Certainty Wealth

Geotechnical Assessment

Proposed Sanctuary Residential Estate

344 John Oxley Drive, Thrumster

Report No. RG\$21087.1-AC 2 June 2021

REGIONAL GEOTECHNICAL SOLUTIONS



RGS21087.1-AC

2 June 2021

Certainty Wealth c-/ Land Dynamics Australia 77 Lord Street PORT MACQUARIE NSW 2444

Attention: Graham Burns

Dear Graham

RE: Proposed Sanctuary Residential Estate – 344 John Oxley Drive, Thrumster Geotechnical Assessment

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the proposed Sanctuary residential development at 344 John Oxley Drive, Lot 1 DP 1245588, Thrumster.

Surface and subsurface conditions at the site and recommendations and advice on foundation conditions, excavation conditions and flexible pavement design are presented in the attached report.

If you have any questions regarding this project, please contact the undersigned.

For and on behalf of Regional Geotechnical Solutions Pty Ltd

Prepared by

Tim Morris Associate Engineering Geologist

Reviewed by

Steve Morton Principal Geotechnical Engineer

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1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd have undertaken a geotechnical assessment of the proposed Sanctuary residential estate at 344 John Oxley Drive, Lot 1 DP 1245588, Thrumster.

The development is for a large-scale residential subdivision with eight proposed stages and will involve:

- Site regrading works with up to approximately 6m cut and placement of up to approximately 3m fill;
- Construction of a road embankment with culverts across a drainage depression in the west of the site;
- Site preparation works for potentially eight stages of residential development, comprising up to approximately 207 residential lots;
- Construction of 12 sections of road pavements within the site. Road classifications have not yet been provided;
- Construction of retaining walls up to approximately 1.5m in height may be required with proposed lot terracing works;
- Installation of light poles at regular intervals which will have a bored pile foundation with a rag bolt type assembly; and
- Construction works for associated infrastructure including water, sewer and stormwater services.

The purpose of the assessment was to provide comments and recommendations on the following:

- Subsurface conditions including the presence of fill, depth to weathered rock and groundwater (if encountered);
- A geotechnical model of the site that includes general foundation conditions and the depth of the soil profiles;
- Preliminary site classifications to AS2870-2011 Residential Slabs and Footings for soil landscapes present;
- Foundation conditions including the presence of rock;
- Recommended foundation types, including bearing capacities, expected settlements, and construction methods;
- Excavation conditions and suitability of excavated material for re-use;
- Pavement thickness design for Stage 1 and 2 only (Road No's 1 to 4, 7 and 10), including
 material requirements and construction recommendations for the internal roads which are
 likely to comprise Collector Roads and Local Streets as defined in Port Macquarie Hastings
 Council Aus-Spec. Where roads will be constructed on fill embankments further subgrade
 CBR testing will be required following completion of bulk earthworks to confirm adopted
 embankment fill CBR values were appropriate;
- Recommendations as to site preparation to support concentrated building loads from foundations, floor slabs and pavements;
- Support of cuts and excavations including design parameters for retaining wall design;
- General recommendations on management of construction and drainage at the site from a geotechnical perspective;
- Presence of groundwater;



- Suitability of site soils for stormwater basin construction; and
- Geotechnical design parameters for proposed light poles that are likely to be supported on bored concrete piers.

The work was commissioned by Graham Burns on behalf of Land Dynamics Australia Pty Ltd and was undertaken in accordance with proposal number RGS21087.1-AA dated 12 March 2021.

2 METHODOLOGY

Field work for the assessment was undertaken on 23 February 2021 and 15 April 2021 and was based on the supplied drawing titled "344 JOHN OXLEY DRIVE THRUMSTER OVERALL CONCEPT STAGING PLAN". Fieldwork was undertaken by an Engineering Geologist from RGS and included:

- Observation of site features and surrounding features relevant to the geotechnical conditions of the site;
- Twenty-four test pits undertaken with a 20t excavator to depths of between 1.5 and 5.0m;
- Collection of samples for subsequent laboratory testing.

Engineering logs of the test pits are presented in Appendix A. Coordinates of investigation locations were recorded using a handheld GPS and the coordinates are shown on the engineering logs. Reduced levels at the test pit locations were estimated from the supplied drawings and are shown on the engineering logs.

3 LABORATORY TESTING

Samples retrieved during field work were returned to a NATA accredited laboratory for testing which included the following;

- Soil volume change over an extreme range of moisture content (shrink / swell index) on one U50 sample;
- Soil volume change over an extreme range of moisture content (shrink / swell index) on three bulk sample of material that had been compacted at 98% Standard Compaction to simulate re-use of material in a placed fill platform;
- CBR testing of ten samples considered representative of the subgrade materials encountered;
- Emerson dispersion; and
- Atterberg Limits testing on selected samples.

The laboratory shrink-swell, Atterberg Limits and Emerson dispersion test results are summarised in Table 1. Laboratory CBR test results are summarised in Section 4.3. Laboratory test result sheets are presented in Appendix B.

Location	Depth	Material	Emerson Class	Plasticity Index (%)	Shrink Swell Index (%)
Hill - A	2.0 - 3.0	Unit 5B: Extremely Weathered Dolerite**	-	-	1.1
TP2	0.5 – 0.6	Unit 4B: Sandy CLAY	2	43	
TP3	0.4 - 0.8	Unit 4A: Sandy CLAY	-	-	3.4
TP11	0.3 – 0.6	Unit 4A: Sandy CLAY**	-	-	3.2
TP21	0.5 – 1.0	Unit 5B: Extremely Weathered Dolerite**	-	-	3.3

Table 1: Laboratory Testing Summary

Note:

Atterberg Limits testing undertaken on U50 sample that crumbled upon extraction Test undertaken on bulk sample recompacted at 98% Standard Compaction

4 SITE CONDITIONS

4.1 Surface Conditions

The site comprises approximately 45hectares of undeveloped rural land situated in gently to moderately undulating topography that includes two low hills in the north and south of the site with surface elevations of up to 16m AHD in the north and 18m AHD in the south. The hills are joined by a low saddle with surface elevations of about 6m AHD. Broad, low lying alluvial depressions are present to the east and west of the saddle and the intermittent drainage lines present within the depressions drain generally towards the north. The inferred extent of the alluvial depressions is shown on Figure 1.

A satellite image that shows the location of the site and the site setting is reproduced in Plate 1.





The areas of proposed development are typically located near the centre of the site and are mostly cleared with scattered large eucalypts. Thick vegetation is present in the low-lying areas to the east and west.

Drainage of the site is via a combination of surface infiltration and overland flow towards the two drainage lines in the east and west of the site. The site is generally well drained on the ridge slopes and poorly drained on the lower slopes and adjacent alluvial depressions. Fieldwork was undertaken following a period of wet weather and vehicle access was restricted to 4WD in the centre of the site on the crest of the low saddle where surface water was present.

A dilapidated farmhouse is present on the crest of the hill in the south of the site, with a gravel access track connecting from John Oxley Drive.

Typical site photographs are presented below.



Looking east from TP2 across undulating residual terrain. Some scattered mature eucalypts remain.



Looking from TP5, to the north across the low-lying depression and onwards to Stage 7 and 8.



Looking west from TP1. Surface soils disturbed by tree removal and some stump holes are likely to be present.



Low lying saddle between TP6 and TP7 near proposed Road 1 alignment. Surface water present and vehicle access restricted to 4WD.

4.2 Subsurface Conditions

The site is located in an area of gently to moderately undulating topography that is underlain by deeply weathered geological units of the Port Macquarie Block which includes slate, chert, basalt, serpentinite and dolerite. Alluvial soils are likely to be present in the low-lying areas of the site which are also likely to be poorly drained.

Reference to the Wauchope Acid Sulfate Soil (ASS) Risk Map (DLWC, 2000) indicates there is a high probability of ASS in the alluvial depression near the eastern boundary, however, it is located outside the area of the proposed development. The proposed development areas are shown as no known occurrence of ASS.

The materials encountered during the investigation are summarised in Table 2. Further details are presented on the attached engineering logs.

Unit	Material	Material Description
UNIT 1	topsoil/ Fill	Sandy SILT, low plasticity, dark brown, trace grass roots
UNIT 2	slopewash	Silty CLAY, pale grey
UNIT 3	ALLUVIUM	Gravelly Silty CLAY, medium plasticity, pale grey / white with red mottling, very stiff with rounded gravel, fine to medium. Inferred Pleistocene alluvial deposits.
UNIT 4A	RESIDUAL (Orange)	Sandy CLAY, medium plasticity, orange/red, increasing pale mottling with depth, stiff to very stiff
UNIT 4B	RESIDUAL (Yellow)	CLAY, medium plasticity, yellow, stiff
UNIT 5A	Extremely Weathered SLATE	Silty CLAY, white / pale grey, very stiff, Gravelly Silty CLAY, pale grey / white with red / yellow mottling, very stiff
UNIT 5B	Extremely Weathered DOLERITE	Sandy CLAY, yellow with grey mottling, very stiff, some rock fabric and trace gravel, low strength.
UNIT 6A	Highly Weathered SLATE	SLATE, white / pale grey, with red staining, fissile, inferred very low to low strength
UNIT 6B	Highly Weathered DOLERITE	DOLERITE, pale grey/brown with orange mottling, massive, inferred very low to medium strength, slow digging with 20T excavator.

Table 2: Summary of Geotechnical Units



Table 3: Summary of Subsurface Materials

E	Depth to Base of Material Layer (m)									
Investigatic	UNIT 1 TOPSOIL/FILL	UNIT 2 SLOPE WASH	UNIT 3 ALLUVIUM	UNIT 4A RESIDUAL (Orange)	UNIT 4B RESIDUAL (Yellow)	UNIT 5A EW SLATE	UNIT 5B EW DOLERITE	UNIT 6A HW SLATE	UNIT 6B HW DOLERITE	Water Inflow (m)
Hill-A	0.0 - 0.2			0.2 – 0.7			2.0 - 5.2		0.7 – 2.0	
Hill-B	0.0 - 0.15			0.15 - 0.4			2.0 - 3.5		0.4 – 2.0	
TP 1	0.0 – 0.25			0.25 – 0.7		0.7 – 1.3		1.3 ≥ 2.0		
TP2	0.0 – 0.35			0.35 – 1.0	0.35 – 1.0		1.0 – 1.5		1.5 ≥ 2.0	
TP3	0.0 - 0.3			0.3≥2.0						
TP4	0.0 – 0.25			0.25 – 1.2		1.2≥2.0				
TP5	0.0 – 0.25			0.25 – 1.3		1.3≥2.0				
TP6	0.0 - 0.2	0.2 – 0.25	0.25 ≥ 1.5							1.1
TP7	0.0 – 0.25	0.25 – 0.3	0.3≥1.5							
TP8	0.0 - 0.3		0.3≥1.5							
TP9	0.0 - 0.3		0.3 ≥ 2.0							
TP10	0.0 - 0.1	0.1 – 0.25	0.25 ≥ 2.0							1.8
TP11	0.0 - 0.1	0.1 – 0.25		0.25 – 1.1		1.1 ≥ 1.8				
TP12	0.0 - 0.1	0.1 – 0.3		0.3 – 1.0		1.0 ≥ 2.0				
TP13	0.0 - 0.1	0.1 – 0.25		0.25 ≥ 2.2						
TP14	0.0 - 0.3			0.3≥2.5						



5	Depth to Base of Material Layer (m)										
Investigatic	UNIT 1 TOPSOIL/FILL	UNIT 2 SLOPE WASH	UNIT 3 ALLUVIUM	UNIT 4A RESIDUAL (Orange)	UNIT 4B RESIDUAL (Yellow)	UNIT 5A EW SLATE	UNIT 5B EW DOLERITE	UNIT 6A HW SLATE	UNIT 6B HW DOLERITE	Water Inflow (m)	
TP15	0.0 – 0.25	0.25 – 0.4		0.4≥1.5							
TP16	0.0 - 0.3			0.3≥1.5							
TP17	0.0 – 0.25			0.25 – 1.25			1.25 ≥ 1.5				
TP18	0.0 – 0.25	0.25 – 0.4		0.4 – 1.2		1.2 ≥ 2.0					
TP19	0.0 – 0.25	0.25 – 0.4		0.4 - 0.8		0.8 – 1.5		1.5≥5.0			
TP20	0.0 – 0.25	0.25 – 0.3		0.3 – 0.8		0.8 – 1.7		1.7 ≥ 2.0			
TP21	0.0 – 0.25			0.25 – 0.5			0.5 – 1.0		1.0≥1.5		
TP22	0.0 – 0.25			0.25 – 1.0		1.0≥1.5					

Note: ≥

Indicates that base of material layer was not encountered Indicates that the material was not encountered at the test location ---



Groundwater inflow was encountered at TP6 and TP10 at the levels shown in Table 3. It should be noted that fluctuations in groundwater levels can occur as a result of seasonal variations, temperature, rainfall, and other similar factors, the influence of which may not have been apparent at the time of the assessment.

4.3 Subgrade Conditions

A summary of CBR test results is presented in Table 3.

Investigation	nvestigation Depth (m)		Location Material		Swell (%)	CBR (%)
TP4	0.3 – 0.7	Road 10	Unit 4A - Residual CLAY	1.542	0.2	7.0
TP5	0.7 – 1.2	Road 10	Unit 4A - Residual CLAY	1.416	0.6	13.0
TP6	0.6 – 0.9	Road 11	Unit 3 - Alluvium	1.590	1.0	1.0
TP11	0.5 – 0.7	Road 13	Unit 4A - Residual CLAY (Overburden)	1.379	0.6	10.0
TP11	1.1 – 1.4	Road 13	Unit 5A – EW Slate (Subgrade)	1.597	1.8	7.0
TP16	0.4 - 0.8	Road 1	Unit 4A - Residual CLAY	1.283	0.4	7.0
TP17	0.7 – 1.0	Road 2	Unit 5B – EW Dolerite	1.422	0.8	4.0
TP18	1.3 – 1.7	Road 2 / Road 3 intersection	Unit 5A – EW Slate	1.420	0.7	1.5
TP19	4.5 – 5.0	Road 4	Unit 6B – HW Slate	1.630	1.5	12.0
TP20	1.3 – 1.7	Road 2 / Road 4 intersection	Unit 5A – EW Slate	1.628	3.1	3.5

Table 3: CBR Testing Summary

5 EARTHWORKS

5.1 Site Preparation

The site is vegetated with grass and scattered trees. Areas of the site that are to support foundations or pavements should be stripped to remove all topsoil, root affected, or other potentially deleterious material including uncontrolled fill in back filled tree stump holes which can be retained on site for re-use in landscaping. Topsoil depths ranged from 150 to 400mm.

It is noted that in some locations the topsoil is underlain by a layer of slopewash soils (Unit 2) approximately 100mm - 200mm thick, above the underlying clays. Past experience with this material indicates moisture will concentrate in the slopewash layer and it will be extremely difficult to work, resulting in wet, soft soils under the vibration effects of construction or compaction equipment. Where such soils are exposed at pavement subgrade level or at foundation level below proposed fill embankments, they should be removed down to clay soils and replaced with site won clay to design subgrade level.



The topsoil and natural clays at the site are considered susceptible to erosion on exposure (i.e. where vegetation is removed) or where exposed to concentrated flow. The clay soils at TP2 are considered dispersible (Emerson Class 2). It is therefore essential that:

- Earthworks should be undertaken progressively, minimising the area and length of time that any part of the site is denuded of vegetation at any one time;
- Re-vegetation or other erosion protection should be undertaken as soon as possible; and
- The erodibility of the soils should be taken into account in the long term stormwater management plan for the site (eg. Sizing and ongoing management or maintenance of detention ponds).

5.2 Excavation Conditions

Slow digging conditions for the 20T excavator were encountered at TP19 and TP HILL-A and HILL-B which were excavated to depths of up 5.2m near the crest of the southern hill (Proposed Lot 51). A single tyne ripper was used to break up a band of highly weathered dolerite (Unit 6B) of very low to medium strength that was present from 0.4m to 2m. The band of rock was underlain by clay soils (Unit 5B) that were excavated with a toothed bucket to the limit of investigation.



TP-HILL B: Single tyne ripper used to break up band of low strength dolerite rock.

TP-HILL A: Band of highly weathered dolerite rock present from 0.7m to 2m was underlain by clay soils to 5.2m.

Bulk excavations within the Unit 6A and 6B weathered rock are likely to require ripping prior to excavation by a large excavator. Some allowance should also be made, for the use of hydraulic rock breakers for when bands of high strength rock are encountered in confined detail excavations such as for footings and service trenches. Previous experience in the area has revealed that the weathering can result in a highly irregular soil/rock profile.

Groundwater inflow was encountered at TP6 and TP10 on the low ridge saddle,

Entry into unsupported trenches deeper than 1.0m should be avoided and appropriate signage and barricading should be installed around all open excavations. Excavation design should take into account maximum batter angle and setback requirements for vehicle traffic as detailed in the Excavation Work Code of Practice (Safe Work Australia – 2020).



The presence of weathered rock at the base of deep cuts may pose construction issues for residential dwelling construction, including the use of hydraulic rock breakers for when bands of high strength rock are encountered.

5.3 Reuse of Site Won Materials

Topsoil or slopewash is not suitable for reuse as engineered fill. This material may be reused for landscaping purposes.

The orange/red residual clay (Unit 4A), extremely weathered slate and dolerite (Units 5A and 5B) clay soils will be suitable for use as engineering fill provided they are placed in accordance with the recommendations presented in this report. The materials are moderately reactive, however, and an allowance should be made for their shrink-swell potential during the design phase for fill platform construction. In addition, the material may be over-wet and drying back may be required before the material is suitable for reuse.

The yellow/pale brown residual clay (Unit 4B) soils overlying the dolerite in TP2 is highly reactive and not recommended for reuse as controlled fill due to high shrink-swell potential. If they must be used due to site cut/fill balances then it may be possible to blend with highly weathered rock (Unit 6A/6B) rock material at a ratio of 1:1 to reduce the potential reactivity.

