	Cohesive soils: hard, friable, dry of plastic limit. Granular soils: cohesionless and free-running	
Moist	Cool feel and darkened colour: Cohesive soils can be moulded. Granular soils tend to cohere	
Wet	Cool feel and darkened colour: Cohesive soils usually weakened and free water forms when handling. Granular soils tend to cohere	

The structure of the soil may be described as follows.

Zoning	Description
Layer	Continuous across exposure or sample
Lens	Discontinuous layer (lenticular shape)
Pocket	Irregular inclusion of different material

The structure of soil layers may include: defects such as softened zones, fissures, cracks, joints and root-holes; and coarse grained soils may be described as strongly or weakly cemented.

The soil origin may also be noted if possible to deduce.

Soil origin a	and description
Fill	Anthropogenic deposits or disturbed material
Topsoil	Zone of soil affected by roots and root fibres
Peat	Significantly organic soils
Colluvial	Transported down slopes by gravity/water
Aeolian	Transported and deposited by wind
Alluvial	Deposited by rivers
Estuarine	Deposited in coastal estuaries
Lacustrine	Deposited in freshwater lakes
Marine	Deposits in marine environments
Residual soil	Soil formed by in situ weathering of rock, with no structure/fabric of parent rock evident
Extremely weathered material	Formed by in situ weathering of geological formations, with the structure/fabric of parent rock intact but with soil strength properties

The origin of the soil generally cannot be deduced solely on the appearance of the material and the inference may be supplemented by further geological evidence or other field observation. Where there is doubt, the terms 'possibly' or 'probably' may be used



Explanatory Notes: General Rock Description

The methods of description and classification of rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, if a material cannot be remoulded by hand in its field condition or in water, it is described as a rock. In general, descriptions cover: rock type, grain size, structure, colour, degree of weathering, strength, minor components or inclusions, and where applicable, the defect types, shape, roughness and coating/infill.

Rock types are generally described according to the predominant grain or crystal size, and in groups for each rock type as follows.

Rock type	Groups
Sedimentary	Deposited, carbonate (porous or non), volcanic ejection
Igneous	Felsic (much quartz, pale), Intermediate, or mafic (little quartz, dark)
Metamorphic	Foliated or non-foliated
Duricrust	Cementing minerology (iron oxides or hydroxides, silica, calcium carbonate, gypsum)

Reference should be made to AS1726 for details of the rock types and methods of classification.

The classification of rock weathering is described based on definitions in AS1726 and summarised as follows.

Term and symbol		Definition	
Residual Soil	RS	Soil developed on rock with the mass structure and substance of the parent rock no longer evident	
Extremely weathered	XW	Weathered to such an extent that the rock has 'soil-like' properties. Mass structure and substance still evident	
Distinctly weathered	DW	The strength is usually changed and may be highly discoloured. Porosity may be increased by leaching, or decreased due to deposition in pores. May be distinguished into MW (Moderately Weathered) and HW (Highly Weathered).	
weathered	SVV	change of strength from fresh rock	
Fresh Rock	FR	The rock shows no sign of decomposition or staining	

The rock material strength can be defined based on the point load index as follows.

Term and symbol		Point Load Index I₅50 (MPa)
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	Μ	0.3 to 1.0
High	Н	1.0 to 3
Very High	VH	3 to 10
Extremely High	EH	> 10

It is important to note that the rock material strength as above is distinct from the rock mass strength which can be significantly weaker due to the effect of defects. A preliminary assessment of rock strength may be made using the field guide detailed in AS1726, and this is conducted in the absence of point load testing.

The defect spacing measured normal to defects of the same set or bedding, is described as follows.

Definition	Defect Spacing (mm)
Thinly laminated	< 6
Laminated	6 to 20
Very thinly bedded	20 to 60
Thinly bedded	60 to 200
Medium bedded	200 to 600
Thickly bedded	600 to 2000
Very thickly bedded	> 2000

Terms for describing rock and defects are as follows.

Defect Terms			
Joint	JT	Sheared zone	SZ
Bedding Parting	BP	Seam	SM
Foliation	FL	Vein	VN
Cleavage	CL	Drill Lift	DL
Crushed Seam	CS	Handling Break	HB
Fracture Zone	FZ	Drilling Break	DB

The shape and roughness of defects in the rock mass are described using the following terms.

Planarity		Roughness	
Planar	PR	Very Rough	VR
Curved	CU	Rough	RF
Undulose	UN	Smooth	S
Irregular	IR	Slickensided	SL
Stepped	ST	Polished	POL
Discontinuous	DIS		

The coating or infill associated with defects in the rock mass are described as follows.

Infill and Coating		
Clean	CN	
Stained	SN	
Carbonaceous	Х	
Minerals	MU	Unidentified mineral
	MS	Secondary mineral
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
Veneer	VNR	Thin or patchy coating
Coating	СТ	Infill up to 1mm



Graphic Symbols Index



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1				ES 0.05 - 0.10 m					TOPSOIL FILL: Clayey SILT, low plasticity, obviously brown, trace rootlets	dark		FILL
				ES 0.10 - 0.20 m		-			0.15m			
	F					-			FILL: Clayey GRAVEL, fine to coarse, angui sub angular, dark brown, trace rootlets 0.25m	M		
	E			ES 0.25 - 0.35 m		-			Silty CLAY, medium plasticity, dark red mott orange and grey, trace rootlets, trace fine gr sand, trace fine angular to sub-rounded grav	led rained vel		RESIDUAL SOIL
bucket		-	untered			- 0.5			As above, Orange mottled dark red	M (>PL)	St	-
600mm toothed	F-H	Stable	Not Enco	ES 0.85 - 0.90 m	11	3			0.85m Clavey SAND/ Sandy CLAY, pale brown mo	ttled	н	EXTREMELY WEATHERED
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						-			with fine to coarse, angular to sub-angular p rock fragments	Down	D	
				ES 1.25 - 1.30 m		_			1.20m SANDSTONE, fine to medium grained, brow mottled orange, low strength, highly weather	/n red		WEATHERED ROCK
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				ES 0.05 - 0.10 m		-				FILL: Clayey SILT, dark brown, trace trace plastic rope fragments	e rootlets,	M (≈ PL)		FILL		-
	E			ES 0.20 - 0.30 m		-			0.20m	Silty SAND, fine to medium grained, trace fine to medium, rounded to sub gravel	pale brown, b-rounded	м	MD	COLLUVIUM		
				B 0.40 - 0.60 m		- 0.5			0.35m	Silty CLAY, medium plasticity, orang red, trace fine to medium grained sar rootlets	e mottled dark nd, trace	M (<pl)< td=""><td>VSt</td><td>RESIDUAL S</td><td>OIL</td><td></td></pl)<>	VSt	RESIDUAL S	OIL	
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		1			14	-			0.80m Sandy CLAY, low plasticity, orange brow	wn mottled		EXTREMELY WEATHERED
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						-			SANDSTONE, medium to coarse graine mottled brown and red, highly weathere strength	ed, orange d, very low		WEATHERED ROCK
	Н					-			1.30m TERMINATED AT 1.30 m			
0						-			Refusal on Weathered Rock			-
						- 1.5						_
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						-						-
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MI EA R HA PT SC AL AL WW RF	ETHOD C Ex Rip A Ha Pu DN Sc A Ha Pu DN Sc S Sh D/V Sc D/V Sc CA Ha B W3 R Rc	L ccavato pper and aug sh tube onic drill hamm rccussio ort spir blid fligh blid fligh blid fligh blid fligh blid fligh blow flig ashbor ock rolle	r bucke er ing er n sam al auge t auge t auge t auge ght auge drillin er	t VE E F H VH Pler WA r: V-Bit r: TC-Bit er g −	LILINIA CONTRACTOR LAND	o Resista efusal) evel on flow utflow	I nce) Date	F C F M F	IELD TESTS IELD TESTS PT - Standard Penetration Test P - Hand/Pocket Penetrometer CP - Dynamic Cone Penetrometer SP - Perth Sand Penetrometer IC - Moisture Content BT - Plate Bearing Test IP - Borehole Impression Test ID - Photoionisation Detector S - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES B - D - Disturbed sa ES - ENvironmen U - MOISTURE D - D - D - D - D - Dry M M - Wet PL PL - Uquid limit w - Moisture control	I ed sample mple tal sample e 'undistu ntent	Soll CONSISTENCY VS - Very Soft S - Soft F - Firm VSt - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
Re abl	fer to exp previation	planatory ns and ba	notes fo	or details of escriptions		S	STAN	1TI	EC AUSTRALIA PTY L	TD		

C	S	tan	tec										TE	ST PIT	LOG SHEET
Cli	ent: piect:	l l	Nalk Geot	er Gilliesto echnical Inv	n Heights Pty vestigation	/ Ltd							H	ole N	o: TP005
Lo	catio	n: 4	157-5	27 Cessno	ck Road, Gill	iestor	n Heigh	ts		Job No: 304100964					Sheet: 1 of 1
Po	sitior	n: Ref	er to	Site Plan						Angle from Horizontal:	90°	5 	Surfac	e Elevatior	1:
Ex	cavat	ion D	e:5t imer	onne Excav Isions:	ator					Excavation Method: 60	Jomm Toot	nea Bu (Contra	ctor: Stan	tec Ptv Ltd
Da	te Ex	cavat	ed: 5	5/10/22						Logged By: JH		C	Checke	ed By: KS	
E	xcava	tion		Samplin	g & Testing					Material	I Description				
Method	Resistance	Stability	Water	Sample o Field Te:	OCP TEST (AS 1289.6. 3.2-1997) st Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	:	SOIL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, onents colour, ering,	Moisture Condition	Consistency Relative Density	& Ot	STRUCTURE her Observations
							لك عك عك عك عك عك كك عك عك كك عك عك يك عك عك		0.10m	TOPSOIL: Silty SAND, fine to medium dark brown, trace organics	m grained,	D		TOPSOIL	
									0.20m	Sandy SILT, low plasticity, dark brow grained sand, trace organics	n, fine	M (<pl)< td=""><td>F</td><td>COLLUVIUM</td><td></td></pl)<>	F	COLLUVIUM	
				ES 0.20 - 0.40) m ₁ 					Sandy SILT, low plasticity, pale grey brown	mottled pale				-
						-						M (<pl)< td=""><td>St</td><td></td><td>-</td></pl)<>	St		-
	F			ES 0.50 - 0.60		- 0.5			0.50m	Silty Sandy CLAY, medium plasticity	brown			RESIDUAL S	OIL
						-				mottled red and pale grey, trace orga medium grained sand, trace medium sub-rounded gravel	anics, fine to to coarse				-
d bucket -			ountered			-						M (>PL)	St		-
m toothe		Stable	Not Enc			-									-
600n					/100mm VF	_			0.90m	Silty CLAV Jour placticity, grange me	ttlad rad and		VSt		WEATHERED
						- 1.0				pale grey, trace medium to coarse sa fragments, trace sandstone cobble	andstone			EXTREME	-
	F-H					-									-
						-						M (<pl)< td=""><td>н</td><td></td><td>-</td></pl)<>	н		-
						-				As above, Lenses of Gravelly SAND	(very low				-
0	н			ES 1.40 - 1.50) m	-				strength rock)					-
I						-1.5-			1.50m	TERMINATED AT 1.50 m					
						-				30. aopa.					-
						_									-
						-									-
						_									-
M		<u> </u>		<u> </u>				FII	ELDT	ESTS	SAMPI ES				
E R H S	X E A H T P ON S	xcavato ipper and aug ush tub onic dril	r buck jer e ling	et	VE Very Easy (N E Easy F Firm H Hard VH Very Hard (Re	o Resista efusal)	nce)	SF HF DC PS	PT - P - CP - SP -	Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer	B - Bull D - Dist ES - Env U - Thir	k disturbe turbed sar ironmenta n wall tube	d sample mple al sample e 'undistu	e V S Irbed' S	/S - Very Soft - Soft - Firm St - Stiff /St - Very Stiff
	H A S P S S D/V S	ir hamm ercussion hort spir olid fligh	er on sam al aug it auge	ipler er r: V-Bit	WATER Water Lu	evel on	Date	PE IM PE		Plate Bearing Test Borehole Impression Test Photoionisation Detector	D - Dry M - Moi W - Wei	st t		F F	I - Hard RELATIVE DENSITY /L - Very Loose
A H W R	D/IS FAH /BW RRR	olid fligh ollow flig /ashbor ock rolle	և auge ght aug e drillir er	ger Ig	 water inf water out 	'low Itflow		VS	3 -	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	PL - Plas LL - Liqu w - Moi	stic limit iid limit sture con	tent		ID - LOOSE ID - Medium Dense D - Dense ID - Very Dense
R	efer to ex obreviatio	planatory ons and b	notes f asis of d	or details of lescriptions		S	STAN	ITE	С	AUSTRALIA PTY	LTD				

(5) St	ant	tec								ΤE	ST PIT	LOG SHEET
C	lie roi	nt: ect:	N (Nalk Geote	er Gillieste echnical Ir	on Heights F	Pty Ltd					Η	ole N	lo: TP006
L	000	ation	: 4	157-5	27 Cessno	ock Road, G	illiestor	n Heigh	Its	Job No: 304100964				Sheet: 1 of 1
F	'osi Iac	ition: hine	Ref	er to	Site Plan	avator				Angle from Horizontal: 90° Excavation Method: 600mm To	othed B	Surfac	e Elevatio	on:
E	xca	avati	on D	imen	isions:							Contra	ctor: Sta	intec Pty Ltd
C)ate	e Exc	avat	ed: 5	/10/22			1		Logged By: JH		Check	ed By: K	S
	Ex	cavati	on		Sampli	ing & Testing				Material Descripti	on I	1	1	
	Method	Resistance	Stability	Water	Sample Field T	e or est Blows, 150 mr 3,6,9	ST	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	&	STRUCTURE Other Observations
							 ¹	لك علد علد علد علد ع علد علد علد علد علد ع علد علد ع علد علد ع		TOPSOIL: Sandy SILT, low plasticity, brown, tra gravel	e M (<pl)< th=""><th>)</th><th>TOPSOIL</th><th></th></pl)<>)	TOPSOIL	
										0.15m Silty SAND, fine to medium grained, pale brown with gravel	M (<pl< td=""><td>) L</td><td>COLLUVIU</td><td>M -</td></pl<>) L	COLLUVIU	M -
		F								0.30m Silty CLAY, medium to high plasticity, mottled orange and dark red -brown, trace rootlets, trace fine grained sand			RESIDUAL	SOIL
5000 B	cket			sred)3 - 0.5 5 - 5 -			inte graineu sanu		St		-
	toothed buc	E-F	Stable	Not Encounte			 ⁷				M (>PL		-	-
	600mm													-
100.00						/50mm F	в 1.0					VSt		_
0.01 04.71 0					B 1.10 - 1.40	0 m	7 			1.20m				-
202/00/141		F			ES 1.20 - 1.3	30 m 				Sitty Sandy CLAY, low plasticity, orange brown, mottled red and pale grey, fine to medium graine sand	d M (< PL)		EXTREME	-Y WEATHERED
							 _ 			As above, Brown orange mottled pale grey	M (1 2	,		-
2000							 1.5 			SANDSTONE, fine to medium grained, brown mottled pale grey and orange, very low strength highly weathered			WEATHER	ED ROCK
	¥									1.60m TERMINATED AT 1.60 m Target depth				
							- - 							-
														-
	ME EX R HA PT SOI AD AD/ AD/ AD/ HFA WB R	THOD Exc Rip Ha Pu: N Sol Air Pei Sh V Sol T Sol A Ho S A Ho S Ro	cavato oper nd aug sh tube nic dril hamm rcussic ort spii lid fligh llow flig ashbor ck rolle	r bucke ler er on sam al auge t auge t auge ght auge drillin er	et er r: V-Bit r: TC-Bit gg	PENETRATIO VE Very Easy E Easy F Firm H Hard VH Very Hard WATER Water Show water Water water	N (No Resistant (Refusal) r Level on n ∵inflow ∵outflow	^{nce)} Date	F F F F F	IELD FESTS SAMPL SPT Standard Penetration Test B IP Hand/Pocket Penetrometer D DCP Dynamic Cone Penetrometer U PSP Perth Sand Penetrometer U PBT Plate Bearing Test M PID Photoionisation Detector W V/S Vane Shear; P=Peak, R=Resdual (uncorrected kPa) W	:S Bulk disturb Disturbed s: Environmen Thin wall tut RE Dry Moist Wet Plastic limit Liquid limit Moisture co	ed sample ample tal sample be 'undistu	≥ ∋ ırbed'	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D Dense VD - Very Dense
	Refe abbr	er to exp reviation	lanatory s and ba	notes fo	or details of escriptions		ę	STAN	IT	EC AUSTRALIA PTY LTD			I	

Q	St	ant	ec								TE	ST PIT LOG SHEET
Clie	ent:	Ň	Valk Seot	er Gillieston	Heights Pty	/ Ltd					Н	ole No: TP007
Loc	ation	n: 4	57-5	27 Cessnoc	k Road, Gill	iestor	n Height	ts	Job No: 304100964			Sheet: 1 of 1
Pos	sition	: Ref	er to	Site Plan	-4				Angle from Horizontal: 90°		Surface	e Elevation:
Exc	cnine :avati	ion D	imer	onne Excava	ator				Excavation Method: 600mm 100t	nea Bl	Contra	ctor: Stantec Ptv Ltd
Dat	e Exc	cavat	ed: 5	/10/22					Logged By: JH	(Checke	ed By: KS
E	xcavat	ion		Sampling	& Testing				Material Description			
Method	Resistance	Stability	Water	Sample o Field Tes	r t b cP TEST (AS 1289.6. 3.2-1997) t Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
				ES 0.05 - 0.10	m 	-	للد علد علد علد علد علد		TOPSOIL: Silty SAND, fine to medium grained, dark brown, trace organics, trace fine to medium, sub-rounded to rounded gravel	м		TOPSOIL
						-			Silty SAND, fine to medium grained, brown mottled pale brown, with fine to coarse, sub-rounded to rounded gravel 0.35m	м	L	COLLUVIUM
d bucket	F		untered	ES 0.65 0.90		- -0.5			Silty CLAY, medium plasticity, mottled orange and dark red -brown, trace rootlets, trace fine grained sand	M (>PL)	F - St	RESIDUAL SOIL
		Stable	Not Enco	ES 0.65 - 0.80	m ₅	-			0.70m Silty Sandy CLAY, medium plasticity, mottled red orange and pale grey, fine to medium grained sand, trace medium to coarse rounded gravel	M (==PI)	VSt	-
5					/2/5mhmi HB	- 1.0			1.00m			-
						-			brown-orange mottled pale grey and red	D	D - VD	-
						-			1.30m			-
	н			ES 1.30 - 1.40	m 				SILTSTONE, grey mottled pale grey and purple, interbedded with SANDSTONE, fine to medium grained, brown mottled pale grey and orange, very			WEATHERED ROCK
						- 1.5			1.40m low strength, highly weathered TERMINATED AT 1.40 m Refusal on Weathered Rock			
						-						-
						-						-
						-						-
MI EX PT SC AFS AS AS AL HF WW RF	ETHOD ETHOD C Ex Rip A Ha Pu DN Sc H Ain S Sh D/V Sc S Sh D/V Sc D/T Sc D/T Sc A Ha B Wi R Rc	ccavato pper and aug ish tube onic drill r hamm ercussion ort spin olid fligh olid fligh ollow flig ashborr ock rolle	r bucke er ing er al aug t auge t auge ght auge drillin er	pler er r: V-Bit r: TC-Bit ger	PENETRATION VE Very Easy (N Easy Hard Hard VH Very Hard (R WATER Water L shown water ou	o Resista efusal) evel on low itflow	nce) Date	F S H D P ≥ P ≦ P ∨	ELD TESTS SAMPLES PT - Standard Penetration Test B - Buil P - Hand/Pocket Penetrometer D - Dis CP - Dynamic Cone Penetrometer ES - Enn CP - Moisture Content MOISTURE T - Plate Bearing Test D - Dry IP - Borehole Impression Test D - Dry D - Photoionisation Detector W - We S - Vane Shear; P=Peak, LL - Liq R=Resdual (uncorrected kPa) W or	k disturbe turbed sai irironmenta n wall tube stic limit stic limit uid limit isture con	d sample mple al sample e 'undistu tent	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD Medium Dense D Dense VD - Very Dense
Re	fer to exp previation	planatory ns and ba	notes f asis of d	or details of escriptions		S	STAN	ITE	EC AUSTRALIA PTY LTD			

(5	St	ant	cec									TE	ST PIT	LOG SHEET
C	lien roie	it: ect:	\ (Valk Geote	er Gillieston He	eights Pty	/ Ltd						Н	ole N	o: TP008
Ŀ	oca	tion	: 2	57-5	27 Cessnock F	Road, Gilli	iestor	n Heigh	ts	Job No: 304100964	1				Sheet: 1 of 1
Ρ	osit	ion:	Ref	er to	Site Plan					Angle from Horizor	ntal: 90°	5	Surface	e Elevatior	ו:
M	lach	nine	Туре	e:5 to	onne Excavato	r				Excavation Method	: 600mm Too	thed Bu	icket		
E	xca	vatio	on D	imen adı E	sions:							(Contra	ctor: Stan	tec Pty Ltd
٣	Exc	avati	aval	eu. o	Sampling &]	Testina				Logged by. Эн Ма	terial Description		JIECKE	u by. No	
\vdash					Sampling &		Ê		_			1			
Mothod	INIEIIIOU	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m	Graphic Log	Classificatior	SOIL TYPE, plasticity or particle colour, secondary and minor ROCK TYPE, grain size and fabric & texture, strength, w defects and structu	e characteristic, components type, colour, eathering, re	Moisture Condition	Consistency Relative Density	& Ot	STRUCTURE her Observations
					ES 0.10 - 0.25 m		-	لك علك علك ع علك علك ع علك علك علك علك علك علك علك علك علك علك علك علك		TOPSOIL: Silty SAND, fine to r dark brown, trace organics, trac sub-rounded to rounded gravel	nedium grained, ce fine to medium,	м		TOPSOIL	-
							-			0.20m Sandy SILT, low plasticity, dark	brown, fine to			COLLUVIUM	
							-			medium grained sand		M (-PL)			-
ţ				pe			-			As above, Pale grey, trace root	lets	WI (<fl)< td=""><td></td><td></td><td>-</td></fl)<>			-
		F		ounter			- 0.5			0.50m				RESIDUAL	
to to the co			Stable	Not Enco			-			Silty CLAY, medium plasticity, t and red, trace rootlets, trace fin grained sand	prown mottled grey le to medium			RESIDUAL S	
Sinci Rim							-			As above, Red mottled pale gre	ey and orange, with	M (>PL)	F		-
							-			As above, Grey mottled brown, cobble	trace sub-rounded				-
ć							-			0.90m					
DOC Infilm						/50mm HB	- 1.0			Clayey SAND, medium to coars brown mottled pale grey with fir angular sandstone fragments, v 1.00m sandy CLAY	se grained, orange ne to coarse with lenses of silty	D	D		WEATHERED
		н								SANDSTONE, medium to coars mottled brown, fine to medium, sub-rounded gravel clasts	se grained, orange rounded to				
01.1							-			Refusal on Weathered Rock					-
							-								-
							-								-
0.00							- 1.5								_
							_								-
							-								-
							-								-
					<u> </u>										-
	MET EX R HA PT SON AH PS AD/V AD/T HFA WB	HOD Exc Rip Hai Sol Air Pei Sol Sol Sol Hol Wa	cavato per nd aug sh tube nic drill hamm rcussic ort spir id fligh id fligh id fligh id fligh	r bucke er er on sam al auge t auge ght auge ght auge ght auge	at VE E F H VH pler WAT ar r: V-Bit g	ETRATION Very Easy (Ne Easy Firm Hard Very Hard (Re TER Water Le shown water inf water ou	efusal) evel on low ttflow	nce) Date		FIELD TESTS SPT - SPT - Standard Penetrometer Docket Penetrometer OCP - Dynamic Cone Penetrometer Perth Sand Penetrometer VC - MOE - Perth Sand Penetrometer VC - Moisture Content PBT - Plate Bearing Test MP - Borehole Impression Test PID - Photoionisation Detector /S - Vane Shear, P=Peak, R=Resdual (uncorrected kPa)	SAMPLES B - Bi D - Di ES - Er U - Tr MOISTURI D - Dr M - Mi W - W PL - Pi LL - Lit w - Mi	Ik disturbe sturbed sa ivironment in wall tube E y bist et astic limit oisture con	d sample mple al sample e 'undistu tent	rbed' S F F R F R N N C C	Soil CONSISTENCY /S - Very Soft S - Soft F - Firm St - Stiff /St - Very Stiff d - Hard RELATIVE DENSITY /L - Very Loose - Loose - Loose - D Dense (D) - Medium Dense
	Refer	to expl	anatory	notes fo	or details of escriptions		ç	STAN	 T	EC AUSTRALIA PI	TY LTD				- very Dense