Achieving a thorough blend of clay and weathered rock gravels will be difficult and potentially costly due to additional handling and placing requirements. Blending may be attempted by placing approximately 150mm of weathered rock fill and then overlaying with a layer of 150mm of clay fill before cross ripping to 300mm and then compacting with a large pad foot roller.

The yellow/pale brown residual clay (Unit 4B) soils and pale coloured extremely weathered rock (Unit 5A/5B) typically have low CBR and are not suitable for reuse in the upper profile of road embankments.

Reuse of the low strength weathered dolerite or slate rock (Unit 6A/6B) as engineering fill or road embankment fill will be possible, however, any oversize material (>100mm) will require screening or further breaking down using large compaction plant.

Due to the variable properties of the clay soils that will be encountered such as high reactivity or low CBR, it is critical that excavated materials be closely monitored and stockpiled separately into stockpiles that are suitable for reuse as general fill (Unit 4A: orange/red clay) and weathered rock (Unit 6), or, unsuitable for use as general fill.

Selected images are presented below to illustrate the variable profiles that may be encountered during excavation works.



with weathered rock.

typically low CBR that should be stockpiled separately during regrading works.

5.4 Retention

Temporary excavations up to 2.0m deep (during construction) in residual soils and weathered rock above the water table can be battered at 1.H:1V. Permanent slopes shall be battered no steeper than 2H:1V and will require re-vegetation or other erosion protection. In weathered rock, subject to geotechnical appraisal on bulk excavation, steeper batters may be adopted, but are likely to require face protection.

Where site constraints preclude the use of such batters, excavations should be supported by temporary shoring or permanent support as appropriate.

Gravity or cantilever retaining walls can be designed on the basis of the parameters presented in Table 4 for walls retaining natural clays or clay fill. Design can be undertaken on the basis of a triangular lateral earth pressure distribution using the characteristic earth pressure coefficients and subsoil parameters provided and should include assessment of the overall stability of the wall.

Material	Unit Weight, Y	Effective Friction Angle	Effective Cohesion, c'	Active Earth Pressure Coefficient, Ka	At Rest Earth Pressure Coefficient, ko	Passive Earth Pressure Coefficient, k _P
UNIT 4A/4B Residual	18	25°	5	0.41	0.58	2.46
UNIT 5A/B EW Rock	19	25°	5	0.41	0.58	2.46
UNIT 6A/B HW Rock	21	35°	50 kPa	0.27	N/A	3.7

Table 4: Retention Design Parameters



The earth pressure coefficients detailed in Table 4 have been calculated using Rankine's Theory assuming level backfill. The retaining wall designer should ensure that the use of this method is appropriate for the individual retaining wall(s). Any surcharge affecting the walls such as adjacent footings, adjacent retaining walls and their backfill, or sloping surfaces, should be allowed for in the design.

5.5 Fill Placement and Compaction Control

All fill placed for the support of structures or pavements should be placed and compacted as outlined below:

- After unsuitable material (including topsoil and slopewash) has been stripped the exposed natural subgrade should be proof roll tested in the presence of a suitably experienced geotechnical practitioner to highlight any soft, wet or excessively deflecting areas. Where these are encountered, they should be over-excavated and removed to spoil and re-used on site as non-structural landscaping material or removed from the site. Excavated areas should be backfilled with an approved granular material;
- In areas where pavements are proposed, the subgrade will be required to be within ±2% of OMC prior to placement of pavement layers. Moisture conditioning of the subgrade may be required prior to compaction;
- Previous experience in the general area with the yellow residual clay soils (Unit 4B) has found that they can be difficult to bridge when over-wet. Over-wet conditions were also encountered at the toe of the slopes and the ridge saddle along the alignment of proposed Road 1. Subgrade improvement works are likely to be required in these areas prior to filling. Treatment of the exposed subgrade with quick lime, incorporation of a granular bridging layer, or, potentially a rock drainage blanket may be required before placement of fill pending geotechnical assessment and it is recommended that an allowance be made for such conditions;
- Where weathered rock is exposed at subgrade level it will require ripping to a depth of 300mm below subgrade level and re-compaction to break up preferential drainage paths that concentrate water beneath the pavement or potential residential lots;
- Maximum particle size for general lot and road embankment fill is 100mm;
- Careful management of clay fill will be required during and after placement. This may include grading of the subgrade towards embankment shoulders, or, edges of fill platforms and temporary drainage diversion measures to prevent water pooling on the surface;
- Where surface slopes are more than 7° the existing surface should be benched prior to placement of fill to provide a level surface suitable for compaction. Each bench will require a minimum width of 3m to allow access for compaction equipment;
- Proposed fill material should comprise suitable fill as defined in AS 3798-2007 Guidelines on Earthworks for Residential and Commercial Developments. Inspection by a geotechnical authority may be required to confirm suitability of proposed fill material;
- Where filling is required beneath structures, approved fill should be placed in layers not exceeding 250 mm loose thickness and compacted to a minimum dry density ratio of not less than 95% of standard compaction. Clay fill should be placed and maintained at no more than ±2% of standard optimum moisture content;
- Where filling is required beneath pavement layers, suitable fill should be placed in layers not exceeding 300 mm loose thickness and compacted to a minimum dry density ratio of 98% standard compaction. The top 300mm of natural subgrade below pavements or the final 300mm of placed road subgrade fill should be compacted to a minimum density ratio of



100% Standard Compaction. Clay fill should be placed and maintained within 2% of standard optimum moisture content; and

• All fill for the support of structures should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 Guidelines on Earthworks for Residential and Commercial Developments, under Level 1 supervision. Areas of the site that are filled to support pavements should be filled under Level 2 supervision and testing.

6 FOUNDATIONS

6.1 Site Classification

AS2870-2011, 'Residential Slabs and Footings', sets out criteria for the classification of a site and the design and construction of a footing system for a single dwelling house, townhouse or a similar structure.

Based on encountered profiles, previous experience with similar soil types in the general vicinity and shrink-swell testing undertaken on collected in-situ samples and recompacted samples, estimated surface movements (excluding tree effects) based on potential development conditions are summarised in Table 5.

Development Condition	Subsurface Soil Unit	Adopted Shrink Swell Index (Iss)	Estimated Surface Movement ys (mm)	Potential Site Classification
On Grade	Unit 4B – Residual Clay (Yellow)	4.0	40 - 60mm	M - H2
On Grade	Unit 4B – Residual Clay (Red)	2.0 - 4.0	2.0 – 4.0 20 - 40mm	
Cut (>0.75m)	Unit 5A/5B – EW Rock	2.0 - 4.0	30 - 50mm	M / H1
Cut (>0.75m)	Unit 6A/6B – HW Rock	1.0 – 2.0	20 – 30mm	М
Fill (>0.75m)	Site won clay fill	2.0 - 4.0	30 - 50mm	M / H1

Table 5: Summary of Potential Site Classifications

In summary, the following comments are made with relation to the potential site classifications outlined in Table 5:

- The potential site classifications are preliminary in nature and will require confirmation following site re-grading once final site levels and natural/fill soil profiles are known;
- Lots where large trees are to be removed will be classified as Class P due to abnormal moisture conditions that can develop below and around the structure/tree footprint. Soil moisture concentrations may reach equilibrium approximately 12 months after removal of the tree/structure;
- The natural profiles can have potential site classifications ranging from M to H2;
- The residual yellow clay soils (Unit 4B) are highly reactive and their reuse as engineering fill is not recommended. The reactivity of the residual clays (Unit 4B) that are present could be



reduced by blending with site won weathered rock. Further testing is recommended to assess properties of the blended materials; and

• Use of clay fill imported from other sites should be avoided until the properties of the imported material have been assessed.

It is noted that all fill for the support of structures should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 under Level 1 inspection and testing to be considered as Controlled Fill.

6.2 Light Poles

Light poles are proposed within the subject sections of road reserves at regular intervals. It is understood that they will have a bored pile foundation with a rag bolt type assembly. Experience with similar foundation systems indicates that the bored piles are typically 0.6m diameter and 1.8m length.

Site regrading works will be undertaken as part of the proposed works which may include cut and placement of fill. It is assumed that all filling works will be undertaken under Level 1 inspection and monitoring as defined in AS3798-2007 Guidelines on Earthworks for Commercial and Residential Developments.

Shallow bored pile design parameters for the anticipated site conditions are presented in Table 6.

Material	Unit Weight, Y	Allowable End Bearing Pressure (kPa)	Allowable Skin Friction (kPa)	Limiting Lateral Yield Pressure (kPa)
Controlled Clay Fill (Very Stiff)	19kN/m³	150	15	100
Unit 4: Residual Clays (Very Stiff)	19kN/m³	150	15	100
Unit 5: EW Rock (Very Stiff)	19kN/m³	150	15	100
Unit 6: Weathered Rock (Low strength or greater)	20kN/m ³	500	50	300

Table 6: Light Pole Foundation Design Parameters

The following points are considered in relation to the parameters provided in Table 6:

- Piles are to be founded below any topsoil or uncontrolled clay fill in residual clay soils or Controlled Clay Fill of at least very stiff strength, or, in weathered rock of at least low strength;
- Limiting lateral yield pressure and skin friction should be ignored in the upper 1.5 x pile diameter below surface;
- Piles must be founded outside or below the zone of influence of existing or proposed service trenches; and



• At least the initial stages of footing excavation should be observed by a suitably experienced Geotechnical Professional to assess that the recommended founding material has been reached and to check initial assumptions about foundation conditions and possible variations between investigation locations.

It is noted that bored pile excavations in weathered rock (Unit 6) may encounter shallow refusal and some allowance should be made for the use of hydraulic rock breakers for when bands of high strength rock are encountered.

7 PAVEMENT DESIGN

7.1 Design Parameters

With reference to Port Macquarie Hastings Aus-Spec, options for pavement design considered the following:

- Road 3 = Access Place design traffic loading = 7 x 10⁴ ESA;
- Road 2, 4, 7 and 10 = Local Street design traffic loading = 5×10^5 ESA;
- Road 1 = Collector Road design traffic loading = 1 x 10⁶ ESA

7.2 General Road Conditions

The following points are noted about the area of the proposed road alignments:

- Road 1 will be constructed mostly around the toe of the residual slopes and across the low saddle, where over-wet subgrade conditions are likely to be encountered. The road is expected to be constructed near grade or with up to approximately 1.5 m of fill through low-lying areas;
- Road 2 (Stage 1 only), will be constructed mostly in cut with finished pavement surface levels up to 1.2m below existing surface levels;
- Road 3 will be constructed in cut with finished pavement surface levels up to approximately 1.3m below existing surface levels;
- Road 4 will be constructed in cut with finished pavement surface levels up to approximately 6m below existing surface levels;
- Road 7 (Stage 2 only) will be constructed in cut with finished pavement surface levels up to approximately 2.5m below existing surface levels;
- Road 10 (Stage 2 only) will be constructed in cut with finished pavement surface levels up to approximately 0.7m below existing surface levels;
- The proposed pavements will have kerb and gutter to collect stormwater;
- Port Macquarie Hastings Council Aus-Spec indicates a minimum of 25mm AC7 seal is required for Local Streets and 40mm AC10 for Collector Roads;
- AC thickness of <30mm is not included in the pavement structural thickness design;
- A minimum base thickness of 140mm has been adopted to assist construction, following discussions with local civil contractors;
- A minimum subbase thickness of 150mm has been adopted for constructability;
- Variable subgrade conditions are anticipated and may include bands of weathered rock between bands of clay. A geotechnical assessment is therefore recommended following



boxing out to assess the extent of the different subgrades and whether the nominated pavement design chainage intervals are appropriate;

- Drainage conditions within the area of the proposed pavement alignment are likely to be via overland flow and subsurface infiltration into the topsoil and slopewash materials;
- Variable subgrade conditions are anticipated in individual sections of road; and
- Over-wet foundation conditions for the proposed fill embankment along the alignment of Road 1 may be encountered as discussed in Section 5.5. Subgrade improvement works are likely to be required in this area prior to filling. Treatment of the exposed subgrade with quick lime, incorporation of a granular bridging layer, or, potentially a rock drainage blanket may be required before placement of fill pending geotechnical assessment and it is recommended that an allowance be made for such conditions.

7.3 Subgrade

Subgrade conditions are variable and range from red residual clay to low CBR pale coloured clays to weathered rock. Proposed cut depths will remove most of the higher CBR material (Unit 4A) and expose the underlying lower CBR clays (Unit 5A/B).

The source of the proposed road embankment fill for Road 1 is likely to be derived from the deep cuts proposed in Stage 1 and 2.

Based on the subsurface profiles observed and the results of in-situ testing the following design subgrade CBR's have been adopted:

- Unit 3: Alluvial clay = CBR 1
- Unit 4A: Residual orange/red clays CBR = 7
- Unit 5A: Extremely weathered siltstone as clay CBR = 2
- Unit 5B: Extremely weathered dolerite as clay CBR = 4
- Unit 6: Weathered Rock CBR = 10
- Site won clay embankment fill CBR = 4

Sections of road where embankment fill will be placed will require CBR testing following completion of bulk earthworks.

A geotechnical assessment of exposed subgrades following boxing out is recommended to delineate the extent of the variable subgrade conditions present.

Previous experience with the weathered dolerite rock has found that the clay/rock profile can vary sharply, resulting in variable subgrade conditions.

7.4 Moisture Environment

The Unit 5B extremely weathered rock clays are considered highly expansive soils as defined in Austroads Part 2 with CBR swells during soaking of up to 3.1%. Extreme moisture variations in these soils can potentially produce soil volume changes. Austroads Part 2 (2017) presents a series of options that could be adopted for highly expansive subgrades to assist in limiting the effects of potential soil volume changes:



- Provide a low permeability capping layer above the expansive subgrade such as a dense graded gravel with a PI>4%. The capping layer should have a thickness of at least 200mm and should extend at least 500mm past the edge of pavement (i.e. lip of kerb). A 250mm Select Fill layer (CBR>15 and PI<15) has therefore been incorporated into the pavement design;
- Construct the pavement when the subgrade is near its long term equilibrium soil moisture content (EMC). It is recommended that where possible the subgrade moisture content be less than OMC prior to placement of pavement layers;
- Install subsoil drains on both sides of the pavement ensuring that they do not extend more than 150mm into the expansive subgrade. The drains cannot be restricted to within the pavement layers as recommended in Austroads for expansive clays as they require adequate fall for drainage. It is noted that there will be large service trenches immediately adjacent to the pavements which will have a greater influence on the moisture conditions in the subgrade and soils adjacent to the pavement than the subsoil drains;
- Restrict planting of trees and shrubs close to the pavement;
- Following construction of pavement and placement of primer seal, an assessment can then be made on whether to place the AC or delay the placement of the AC based on weather conditions at the time.

7.5 Pavement Design

Pavement thickness design sheets based on PMHC AUS-SPEC and AUSTROADS Part 2 (2019) with reference to the Austroads empirical design chart (Figure 8.4) are presented in Appendix C. Nominal pavement types are proposed and summarised in Table 7.

Pavement	Type 1 Collector	Type 2A Local Street	Type 2B Local Street	Type 2C Local Street	Type 2D Local Street	Type 3 Access
Design Traffic	1 x 10º ESA	5 x 10⁵ ESA	5 x 105 ESA	5 x 10⁵ ESA	5 x 105 ESA	7 x 10⁴ ESA
Subgrade Material	Clay Fill 5B: EW Dolerite	6: Rock	4A: Clay	5A: Clay	5A: Clay	5A: Clay
Subgrade Design CBR	4	10	7	2	4	2
Asphalt	40 (AC10)	25 (AC7)	25 (AC7)	25 (AC7)	25 (AC7)	25 (AC7)
Base Course	140	140	140	140	140	140
Subbase	260	150	170	150	270	150
Select Fill (CBR>15, PI<15)				290		200
Total Thickness	440	315	335	605	435	515

Table 7	7 - Nominal	Pavement	Types	(Thickness i	in mm)
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Nominal pavement design types for each subject pavement interval are summarised in Table 8.

Road	Chainage (m)	Classification	Subgrade	Design CBR	Nominal Pavement	Total Pavement Thickness (mm)
1	40 – 690m	Collector	Clay Fill	4	Type 1	440
2	220 – 490m	Local Street	Cut: Unit 5A Clay	2	Type 2C	605
3	0-41m	Access Place	Cut: Unit 5A Clay	2	Туре 3	515
4	0 – 175m	Local Street	Cut: Unit 6 Rock	10	Type 2A	315
7	400 – 550m	Local Street	Cut: Unit 5B	4	Type 2D	435
10	240 – 345m	Local Street	Ongrade: Unit 4A	7	Type 2B	335

Table 8 – Pavement Design Summary

7.6 Construction

Construction recommendations for specific pavement designs are included in the appended Pavement Thickness Design Sheets. In addition, the following general construction advice is given:

- After unsuitable material (including topsoil and slopewash) has been stripped the exposed natural subgrade should be proof roll tested in the presence of a suitably experienced geotechnical practitioner to highlight any soft, wet or excessively deflecting areas. Where these are encountered they should be over-excavated and removed to spoil and either re-used on site as non-structural landscaping material or removed from the site. Excavated areas should be backfilled with an approved granular material;
- A geotechnical assessment of the roads should be undertaken following boxing out of pavement areas to assess the need for localised areas requiring subgrade replacement or other treatment. Particular attention should be given to cut/fill boundaries;
- Over-wet foundation conditions for the proposed fill embankment along the alignment of Road 1 may be encountered as discussed in Section 5.5. Subgrade improvement works are likely to be required in this area prior to filling. Treatment of the exposed subgrade with quick lime, incorporation of a granular bridging layer, or, potentially a rock drainage blanket may be required before placement of fill pending geotechnical assessment and it is recommended that an allowance be made for such conditions;
- Grade subgrade down towards shoulders;
- Proof roll the exposed subgrade to highlight any loose, soft, wet, or heaving areas. Where such areas are identified they should be removed and replaced with approved granular or Select Fill (CBR >15, PI<12) to design subgrade level;
- Drying back and moisture conditioning of the subgrade may be required prior to compaction;
- The top 300mm of natural subgrade below pavements or the final 300mm of placed road subgrade fill should be compacted to a minimum density ratio of 100% Standard Compaction;
- Pavement gravels should be placed and maintained at 60% to 90% of Optimum Moisture Content;



- DGS sub-base material should be placed and compacted to a minimum 95% Modified Compaction;
- DGB base material should be placed and compacted to a minimum 98% Modified Compaction;
- Should wet weather occur prior to final sealing, the base course should be allowed to dry back to not more than 90% of Optimum Moisture Content prior to sealing. Trapping of excess moisture below the final seal will significantly reduce pavement life.

7.7 Drainage

Care will be required to promote subsurface drainage to avoid accumulation of water in the pavement profile. To achieve this, we recommend that:

- Subsoil drains be constructed to 300mm below base of pavement on both sides of the road;
- It is critical that granular pavement materials extend laterally to the subsoil drains to allow lateral drainage and prevent ponding of water within the pavement edges.

8 LIMITATIONS

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Regional Geotechnical Solutions Pty Ltd.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in this report and used as the basis for the recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Regional Geotechnical Solutions for the purposes of preparing this report it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Regional Geotechnical Solutions for inaccuracies within any data supplied by others.

If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of Regional Geotechnical Solutions Pty Ltd

Prepared by

Reviewed by

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Tim Morris Associate Engineering Geologist

CQ

Steve Morton Principal Geotechnical Engineer



Figures



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	Client:	Land Dynamics Australia
REGIONAL GEOTECHNICAL SOLUTIONS	Project:	Proposed Residential Subdivision 344 John Oxley Highway, Thrumster
	Title:	INVESTIGATION LOCATION PLAN





Appendix A

Results of Field Investigations

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LEGEND: 2.0 2.0m Water - - U 7.5 - - - - - - - Water - - Water Level (Date and time shown) Somm Diameter tube sample Consistency UCS (kPa) Water Level (Date and time shown) 0 Somm Diameter tube sample VS< Very Soft	210016						555			Sandy GIVAVEL.							
LEGEND: Motes, Samples and Tests Consistency UCS (KPa) Moisture Condition Vater Uso 50mm Diameter tube sample VS Very Soft -25 D D Dry Water Level (Date and time shown) Uso 50mm Diameter tube sample VS Very Soft -25 Moisture Condition Water Level (Date and time shown) E Environmental sample VS Very Soft -25 M Moist Water Cuttlow B Buik sample E Firm 50.00 W Wet State Changes						-	ŤŹŹŹ	:									
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition Vater -	awiiyi					-	-{}}										
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition Vater -	7					_											
LEGEND: Motes, Samples and Tests Consistency UCS (kPa) Moisture Condition Water Uso 50mm Diameter tube sample VS Very Soft <25	10.77					2.0	$\langle \rangle \rangle$		2.00m								
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition Water Uso 50mm Diameter tube sample S Soft <25					7	5				Hole Terminated at 2.00 m							
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition ✓ Water U ₅₀ 50mm Diameter tube sample S Soft 25 - 50 M Moist ✓ Water Level (Date and time shown) U ₅₀ 50mm Diameter tube sample S Soft 25 - 50 M Moist ✓ Water Level (Date and time shown) E Environmental sample St Stiff 100 - 200 W _p Plastic Limit ✓ Water Cutflow B Bulk Sample F Firm 50 - 100 W _p W _p Plastic Limit Strata Changes Gradational or transitional strata Field Tests PlD Photoionisation detector reading (ppm) Density V Very Loose Density Index <15%					1.		-										
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition Water Uso 50mm Diameter tube sample VS Very Soft <25	1001 70					-	-										
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition Water Uso 50mm Diameter tube sample S Soft 25 - 50 M Moist Water Level (Date and time shown) Uso 50mm Diameter tube sample S Soft 25 - 50 M Moist Water Inflow E Environmental sample St Stiff 100 - 200 W, Plastic Limit Water Outflow B Bulk Sample VSt Very Stiff 200 - 400 WL Liquid Limit Field Tests PID Photoionisation detector reading (ppm) Friable Density V Very Loose Density Index <15%	Ź					_	_										
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition Water Uso 50mm Diameter tube sample S Soft 25 - 50 M Moist Water Level (Date and time shown) Uso 50mm Diameter tube sample S Soft 25 - 50 M Moist Water Inflow B Bulk sample for CBR testing F Firm 50 - 100 W W Water Outflow B Bulk Sample Sample VSt Very Stiff 100 - 200 Wp Plastic Limit Strata Changes Gradational or transitional strata Field Tests Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) MD Medium Dense Density Index <15%	2																
LEGEND: Notes, Samples and Tests Consistency UCS (kPa) Moisture Condition ✓ Water U ₅₀ 50mm Diameter tube sample S Soft 25 - 50 M Moist ✓ Water Level (Date and time shown) U ₅₀ 50mm Diameter tube sample S Soft 25 - 50 M Moist ✓ Water Inflow ✓ E Environmental sample St Stiff 100 - 200 Wp, Plastic Limit ✓ Water Outflow B Bulk Sample VSt Very Stiff 200 - 400 WL Liquid Limit ✓ Water Outflow B Bulk Sample Fb Friable PlD Photoionisation detector reading (ppm) Fb L Loose Density Index <15%	-																
Water VS Very Soft <25		EGE	ND:			Notes, Sa	amples a	nd Tes	its			Consister		I	U	L CS (kPa	A) Moisture Condition
CBR Bulk sample for CBR testing F Firm 50 - 100 W Wet (Date and time shown) E Environmental sample St Stiff 100 - 200 Wp, Plastic Limit Water Inflow ASS Acid Sulfate Soil Sample VSt Very Stiff 200 - 400 WL Liquid Limit Water Outflow B Bulk Sample H Hard >400 Fb Friable Field Tests		Vater	[Wate	er Level		U ₅₀	50mn	n Diame	eter tuk	be sample		vs v S S	ery Soft oft		<2 25	25 5 - 50	M Moist
Water Inflow ASS Acid Sulfate Soil Sample VSt Very Stiff 200 - 400 WL Liquid Limit Water Outflow B Bulk Sample H Hard >400 Fb Friable Liquid Limit Strata Changes Gradational or transitional strata PID Photoionisation detector reading (ppm) Definitive or distict DCP(x-y) Dynamic penetrometer test (test depth interval shown) MD Medium Dense Density Index 35 - 65%		_	(Date	e and time s	hown)	CBR E	Bulk s Envir	sample t onmenta	for CB al sam	R testing ple		F Fi St S	irm tiff		50 10) - 100)0 - 200	W Wet W _p Plastic Limit
Strata Changes Field Tests Gradational or transitional strata PID Definitive or distict DCP(x-y) Dynamic penetrometer test (test depth interval shown) MD MD Medium Dense Density Index 35 - 65%		-	Wate Wate	er Inflow er Outflow		ASS B	Acid S Bulk S	Sulfate S Sample	Soil Sa	ample		VSt V Н Н	ery Stiff ard		20 >4)0 - 400 100	W _L Liquid Limit
Gradational or transitional strata Intervision PID Photoionisation detector reading (ppm) L Loose Density Index < 15 % Definitive or distict DCP(x-y) Dynamic penetrometer test (test depth interval shown) MD Medium Dense Density Index 35 - 65%	ב מ	trata	Cha	nges		-	te					Fb Fi	riable	1/		0050	Density Index <15%
Definitive or distict UCP(x-y) Dynamic penetrometer test (test depth interval shown) MD Medium Dense Density Index 35 - 65%	- 10.61		Gr Gr	adational or nsitional stra	ata	PID	Photo	oionisati	on det	ector reading (ppm)	,	Density	v L	Lc	⇒iy L0 bose 	058	Density Index < 15% Density Index 15 - 35%
strata change HP Hand Penetrometer test (UCS kPa) D Dense Density Index 65 - 85%			- De str	finitive or di ata change	stict	DCP(x-y) HP	Dyna Hand	mic pen Penetro	ietrom ometei	eter test (test depth interval sho r test (UCS kPa)	wn)		ME D	ע א D	ediun ense	n Dense	Density Index 35 - 65% Density Index 65 - 85%

ſ						ENGI	NEE	RING LOG - TEST PIT			Т	EST	PIT N	io: TP3
		4				CLIENT	:	Land Dynamics Australia			P	AGE	:	1 of 1
			SOLUT	IONS	UAL	PROJE	CT N/	AME: Sanctuary Development			J	овι	NO:	RGS21087.1
						SITE LO	CAT	ION: 344 John Oxley Drive, Thrumster			L	ogo	GED B	Y: GC
					-	TEST L	OCAT	FION: Road 7 / Ch200m			D	ATE		15/4/21
ŀ	FO			F۰	20T F	Excavat	or	FASTING	485250	m 9			RI ·	8 5 m
	TES	ST PI	T LENGT	—. Н:	2011	W	IDTH	: NORTHING:	6519840	m I	DATU	N:		AHD
ŀ		Drill	ing and Sar	npling				Material description and profile information				Fiel	d Test	
ľ							NO				5			
	₽ ₽	ËR		RL	DEPTH	비분이	CATI	MATERIAL DESCRIPTION: Soil type, plasticity	/particle	TURE	SITY (Lype	sult	Structure and additional observations
	METH	WAT	SAMPLES	(m)	(m)	LO	SSIFI	characteristics,colour,minor components	5		NSIS	[est	Res	
							CLA			20	0 C			
Γ	icket	ered			_		MH	TOPSOIL Sandy Clayey SILT, dark grey.		D	Fb			TOPSOIL
	d Bu	ounte				-	:							
	pothe	Enc			1	-								
	ш Ц	Noi			-			0.30m						
	000u		0 40m		-		СН	Sandy CLAY medium plasticity, red, traces gravel, fine grained, subrounded ironstone.	of	× ∧	Fb / VSt			RESIDUAL
	-		0.1011	8.	D					Σ		HP	380	
					0.5							ΗP	350	
			U50		-									
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			0.80m											
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				7.	<u>5</u> 1.(нр	380	
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rawing														
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5.77-				0.3	2.0			2.00m						
200					-			Hole Terminated at 2.00 m						
					_	1								
901.7C						-								
2						-								
					-									
- C C				6.	D									
BOREL	LEG	END:	L	<u> </u>	Notes, S	amples a	nd Tes	sts	Consister			U	- CS (kPa 25	A) Moisture Condition
LEU LEU	Wate	<u>ər</u> Wət	er Level		U ₅₀	50mn	n Diame	eter tube sample	s So	əry SON Oft		25	5 - 50	M Moist
	_	(Dat	e and time s	hown)	CBR E	Bulk s Envir	sample onment	for CBR testing tal sample	F Fi St St	rm iff		50 10) - 100)0 - 200	W Wet W _p Plastic Limit
ע פא		Wat Wat	er Inflow er Outflow		ASS B	Acid S Bulk S	Sulfate Sample	Soil Sample	VSt Ve H H	ery Stiff ard		20 >4	00 - 400 400	W _L Liquid Limit
р год	<u>Strat</u>	ta Cha	anges		Field To	\		-	Fb Fr	iable	1/		0050	Density Index <15%
14.0.6		Gi tra	radational or ansitional stra	ata	PID	Photo	ionisati	ion detector reading (ppm)	Density	L	Lc	ose 	-030	Density Index 15 - 35%
G LIB 1.		– De st	əfinitive or di: rata change	stict	HP	Hand	Penetro	rometer test (UCS kPa)		D		eaiun ense	Dense	Density Index 30 - 65%

				E	ENGI	NEE	RING LOG	- TEST PI	Т			Т	EST	PIT N	IO:	TP4
	4				LIENT	:	Land D	alia			P	AGE			1 of 1	
		SOLUT	IONS	F	ROJE	CT NA	ME: Sanctu	ary Developme	ent			J	OBN	NO:		RGS21087.1
				S	SITE LO	CATI	ON: 344 Jo	hn Oxley Drive	, Thrumster			L	oge	GED B	Y:	GC
				т	EST L	OCAT	ION: Road 1	0 / Ch260m				D	ATE	:		15/4/21
EC			E:	20T E	xcavat	or			EASTING:	485324	m	SURF	ACE	RL:	12.4	m
TE	ST P	IT LENGT	H:		w	IDTH:			NORTHING:	6519901	m I	DATU	И:		AHD	
	Dril	ling and Sar	npling				Material de	escription and prof	ile information				Field	d Test		
						NOI						ς	0		_	
НОН	TER	SAMPLES	RL	DEPTH	I H S	FICAT BOL	MATERIAL [DESCRIPTION: S	oil type, plasticity	/particle	TURE	STEN	Type	sult	Structu o	ure and additional bservations
MET	MA	0,1111 220	(m)	(m)	GRA	ASSIF	chara	icteristics,colour,m	ninor components	s	MOIS	ONSIG	Test	Re		
Ļ						5		<u> </u>			<u> </u>	0 E			TOPSOIL	
ucke	tered			-		MH	TOPSOIL brown, tra	Sandy Clayey SI aces of tree roots	ILT, dark grey/da to 200mm	ırk	D	Fb			TOPSOIL	
led B	coun															
Toot	ot En															
ш ш	ž			-			0.30m				_ <u>C</u>	Eh /			RESIDUA	
1000			12.0	<u>'</u>			sand fine	to medium graine	ed.	orange,	> >	VSt	нр	250		-
				0.5							2			200		
				0.9												
				- -												
				-									ΗP	280		
				-												
			11.5	5												
				- 1. <u>0</u>												
				-												
				_			1.20m									
						СН	Gravelly brown/wh	Silty CLAY mediu	um to high plastic	ty, pale	1				EXTREM SLATE	ELY WEATHERED
מ			11.0				coarse gr	ained, subangular	r slate, some roc	k fabric.						
				<u>'</u>												
				1.5												
				-												
0				-												
			10.5	<u>;</u>												
				- 2.0			2 00m									
						1	Hole Terr	ninated at 2.00 m								
					-											
				1.	4											
				-												
			10.0													
					1											
LE	GEND:			[−] Notes, Sa	amples a	nd Tes	<u>s</u>			Consister	l ncy		<u>U</u>	CS (kPa	a) <u>Moist</u> u	re Condition
Wa	iter			U ₅₀	50mm	n Diame	ter tube sample			VS V S S	ery Soft oft		<2 25	25 5 - 50	D M	Dry Moist
	- Wat (Da	er Level te and time s	hown)	CBR	Bulk s	sample	or CBR testing			F Fi	irm tiff		50 10) - 100)0 - 200	W	Wet Plastic Limit
┣►	– Wat	ter Inflow		ASS	Acid	Sulfate	Soil Sample			VSt V	ery Stiff		20)0 - 400	W _L	Liquid Limit
<u>Str</u>	ata Ch	anges		D	BUIKS	затре				Fb Fi	aiù riable		>4	ŧUU		1 1 .450/
-	G	radational or ansitional stra	ata	Field Tes PID	e <u>ts</u> Photo	ionisati	on detector reading	g (ppm)		<u>Density</u>	V L	Ve Lo	ery Lo bose	ose	Density Density	Index <15% Index 15 - 35%
	D	efinitive or di	stict	DCP(x-y) HP	Dynai Hand	mic pen Penetro	etrometer test (tes meter test (UCS I	t depth interval sho ⟨Pa)	wn)		ME D	D M	ediun ense	n Dense	e Density Densitv	Index 35 - 65% Index 65 - 85%
	31	.au ondrige									VD	V.	erv De	ense	Density	Index 85 - 100%

Γ					E	ENGI	NEE	RING LOG - TEST PIT			Т	EST	PIT N	io: TP5
		4						P	AGE		1 of 1			
	2		SOLUT	IONS	P	ROJE		IE: Sanctuary Development			J	ов і	NO:	RGS21087.1
					s	ITE LO	CATI	N: 344 John Oxley Drive, Thrumster			LC	COC	SED B	Y: GC
					т	EST L	осат	ON: Road 10 / Road1			D	ATE	:	15/4/21
F				Ę۰	20T F	vcavat	or	EASTING	485379	m 9		CE	RI ·	8.6 m
	TES	ST PI	T LENGT	L. H:	201 L	W	IDTH:	NORTHING:	6519903	m I	DATUN	л: И:	I.L.	AHD
		Drill	ing and Sar	npling				Material description and profile information				Field	d Test	
							NO				2			
		ER		RL	DEPTH	L DHO	BOL	MATERIAL DESCRIPTION: Soil type, plasticity	/particle	TURE	SITY SITY	Type	sult	Structure and additional observations
	ME	WA ⁻	SAIVIFLES	(m)	(m)	GRA	SSIF	characteristics, colour, minor component	s	UND:	DEN	Test	Re	
							CL/				ŏ			70000
	ncket	ered		8.5	-		MH	TOPSOIL Sandy Clayey SILT, dark brown, of tree roots to 50mm	traces	M	Fb			TOPSOIL
-	ed Bi	count												
1	ooth	t Enc			1 -	- } ;		1.25m						
'	- E	Ň	0.30m				СН	Sandy CLAY medium to high plasticity red/	orange.	Š	Fb /			RESIDUAL
	000				4					ž	VSt			
`												ΗP	270	
			CBR		0.5									
				8.0										
			0.70m		-								070	
												пр	270	
					-									
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					1.0									
00				7.5										
D and														
arger La					-			.30m						
40.					_		СН	Gravelly Silty CLAY medium to high plastic white/pale grey, red/yellow mottling, gravel f	city, fine to					EXTREMELY WEATHERED
10770'r					-			coarse grained, subangular slate, some roc	k fabric.					
0.0					1. <u>5</u>									
				7.0	-									
710016														
622					-									
awingr					- -									
22.6FJ					2.0			2.00m						
				6.5				Hole Terminated at 2.00 m						
2					-	1								
7 1001 7					-	-								
0 DL					{									
-					-	1								
	EGI	END:			Notes. Sa	mples a	nd Tes	4	Consister	l		U	CS (kPa	a) Moisture Condition
	Nate	<u>er</u>			<u>, э</u> е	50mm	1 Diamo	- er tuhe sample	VS V	ery Soft		<2 2	25 5 - 50	D Dry M Moist
	¥	Wate	er Level	hown	CBR	Bulk s	ample f	r CBR testing	F Fi	rm		25 50) - 100	W Wet
	-	Wat	er Inflow		E ASS	Enviro Acid S	onmenta Sulfate S	sample jil Sample	St St VSt V	tiff ery Stiff		10 20)0 - 200)0 - 400	W _p Plastic Limit W _L Liquid Limit
L -		Wate	er Outflow		В	Bulk S	Sample		H H	ard 'iable		>2	100	
	orat	<u>a cha</u> Gr	nges radational or		Field Tes	ts	iori- "	a data ataz zaading (n)	Density	V	Ve	ery Lo	ose	Density Index <15%
C.4U.1		tra De	ansitional stra	ata stict	PID DCP(x-y)	Photo Dynai	nonisatio mic pen	n detector reading (ppm) trometer test (test depth interval shown)		L ME	Lo D Me	ose ediun	n Dense	Density Index 15 - 35% Density Index 35 - 65%
		str	rata change		HP	Hand	Penetro	neter test (UCS kPa)			De Ve	ense erv De	ense	Density Index 65 - 85% Density Index 85 - 100%