	\mathbf{O}) St	ant	cec								TE	ST PIT LOG SHEET
ſ	Clie Proi	nt: iect:	۱ ر	Valke Geote	er Gillieston H	eights Pty L	td					H	ole No: TP009
	Loc	ation	: 4	57-5	27 Cessnock I	Road, Gillie	ston	Heigh	ts	Job No: 304100964			Sheet: 1 of 1
╞	Pos	ition	: Ref	er to	Site Plan					Angle from Horizontal: 90°		Surfac	e Elevation:
\mathbf{F}	Mac	chine avati	I ype	e: 5 to imen	onne Excavato	or				Excavation Method: 600mm	oothed B	ucket Contra	ctor: Stantec Ptv I td
ł	Date	e Exc	avat	ed: 5	/10/22					Logged By: JH		Checke	ed By: KS
ſ	Ex	cavati	ion		Sampling &	Testing				Material Descrip	tion		
	Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
								لك علك علك علك علك علك لك علك علك علك علك علك علك علك علك علك علك علك ع		TOPSOIL: Sitty SAND, fine to medium grained dark brown, trace organics, trace fine to mediu sub-rounded to rounded gravel	m, M		TOPSOIL
								للہ علہ علہ علہ علہ علہ علہ علہ علہ علہ علہ الہ علہ علہ		0.20m Silly CLAV, medium to high electricity brown			RESIDUAL SOIL
					B 0.30 - 0.60 m					mottled grey, trace fine to medium rounded gra trace fine grained sand, trace rootlets	ivel,		-
													-
							0.5				M (>PL)) F	-
2000	bucket			Intered						As above, High plasticity, mottled pale grey an red	ь		-
Billion ion io	im toothed		Stable	Not Encou									-
1011										0.90m Silty CLAY, low to medium plasticity, mottled			EXTREMELY WEATHERED
							1.0			orange brown		St	-
0.00.01													-
0404004-		F								As above, Pale grey, mottled red orange, trace coarse angular sandstone fragments	M (≈ PL) VSt	
- DI IRIIMPIO						12							-
	V						·1.5—			1.50m			
										Target depth			-
													-
													-
													-
İ	ME		cavete	r hucks	PEN	ETRATION			F	ELD TESTS SAMP	LES Bulk disturb	, ed samola	SOIL CONSISTENCY
	R HA PT SO	Rip Rip Ha Pu Ν So	oper and aug sh tube nic dril	i bucke er ing er	VE E F H VH	Very Easy (No R Easy Firm Hard Very Hard (Refu	tesistar sal)	nce)		P - Hand/Pocket Penetrometer CP - Dynamic Cone Penetrometer SP - Perth Sand Penetrometer C - Moisture Content MOIS	Disturbed sa Disturbed sa Environmen Thin wall tub	ample ample tal sample be 'undistu	s - Very Sont S - Soft F - Firm VSt - Stiff VSt - Very Stiff H - Hard
	PS AS AD AD HF	/V So /T So A Ho	incussion ort spir lid fligh lid fligh	an sam al auge t auge t auge t auge	pler ₩A er \ ∵V-Bit - ∵TC-Bit er	TER Water Leve shown water inflow	el on l w	Date	F IN P	AP Plate Bearing Test D MP - Borehole Impression Test M ID - Photoionisation Detector W S - Vane Shear: P=Peak. PL	Dry Moist Wet Plastic limit		RELATIVE DENSITY VL - Very Loose L - Loose MD Medium Dense
~~~~~	RR Ref	Ro	ock rolle	n aug e drillin er notes fo	g -	water outfle	ow C	27/1	 		Liquid limit Moisture co	ntent	D - Dense VD - Very Dense
	abb	reviation	is and ba	asis of de	escriptions		C	2 I AIN	N I I				

C	S	tan	tec								TE	ST PIT LO	G SHEET
Cli	ent:	N	Nalk Geote	er Gillieston	Heights Pty	Ltd					Η	ole No:	<b>TP010</b>
Lo	catior	1: 4	157-5	27 Cessnocl	k Road, Gilli	estor	n Heigh	ts	Job No: 304100964				Sheet: 1 of 1
Po	sition	: Ref	er to	Site Plan	tor				Angle from Horizontal: 90°	othed D	Surfac	e Elevation:	
Ex	cavat	ion D	imen	sions:	llor				Excavation Method: 600mm 10		Contra	ctor: Stantec F	tv Ltd
Da	te Exc	cavat	ed: 5	/10/22					Logged By: JH		Checke	ed By: KS	<b>.</b>
E	xcava	tion		Sampling	& Testing				Material Descripti	on			
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUC & Other Ob	CTURE servations
						_			FILL: Silty SAND, fine to medium grained, dark brown trace gravel, trace organics, trace glass fragments 0.15m	М		FILL	
						-			Sandy SILT, low plasticity, dark brown, fine to medium grained sand, trace organics	M ( <pl)< td=""><td>s</td><td>COLLUVIUM</td><td>-</td></pl)<>	s	COLLUVIUM	-
		_				- 0.5			Silty CLAY, medium plasticity, mottled orange ar dark red -brown, trace rootlets, trace fine grainer sand	d I		RESIDUAL SOIL	-
toothed bucket		Stable	Vot Encountered	B 0.60 - 0.80 m		-			As above, High plasticity, trace fine to medium, sub-rounded to sub-angular gravel	M (>PL)	St		-
600mm	F		2			- - 1.0							
	F-H	-				-			Sity Sandy CLAY, low to medium plasticity, mottled pale grey orange and red, fine to mediun grained sand	n M ( <pl)< td=""><td>VSt to H</td><td>EXTREMELY WEAT</td><td>"HERED -</td></pl)<>	VSt to H	EXTREMELY WEAT	"HERED -
101					/100mm HB								
	н					_			1.30m SANDSTONE, medium to coarse grained, grey orange brown, fine to medium, rounded to sub-rounded gravel clasts 1.40m			WEATHERED ROC	к
						- 1.5			TERMINATED AT 1.40 m Refusal on Weathered Rock				-
						-							
						-							-
						-							-
∎ E R H	ETHOD X Ex Ri A Ha	cavato pper and aug	r bucke jer	et v F	PENETRATION /E Very Easy (No Easy Firm	Resista	nce)	F S F	BELD TESTS     SAMPL       SPT - Standard Penetration Test     B -       IP - Hand/Pocket Penetrometer     D -       ICP - Dynamic Cone Penetrometer     ES -	ES Bulk disturbe Disturbed sa Environmen	ed sample imple tal sample	SOIL C SOIL C VS - S - F -	ONSISTENCY Very Soft Soft Firm
	T PU ON So H Ai S Pe S Sh D/V So D/T So FA Ho /B W	ush tube onic dril r hamm ercussio nort spin olid fligh olid fligh ollow flig ashbor	e er on sam al auge t auge t auge ght auge ght auge ght aug	pler V er r: V-Bit r: TC-Bit jer g	Hard H Very Hard (Re VATER Water Le shown water infl water ou	fusal) evel on ow tflow	Date	F F II F	SP     Perth Sand Penetrometer       VB     Perth Sand Penetrometer       MC     Moisture Content       PBT     Plate Bearing Test       VP     Borehole Impression Test       VP     Photoionisation Detector       VS     Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	Thin wall tub IRE Dry Moist Wet Plastic limit Liquid limit	e 'undistu	Irbed' St - VSt - H - <b>RELAT</b> VL - L - MD - D -	Stiff Very Stiff Hard IVE DENSITY Very Loose Loose Medium Dense Dense
R R at	R Ro efer to ex obreviation	planatory	notes fo	or details of escriptions		ç	STAN	  T	EC AUSTRALIA PTY LTD	WOISTULE COL	nent	VD -	Very Dense

C	St	ant	cec									TE	ST PIT LOG SHEET
Cli	ent: piect:	۱ ر	Valk Geot	er Gillieston H echnical Inves	leights Pty Li tigation	td						Н	ole No: TP011
Lo	cation	n: 4	57-5	27 Cessnock	Road, Gillies	ton	Heigh	ts	Job No: 304100964				Sheet: 1 of 2
Po	sition	: Ref	er to	Site Plan					Angle from Horizontal: 9	0°	5	Surface	e Elevation:
Ma	chine	Type	): 5 t	onne Excavato	or				Excavation Method: 600r	mm Tooth	hed Bu	Cket	ctor: Stantoc Phy I td
Da	te Exc	cavat	ed: 5	5/10/22					Logged By: JH			Checke	ed Bv: KS
E	xcavat	ion		Sampling &	Testing				Material De	escription			<i></i>
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3.6.9.12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle character colour, secondary and minor compone ROCK TYPE, grain size and type, colo fabric & texture, strength, weathering defects and structure	eristic, ents our, g,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
				ES 0.05 - 0.10 m					FILL: Silty clayey SAND, fine grained, broorange	rown	М		FILL
									0.25m	ine to	M ( <pl)< td=""><td>F</td><td>COLLUVIUM</td></pl)<>	F	COLLUVIUM
				ES 0.45 - 0.55 m		).5			Silty CLAY, medium plasticity, brown ora mottled red , trace rootlets, with fine grain	ange ined sand	M (>PL)	F to St	RESIDUAL SOIL
ucket			Itered	B 0.60 - 0.90 m					0.60m Silty Sandy CLAY, low to medium plastic mottled pale grey brown orange red, fine medium grained sand, trace organics	city, e to			EXTREMELY WEATHERED
toothed b	E	Stable	Not Encoun									VSt	
5					17	.0					M ( <pl)< td=""><td></td><td></td></pl)<>		
					21							н	
									1.25m Silty Clayey SAND, fine to medium grain brown to orange mottled pale grey, with coarse anoulta pebbly sandstone frame	ned sand, fine to			_
										ente	м	D - VD	
						.5—	XX/-2		1.50m TERMINATED AT 1.50 m Target depth			1	
								   .		SAMPLES			
	X Ex A Ha T Pu ON Sc H Ain S Pe S Sh D/V Sc D/T Sc FA Ho /B W/ R R R	ccavato pper and aug ish tube onic drill r hamm ercussic ort spir olid fligh olid fligh ollow flig ashborr ock rolle	r bucke er ing er on sam al aug t auge t auge ght aug e drillin er	et VE E F H VH er V r: TC-Bit ↓ gg ↓	Very Easy (No Re Easy Firm Hard Very Hard (Refusi TER Water Leve shown water inflow water outflow	esistar al) I on I , w	nce) Date	F F F F	SPT       Standard Penetration Test         HP       Hand/Pocket Penetrometer         DCP       Dynamic Cone Penetrometer         PSP       Perth Sand Penetrometer         MC       Moisture Content         PBT       Plate Bearing Test         IMP       Borehole Impression Test         PID       Photoionisation Detector         VS       Vane Shear, P=Peak,         R=Resdual (uncorrected kPa)	B - Bulk D - Dist ES - Envi U - Thin MOISTURE D - Dry M - Mois U - Plas LL - Liqu w - Mois	a disturbed urbed sar ironmenta wall tube st stic limit sture cont	d sample nple al sample e 'undistu	solit Consist EMCY s VS - Very Soft S - Soft F - Firm VSt - Very Stiff H - Hard <b>RELATIVE DENSITY</b> VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
Real	efer to exp obreviation	planatory ns and ba	notes f asis of d	or details of lescriptions		S	STAN	IT	TEC AUSTRALIA PTY L	TD			I

C	S	tan	tec									TE	ST PIT LOG SHEET
CI	ient: oiect	:	Walk Geote	er Gillieston He	eights Pty	/ Ltd						Н	ole No: TP012
Lo	catio	n: 4	457-5	27 Cessnock F	Road, Gill	iesto	n Heigh	Its	Job No: 304100964				Sheet: 1 of 1
Po	ositio	n: Ref	er to	Site Plan	r				Angle from Horizontal:	90° 0mm Tooth	ed Br	Surface	e Elevation:
E	cava	tion D	imen	sions:	•				Excavation method. 00		(	Contra	ctor: Stantec Pty Ltd
Da	ate Ex	cavat	ed: 1	2/10/22		1	1		Logged By: JH		(	Checke	ed By: KS
	Excava	ation	-	Sampling &	Testing	- -			Material	Description		1	
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m	Graphic Log	Classification	SOIL TYPE, plasticity or particle chara colour, secondary and minor compo ROCK TYPE, grain size and type, c fabric & texture, strength, weather defects and structure	cteristic, onents olour, ring,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						_			FILL: Silty SAND, fine to medium grain brown, with lenses of clay, trace rootle	ned, dark ets	м		FILL
						-			0.15m FILL: Clayey Sandy SILT, low plasticit pale brown trace gravel, fine to coarse sand, trace medium sub-rounded grav	y, brown to e grained /el	M ( <pl)< td=""><td></td><td></td></pl)<>		
						-			0.30m Sandy CLAY, medium to high plasticit orange-brown and grey, fine to mediui sand	y, mottled m grained	M (>PL)	St	RESIDUAL SOIL
ucket			tered			-0.5			0.45m Silty CLAY, medium plasticity, orange brown and red, with fine grained sand	mottled			-
ng Tools mm toothed bi		Stable	Not Encoun			-				1	M ( <b>≈</b> PL)	St to VSt	
1 A, Photo, Monitor						-			0.90m				
atgel AGS R						- 1.0			Clayey SAND, fine to medium grained mottled pale grey, with medium to coa to sub-angular gravel	l, orange arse, angular	D	D	EXTREMELY WEATHERED
03.00.09					/50mm HB	_			1.10m				
23 12:48 10	F					-			SANDSTONE, fine to medium grained mottled pale grey, highly weathered, v strength	d, orange very low			WEATHERED ROCK
> 14/06/202	н								1.30m				
GPJ < <drawingfile></drawingfile>						-			Refusal on Weathered Rock				
HEIGH IS GI						-							
GILLIESTON						-							
XED 304100XXX - SOUTH (						-							
	METHO EX E R F HA H PT F SON S SON S SON S SON S AD/V S AD	D Excavato Ripper Hand aug Push tub Sonic dril Air hamn Percussi Short spi Solid fligh Solid fligh Solid fligh Hollow fli Washbor Rock roll	er bucke e ling ner on sam ral auge tt auge tt auge ght auge drillin er	pler VA r: V-Bit g −	Very Easy (N Easy Firm Hard Very Hard (Ro TER Water Lu shown water inf	o Resista efusal) evel on low itflow	nce) Date	FI SI HI D' P' M PI N PI	ELD TESTS         PT       Standard Penetration Test         P       Hand/Pocket Penetrometer         CP       Dynamic Cone Penetrometer         CP       Perth Sand Penetrometer         CP       Moisture Content         3T       Plate Bearing Test         IP       Borehole Impression Test         D       Photoionisation Detector         S       Vane Shear, P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         - Bulk           D         - Distu           ES         - Envir           WOISTURE         D           D         - Dry           M         - Moist           W         - Wet           PL         - Plast           LL         - Liquid           w         - Moist	disturbe Irbed sa ronment wall tube t t tic limit ture con	d sample mple al sample e 'undistu tent	soll_CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard <b>RELATIVE DENSITY</b> VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
STANTE(	Refer to e Ibbreviati	explanator ons and b	/ notes for asis of d	or details of escriptions		Ś	STAN	<u> </u> TE	EC AUSTRALIA PTY L	_TD			I

(	5	) St	ant	cec							TEST PIT LOG SHEET							
Client: Walker Gillieston Heights Pty Ltd Project: Geotechnical Investigation														Η	ole	No: TP013		
Ĺ	Location: 457-527 Cessnock Road, Gillieston Heights										Job No: 304100964		Sheet: 1 of 1					
P	osi Iacl	tion: hine	: Refe	erto er5to	Site Plan	vator					Angle from Horizontal: 90° Surface Elevation: Excavation Method: 600mm Toothed Bucket							
E	хса	avati	on D	imen	sions:								(	Contra	ctor: S	tantec Pty Ltd		
D	ate	Exc	avat	ed: 1	2/10/22			1			Logged By: JH	(	Check	ed By:	KS			
Excavation Sampling & Testing											Materia	l Description	1					
Mothod	INIELIDO	Resistance	Stability	Water	Sample or Field Test	e or est Blows/ 3 6 9 12	Depth (m	Graphic Log	Classification		SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure		Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations			
							_				FILL: Silty CLAY, low to medium plas brown, with fine to coarse angular to gravel, trace rootlets, trace metal fra-	sticity, dark 9 sub-angular gments	M (≈PL)		FILL			
2000 BUILDER PORT			Stable	Not Encountered			- 0.5			0.25m	<u>5m</u> Silty CLAY, medium to high plasticity, orange brown mottled grey, trace fine sub-rounded to angular gravel, trace rootlets			St	RESIDUAL SOIL			
		F								0.95m					EXTREM			
						14 /25mm HB	- 1.0			1.10m	pale grey, fine to medium grained sa	and	M ( <pl)< td=""><td>н</td><td>EXTREM</td><td>-</td></pl)<>	н	EXTREM	-		
	,	Н								1.20m	SANDSTONE, fine to medium graine mottled red orange, fine to medium, sub-rounded gravel clasts			WEATHERED ROCK				
202 0004											TERMINATED AT 1.20 m Refusal on Weathered Rock							
							-									-		
							-15									_		
							-									-		
							-									-		
	METHOD PENETRATION FIEL EX Excavator bucket										ESTS Standard Penetration Test	SOIL CONSISTENCY						
	EX R HA PT SON AD AD AD AD HFA WB RR	EX Rip Ha Pu So Air Pe Sh V So T So V So Wa Ro	cavato oper and aug sh tube nic drill hamm rcussic ort spir lid fligh lid fligh llow flig ashborr ck rolle	or pucket UE Very Easy (No E Easy Pe H Hard Illing WH Very Hard (Re mer ion sampler iral auger th auger: TC-Bit ight auger re drilling ler			o Resista efusal) evel on flow utflow	tesistance) SPI HP DCP sal) PSP MC PBT el on Date IMP PID W VS SW			- Gaindard Penetrometer - Hand/Pocket Penetrometer - Dynamic Cone Penetrometer - Perth Sand Penetrometer - Plate Bearing Test - Phate Bang Test - Phate Bang Test - Photoionisation Detector - Vane Shear; P=Peak, R=Resdual (uncorrected kPa) - Standard Penetrometer - But Bearing Test - Dot Dist - Drot - Dr			u sample mple al sample e 'undistu tent	; irbed'	vs         - Very Soft           S         - Soft           F         - Firm           St         - Stiff           VSt         - Very Stiff           H         - Hard <b>RELATIVE DENSITY</b> VL         - Very Loose           L         - Loose           MD         - Medium Dense           D         - Dense           VD         - Very Dense		
	Refer to explanatory notes for details of abbreviations and basis of descriptions STANTEC AUSTRALIA PTY LTD												I					

Q	S	tan	tec										TE	ST PIT I	LOG SHEET	
Clie	Client: Walker Gillieston Heights Pty Ltd Project: Geotechnical Investigation Location: 457-527 Cessnock Road, Gillieston Heigh												H	ole No	o: TP014	
Loc									Heights Job No: 304100964					Sheet: 1 of 1		
Pos	sition chine	: Ref	er to e [.] 5 f	Site Plan	tor					Angle from Horizontal: 90° Surfac					:	
Exc	cavat	ion D	imer	nsions:	•••							(	Contra	ctor: Stant	ec Pty Ltd	
Date Excavated: 12/10/22										Logged By: JH	ed By: KS					
E	Excavation Sampling & Testing									Materia	1					
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m	Graphic Log	Classification	s	OIL TYPE, plasticity or particle cha colour, secondary and minor com ROCK TYPE, grain size and type fabric & texture, strength, weath defects and structure	racteristic, ponents , colour, ering,	Moisture Condition	Consistency Relative Density	S & Oth	TRUCTURE ner Observations	
				ES 0.05 - 0.10 n		-				FILL: Clayey Sandy SILT, low plasti brown, fine to medium grained sand organics, trace fine to medium, sub- angular gravel	city, dark I, trace rounded to	M ( <pl)< td=""><td></td><td>FILL</td><td></td></pl)<>		FILL		
				ES 0.25 - 0.35 n		-			0.25m	FILL: Clayey GRAVEL, fine to coars sub-rounded to sub-angular, yellow	se, brown	M - W				
	E		Not Encountered						0.40m	Om				RESIDUAL SC	DIL	
				ES 0.45 - 0.60 n		- 0.5				grey, trace fine sub-rounded to angutate rootlets	ar gravel,				-	
ous ucket				B 0.60 - 0.70 m									St to VSt			
m toothed b		Stable				-					M ( <b>≈</b> P					
600r				ES 0.90 - 1.00 n		F										
naiger	F			B 1.00 - 1.20 m	1.			1.00m						-		
80.00.00.0				ES 1 10 - 1 20 m	/100mm HE					pale gray and orange, trace fine grained sand, trace rootlets						
1 04:21 2023						_						M ( <pl)< td=""><td>н</td><td></td><td></td></pl)<>	н			
Igrieve 14/00	F-H				ES 1.40 - 1.50 m	-				40m						
				ES 1.40 - 1.50 n		F			1.40m	Silty CLAY, low to medium plasticity mottled orange	, pale grey	M ( <pl)< td=""><td>н</td><td>EXTREMELY</td><td>WEATHERED</td></pl)<>	н	EXTREMELY	WEATHERED	
	-	-						1	1.50m	TERMINATED AT 1.50 m			<u> </u>			
						-				Target depth						
						-										
										D TESTS SAMPI FS				 	OIL CONSISTENCY	
	EX     Excavator bucket     VE     Very Easy (No Resistance)       R     Ripper     E     Easy       HA     Hand auger     F     Firm       PT     Push tube     H     Hard       SON     Sonic drilling     VH     Very Hard (Refusal)       AH     Air hammer     VH     Very Hard (Refusal)       PS     Percussion sampler     AD/T     Solid flight auger: V-Bit       AD/T     Solid flight auger: TO-Bit     Shown       HFA     Hollow flight auger     water inflow								PT - Standard Penetration Test     B - Bulk disturt       P - Hand/Pocket Penetrometer     D - Disturbed s       CP - Dynamic Cone Penetrometer     U - Thin walit       CP - Perth Sand Penetrometer     U - Thin walit       C - Moisture Content     MOISTURE       BT - Plate Bearing Test     D - Dry       ID - Photoinsiation Detector     W - Wet       S - Vane Shear, P=Peak,     PL - Plastic limit			k disturbe turbed sa vironment n wall tub st ist stc limit uid limit	ed sample mple al sample e 'undistu	rbed'	S - Very Soft - Soft - Firm t - Stiff St - Very Stiff - Hard ELATIVE DENSITY L - Very Loose - Loose D - Medium Dense	
RR     Rock roller       Refer to explanatory notes for details of											D - Very Dense					
o ao	or oviduO						1	• • •	/							
(	$\mathbb{S}$	) St	ant	ec									TE	ST PIT	LO	G SHEET
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------	------------------------	----------------------	----------------	------------------------------	----------------------------------------------------------	-----------	----------------------------------------------	---------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------	-------------------------------------------------------------------------------------------------	---------------------------------------------	-------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------
[	Clie	nt:	Ņ	Valk	er Gillieston H	leights Pty	Ltd						Н	ole N	lo:	<b>TP015</b>
ľ	Loc	ation	: 2	5eole 157-5	27 Cessnock	Road, Gillie	estor	n Heigh	ts	s Job No: 304100964					s	Sheet: 1 of 1
I	Pos	ition	Ref	er to	Site Plan					Angle from Horizontal: 9	90°	5	Surface	e Elevatio	on:	
H	Mac	hine	Type	e: 5 to	onne Excavat	or				Excavation Method: 600	mm Tooth	ned Bu	cket	otor: Sta	ntoo D	tu i ta
H	Date	avau e Exc	avat	ed: 1	2/10/22					Logged By: JH			Checke	ed Bv: K	S	
F	Ex	cavati	on		Sampling 8	Testing				Material D	Description				-	
	Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	lassification	SOIL TYPE, plasticity or particle charact colour, secondary and minor compon ROCK TYPE, grain size and type, col fabric & texture, strength, weatherin defects and structure	teristic, nents lour, ng,	Moisture Condition	Consistency Relative Density	& 0	STRUC Other Ob:	TURE servations
		ш				3 6 9 12                               			ō	FILL: Sandy SILT, low plasticity, dark br medium to coarse, angular to sub-angu trace rootiets	rown, with Ilar gravel,	M ( <pl)< th=""><th></th><th>FILL</th><th>501</th><th>-</th></pl)<>		FILL	501	-
							-0.5			Sity CLAY, medium to high plasticity, in red and grey, with fine to medium grain trace rootlets	ed sand,	M (>PL)	St			-
	cket			sred		   ₁₀   -							VSt			-
	nd be		Ð	counte						0.75m Silty Sandy CLAY, medium plasticity, m	ottled pale			EXTREMEL	Y WEAT	HERED
1010	toothe		Stabl	lot Enc		17				grey and orange						-
	600mm		F				- 1.0									-
00000000000000000000000000000000000000		F										M ( <pl)< td=""><td>Н</td><td></td><td></td><td>-</td></pl)<>	Н			-
		F-H					- 1.5			As above, With medium to coarse angu sandstone fragments	ılar					_
	<u> </u>				<u> </u>			<u>                                     </u>		TERMINATED AT 1.60 m						
																-
2001 too																-
METHOD       PENETRATION       FIELD TESTS       SAMPLES         EX       Excavator bucket       VE       Very Easy (No Resistance)       SPT       SPT       Standard Penetration Test       B       B       B       D       Disture         HA       Hand auger       F       Firm       H       Hard       DCP       Dynamic Cone Penetrometer       D       D       Disture         PS       Percussion sampler       AS       Short spiral auger:       V-Bit       WATER       Water Level on Date       BMP       Photoionisation Detector       D       D       D       D       Thin w         WB       Washbore drilling       water outflow       water outflow       Water cutoflow       VS       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)       W       Weister Cutoflow												t disturbed urbed sar ironmenta wall tube st tic limit id limit sture cont	d sample nple al sample e 'undistu	I Prbed'	SOIL CC           VS         -           S         -           F         -           St         -           VSt         -           H         -           RELATI         -           VL         -           L         -           D         -           VD         -	NSISTENCY Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Loose Medium Dense Dense Very Dense
	Refe	er to exp reviation	lanatory s and ba	notes fo	or details of escriptions		ę	STAN	IT	TEC AUSTRALIA PTY L	TD			I		

Q	St	ant	ec										TE	ST PIT LOG SHEET
Clie	ent: oject:	1	Valk Geote	er Gillieston He echnical Investi	ights Pty gation	Ltd							Н	ole No: TP016
Loc	ation	1: 4	157-5 or to	27 Cessnock R	oad, Gilli	estor	n Heigh	Its		Job No: 304100964	۹۵°		Surface	Sheet: 1 of 1
Ma	chine	Туре	e:5 t	onne Excavator	•					Excavation Method: 60	00mm Toot	hed Bu	icket	
Exc	cavati	ion D	imen	sions:								(	Contra	ctor: Stantec Pty Ltd
Dat	e Exc	cavat	ed: 1	2/10/22			1			Logged By: JH		(	Checke	ed By: KS
E	xcavat	ion		Sampling & T	esting					Materia	I Description			
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	5	SOL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, oonents colour, ering,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
										FILL: Clayey Gravelly SILT, low plast brown, fine to coarse angular to sub gravel	ticity, dark angular			FILL 0.00 m: Ponded water on surface
				ES 0 20 0 40 m		-			0.25m	FILL: Clayey Silty GRAVEL, fine to m sub-rounded to angular, pale grey, tr	nedium race organics	M ( <pl)< td=""><td></td><td>-</td></pl)<>		-
				L3 0.30 - 0.40 m								w		
						-			0.45m					0.40 m: Water Seepage
	E					- 0.5				Silty CLAY, medium plasticity, mottle red and orange, with fine to coarse s to angular gravel, with fine grained s: rootlets, trace sub-rounded cobbles	d grey, dark sub-rounded and, trace	M (>PL)	St to VSt	RESIDUAL SOIL -
d bucket			ountered		9 	-			0.80m					-
- 600mm toothe		Stable	Not Enco			-				Sity CLAY, medium to high plasticity red and grey, with fine to medium gra trace rootlets	, mottled dark ained sand,			
		-				- 1.0						M ( <pl)< td=""><td>н</td><td>-</td></pl)<>	н	-
D						-			1.40m	Silty Sandy CLAY/ Sandy Clayey SIL	.T, low			-
	F					- 1.5				plasticity, red brown mottled grey, fin grained sand	e to medium	M ( <pl)< td=""><td></td><td>-</td></pl)<>		-