				E	INGI	NEE	RING LOG	- TEST PI	Т			Т	EST	PIT N	io: TP6
		REGIO	NAL		LIENT	:	Land D	ynamics Austr	alia			P	AGE	:	1 of 1
		SOLUT	IONS	P	ROJE		ME: Sanctua	ary Developme	ent			J	OB I	NO:	RGS21087.1
				S	ITE LC	CATI	DN: 344 Joł	hn Oxley Drive	, Thrumster			L	OGC	GED B	Y: GC
				т	EST L	OCAT	ON: Road 1	/ Road 11				D	ATE	:	15/4/21
E	QUIP EST	'MENT TYP PIT LENGT	'E: H:	20T E	xcavat W	:or /IDTH:			EASTING: NORTHING:	485379 6519975	m \$ m [SURF <i>A</i> DATUI	ACE M:	RL:	8.0 m AHD
	Di	rilling and Sar	mpling				Material de	scription and prof	file information				Fiek	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL D chara	DESCRIPTION: S cteristics,colour,n	oil type, plasticity ninor component	y/particle s	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
1000mm Toothed Blicket						CL	TOPSOIL of grass ro 0.20m Silty CLA 0.40m	Sandy Clayey Si oots to 5mm	ILT, dark brown,	traces	M > W _P	Fb Fb			TOPSOIL SLOPEWASH
		<u>0.60m</u>	7.5	0. <u>5_</u>		СН	Sandy CL yellow, ora 0.60m Gravelly S	LAY medium plas ange/red mottling Silty CLAY medii	ticity, pale brown	with	M < W _P	Fb / VSt	ΗP	300	ALLUVIAL
				-			grey/white	e with red mottling	J.	oity, paie					
		CBR													
tu Tool		0.00m		-											
<< DrawingFile>> 19/05/2021 16:03 10.02.00.04 Datget Lab and In Situ	15/04/2021	<u>0.90m</u>	7. <u>0</u> 6. <u>5</u>	- 1. <u>0</u> - 1. <u>5</u>			1.50m	ninoted of 1.50 m					HP	350	
CPJ <				-			Hole Term	ninated at 1.50 m							
OKEHOLE - TEST PIT RGS21087.1LOGS IP1-22	EGENI	D:	6.0		- - - amples a	and Tes	<u>s</u>			Consister				CS (kPa	a) Moisture Condition
	later			U ₅₀	50mn	n Diame	er tube sample			VS Ve S Se	ery Soft		<2 25	25 5 - 50	D Dry M Moist
	⊻ w (D — w ≺ w	ater Level late and time s later Inflow later Outflow	shown)	CBR E ASS B	Bulk s Enviro Acid s Bulk s	sample f onmenta Sulfate (Sample	or CBR testing I sample coil Sample			F Fi St St VSt Ve H Ha	rm iff ery Stiff ard		50 10 20 >4) - 100)0 - 200)0 - 400 100	W Wet W _p Plastic Limit W _L Liquid Limit
3G LIB 1.04.5.GLB L	<u>trata C</u>	nanges Gradational or transitional stra Definitive or di strata change	ata istict	Field Test PID DCP(x-y) HP	<u>ts</u> Photo Dynaı Hand	ionisatio mic pen Penetro	n detector reading etrometer test (tes meter test (UCS k	g (ppm) t depth interval sho (Pa)	wn)	Density	N L ME D VD	Ve Lo D De Ve	ry Lo ose edium ense ery D₀	oose n Dense ense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%

SEGURAL- NOT CLENT: Land Dynamics Australia PAGE: 1 of 1 PROJECT NAME: Sanchary Development JOB NO: R (1071) STELECATION: Read 1 / Ch 520m DATE: 154/21 EQUIPMENT TYPE: 20 Excavalor Read 1 / Ch 520m DATE: 2.2 TEST LOCATION: Read 1 / Ch 520m DATE: 1.5 2.2.m. TEST PT LICENT Read 1 / Ch 520m DATUE: 2.2 AnD TOPSOL: Material description and particle information Find Test AnD Topsol: Read 1 / Ch 520m DATUE: 2.2 AnD Topsol: Read 1 / Ch 520m DATUE: 2.2 AnD Topsol: Read 1 / Ch 520m DATUE: AnD AnD Topsol: Read 1 / Ch 520m Read 1 / Ch 520m AnD AnD Topsol: Read 1 / Ch 520m Read 1 / Ch 520m Read 1 / Ch 520m AnD Topsol: Read 1 / Ch 520m Topsol: Read 1 / Ch 520m Read 1 / Ch 520m Read 1 / Ch 520m Read 2 / Ch 500m					E	ENGI	NEE	RIN	G LOG - TEST PIT				Т	EST	PIT N	io: TP7
EULIFICATION PROJECT NAME: Sanctuary Development JOB NO: RGS21087.1 STE LOCATION: 344 John Okey Drive, Trummer LOGGED BY: GC STE LOCATION: Road 1 / Ch Save MATERIAL EASTING: 486376 m SURFACE RL: 8.2 m EQUIPMENT TYPE: 201 Excavator Montraine MORTHANNE: 662029 m DUTIM: A-D TOTINg and Sampler Material development NORTHANNE: 662029 m DUTIM: A-D Output Mit Opport Material development Material profile information TOPEDIC: Saventure information Material development Material profile information Material information		4					:		Land Dynamics Australia				P	AGE	:	1 of 1
STE LOGATION: 344 John Oxley Drive. Thrumset: LOGGED BY: CR TEXT LOGATION: 344 John Oxley Drive. Thrumset: CORE 32.07 Text LogATION: 344 John Oxley Drive. Thrumset: CORE 32.07 Text LogATION: Main Transformation Version Version Second Core Second				IONS	F	ROJE		ME:	Sanctuary Development				J	ови	NO:	RGS21087.1
TEST LOCATION: Read 1/ Ch S200 DATE: 19421 EQUIPENT TYPE: Software Read 1// Ch S200 Mark ADD 1000 Software So					s	SITE LO	CATI	ON:	344 John Oxley Drive, Thrums	ster			L	OGO	GED B	SY: GC
EQUIPMENT TYPE: 20 T Excavator EASTING: 485776 m SURFACE RL: 6.2 m OUID UT LENGTI: 20 T Excavator Material discorption and profile information Field Test AnD OUID UT US 0 mm Profile and Sampling Material discorption and profile information Field Test Situature and additional discorption and profile information Field Test USU UT US Risk 0 mm Profile State Situature and additional discorption and profile information M Field Test USU UT US Risk 0 mm Profile State Situature and additional discorption and profile information M Field Test USU UT US Risk 0 mm Profile State Situature and additional discorption and profile information components M Field Test USU UT USU UT USU UT USU UT USU UT USU UT USU USU					т	EST L	осат	ION:	Road 1 / Ch 520m				D	ATE	:	15/4/21
Bully Head Hill Title: Call Exclusion Deck Title: Subtract: Add to the control of the control o	╞╴			- .	007 5					10	405070					0.0
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Top Bill of Bill of Bill of Bill of Bill of CAM medium plasticity, gray. S Pb SOCE SOCE 1 0.1 0.1 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2 0.2 0.1 0.2	Σ	>				0	CLAS					ĭ₹S	CON	Ť		
Big out	ket	eq				13111	MH		TOPSOIL Sandy Clayey SILT, dark g	grey, trac	es of	М	Fb			TOPSOIL
Subject	Buck	Intere			-				grass roots to 5mm							
OP OP <t< td=""><td>thed</td><td>ucor</td><td></td><td>8.0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	thed	ucor		8.0												
Solution Image: Solution of the second o	Too	Not E		-].											
Set Use					-			0.25m	Silty CLAY medium plasticity, grey				Fb			SLOPEWASH
Lécono Moise Semiles and Tests Consistency Visit HP 300 1 0.5 0.5 0.5 0.5 0.5 0.5 0.5 7.5 1 0.5 0.5 0.5 0.5 0.5 0.5 1 0.5 0.5 0.5 0.5 0.5 0.5 0.5 7.5 1 0.5 0.5 0.5 0.5 0.5 0.5 1 0.5 0.5 0.5 0.5 0.5 0.5 0.5 1 0 0.5 0.5 0.5 0.5 0.5 0.5 0.5 1 0 0.5 1.5 0.5 0.5 0.5 0.5 0.5 1.5 0 1.5 0.5 0.5 0.5 0.5 0.5 0.5 1.5 0 0 0.5 0.5 0.5 0.5 0.5 1.6 0 0 0.5 0.5 0.5 0.5 0.5 1.6 0 0.5 0.5 0.5 0.5 <td< td=""><td>100</td><td></td><td></td><td></td><td>· ·</td><td></td><td>CH</td><td>0.30m</td><td>Sandy CLAY medium plasticity, grey.</td><td>brown w</td><td>vith red</td><td>> ^₁ ¥</td><td>Fb/</td><td></td><td></td><td>ALLUVIAL</td></td<>	100				· ·		CH	0.30m	Sandy CLAY medium plasticity, grey.	brown w	vith red	> ^₁ ¥	Fb/			ALLUVIAL
Listerior Mater Large CH Standy Sity CLAY medium to high plasticity. white/plage yeak from endium to sing plasticity.					1			0.40m	mottling.			× ≻	VSt	ΗP	300	
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Water Outflow ASS Acid Sulfate Soil Sample VSt Very Stiff 200 - 400 W _⊥ Liquid Limit H Hard >400		(Da	ite and time s	hown)	E	Enviro	onmenta	al sam	ple		St S	tiff		10)0 - 200	W _p Plastic Limit
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Strata Changes Fb Friable Operativities Less Density V Very Loose Density Index <15%	<u>S</u>	rata Ch	anges		Field Tes	ts				-	Fb F	riable V	Ve	ervio	ose	Density Index <15%
Gradational or transitional strata PID Photoionisation detector reading (ppm) L Loose Density Index 15 - 35%		G tr	radational or ansitional stra	ata	PID	Photo	ionisati	on dete	ector reading (ppm)		y	Ľ	Lc	ose	- D-	Density Index 15 - 35%
Definitive or distict Der(x-y) Dynamic peneurometer test (test depth interval shown) MD Medium Dense Density Index 35 - 65% strata change HP Hand Penetrometer test (UCS kPa) D Dense Density Index 35 - 85%	_	D sf	efinitive or dis trata change	stict	HP	Hand	Penetro	ometer	rtest (UCS kPa)			D	De	eaiun ense	Dense	Density Index 65 - 85%

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	- 4		NAL		CLIENT	:	Land Dynam	ics Australia			P	AGE	:	1 of 1
			IONS	UAL F	PROJE		ME: Sanctuary De	evelopment			J	OB I	NO:	RGS21087.1
				5	SITE LO	CATI	ON: 344 John Ox	ley Drive, Thrumster			L	OGO	GED B	Y: GC
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cket	ered			-	X	MH	FILL Sandy Clay	yey SILT, dark grey, traces	of grass	М	Fb			FILL/TOPSOIL
d Bu	ounte				-81									
othe	Enc													
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ÌÉ				1		СН	Sandy CLAY me orange mottling.	edium plasticity, pale browr	n with	× K	Fb / VSt			ALLUVIAL
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]		СН	Gravelly Sandy pale grey/grey w	CLAY medium to high plase vith traces of orange mottlin	sticity, g.					
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	GEND:	<u> </u>		Notes, Sa	amples a	Ind Tes	<u>1</u>		Consister	ncy		U	CS (kPa	Moisture Condition
	ater	tor Lour'		U ₅₀	50mm	n Diame	er tube sample		VS V S S	ery Soft oft		<2 25	25 5 - 50	D Dry M Moist
	- vvat (Da	ter Level	hown)	CBR E	Bulk s	sample f	r CBR testing		F Fi	rm tiff		50 10) - 100)0 - 200	W Wet W Plastic Limit
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ີ <u>St</u>	rata Ch	er Outtiow		в	Bulk S	sample			Fb Fi	ard riable		>4	ŧUU	
	G	radational or	ata	Field Tes PID	<u>sts</u> Photo	ionisatio	n detector reading (ppm))	Density	V L	Ve Lo	ery Lo bose	oose	Density Index <15% Density Index 15 - 35%
n	D	efinitive or di	stict	DCP(x-y) HP	Dynai Hand	mic pen Penetro	trometer test (test depth neter test (UCS kPa)	interval shown)		ME D	M (ediun ense	n Dense	Density Index 35 - 65% Density Index 65 - 85%
2	st	rata change					······································		1	VD	v Ve	erv D	ense	Density Index 85 - 100%

		REGIONAL GEOTECHNICAL ENGINEERING LOG - TEST PIT Land Dynamics Australia TEST PIT NO: TP9 PAGE: 1 of 1													
			NAL	• • • C	LIENT	:		Land Dynamics Australia				P	AGE	E:	1 of 1
		SOLUT	IONS	P	ROJE	CT N/	AME:	Sanctuary Development				J	ови	NO:	RGS21087.1
				S	ITE LC	CAT	ION:	344 John Oxley Drive, Thrumster	r			L	OGG	JED B	SY: GC
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E ⁱ	QUIPN EST P	IENT TYP	E: H:	20T E	xcavat W	or I DTH	:	EASTING: NORTHIN	4854 G: 65201	461 m 136 m	S	SURF#	ACE M:	RL:	4.5 m AHD
	Dril	lling and Sar	mpling					Material description and profile information	n				Field	d Test	
	—					z						~			
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATIO SYMBOL	M	IATERIAL DESCRIPTION: Soil type, plasti characteristics,colour,minor compon	icity/particle .ents	MOISTURE	CONDITION	CONSISTENC DENSITY	Test Type	Result	Structure and additional observations
icket	ered					MH		TOPSOIL Sandy Clayey SILT, dark grey grass roots to 5mm	/, traces of		м				TOPSOIL
1000mm Toothed Buc	Not Encounte			 - 0. <u>5</u> 		СН	<u>0.30m</u>	Sandy CLAY medium plasticity, red with mottling, traces of gravel, fine grained, su	– – – – – – ı pale browr ubangular.	 n	M > Wp	Fb / St	HP	150	
		3.0 1.5 3.5 2.0					0.90m	Gravelly Sandy CLAY medium to high p mape grey with pale brown mottling, grav rock fabric.	plasticity, vel, some		M < W _P				
								Hole Terminated at 2.00 m							
	EGEND:				- - - - -	Ind Tes	sts_		Consi	istency	Ĺ		<u> </u>	CS (kPa	a) Moisture Condition
	ater	tor Loval		U ₅₀	50mm	۱ Diame	eter tuk	be sample	S	very Soft	Solt		<2 25	25 5 - 50	M Moist
-	⊻ vva (Da	ter Level ite and time s	hown)	CBR	Bulk s	ample	for CB	R testing	F	Firm			50) - 100	W Wet
►	— Wa	ter Inflow	1	ASS	Acid S	Sulfate	Soil Sa	ample	VSt	Very	Stiff		20)0 - 200)0 - 400	W_{L} Liquid Limit
Sí	· ∢ Wai trata Ch	ter Outflow		В	Bulk S	Jample			H Fb	Hard Friab	i ole		>4	100	
	GG	Gradational or	. !	Field Test	<u>ts</u> Dhoto	ionioati	ion dat	tester reading (nom)	Densi	ity	V	Ve	ery Lo	ose	Density Index <15%
_	tr. D s'	ansitional stra lefinitive or di trata change	ata stict [[]	DCP(x-y) HP	Photo Dynar Hand	nic pen Penetr	on dete netrome ometer	eter test (test depth interval shown) r test (UCS kPa)			L MD D	La Me De	edium edium ense	າ Dense ense	 Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%

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				S	SITE LC	CATI	DN: 34	4 John Oxley Dr	ive, Thrumster			L	OGG	SED B	BY: [DS
				т	EST L	OCAT	ON: Ro	ad 1 / Road 13				D	ATE	:	1	5/4/21
E	JUIPN		E:	20T F	- xcavat	or			EASTING:			SURF	ACE	RL:	4 5 m	
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	Drill	ling and Sar	mpling				Mater	rial description and	profile information				Field	d Test		
						NO						5				
THOD	ATER	SAMPLES	RL (m)	DEPTH	APHIC	IFICAT MBOL	MATER	RIAL DESCRIPTION	N: Soil type, plasticity	y/particle	STURE	ISTEN NSITY	st Typ€	esult	Structur	re and additional oservations
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cket				-		MH	FILL	Sandy SILT, low p	plasticity, brown-grey	/, sand	Å X				FILL/TOPS	SOIL
ed Bu							0.10m San	dy Silty CLAY mer	dium plasticity, brow	 n, sand	ž				SLOPEWA	<u></u>
oothe					-////		fine	to coarse grained.								
L L					\$ <i>1111</i>	СН	San	dy CLAY medium	plasticity, red/mottled	d pale	Š	Fb /			ALLUVIAL	
1000r							grey		e graineu.		Š	VOL				
Ì			4.0													
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				1 .		СН	Gray	velly Silty CLAY m	edium plasticity, red	/yellow						
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LE	GEND:	L		Notes, Sa	amples a	Ind Tes	<u>s</u>			Consiste	ncy	<u> </u>	U	CS (kPa	a) <u>Moisture</u>	e Condition
<u>Wa</u>	i <u>ter</u> Wat	ter l evel		U ₅₀	50mm	ו Diame	er tube sam	ıple		s s	ery Soft oft		<2 25	:5 5 - 50	M	Dry Moist
	(Dat	te and time s	hown)	CBR E	Bulk s Envire	ample f	or CBR testi I sample	ing		F F St S	irm tiff		50 10) - 100)0 - 200	W Wp	Wet Plastic Limit
	- Wat ◀ Wat	er Inflow ter Outflow		ASS B	Acid S Bulk S	Sulfate S Sample	oil Sample			VSt V	′ery Stiff lard		20 >4	0 - 400 100	W_	Liquid Limit
<u>Str</u>	ata Cha	anges		-	te					Fb F	riable	14		050	Density	Index <15%
-	Gi tra	radational or ansitional stra	ata	PID	Photo	ionisatio	n detector r	eading (ppm)			V L	Lc	ery LC Dose	050	Density	Index 15 - 35%
-	— De st	efinitive or di irata change	stict	HP	Dynar Hand	nic pen Penetro	meter test (st (test depth interval UCS kPa)	snown)		ME D	J M	edium ense		e Density Density	Index 35 - 65% Index 65 - 85%

				F	ENGI	NEE	RING LOG - TEST PIT			T	EST	PIT N	io: TP11
	-		NAL		LIENT	:	Land Dynamics Australia			P	AGE	:	1 of 1
		SOLUT	IONS	F	PROJE	CT N/	ME: Sanctuary Development			J	OB I	NO:	RGS21087.1
				S	SITE LC	CAT	ON: 344 John Oxley Drive, Thrumster			Ľ	OGC	JED B	Y: DS
				т	IEST L	OCAT	ION: Road 13 / Ch 50m			D	ATE	:	15/4/21
EQ	UIPN	IENT TYP	'E:	20T E	Excavat	or	EASTING:		5	SURF/	ACE	RL:	14.9 m
TE	ST PI		H:		w	IDTH	NORTHING:		[DATU	M:		AHD
L	Drill	ling and Sar	npling				Material description and profile information				Field	d Test	
6	Ľ,				₽	ATION			ION N	ZNCY T	/be	±	Structure and additional
ЛЕТНС	WATE	SAMPLES	RL (m)	DEPTH (m)	LOG	SSIFIC. SYMBC	MATERIAL DESCRIPTION: Soil type, plasticity characteristics,colour,minor components	/particle s		NSISTE DENSI [°]	est Ty	Resu	observations
Ĺ						CLA:			20	0 C			
Bucket	ntered					ML	FILL Sandy SILT		< W _P				FILL/TOPSOIL
othed F	Encour			-		CL	Sandy CLAY low plasticity brown, sand fine coarse grained.	: to	_ 2				SLOPEWASH.
m Toc	Not E												
000mr		0.30m		-		CL	Sandy CLAY medium plasticity, red, sand fi	ine to	_ ≤				RESIDUAL
-			14.5	;					Σ				
		В] -									
		0.50m	. 	- 0.5									
		000		-									
		CBK											
	<u>0.70m</u> -			1 -		•							
	-												
			14.0	<u>)</u>		***							
				-									
5				- 1. <u>0</u>									
				-			<u>1.10m</u>						
						СН	Gravelly Silty CLAY medium plasticity, red/ yellow, gravel fine to coarse grained, suban	mottled gular.					SLATE
] -		***							
				-									
			13.5	<u>;</u>									
D													
				- 1. <u>5</u>									
				-									
				_									
-				-									
	'					1	1.80m Hole Terminated at 1.80 m		+		$\left - \right $		
			<u>ц</u> .										
LEC	SEND:			Notes, Sa	amples a	nd Tes	<u>its</u>	Consiste	ency Verv Soft			<u>CS (kPa</u>	a) Moisture Condition
	<u>er</u> Wat	ter Level			50mm Bulk	າ Diame	eter tube sample	S	Soft Firm		25	.5 5 - 50 0 - 100	M Moist W Wet
	(Dat - Wat	te and time s ter Inflow	hown)	E	Envire	onment	al sample	St	Stiff		10)0 - 200	W Wet
	Wat	ter Outflow		В	Bulk S	Sample	Son Sample	H Eb	Hard		>4	100 - 400 100	
<u>Stra</u>	<u></u> G	radational or		Field Tes	<u>its</u> Phote	vionisati	ion detector reading (nnm)	Density	V	Ve	ery Lo	ose	Density Index <15%
	tra D [.]	ansitional stra efinitive or di	ata .stict	DCP(x-y)	Dynar	nic per	etrometer test (test depth interval shown)) M	edium	ו Dense	 Density Index 15 - 55% Density Index 65 - 55%
1	st	.rata change		TIF.	папи	Fenelia		1		i Vi	erv Dr	ense	Density Index 85 - 100%

				E	ENGI	NEE	RING LOG - TEST PIT			т	EST	PIT N	io: TP12
				CAL C	LIENT	:	Land Dynamics Australia			Р	AGE		- 1 of 1
		SOLUT	IONS	F	ROJE	CT N/	ME: Sanctuary Development			J	ові	NO:	RGS21087.1
				S	SITE LC	CAT	ON: 344 John Oxley Drive, Thrumster			L	OGO	GED B	Y: DS
				т	EST L	OCAT	ION: Road 11 / Ch 170m			D	ATE	:	15/4/21
E	QUIF	MENT TYP	'E: H:	20T E	xcavat W	or IDTH :	EASTING: NORTHING:		: [ACE M:	RL:	7.3 m AHD
\vdash	D	rilling and Sar	mpling		Τ		Material description and profile information				Fiel	d Test	
\vdash	Τ	$\overline{1}$			<u> </u>	z				~			
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATIO SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity characteristics,colour,minor component	//particle s	MOISTURE	CONSISTENC DENSITY	Test Type	Result	Structure and additional observations
ck of	red			_		ML	FILL: Sandy SILT, low plasticity, brown, sar	nd fine to	^d ×				FILL/TOPSOIL
	י ריי inte					CL	Sandy Silty CLAY: low plasticity, brown, sa						SLOPEWASH
otho		i		1.			coarse grained.		ĺ~ ∑				
L L	Vot	0.30m	7.0)					/ _P to				
6									× v				
	2	U50			¥////				2				
		0.50m		0.5									
				-									
			6.6			СН	Sandy CLAY: medium plasticity, red, sand						RESIDUAL — — — — — — — —
			0.2				coarse grained.		> ^ 5				
			-										
				1. <u>0</u>									
				-			<u>1.10m</u>		_				
				-		СН	Gravelly Silty CLAY: low to medium plastic red/mottled yellow, gravel fine to coarse gra	city, ained, sub	_×				EXTREMELY WEATHERED
			6.0)			angular.		Σ				
Cargo			-	- ·									
5				-									
				1.5									
500				1.5									
1707				1.									
200				-									
b			5.5	5									
Ri wa					<u>VIII</u>								
7				- .	L///								
0.1				- 2.0			2.00m						
				_			Hole Terminated at 2.00 m						
					1								
].	-								
			5.0)									
				_									
1 				-	-								
	FGEN		<u> </u>	Notes Sa		nd Tos	te .	Consist	ency			CS (kPa	Moisture Condition
	later				<u></u>	<u></u>	<u>.</u>	VS	Very Soft		<2	25	D Dry
	Z w	ater Level		U₅₀ CBR	50mm Bulk ទ	n Diame sample	eter tube sample for CBR testing	S F	Soft Firm		25 50	5 - 50) - 100	M Moist W Wet
	(D — V	∂ate and time s /ater Inflow	snown)	E ASS	Enviro Acid S	onment Sulfate	al sample Soil Sample	St VSt	Stiff Verv Stiff		10 20)0 - 200)0 - 400	W _p Plastic Limit W, Liquid Limit
- 60	- 4 W	ater Outflow		В	Bulk S	Sample		н	Hard		>2	100	
S S	<u>trata C</u>	hanges Gradational or	.	Field Tes	its			⊢b <u>Density</u>	riable V	V	ery Lo	ose	Density Index <15%
.0.4.0.		transitional stra	ata	PID DCP(x-v)	Photo Dvnai	ionisati mic per	on detector reading (ppm) etrometer test (test depth interval shown)		L MF	Lo D M	oose ediun	1 Dense	Density Index 15 - 35% Density Index 35 - 65%
		strata change	SUCL	HP	Hand	Penetr	ometer test (UCS kPa)		D	D	ense		Density Index 65 - 85%

		ENGINEERING LOG - TEST PIT											т	EST	PIT N	io: TP13
	4			олі (LIENT	:		Land Dynamics	s Australia				Р	AGE		1 of 1
		SOLUT	IONS	F	ROJE		ME:	Sanctuary Dev	elopment				J	ові	NO:	RGS21087.1
				S	SITE LC	CATI	ON:	344 John Oxley	y Drive, Thru	mster			L	ogo	GED B	Y: DS
				т	EST L	OCAT	'ION:	Road 1 / Road	7				D	ATE	:	15/4/21
EC	QUIPN		E:	20T E	Excavat	or			EAS	TING:		5	SURF	ACE	RL:	9.4 m
ТЕ	ST P	IT LENGT	H:		w	IDTH:	:		NOR	THING:		ſ	DATU	M:		AHD
	Drill	ling and Sar	mpling					Material description	and profile info	rmation				Fiel	d Test	
g	e د				<u></u>							₩ N	≺nc	be	-	Structure and additional
IETHO	NATE	SAMPLES	RL (m)	DEPTH (m)	LOG	SSIFIC, SYMBC	M	ATERIAL DESCRIP characteristics,	TION: Soil type colour,minor co	e, plasticity omponents	/particle s		VSISTE	est Ty	Resu	observations
2					0	CLAS						≥ö	5 C			
ucket	tered					SM	0.10m	TOPSOIL: Silty SA brown.	ND, fine to coa	arse graine	ed,	D - M	VSt			TOPSOIL
thed B	ncoun					CL	Γ_	Sandy Silty CLAY	: brown, fine to	coarse gr	ained.	< W _P				SLOPEWASH
n Too	Not E			-			0.25m	Sandy CLAV rod			- <u>—</u> — –	- <u> </u>				
D0mm						CH		Sandy CLAY red, s	sand fine to coa	arse graine	ed.	A > W				RESIDUAL
100			9.0	-								2				
				0.5_	-											
				-												
				 -												
			8.5													
				_ 1. <u>0</u>												
] .												
D																
			8.0	4.												
				_ 1.5_												
				-												
D																
			7.5	i .												
				2.0												
				1 -												
—						1	2.20m	Hole Terminated at	t 2.20 m							
					-											
			7.0	4.	-											
L			<u> </u>								0	tanco			00 // -	Majature Oraditi :
	GEND: iter			NOTES, Sa	amples a		<u>15</u>				VS	Very Soft		<u>U</u> <2	<u>сэ (кРа</u> 25	D Dry
_	Wat	ter Level		U₅₀ CBR	50mm Bulk ៖	ו Diame sample י	ter tub	e sample R testing			S F	Soft Firm		25 50	5 - 50) - 100	M Moist W Wet
►	(Dat – Wat	ter Inflow	nown)	E ASS	Enviro Acid \$	onmenta Sulfate (al samı Soil Sa	ple ample			St VSt	Stiff Very Stiff		10 20)0 - 200)0 - 400	W _p Plastic Limit W _L Liquid Limit
St.	◀ Wat	ter Outflow		В	Bulk S	Sample					H Fb	Hard Friable		>2	100	
	G	radational or		Field Tes PID	i ts Photo	vionisati	on dete	ector reading (ppm)			Density	<u>v</u> V L	Ve	ery Lo bose	ose	Density Index <15% Density Index 15 - 35%
_	tra D	ansitional stra efinitive or di	ata stict	DCP(x-y)	Dynar	mic pen	etrome	eter test (test depth int	erval shown)			ME) M	ediun	n Dense	 Density Index 65 - 65% Density Index 65 - 65%
i	st	rata change.		п۲	riand	renetro	Juneter	iesi (UCS KPa)						ense onv Dr	2000	Density Index 65 - 85%

			NEE	RIN			TI	EST	PIT N	io: T	P14					
	-			слі (LIENT	:		Land Dynamics Australia	i			P	AGE	:	1	l of 1
		SOLUT	IONS	F	ROJE	CT NA	AME:	Sanctuary Development				J		10:	F	RGS21087.1
				S	SITE LC	JCATI	ON:	344 John Oxley Drive, Th	nrumster			L	OGG	ED B	i Y: E)S
				т	EST L	OCAT	ION:	Road 4 / Road 7				D	ATE	:	1	15/4/21
E			Έ: •ι.	20T E	xcavat	ior		E/				SURF/	ACE	RL:	17.1 r	n
<u> </u>			H:						JRINING.			JATU	VI:	' Teat		
\vdash		ling and Sam	npling	T	+	z	T	Material description and prome in	nformation				Fierc	Test	1	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	LASSIFICATIO ^U SYMBOL	м	IATERIAL DESCRIPTION: Soil ty characteristics,colour,mino	ype, plasticity/ r components	particle	MOISTURE	CONSISTENCY	Test Type	Result	Structur	re and additional servations
sucket	tered		17.0			ML		TOPSOIL: Sandy SILT, low platine to coarse grained.	asticity, brown	, sand	~ ≪	VSt			TOPSOIL	
oothed B	t Encoun			-							Σ					
00mm T	Not			-		сн	0.30m	Sandy CLAY: red, sand fine to	coarse graine	ed.	× ×				RESIDUAL	
6				- 0.5							Σ					
			16. <u>5</u>	-												
				-												
				-												
				- 1.0												
8			16. <u>0</u>	-												
5				-												
5] .												
			·	1.												
				- 1.5												
			15. <u>5</u>	<u>'</u>												
].												
þ				-												
				-												
	+		15.0	2.0		1	2.00m	Hole Terminated at 2.00 m					\vdash			
].	-											
			· ·	1.	-											
				-												
				-	1											
					-											
LE	GEND	! :		Notes, Sa	am <u>ples a</u>	and Tes	sts		T	Consist	ency			CS <u>(kP</u> a	a) <u>Moistur</u>	e Condi <u>tion</u>
Wa	ater			U	50mr	n Diame	eter tul	ne sample		VS	Very Soft		-2 25	5		Dry Moist
	Wat (Da	ter Level ate and time s	hown)	CBR	Bulk s	sample	for CB	R testing		F	Firm		50	- 100 - 100	W	Wet
	— Wa	ter Inflow		ASS	Acid §	Sulfate ?	ai sami Soil Sa	pie ample		VSt	Stiff Very Stiff		10 20	0 - 200 0 - 400	W _p W _L	Liquid Limit
St	◀ Wat rata Ch	ter Outflow nanges		В	Bulk S	3ample				H Fb	Hard Friable		>4	.00		
	G	Jradational or	ata	Field Tes	ts Photc	oionisati	ion det	ector reading (ppm)		<u>Density</u>	V L	Ve Lc	ery Lo	ose	Density I Density	Index <15% Index 15 - 35%
	D s	efinitive or di- trata change	stict	DCP(x-y) HP	Dynar Hand	nic pen Penetro	etrome ometer	eter test (test depth interval shown) r test (UCS kPa)			MD D) Me De	edium ense erv Dé	I Dense	 Density I Density I 	Index 35 - 65% Index 65 - 85% Index 85 - 100%

						EN	IGII	NEE	RIN	G LOG - TEST PIT				Т	EST	PIT N	io: TP15	
		4	REGIO	NAL	CAL	CLI	ENT	:		Land Dynamics Australi	а			P	AGE	:	1 of 1	
	/			IONS	UAL	PRO	OJE		ME:	Sanctuary Developmen	t			J	OBI	NO:	RGS21087.1	1
						SIT	E LC	CATI	ON:	344 John Oxley Drive, 1	hrumster			L	OGO	GED B	SY: GC	
						TES	ST LO	OCAT	ION:	Road 1 / Road 2				D	ATE	:	15/4/21	
					007				-			405500					0.7	
	ES	T PI	T LENGT	E: H:	201	EXC	avat W	or IDTH:		E	IORTHING:	400020 6519748	m i		чсе И:	RL:	AHD	
		Drilli	ing and Sar	npling						Material description and profile	information				Fiel	d Test		
								Z						≻				
Ę		ËR		RI	DED.	гн 3	с Н U	CATIC	М	ATERIAL DESCRIPTION Soil	type plasticity	/narticle	URE	IENC	ype	Ħ	Structure and addition	nal
		WAT	SAMPLES	(m)	(m		ξ <u>Ω</u>	SSIFI		characteristics,colour,min	or components	s		NSIS DENS	est T	Res	0000110110110	
	-						9	CLA					20	S				
ckat	CVCI	ered					Κ	MH		Sandy Clayey SILT: dark gre to 5mm.	ey, traces of gr	ass roots	М	Fb			TOPSOIL	
a d		ounte			1	-									ΗP	300		
dto		Enc		6.	5													
E E		No							0.25m									
					-		1	МН		Sandy Clayey SILT: pale bro	wn.						SLOPEWASH	
-	-																	
								сн	0.40m		plasticity red/		م ح	Fb/			RESIDUAL — — — — —	·
				- c	.5				with pale brown mottling, san grained.	d fine to mediu	m	× ×	VSt					
										0								
		6.0																
					-													
100																		
In Situ																		
ab and					- 1													
atgel Li																		
07 07					-													
0.02.00				5.	5													
6:04 1															ΗP	350		
2021 1					-													
19/05/																		
File>					-	-V												
rawing						_												
- С	+							1	1.50m	Hole Terminated at 1.50 m					-			
1-22.G					-													
GS IP				5.	D													
7.1 LO						+												
S2108					-													
L KG																		
ESTP					-	-												
OLE - 1					_													
	EGE	ND:		·	Notes,	Samp	oles a	nd Tes	l ts			Consister		I	U	լ CS (kPa	a) Moisture Condition	
	Vater Water Level					Ę	50mm	n Diame	ter tub	e sample		VS V S S	ery Soft oft		<2 25	25 5 - 50	D Dry M Moist	
ov-cc	Yeater Level (Date and time shown) Uo₅ CBF					E	Bulk s Envirc	ample f	for CBI al sami	R testing ple		F Fi St St	rm tiff		50 10) - 100)0 - 200	W Wet W _p Plastic Limit	
NG N	Water Outflow					4	Acid S	Sulfate Sample	Soil Sa	mple		VSt Ve	ery Stiff ard		20)0 - 400 100	W _L Liquid Limit	
_в	trata	a Cha	anges					annhie				Fb Fr	riable			+00		
4.5.GL		- Gr	adational or	ata	PID	ests F	Photo	ionisatio	on dete	ector reading (ppm)		Density	V L	Ve Lo	ery Lo bose	oose	Density Index <15% Density Index 15 - 35%	
LIB 1.0		- De	efinitive or di	stict	DCP(x- HP	·y) [Dynar Hand	nic pen Penetro	etrome ometer	eter test (test depth interval showr test (UCS kPa)	1)		ME D) M De	ediun ense	n Dense	e Density Index 35 - 65% Density Index 65 - 85%	5
g	Definitive or distict Strata change												VD	V.	erv Dr	ense	Density Index 85 - 100%	6