						_			1.70m					
						-				TERMINATED AT 1.70 m Target depth				-
MI ED R H/ PT SC AF SC AF SC AF SC AF SC AF	ETHOD ( Ex Rij A Ha Pu DN Sc H Ain S Pe S Sh D/V Sc D/V Sc D/T Sc FA Ho B Wi R Rc fort	ccavato pper and augush tubo pnic dril r hamm ercussic ort spin blid fligh blid fligh blid fligh blow flig ashbor pock rolle	r bucke er er on sam al auge t auge t auge ght auge e drillin er	t VE E F H H Pler WAT er : V-Bit : : TC-Bit g	L L L L L L L L L L L L L L L L L L L	efusal) evel on low tflow	nce) Date	F S F N F	I           FIELD TI           SPT           -1P           -2P           PSP           MC           PBT           PBT           MP           PID           /S	ESTS Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         -         Bulk           D         -         Dist           ES         -         Env           U         -         Thir           MOISTURE         -         Drog           D         -         Dry           M         -         Mois           W         -         Pias           LL         -         Liqu           W         -         Mois	I st disturbe st t st c limit sture con	l mple al sample e 'undistu tent	SOIL CONSISTENCY         VS       Very Soft         S       Soft         F       Firm         St       Stiff         VSt       Very Stiff         H       Hard         RELATIVE DENSITY         VL       Very Loose         L       Loose         MD       Medium Dense         D       Dense         VD       Very Dense
Re ab	rer to exp breviatior	planatory ns and ba	notes for a sis of d	or details of escriptions		S	STAN	1LI	EC /	AUSTRALIA PTY	LTD			

(	5	) St	ant	tec										TE	ST PI	T LO	G SHE	ΕT
	Clie Proi	nt: ect:	N	Nalke Geote	er Gillieston	Heights Pty	Ltd							Н	ole I	No:	TP0'	17
Ĺ	.00	ation	: 4	157-5	27 Cessnock	Road, Gilli	estor	n Heigh	nts		Job No: 304100964					5	Sheet: 1 d	of 1
P	osi	ition	Ref	er to	Site Plan	4					Angle from Horizontal:	90°	<u> </u>	Surface	e Elevat	ion:		
	nac Ixca	nine avati	iype on D	e: 5 to imen	sions:	tor					Excavation Method: 60	Jumm Toot	nea BL (	icket Contra	ctor: St	antec P	Ptv Ltd	
	Date	Exc	avat	ed: 1	2/10/22						Logged By: JH		(	Checke	ed By: I	<b>(</b> S	.,	
	Ex	cavati	on		Sampling	& Testing					Materia	I Description						
	Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification		SOIL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, ponents colour, ering,	Moisture Condition	Consistency Relative Density	٤	STRUC & Other Ob	CTURE servations	
											FILL: Clayey SILT, low plasticity, darl organics	k brown, trace			FILL			
		E					-				As above, With fine to coarse angula sub-angular gravel, grey to brown	ar to	M ( <pl)< td=""><td></td><td></td><td></td><td></td><td>-</td></pl)<>					-
							_			0.35m	Silty CLAY, high plasticity, brown mo pale brown, trace fine grained sand, organics	ttled grey and trace		St	RESIDUA	IL SOIL		
							- 0.5								-			_
	toothed bucke	F	Stable	Not Encountered		9	-				As above, Pale red mottled pale grey orange, no organics	y and brown	M (>PL)	VSt	-			_
	— 600mm			-		15	_											-
						18	- 1.0							н				_
						/100mm VR           	-			1.10m	Silty CLAY, low to medium plasticity, grey and orange brown, with medium	mottled pale n to coarse			EXTREM	ELY WEAT	HERED	
		F-H					-				angular to sub-angular fragments							-
							-						M ( <pl)< td=""><td>н</td><td></td><td></td><td></td><td>-</td></pl)<>	н				-
	<b>V</b>						-1.5-			1.50m	TERMINATED AT 1.50 m Target depth							
							-				-							-
							_											-
							-											-
	ME	THOP			<b>_</b>						FSTS					SOIL C	ONSISTENCY	,
	METHOD     PENETRATION       EX     Excavator bucket     VE     Very Easy (No Resistance)       R     Ripper     E     Easy       HA     Hand auger     F     Firm       PT     Push tube     H     Hard       SON     Sonic drilling     H     Hard       AH     Air hammer     H     Hard       PS     Percussion sampler     AD/T     Solid flight auger: V-Bit       AD/T     Solid flight auger     TC-Bit       HFA     Hollow flight auger     Water Level on Date       water outflow     water outflow									SPT - HP - DCP - PSP - MC - PBT - MP - PID - VS -	Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak,	B - Buil D - Dist ES - Env U - Thir MOISTURE D - Dry M - Moi W - We PL - Plas LL - Liqu	k disturbe turbed sar vironmenta n wall tube , ist t stic limit uid limit	d sample mple al sample e 'undistu	e irbed'	VS - S - F - St - VSt - H - <b>RELAT</b> VL - L - D	Very Soft Soft Firm Stiff Very Stiff Hard VED DENSITY Very Loose Loose Medium Den Dense	se
	RR	Ro er to exp reviation	ck rolle	notes fo	escriptions		(	STAN	   	EC	AUSTRALIA PTY	LTD	isture con	tent		VD -	Very Dense	

Q	S	tant	tec								TE	ST PII	LOG SHEE	ΞT
Cli	ent:	\ (	Valk Geote	er Gillieston He	ights Pty Lto						Н	ole N	lo: TP01	8
Lo	catio	n: 4	57-5	27 Cessnock R	oad, Gilliesto	on Heigl	nts	Job No: 304100964					Sheet: 1 of	[;] 1
Po	sition	1: Ref	erto Stor	Site Plan				Angle from Horizontal: 9 Excavation Method: 600	90° mm Tooth	ed Bu	Surface	e Elevatio	on:	
Ex	cavat	ion D	imen	sions:				Excavation method. 000		<u>cu Du</u> (	Contra	ctor: Sta	antec Pty Ltd	
Da	te Ex	cavat	ed: 1	2/10/22				Logged By: JH		C	Checke	ed By: K	S	
E	Excava	tion		Sampling & T	esting			Material D	escription			1		
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Graphic Log	Classification	SOIL TYPE, plasticity or particle charact colour, secondary and minor compon ROCK TYPE, grain size and type, col fabric & texture, strength, weatherin defects and structure	teristic, ents lour, ng,	Moisture Condition	Consistency Relative Density	&	STRUCTURE Other Observations	
								FILL: Silty CLAY, low plasticity, dark bro fine to coarse angular to sub-angular gr. cobbles	own, with avel, trace	M ( <pl)< td=""><td></td><td>FILL</td><td></td><td></td></pl)<>		FILL		
	E	_		ES 0.30 - 0.60 m				Sitty CLAY, high plasticity, brown mottle pale brown, trace fine grained sand, trac organics As above, Pale brown mottled orange	d grey and ce	M (>PL)	St	RESIDUAL	SOIL	-
00mm toothed bucket	F	Stable	Not Encountered					0.85m			VSt			-
9				ES 0.90 - 1.00 m				Silty Gravelly CLAY, low plasticity, pale mottled grey, fine to medium angular to sub-angular gravel	brown			EXIREMEN	LY WEATHERED	-
					/50mm HB				1	M ( <pl)< td=""><td>н</td><td></td><td></td><td>-</td></pl)<>	н			-
				ES 1.20 - 1.30 m				1.20m SILTSTONE, grey to dark blue, very low highly weathered	v strength,			WEATHER	ED ROCK	
5	F-H													-
					-                     ++++++=1.5			1.50m						
								TERMINATED AT 1.50 m Target depth						-
														-
														-
	IETHOL X E A H T P ON S H A S P O/V S D/V S D/V S D/V S D/V S D/V S R R R R efer to ex	C xcavato ipper and aug ush tube onic drill ir hamm ercussic hort spir olid fligh olid fligh olid fligh olid fligh olid fligh olid fligh olid fligh olid fligh olid fligh ock rolle	r bucke er ing er on sam al auge t auge t auge drillin er	et VE E F H VH VH VH VH VH VH VH VH VH VH VH VH V	ETRATION Very Easy (No Resit Easy Firm Hard Very Hard (Refusal) ER Water Level c shown water inflow water outflow	n Date		IELD TESTS         PT - Standard Penetration Test         IP - Hand/Pocket Penetrometer         ICP - Dynamic Cone Penetrometer         SP - Perth Sand Penetrometer         CO - Moisture Content         BT - Plate Bearing Test         IP - Borehole Impression Test         ID - Photoionisation Detector         S - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES B - Bulk ( D - Distu ES - Envir U - Thin MOISTURE D - Dry M - Moist W - Wet PL - Plasti LL - Liqui w - Moist	disturbed rbed sar ronmenta wall tube t t t tube ture cont	d sample nple al sample • 'undistu	rbed'	SOIL CONSISTENCY           VS         - Very Soft           S         - Soft           F         - Firm           St         - Stiff           VSt         - Very Stiff           H         - Hard           RELATIVE DENSITY           VL         - Very Loose           L         - Loose           MD         - Medium Dense           VD         - Very Dense	Ð

(	5	) St	ant	cec										TE	ST PI	T LOG	SHEET
	Clie	nt: iect:	١	Valke Geote	er Gilliesto echnical In	n Heights Pty vestigation	' Ltd							Н	ole l	No: '	<b>TP019</b>
Ĺ	.00	ation	: 2	57-5	27 Cessno	ck Road, Gilli	iestor	n Heigh	nts		Job No: 304100964					Sh	eet: 1 of 1
F	Pos	ition	Ref	er to	Site Plan						Angle from Horizont	al: 90°	; 	Surface	e Elevat	tion:	
E	viac Exc	nine avati	iype on D	imen	sions:	vator					Excavation Method:	600mm 100	inea Bl	icket Contra	ctor: S	tantec Ptv	/ Ltd
	Date	e Exc	avat	ed: 1	2/10/22						Logged By: JH		(	Checke	ed By:	KS	
	Ex	cavati	on		Samplin	ng & Testing					Mate	erial Description					
	Method	Resistance	Stability	Water	Sample Field Te	or est Blows/ 150 mm	Depth (m)	Graphic Log	Classification		SOIL TYPE, plasticity or particle c colour, secondary and minor cc ROCK TYPE, grain size and ty fabric & texture, strength, we defects and structure	characteristic, omponents pe, colour, athering,	Moisture Condition	Consistency Relative Density		STRUCTI & Other Obse	JRE rvations
							-			0.15m	FILL: Silty CLAY, low plasticity, d fine to coarse angular to sub-ang cobbles	ark brown, with jular gravel, trace	M ( <pl)< td=""><td></td><td>FILL</td><td></td><td>-</td></pl)<>		FILL		-
		E					_			0.30m	Silty Clayey SAND, fine to mediu grey mottled brown, trace organio	m grained, pale cs	м	L	COLLUV	IUM	-
							- - 0.5			0.3011	Silty CLAY, high plasticity, brown pale brown, trace fine grained sa organics	mottled grey and nd, trace			RESIDUA	AL SOIL	
600 B	ed bucket		0	ountered			-							St			-
	00mm toothe	F	Stable	Not End			-						M (>PL)				-
	90						-										-
0.00.00							- 1.0										_
		F-H				/100mm VR								VSt			-
						15	_			1.30m							
		н					-				Silty Sandy CLAY, medium plasti grey orange and brown, fine to m sand	icity, mottled pale nedium grained	M ( <pl)< td=""><td>н</td><td>EXTREM</td><td>IELY WEATHI</td><td>ERED -</td></pl)<>	н	EXTREM	IELY WEATHI	ERED -
5550	¥						-1.5-			1.50m	TERMINATED AT 1.50 m Target depth						
							-										-
							-										-
							-										-
					 						1010	0.000				0011 05	
	ME EX R HA PTO APS AD AD HE W	FIHOD Ex Rip Pu N So Air Pe Sh /V So /T So A Ho 3 Wa	cavato oper nd aug sh tube nic drill hamm rcussic ort spir lid fligh llow flig ashborr	r bucke er er on sam al auge t auge t auge ght aug ght aug	pler er r: V-Bit r: TC-Bit er g	PENETRATION VE Very Easy (M E Easy F Firm H Hard VH Very Hard (R WATER WATER Water Lu shown water inf water out	o Resista efusal) evel on low tflow	^{nce)} Date	F   S   H   C   F           	- <b>IELD T</b> SPT - HP - DCP - PSP - MC - PBT - MP - PID - /S -	IESTS Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         - Bu           D         - Dis           ES         - En           U         - Th           MOISTURE           D         - Dr           M         - MO           W         - We           PL         - Pla           LL         - Lig           w         - Mo	Ik disturbe sturbed sa vironment in wall tubo sist vist stic limit uid limit sisture con	d sample mple al sample e 'undistu tent	rbed'	SOIL CON           VS         - N           S         - S           F         - F           St         - S           VSt         - N           H         - F           RELATIVI         VL           VL         - N           MD         - M           D         - N	ISISTENCY Very Soft Soft Very Stiff Very Stiff Very Loose .oose Very Loose .oose Very Loose .oose Very Loose .oose
	Refe abb	er to exp reviation	CK FOIL	notes fo	or details of escriptions			STAN	 	EC	AUSTRALIA PT	Y LTD				νυ - \	rei y Dense

C	S	tan	tec										TE	ST PI	T LO	G SHEET
Cli	ent:		Nalk	er Gillieston He	eights Pty	Ltd							Н	ole N	lo:	<b>TP020</b>
Lo	cation	ו: י	157-5	27 Cessnock F	Road, Gillie	stor	n Heigh	ts		Job No: 304100964					5	Sheet: 1 of 1
Po	sition	: Ref	er to	Site Plan						Angle from Horizontal:	90°		Surface	e Elevati	ion:	
Fx	cavat	ion D	e: 5 ti imen	onne Excavato	r					Excavation Method: 60	Jumm Toot	nea BL	Contra	ctor: St	antec P	Ptv I td
Da	te Ex	cavat	ed: 1	2/10/22						Logged By: JH			Checke	ed By: K	(S	
E	xcava	tion		Sampling &	Testing					Materia	I Description					
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification		SOIL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, onents colour, ering,	Moisture Condition	Consistency Relative Density	8	STRUC Other Ob	CTURE servations
					3 6 9 12                                     			0	0.30m	FILL: Clayey SILT, low plasticity, darl organics	k brown, trace	M ( <pl)< td=""><td></td><td>FILL</td><td></td><td>-</td></pl)<>		FILL		-
									0.45m	FILL: Silty CLAY, medium to high pla mottled orange and grey, trace rootle	isticity, brown ets	M (>PL)				-
hed bucket		ole	ncountered	ES 0.50 - 0.60 m		-0.5				Silty CLAY, medium to high plasticity brown mottled pale grey, with fine to angular to sub-angular gravel	, orange medium		St	RESIDUA	L SOIL	-
600mm tooth	E	Stab	Not E			- 1.0				As above, Pale grey mottled orange	and brown	M (>PL)	VSt			-
									1.40m	Silty CLAY, low plasticity, pale grey/ orange	white, mottled	M ( <pl)< td=""><td>VSt</td><td>EXTREME</td><td>ELYWEAT</td><td>- HERED</td></pl)<>	VSt	EXTREME	ELYWEAT	- HERED
						-1.5—			1.0011	TERMINATED AT 1.50 m Target depth						
					13											-
					13											-
5					13											-
					14	- 2.0										-
					15											-
					15 /100mm ÝR											-
METHOD       PENETRATION         K       Excavator bucket         R       Ripper         HA       Hand auger         PT       Push tube         SON       Sonic drilling         AH       Air hammer         PS       Percussion sampler         AD/V       Solid flight auger.         AD/V       Solid flight auger.         HFA       Hollow flight auger.         HFA       Hollow flight auger.         WHEA       Water inflow												disturbe urbed sar ironmenta wall tube st stc limit id limit	d sample mple al sample e 'undistu	rbed'	SOIL C           VS         -           S         -           F         -           St         -           VSt         -           H         -           RELATI         VL           VL         -           L         -           MD         -           D         -	ONSISTENCY Very Soft Soft Firm Stiff Very Stiff Hard VE DENSITY Very Loose Loose Medium Dense Dense
R	efer to ex	planatory	notes fo	or details of escriptions		5	STAN	  T	EC	AUSTRALIA PTY		Sture CON	lent		VD -	Very Dense

Stantec TEST PIT LOG													<b>G SHEET</b>			
C	lie	nt: ect:	N	Valke Geote	er Gilliestor	n Heights Pty restigation	Ltd						Н	ole N	lo:	<b>TP021</b>
Ŀ	00	ation	: 4	57-5	27 Cessnoo	k Road, Gilli	estor	n Heigh	ts	Job No: 304100964					S	heet: 1 of 1
P	osi	ition:	Ref	er to	Site Plan					Angle from Horizontal:	90°		Surface	e Elevati	on:	
		nine avati	iype on D	e: 5 to imen	onne Excav	ator				Excavation Method: 600		iea Bu	Contra	ctor St	antec Pi	tv I td
	ate	e Exc	avat	ed: 1	2/10/22					Logged By: JH			Checke	ed By: K	(S	.,
	Ex	cavati	ion		Sampling	g & Testing				Material	Description					
+ M	Method	Resistance	Stability	Water	Sample c Field Tes	DCP TEST (AS 1289.6. 3.2-1997) st Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle charac colour, secondary and minor compo ROCK TYPE, grain size and type, c fabric & texture, strength, weather defects and structure	octeristic, onents olour, ring,	Moisture Condition	Consistency Relative Density	&	STRUC Other Obs	TURE servations
-										FILL: Silty CLAY/ Clayey SILT, low pla brown, trace organics	asticity, dark			FILL		
							-					M ( <pl)< td=""><td></td><td></td><td></td><td>-</td></pl)<>				-
							-			0.25m Silty CLAY, high plasticity, brown mottl pale brown, trace fine grained sand, tr organics	tled grey and race			RESIDUAI	LSOIL	
							-									-
							- 0.5						qt			_
	ucket			Itered			-			As above, Mottled grey and pale red, r	no organics		51			-
	m toothed r		Stable	Not Encour			-					M (>PL)				-
	600m						-									-
2		F				    7 	- 1.0									-
0000						15	-						VSt to H			-
040400						VR       	-			1.20m Silty CLAY, low to medium plasticity, re pale grey	ed mottled			EXTREME	LY WEATH	HERED
		F-H					-					M ( <pl)< td=""><td>н</td><td></td><td></td><td>-</td></pl)<>	н			-
2	V						- 1.5			1.50m						
							_			TERMINATED AT 1.50 m Target depth						-
OILLIEO							_									-
							-									-
100 H 100							_									-
	ME	THOD				PENETRATION		1	F	FIELD TESTS	SAMPLES				SOIL CO	DNSISTENCY
	EX R HA PT SOI AH	Ex Rip Ha Pu N So Air	cavato oper ind aug sh tube nic dril	r bucke er e ing er	ət	VE Very Easy (No E Easy F Firm H Hard VH Very Hard (Re	o Resista efusal)	nce)	S   F   F	SP1     -     Standard Penetration Test       HP     -     Hand/Pocket Penetrometer       DCP     -     Dynamic Cone Penetrometer       PSP     -     Perth Sand Penetrometer       MC     -     Moisture Content	B - Bulk D - Distu ES - Envin U - Thin <b>MOISTURE</b>	disturbe urbed sar ronmenta wall tube	d sample mple al sample e 'undistu	rbed'	VS - S - F - St - VSt - H -	Very Soft Soft Firm Stiff Very Stiff Hard
02:0	PS AS AD/ AD/ HF/ WB	Pe Sh V So T So A Ho	rcussic ort spir lid fligh lid fligh llow flig ashbor	n sam al auge t auge t auge t auge ght aug drillin	pler er r: V-Bit r: TC-Bit ler g	WATER Water Le shown water inf water ou	evel on low tflow	Date	F   II   F   V	PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photoionisation Detector VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	D - Dry M - Mois W - Wet PL - Plast LL - Liqui	tic limit id limit	tent		<b>RELATIV</b> VL - L - MD - D -	VE DENSITY Very Loose Loose Medium Dense Dense
	RR Refe	Ro er to exp reviation	lanatory	notes fo	or details of escriptions			STAN	   	EC AUSTRALIA PTY L		aare con			VD -	Very Dense

C		St	ant	ec								TE	ST PIT	LOG SHEET	Г
CI	ient	t: ct:	V	Valk	er Gillieston He	eights Pty I	Ltd					Н	ole N	o: TP022	)
Lo	ocat	ion:	: 4	57-5	27 Cessnock F	Road, Gillie	stor	h Heigh	ts	Job No: 304100964				Sheet: 1 of	1
Po	ositi	ion:	Refe	er to	Site Plan					Angle from Horizontal: 90°	(	Surface	e Elevatio	n:	
E	achi (cav	ine /atio	i ype on Di	: 5 te men	onne Excavato sions:	br				Excavation Method: 600mm 100	inea Bl	icket Contra	ctor: Star	ntec Ptv Ltd	_
Da	ate E	Exc	avate	ed: 1	2/10/22					Logged By: JH	(	Checke	ed By: KS	3	_
	Exca	avatio	on		Sampling & ⁻	Testing				Material Description					
Method		Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	& C	STRUCTURE Other Observations	
					ES 0.30 - 0.50 m	3 6 9 12                               				FILL: Clayey SILT, low plasticity, dark brown, trace organics, trace fine to medium, angular to sub-rounded gravel 0.30m FILL: Sandy SILT, low plasticity, pale grey, mottled pale brown, trace organics	M ( <pl)< th=""><th></th><th>FILL</th><th></th><th></th></pl)<>		FILL		
							0.5			0.50m Silty CLAY, high plasticity, grey mottled brown to light brown, trace organics, trace medium to coarse rounded gravel			COLLUVIUN	1	
cket				ered	ES 0.60 - 0.80 m										-
im toothed bu			Stable	Not Encount							M (>PL)	VSt			-
							1.0								_
		F			ES 1.20 - 1.40 m	VR                         				1.05m Silty CLAY, high plasticity, mottled grey and dark red, trace fine grained sand	M (>PL)	н	RESIDUAL S	SOIL	
							1.5								_
										1.60m TERMINATED AT 1.60 m Target depth					
															-
															-
	METH EX R HA PT SON AH PS AS AD/V AD/T HFA WB RR	HOD Exc Rip Har Pus Sor Air Per Sho Soli Soli Hol Wa Roo	avator per nd aug sh tube nic drill hamm cussic ort spir id fligh low flig shbore ck rolle	er er er n sam al auge t auge t auge ht auge ht auge o drillin r	et VE E F H VH VH VH VH T V-Bit r: V-Bit er g	Very Easy (No F Easy Firm Hard Very Hard (Refu Very Hard (Refu TER Water Lev shown water inflo	Resistan Isal) Iel on W OW	nce) Date	F S F F M F III F V	IELD TESTS       SAMPLES         PT - Standard Penetration Test       B - Bu         IP - Hand/Pocket Penetrometer       D - Dis         CP - Dynamic Cone Penetrometer       ES - En         SP - Perth Sand Penetrometer       U - Th         IC - Moisture Content       MOISTURE         BT - Plate Bearing Test       D - Dr         MP - Borehole Impression Test       M - Moc         ID - Photoionisation Detector       W - Wc         'S - Vane Shear; P=Peak,       R=Resdual (uncorrected kPa)	Ik disturbed sturbed sa vironment n wall tube : ist ist stic limit uid limit isture con	d sample mple al sample e 'undistu tent	rbed'	SOIL CONSISTENCY       VS     - Very Soft       S     - Soft       F     - Firm       St     - Stiff       H     - Hard       RELATIVE DENSITY       VL     - Very Loose       L     - Loose       MD     - Medium Dense       D     - Dense       VD     Very Dense	
F	Refer to abbrevi	o explai	anatory and ba	notes fo sis of d	or details of escriptions		S	STAN	1T	EC AUSTRALIA PTY LTD					

C	S	tan	tec								Т	EST PI	T LOG SHEET
CI	ient:		Walk	er Gillieston	Heights Pty	Ltd					F	lole l	No: TP023
Lo	catio	n: 4	457-5	27 Cessnoc	k Road, Gilli	estor	n Heigh	nts	Job No: 304100964				Sheet: 1 of 1
Po	sitio	1: Ref	er to	Site Plan	otor				Angle from Horizontal: 90	0° nan Taathad	Surfa	ce Elevat	ion:
E	cava	tion D	imen	isions:	alor					nin rootned	Conti	actor: S	tantec Pty Ltd
Da	ate Ex	cavat	ed: 1	2/10/22					Logged By: JH		Chec	ked By: I	KS
	Excava	ition		Sampling	& Testing	_			Material De	escription			
Method	Resistance	Stability	Water	Sample o Field Tes	r t Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characte colour, secondary and minor compone ROCK TYPE, grain size and type, colo fabric & texture, strength, weathering defects and structure	eristic, ents pur, iso g, Ø	Condition Consistency Relative		STRUCTURE & Other Observations
						_			FILL: Silty CLAY, low to medium plasticity brown with fine to coarse angular to sub- gravel, trace organics	y, dark rounded M (*	PL)	FILL	-
						-			0.15m CLAY, high plasticity, brown mottled grey brown, trace fine grained sand, trace orga	/ and pale anics		RESIDUA	NL SOIL -
						-					St		-
				B 0.55 - 0.90 m		-0.5			As above, Grey mottled dark red				-
bucket			untered			-				M (?	PL)		-
mm toothed	F	Stable	Not Enco		13	-						_	-
900					14	-							-
					/7 <mark>/5m/m/</mark> VR	- 1.0					н		-
						-							-
									Silty Sandy CLAY, low to medium plastici	ity, grey		EXTREM	ELY WEATHERED
	F-H					-				M (*	PL) H		-
						_1 F			1.50m				
									TERMINATED AT 1.50 m Target depth				
						-							-
						-							-
						_							-
	METHO EX E R F HA H PT F SON S AH A PS F AS S AD/V S AD/V S AD/V S AD/V S AD/V S	C xcavato tipper and augush tub conic dril ir hammercussion hort spi olid fligh olid fligh lollow fli	er bucke e ling ier on sam ral auge nt auge nt auge ght aug	pler er r: V-Bit r: TC-Bit jer	PENETRATION VE Very Easy (Ne E Easy F Firm H Hard VH Very Hard (Re WATER Water Le shown water inf	efusal) evel on	nce) Date	F S F F M F II	FIELD TESTS     S       SPT     - Standard Penetration Test     E       HP     - Hand/Pocket Penetrometer     E       OCP     Dynamic Cone Penetrometer     E       PSP     - Perth Sand Penetrometer     E       VC     - Moisture Content     M       PBT     - Plate Bearing Test     E       MP     - Borehole Impression Test     M       V/S     - Vane Shear; P=Peak,     F	SAMPLES B - Bulk dist D - Disturbe S - Environr J - Thin wal MOISTURE 0 - Dry M - Moist W - Wet PL - Plastic lin L - Liquid lin	urbed sample d sample nental samp tube 'undis nit	ble ble sturbed'	SOIL CONSISTENCY           VS         - Very Soft           S         - Soft           F         - Firm           St         - Stiff           H         - Hard           RELATIVE DENSITY           VL         - Very Loose           L         - Loose           MD         - Medium Dense
	VB V RR F Refer to e	vashbor lock rolle xplanator	e drillin er / notes fr asis of d	or details of escriptions	water ou		STAN	 	R=Resdual (uncorrected kPa)	W - Moisture	content		VD - Very Dense

Q	) St	ant	ec							TE	ST PIT LOG SHEET
Clie	ent:	V	Valk	er Gillieston He	ights Pty Ltd					H	ole No: TP024
Loc	catior	n: 4	57-5	27 Cessnock R	oad, Gilliesto	on Heigl	nts	Job No: 304100964			Sheet: 1 of 1
Pos	sition	: Refe	er to	Site Plan				Angle from Horizontal: 90°	thod Bi	Surface	e Elevation:
Exe	cavati	ion D	imen	sions:				Excavation Method. 600mm 100		Contra	ctor: Stantec Pty Ltd
Dat	te Exc	cavat	ed: 1	2/10/22				Logged By: JH	(	Checke	ed By: KS
E	xcavat	ion		Sampling & T	esting		1	Material Description	1		
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
							××××	FILL: Clayey SILT, low plasticity, dark brown, trace organics, trace fine to coarse angular to sub-angular gravel	M ( <pl)< td=""><td></td><td>FILL</td></pl)<>		FILL
	E			ES 0.20 - 0.40 m			×	0.20m Silty CLAY, medium to high plasticity, brown mottled grey and red, with fine to coarse angular to out b council or scred, trace arcranic			RESIDUAL SOIL
othed bucket		able	Encountered					to sub-rounded gravel, trace organics	M (>PL)	St	-
		Ste	Not					0.45m Sitly Gravelly CLAY, medium to high plasticity, red mottled grey, fine to coarse sub-rounded to rounded gravel, trace rootlets	M (>PL)	VSt	-
20	F				19			SILTSTONE, grey, dark blue mottled orange, very low strength		н	WEATHERED ROCK
	н	]			-						-
					13			0.85m TERMINATED AT 0.85 m			
					/50mlml VR         			Refusal on Weathered Rock			-
											-
											-
5											-
					           - 1.5						-
											-
											-
											-
				<b></b>							
	ETHOD K Ex Ri A Ha F Pu ON So H Air S Pe	cavato pper and aug ush tube onic drill r hamm ercussic	r bucke er er ing er on sam	et VE E F H VH	E I RATION Very Easy (No Resis Easy Firm Hard Very Hard (Refusal) ER	tance)		IELD I ESTS     SAMPLES       PT - Standard Penetration Test     B - Bu       P - Hand/Pocket Penetrometer     D - Dis       CP - Dynamic Cone Penetrometer     ES - En       SP - Perth Sand Penetrometer     U - Th       C - Moisture Content     MOISTURE       BT - Plate Bearing Test     D - Dis	lk disturbe sturbed sa vironment in wall tub	ed sample mple al sample e 'undistu	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard
AS AI HI W	S Sh D/V So D/T So FA Ho B W R Ro	nort spir blid fligh blid fligh bllow flig ashbore bck rolle	al auge t auge t auge ht auge ht aug drillin	er :: V-Bit :: TC-Bit er g	<ul> <li>✓ Water Level of shown</li> <li>→ water inflow</li> <li>✓ water outflow</li> </ul>	n Date	F V	ID     -     Dorehole     Impression Test       ID     -     Photoionisation Detector     W     -       ID     -     Photoionisation Detector     W     -       S     -     Vane Shear; P=Peak, R=Resdual (uncorrected kPa)     L     -     Liq W     -	y bist astic limit juid limit bisture con	itent	KELATIVE DENSITY         VL       - Very Loose         L       - Loose         MD       - Medium Dense         D       - Dense         VD       - Very Dense
Re ab	efer to exp breviation	planatory ns and ba	notes fo	or details of escriptions		STA	IT۷	EC AUSTRALIA PTY LTD			

(	S	) St	ant	ec									TE	ST PIT LO	OG SHEET
	Clie	nt:	V	Valke	er Gillieston	Heights Pty	Ltd						Н	ole No	: TP025
ľ	_00	ation	: 4	157-5	27 Cessnoc	k Road, Gilli	iestor	h Heigh	ts	Job No: 304100964					Sheet: 1 of 1
F	Pos	ition	Refe	er to	Site Plan					Angle from Horizontal:	90°	S	Surface	e Elevation:	
	Mac	hine:	Type	e: 5 te imon	onne Excava	ator				Excavation Method: 6	00mm Toothe	ed Bu	cket	ctor: Stantor	Dtv I to
	Date	avau e Exc	avat	ed: 1	2/10/22					Logged By: JH			Checke	ed Bv: KS	
	Ex	cavati	on		Sampling	& Testing				Materia	I Description				
	Method	Resistance	Stability	Water	Sample o Field Tes	DCP TEST (AS 1289.6. 3.2-1997) t Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle char colour, secondary and minor com ROCK TYPE, grain size and type, fabric & texture, strength, weath defects and structure	racteristic, bonents colour, ering,	Moisture Condition	Consistency Relative Density	STR & Other	UCTURE Observations
	A					3 6 9 12		ىلىر غلىر غلىر غلىر غلىر غ		TOPSOIL: Clayey SILT, low plasticit	y, brown			TOPSOIL	
		E					-			0.20m Silty CLAY, medium to high plasticity orange mottled grey, trace fine grain trace rootlets	/, brown ied sand,	M (>PL)		RESIDUAL SOIL	-
							- 0.5			As above. Orange mottled brown	л	VI (>PL)	St		-
and Running	toothed bucket		Stable	Not Encountered			-			0.80m			VSt		-
		F (Vi Bable 1997)					- 1.0 -			Sitty CLAY, low plasticity, brown oral grey, with lenses of pale grey	nge mottled	M ( <pl)< td=""><td>Н</td><td>EXTREMELY WE</td><td>- ATHERED</td></pl)<>	Н	EXTREMELY WE	- ATHERED
							-			1.30m Clayey SAND, fine to medium graine orange mottled grey, with fine to coa sub-angular gravel	ed, brown Irise angular to	D	VD		-
	V						-1.5-			1.50m					
							-			Target depth					-
	ME	THOD				PENETRATION			F	IELD TESTS	SAMPLES			SOIL	- CONSISTENCY
	EX R HA PT SO APS AD AD HF WE R R	Ex Rip Pu N So Air Pe Sh V So T So A Ho B Wa Ro	cavato oper nd aug sh tube nic drill hamm rcussic ort spir lid fligh lid fligh llow flig ashbore ck rolle	r bucke er on sam al auge t auger t auger drillin er	t , , , , , , , , , , , , , , , , , , ,	VE Very Easy (No Easy H Hard VH Very Hard (Re WATER Water Lt shown water inf water ou	efusal) evel on low tflow	Date		PT       Standard Penetration Test         P       Hand/Pocket Penetrometer         CP       Dynamic Cone Penetrometer         SP       Perth Sand Penetrometer         CP       Perth Sand Penetrometer         CP       Perth Sand Penetrometer         CP       Perth Sand Penetrometer         BT       Plate Bearing Test         IP       Borehole Impression Test         ID       Photoionisation Detector         S       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	B - Bulk c D - Distur ES - Envirc U - Thin v MOISTURE D - Dry M - Moist W - Wet PL - Plasti LL - Liquid w - Moist	disturbed bed sar onmenta vall tube c limit l limit ure cont	d sample nple al sample • 'undistu	rbed' VS F St VSt H <b>REL</b> MD D VD	<ul> <li>Very Soft</li> <li>Soft</li> <li>Firm</li> <li>Stiff</li> <li>Very Stiff</li> <li>Hard</li> <li>Ative DeNSITY</li> <li>Very Loose</li> <li>Loose</li> <li>Medium Dense</li> <li>Dense</li> <li>Very Dense</li> </ul>
	abb	reviation	s and ba	asis of de	escriptions		S	STAN	111	=CAUSTRALIA PTY	LID				

Q	S1	tant	ec								TE	ST PIT	LOG SHEET
Clie	ent:	Ň	Valke	er Gillieston	Heights Pty	Ltd					Н	ole N	o: <b>TP026</b>
Lo	catior	1: 4	57-5	27 Cessnoc	k Road, Gillio	estor	h Heigh	ts	Job No: 304100964				Sheet: 1 of 1
Po	sition	: Ref	er to	Site Plan	-4				Angle from Horizontal: 90°		Surface	e Elevatior	1:
Exe	cnine	e ⊺yp∉ ion D	e: 5 to imen	onne Excava sions:	ator				Excavation Method: 600mm Too	thea BL	ICKET Contra	ctor: Stan	tec Ptv Ltd
Dat	te Exc	cavat	ed: 1	2/10/22					Logged By: JH	(	Checke	ed By: KS	
E	xcavat	tion		Sampling	& Testing				Material Description	1			
Method	Resistance	Stability	Water	Sample o Field Test	DCP TEST (AS 1289.6. 3.3-1997) t Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	& Ot	STRUCTURE her Observations
						-	لك على على على على على على على على على على على على على على على على على على على على		TOPSOIL: Clayey SILT, low plasticity, dark brown trace organics	M ( <pl)< td=""><td></td><td>TOPSOIL</td><td>-</td></pl)<>		TOPSOIL	-
									Clayey GRAVEL, fine to coarse angular to sub-rounded, pale brown mottled pale grey	M - W	L	COLLUVIUM	-
	E					- 0.5			Sifty CLAY, high plasticity, brown to orange mottled pale grey, trace fine grained sand, trace rootlets			RESIDUAL S	OIL -
oucket			ntered							M (>PL)	St		-
othed		table	t Encou			•							-
0mm to		S	Ñ		- 19				0.80m Silty Sandy CLAY, low plasticity, orange brown			EXTREMELY	WEATHERED
09	F				VR       				with fine to medium, angular to sub-angular sandstone fragments				-
						- 1.0				M ( <pl)< td=""><td>н</td><td></td><td>-</td></pl)<>	н		-
									1.20m			WEATHERE	
	н								SANDS I ONE, thre to mealum grained, grey mottled dark purple, very low strength, highly weathered			WEATHERE	-
0													-
<b>.</b>						-1.5-			1.50m TERMINATED AT 1.50 m Target depth				
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	ETHOD X Ex Ri A Ha T Pu ON So H Ain S Pe S Sh D/V So D/T So FA Ho B W	ccavato pper and aug ush tube pnic drill r hamm ercussic nort spir blid fligh blid fligh blid fligh blow flig ashbor	r bucke er ing er on samp al auge t auger t auger ght auger ght auger	et V pler V er V-Bit r: V-Bit g	PENETRATION VE Very Easy (No Easy Firm H Hard VH Very Hard (Rei WATER Water Le shown water infle water out	Resistan fusal) vel on DW flow	nce) Date	F S F M F II F	IELD TESTS       SAMPLES         PT       Standard Penetration Test       B       B         P       Hand/Pocket Penetrometer       D       D       D         CP       Dynamic Cone Penetrometer       U       - TI         CP       Perth Sand Penetrometer       U       - TI         IC       Moisture Content       MOISTUR         BT       Plate Bearing Test       D       - D         ID       Photoionisation Detector       W       - W         S       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)       PL       - PI	ulk disturbe sturbed sa nvironment in wall tube E y oist et astic limit quid limit oisture con	ed sample mple al sample e 'undistur	rbed"	SOL CONSISTENCY       /S     - Very Soft       5     - Soft       -     Firm       St     - Stiff       /St     - Suff       /St     - Very Stiff       4     - Hard       RELATIVE DENSITY       /L     - Very Loose       -     - Loose       0     - Medium Dense       0     - Dense
Ri Re ab	efer to export	planatory	notes fo	or details of escriptions		5	STAN	  T	EC AUSTRALIA PTY LTD				very Dense - עי

	0	) St	ant	ec									TE	ST PI	T LOG SHEI	ΞТ
	Clie Proi	nt: ject:	۱ ر	Valke Geote	er Gilliestor echnical Inv	n Heights Pty restigation	Ltd						Н	ole I	No: TP02	27
	Loc	ation	: 4	57-5	27 Cessnoo	k Road, Gilli	estor	n Heigh	ts	Job No: 304100964					Sheet: 1 o	of 1
L	Pos	ition	Ref	er to	Site Plan					Angle from Horizontal:	90°	8	Surface	e Elevat	ion:	
┝	Mac	hine:	Type	e: 5 to imon	onne Excav	ator				Excavation Method: 600	mm Tooth	ned Bu	icket	ctor: St	antos Pty I td	
┢	Date	avau e Exc	avat	ed: 1	2/10/22					Loaged By: JH			Checke	ed Bv: k	S	
F	Ex	cavati	on		Sampling	g & Testing				Material E	Description					
ŀ		0				DCP TEST	Ê		Ľ							
	Method	Resistance	Stability	Water	Sample o Field Tes	AS 1289.6. 3.2-1997) st Blows/ 150 mm 3 6 9 12	Depth (r	Graphic Log	Classificatio	SOIL TYPE, plasticity or particle charac colour, secondary and minor compor ROCK TYPE, grain size and type, cc fabric & texture, strength, weatheri defects and structure	cteristic, nents blour, ng,	Moisture Condition	Consistency Relative Density	8	STRUCTURE Other Observations	
							_	لله علم علم علم علم علم علم ع علم علم علم ع علم علم علم علم علم علم علم علم علم		TOPSOIL: Clayey SILT, low plasticity, I	brown	M ( <pl)< td=""><td></td><td>TOPSOIL</td><td></td><td></td></pl)<>		TOPSOIL		
							_			Clayey Sandy SILT, low plasticity, pale	brown	M ( <pl)< td=""><td>S</td><td>COLLUVI</td><td>MU</td><td></td></pl)<>	S	COLLUVI	MU	
		E					- 0.5			Silty CLAY, high plasticity, brown mottly pale brown, trace fine grained sand, tra organics	ed grey and ace		St	RESIDUA	L SOIL	-
	600mm toothed bucket		Stable	Not Encountered		VR	-			Pale brown mottled pale grey and oran	ıge	M (>PL)	VSt to H			-
0.00.00.00 Daly							- 1.0									-
01.31 03030							-			1.15m Silty CLAY, low to medium plasticity, pa mottled orange and red	ale grey			EXTREME	ELY WEATHERED	
		F					- 					M ( <pl)< td=""><td>н</td><td></td><td></td><td>-</td></pl)<>	н			-
	V									1.60m TERMINATED AT 1.60 m						
							-			rarget depth						-
							_									-
VED 304100							_									-
	ME R HA PT S A B S A D A D HF WE R	THOD Ex Rip Ha Pu N So Air Pe Sh /V So /T So A Ho 3 Wa	cavato oper nd aug sh tube nic drill hamm rcussic ort spir lid fligh lid fligh llow flig ashbor ck roll	r bucke er ing er on samp al auge t auger t auger ght aug e drilling	pler er r: V-Bit r: TC-Bit ler g	PENETRATION VE Very Easy (No E Easy F Firm H Hard VH Very Hard (Re WATER Water Le Shown water inf Water out	o Resista efusal) evel on low tflow	, nce) Date		FIELD TESTS         SPT       Standard Penetration Test         HP       Hand/Pocket Penetrometer         DCP       Dynamic Cone Penetrometer         PSP       Perth Sand Penetrometer         MC       Moisture Content         PBT       Plate Bearing Test         IMP       Borehole Impression Test         PID       Photoionisation Detector         VS       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         -         Bulk           D         -         Dista           ES         -         Envi           U         -         Thin           MOISTURE         D         -         Dry           M         -         Mois           W         -         Wet           PL         -         Plass           LL         -         Liqui           w         -         Mois	disturbe urbed sar ronmenta wall tube st tic limit id limit sture con	d sample mple al sample e 'undistu tent	rbed'	SOIL CONSISTENCY           VS         - Very Soft           S         - Soft           F         - Firm           St         - Stiff           VSt         - Very Stiff           H         - Hard           RELATIVE DENSITY           VL         - Very Loose           L         - Loose           MD         - Medium Dens           D         - Dense           VD         - Very Dense	se
	Ref	er to exp reviation	lanatory s and ba	notes fo	or details of escriptions			STAN	  T	LEC AUSTRALIA PTY L	TD				2 Vory Dense	

Q	) St	tant	tec								TE	ST PIT LOG SHEET
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Loc	ation	n: 4	157-5	27 Cessnock R	oad, Gill	iestor	n Heigh	nts	Job No: 304100964			Sheet: 1 of 1
Ma	chine	: Refe Type	er to e: 5 t	Site Plan onne Excavato	•				Excavation Method: 600mm Too	thed Bu	Jurfac	e Elevation:
Exc	avat	ion D	imer	nsions:						(	Contra	ctor: Stantec Pty Ltd
Dat		cavat	ed: 1	2/10/22	ostina				Logged By: JH	(	Checke	ed By: KS
				Camping & I	DCP TEST	Ē		Ę				
Method	Resistance	Stability	Water	Sample or Field Test	(AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (r	Graphic Log	Classificatio	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
				ES 0.05 - 0.10 m		_	لد علد علد علد علد علد لد علد علد علد علد ع علد علد علد علد علد ع		TOPSOIL: Sandy SILT, low plasticity, brown, fine to medium grained sand	M ( <pl)< td=""><td></td><td>TOPSOIL</td></pl)<>		TOPSOIL
	E			ES 0.20 - 0.35 m B 0.30 - 0.45 m		-			0.15m Silty CLAY, medium to high plasticity, brown to orange mottled grey and red, trace fine to medium grained sand, trace rootlets	M (>PL)	St	RESIDUAL SOIL
toothed bucket		Stable	lot Encountered		/100/mm VF	- 0.5			0.70m Clayey SAND, medium to coarse grained, brown		н	- EXTREMELY WEATHERED
—600mm t			z			-			to orange mottled pale grey, with fine to coarse angular sandstone fragments			
	F					-						
				ES 1.00 - 1.20 m	=	- 1.0				D	VD	-
R _ V	н					-			1.40m			
						- 1.5			TERMINATED AT 1.40 m Refusal on Weathered Rock			-
						-						
ME EX PT SC AL PSS AL PSS AL PSS AL FSS AL AL FSS AL FSS AL FSS AL FSS AL FSS AL FSS AL FSS A	ETHOD ( E) Ria PL DN So H Ai Pe DN So Pe S Sh D/V So D/V So D/V So D/V So D/V So CA Ho B W R Ro fer to expendence	xcavato ipper and aug ush tube onic drill ir hamm ercussic hort spir bild fligh ollow flig /ashbor ock rolle	r bucke er bing er on sam al aug t auge t auge drillin er	et VE E F H VH er T: V-Bit r: TC-Bit ger ger or details of	ETRATION Very Easy (N Easy Firm Hard Very Hard (R ER Water L shown water ou	o Resista efusal) evel on flow utflow	nce) Date		IELD TESTS       SAMPLES         PT - Standard Penetration Test       B - But         P - Hand/Pocket Penetrometer       D - Dit         CP - Dynamic Cone Penetrometer       ES - En         SP - Perth Sand Penetrometer       Th         SC - Moisture Content       B - Dit         BT - Plate Bearing Test       MOISTURE         ID - Photoinisation Detector       W - Wk         S - Vane Shear, P=Peak,       R=Resdual (uncorrected kPa)         FC AUSTRAI IA PTY I TD	Ik disturbed sa vironment in wall tube s y sist satic limit juid limit isture con	ed sample mple al sample e 'undistu	SOIL CONSISTENCY VS - Very Soft S - Soft brbed' St - Siff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense

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ſ	Clie Proi	nt: iect:	V	Valke Geote	er Gilliesto echnical In	n Heights Pty vestigation	Ltd						H	ole No: TP101	
	Loc	ation	: 4	57-5	27 Cessno	ck Road, Gilli	estor	h Heigh	ts	Job No: 304100964				Sheet: 1 of 1	
$\left  \right $	Pos Mac	ition	: Refe	erto er5to	Site Plan	vator				Angle from Horizontal: Excavation Method: 60	90° I0mm Tooth	ned Bu	Surface Joket	e Elevation:	
ł	Exc	avati	on D	imen	sions:	Valor				Excuvation method. Of		(	Contra	ctor: Stantec Pty Ltd	
F	Date	e Exc	avat	ed: 1	9/4/23			1		Logged By: JH		(	Checke	ed By:	
ŀ	Ex	cavat	ion		Samplin	ng & Testing				Material	Description				
	Method	Resistance	Stability	Water	Sample Field Te	or est Blows/ 150 mm 3 6 9 12	Depth (m	Graphic Log	Classification	SOIL TYPE, plasticity or particle chara colour, secondary and minor comp ROCK TYPE, grain size and type, o fabric & texture, strength, weathe defects and structure	acteristic, onents colour, ring,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations	
								لك علد عك علد علد ع لك علد عك بي علد علد ع		TOPSOIL: Sandy SILT: low plasticity, with clay, trace fine rounded gravel, tr	, dark brown, race rootlets			TOPSOIL	
							-	علم		0.25m		M ( <pl)< td=""><td></td><td>-</td></pl)<>		-	
		E	0	countered			-			Clayey SILT: low plasticity, grey, with medium rounded gravel, trace rootlet:	fine to s	M ( <pl)< td=""><td></td><td>COLLUVIUM</td></pl)<>		COLLUVIUM	
	- EX-	Image: Second													
						н <mark>в ' ' '</mark>	-			0.65m		M (>PL)	н	-	
		F-H					-			Silty Sandy CLAY: medium plasticity, mottled pale grey	orange	M ( <b>≈</b> PL)	н	EXTREMELY WEATHERED	
		н					-			SANDSTONE: fine to medium grainer strength, highly weathered	d, grey, low			WEATHERED ROCK	
							_			TERMINATED AT 0.90 m Refusal on Weathered Rock					
0.00							- 1.0							-	
20000101-12							-							-	
0707/00/1-1							-							-	
- ALIAN							-							-	
							- 15								
							-							-	
							-							-	
	ME EX	THOD Ex	cavato	r bucke	et		Desi-t	200)	F	IELD TESTS PT - Standard Penetration Test	SAMPLES B - Bulk	disturbe	d sample	SOIL CONSISTENCY VS - Verv Soft	
	R HA PT SO AH PS AD AD	Rip Ha Pu N So Air Pe Sh /V So /T So	oper ind aug sh tube nic drill hamm rcussic ort spir lid fligh	er ing er on samp al auger t auger	pler er r: V-Bit r: TC-Bit	vE Very Easy (No E Easy F Firm H Hard VH Very Hard (Re WATER Water Le shown water inf	fusal) evel on	nce) Date	H C F M F	IP     Hand/Pocket Penetrometer       DCP     Dynamic Cone Penetrometer       DCP     Perth Sand Penetrometer       IC     Moisture Content       BT     Plate Bearing Test       VIP     Borehole Impression Test       ID     Photoionisation Detector	D - Dist ES - Envi U - Thin MOISTURE D - Dry M - Mois W - Wet PL - Plac	urbed sar ironmenta wall tube	mple al sample e 'undistu	S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard <b>RELATIVE DENSITY</b> VL - Very Loose L - Loose	
	HF/ WE RR	A Ho B Wa Ro er to exp	llow flig ashbore ick rolle lanatory	ht aug e drillin er notes fo	g or details of	water ou	tflow		` 	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)           FC ALISTRALIA DTV	LL - Liqui w - Mois	id limit sture con	tent	MD - Medium Dense D - Dense VD - Very Dense	

C		Stan	tec									TE	ST PIT LOG SHEET
CI	ient: oiect	t:	Walk Geote	er Gillieston echnical Inve	Heights Pty estigation	Ltd						Н	ole No: TP102
Lo	catio	on:	457-5	27 Cessnoc	k Road, Gilli	estor	n Heigh	ts	Job No: 304100964				Sheet: 1 of 1
Po	ositio	n: Ref	er to	Site Plan	4.5.4				Angle from Horizontal: 9	90° Name To oth	Seed Bu	Burface	e Elevation:
E	cava	ation D	e: 5 ti Jimen	sions:	ator				Excavation Method: 600			CKeL Contra	ctor: Stantec Ptv Ltd
Da	ate E	xcava	ed: 1	9/4/23					Logged By: JH		C	hecke	ed By:
	Excav	ation		Sampling	& Testing				Material D	Description			
Method	Resistance	Stability	Water	Sample o Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle charac colour, secondary and minor compor ROCK TYPE, grain size and type, co fabric & texture, strength, weatherin defects and structure	steristic, nents blour, ng,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
	E	Stable	Not Encountered		HB	- - - 0.5 - -			FILL: Sitty SAND: fine to coarse graines brown, with foreign building waste inclu	d, dark Isions	D M (>PL)	St	FILL 0.00 m: Distinct ground disturbance in the form of uneven surfaces surrounding TP 0.25 m: Bricks, ceramic tiles, timber fragments, Coal Wash Reject fragments Composition: Approx. 25% Foreign, 75% Soil.
2						- 1.0			1.00m Silty CLAY: low plasticity (friable), pale	grey			EXTREMELY WEATHERED
	F-I	н				_			motiled brown, trace rootiets				-
						-					M ( <pl)< td=""><td>VSt</td><td>-</td></pl)<>	VSt	-
									1.25m TERMINATED AT 1.25 m				
D						-			Refusal on Weathered Rock				
						- 1.5							-
						-							-
						-							-
						_							-
	METHO EX A A A A A A A A D/V A D/T A D/T A D/T A B A C R B C F F C C C C C C C C C C C C C C C C	DD Excavate Ripper Hand au Push tub Sonic dri Air hamr Percussi Solid flig Solid flig Solid flig Solid flig Rock roll	ger e liling her on sam ral auge nt auge ght auge ght auge e drillin er	pler VBit r: V-Bit g g	PENETRATION /E Very Easy (No Easy Firm H Hard /H Very Hard (Ro NATER Water L Shown water inf water ou	erusal) erusal) evel on low tflow	Date	F F F I I F	FIELD TESTS         SPT       Standard Penetration Test         HP       Hand/Pocket Penetrometer         DCP       Dynamic Cone Penetrometer         PSP       Perth Sand Penetrometer         MC       Moisture Content         PBT       Plate Bearing Test         IMP       Borehole Impression Test         PID       Photoinisation Detector         VS       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         -         Bulk           D         -         Dist.           ES         -         Envi           U         -         Thin           MOISTURE         D         -         Dry           M         -         Mois           VU         -         Plas           LL         -         Liqu           W         -         Mois	s disturbed urbed sar ironmenta wall tube stic limit id limit sture cont	d sample nple I sample 'undistu ent	soil Consistency VS - Very Soft S - Soft F - Firm VSt - Stiff VSt - Very Stiff H - Hard <b>RELATIVE DENSITY</b> VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
	bbreviat	tions and b	asis of d	escriptions			SIAN	11	TEC AUSTRALIA PTY L	.וט			

C	) s	tan	tec										TE	ST PI	TLOG	<b>SHEET</b>
CI	ient: oiect		Nalk Geote	er Gillieston He	eights Pty	Ltd							Н	ole I	No:	TP103
Lo	catio	n: 4	157-5	27 Cessnock F	Road, Gilli	estor	n Heigh	ts		Job No: 304100964					Sł	neet: 1 of 1
PC M	ositio	1: Ref	erto	Site Plan	Nr.					Angle from Horizontal:	90°	hed Bi	Surface	e Elevat	ion:	
Ex	cava	tion D	imen	sions:								(	Contra	ctor: St	tantec Pt	y Ltd
Da	ate Ex	cavat	ed: 1	9/4/23			1			Logged By: JH		(	Checke	ed By:		-
E	Excava	ation	-	Sampling &	Testing				1	Materia	I Description	1				
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	:	SOIL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weath defects and structure	acteristic, ionents colour, ering,	Moisture Condition	Consistency Relative Density	٤	STRUCT & Other Obse	URE ervations
						-			0.25m	FILL: Sitty SAND: fine to coarse grain brown, with fine to coarse angular gr rootlets	ned, dark avels, trace	D		FILL		-
						-			0.40m	FILL: Gravely SAND: fine to coarse fine to coarse angular to sub-angular rounded to sub-rounded cobbles, tra wrap fragments	grained, grey, r gravel, trace ce plastic	D				
	E-F		ountered			-0.5				Silty CLAY: high plasticity, red mottle and brown, trace fine grained sand	d pale grey			RESIDUA	AL SOIL	-
EX -		Stable	Not Enco			-						M (>PL)	St			
2									0.75m	Sandy CLAY: low to medium plasticit				EXTREM	ELY WEATH	IERED
200					12	_				mottled red and brown, fine to mediu sand	m grained					-
		-			12 VR	-						M (cPL)	VSt - H			-
6mg 60.00.0	F				(12/50/mm)           	- 1.0						(12)	Vot			-
	н								1.20m							
						-				Refusal on Weathered Rock						-
						-										-
						-										-
						-										-
	IETHO	D Excavato	r bucke	PEN		Deni-t		F	F <b>IELD T</b>	ESTS Standard Penetration Test	SAMPLES B - Bull	k disturbe	d sample		SOIL CO	NSISTENCY Very Soft
	A F A F SON S AH A SON S AH A S AD/V S AD/V S AD/T S AD/T S AD/T S	Ripper land aug Push tub conic dril ir hamm Percussio colid fligh colid fligh colid fligh colid fligh	jer e ling er on sam ral auge tt auge tt auge ght auge	pler WA er sr ∵ V-Bit cr C-Bit ↓ er	very Easy (No Easy Firm Hard Very Hard (Re TER Water Le shown water inf	efusal) evel on	nce) Date	F F F F	HP - DCP - PSP - MC - PBT - MP - PID - /S -	Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak,	D - Dist ES - Env U - Thir <b>MOISTURE</b> D - Dry M - Moi W - Wei PL - Plas LL - Liqu	st stc limit uid limit	mple al sample e 'undistu	rbed'	S - F - St - VSt - H - <b>RELATIV</b> VL - L - D -	Soft Firm Stiff Very Stiff Hard <b>TE DENSITY</b> Very Loose Loose Medium Dense Dense
	RR F	xplanator	e unilin er v notes fo	9	valer ou	CIIOW	STAN	  T	EC	RERESENTING (UNCOFFECTED & RPa)	w - Moi	sture con	tent		VD -	Very Dense

(	$\mathbf{S}$	St	ant	ec										TE	ST PI		G SHEET
C	lien roie	nt: act:	V	Valk Geote	er Gilliesto	n Heights Pty vestigation	/ Ltd							Η	ole N	lo:	<b>TP104</b>
Ŀ	oca	tion	: 4	57-5	27 Cessno	ck Road, Gill	iestor	n Heigh	ts		Job No: 304100964					S	heet: 1 of 1
P	osit lack	tion:	Refe	er to	Site Plan	ator					Angle from Horizontal:	90°	bod Bi	Surfac	e Elevati	on:	
E	xca	vati	on D	imen	sions:	70101					Excavation method. or		(	Contra	ctor: Sta	antec P	ty Ltd
D	ate	Exc	avat	ed: 1	9/4/23		1	1			Logged By: JH		(	Checke	ed By:		
	Exc	avati	on		Sampling	g & Testing	-				Materia	I Description		1			