		ENGINEERING LOG - TEST PIT											PIT N	io: TP16
	-			0A1 C	LIENT	:		Land Dynamics Australia			P	AGE	Ξ:	1 of 1
		SOLUT	IONS	P	ROJE	CT NA	ME:	Sanctuary Development			JI	OBI	NO:	RGS21087.1
				S	SITE LC	CATI	ON:	344 John Oxley Drive, Thrumster			L	OGC	GED B	SY: GC
				т	EST L	OCAT	ION:	Road 1 / Ch60m			D	ATE	:	15/4/21
F			F·	20T F	xcavat	tor		EASTING.	485498	m ያ	SURF/		RI	10.0 m
Т	EST P	IT LENGT	н:	201 2	W	/IDTH:		NORTHING:	: 6519050	m I	DATU	M:		AHD
	Dri	lling and Sar	npling				î	Material description and profile information				Fiel	d Test	
						NO					7			
DOH	TER	SAMPI ES	RL	DEPTH	DHG	ICAT IBOL	м	IATERIAL DESCRIPTION: Soil type, plasticit	ty/particle	TURE	SITY	Type	sult	Structure and additional observations
MET	MA		(m)	(m)	GRA	ASSIF		characteristics,colour,minor componen	its	MOIS	DEN	Test	Re	
Ļ			<u> </u>	<u> </u>	+	G	<u> </u>				ŏ	<u> </u>		T0000
ucket	tered					MH		TOPSOIL: Sandy Clayey SILT, dark grey, grass roots to 5mm.	traces of	M	Fb			TOPSOIL
ed B	count		.			i i								
Tooth	ot En					i								
_ mm	ž					6								
1000	:						0.30m	Sandy CLAV modium plasticity rad/arang						
								fine to medium grained, traces of gravel fin	je, sand ie grained,	×	VSt			
								sub angular.		2				
			9.5	0.5								HP	380	
				-										
			9.0	1. <u>0</u>										
0				1										
												HP	390	
								Some pale brown mottling						
			8.5	1.5			1.50m							
								Hole Terminated at 1.50 m						
					-									
					1									
					1									
					-									
LE	GEND:			Notes, Sa	imples a	ind Tes	ts		Consister	<u>ICY</u> erv Soft	I	U	CS (kPa	a) Moisture Condition
	<u>ater</u> Z Wa	iter Level		U ₅₀	50mm	n Diame	ter tub	be sample	S S	oft		25	5 - 50	M Moist
_	- (Da	te and time s	hown)	E	Bulk s Envir	ample f onment	or CBF al sam	R testing iple	F Fi St S	rm tiff		50 1() - 100)0 - 200	W Wet W _p Plastic Limit
	— Wat ⊸ Wa	ter Inflow		ASS B	Acid S Bulk \$	3ulfate S Sample	3oil Sa	ample	VSt Vo	ery Stiff ard		20 >4)0 - 400 400	W _L Liquid Limit
<u>St</u>	rata Ch	anges		Field Tes	ts				Fb Fr	riable V	Ve	ervlo	oose	Density Index <15%
-	—- G tr	radational or ansitional stra	ata	PID	Photo	ionisatio	on dete	ector reading (ppm)		L	Lc)OSE		Density Index 15 - 35%
-	— D s	efinitive or dis trata change	stict	HP	Hand	Penetro	ometer	r test (UCS kPa)		D		ense	Dense	Density Index 65 - 85%

Γ					F	ENGI	NEE	RING LOG - TEST PIT			T	EST	PIT N	io: TP17
		-			CAL C	LIENT	:	Land Dynamics Australia			P	AGE	E:	1 of 1
	1		SOLUT	IONS	F	ROJE	CT NA	ME: Sanctuary Development			J	OB I	NO:	RGS21087.1
					5	SITE LO	CATI	ON: 344 John Oxley Drive, Thrumster			L	OGG	JED B	Y: GC
					Т	EST L	OCAT	ION: Road 2 / Ch320m			D	ATE	i:	15/4/21
E	:QU res	IIPM T PI	IENT TYP	'E: H:	20T E	xcavat W	tor /IDTH:	EASTING: NORTHING: 6	485450 6519651	m \$ m [SURF#	ACE M:	RL:	14.6 m AHD
		Drill	ing and Sar	npling				Material description and profile information				Field	d Test	
METHOD	יכנ	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/ characteristics,colour,minor components	particle	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
w Toothod Bucket	שש וסטווופח בחרעבי	Not Encountered		14. <u>5</u>	- - -		MH	TOPSOIL: Sandy Clayey SILT, dark grey, tra grass roots to 5mm.	aces of	М	Fb			
				14 (- - 0. <u>5</u>		СН	Sandy CLAY: medium to high plasticity, oran with pale brown mottling.	nge/red	M > W	Fb / VSt	HP	250	RESIDUAL
			<u>0.70m</u>		-									
ab and In Situ Tool			CBR		- - - 1 0									
16:04 10.02.00.04 Datger La			1.0011	13. <u>5</u>	- - -			1.25m				ΗP	220	
<pre><drawingfile>> 19/05/20/21</drawingfile></pre>					- 1.5		СН	Silty CLAY: medium plasticity, pale brown/wh with traces of gravel fine to medium grained, angular, iron oxide staining.	hite sub					EXTREMELY WEATHERED DOLERITE
.0GS TP1-22.GPJ <				13. <u>C</u>	- - -	-		Hole Terminated at 1.50 m						
IOLE - TEST PIT RGS21087.1L														
	EGF	IND:			Notes, Sa	imples a	ind Tes	its	Consisten	erv Soft		<u>U</u> (CS (kPa	a) Moisture Condition
		EGEND: Not <u>/ater</u> U _s Water Level CBF (Date and time shown) E → Water Inflow ASS ✓ Water Outflow B trata Changes			U ₅₀ CBR E ASS B	50mn Bulk s Envire Acid \$ Bulk \$	n Diame sample f onmenta Sulfate \$ Sample	iter tube sample for CBR testing al sample Soil Sample	S Sc F Fir St St VSt Ve H Ha	ify Son oft rm iff ery Stiff ard iable		25 50 10 20	;5 ; - 50) - 100)0 - 200)0 - 400 400	M Moist W Wet W _p Plastic Limit W _L Liquid Limit
I I I IC	<u>trata</u> 					i <u>ts</u> Photo Dyna Hand	vionisatio mic pen Penetro	on detector reading (ppm) ietrometer test (test depth interval shown) ometer test (UCS kPa)	Density	V L ME D	Ve La) Me De	ediun ense erv D	n Dense	Density Index <15% Density Index 15 - 35% e Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%

				E	ENGI	NEE			Т	EST		ю: ТР18	
	4			CAL C	LIENT	:	Land Dynamics Australia			P	AGE	<u>:</u> :	1 of 1
		SOLUT	IONS	P	ROJE	CT NA	ME: Sanctuary Development			J	OB I	NO:	RGS21087.1
			•	s	ITE LC	CATI	DN: 344 John Oxley Drive, Thrumster			L	OGO	GED B	SY: GC
				т	EST L	OCAT	ON: Road 2 / Ch400m			D	ATE	:	15/4/21
EC			'E:	20T E	xcavat	or	EASTING:	485451	m	SURF	ACE	RL:	13.4 m
TE	ST P	IT LENGT	H:		w	IDTH:	NORTHING:	6519718	m l	DATU	M :		AHD
	Dril	ling and Sar	npling				Material description and profile information				Fiel	d Test	
					0	NOI			шz	, ⊑	e		
METHOI	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC	-ASSIFICA SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor component	y/particle ts	MOISTUR CONDITIO		Test Typ	Result	observations
et				╡───		МН	TOPSOIL · Sandy Clavey SILT. dark grey t	traces of	м	O Fh			TOPSOIL
Bucke	Itered						grass roots to 5mm.						
thed	ncoul]									
Toot	lot El		-	-		, 	<u>0.25m</u>						
Omm	2		-			CL	Sandy Silty CLAY: medium plasticity, pale	brown.	≥ ∧	Fb			SLOPEWASH
100			13. <u>0</u>	- 1					Σ				RESIDUAL
				0.5		СН	Sandy CLAY: medium to high plasticity, or with pale brown mottling.	ange/red	×	VSt			RESIDUAL
			-	1					Σ				
			-								ΗP	250	
			-	-									
			-	1									
			12.5										
			-	1.0							ΗP	230	
			-	1									
Laual			-			СН	Silty CLAY: medium to high plasticity, white	e/pale					EXTREMELY WEATHERED
Laige		1.30m			- VXII		grey, with traces of red mottling, some grav grained, sub rounded.	el fine			ΗP	350	SLATE
5.00			12.0										
20.01				15									
t 0.01		CBR	-	-									
1202/0			-		Ŧ <i>ŊŊ</i>								
50/61		1.70m											
6 L													
Liawin			-	-									
₹ 2			11.5		¥XVI								
5.77.P			<u> </u>	2.0	<u> XXII</u>	1	2.00m						
3							Hole Terminated at 2.00 m						
7.1 LO			-	1 -]								
22108			-		1								
19 1					-								
2			110										
				-	1								
	GEND:	<u> </u>	L !	Notes, Sa	Imples a	nd Tes	<u>§</u>	Consister	ncy		U	CS (kPa	a) Moisture Condition
[™] <u>Wa</u>	ter	4 1 1		U ₅₀	50mm	n Diame	er tube sample	S S	ery Sofi oft		<2 25	25 5 - 50	D Dry M Moist
	- vvat (Da	ter Level te and time s	hown)	CBR F	Bulk s Envir	ample f	or CBR testing	F Fi St S	irm tiff		50 10) - 100)0 - 200	W Wet
N P	- Wat	ter Inflow	/	ASS	Acid S	Sulfate S	oil Sample	VSt V	ery Stiff		20)0 - 400	W_{L} Liquid Limit
Str	vvati ata Chi	ier Outnow		в	BUIKS	sample		Fb F	ard riable		>/	100	
	G	radational or	oto	Field Test PID	ts Photo	vionisatir	n detector reading (ppm)	<u>Density</u>	V L	Ve Lo	ery Lo bose	ose	Density Index <15% Density Index 15 - 35%
P 1.04	D	efinitive or di	stict	DCP(x-y)	Dynar Hand	nic pen	trometer test (test depth interval shown)		M) M	ediun	n Dense	Density Index 35 - 65%
L U	st	rata change.			, iand	. oneut) Ve	onoe ony Di	ence	Density Index 85 - 100%

					E	INGI	NEE	RIN	G LOG - TEST PIT			Т	EST	PIT N	IO: TP19
		4	REGIO			LIENT	:		Land Dynamics Australia			P	AGE	:	1 of 1
	/		SOLUT	IONS	P	ROJE		ME:	Sanctuary Development			J	ови	NO:	RGS21087.1
					s	ITE LO	CATI	ON:	344 John Oxley Drive, Thrumster			L	ogo	GED B	Y: GC
					т	EST L	OCAT	ION:	Road 4 / Ch100m			D	ATE		15/4/21
╞				E .	20T F	vcavat	or		FASTING	485307	m (RI ·	21.5 m
1	TES'	T Pľ	T LENGT	L. H:	201 L	W	IDTH:	1	NORTHING:	6519735	m [чос И:	1.	AHD
\vdash		Drilli	ng and San	npling					Material description and profile information				Fiel	d Test	
			<u> </u>				z					~			
6	3	Ř		ы	DEDTU	₽,	OL			(norticle	ION Nor	L N EN EN EN	ype	벅	Structure and additional
		VATI	SAMPLES	(m)	(m)	LOC	SIFIC	IVI	characteristics,colour,minor component	y/particle ts	ILIUN	ISIST	est T	Rest	observations
	2	>				U	CLAS				žΫ		Ĕ		
10	ы Ке	ed				BIH	MH		TOPSOIL: Sandy Clayey SILT, dark grey, t	traces of	м	Fb			TOPSOIL
		unter				-1311/1		0.25m	grass roots to 5mm.		-				
		Enco		21.0))			0.40m	Sandy SILT: pale brown.	1					
		Not E			- 0.5		CH		fine to medium grained, traces of gravel, fin	a, sand Ne	× ×	VSt	цр	350	RESIDORE
		-			-				grained, subangular.		Σ			330	
			0.90m	20	- 			0.90m							
				20.	1.0		СН		Gravelly Silty CLAY: medium to high plast white/pale grey with traces of red mottling of	icity, gravel fine					EXTREMELY WEATHERED
			CRP						to coarse grained, subangular, slate some i	rock			HP	380	
			ODIX												
			1.50m	20.	1.5		1	1.50m							
									SLATE: fine to medium grained, pale grey/ very coarse to coarse strength, foliated, so	white, me clay					SLATE
					-				seams.						
				19.	5 2.0		-								
					-										
8															
				19.	2.5										
2															
						===	-								
Laig				18.	5 20	1									
5					- 3.0		-								
20.0															
5				18.	- 										
202					3.5		-		Colour change to vellow/pale brown						
300						<u> </u>	1								
				17] . =] .	<u> </u>	1								
R Ma				17.	4.0										
2							1								
							-								
			4.50m	17.0	4.5	<u> </u>]								
8						<u> </u>	1								
			CBR		-		-								
100			5.00m	16.	5 5.0			5.00m							
					-				Hole Terminated at 5.00 m						
2						1									
				16.	<u>-</u>										
	EGE	ND:			Notes, Sa	mples a	nd Tes	ts		Consister	ncy erv Soff		U	CS (kPa 25	a) Moisture Condition
⊻	vate	<u>r</u> Wate	er Level		U ₅₀	50mm	n Diame	eter tub	e sample	S S	oft		25	5 - 50	M Moist
	_	(Date	e and time sl	hown)	CBR E	Bulk s Enviro	ample to nmenta	tor CBI al sami	R testing ple	F Fi St S	rm tiff		50 10) - 100)0 - 200	W Wet W _n Plastic Limit
		Wate	er Inflow		ASS	Acid S	Sulfate S	Soil Sa	mple	VSt V	ery Stiff		20)0 - 400	W _L Liquid Limit
ŝ	Strata	vvate <u>a Ch</u> a	nges		D		parnple			Fb Fi	aru riable		>/	ŧUU	
- 15		Gr	adational or		Field Tes	ts Photo	ionisati	on dete	ector reading (ppm)	Density	V	Ve	ery Lo	oose	Density Index <15% Density Index 15 - 35%
5 -		tra - De	insitional stra efinitive or dis	ata stict	DCP(x-y)	Dynai	nic pen	etrome	eter test (test depth interval shown)		MC) M	ediun	n Dense	Density Index 35 - 65%
		str	ata change		HP	Hand	Penetro	ometer	test (UCS kPa)		D VD	De Ve	ense ery De	ense	Density Index 65 - 85% Density Index 85 - 100%