Mothood	INIEIIIOU	Resistance	Stability	Water	Sample o Field Tes	or st Blows/ 150 mm	Depth (m)	Graphic Log	Classification		SOIL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, oonents colour, ering,	Moisture Condition	Consistency Relative Density	&	STRUC Other Obs	TURE servations
							-			0.25m	FILL: Clayey SILT: low plasticity, dar brown-black, with fine to medium gra trace rootlets, trace glass fragments	k lined sand,	M ( <pl)< th=""><th></th><th>FILL</th><th></th><th>-</th></pl)<>		FILL		-
							-				Clayey SILT: low plasticity, grey, with coarse rub-rounded to sub-angular g	n fine to Iravels	M ( <pl)< td=""><td></td><td>COLLUVIU</td><td>IM</td><td>-</td></pl)<>		COLLUVIU	IM	-
		F			P 0 50 0 70 r		- 0.5			0.40m	Silty CLAY: high plasticity, red mottle and brown, trace fine grained sand	ed pale grey			RESIDUAL	SOIL	
					0.50 - 0.701		-						M (>PL)	St			-
			Ð	countered			-										-
			Stabl	Not En			-			0.80m	Silty CLAY: low to medium plasticity	(friable), pale			EXTREME	LY WEATH	HERED
							-				grey noticet orange, with nife graine	u sanu					-
					B 1.00 - 1.30 r	m	- 1.0										-
		F-H					-						M ( <pl)< td=""><td>St - VSt</td><td></td><td></td><td>-</td></pl)<>	St - VSt			-
						     ⁸ 	-										-
						  10	-										-
		н				14 VR (14/75mm)	- 1.5			1.60m	TERMINATED AT 1.60 m						
							-				Refusal on Weathered Rock						-
ביורבים בוחיסבות בעם מיייהיי אייי ייי	MET EX R HA PT SON AH PS AD/N AD/T HFA WB RR	FHOD Exc Rip Hai Pus Air Per Sho X Sol X Sol X Sol X Ro	cavato per nd aug sh tube nic drill hamm ccussic ort spir id fligh id fligh llow flig ishbore ck rolle	er er ing er al auge t auge t auge t auge ght auge ght auge ght auge	bler ar ∵V-Bit ∵TC-Bit er 9	PENETRATION VE Very Easy (N E Easy H Hard VH Very Hard (R WATER WATER Water L shown water inf	o Resista efusal) evel on low itflow	nce) Date	F S F N F II F V	IELD           SPT         -           IP         -           IP         -           OCP         -           PSP         -           MC         -           PBT         -           PBT         -           PBT         -           PBT         -           PBT         -           PBT         -           YE         -           YE         -           YE         -           YE         -           YE         -           YE         -	TESTS Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES B - Bull D - Disis ES - Env U - Thir MOISTURE D - Dry M - Moi W - We PL - Plaa LL - Liqu w - Moi	k disturbe turbed sar vironmenta n wall tube st st t stic limit stic limit sture con	d sample mple al sample 'undistu	e irbed'	SOIL CC           VS         -           S         -           F         -           St         -           VSt         -           H         -           RELATIN         VL           VL         -           L         -           MD         -           D         -           VD         -	Very Soft Soft Firm Stiff Hard /E DENSITY Very Loose Loose Dense Dense Very Dense
	Refer abbre	to expleviations	anatory s and ba	notes fo	or details of escriptions			STAN	11  11	EC	AUSTRALIA PTY	LTD			1		

Q	) St	ant	cec								TE	ST PIT LO	G SHEET
Clie	ent:	Ň	Valk	er Gillieston He	eights Pty L	_td					Н	ole No:	<b>TP105</b>
Loc	cation	n: 4	57-5	27 Cessnock R	load, Gillie	ston	Height	ts	Job No: 304100964			S	Sheet: 1 of 1
Pos	sition	: Ref	er to	Site Plan					Angle from Horizontal: 90°		Surface	e Elevation:	
Ma	chine cavati	Type ion D	e: 5 te imen	onne Excavato	r				Excavation Method: 600mm Too	thed B	ucket Contra	ctor: Stantec P	tv I td
Dat	te Exc	cavat	ed: 1	9/4/23					Logged By: JH		Checke	ed By:	
E	xcavat	ion		Sampling & T	esting				Material Description	ı		•	
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUC & Other Ob	TURE servations
					3 6 9 12                                       4			0	TOPSOIL: Silty SAND: fine to medium grained, dark brown, with fine to medium rounded gravel, trace organics	D		TOPSOIL	-
2	E			B 0.50 - 0.80 m		0.5			Silty CLAY: high plasticity, dark grey mottled orange and brown, trace fine to medium rounded gravels, trace rootlets	M (>PL)	St	Probably COLLUVIU	M
		Stable	Not Encountered			1.0			1.00m Silty CLAY: high plasticity, red mottled pale grey and brown, trace fine grained sand	M (≈PL)	St - VSt	RESIDUAL SOIL	-
	F-H				HB	2.0			1.60m Sitty CLAY: low plasticity (friable), mottled pale grey and red	M ( <pl)< td=""><td>VSt-H</td><td>EXTREMELY WEAT</td><td></td></pl)<>	VSt-H	EXTREMELY WEAT	
	ETHOD C Ex Riµ A Ha F Pu DN Sci A Ha F Pu DN Sci A Ha S Pe S St D/V Sci D/V Sci D/V Sci D/V Sci A Ha B Wi R R Rc efferto extension	accavato pper and aug ush tube onic drill r hamm ercussic ort spir blid fligh blid fligh blid fligh blid fligh blid fligh blid fligh cock rolle	r bucke er er on sam al auge t auge t auge ght aug e drillin er	et VE F H VH VH VH VH VH VH VH VH VH VH VH VH V	ETRATION Very Easy (No R Easy Firm Hard Very Hard (Refu Very Hard (Refu Very Hard (Refu Water Levv shown water inflov d water outflo	Resistar Isal) el on l w ow	Date	F S H D P M P V V	Target depth         IELD TESTS         PT - Standard Penetration Test         P - Hand/Pocket Penetrometer         CP - Dynamic Cone Penetrometer         SP - Perth Sand Penetrometer         CP - Borehole Impression Test         ID - Photoionisation Detector         S - Vane Shear, P=Peak, R=Resdual (uncorrected kPa)         CALLSTRALIA PTY ITD	i isturbed sa vvironment nin wall tub E ry oist fet astic limit quid limit oisture cor	ed sample mple al sample e 'undistu	rbed' <b>SOIL CC</b> VS - S - St - VSt - H - <b>RELATI</b> VL - L - MD - VD -	DNSISTENCY Very Soft Soft Firm Stiff Very Stiff Hard VE DENSITY Very Loose Loose Medium Dense Dense Very Dense

(	5	) St	ant	ec									TE	ST PIT LOG SHEET
C	lie	nt: ect:	\ (	Valke Geote	er Gillieston	Heights Pty	Ltd						Н	ole No: TP106
Ĺ	00	ation	: 4	57-5	27 Cessnoc	k Road, Gillie	estor	h Heigh	ts	Job No: 304100964				Sheet: 1 of 1
P	'osi Iac	tion:	Ref	er to	Site Plan	ator				Angle from Horizontal:	90° Jmm Tooth	ed Bu	Surface	e Elevation:
E	xca	avati	on D	imen	sions:					Excavation method. 000		(	Contra	ctor: Stantec Pty Ltd
D	ate	Exc	avat	ed: 1	9/4/23			I		Logged By: JH		C	Checke	ed By:
	Ex	cavati	on		Sampling	& Testing				Material E	Description			
14 - 14 - M	Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m	Graphic Log	Classification	SOIL TYPE, plasticity or particle charact colour, secondary and minor compor ROCK TYPE, grain size and type, co fabric & texture, strength, weatherid defects and structure	cteristic, nents blour, ing,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
ľ								على على على على على على على على على على على على على على على على على		TOPSOIL: Silty SAND: fine to medium dark brown, with fine to medium rounde trace organics	grained, ed gravel,	D		TOPSOIL -
		F								0.20m Sandy GRAVEL: fine to coarse rounde sub-rounded, grey, fine to medium grai trace rootlets	ed to ined sand,	D		COLLUVIUM -
		E-H					- 0.5			Sitty CLAY: high plasticity, red mottled trace fine grained sand	brown,	M (>PL)		RESIDUAL SOIL
	F-H									As Above, orange-brown mottled grey			St	-
	H H H H H H H H H H H H H H H H H H H									1.05m		M ( <b>≈</b> PL)		-
						15				Silty CLAY: low to medium plasticity, m grey and red-orange, with fine grained	nottled pale sand			EXTREMELY WEATHERED -
2 0000000 01-2						VR (15/75mm) (15/75mm)                     -								-
1 0707004-1 2001 BUIMBUTCE 0 -		F-H					- 1.5					M ( <pl)< td=""><td>VSt - H</td><td>-</td></pl)<>	VSt - H	-
							-2.0-			2.00m				-
										Target depth				-
														-
					<u> </u>									
	ME EX HA PT SOI AD AD/ AD/ AD/	THOD Exi Rip Ha Pu N So Air Pe Sh V So T So A Ho	cavato oper nd aug sh tube nic drill hamm rcussic ort spir lid fligh lid fligh llow flig	r bucke er ing er on sam al auge t auger t auger t auger drillic	pler V r: V-Bit r: TC-Bit o	Very Easy (No Easy Firm H Hard VI Very Hard (Ref VATER Water Lev shown water inflo	Resistai iusal) vel on ow	nce) Date		FIELD TESTS         SPT       Standard Penetration Test         HP       Hand/Pocket Penetrometer         DCP       Dynamic Cone Penetrometer         PSP       Perth Sand Penetrometer         MC       Moisture Content         PBT       Plate Bearing Test         IMP       Borehole Impression Test         PID       Photoionisation Detector         VS       Vane Shear; P=Peak,         Bedrauf (Unserstruct 11 Data)	SAMPLES           B         -         Bulk           D         -         Dist           ES         -         Envi           U         -         Thin           MOISTURE         D         -         Dry           M         -         Dry           M         -         Mois           W         -         Wet           PL         -         Plas           LL         -         Liqui	disturbe urbed sar ronmenta wall tube st tic limit id limit	d sample mple al sample e 'undistu	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense
	RR Refe	Ro er to exp eviation	ck rolle	notes fo	or details of escriptions		5	STAN	  T	TEC AUSTRALIA PTY L	w - Mois	sture con	tent	VD - Very Dense

Q	) St	ant	tec									TE	ST PIT LOG SHEET
Clie	ent:	Ň	Valke	er Gillieston He	eights Pty	Ltd						Н	ole No: TP107
Loc	ation	ı: 4	57-5	27 Cessnock F	Road, Gillio	estor	n Heigh	ts	Job No: 304100964				Sheet: 1 of 1
Pos	sition	: Ref	er to	Site Plan					Angle from Horizontal:	90°	5	Surface	e Elevation:
Ma Exc	chine Savati	I ype	e: 5 to imen	onne Excavato	r				Excavation Method: 60	00mm Tootr	ned Bu	CKet	ctor: Stantec Ptv I td
Dat	e Exc	avat	ed: 1	9/4/23					Logged By: JH			Checke	ed By:
E	xcavat	ion		Sampling & T	Testing				Materia	I Description			-
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle char colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, ponents colour, ering,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
	E				3 6 9 12 	- 0.5			FILL: Sandy CLAY: low plasticity, da brown-black, with fine to coarse ang sub-angular gravel	rk Jlar to	M ( <pl)< td=""><td></td><td>FILL -</td></pl)<>		FILL -
D	F-H		ountered			- - - 1.0			Sitty CLAY: high plasticity, dark grey red, trace fine to coarse sub-rounder gravels, trace rounded cobbles	mottled dark d to angular	M (>PL)	St	COLLUVIUM - - -
— ЕХ –		Stable	Not Enco						1.30m Sity CLAY: high plasticity, dark red r with grange staining with fire to coa	nottled brown			1.20 m: Minor olfactory odour RESIDUAL SOIL
	н				23 VI ^{I           -}	- 1.5			sub-rounded to sub-angular gravel, t grained sand	race fine			1.50 m: Possible jarosite staining
						- 2.0			2.20m		M (>PL)	VSt - H	-
									Silty CLAY: low plasticity (friable), mo grey and red	ottled pale	M ( <pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td></pl)<>	н	EXTREMELY WEATHERED
						-			Z.30m TERMINATED AT 2.30 m Target depth				-
MI EX PT SC AF PS AS AS AL HF WI RF	ETHOD ( Ex. Rip A Ha Pu DN So H Air S Pe S Pe S Pe S A D/V So D/V	ccavato pper and aug ish tube nic drill hammercussic ort spir blid fligh blid fligh blow flig ashbor ock rolle	r bucke er ing er on samp al auge t auger t auger ght auge drillin er	et VE E F H VH VH VH VH VH VH VH VH VH VH V P or details of escriptione	Very Easy (No Easy Firm Hard Very Hard (Rei TER Water Le shown water inflo	Resista fusal) vel on cow flow	nce) Date	F S H D P M P V	IELD TESTS         PT       Standard Penetration Test         P       Hand/Pocket Penetrometer         CP       Dynamic Cone Penetrometer         SP       Perth Sand Penetrometer         IC       Moisture Content         BT       Plate Bearing Test         ID       Photoionisation Detector         S       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES B - Buik D - Distk ES - Envi U - Thin MOISTURE D - Dry M - Mois W - Wet PL - Plas LL - Liqu w - Mois	disturbed sar ironmenta wall tube st tic limit id limit sture cont	d sample mple al sample e 'undistu	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense

Q	St	ant	cec								ΤE	ST PIT LOG SHEET
Clie	ent:		Nalke	er Gillieston	Heights Pty I	Ltd					Η	ole No: TP108
Loc	cation	1: 4	157-5	27 Cessnoci	k Road, Gillie	stor	h Heigh	ts	Job No: 304100964			Sheet: 1 of 1
Pos	sition	: Ref	ər to	Site Plan					Angle from Horizontal: 90°		Surfac	e Elevation:
Ma	chine cavati	Type on D	): 5 to imon	onne Excava	itor				Excavation Method: 600mm To	othed Bu	ucket Contra	ctor: Stantoc Ptv I td
Dat	te Exc	cavat	ed: 1	9/4/23					Logged By: JH		Checke	ed By:
E	xcavat	ion		Sampling	& Testing				Material Description	n		
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
							يلير علير علير علير علير ع يلير علير علير علير علير ع		TOPSOIL: Clayey SILT: low plasticity, dark browr trace organics	,		TOPSOIL 0.00 m: Within gully line
							بلد علد علد علد علد علد علد علد علد علد علد علد علد علد علد علد علد علد		0.25m	M ( <pl)< td=""><td></td><td></td></pl)<>		
									Sitty CLAY: high plasticity, grey mottled pale brown, trace fine to medium rounded gravels, trace rootlets			COLLUVIUM
					9  9	0.5				M (>PL)	St - VSt	-
									0.80m Silty CLAY: high plasticity, mottled pale grey and orange-brown			RESIDUAL SOIL
		e	countered			1.0						-
	F-H	Stab	Not Er							M (>PL)	St - VSt	· · · ·
					9 	1.5						-
					VR				1.60m Silty CLAY: low plasticity, mottled pale grey and red			EXTREMELY WEATHERED
									4.00-	M ( <pl)< td=""><td>н</td><td></td></pl)<>	н	
						2.0			SILTSTONE: pale grey and dark red, very low to low strength, highly weathered			WEATHERED ROCK
									2.20m			-
									TERMINATED AT 2.20 m Target depth			
M				P	PENETRATION		<u> </u>	F	IELD TESTS SAMPLE	S		
E) R H/ PT S(	K Ex Rij A Ha F Pu DN So H Air	cavato pper and aug ish tube nic dril	r bucke Ier e ling Ier	et V E F H V	YE Very Easy (No F Easy Firm Hard YH Very Hard (Refu	Resistai usal)	nce)		IPI     Standard Penetration Test     B     I       IP     Hand/Pocket Penetrometer     D     I       ICP     Dynamic Cone Penetrometer     ES     I       SP     Perth Sand Penetrometer     U     I       ICP     Avisture Content     MOISTUI	Bulk disturbe Disturbed sa Environment Thin wall tub	ed sample imple al sample e 'undistu	<ul> <li>VS - Very Soft</li> <li>S - Soft</li> <li>F - Firm</li> <li>Irbed' St - Stiff</li> <li>VSt - Very Stiff</li> <li>H - Hard</li> </ul>
	S Pe S Sh D/V So D/T So FA Ho B Wa	ort spin lid fligh lid fligh blid fligh blow flig ashbor	in samp al auge t auger it auger ght aug e drillin	oler V er ": V-Bit ": TC-Bit er g	VATER Water Lev shown water inflor water outfl	vel on w ow	Date	P IN P V	MBT - Plate Bearing Test     D - I       MP - Borehole Impression Test     M - I       ID - Photoionisation Detector     W - M       'S - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)     LL - I	Dry Aoist Vet Plastic limit iquid limit Aoisture cor	ntent	RELATIVE DENSITY       VL     - Very Loose       L     - Loose       MD     - Medium Dense       D     - Dense       VD     Very Loose
Re	fer to exp	blanatory	notes fo	or details of		S	STAN	  T	EC AUSTRALIA PTY LTD			vo - very Dense

Q	) St	an	tec									TE	ST PIT LOG SHEET
Clic	ent:		Nalk	er Gillieston H	Heights Pty L	td						Н	ole No: TP109
Lo	cation	1: 4	157-5	27 Cessnock	Road, Gillie	ston	Heigh	ts	Job No: 30410096	4			Sheet: 1 of 1
Pos	sition	: Ref	er to	Site Plan	or				Angle from Horizon	ntal: 90°	bod Ru	Surface	e Elevation:
Exc	cavati	on D	imen	sions:	01						(	Contra	ctor: Stantec Pty Ltd
Dat	te Exc	cavat	ed: 1	9/4/23					Logged By: JH		(	Checke	ed By:
E	xcavat	ion		Sampling 8	Testing	_			Ma	terial Description	-	i	1
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6. 3.2-1997) Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle colour, secondary and minor ROCK TYPE, grain size and fabric & texture, strength, v defects and structu	e characteristic, components type, colour, <i>v</i> eathering, ire	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
	F						لك علك علك علك علك علك علك		TOPSOIL: Sandy SILT: low pla organics	sticity, brown, trace	M ( <pl)< td=""><td></td><td>TOPSOIL</td></pl)<>		TOPSOIL
		-				0.5			Silty CLAY: high plasticity, brow with fine to medium rounded gr grained sand, trace roolets	vn-grey mottled red, avel, trace fine	M (>PL)		COLLUVIUM -
	F-H	-							0.75m Silty CLAY: high plasticity, gree	r mottled red, with		St	- RESIDUAL SOIL
0			pe			1.0			tine to medium rounded gravel sand	trace fine grained			-
EX		Stable	Not Encountere										
	н					1.5					M (>PL)	VSt	-
	F-H	-		B 1.80 - 2.00 m	VR     0 (10/75mm)                     	2.0			1.80m Sandy CLAY: low plasticity, pa orange-brown, fine to medium	e grey mottled grained	M ( <pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td></pl)<>	н	EXTREMELY WEATHERED
									2.30m TERMINATED AT 2.30 m Target depth				-
													-
M ED R H/ PT SC AL PT SC AL PT AL R R R R	ETHOD X Ex Rip A Ha T Pu DN So H Air S Pe S Sh D/V So D/V So D/V So D/V So D/T So FA Hd B Wa R Rd	cavato pper and aug ish tub onic dril r hamm rcussio ort spin bild fligh bild fligh bilow flig ashbor ock rolle	r bucke jer er on sam ral auge t auge t auge t auge drillin er	I PE et VE F H VH er W er TC-Bit I g J	Very Easy (No R Easy Firm Hard Very Hard (Refu ATER Water Levv shown water inflov water outflo	sal) el on [ w ow	Date	FII SF HF DC PS MC PE IM PII VS	ELD TESTS         PT       Standard Penetration Test         Hand/Pocket Penetrometer         CP       Dynamic Cone Penetrometer         CP       Perth Sand Penetrometer         C       Moisture Content         31       Plate Bearing Test         IP       Borehole Impression Test         D       Photoionisation Detector         S       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         -         Build           D         -         Dise           ES         -         Dise           U         -         Thi           MOISTURE         D         -         Drive           M         -         Moisture         -         Moisture           PL         -         -         Prive         -         Prive           LL         -         Liq         w         -         Moisture	k disturbe vironmenta n wall tube ist ist ist istc limit isture con	l mple al sample e 'undistu tent	SOIL CONSISTENCY       e     VS     - Very Soft       S     - Soft       F     - Firm       Vst     - Very Stiff       H     - Hard       RELATIVE DENSITY       VL     - Very Loose       L     - Loose       MD     - Medium Dense       D     - Dense       VD     - Very Dense

Q	St	ant	ec									TE	ST PI	<b>FLOG SHEET</b>
Clie	ent:	Ň	Valke	er Gillieston F	leights Pt	/ Ltd						Н	ole N	No: TP110
Loc	cation	1: ²	57-5	27 Cessnock	Road, Gill	iestor	n Heigh	ts	Job No: 304100964					Sheet: 1 of 1
Pos	sition	: Ref	er to	Site Plan	or				Angle from Horizontal:	90°	ed Bu	Surface	e Elevati	on:
Exe	cavati	on D	imen	sions:	01				Excavation method. of		C	Contra	ctor: Sta	antec Pty Ltd
Dat	te Exc	avat	ed: 1	9/4/23		1	1		Logged By: JH		C	Checke	ed By:	-
E	xcavat	ion		Sampling &	Testing				Material	I Description				
Method	Resistance	Stability	Water	Sample or Field Test	DCP TEST (AS 1289.6 3.2-1997) Blows/ 150 mm	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle char, colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, ponents colour, ering,	Moisture Condition	Consistency Relative Density	&	STRUCTURE Other Observations
	F					-			TOPSOIL: Clayey SILT: low plasticity trace rootlets	y, dark brown,	M ( <pl)< td=""><td></td><td>TOPSOIL</td><td>-</td></pl)<>		TOPSOIL	-
						- 0.5			0.25m Silty CLAY: high plasticity, brown-gre with fine to medium rounded gravel, I grained sand, trace roolets	ey mottled red, trace fine			RESIDUAL	- SOIL -
EX	F-H	Stable	Not Encountered			-					M (>PL)	St		-
-						-								-
					1	7			1.00m					
					14	- 1.0			Silty Gravelly CLAY: medium to high mottled grey-brown, fine to coarse ro	plasticity, red ounded to			EXTREME	LY WEATHERED
		-			HB       (10/25mm) 	_	8		sub-rounded, trace line grained sand	1	M (≈PL)	VSt - H		
									1.25m	a grained			WEATHER	
	Н					-			sand, fine to coarse rounded to sub- gravels, orange-brown and red, very highly weathered	rounded low strength,				-
						- 1.5			TERMINATED AT 1.40 m Refusal on Weathered Rock					
						-								-
						-								-
						-								-
M E) R H/ PT SC AF SC AF R AS AI HI WR	ETHOD ETHOD K Ex Rip A Ha F Pu DN Sco H Ain S Pe S Sh D/V Sco D/T Sco FA Hc B W R Rc	ccavato pper and aug sh tube nic drill hamm rcussic fild fligh blid fligh blid fligh blow flig ashbor pock rolle	r bucke er ing er n sam al auge t auge t auge jht aug e drillin er	PE           at         VE           F         F           H         VH           VH         VH           Per         **           *: TO-Bit         **           er         9	NETRATION Very Easy (N Easy Firm Hard Very Hard (F ATER Water L shown water in water of	efusal) evel on flow	, nce) Date	F S F N F I I S	FIELD TESTS         SPT       Standard Penetration Test         HP       Hand/Pocket Penetrometer         DCP       Dynamic Cone Penetrometer         PSP       Perth Sand Penetrometer         MC       Moisture Content         PBT       Plate Bearing Test         IMP       Borehole Impression Test         PID       Photoionisation Detector         VS       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES       B     - Buik       D     - Dist       ES     - Envi       U     - Thin       MOISTURE     D       D     - Dry       M     - Mois       W     - Weit       PL     - Plas       LL     - Liqu       w     - Mois	t disturbe urbed sar ironmenta wall tube st st tic limit sture cont	d sample mple al sample 'undistu tent	; ; irbed'	SOIL CONSISTENCY           VS         -         Very Soft           S         -         Soft           F         -         Firm           St         -         Stiff           VSt         -         Very Stiff           H         -         Hard           RELATIVE DENSITY         VL         -           VL         -         Very Loose           L         -         Loose           MD         -         Medium Dense           D         -         Dense           VD         -         Very Dense
Reab	efer to exp breviatior	planatory ns and ba	notes fo	or details of escriptions		Ś	STAN	١T	EC AUSTRALIA PTY	LTD			1	

Q	Stantec TEST PIT LOG SHEET															
Client: Walker Gillieston Heights Pty Ltd Hole No: T						TP111										
Loc	ation	1: 4	157-5	27 Cessno	ck Road, Gilli	iestor	n Heigh	Its		Job No: 304100964					Sh	eet: 1 of 1
Pos	sition chine	: Ref	erto erto	Site Plan	ator					Angle from Horizontal: Excavation Method: 60	90° 00mm Tooti	hed Bu	Surface Icket	e Elevat	ion:	
Exc	avati	on D	imen	sions:								(	Contra	ctor: St	tantec Pty	/ Ltd
Dat	e Exc	cavat	ed: 1	9/4/23		1	1			Logged By: JH		(	Checke	ed By:		
E	xcavat	ion		Sampling	g & Testing					Material	Description		1	1		
Method	Resistance	Stability	Water	Sample o Field Tes	or st Blows/ 150 mm 3 6 9 12	Depth (m)	Graphic Log	Classification	:	SOIL TYPE, plasticity or particle char, colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, onents colour, ering,	Moisture Condition	Consistency Relative Density	٤	STRUCTI & Other Obse	JRE rvations
	F					-			0.20m	FILL: Silty SAND: fine to medium gra brown, with fine to medium rounded g organics FILL: Silty Gravelly CLAY: medium pl	ined, dark gravel, trace lasticity, pale	D		FILL		-
		-				-				grey, brown red and orange, fine to angular to sub-angular, with fine to m grained sand, trace angular cobbles	xoarse nedium	M (>PL)				-
		D				- 0.5			0.50m	Silty Gravelly CLAY: medium to high pale grey mottled brown-orange, fine angular to sub-angular, with fine to m grained sand	plasticity, to coarse nedium	M (>PL)	VSt	RESIDUA	AL SOIL	
н Н Н Н Н С		Stabl			15		<u>//×//</u> 2		0.65m	SILTSTONE: pale grey and dark red,	, highly			WEATHE	RED ROCK	
0					VR       	-				weathered	griiy			0.70 m: V	Vater inflow	-
	н					- 1.0										-
						-										-
V									1.30m	TERMINATED AT 1.30 m						
						-				Refusal on Weathered Rock						-
						- 1.5										-
						-										-
						-										-
						-										-
						-										-
METHOD     PENETRATION       EX     Excavator bucket     PENETRATION       R     Ripper     Easy       HA     Hand auger     F       PT     Push tube     H       SON     Sonic drilling     VH       AH     Air hammer     VH       PS     Percussion sampler     AS       AD/T     Solid flight auger:     TC-Bit       HFA     Hollow flight auger     water inflow       WB     Washbore drilling     water outflow				F S F F II F	' FIELD T SPT - HP - DCP - PSP - MC - PBT - MP - PID - /S -	ESTS Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES           B         -         Buil           D         -         Dist           ES         -         Env           U         -         Thir           MOISTURE         -         Dry           D         -         Dry           M         -         Mois           W         -         Weit           PL         -         Plaq           LL         -         Lique           W         -         Mois	c disturbe urbed sar ironmenta n wall tube st stic limit id limit sture con	d sample mple al sample e 'undistu tent	rbed'	SOIL CON           VS         -           S         F         -           F         -         F           St         -         S           VS         -         N           H         -         H           RELATIVE         VL         -           VL         -         L           MD         -         M           D         -         L	ISISTENCY Very Soft Soft Tim Stiff tery Stiff tard E DENSITY Very Loose Joose Aedium Dense Dense Very Dense				
Re	Refer to explanatory notes for details of abbreviations and basis of descriptions STANTEC AUSTRALIA PTY LTD															

C	Stantec TEST PIT LOG SHEET												
Client: Walker Gillieston Heights Pty Ltd										Н	ole No: TP112		
Lo	catior	1: 4	157-5	27 Cessno	ck Road, Gillio	estor	n Heigh	ts	Job No: 304100964				Sheet: 1 of 1
Po	sition	: Ref	er to	Site Plan					Angle from Horizontal:	90°	5 	Surface	e Elevation:
Ex	cavat	ion D	e:5to imen	sions:	vator				Excavation Method: 60		nea BL (	icket Contra	ctor: Stantec Ptv Ltd
Da	te Exc	cavat	ed: 1	9/4/23					Logged By: JH		(	Checke	ed By:
E	xcava	tion		Samplin	ng & Testing				Materia	I Description			
Method	Resistance	Stability	Water	Sample Field Te	or st Blows/ 150 mm 3.6.9.12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle char. colour, secondary and minor comp ROCK TYPE, grain size and type, fabric & texture, strength, weathe defects and structure	acteristic, oonents colour, ering,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
									FILL: Silty Gravelly SAND: fine to me grained, dark brown, fine to coarse ro angular	edium ounded to	D		FILL
	F		ntered						Sitty CLAY: high plasticity, red mottle and brown, trace fine grained sand	ed pale grey	M (>PL)	St	RESIDUAL SOIL
- X3-		Stable	Not Encour			- 0.5			Silty Gravelly CLAY: medium plasticit brown-orange mottled grey and pale coarse angular to sub-angular	ty, grey, fine to	M ( <pl)< td=""><td>St - VSt</td><td>EXTREMELY WEATHERED</td></pl)<>	St - VSt	EXTREMELY WEATHERED
		_			(17/125mm)				0.90m				
200	н					- 1.0			grey, highly fractured, very low to low highly weathered	grey and pale v strength,			-
									1.10m TERMINATED AT 1.10 m Refusal on Weathered Rock				
0404													-
2													-
						- 1.5							-
	METHOD       PENETRATION         R       Ripper         HA       Hand auger         PT       Push tube         SON       Sonic drilling         AH       Air hammer         PS       Percussion sampler         AD/V       Solid flight auger: V-Bit         AD/T       Solid flight auger: Ct-Bit         HFA       Hollow flight auger         WB       Washbore drilling         RR       Rock roller			nce) Date	F S F D F N F II F V	FIELD TESTS         SPT       Standard Penetration Test         HP       Hand/Pocket Penetrometer         DCP       Dynamic Cone Penetrometer         SP       Perth Sand Penetrometer         MC       Moisture Content         PBT       Plate Bearing Test         MP       Borehole Impression Test         PID       Photoionisation Detector         S       Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	SAMPLES       B     -       D     -       D     -       ES     -       WOISTURE       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     -       D     - <th>c disturbe urbed sai ironment n wall tube sti t stic limit id limit sture con</th> <th>d sample mple al sample e 'undistu tent</th> <th>SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm VSt - Stiff VSt - Very Sliff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense</th>	c disturbe urbed sai ironment n wall tube sti t stic limit id limit sture con	d sample mple al sample e 'undistu tent	SOIL CONSISTENCY VS - Very Soft S - Soft F - Firm VSt - Stiff VSt - Very Sliff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense			
Reat	Refer to explanatory notes for details of abbreviations and basis of descriptions STANTEC AUSTRALIA PTY LTD												

## APPENDIX



## LABORATORY TEST RESULTS





# Laboratory Chain of Custody



Client Name	Stantec	Sampler	Jack Hanlon	Contact	Jack Hanlon	
	Suite 2, Level 2, 22 Honeysuckle Drive					
Client Address	Newcastle	Method	Test Pit	Mobile	0422206115	
Project Ref	304100808	Request by	Jack Hanlon	Email	jack.hanlon@cardno.com.au	
Project Name	South Gillieston Heights GI	Date	7/10/2022	Special		
Site Location	Gillieston Heights	Results by	Standard TAT	Requirements		
Component/Stage		Sample Hold		/ Comments		

							Tests Required			
						Soil				
						California Bearing Ratio				
						AS				
Sample #	Location	Depth	Date	Туре	Material Description	1289 6.1.1				
	TP02	0.4-0.6	5/10/22	Bulk Bag	Silty CLAY t gravel	√				
	TP04	0.5-0.65	5/10/22	Bulk Bag	Silty Sandy CLAY t gravel	✓				
	TP06	1.1-1.4	5/10/22	Bulk Bag	Silty Sandy CLAY	√				
	TP09	0.3-0.6	5/10/22	Bulk Bag	Silty CALY t sand t gravel	√				
	TP10	0.6-0.8	5/10/22	Bulk Bag	Silty CLAY t gravel	✓				
	TP11	0.6-0.9	5/10/22	Bulk Bag	Silty Sandy CLAY	√				

PRJ771047-1
1
25/10/2022
Stantec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4652
Sample Number:	M22-4652A
Date Sampled:	07/10/2022
Dates Tested:	11/10/2022 - 20/10/2022
Sample Location:	TP02, Depth: 0.4 - 0.6m

California Bearing Ratio (AS 1289 6.1.1 & 2.	.1.1)	Min	Max
CBR taken at	2.5 mm		
CBR %	6		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	AS 1289 5	.1.1 & 2	2.1.1
Method used to Determine Plasticity	Vis	sual	
Maximum Dry Density (t/m ³ )	1.60		
Optimum Moisture Content (%)	22.5		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.5		
Dry Density after Soaking (t/m ³ )	1.59		
Field Moisture Content (%)	23.5		
Moisture Content at Placement (%)	22.1		
Moisture Content Top 30mm (%)	24.8		
Moisture Content Rest of Sample (%)	23.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	145.2		_
Swell (%)	1.5		
Oversize Material (mm)	19	1	
Oversize Material Included	Excluded	1	
Oversize Material (%)	0		

Intrax Consulting Engineers Pty Ltd Morisset Laboratory Unit 2, 50 Alliance Avenue Morisset NSW 2264 Phone: 0499 779 118 Email: james.obrien@intrax.com.au



WORLD RECOGNISED ACCREDITATION

NATA

Approved Signatory: James O'Brien Laboratory Manager NATA Accredited Laboratory Number: 19862

#### California Bearing Ratio



PRJ771047-1
1
25/10/2022
Stantec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4652
Sample Number:	M22-4652B
Date Sampled:	07/10/2022
Dates Tested:	11/10/2022 - 20/10/2022
Sample Location:	TP04, Depth: 0.5 - 0.65m

California Bearing Ratio (AS 1289 6.1.1 & 2.	1.1)	Min	Max
CBR taken at	2.5 mm		
CBR %	6		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	AS 1289 5	.1.1 & 2	.1.1
Method used to Determine Plasticity	Vis	ual	
Maximum Dry Density (t/m ³ )	1.64		
Optimum Moisture Content (%)	20.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.0		
Dry Density after Soaking (t/m ³ )	1.64		
Field Moisture Content (%)	22.8		
Moisture Content at Placement (%)	19.4		
Moisture Content Top 30mm (%)	24.7		
Moisture Content Rest of Sample (%)	21.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	139.7		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Intrax Consulting Engineers Pty Ltd Morisset Laboratory Unit 2, 50 Alliance Avenue Morisset NSW 2264 Phone: 0499 779 118 Email: james.obrien@intrax.com.au



WORLD RECOGNISED ACCREDITATION

Approved Signatory: James O'Brien Laboratory Manager NATA Accredited Laboratory Number: 19862

#### California Bearing Ratio 1.8 1.6 1.4 Applied Load (kN) 8.0 9.0 0.6 0.4 0.2 0 2 12 13 5 6 8 9 10 11 0 3 4 7 1 Penetration (mm) **–** Results 🗰 2.5 🗰 5

PRJ771047-1
1
25/10/2022
Stantec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4652
Sample Number:	M22-4652C
Date Sampled:	07/10/2022
Dates Tested:	11/10/2022 - 24/10/2022
Sample Location:	TP06, Depth: 1.1 - 1.4m

California Bearing Ratio (AS 1289 6.1.1 & 2	.1.1)	Min	Max	
CBR taken at	5 mm			
CBR %	8			
Method of Compactive Effort	Star	ndard		
Method used to Determine MDD	AS 1289 5	.1.1 & 2	2.1.1	
Method used to Determine Plasticity	Vis	sual		
Maximum Dry Density (t/m ³ )	1.93			
Optimum Moisture Content (%)	12.5			
Laboratory Density Ratio (%)	99.5			
Laboratory Moisture Ratio (%)	98.0			
Dry Density after Soaking (t/m ³ )	1.90			
Field Moisture Content (%)	14.9			
Moisture Content at Placement (%)	12.3			
Moisture Content Top 30mm (%)	16.9			
Moisture Content Rest of Sample (%)	13.4			
Mass Surcharge (kg)	4.5			
Soaking Period (days)	4			
Curing Hours	148.5			
Swell (%)	1.0			
Oversize Material (mm)	19			
Oversize Material Included	Excluded			
Oversize Material (%)	0.0			



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Approved Signatory: James O'Brien Laboratory Manager NATA Accredited Laboratory Number: 19862

#### California Bearing Ratio

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Report Number:	PRJ771047-1
Issue Number:	1
Date Issued:	25/10/2022
Client:	Stantec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4652
Sample Number:	M22-4652D
Date Sampled:	07/10/2022
Dates Tested:	11/10/2022 - 24/10/2022
Sample Location:	TP09, Depth: 0.3 - 0.6m

California Bearing Ratio (AS 1289 6.1.1 & 2.	1.1)	Min	Max
CBR taken at	2.5 mm		
CBR %	3.0		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	AS 1289 5	.1.1 & 2	.1.1
Method used to Determine Plasticity	Vis	sual	
Maximum Dry Density (t/m ³ )	1.50		
Optimum Moisture Content (%)	25.5		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.5		
Dry Density after Soaking (t/m ³ )	1.48		
Field Moisture Content (%)	32.5		
Moisture Content at Placement (%)	25.1		
Moisture Content Top 30mm (%)	30.9		
Moisture Content Rest of Sample (%)	25.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	153.2		_
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



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RJ771047-1
5/10/2022
antec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4652
Sample Number:	M22-4652E
Date Sampled:	07/10/2022
Dates Tested:	11/10/2022 - 20/10/2022
Sample Location:	TP10, Depth: 0.6 - 0.8m

California Bearing Ratio (AS 1289 6.1.1 & 2.	1.1)	Min	Max
CBR taken at	2.5 mm		
CBR %	3.5		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	AS 1289 5	.1.1 & 2	.1.1
Method used to Determine Plasticity	Vis	ual	
Maximum Dry Density (t/m ³ )	1.51		
Optimum Moisture Content (%)	26.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m ³ )	1.49		
Field Moisture Content (%)	28.7		
Moisture Content at Placement (%)	26.4		
Moisture Content Top 30mm (%)	30.7		
Moisture Content Rest of Sample (%)	27.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	140.8		
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



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#### California Bearing Ratio



Report Number:	PRJ771047-1
Issue Number:	1
Date Issued:	25/10/2022
Client:	Stantec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4652
Sample Number:	M22-4652F
Date Sampled:	07/10/2022
Dates Tested:	11/10/2022 - 20/10/2022
Sample Location:	TP11, Depth: 0.6 - 0.9m

California Bearing Ratio (AS 1289 6.1.1 & 2	.1.1)	Min	Max	
CBR taken at	5 mm			
CBR %	7			
Method of Compactive Effort	Star	dard		
Method used to Determine MDD	AS 1289 5	.1.1 & 2	.1.1	
Method used to Determine Plasticity	Visual			
Maximum Dry Density (t/m ³ )	1.83			
Optimum Moisture Content (%)	14.5			
Laboratory Density Ratio (%)	100.0			
Laboratory Moisture Ratio (%)	99.5			
Dry Density after Soaking (t/m ³ )	1.81			
Field Moisture Content (%)	17.1			
Moisture Content at Placement (%)	14.3			
Moisture Content Top 30mm (%)	19.1			
Moisture Content Rest of Sample (%)	15.0			
Mass Surcharge (kg)	4.5			
Soaking Period (days)	4			
Curing Hours	139.8			
Swell (%)	1.0			
Oversize Material (mm)	19			
Oversize Material Included	Excluded			
Oversize Material (%)	0			



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Approved

NAT

Approved Signatory: James O'Brien Laboratory Manager NATA Accredited Laboratory Number: 19862

#### California Bearing Ratio



### Laboratory Chain of Custody



Client Name	Stantec	Sampler	Jack Hanlon	Contact	Jack Hanlon
	Suite 2, Level 2, 22 Honeysuckle Drive				
Client Address	Newcastle	Method	Test Pit	Mobile	0422206115
Project Ref	304100964	Request by	Jack Hanlon	Email	jack.hanlon@cardno.com.au
Project Name	South Gillieston Heights GI	Date	19/04/2023	Special	
Site Location	507 Main Road, Gillieston Heights	Results by	Standard TAT	Requirements /	
Component/Stage		Sample Hold		Comments	

						Tests Required				Notes	
						Soil	Soil	Soil	Soil		
						California Bearing Ratio	Atterberg Limits	Emerson Class Number	Permeability (Constant)		
						AS	AS	AS	AS		
Sample #	Location	Depth	Date	Туре	Material Description	1289 6.1.1	1289 3.3.1	1289 3.8.1	1289 6.7.1		
	TP104	0.5-0.7	19/04/23	Bulk Bag	Silty CLAY (RS)						
	TP104	1.0-1.3	19/04/23	Bulk Bag	Silty CLAY (EWM)						
	TP105	0.5-0.8	19/04/23	Bulk Bag	Silty CLAY (ALV)	$\checkmark$					
	TP109	1.8-2.0	19/04/23	Bulk Bag	Sandy CLAY (EWM)	$\checkmark$					

Report Number:	PRJ914989-1		
Issue Number:	1		
Date Issued:	11/05/2023		
Client:	Stantec Pty Ltd		

Contact:	Jack Hanlon
Project Number:	PRJ914989
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd - Gillieston Heights
Client Reference:	304100964
Work Request:	5865
Sample Number:	M23-5865A
Date Sampled:	19/04/2023
Dates Tested:	01/05/2023 - 05/05/2023
Sampling Method:	Sampled by Client - Tested as Received
	The results apply to the sample as received
Site Selection:	Selected by Client
Sample Location:	TP105 (0.5-0.8m)
Material:	Refer to Client logs
Material Source:	insitu





Trading as QGS Quality Geotechnical Services Pty Ltd Intrax Consulting Engineers Pty Ltd 8/34 Alliance Avenue Morisset NSW 2264 Phone: 0475 008 651 Email: steve.waugh@qgs.com Accredited for compliance with ISO/IEC 17025 - Testing

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Sta Hairy

Approved Signatory: Steve Waugh Managing Director NATA Accredited Laboratory Number: 19862

California Bearing Ratio (AS 1289 6.1.1 & 2.	.1.1)	win	Max
CBR taken at	2.5 mm		
CBR %	2.5		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	visual		
Maximum Dry Density (t/m ³ )	1.49		
Optimum Moisture Content (%)	27.5		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m ³ )	1.44		
Field Moisture Content (%)	28.1		
Moisture Content at Placement (%)	27.9		
Moisture Content Top 30mm (%)	36.0		
Moisture Content Rest of Sample (%)	30.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96.0		
Swell (%)	3.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		


### **Material Test Report**

Report Number:	PRJ914989-1
Issue Number:	1
Date Issued:	11/05/2023
Client:	Stantec Pty Ltd

Contact:	Jack Hanlon
Project Number:	PRJ914989
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd - Gillieston Heights
Client Reference:	304100964
Work Request:	5865
Sample Number:	M23-5865B
Date Sampled:	19/04/2023
Dates Tested:	01/05/2023 - 05/05/2023
Sampling Method:	Sampled by Client - Tested as Received
	The results apply to the sample as received
Site Selection:	Selected by Client
Sample Location:	TP109 (1.8-2.0m)
Material:	Refer to Client logs
Material Source:	insitu

California Bearing Ratio (AS 1289 6.1.1 & 2.	1.1)	IVIIN	Max
CBR taken at	2.5 mm		
CBR %	12		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.	.1.1 & 2	.1.1
Method used to Determine Plasticity	vis	ual	
Maximum Dry Density (t/m ³ )	1.83		
Optimum Moisture Content (%)	15.5		
Laboratory Density Ratio (%)	101.0		
Laboratory Moisture Ratio (%)	93.0		
Dry Density after Soaking (t/m ³ )	1.82		
Field Moisture Content (%)	15.1		
Moisture Content at Placement (%)	14.4		
Moisture Content Top 30mm (%)	17.0		
Moisture Content Rest of Sample (%)	16.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	97.0		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		





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Star Ward

Approved Signatory: Steve Waugh Managing Director NATA Accredited Laboratory Number: 19862



## **CHAIN OF CUSTODY - Stantec**

Client: St	Client: Stantec					Project Number - task : 304100808					
Contact	Berson: Kosta Suki	tic and lack h	lanlon		Project Name / Site atc (is report title):						
Contact	Person: Kosta Sykic	DUS and Jack P	lanion		South Gillieston Heights						
Project M	ngr: Kosta Sykiotis										
Sampler:	Jack Hanlon				Quote No. : Date results required:						
Address:	Suite 2, Level 2, 22	2 Honeysuckle	Drive Newcastle NS	w							
	1 Section 1	-			Or choose: stand	lard / sa	me day	/ 1 d	ay / 2	day / 3	day
Dhanas		Mahi	0422 206 115 (1ack)		Note: Inform lab in	advance	if urgen	nt turna	round i.	s requir	ed -
Phone:		MOD:	0422 200 115 (Jack)		Benort format: or	dat / or	uic /				_
Results and Invoice:	kosta.sykiotis@cardno.com.au jack.hanlon@cardno.com.au			Please hold No of initial result	on testin	ig sam	ples u	ntil o	ur revi	ew	
	Sa	mple informa	tion			Test	s Requ	uired			
Sample ID	Client Sample ID or information	Depth	Date sampled	<u>Type</u> of sampi £	Salinity Suite (CEC, ESP, Chloride, Sulfate, pH, EC, Resistivity and Sodicity)	Acid Sulfate - pH Field Screen	EC	рюн		3g	
	TP001 / ES:	0.05 - 0.10	5/10/2022	Soil		1		x		<u> </u>	-
	TP001 / ES:	0.10 - 0.20	5/10/2022	Soil				X			
	TP001 / ES:	0.25 - 0.35	5/10/2022	Soil				X			
	TP001 / ES:	0.85 - 0.90	5/10/2022	Soil			a seal	X			
	TP001 / ES:	1.00 - 1.15	5/10/2022	Soil				X			
	TP001 / ES:	1.25 - 1.30	5/10/2022	Soil	1			X			1.1
	TP002 / ES:	0.05 - 0.10	5/10/2022	Soil				X		1000	
	TP002 / ES:	0.20 - 0.30	5/10/2022	Soil			X		1000		1
	TP002 / ES:	1.20 - 1.40	5/10/2022	Soil			х				
1	TP004 / ES:	0.05 - 0.10	5/10/2022	Soil		X					
12.1.1	TP005 / ES:	0.20 - 0.40	5/10/2022	Soil		x	X				
	TP005 / ES:	0.50 - 0.60	5/10/2022	Soil		x					
	TP005 / ES:	1.40 - 1.50	5/10/2022	Soil				х			
12	TP006 / ES:	1.20 - 1.30	5/10/2022	Soil			X				
	TP007/ES:	0.05 - 0.10	5/10/2022	Soil			X	_			
-	TP007/ES:	0.65 - 0.80	5/10/2022	Soil			X				
	TP007/ES:	1.30 - 1.40	5/10/2022	Soil			X			-	
	TP011 / ES:	0.10 - 0.25	5/10/2022	Soil		x			-	-	
	TPO11/ES:	0.05 - 0.10	5/10/2022	Soil				X		-	
	IPUTI/ES:	0.45 - 0.55	5/10/2022	501		X			_	-	
				-						4	
				-							
-				-			_	_		-	-
Relinquis	telinguished by (Company): Stantos Div Ltd		Received by (Con	nany).		-					
ABN			17 007 820 222	8							
Print Nan	ne:	Jack Hanlon	17 007 620 322	-	Print Name:						
Date & Ti	me:	7/10/2022			Date & Time:						
Signature	e:		M		Signature:						

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### **CHAIN OF CUSTODY - Stantec**

Client: S	nt: Stantec Proje				Project Number - task : 304100808						
Contact I	Person: Kosta Sykk	otis and Jack H	lanion		Project Name / S	lte etc (	le repo	ort title	):		
Project M	Igr: Kosta Sykiotis				South Gillieston Heights						
Sampler	Tack Hanlon				Quete No. 1						
Address	Suite 2 Level 2 2		Datas Nasara di Ne		Date results requ	ired:		-			
Address:	Suite 2, Level 2, 2	2 Honeysuckie	Drive Newcastle NS	W	Or choose: stand	and / sa	me da	v / 1 d	av / 2	day /	3 day
					Note: Inform lab in	advance	if uraer	nt turna	round is	s reauli	red -
Phone:		Mob:	0422 206 115 (Jack)		surcharges apply					,	
					Report format: e	<u>sdat</u> / ec	juis /				
Results	kosta.sykiotis@	cardno.com.a	au		places had be						•
and Trivolce:	jack.hanlon@ca	rdno.com.au			Please noid No	n testir	ng sam	iples u		Jr revi	lew
					of initial result	S					
-	Sa	mple Informat	tion			Tes	s Regi	uired			
				1	ψ,	T					1
				Type	L D S S L L	ja E					
Sample	Client Sample ID	Douth	Data assured	of	E E E E	ste			<u>e</u>		
ID	or information	Depth	Date sampled	<u>sampl</u>	g st e c v	Sulf Id S	μŭ		운		
				e	Resi Sesi	Field					
					Sal	Ā					
	TP001 / ES:	0.05 - 0.10	5/10/2022	Soil					X		
	TP001 / ES:	0.10 - 0.20	5/10/2022	Soil					X		
	TP001 / ES:	0.25 - 0.35	5/10/2022	Soil					X		$\vdash$
	TP001 / ES:	0.85 - 0.90	5/10/2022	Soil					X		
	TP001/ES:	1.00 - 1.15	5/10/2022	Soil					X		
	TP001/ES:	1.25 - 1.30	5/10/2022	Soil	X			<u> </u>		<u> </u>	—
	TP0027ES.	0.03 - 0.10	5/10/2022	Soil				<u> </u>	X	<u> </u>	──
	TP002 / ES:	120 - 140	5/10/2022	Soil						<u> </u>	<u> </u>
	TP004 / ES:	0.05 - 0.10	5/10/2022	Soil					Ŷ		-
	TP005 / ES:	0.20 - 0.40	5/10/2022	Soil					Ŷ		<u> </u>
	TP005 / ES:	0.50 - 0.60	5/10/2022	Soil					x		<u> </u>
	TP005 / ES:	1.40 - 1.50	5/10/2022	Soil					x		
	TP006 / ES:	1.20 - 1.30	5/10/2022	Soil	x						
	TP007 / ES:	0.05 - 0.10	5/10/2022	Soil					X		
	TP007 / ES:	0.65 - 0.80	5/10/2022	Soil					X		
	TP007 / ES:	1.30 - 1.40	5/10/2022	Soil					X		
	TP008 / ES:	0.10 - 0.25	5/10/2022	Soil					X		
	TD011/ES:	0.05 - 0.10	5/10/2022	Soil					X		<u> </u>
	IPUTT/ES:	0.45 - 0.55	0/10/2022	501					X	<u> </u>	<u> </u>
	TP014	0.05-0.1	12/10/2022	Coil					~		<u> </u>
	TP014	0.25-0.35	12/10/2022	Soil					×		<u> </u>
	TP014	0.45-0.6	12/10/2022	Soil	x	x			-		
29	TP014	0.9-1.0	12/10/2022	Soil	^	~	x				<u> </u>
2.8	TP014	1.1-1.2	12/10/2022	Soil		x	-		-		
	TP014	1.4-1.5	12/10/2022	Soil		X		-			
	TP016	0.3-0.4	12/10/2022	Soil					x		
	TP018	0.3-0.6	12/10/2022	Soil					X		
	TP018	0.9-1.0	12/10/2022	Soil			0		X		
	TP018	1.2-1.3	12/10/2022	Soil			X				

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18/10/22 9:41 AM

Form: 302 - Chain of Custody-Client, Issued 22/05/12, Version 5, Page 1 of 1.

2/2

	TP020	0.5-0.6	12/10/2022	Soil				x			
	TP022	0.3-0.5	12/10/2022	Soil		X	X				
	TP022	0.6-0.8	12/10/2022	Soil	Х	X					
	TP022	1.2-1.4	12/10/2022	Soil		X					
	TP024	0.2-0.4	12/10/2022	Soil		X			_		
	TP028	0.05-0.1	12/10/2022	Soil		X					
	TP028	0.2-0.35	12/10/2022	Soil		X					
	TP028	1.0-1.2	12/10/2022	Soil	X	X					
						_	$ \downarrow \downarrow$		_		
				-		+	+				
Relingui	shed by (Com	pany):	Stantec Pty Ltd		Received by (Company):						
ABN:			17 007 820 322								
Print Na	me:	Jack Hanlon			Print Name: Jaidyn Slowym						
Date & 1	lime:	13/10/2022			Date & Time: 18/		122	9:9	( A	m	
Signatu	re:			Signature: )	m	~					

White - Lab copy / Blue - Client copy / Pink - Retain in Book

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

NATA Accredited Accreditation Number 1261 Site Number 20794



### **Environment Testing**

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NATA

Stantec Australia Pty Ltd Level 22, 570 Bourke Street Melbourne **VIC 3000** 

Kosta Sykiotis

Report Project name Project ID **Received Date** 

Attention:

930290-S SOUTH GILLIESTON HEIGHTS 304100808 Oct 07, 2022

Client Sample ID			TP002 / ES: 0.20 - 0.30	TP002 / ES: 1.20 - 1.40	TP004 / ES: 0.05 - 0.10	TP005 / ES: 0.20 - 0.40
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B22- Oc0017051	B22- Oc0017052	B22- Oc0017053	B22- Oc0017054
Date Sampled			Oct 05, 2022	Oct 05, 2022	Oct 05, 2022	Oct 05, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	16	79	-	< 10
% Moisture	1	%	13	6.7	-	15
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	-	6.2	6.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	-	3.3	4.1
Reaction Ratings* ^{S05}	0	-	-	-	4.0	2.0

Client Sample ID			TP005 / ES: 0.50 - 0.60	TP006 / ES: 1.20 - 1.30	TP007 / ES: 0.05 - 0.10	TP007 / ES: 0.65 - 0.80
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B22- Oc0017055	B22- Oc0017056	B22- Oc0017057	B22- Oc0017058
Date Sampled			Oct 05, 2022	Oct 05, 2022	Oct 05, 2022	Oct 05, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	56	12	41
% Moisture	1	%	-	12	14	14
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.1	-	-	-
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.5	-	-	-
Reaction Ratings* ^{S05}	0	-	2.0	-	-	-



Client Sample ID Sample Matrix			TP007 / ES: 1.30 - 1.40 Soil	TP008 / ES: 0.10 - 0.25 Soil	TP011 / ES: 0.45 - 0.55 Soil	TP014_0.45-0.6 Soil
Eurofins Sample No.			B22- Oc0017059	B22- Oc0017060	B22- Oc0017061	B22- Oc0039040
Date Sampled			Oct 05, 2022	Oct 05, 2022	Oct 05, 2022	Oct 12, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	48	-	-	34
% Moisture	1	%	15	-	-	-
Chloride	5	mg/kg	-	-	-	6.0
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	-	-	7.0
Resistivity*	0.5	ohm.m	-	-	-	120
Sulphate (as SO4)	30	mg/kg	-	-	-	92
Exchangeable Sodium Percentage (ESP)	0.1	%	-	-	-	0.2
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	6.2	6.1	6.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	2.9	4.7	4.6
Reaction Ratings* ^{S05}	0	-	-	3.0	3.0	3.0
Cation Exchange Capacity						
Cation Exchange Capacity	0.05	meq/100g	-	-	-	33

Client Sample ID			TP014_0.9-1.0	TP014_1.1-1.2	TP014_1.4-1.5	TP018_1.2-1.3
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B22- Oc0039041	B22- Oc0039042	B22- Oc0039043	B22- Oc0039047
Date Sampled			Oct 12, 2022	Oct 12, 2022	Oct 12, 2022	Oct 12, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	94	-	-	110
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	-	5.2	5.7	-
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	-	4.3	4.5	-
Reaction Ratings* ^{S05}	0	-	-	2.0	1.0	-

Client Sample ID Sample Matrix Eurofins Sample No.			TP022_0.3-0.5 Soil B22- Oc0039049	TP022_0.6-0.8 Soil B22- Oc0039050	TP022_1.2-1.4 Soil B22- Oc0039051	TP024_0.2-0.4 Soil B22- Oc0039052
Date Sampled			Oct 12, 2022	Oct 12, 2022	Oct 12, 2022	Oct 12, 2022
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	< 10	780	-	-