				E	ENGI	NEE	RING LOG - TEST PIT			т	EST		IO: TP20
	4			CAL (LIENT	:	Land Dynamics Australia			Р	AGE	:	1 of 1
		SOLUT	IONS	GAL F	ROJE		ME: Sanctuary Development			J	OB I	NO:	RGS21087.1
				5	SITE LO	CATI	DN: 344 John Oxley Drive, Thrumster			L	ogo	GED B	Y: GC
				1	EST L	осат	ON: Road 2 / Road 4			D	ATE		15/4/21
			_										
	JUINN ST P		E: H·	201 E	xcava:	or Inth ·	EASTING: 4 NORTHING: 65	185383	m : m		ACE M·	RL:	19.3 m AHD
<u> </u>	Dril	ling and Sar	nnling		1		Material description and profile information	010010			Field	d Toet	
-						z							
B	ц				₽	ATIO DL			ION ION	l ∑ LNC	be		Structure and additional
HH	ATE	SAMPLES	RL (m)	DEPTH (m)		MBC	MATERIAL DESCRIPTION: Soil type, plasticity/pa characteristics,colour,minor components	article	ISTU NDITI	SISTE ENSI	st Ty	sesu	observations
M	3				В	S			ΜÖ	DON	Te		
et	ğ					MH	TOPSOIL: Sandy Clayey SILT, dark grey, trace	es of	М	Fb			TOPSOIL
Buck	ntere						grass roots to 5mm.						
thed	ncon												
Toot	lot E			-			<u>0.25m</u>						
mm M	2		19.0	<u> </u>		ML	Sandy SILT: pale brown.						SLOPEWASH
1000													
				0.5			0.50m						
				-		СН	Sandy CLAY: medium plasticity, red/orange, sa	sand	× K	Fb/	1		RESIDUAL
				-			fine to coarse grained, traces of gravel, fine gra subangular.	ained,	v E	VSt			
											нр	350	
	18.5						0.90m						
	18. <u>5</u>					СН	Gravelly Silty CLAY: medium to high plasticity.	/,					EXTREMELY WEATHERED
							white/pale grey, gravel fine to coarse grained, subangular, slate.						SLATE
				1.0									
00													
n Situ				-									
b and				-									
tgel La		1.30m	18.0										
04 Da													
02:00				-									
04 10		CBR		1.5									
CQL 1.2													SLATE
77/90/6		. =0]									
~~~		1.70m		-		1	1.70m SLATE: dark grey/white, very low to low streng	gth.					
vingFile			17.5	<u>.</u>									
< <ur></ur>						-							
- GB													
57				2.0			2.00m Hole Terminated at 2.00 m						
2000					4								
JB7.1L													
65210				1	1								
2			17. <u>0</u>	<u>)</u>	-								
EN					1								
- OLE -													
	GEND:	1		Notes, Sa	amples a	nd Tes	<u>s</u>	Consisten	cy		U	- CS (kPa	a) Moisture Condition
	ter Mo	ter Level		U ₅₀	50mn	n Diame	er tube sample	vo Ve S Sc	ary Soft oft		<2 25	∠5 5 - 50	M Moist
	, vva (Da	te and time s	hown)	CBR E	Bulk s Envin	sample f	or CBR testing	F Fir	rm iff		50 10	) - 100 )0 - 200	W Wet W ₂ Plastic Limit
	– Wai	ter Inflow		ASS	Acid	Sulfate S	oil Sample	/St Ve	ery Stiff		20	00 - 400	$W_{L}$ Liquid Limit
Sti	∎ Wa ata <u>C</u> h	ter Outflow anges		в	Bulk	Sample		н На <u>Fb F</u> ri	ara iable		>/	+00	
	G	iradational or	ata	Field Tes PID	its Photo	ionisatio	n detector reading (ppm)	Density	V	Ve	ery Lo bose	oose	Density Index <15% Density Index 15 - 35%
B 1.04	tr. D	ansidonal stra efinitive or di	ata stict	DCP(x-y)	Dyna	mic pen	etrometer test (test depth interval shown)		ME	) M	ediun	n Dense	e Density Index 35 - 65%
2	st	trata change		ΗP	Hand	Penetro	meter test (UCS kPa)		D		ense erv D	onco	Density Index 65 - 85%

				E	ENGI	NEE	RING LOG - TEST PIT			Т	EST	PIT N	io: TP21
	-		NAL	CAL C	LIENT	:	Land Dynamics Australia			P	AGE	:	- 1 of 1
		SOLUT	IONS	F	ROJE	CT NA	ME: Sanctuary Development			J	OB I	NO:	RGS21087.1
				S	SITE LO	OCATI	<b>ON:</b> 344 John Oxley Drive, Thrumster			L	OGC	GED B	SY: GC
				т	EST L	OCAT	ION: Road 5 / Road 6			D	ATE	:	15/4/21
FC			·F·	20T F	xcava	or	FASTING	485251	m 9		<b>ACF</b>	RI ·	17 0 m
TE	ST P	IT LENGT	H:	201 2	W	IDTH:	NORTHING:	6519745	m <b>I</b>	DATU	M:		AHD
	Dril	lling and Sar	mpling				Material description and profile information				Fiel	d Test	
						NO				2			
ПОН	TER	SAMDI ES	RL	DEPTH	HED	ICAT BOL	MATERIAL DESCRIPTION: Soil type, plasticity/	/particle	TURE	SITY	Type	sult	Structure and additional observations
MET	WA ⁻	SAMPLES	(m)	(m)	GRA	ASSIF	characteristics,colour,minor components	5	MOIS	DEN	Test	Re	
						CL/				ö			
lcket	ered		17.0	1			<b>TOPSOIL:</b> Sandy Clayey SILT, dark grey, tra grass roots to 5mm.	aces of	M	Fb			TOPSOIL
ed Bu	sount												
ooth	t Enc			-									
L H	Ž			·			0.25m						
000							Sandy CLAY: medium plasticity, dark brown	n/pale	_ × ×	Fb / VSt			RESIDUAL
-				-					ž				
											HP	350	
		0.50m		0.5			0.50m						
		0.0011	16.5	<u>i</u>		СН	Sandy Silty CLAY: medium plasticity, pale	- <u>— —</u> — -	1				EXTREMELY WEATHERED
							fine to coarse grained, subangular.	gravei					
				-									
		CBR		1									
8				·							HP	300	
Situ													
and In				-									
jel Lab		1.00m	160	1.0			1.00m	rev.					HIGHLY WEATHERED
4 Datç			10.0	4	$\mathbb{R}$		medium to high strength.	cy,					DOLERITE
2.00.0				·	1555								
4 10.0					$\langle \langle \langle \rangle \rangle$								
1 16:0				-	$\mathbb{R}$								
02/202					55								
~> 19/				-	$\langle \rangle \rangle \rangle$								
ngFile:					122								
Clrawi				1.5	555		1.50m						
¢ Ras			15.5	5			Hole Terminated at 1.50 m						
-1-22.0					-								
1 SOC				-									
37.1 LC					1								
ss2108													
E E				-									
ESTE					-								
OLE -				-									
	GEND:	1	-	Notes, Sa	amples a	nd Tes	ts	Consister			U	L CS (kPa	a) Moisture Condition
	ter Wa	ter l evel		U ₅₀	50mm	n Diame	eter tube sample	S S	ery Soft oft		<2 25	20 5 - 50	M Moist
	Water Level (Date and time shown)				Bulk : Envir	sample f onmenta	for CBR testing al sample	F Fi St S	irm tiff		50 10	) - 100 )0 - 200	W Wet W Plastic Limit
N NG N	– Wa ∎ Wa	ter Inflow		ASS	Acid	Sulfate Sample	Soil Sample	VSt V	ery Stiff ard		20	)0 - 400 100	W ^L Liquid Limit
ا <u>Str</u>	∎ vva ata Ch	anges		D	BUIK	затре		Fb Fi	aiù riable		>/	ŧUU	
1.5.GLE	G	Gradational or	ata	Field Tes PID	t <u>s</u> Photo	oionisatio	on detector reading (ppm)	<u>Density</u>	V L	Ve Lo	ery Lo bose	oose	Density Index <15% Density Index 15 - 35%
B 1.04	יז D	efinitive or di	istict	DCP(x-y)	Dyna	mic pen	etrometer test (test depth interval shown)		ME	) M	ediun	n Dense	e Density Index 35 - 65%
GL	S	trata change		115		r eneuro					ense erv Di	ense	Density Index 85 - 85%

Γ	ENGINEERING LOG - TEST PIT TEST PIT NO: TP2					IO: TP22										
				Land Dynamics Au	stralia			P	AGE	:	1 of 1					
	SOLUTIONS PROJECT NAME:			Sanctuary Development			J	ові	RGS21087.1							
	SITE LOCATION:			ON:	344 John Oxley Dri	ve, Thrumster			L	OGO	GED B	SY: GC				
	TEST LOCATION:			Road 5 / Ch140m				D	ATE	:	15/4/21					
EQUIPMENT TYPE: 20T Excavator					EASTING: NORTHING:	485117 6519714	m \$ m [		ACE M:	RL:	16.2 m AHD					
┢	Drilling and Sampling			Material description and p	profile information				Fiel	d Test						
F					1	+	z						≻			
	MEIHUU	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATIC SYMBOL	M	IATERIAL DESCRIPTION characteristics,colou	: Soil type, plasticity ır,minor component:	y/particle ts	MOISTURE CONDITION	CONSISTENC DENSITY	Test Type	Result	Structure and additional observations
	nm Toothed Bucket	Not Encountered		16. <u>0</u>	- - - -			0.25m	TOPSOIL: Sandy Claye grass roots to 5mm.	y SILT, dark grey, tr	races of	M	Fb			TOPSOIL
L 16.0 CH Sandy CLAY: medium plasticity, pale brown, Sandy CLAY: medium plasticity, pale brown, Sandy CLAY: medium plasticity, pale brown, Sandy Silty CLAY: medium plasticity, white/pale 15.0 15.0 15.0		Fb / VSt	HP	350	EXTREMELY WEATHERED											
	-				- 1.5		1	1.50m	Hole Terminated at 1.50	m						
				14.5		-										
	LEG	END:			Notes, Sa	amples a	Ind Tes	its			Consister	l ICY		<u>U</u>	∣ CS (kPa	a) Moisture Condition
1	<u>Wate</u>	<u>ər</u>			U ₅₀	50mm	n Diame	eter tub	be sample		VS V S S	ery Soft oft		<2 25	25 5 - 50	D Dry M Moist
202	₹	Wate (Dat	er Level te and time si	hown)	CBR	Bulk s	sample f	for CBI	, R testing		F Fi	rm		50	) - 100	W Wet
	▶	Wate	er Inflow		E ASS	Enviro Acid \$	onmenta Sulfate {	ai samj Soil Sa	ipie ample		VSt V	uπ ery Stiff		10 20	)0 - 200 )0 - 400	V VV _p Plastic Limit
- Ro		Wate	er Outflow		В	Bulk S	Sample					ard riable		>2	100	
	Strat	<u>a Cha</u> Gr	niges radational or		Field Tes	<u>ts</u>					Density	V	Ve	ery Lo	ose	Density Index <15%
2.42		tra	ansitional stra	ata	PID DCP(x-y)	Photo Dynar	ionisatio mic pen	on dete ietrome	ector reading (ppm) eter test (test depth interval	shown)		L MC	Lo M	oose ediun	n Dense	Density Index 15 - 35% e Density Index 35 - 65%
strata change				r test (UCS kPa)			D VD	D	ense erv De	ense	Density Index 65 - 85% Density Index 85 - 100%					



# Appendix B

Laboratory Test Result Sheets

Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864A
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 07/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP4, Depth: 0.3-0.7
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max
CBR taken at	2.5 mm		
CBR %	7.0		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	RMS T11	11 & T1	120
Maximum Dry Density (t/m ³ )	1.542		
Optimum Moisture Content (%)	26.8		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	101		
Dry Density after Soaking (t/m ³ )	1.534		
Field Moisture Content (%)	26.7		
Moisture Content Top 30mm (%)	39.1		
Moisture Content Full Depth (%)	38.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.2		
Material Retained on 19mm (%)	1		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	1		



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: T ACCREDITATION S



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864B
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP5, Depth: 0.7-1.2
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max			
CBR taken at	2.5 mm					
CBR %	13.0					
Method of Compactive Effort	Star	ndard				
Method used to Determine MDD	RMS T11	RMS T111 & T120				
Maximum Dry Density (t/m ³ )	1.416					
Optimum Moisture Content (%)	32.5					
Target Laboratory Density Ratio (%)	100					
Laboratory Density Ratio (%)	100					
Target Laboratory Moisture Ratio (%)	100					
Laboratory Moisture Ratio (%)	99					
Dry Density after Soaking (t/m ³ )	1.412					
Field Moisture Content (%)	34.2					
Moisture Content Top 30mm (%)	36.7					
Moisture Content Full Depth (%)	34.9					
Mass Surcharge (kg)	4.5					
Soaking Period (days)	4					
Swell (%)	0.6					
Material Retained on 19mm (%)	0					
Oversize Material (mm)	19	]				
Oversize Material Included	Excluded	]				
Oversize Material (%)	0					



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NATA App



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864C
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP6, Depth: 0.6-0.9
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max			
CBR taken at	2.5 mm					
CBR %	1.0					
Method of Compactive Effort	Star	dard				
Method used to Determine MDD	RMS T11	RMS T111 & T120				
Maximum Dry Density (t/m ³ )	1.590					
Optimum Moisture Content (%)	24.0					
Target Laboratory Density Ratio (%)	100					
Laboratory Density Ratio (%)	100					
Target Laboratory Moisture Ratio (%)	100					
Laboratory Moisture Ratio (%)	99					
Dry Density after Soaking (t/m ³ )	1.575					
Field Moisture Content (%)	28.6					
Moisture Content Top 30mm (%)	34.1					
Moisture Content Full Depth (%)	28.0					
Mass Surcharge (kg)	4.5					
Soaking Period (days)	4					
Swell (%)	1.0					
Material Retained on 19mm (%)	0					
Oversize Material (mm)	19					
Oversize Material Included	Excluded					
Oversize Material (%)	0					



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

WORLD RECOGNISED



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864D
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP11, Depth: 0.5-0.7
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120		Min	Max
CBR taken at	2.5 mm		
CBR %	10.0		
Method of Compactive Effort	Star	dard	
Method used to Determine MDD	RMS T11	1 & T1	20
Maximum Dry Density (t/m ³ )	1.379		
Optimum Moisture Content (%)	35.1		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99		
Dry Density after Soaking (t/m ³ )	1.373		
Field Moisture Content (%)	37.9		
Moisture Content Top 30mm (%)	39.6		
Moisture Content Full Depth (%)	36.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.6		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



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WORLD RECOGNISED





Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864E
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 03/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP11, Depth: 1.1-1.4
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max
CBR taken at	5 mm		
CBR %	7.0		
Method of Compactive Effort	Star	dard	
Method used to Determine MDD	RMS T11	1 & T1	120
Maximum Dry Density (t/m ³ )	1.597		
Optimum Moisture Content (%)	24.5		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99		
Dry Density after Soaking (t/m ³ )	1.570		
Field Moisture Content (%)	24.4		
Moisture Content Top 30mm (%)	28.6		
Moisture Content Full Depth (%)	25.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		_
Swell (%)	1.8		
Material Retained on 19mm (%)	2		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	2		



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WORLD RECOGNISED



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864F
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP16, Depth: 0.4-0.8
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max
CBR taken at	2.5 mm		
CBR %	7.0		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	RMS T11	1 & T ²	120
Maximum Dry Density (t/m ³ )	1.283		
Optimum Moisture Content (%)	40.3		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	98		
Dry Density after Soaking (t/m ³ )	1.285		
Field Moisture Content (%)	41.9		
Moisture Content Top 30mm (%)	42.9		
Moisture Content Full Depth (%)	41.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.4		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Tom Paulsen Senior Tech NATA Accredited Laboratory Number: 16993

NATA



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864G
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP17, Depth: 0.7-1.0
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max
CBR taken at	5 mm		
CBR %	4.0		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	RMS T11	11 & T1	120
Maximum Dry Density (t/m ³ )	1.422		
Optimum Moisture Content (%)	30.2		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99		
Dry Density after Soaking (t/m ³ )	1.412		
Field Moisture Content (%)	38.6		
Moisture Content Top 30mm (%)	39.4		
Moisture Content Full Depth (%)	32.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.8		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

WORLD RECOGNISED ACCREDITATION



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864H
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP18, Depth: 1.3-1.7
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max
CBR taken at	5 mm		
CBR %	1.5		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	RMS T11	1 & T ²	120
Maximum Dry Density (t/m ³ )	1.420		
Optimum Moisture Content (%)	29.8		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99		
Dry Density after Soaking (t/m ³ )	1.416		
Field Moisture Content (%)	30.7		
Moisture Content Top 30mm (%)	40.8		
Moisture Content Full Depth (%)	34.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.7		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-28641
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 06/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP19, Depth: 4.5-5.0
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120		Min	Max
CBR taken at	5 mm		
CBR %	12.0		
Method of Compactive Effort	Stan	dard	
Method used to Determine MDD	RMS T11	1 & T1	20
Maximum Dry Density (t/m ³ )	1.630		
Optimum Moisture Content (%)	21.7		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100		
Dry Density after Soaking (t/m ³ )	1.603		
Field Moisture Content (%)	20.1		
Moisture Content Top 30mm (%)	26.9		
Moisture Content Full Depth (%)	24.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	1.5		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION



Report Number:	P21416-1
Issue Number:	1
Date Issued:	12/05/2021
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Contact:	Steve Morton
Project Number:	P21416
Project Name:	Sanctuary Development
Project Location:	344 John Oxley Drive, Thrumster
Client Reference:	RGS21087.1
Work Request:	2864
Sample Number:	21-2864J
Date Sampled:	20/04/2021
Dates Tested:	20/04/2021 - 03/05/2021
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	TP20, Depth: 1.3-1.7
Material Source:	Insitu

California Bearing Ratio (RMS T117 & T120	)	Min	Max
CBR taken at	5 mm		
CBR %	3.5		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	RMS T11	1 & T ²	120
Maximum Dry Density (t/m ³ )	1.628		
Optimum Moisture Content (%)	21.8		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100		
Dry Density after Soaking (t/m ³ )	1.572		
Field Moisture Content (%)	22.2		
Moisture Content Top 30mm (%)	28.9		
Moisture Content Full Depth (%)	25.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	3.1		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Pacific Blue Metal Pty Ltd Possum Brush Laboratory 113-116 Possum Brush Road Possum Brush NSW 2430 Phone: (02) 6554 3206 Fax: (02) 6554 3250 Email: labmanager@pacificbluemetal.com.au Accredited for compliance with ISO/IEC 17025 - Testing

WORLD RECOGNISED





				Report	No: SSI:NEW21V	V-1729-S05		
Shrin	k Swell Inde	x Report				Issue No: 1		