Chloride	5	mg/kg	-	270	-	-
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	5.4	-	-
Resistivity*	0.5	ohm.m	-	13	-	-
Sulphate (as SO4)	30	mg/kg	-	56	-	-
Exchangeable Sodium Percentage (ESP)	0.1	%	-	19	-	-
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.5	5.2	5.4	6.2
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.4	4.0	3.9	3.8
Reaction Ratings* ^{S05}	0	-	3.0	2.0	1.0	2.0
Cation Exchange Capacity						
Cation Exchange Capacity	0.05	meq/100g	-	19	-	-



Client Sample ID Sample Matrix Eurofins Sample No.			TP028_0.05-0.1 Soil B22- Oc0039053	TP028_1.0-1.2 Soil B22- Oc0039055	TP028_0.2-0.35 Soil B22- Oc0039129
	LOR	Unit	OCT 12, 2022	OCT 12, 2022	Oct 12, 2022
	Lon	Onit			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	-	130	-
Chloride	5	mg/kg	-	< 5	-
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	-	8.0	-
Resistivity*	0.5	ohm.m	-	79	-
Sulphate (as SO4)	30	mg/kg	-	< 30	-
Exchangeable Sodium Percentage (ESP)	0.1	%	-	3.5	-
Acid Sulfate Soils Field pH Test					
pH-F (Field pH test)*	0.1	pH Units	6.1	8.4	6.4
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.3	8.8	4.6
Reaction Ratings* ^{S05}	0	-	4.0	4.0	4.0
Cation Exchange Capacity					
Cation Exchange Capacity	0.05	meq/100g	-	21	-



### Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Melbourne	Oct 27, 2022	7 Days
- Method: LTM-INO-4030 Conductivity			
Exchangeable Sodium Percentage (ESP)	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-MET-3060 - Cation Exchange Capacity (CEC) & Exchangeable Sodium Percentage (ESP)			
% Moisture	Brisbane	Oct 11, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			
Chloride	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
pH (1:5 Aqueous extract at 25 °C as rec.)	Brisbane	Oct 25, 2022	7 Days
- Method: APHA 4500-H+ B. Electrometric Method			
Sulphate (as SO4)	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Acid Sulfate Soils Field pH Test	Brisbane	Oct 25, 2022	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			
Cation Exchange Capacity	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-MET-3060 Cation Exchange Capacity by bases & Exchangeable Sodium Percentage			

### **Repeat Samples**

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Melbourne	Oct 27, 2022	7 Days
- Method: LTM-INO-4030 Conductivity			
Exchangeable Sodium Percentage (ESP)	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-MET-3060 - Cation Exchange Capacity (CEC) & Exchangeable Sodium Percentage (ESP)			
% Moisture	Brisbane	Oct 11, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			
Chloride	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
pH (1:5 Aqueous extract at 25 °C as rec.)	Brisbane	Oct 25, 2022	7 Days
- Method: APHA 4500-H+ B. Electrometric Method			
Sulphate (as SO4)	Melbourne	Oct 27, 2022	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Acid Sulfate Soils Field pH Test	Brisbane	Oct 25, 2022	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			
Cation Exchange Capacity	Melbourne	Oct 27, 2022	28 Days

- Method: LTM-MET-3060 Cation Exchange Capacity by bases & Exchangeable Sodium Percentage

	ABN: 50 005 085 521				Pty Ltd	d											Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Environm	ent Testing NZ Ltd	
web: www.eurofins.com.au email: EnviroSales@eurofins.com		.com	Melbourne         Geelong         Seelong         Seelong		Sydney 179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 1821		Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091		t 1/ M Q 1 Te N	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794			Newc 4/52 I Mayfiu PO Bo Tel: + 4 NATA	castle Industrial Drive ield East NSW 2304 iox 60 Wickham 2293 •61 2 4968 8448 A# 1261 Site# 25079	Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: 0800 856 450 IANZ# 1290			
Co Ad	mpany Name: dress:	Stantec Aus Level 22, 57 Melbourne VIC 3000	tralia Pty Ltd 0 Bourke Str	(NSW/A eet	ACT)			O Re Pi Fa	rder N eport hone: ax:	lo.: #:	ę	3029	0					Received: Due: Priority: Contact Name:	Oct 7, 2022 3:00 P Oct 25, 2022 5 Day Kosta Sykiotis	Μ
Pro Pro	oject Name: oject ID:	SOUTH GIL 304100808	LIESTON HE	EIGHTS													Euro	fins Analytical Servic	es Manager : Hanr	nah Mawbey
		Sa	ample Detail				Chloride	Conductivity (1:5 aqueous extract at 25 °C as rec.)	HOLD	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Acid Sulfate Soils Field pH Test	Moisture Set	Cation Exchange Capacity	Exchangeable Sodium Percentage (ESP)				
Mell	ourne Laborato	ory - NATA # 12	261 Site # 12	54			Х			~	X	Х			X	X				
Bris	bane Laboratory	y - NATA # 126	1 Site # 2079	94				X	X	X			X	X	X	X				
No	Sample ID	Sample Date	Sampling Time	Ма	trix LAB	ID											-			
1	TP002 / ES: 0.20 - 0.30	Oct 05, 2022		Soil	B22-Oc0	017051		x						x						
2	TP002 / ES: 1.20 - 1.40	Oct 05, 2022		Soil	B22-Oc0	017052		x						x						
3	TP004 / ES: 0.05 - 0.10	Oct 05, 2022		Soil	B22-Oc0	017053							х							
4	TP005 / ES: 0.20 - 0.40	Oct 05, 2022		Soil	B22-Oc0	017054		х					х	х						
5	TP005 / ES: 0.50 - 0.60	Oct 05, 2022		Soil	B22-Oc0	017055							x							
6	TP006 / ES: 1.20 - 1.30	Oct 05, 2022		Soil	B22-Oc0	017056		x						х						
7	TP007 / ES: 0.05 - 0.10	Oct 05, 2022		Soil	B22-Oc0	017057		x						Х						

			Eurofins Environme	I <mark>rofins Environment Testing Australia Pty Ltd</mark> IN: 50 005 085 521													Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Environment Testing NZ Ltd NZBN: 9429046024954		
web: www.eurofins.com.au email: EnviroSales@eurofins.com		Melbourne         Geelong         Sy           6 Monterey Road         19/8 Lewalan Street         17           Dandenong South         Grovedale         Gi           VIC 3175         VIC 3216         NS           Tel: +61 3 8564 5000         Tel: +61 3 8564 5000         Tel: +61 3 8564 5000           NATA# 1261 Site# 1254         NATA# 1261 Site# 1254         NATA# 1261 Site# 1254			Sydney 179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 182			Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 217			Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794			Newo 4/52 Mayfi PO B Tel: + 94 NATA	castle Industrial Drive ield East NSW 2304 iox 60 Wickham 2293 r61 2 4968 8448 A# 1261 Site# 25079	Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: 0800 856 450 IANZ# 1290		
Co Ao	ompany Name: Idress:	Stantec Aus Level 22, 5 Melbourne VIC 3000	stralia Pty Ltd (NSW 70 Bourke Street	//ACT)			Or Re Ph Fa	der N eport none: ix:	lo.: #:	ç	93029	0					Received: Due: Priority: Contact Name:	Oct 7, 2022 3:00 P Oct 25, 2022 5 Day Kosta Sykiotis	Μ	
Pr Pr	oject Name: oject ID:	SOUTH GII 304100808	LIESTON HEIGHT	S												Euro	fins Analytical Servic	es Manager : Hanr	nah Mawbey	
		S	ample Detail			Chloride	Conductivity (1:5 aqueous extract at 25 °C as rec.)	HOLD	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Acid Sulfate Soils Field pH Test	Moisture Set	Cation Exchange Capacity	Exchangeable Sodium Percentage (ESP)					
Mel	bourne Laborate	ory - NATA # 1	261 Site # 1254			Х				Х	х			х	x	_				
Bris	bane Laborator	y - NATA # 126	51 Site # 20794				X	Х	X			X	X	Х	X	_				
8	TP007 / ES: 0.65 - 0.80	Oct 05, 2022	Soil	B22-Oc00	17058		x						x			_				
9	TP007 / ES: 1.30 - 1.40	Oct 05, 2022	Soil	B22-Oc00	17059		х						х							
10	TP008 / ES: 0.10 - 0.25	Oct 05, 2022	Soil	B22-Oc00	17060							x								
11	TP011 / ES: 0.45 - 0.55	Oct 05, 2022	Soil	B22-Oc00	17061							x								
12	TP001 / ES: 0.05 - 0.10	Oct 05, 2022	Soil	B22-Oc00	17062			х												
13	TP001 / ES: 0.10 - 0.20	Oct 05, 2022	Soil	B22-Oc00	17063			х												
14	TP001 / ES: 0.25 - 0.35	Oct 05, 2022	Soil	B22-Oc00	)17064			х								1				
15	TP001 / ES: 0.85 - 0.90	Oct 05, 2022	Soil	B22-Oc00	17065			х								1				
16	TP001 / ES: 1.00 - 1.15	Oct 05, 2022	Soil	B22-Oc00	17066			х								]				

	Eurofins Environment Testing Australia Pty L ABN: 50 005 085 521				Pty Ltd									Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Environment Testing NZ Ltd NZBN: 9429046024954				
web: www.eurofins.com.au email: EnviroSales@eurofins.com		com	Melbourne         Geelong           6 Monterey Road         19/8 Lewalan Street           Dandenong South         Grovedale           VIC 3175         VIC 3216           Tel: +61 3 8564 5000         Tel: +61 3 8564 5000           NATA# 1261 Site# 1254         NATA# 1261 Site# 1254			Sydney 179 Magowar Road Girraween NSW 2145 Tel: +61 2 9900 8400 NATA# 1261 Site# 1821			Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 217			Brisbane           1/21 Smallwood Place           Murarrie           QLD 4172           Tel: +61 7 3902 4600           NATA# 1261 Site# 20794			Newo 4/52   Mayfi PO B Tel: + 04 NATA	castle Industrial Drive ield East NSW 2304 iox 60 Wickham 2293 •61 2 4968 8448 A# 1261 Site# 25079	Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: 0800 856 450 IANZ# 1290
Co Ad	mpany Name: dress:	Stantec Aus Level 22, 57 Melbourne VIC 3000	stralia Pty Ltd (NS) 70 Bourke Street	V/ACT)			Oi Re Pl Fa	rder N eport none: ax:	lo.: #:	ę	93029	0					Received: Due: Priority: Contact Name:	Oct 7, 2022 3:00 P Oct 25, 2022 5 Day Kosta Sykiotis	М
Pro Pro	oject Name: oject ID:	SOUTH GIL 304100808	LIESTON HEIGH	rs												Euro	fins Analytical Servic	es Manager : Hanr	nah Mawbey
		S	ample Detail			Chloride	Conductivity (1:5 aqueous extract at 25 °C as rec.)	HOLD	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Acid Sulfate Soils Field pH Test	Moisture Set	Cation Exchange Capacity	Exchangeable Sodium Percentage (ESP)				
Mell	oourne Laborato	ory - NATA # 1	261 Site # 1254			X				X	Х			Х	X	_			
Bris	bane Laboratory	y - NATA # 126	1 Site # 20794				X	Х	X			X	Х	Х	X	_			
17	TP001 / ES: 1.25 - 1.30	Oct 05, 2022	Soil	B22-Oc00	017067			х											
18	TP002 / ES: 0.05 - 0.10	Oct 05, 2022	Soil	B22-Oc00	017068			х											
19	TP005 / ES: 1.40 - 1.50	Oct 05, 2022	Soil	B22-Oc00	017069			х											
20	TP011 / ES: 0.05 - 0.10	Oct 05, 2022	Soil	B22-Oc00	017070			х											
21	TP014_0.05- 0.1	Oct 12, 2022	Soil	B22-Oc00	039038			х											
22	TP014_0.25- 0.35	Oct 12, 2022	Soil	B22-Oc00	039039			х											
23	TP014_0.45- 0.6	Oct 12, 2022	Soil	B22-Oc00	039040	х			х	х	х	х		х	х				
24	TP014_0.9-1.0	Oct 12, 2022	Soil	B22-Oc00	039041		Х									1			
25	TP014_1.1-1.2	Oct 12, 2022	Soil	B22-Oc00	039042							X				]			
26	TP014_1.4-1.5	Oct 12, 2022	Soil	B22-Oc00	039043							Х							

Eurofins Environment Testing Australia Pty Lto ABN: 50 005 085 521					Pty Ltd									Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Environment Testing NZ Ltd NZBN: 9429046024954				
web: www.eurofins.com.au email: EnviroSales@eurofins.com		Melbourne         Geelong         Sydney           6 Monterey Road         19/8 Lewalan Street         179 Mag           Dandenong South         Grovedale         Girrawe           VIC 3175         VIC 3216         NSW 21           Tel: +61 3 8564 5000         Tel: +61 3 8564 5000         Tel: +61           NATA# 1261 Site# 1254         NATA# 1261 Site# 1254         NATA#			ydney 79 Magowar Road irraween SW 2145 el: +61 2 9900 8400 ATA# 1261 Site# 18217			Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 Tel: +61 2 6113 8091 7		t 1, N Q 1 T	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 20794			Newo 4/52 I Mayfi PO B Tel: + 94 NATA	castle Industrial Drive eld East NSW 2304 ox 60 Wickham 2293 -61 2 4968 8448 \# 1261 Site# 25079	Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: 0800 856 450 IANZ# 1290	
Cc Ac	ompany Name: Idress:	Stantec Aus Level 22, 5 Melbourne VIC 3000	stralia Pty Ltd (NSW 70 Bourke Street	//ACT)			O Re Pl Fa	rder N eport hone: ax:	No.: #:	ç	93029	0					Received: Due: Priority: Contact Name:	Oct 7, 2022 3:00 P Oct 25, 2022 5 Day Kosta Sykiotis	Μ
Pr Pr	oject Name: oject ID:	SOUTH GII 304100808	LIESTON HEIGHT	S												Euro	fins Analytical Servic	es Manager : Hanr	nah Mawbey
		S	ample Detail			Chloride	Conductivity (1:5 aqueous extract at 25 °C as rec.)	HOLD	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Acid Sulfate Soils Field pH Test	Moisture Set	Cation Exchange Capacity	Exchangeable Sodium Percentage (ESP)				
Mell	oourne Laborato	ory - NATA # 1	261 Site # 1254			Х				X	X			X	X	-			
Bris	bane Laborator	y - NATA # 126	51 Site # 20794				X	Х	X			X	X	X	X	-			
27	IP016_0.3-0.4	Oct 12, 2022	Soil	B22-Oc00	039044			X							-	4			
28	TP018_0.3-0.6	Oct 12, 2022	Soil	B22-Oc00	39045			X								4			
29		Oct 12, 2022	Soil	B22-Oc00	039046			X								4			
30	TP018_1.2-1.3	Oct 12, 2022	Soil	B22-OCU	039047		_ ^	v								-			
32	TP022_0.3-0.5	Oct 12, 2022	Soil	B22-000	30040		x					× ×				-			
32	TP022_0.3-0.3	Oct 12, 2022	Soil	B22-Oc00	39049	x			x	×	x			x	x	-			
34	TP022_0.0-0.0	Oct 12, 2022	Soil	B22-000	139050	~						X				-			
35	TP024_02-04	Oct 12, 2022	Soil	B22-Oc00	39052							X				-			
36	TP028_0.05- 0.1	Oct 12, 2022	Soil	B22-Oc00	)39053							x				-			
37	TP028_1.0-1.2	Oct 12, 2022	Soil	B22-Oc00	039055	Х			Х	Х	Х	X		Х	X	1			
38	TP028_0.2- 0.35	Oct 12, 2022	Soil	B22-Oc00	039129							x							
Test	t Counts					3	10	15	3	3	3	15	7	3	3				



### Internal Quality Control Review and Glossary

#### General

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

### **Holding Times**

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

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA. If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

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

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

### Units

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

#### Terms

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

### **QC** - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

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

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

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

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

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

### **QC Data General Comments**

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



### **Quality Control Results**

Test		Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code	
Method Blank									
Chloride			mg/kg	< 5			5	Pass	
Sulphate (as SO4)			mg/kg	< 30			30	Pass	
Method Blank									
Cation Exchange Capacity									
Cation Exchange Capacity			meq/100g	< 0.05			0.05	Pass	
LCS - % Recovery									
Chloride			%	111			70-130	Pass	
Sulphate (as SO4)			%	110			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	B22-Oc0017054	СР	uS/cm	< 10	< 10	<1	30%	Pass	
% Moisture	B22-Oc0017054	CP	%	15	15	<1	30%	Pass	
Duplicate	•								
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B22-Oc0017060	CP	pH Units	6.2	6.2	pass	20%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Exchangeable Sodium Percentage (ESP)	B22-Oc0039040	СР	%	0.2	< 0.1	95	30%	Fail	Q15
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B22-Oc0039040	CP	pH Units	6.7	6.9	pass	20%	Pass	
Duplicate									
Cation Exchange Capacity		-		Result 1	Result 2	RPD			
Cation Exchange Capacity	B22-Oc0039040	CP	meq/100g	33	33	1.3	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Exchangeable Sodium Percentage (ESP)	B22-Oc0039050	СР	%	19	19	1.0	30%	Pass	
Duplicate									
Cation Exchange Capacity				Result 1	Result 2	RPD			
Cation Exchange Capacity	B22-Oc0039050	CP	meq/100g	19	17	11	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B22-Oc0039055	CP	pH Units	8.4	8.3	pass	20%	Pass	



### Comments

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

### **Qualifier Codes/Comments**

 Code
 Description

 Q15
 The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

 S05
 Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

### Authorised by:

Hannah Mawbey	Analytical Services Manager
Jonathon Angell	Senior Analyst-Inorganic
Jonathon Angell	Senior Analyst-Sample Properties
Mary Makarios	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Metal
Myles Clark	Senior Analyst-SPOCAS
Scott Beddoes	Senior Analyst-Metal

All

Glenn Jackson General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

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From: Jack Hanlon <jack.hanlon@cardno.com.au> Sent: Tuesday, 18 October 2022 10:29 AM To: Roberto Biviano <RobertoBiviano@eurofins.com> Cc: Kostandreas Sykiotis <Kosta.Sykiotis@cardno.com.au> Subject: RE: Eurofins Test Results, Invoice - Report 930290 : Site SOUTH GILLIESTON HEIGHTS (304100808)

CAUTION: EXTERNAL EMAIL - Sent from an email domain that is not formally trusted by Eurofins.

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DHOC 007, BSOCIOI

Hi Roberto thank you for the results,

Could I please request detailed ASS testing (Chromium Reducible Sulfur Scr Suite) on the following samples;

TP004 / ES: 0.05 - 0.10 m

TP008 / ES: 0.10 - 0.25 m

25 m Oc 0017060

010017053

Kind regards,

Jack Hanlon Graduate Engineer

jack.hanlon@cardno.com.au

Stantec Australia Suite 22, Level 2, 22 Honeysuckle Drive Newcastle New South Wales 2300 Australia

Cardno " () Stantec

### f 🖸 🛅

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Please consider the environment before printing this email.
 From: <u>RobertoBiviano@eurofins.com</u> <<u>RobertoBiviano@eurofins.com</u>>
 Sent: Friday, 14 October 2022 5:56 PM
 To: Kostandreas Sykiotis <<u>Kosta.Sykiotis@cardno.com.au</u>>
 Cc: Jack Hanlon <<u>jack.hanlon@cardno.com.au</u>>
 Subject: Eurofins Test Results, Invoice - Report 930290 : Site SOUTH GILLIESTON HEIGHTS (304100808)

## #934161



Stantec Australia Pty Ltd Level 22, 570 Bourke Street Melbourne VIC 3000



NATA Accreditatio

NATA Accredited Accreditation Number 1261 Site Number 20794

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

### Attention:

Jack Hanlon

Report Project name Project ID Received Date **934161-S** SOUTH GILLIESTON HEIGHTS 304100808 Oct 18, 2022

Client Sample ID			TP004 / ES: 0.05 - 0.10	TP008 / ES: 0.10 - 0.25
Sample Matrix			Soil	Soil
Eurofins Sample No.			B22- Oc0047111	B22- Oc0047112
Date Sampled			Oct 05, 2022	Oct 05, 2022
Test/Reference	LOR	Unit		
Actual Acidity (NLM-3.2)				
pH-KCL (NLM-3.1)	0.1	pH Units	5.6	5.0
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.013	0.024
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	8.3	15
Potential Acidity - Chromium Reducible Sulfur				
Chromium Reducible Sulfur (s-SCr) (NLM-2.1) ^{S04}	0.005	% S	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3
Extractable Sulfur				
Sulfur - KCI Extractable	0.005	% S	N/A	N/A
HCI Extractable Sulfur	0.005	% S	N/A	N/A
Retained Acidity (S-NAS)				
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1 ^{S02}	0.02	% S	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	N/A
HCI Extractable Sulfur Correction Factor	1	factor	2.0	2.0
Acid Neutralising Capacity (ANCbt)				
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2) ^{S03}	0.02	% S	N/A	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	N/A
ANC Fineness Factor		factor	1.5	1.5
Net Acidity (Including ANC)				
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	< 10	15
CRS Suite - Liming Rate - NASSG (Including ANC) ^{S01}	1	kg CaCO3/t	< 1	1.1
Extraneous Material				
<2mm Fraction	0.005	g	44	47
>2mm Fraction	0.005	g	< 0.005	< 0.005
Analysed Material	0.1	%	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1
% Moisture	1	%	9.5	9.4



### Sample History

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

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

Description	Tacting Site	Extracted	Holding Time
	resting Site	Extracted	Holding Time
Chromium Reducible Sultur Sulte			
Chromium Suite	Brisbane	Oct 27, 2022	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Oct 27, 2022	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Oct 24, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			

Eurofins Environment Testing Australia Pty Ltd ABN: 50 005 085 521										Eurofins ARL Pty Ltd	Eurofins Environment Testing NZ Ltd		
eurorins		rins	Melbourne Geelong 6 Monterey Road 19/8 Lewalan Street Dandenong South Grovedale		alan Street 179 Ma e Girrawe	Sydney 179 Magowar Road Girraween		Canberra Unit 1,2 Dacre Street Mitchell	Brisbane 1/21 Smallwood Place Murarrie	Newcastle 4/52 Industrial Drive Mayfield East NSW 2304	Perth 46-48 Banksia Road Welshpool	Auckland 35 O'Rorke Road Penrose,	Christchurch 43 Detroit Drive Rolleston,
web: v email:	www.eurofins.com.au : EnviroSales@eurofins	.com	VIC 3175 Tel: +61 3 8564 5 NATA# 1261 Site	VIC 3216 000 Tel: +61 3 # 1254 NATA# 1	i NSW 2 3 8564 5000 Tel: +6 261 Site# 1254 NATA#	145 1 2 9900 1261 Site	8400 e# 182	ACT 2911 Tel: +61 2 6113 8091 217	QLD 4172 Tel: +61 7 3902 4600 NATA# 1261 Site# 2079	PO Box 60 Wickham 2293 Tel: +61 2 4968 8448 44 NATA# 1261 Site# 25079	WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 7675 Tel: 0800 856 450 IANZ# 1290
Co Ao	ompany Name: ddress:	Stantec Aus Level 22, 57 Melbourne VIC 3000	stralia Pty Ltd ( ′0 Bourke Stre	NSW/ACT) eet			C R F	Drder No.: Report #: 934 Phone: Fax:	4161		Received: Due: Priority: Contact Name:	Oct 18, 2022 10:29 Oct 25, 2022 5 Day Jack Hanlon	) AM
Pr Pr	oject Name: oject ID:	SOUTH GIL 304100808	LIESTON HE	IGHTS						Euro	ofins Analytical Servic	es Manager : Hanı	nah Mawbey
		Sa	ample Detail			Chromium Reducible Sulfur Suite	Moisture Set						
Bris	sbane Laboratory	y - NATA # 126	1 Site # 2079	4		X	X	_					
Exte	ernal Laboratory	Sample Data	Sompling	Motrix			-	-					
NO	Sample ID	Sample Date	Time	Watrix									
1	TP004 / ES: 0.05 - 0.10	Oct 05, 2022		Soil	B22-Oc0047111	x	x						
2	TP008 / ES: 0.10 - 0.25	Oct 05, 2022		Soil	B22-Oc0047112	2 x	х						
Tes	t Counts		•		•	2	2						



### Internal Quality Control Review and Glossary

#### General

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

### **Holding Times**

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

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA. If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

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

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

### Units

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

#### Terms

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

### **QC** - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

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

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

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

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

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

### **QC Data General Comments**

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



### **Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code		
LCS - % Recovery									
Actual Acidity (NLM-3.2)									
pH-KCL (NLM-3.1)			%	97			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)			%	100			80-120	Pass	
LCS - % Recovery								•	
Potential Acidity - Chromium Redu	ucible Sulfur								
Chromium Reducible Sulfur (s-SCr)	(NLM-2.1)		%	100			80-120	Pass	
LCS - % Recovery	×/								
Extractable Sulfur									
HCI Extractable Sulfur			%	113			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate					<u> </u>				
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	L22-Oc0051820	NCP	pH Units	8.9	8.9	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-Oc0051820	NCP	% pvrite S	< 0.003	< 0.003	<1	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	L22-Oc0051820	NCP	mol H+/t	< 2	< 2	<1	20%	Pass	
Duplicate					·				
Potential Acidity - Chromium Redu	ucible Sulfur			Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr)									
(NLM-2.1) Chromium Reducible Sulfur (a-SCr)	L22-Oc0051820	NCP	% S	0.19	0.19	<1	20%	Pass	
(NLM-2.1)	L22-Oc0051820	NCP	mol H+/t	120	120	<1	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCI Extractable	L22-Oc0051820	NCP	% S	N/A	N/A	N/A	30%	Pass	
HCI Extractable Sulfur	L22-Oc0051820	NCP	% S	N/A	N/A	<1	20%	Pass	
Duplicate								-	
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	L22-Oc0051820	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	L22-Oc0051820	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	L22-Oc0051820	NCP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt	)			Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	L22-Oc0051820	NCP	% CaCO3	1.4	1.2	14	20%	Pass	
Acid Neutralising Capacity - (s- ANCbt) (NLM-5.2)	L22-Oc0051820	NCP	% S	0.44	0.38	14	30%	Pass	
ANC Fineness Factor	L22-Oc0051820	NCP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-Oc0051820	NCP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	L22-Oc0051820	NCP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	L22-Oc0051820	NCP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B22-Oc0047649	NCP	%	8.9	8.5	5.1	30%	Pass	
				- • •					·



### Comments

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

### **Qualifier Codes/Comments**

Code Description

0000	
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

### Authorised by:

 Bonnie Pu
 Ar

 Jonathon Angell
 Se

 Jonathon Angell
 Se

 Myles Clark
 Se

Analytical Services Manager Senior Analyst-Sample Properties Senior Analyst-SPOCAS Senior Analyst-SPOCAS

Glenn Jackson General Manager

Final Report - this report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

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From:	Jack Hanlon
Sent:	Thursday, 27 October 2022 5:08 PM
То:	BonniePu@eurofins.com; Kostandreas Sykiotis
Subject:	RE: Eurofins Test Results, Invoice - Report 930290 : Site SOUTH
	GILLIESTON HEIGHTS (304100808)

Hi Bonnie thank you for the results,

Could I please request detailed ASS testing (Chromium Reducible Sulfur Scr Suite) on the following samples;

TP022 / ES: 0.30 - 0.50 m

TP022 / ES: 0.60 - 0.80 m

TP024 / ES: 0.20 - 0.40 m

TP028 / ES: 0.05 – 0.10 m

Standard 5 day TAT is fine.

Kind regards,

### **Jack Hanlon**

Graduate Engineer

### jack.hanlon@cardno.com.au

Stantec Australia Suite 22, Level 2, 22 Honeysuckle Drive Newcastle New South Wales 2300 Australia





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Please consider the environment before printing this email.

From: BonniePu@eurofins.com <BonniePu@eurofins.com>
Sent: Thursday, 27 October 2022 4:16 PM
To: Kostandreas Sykiotis <<u>Kosta.Sykiotis@cardno.com.au</u>>
Cc: Jack Hanlon <<u>jack.hanlon@cardno.com.au</u>>
Subject: Eurofins Test Results, Invoice - Report 930290 : Site SOUTH GILLIESTON HEIGHTS (304100808)

### Hi Kostandreas

Please find the attached draft report as discussed



Stantec Australia Pty Ltd Level 22, 570 Bourke Street Melbourne **VIC 3000** 

Kosta Sykiotis

Report Project name Project ID **Received Date** 

Attention:

936167-S SOUTH GILLIESTON HEIGHTS 304100808 Oct 27, 2022

Client Sample ID			TP022 / ES: 0.30 - 0.50 M	TP022 / ES: 0.60 - 0.80 M	TP024 / ES: 0.20 - 0.40 M	TP028 / ES: 0.05 - 0.10 M
Sample Matrix			Soil	Soil	Soil	Soil
			B22-	B22-	B22-	B22-
Eurofins Sample No.			Oc0063190	Oc0063191	Oc0063192	Oc0063193
Date Sampled			Oct 05, 2022	Oct 05, 2022	Oct 05, 2022	Oct 05, 2022
Test/Reference	LOR	Unit				
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	5.1	4.4	4.5	6.5
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.020	0.12	0.095	< 0.003
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	12	74	59	< 2
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1) ^{S04}	0.005	% S	< 0.005	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	< 3	< 3	< 3	< 3
Extractable Sulfur						
Sulfur - KCI Extractable	0.005	% S	N/A	0.023	< 0.005	N/A
HCI Extractable Sulfur	0.005	% S	N/A	0.031	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.02	% S	N/A	< 0.02	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1 ^{S02}	0.02	% S	N/A	< 0.02	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	10	mol H+/t	N/A	< 10	N/A	N/A
HCI Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	N/A	N/A	0.24
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2) ^{S03}	0.02	% S	N/A	N/A	N/A	0.08
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	N/A	N/A	47
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	< 0.02	0.13	0.10	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	12	82	59	< 10
CRS Suite - Liming Rate - NASSG (Including ANC) ^{S01}	1	kg CaCO3/t	< 1	6.1	4.5	< 1
Extraneous Material		-				
<2mm Fraction	0.005	g	51	27	33	28
>2mm Fraction	0.005	g	< 0.005	3.5	5.1	< 0.005
Analysed Material	0.1	%	100	88	87	100
Extraneous Material	0.1	%	< 0.1	12	13	< 0.1
				ļ		
% Moisture	1	%	14	22	19	19



NATA Accredited Accreditation Number 1261 Site Number 20794

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



### Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Nov 03, 2022	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Nov 02, 2022	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Oct 28, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			

		<b>C:</b>	Eurofins Env	ironmen 5 521	t Testing Australia	Pty Ltd						Eurofins ARL Pty Ltd	Eurofins Environm	ent Testing NZ Ltd
Melbourne       Geelong       Sydney         6 Monterey Road       19/8 Lewalan Street       179 Mag         Dandenong South       Grovedale       Girrawer         VIC 3175       VIC 3216       NSW 21         Tel: +61 3 8564 5000       Tel: +61 3 8564 5000       Tel: +61 3 8564 5000         NATA# 1261 Site# 1254       NATA# 1261 Site# 1254       NATA# 1261 Site# 1254			Sydney 179 Mago Girraweeu NSW 214 Tel: +61 2 NATA# 12	ey         Canberra         Brisbane         Newcastle           fagowar Road         Unit 1,2 Dacre Street         1/21 Smallwood Place         4/52 Industrial Drive           ween         Mitchell         Murarrie         Mayfield East NSW 2304           2145         ACT 2911         QLD 4172         PO Box 60 Wickham 2293           61 2 9900 8400         Tel: +61 2 6113 8091         Tel: +61 7 3902 4600         Tel: +61 2 4968 8448           # 1261 Site# 18217         NATA# 1261 Site# 20794 NATA# 1261 Site# 25079         NATA# 1261 Site# 20794 NATA# 1261 Site# 25079			Perth 46-48 Banksia Road Welshpool WA 6106 Tel: +61 8 6253 4444 NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: 0800 856 450 IANZ# 1290					
Company Name:       Stantec Australia Pty Ltd (NSW/ACT)         Address:       Level 22, 570 Bourke Street         Melbourne       VIC 3000							O Ri Pi Fa	rder No.: eport #: 936 hone: ax:	6167		Received: Due: Priority: Contact Name:	Oct 27, 2022 4:13 Nov 3, 2022 5 Day Kosta Sykiotis	ΡM	
Pro Pro	ject Name: ject ID:	SOUTH GIL 304100808	LIESTON HE	EIGHTS							Euro	fins Analytical Servic	es Manager : Hanr	ah Mawbey
		Sa	ample Detail				Moisture Set	Chromium Suite - NASSG (Excluding ANC)						
Brist	oane Laborator	y - NATA # 126	1 Site # 2079	94			х	х						
Exte No	rnal Laboratory Sample ID	Sample Date	Sampling	Ма	trix LAE	ID			-					
1	TP022 / ES:	Oct 05, 2022	Time	Soil	B22-Oc0	063190			-					
	0.30 - 0.50 M	0.1 05, 2022		0	D22-000	003130	Х	X	-					
2	0.60 - 0.80 M	Oct 05, 2022		5011	B22-Oc0	063191	Х	X						
3	TP024 / ES: 0.20 - 0.40 M	Oct 05, 2022		Soil	B22-Oc0	063192	х	х						
4	TP028 / ES: 0.05 - 0.10 M	Oct 05, 2022		Soil	B22-Oc0	063193	х	x						
Test	Counts						4	4	]					



### Internal Quality Control Review and Glossary

#### General

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

### **Holding Times**

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

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA. If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

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

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

### Units

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

#### Terms

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

### **QC** - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

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

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

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

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

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

### **QC Data General Comments**

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



### **Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code		
LCS - % Recovery					1				
Actual Acidity (NLM-3.2)									
pH-KCL (NLM-3.1)			%	97			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)			%	95			80-120	Pass	
LCS - % Recovery			/0		11		00 120	1 400	
Potential Acidity - Chromium Redu	ucible Sulfur								
Chromium Reducible Sulfur (s-SCr)	(NI M-2 1)		%	104			80-120	Pass	
LCS - % Recovery			/0	10-1	<u> </u>		00 120	1 400	
Extractable Sulfur									
HCI Extractable Sulfur			%	106			80-120	Pass	
		04	70	100				Pass	Qualifying
Test	Lab Sample ID	Source	Units	Result 1			Limits	Limits	Code
Duplicate							1		
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	B22-Oc0060392	NCP	pH Units	4.3	4.3	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	B22-Oc0060392	NCP	% pyrite S	0.15	0.14	1.7	30%	Pass	
Titratable Actual Acidity (NLM-3.2)	B22-Oc0060392	NCP	mol H+/t	92	90	1.7	20%	Pass	
Duplicate									
Potential Acidity - Chromium Redu	ucible Sulfur			Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	B22-Oc0060392	NCP	% S	0.045	0.043	3.6	20%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	B22-Oc0060392	NCP	mol H+/t	28	27	3.6	30%	Pass	
Duplicate					1				
Extractable Sulfur		Result 1	Result 2	RPD					
Sulfur - KCI Extractable	B22-Oc0060392	NCP	% S	0.005	0.006	9.7	30%	Pass	
HCI Extractable Sulfur	B22-Oc0060392	NCP	% S	0.006	0.006	<1	20%	Pass	
Duplicate			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	B22-Oc0060392	NCP	% S	< 0.02	< 0.02	<1	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	B22-Oc0060392	NCP	% S	< 0.02	< 0.02	<1	30%	Pass	
Net Acid soluble sulfur (a-SNAS)	B22-Oc0060392	NCP	mol H+/t	< 10	< 10	-1	30%	Pass	
Duplicate	BEE GOOGGOODE	1101	1101111/1			1	0070	1 400	
Acid Neutralising Capacity (ANCht	)			Result 1	Result 2	RPD			
Acid Neutralising Capacity -	B22-Oc0060392	NCP	% CaCO3	N/A	N/A	N/A	20%	Pass	
Acid Neutralising Capacity - (s-	B22-Oc0060392	NCP	% S	Ν/Δ	N/A	N/A	30%	Pass	
ANC Fineness Factor	B22-Oc0060392	NCP	factor	15	15	<1	30%	Pass	
	laotoi	1.0	1.0		0070	1 400			
Net Acidity (Including ANC)		Result 1	Result 2	RPD					
CRS Suite - Net Acidity - NASSG				rtoour r	rtooun 2				
(Including ANC)	B22-Oc0060392	NCP	% S	0.19	0.19	2.5	30%	Pass	
(Including ANC)	B22-Oc0060392	NCP	mol H+/t	120	120	2.5	30%	Pass	
(Including ANC)	B22-Oc0060392	NCP	kg CaCO3/t	9.1	8.8	2.5	30%	Pass	
Duplicate							1		
				Result 1	Result 2	RPD			
% Moisture	B22-Oc0065294	NCP	%	6.2	5.9	4.4	30%	Pass	



### Comments

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

### **Qualifier Codes/Comments**

Code Description

Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
Retained Acidity is Reported when the pHKCI is less than pH 4.5
Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

### Authorised by:

Hannah Mawbey Jonathon Angell Jonathon Angell Analytical Services Manager Senior Analyst-Sample Properties Senior Analyst-SPOCAS

Glenn Jackson General Manager

Final Report - this report replaces any previously issued Report

- Indicates Not Requested

- * Indicates NATA accreditation does not cover the performance of this service
- Measurement uncertainty of test data is available on request or please click here.

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### #AU03_EnviroSampleBris

From:	Hannah Mawbey
Sent:	Thursday, 17 November 2022 1:17 PM
To:	#AU03_EnviroSampleBris
Subject:	FW: Eurofins Test Results, Invoice - Report 930290 : Site SOUTH GILLIESTON HEIGHTS (304100808)
Follow Up Flag:	Follow up
Flag Status:	Flagged

**Categories:** 

Awaiting Action

### INFO: INTERNAL EMAIL - Sent from your own Eurofins email domain.

Hi Team,

Analysis was not added to the following samples: TP001 / 1.25-1.30 and TP006 / 1.20-1.30, can analysis please be added and the samples pushed into the lab? Dc0017067 020017056

BSOCIO3

BSOCIOI

Kind Regards, Hannah Mawbey Analytical Services Manager

### **Eurofins** Environment Testing

Unit 16/7 Investigator Dr Unanderra NSW 2526 AUSTRALIA

Phone : +61 2 9900 8492 Mobile : +61 447 584 487

Email : HannahMawbey@eurofins.com Website: www.eurofins.com.au/environmental-testing

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Salinity suite = CEC, ESP, Chlonide Sulfate, pH, EC, Resistivity * Sodicity.

Stantec Australia Pty Ltd Level 22, 570 Bourke Street Melbourne VIC 3000



NATA Accredited Accreditation Number 1261 Site Number 1254

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

|--|

Jack Hanlon

Report Project name Project ID Received Date 942316-S SOUTH GILLIESTON HEIGHTS 304100808 Nov 17, 2022

Client Sample ID			TP001 / ES: 1.25 - 1.30	TP006 / ES: 1.20 - 1.30
Sample Matrix			Soil	Soil
Eurofins Sample No.			B22- No0043695	B22- No0043696
Date Sampled			Oct 05, 2022	Oct 05, 2022
Test/Reference	LOR	Unit		
Chloride	5	mg/kg	< 5	11
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	74	50
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	8.9	8.1
Resistivity*	0.5	ohm.m	140	200
Sulphate (as SO4)	30	mg/kg	< 30	< 30
Exchangeable Sodium Percentage (ESP)	0.1	%	4.2	15
% Moisture	1	%	8.8	11
Cation Exchange Capacity				
Cation Exchange Capacity	0.05	meq/100g	27	5.0



### Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Chloride	Melbourne	Nov 21, 2022	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
pH (1:5 Aqueous extract at 25 °C as rec.)	Melbourne	Nov 21, 2022	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO4)	Melbourne	Nov 21, 2022	28 Days
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	Melbourne	Nov 21, 2022	7 Days
- Method: LTM-INO-4030 Conductivity			
Exchangeable Sodium Percentage (ESP)	Melbourne	Nov 22, 2022	28 Days
- Method: LTM-MET-3060 - Cation Exchange Capacity (CEC) & Exchangeable Sodium Percentage (ESP)			
% Moisture	Melbourne	Nov 18, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			
Cation Exchange Capacity	Melbourne	Nov 22, 2022	28 Days
- Method: LTM-MET-3060 Cation Exchange Capacity by bases & Exchangeable Sodium Percentage			

Date Reported: Nov 22, 2022

web: www.eurofins.com.au email: EnviroSales@eurofins.com		Eurofins Environment Testing Australia Pty Ltd     F       ABN: 50 005 085 521     //												Eurofins ARL Pty Ltd ABN: 91 05 0159 898	Eurofins Environn NZBN: 942904602495	nent Testing NZ Ltd	
		Melbourne         Geelong         Sydney           6 Monterey Road         19/8 Lewalan Street         179 Mag           Dandenong South         Grovedale         Girrawe           VIC 3175         VIC 3216         NSW 21           Tel: +61 3 8564 5000         Tel: +61 3 8564 5000         Tel: +61           NATA# 1261 Site# 1254         NATA# 1261 Site# 1254         NATA#				ydney         Canberr           79 Magowar Road         Unit 1,2 I           sirraween         Mitchell           ISW 2145         ACT 291           fel: +61 2 9900 8400         Tel: +61           IATA# 1261 Site# 18217			Canberra Jnit 1,2 Dacre Street Vitchell ACT 2911 Tel: +61 2 6113 8091		Brisbane         Newcastle           1/21 Smallwood Place         4/52 Industrial Drive           Murarrie         Mayfield East NSW 23i           QLD 4172         PO Box 60 Wickham 2           Tel: +61 7 3902 4600         Tel: +61 2 4968 8448           NATA# 1261 Site# 20794 NATA# 1261 Site# 250		Newcastle 4/52 Industrial Drive Mayfield East NSW 2304 PO Box 60 Wickham 2293 Tel: +61 2 4968 8448 14 NATA# 1261 Site# 25079	Perth           46-48 Banksia Road           Welshpool           3         WA 6106           Tel: +61 8 6253 4444           NATA# 2377 Site# 2370	Auckland 35 O'Rorke Road Penrose, Auckland 1061 Tel: +64 9 526 45 51 IANZ# 1327	Christchurch 43 Detroit Drive Rolleston, Christchurch 7675 Tel: 0800 856 450 IANZ# 1290	
Company Name:       Stantec Australia Pty Ltd (NSW/ACT)         Address:       Level 22, 570 Bourke Street         Melbourne       VIC 3000						O R P F	Order I Report Phone: Tax:	No.: #:	!	94231	6			Received: Due: Priority: Contact Name:	Nov 17, 2022 1:17 Nov 24, 2022 5 Day Jack Hanlon	РМ	
Pr Pr	oject Name: oject ID:	SOUTH GIL 304100808	LIESTON HE	EIGHTS										Euro	fins Analytical Servic	es Manager : Han	nah Mawbey
		S	ample Detail			Chloride	pH (1:5 Aqueous extract at 25 °C as rec.)	Resistivity*	Sulphate (as SO4)	Moisture Set	Cation Exchange Capacity	Exchangeable Sodium Percentage (ESP)					
Melbourne Laboratory - NATA # 1261 Site # 1254				X	X	X	X	X	X	X	_						
Exte No	Sample ID	Sample Date	Sampling	Matrix	LAB ID								-				
1	TP001 / ES: 1.25 - 1.30	Oct 05, 2022	Time	Soil	B22-No0043695	x	x	x	x	x	x	x	-				
2	TP006 / ES: 1.20 - 1.30	Oct 05, 2022		Soil	B22-No0043696	x	x	x	x	х	х	x					
Test	Counts			•		2	2	2	2	2	2	2	]				



### Internal Quality Control Review and Glossary

#### General

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

### **Holding Times**

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

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA. If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

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

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

### Units

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

#### Terms

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

### **QC** - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR: No Limit

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

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

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

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

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

### **QC Data General Comments**

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



### **Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code		
Method Blank							•		
Chloride			mg/kg	< 5			5	Pass	
Conductivity (1:5 aqueous extract at	25 °C as rec.)		uS/cm	< 10			10	Pass	
Sulphate (as SO4)			mg/kg	< 30			30	Pass	
LCS - % Recovery								-	
Chloride			%	120			70-130	Pass	
Conductivity (1:5 aqueous extract at	25 °C as rec.)		%	96			70-130	Pass	
Sulphate (as SO4)			%	123			70-130	Pass	
Test Lab Sample ID QA Source				Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate					-				
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25 °C as rec.)	M22-No0043087	NCP	uS/cm	220	230	4.0	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	M22-No0043087	NCP	pH Units	8.4	8.3	pass	30%	Pass	
Resistivity*	M22-No0043087	NCP	ohm.m	45	43	4.0	30%	Pass	
% Moisture	B22-No0043695	CP	%	8.8	8.0	9.3	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	B22-No0043696	CP	mg/kg	11	5.7	61	30%	Fail	Q15
Sulphate (as SO4)	B22-No0043696	CP	mg/kg	< 30	< 30	<1	30%	Pass	



### Comments

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

### **Qualifier Codes/Comments**

 Code
 Description

 Q15
 The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

### Authorised by:

Bonnie Pu Mary Makarios Linda Chouman Mary Makarios Analytical Services Manager Senior Analyst-Metal Senior Analyst-Sample Properties Senior Analyst-Inorganic

Glenn Jackson General Manager

Final Report - this report replaces any previously issued Report

### - Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

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# Laboratory Chain of Custody



Client Name	Stantec	Sampler	Jack Hanlon	Contact	Jack Hanlon
	Suite 2, Level 2, 22 Honeysuckle Drive				
Client Address	Newcastle	Method	Test Pit	Mobile	0422206115
Project Ref	304100808	Request by	Jack Hanlon	Email	jack.hanlon@cardno.com.au
Project Name	South Gillieston Heights GI	Date	7/10/2022	Special	
Site Location	507 Main Road, Gillieston Heights	Results by	Standard TAT	Requirements /	
Component/Stage		Sample Hold		Comments	

						Tests Required			Notes		
						Soil	Soil	Soil	Soil		
						California Bearing Ratio	Atterberg Limits	Emerson Class Number	Permeability (Constant)		
						AS	AS	AS	AS		
Sample #	Location	Depth	Date	Туре	Material Description	1289 6.1.1	1289 3.3.1	1289 3.8.1	1289 6.7.1		
	TP014	0.6-0.7	12/10/22	Bulk Bag	Silty CLAY t gravel			~			
	TP014	1.0-1.2	12/10/22	Bulk Bag	Silty CLAY t sand						
	TP023	0.55-0.90	12/10/22	Bulk Bag	Silty CLAY t sand			~	✓		These two bags are the same if you
	TP023	0.55-0.90	12/10/22	Bulk Bag	Silty CLAY t sand						require more material
	TP028	0.3-0.45	12/10/22	Bulk Bag	Silty CLAY t sand						



Sydney Laboratory Unit 5/43 Herbert St Artarmon NSW 2064 email: artarmon@ghd.com.au web: www.ghd.com.au/ghdgeotechnics Tel: (02) 9462 4860 Fax:(02) 9462 4710

Materi	al Test Report	Report No: SYD2202616 Issue No: 1
Client:	Intrax Consulting Engineers Pty Ltd U2, 50 Alliance Ave Morisset NSW 2264	Accredited for compliance with ISO / IEC 17025 - Testing
Project:	12534258	NATA Accreditation Approved Signatory: Jure G Vukovic No: 679 Date of Issue: 11/11/2022 THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL
Sample D	Details	
GHD Sampl	le No SYD22-0493-01	

GHD Sample NO	31022-0493-01
Client Sample ID	4682B
Date Sampled	07/10/2022
Sampled By	Supplied by Client
-	Gillieston Heights, NSW
Client Location	TP23 (0.55-0.90m)
	CLAY with sand; brown

# Test Results

Description	Method	Result	Limits
Standard MDD (t/m ³ )	AS 1289.5.1.1 - 2017	1.62	
Standard OMC (%)		22.0	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		66	
Date Tested		2/11/2022	
Coef of Permeability (m/s)	AS 1289.6.7.3	2 E-10	
Mean Stress Level (kPa)		30	
Permeant Used		Syd tap water	
Length (mm)		74.4	
Diameter (mm)		64.0	
Length/Diameter Ratio		1.16	
Laboratory Moisture Ratio (%)		99.0	
Laboratory Density Ratio (%)		100.0	
CompactiveEffort		Standard	
Method of Compaction		Remoulded	
Surcharge Applied (kg)		0.0	
Pressure Applied (kPa)		10	
Oversize Sieve (mm)		9.5	
Percentage Oversize (%)		0.0	
Moisture Content (%)		25.0	
Date Tested		4/11/2022	

### Comments

# **Material Test Report**

Report Number:	PRJ771047-2
Issue Number:	1
Date Issued:	25/10/2022
Client:	Stantec Pty Ltd

Contact:	lan Piper
Project Number:	PRJ771047
Project Name:	South Gillieston Heights GI
Project Location:	507 Main Rd, Gillieston Heights NSW
Work Request:	4682
Sample Number:	M22-4682A
Date Sampled:	18/10/2022
Dates Tested:	18/10/2022 - 24/10/2022
Sample Location:	TP014 , Depth: 0.6m - 0.7m



Intrax Consulting Engineers Pty Ltd Morisset Laboratory Unit 2, 50 Alliance Avenue Morisset NSW 2264 Phone: 0499 779 118 Email: james.obrien@intrax.com.au Accredited for compliance with ISO/IEC 17025 - Testing

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Approved Signatory: James O'Brien Laboratory Manager NATA Accredited Laboratory Number: 19862

Emerson Class Number of a Soil (A	Min	Max	
Emerson Class	4 *		
Soil Description	Sandy CLAY, red / brown.		
Nature of Water	Distilled		
Temperature of Water (°C)	16		
* Mineral Present	Carbonate and Gypsum		

# **Material Test Report**

Report Number:	PRJ771047-2
Issue Number:	1
Date Issued:	25/10/2022
Client:	Stantec Pty Ltd

Contact:	lan Piper				
Project Number:	PRJ771047				
Project Name:	South Gillieston Heights GI				
Project Location:	507 Main Rd, Gillieston Heights NSW				
Work Request:	4682				
Sample Number:	M22-4682B				
Date Sampled:	18/10/2022				
Dates Tested:	18/10/2022 - 24/10/2022				
Sample Location:	TP023, Depth: 0.55m - 0.9m				



Intrax Consulting Engineers Pty Ltd Morisset Laboratory Unit 2, 50 Alliance Avenue Morisset NSW 2264 Phone: 0499 779 118 Email: james.obrien@intrax.com.au Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED

Approved Signatory: James O'Brien

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Laboratory Manager NATA Accredited Laboratory Number: 19862

Emerson Class Number of a Soil (A	Min	Max	
Emerson Class	8		
Soil Description	CLAY, dark brown.		
Nature of Water	Distilled		
Temperature of Water ( ^o C)	16		

# APPENDIX



# AUSTRALIAN GEOGUIDE (LR8) HILLSIDE CONSTRUCTION PRACTICE



# Stantec

# AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

#### HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.



#### WHY ARE THESE PRACTICES GOOD?

**Roadways and parking areas -** are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

**Retaining walls** - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

**Sewage** - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

**Surface water -** from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

**Surface loads** - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

**Flexible structures -** have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

**Vegetation clearance -** on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

#### ADOPT GOOD PRACTICE ON HILLSIDE SITES

## **AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)**

# EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE



#### WHY ARE THESE PRACTICES POOR?

**Roadways and parking areas -** are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soak into the ground.

**Cut and fill -** has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

**Retaining walls -** have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

**Soak-away drainage -** has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herring bone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

**Rock debris** - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

**Vegetation** - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

#### DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

#### More information relevant to your particular situation may be found in other Australian GeoGuides:

•	GeoGuide LR1	- Introduction	•	GeoGuide LR6	- Retaining Walls
•	GeoGuide LR2	- Landslides	•	GeoGuide LR7	- Landslide Risk
•	GeoGuide LR3	- Landslides in Soil	•	GeoGuide LR9	- Effluent & Surface Water Disposal
•	GeoGuide LR4	- Landslides in Rock		GeoGuide LR10	- Coastal Landslides
•	GeoGuide LR5	- Water & Drainage	•	GeoGuide LR11	- Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the <u>Australian Geomechanics Society</u>, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.