Client:	Regional Geotechnic 44 Bent Street Wingham NSW 242	cal Solutions Pty Ltd		Accree The re includ standa Result	dited for compliance with ISO/IEC 17 sults of the tests, calibrations and/o ed in this document are traceable to ards. is provided relate only to the items to	7025-Testing. r measurements Australian/national ested or sampled.		
Project No	.: MNC16P-0001			↓ <b>⊅</b> ·	Call			
Project Na	me: Various Testing			WORLD RECOGNISED ACCREDITATION NAT/ Date	oved Signatory: Brent Cullen or Geotechnician) A Accredited Laboratory Numl of Issue: 6/05/2021	ber: 18686		
Sample	Details							
Sample ID:	NEW21W-1729-S0	5	Test Reques	st No.: RGS21087.1				
Sampling N	lethod: The results outlined	below apply to the sam	ple as received					
Material:	Clay		Date Sample	ed: 20/04/2021				
Source:	On Site		Date Submit	ted: 29/04/2021				
Specification	on: No Specification							
Project Loo	ation: 344 John Oxley Driv	/e, Thrumster, NSW						
Sample Lo	cation: TP21 - (0.5 - 1.0m)							
Date Teste	<b>d:</b> 29/04/2021							
Swell Te	st	AS 1289.	7.1.1 Shrink Te	est	AS 1	289.7.1.1		
Swell on Sa	aturation (%):	0.3	Shrink on d	rying (%):	5.7			
Moisture C	ontent before (%):	30.4	Shrinkage N	/loisture Content (%	<b>):</b> 30.3			
Moisture C	ontent after (%):	34.1	Est. inert ma	Est. inert material (%): 10%				
Est. Unc. C	omp. Strength before (k	<b>Pa):</b> 140	Crumbling c	during shrinkage:	Nil			
Est. Unc. C	omp. Strength after (kPa	): 300	Cracking du	iring shrinkage:	Moderate			
Shrink S	well							
		Sh	rinkage 🔶	Sw ell				
	10.0 + · · · · · · · · · · · · · · · · · ·							
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	0.0 5.0 1	0.0 15.0 2	20.0 25.0 3	30.0 35.0	40.0 45.0	50.0		
				<i>)</i>				
Shrink S	well Index - Iss (%	): 3.3						
1	•							

## Comments



QUALTEST Laboratory (NSW) Pty Ltd (20708) 2 Murray Dwyer Circuit, Mayfield West, NSW 2304

- 02 4968 4468 т٠
- 02 4960 9775
- F: E: W: E: admin@qualtest.com.au W: www.qualtest.com.au ABN: 98 153 268 896

Report No: SSI:NEW21W-1729-S04 Issue No: 1 **Shrink Swell Index Report** Client: Regional Geotechnical Solutions Pty Ltd Accredited for compliance with ISO/IEC 17025-Testing. The results of the tests calibrations and/or measurements 44 Bent Street included in this document are traceable to Australian/national Wingham NSW 2429 standards. ΝΔΤ Results provided relate only to the items tested or sampled. (all Project No.: MNC16P-0001 Approved Signatory: Brent Cullen Project Name: Various Testing BLD REC (Senior Geotechnician) ACCREDITATION NATA Accredited Laboratory Number: 18686 Date of Issue: 6/05/2021 Sample Details Sample ID: Test Request No.: RGS21087.1 NEW21W-1729-S04 Sampling Method: The results outlined below apply to the sample as received Material: **Date Sampled:** 20/04/2021 Clay Source: **Date Submitted:** On Site 29/04/2021 Specification: No Specification Project Location: 344 John Oxley Drive, Thrumster, NSW Sample Location: TP11 - (0.3 - 0.6m) Date Tested: 29/04/2021 AS 1289.7.1.1 AS 1289.7.1.1 Swell Test Shrink Test Swell on Saturation (%): Shrink on drying (%): -1.1 5.7 Moisture Content before (%): Shrinkage Moisture Content (%): 33.4 32.4 Moisture Content after (%): Est. inert material (%): 38 5 1% Est. Unc. Comp. Strength before (kPa): 270 Crumbling during shrinkage: Nil Est. Unc. Comp. Strength after (kPa): 250 Cracking during shrinkage: Minor Shrink Swell Shrinkage Sw ell 10.0 Shrink (%) Esh - Swell (%) Esw 5.0 0.0 -5.0 -10.0 0.0 5.0 10.0 15.0 20.0 25.0 30.0 35.0 40.0 50.0 45.0 Moisture Content (%) Shrink Swell Index - Iss (%): 3.2

#### Comments

Sample remoulded at estimated OMC and approximately 98% Standard Compaction



	Report No: SSI:NEW21W-1729-S03
Shrink Swell Index Report	Issue No: 1
Client: Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429	Accredited for compliance with ISO/IEC 17025-Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Results provided relate only to the items tested or sampled.
Project No.: MNC16P-0001	B. Call
Project Name: Various Testing	Approved Signatory: Brent Cullen (Senior Geotechnician) ACCREDITATION NATA Accredited Laboratory Number: 18686 Date of Issue: 6/05/2021
Sample Details	
Sample ID: NEW21W-1729-S03 Test Reques	t No.: RGS21087.1
Sampling Method: The results outlined below apply to the sample as received	
Material: Clay Date Sample	ed: 20/04/2021
Source: On Site Date Submit	ted: 29/04/2021
Specification: No Specification	
Project Location: 344 John Oxley Drive, Thrumster, NSW	
Sample Location: TP3 - (0.4 - 0.8m)	
Date lested: 29/04/2021	
Swell Test AS 1289.7.1.1 Shrink Te	est AS 1289.7.1.1
Swell on Saturation (%): -0.6 Shrink on di	rying (%): 6.2
Moisture Content before (%): 38.2 Shrinkage M	loisture Content (%): 40.9
Moisture Content after (%): 39.9 Est. inert ma	aterial (%): 1%
Est. Unc. Comp. Strength before (kPa): 140 Crumbling d	during shrinkage: Nil
Est. Unc. Comp. Strength after (kPa): 310 Cracking du	rring shrinkage: Moderate
Shrink Swell	
Shrinkage 🔶	Sw ell
10.0 ₁	
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$\overline{\mathbf{o}}$ - $\overline{\mathbf{o}$ - $\overline{\mathbf{o}}$ - $\mathbf{o$	
-10.0+	
0.0 5.0 10.0 15.0 20.0 25.0 3 Moisture Content (%	)) )
	·
Shrink Swell Index - Iss (%): 3.4	

### Comments



Depart No. COUNEW24W/ 4720 CO4

I

Shrin	k S	well	Inde	x Re	epor	t			Кер	ort NO. 33	01.INE VVZ 1	Issue No: 1
Client:	F 2 \	Regional G 14 Bent St Wingham	Geotechn reet NSW 24	ical Solu 29	tions Pty	Ltd		N		Accredited for comp The results of the te included in this docu standards. Results provided rel	liance with ISO/IEC sts, calibrations and iment are traceable ate only to the items	17025-Testing. /or measurements to Australian/national : tested or sampled.
Project No Project Na	o.: I nme: \	MNC16P-0 /arious Te	0001 esting					WORLD	RECOGNISED	Approved Signat (Senior Geotech NATA Accredited Date of Issue: 6	ory: Brent Culler nician) d Laboratory Nur /05/2021	າ nber: 18686
Sample	Deta	ils										
Sample ID: Sampling M Material: Source: Specificati Project Loo Sample Lo Date Teste	Method on: cation cation d:	NEW21V d: The resu Clay On Site No Spec : 344 Johr : Hill - A - 29/04/20	V-1729-SC ilts outlined ification n Oxley Dr (2.0 - 3.0n 21	)1 d below a ive, Thrui า)	pply to the	sample as r V	Test Ree eceived Date Sa Date Su	quest No.: mpled: bmitted:	RGS21087 20/04/202 ⁻ 29/04/202 ⁻	7.1 1 1		
Swell Te	st				AS 12	89.7.1.1	Shrin	k Test			AS	1289.7.1.1
Swell on S	aturati	ion (%):		-0.8	3		Shrink	on drying (	%):	2.1		
Moisture C	onten	t before (	%):	29.	4		Shrinka	ige Moistur	e Conten	it (%): 30.7		
Moisture C	onten	t after (%)	): hofens (l	34.	8		Est. ine	rt material	(%): 	5%		
Est. Unc. C	omp.	Strength	oelore (r oftor /kD	a): 100	)		Crackin	ing auring : a during sk	shrinkago vrinkago:	e: Nil Mode	rato	
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Shrink S	Swell	Index -	- Iss (%	<b>6):</b> 1.1								

#### Comments

Sample remoulded at estimated OMC and approximately 98% Standard Compaction



Materia	Test Report	Report No: MAT:NEW21W-1729-S02 Issue No: 1
Client:	Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429	Accredited for compliance with ISO/IEC 17025-Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Results provided relate only to the items tested or sampled.
Project No.: Project Name:	MNC16P-0001 Various Testing	Accreditation ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION ACCREDITATION AC

#### **Sample Details**

Sample ID:	NEW21W-1729-S02
Date Sampled:	20/04/2021
Source:	On Site
Material:	Clay
Specification:	No Specification
Project Location:	344 John Oxley Drive, Thrumster, NSW
TRN:	RGS21087.1
Sample Location:	TP2 - (0.5 - 0.6m)

#### **Test Results**

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	14.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	67	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	24	
Plasticity Index (%)	AS 1289.3.3.1	43	
Date Tested		6/05/2021	
Emerson Class Number	AS 1289.3.8.1 - 2017	2	
Soil Description		CLAY	
Type of Water		Distilled	
Date Tested		30/04/2021	

#### Comments



# Appendix C

**Pavement Thickness Design Sheets** 

### **FLEXIBLE PAVEMENT THICKNESS DESIGN - TYPE 1**

CLIENT:	Land Dynamics A	ustralia		Job No.:	RGS21087.1	R G	EGIONAL EOTECHNICAL	
PROJECT:	Proposed Resider	ntial Subdivision				S	OLUTIONS	
LOCATION:	344 John Oxley D	rive, Thrumster						
						Date:	19-May-21	
ROAD NAME:		Road 1		Refer to d	rawing:	Fi	gure 1	
Chainage Inte	rval (m):			Road classification ref:		PMHC	Aus-Spec	
Road Classifica	ation:	Collector Road		Design Traffic:		<b>1</b> x 1	1 x 10 ⁶ ESA	
Pavement Des	sign Methodology	Empirical with reference to Austro	oads Part 2					
		Subg	grade Conc	litions				
Expected subgr	ade:	Clay Embankment Fill of CBR≥4						
Adopted Subgra	ade CBR value:	4		Require	d subgrade compactior	n: 100% S	Standard Compaction	
performance is	sues:	In areas of road construction, strip al highlight any loose, soft, wet, or hear approved granular fill. It is noted tha granular or rock bridging layer to pro design subgrade level, CBR testing wi assist drainage. Place pavement layer	I vegetation, ving areas. W t the embank wide a suitab ill be reuqired rs as specifed	root affecte here such a ment found le surface fo d to assess e	d soils and topsoil and reas are identified they lation is likely to be ove or placement of clay fill, embankment fill proper	proof roll the exp should be remover r-wet and may re- pending geotech ties. Grade subgr	oosed subgrade to ved and replaced with equire placement of a nnical assessment. At rade towards road edge to	
		Pav	vement De	esign				
Recommende	d Pavement Layer T	Thickness:	Recom	mended M	aterial requirements	Requ	uired Compaction	
Wearing cours	e thickness (mm):	40	AC1	0 as Per PM	HC requirements*	3%< I	nsitu Air Voids <8%	
Base thickness	; (mm):	140	DGB20 m	aterial com	olying to PMHC AUSPE	C 98% N	1odified Compaction	
Sub-base thick	mess (mm):	260	DGS20 or DGS40 complying to PMHC AUSPEC		C 95% N	1odified Compaction		
Select thickne	ss (mm):		CBR>15; PI<12; Max Particle size 100mm		Max Particle size 100mm 100% Standard Compacti		Standard Compaction	
Total thickness	s (mm):	440	*Note: AC layer to be underlain by 7mm primer seal					
			Definition	s:				
Design traffic loadi	esign traffic loading: The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.						of the pavement.	
Modified Compacti	on:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.						
Standard Compacti	on:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.						
Density Index:		Minimum required Density Index AS1289 5.6.1 values of maximum and minimum density obt	6.1-1998, defined as the ratio of field dry density determined by AS1289 5.8.1-2004 or equivalent to the laboratory obtained by AS1289 5.5.1-1998 or equivalent					
Note:	Pavement designs for recommendation	assume appropriate drainage is installe ons regarding drainage.	ed and mainta	ained. Refe	r to Regional Geotechni	ical Solutions Rep	oort No. RGS21087.1-AB	

# FLEXIBLE PAVEMENT THICKNESS DESIGN - TYPE 2A

CLIENT:	Land Dynamics A	ustralia		Job No.:	RGS21087.1	R	EGIONAL
PROJECT:	Proposed Resider	ntial Subdivision			1002100711		
LOCATION:	344 John Oxley D	rive, Thrumster					
						Date:	19-May-21
ROAD NAME:		Road 10		Refer to dr	awing:	Fi	gure 1
Chainage Inter	val (m):			Road classification ref:		PMHC Aus-Spec	
Road Classifica	ation:	Local Street		Design Tra	ffic:	5 x 10 ⁵ ESA	
Pavement Des	ign Methodology	Empirical with reference to Austro	oads Part 2				
		Subg	grade Cond	litions			
Expected subgra	ade:	Residual Clay. Possible bands of weat	thered rock ir	n Road 4			
Adopted Subgra	de CBR value:	7	Req		subgrade compaction:	100% 5	Standard Compaction
performance iss	performance issues: In areas of road construction, strip all vegetation, root affected soils and topsoil and proof roll the exposed subgrade to highlight any loose, soft, wet, or heaving areas. Where such areas are identified they should be removed and replaced with approved granular fill. Where rock is encountered at subgrade level, rip to 300mm and recompact to break up drainage pa Grade subgrade towards road edge to assist drainage. Place pavement layers as specifed.					oosed subgrade to ved and replaced with break up drainage paths.	
		Pav	vement De	esign			
Recommende	d Pavement Layer T	hickness:	Recom	mended Ma	terial requirements	Requ	uired Compaction
Wearing cours	e thickness (mm):	25	AC	7 as Per PMH	C requirements*		
Base thickness	(mm):	140	DGB20 m	aterial comp	lying to PMHC AUSPEC	98% N	1odified Compaction
Sub-base thick	ness (mm):	170	DGS20 or DGS40 complying to PMHC AUSPEC		olying to PMHC AUSPEC	95% N	1odified Compaction
Select thicknes	s (mm):		CBR>15; PI<12; Max Particle size 100mm		Particle size 100mm	100% Standard Compaction	
Total thickness	(mm):	335	*Note: AC layer to be underlain by 7mm primer seal				
			Definition	s:			
Design traffic loadiı	Pesign traffic loading: The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.						
Modified Compacti	on:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.					
Standard Compacti	on:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.					
Density Index:		Minimum required Density Index AS1289 5.6.: values of maximum and minimum density obt	quired Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.8.1-2004 or equivalent to the laboratory aximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent				
Note:	Pavement designs for recommendation	assume appropriate drainage is installe ons regarding drainage.	ed and mainta	ained. Refer	to Regional Geotechnica	l Solutions Rep	oort No. RGS21087.1-AB

#### FLEXIBLE PAVEMENT THICKNESS DESIGN - TYPE 2B

Job No.: RGS21087.1



PROJECT: Proposed Residential Subdivision

Land Dynamics Australia

LOCATION: 344 John Oxley Drive, Thrumster

CLIENT:

			Date:	19-May-21		
ROAD NAME:	Road 2	Refer to drawing:	Fi	gure 1		
Chainage Interval (m):		Road classification ref:	РМНС	PMHC Aus-Spec		
Road Classification:	Local Street	Design Traffic:	5 x	10 ⁵ ESA		
Pavement Design Methodology	Empirical with reference to Austro	bads Part 2				
	Subg	grade Conditions				
Expected subgrade:	Low CBR - Residual Clay / Extremely \	Neathered Slate				
Adopted Subgrade CBR value:	2	Required subgrade compactio	n: 100%	Standard Compaction		
155005.	In areas of road construction, strip all vegetation, root affected soils and topsoil and proof roll the exposed subgrade to highlight any loose, soft, wet, or heaving areas. Where such areas are identified they should be removed and replaced with approved granular fill. The subgrades are moisture sensitive and prone to water retention and strength loss during wet weather. Adopt a select layer at base of pavement to assist construction, reduce potential for shear failure, and reduce overall pavement thickne required. Place 290mm layer of Select Fill (CBR >15 and Pl<12) to subgrade design. Grade subgrade towards road edge to assis drainage. Place pavement layers as specifed.					
	Pav	vement Design				
Recommended Pavement Layer Thickness: Recommended Material requirements Required Compact						
Wearing course thickness (mm):	25	AC7 as Per PMHC requirements*				
Base thickness (mm):	140	DGB20 material complying to PMHC AUSPE	C 98% I	Vodified Compaction		
Sub-base thickness (mm):	150	DGS20 or DGS40 complying to PMHC AUSP	EC 95% 1	Vodified Compaction		
Select thickness (mm):	290	CBR>15; PI<12; Max Particle size 100mm	100%	Standard Compaction		
Total thickness (mm):	605	*Note: AC layer to be underl	ain by 7mm prim	er seal		
		Definitions:				
Design traffic loading:	raffic loading: The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.					
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.					
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.					
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.8.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent					
Note: Pavement designs a recommendations r	ssume appropriate drainage is installe egarding drainage.	d and maintained. Refer to Regional Geotechni	cal Solutions Repo	ort No. RGS21087.1-AB for		

#### FLEXIBLE PAVEMENT THICKNESS DESIGN - TYPE 2C

Job No.: RGS21087.1



PROJECT: Proposed Residential Subdivision

Land Dynamics Australia

CLIENT:

**LOCATION:** 344 John Oxley Drive, Thrumster

			Date: 19-May-21	
ROAD NAME:	Road 7	Refer to drawing:	Figure 1	
Chainage Interval (m):		Road classification ref:	PMHC Aus-Spec	
Road Classification:	Local Street	Design Traffic:	5 x 10 ⁵ ESA	
Pavement Design Methodology	Empirical with reference to Austro	ads Part 2		
	Subg	rade Conditions		
Expected subgrade:	Extremely Weathered Dolerite			
Adopted Subgrade CBR value:	4	Required subgrade compaction:	100% Standard Compaction	
issues:	In areas of road construction, strip all any loose, soft, wet, or heaving areas. granular fill. The subgrades are moistu select layer at base of pavement to as required. Place 290mm layer of Select drainage. Place pavement layers as sp	vegetation, root affected soils and topsoil and pr Where such areas are identified they should be are sensitive and prone to water retention and st sist construction, reduce potential for shear failu Fill (CBR >15 and PI<12) to subgrade design. Gra ecifed.	oof roll the exposed subgrade to highlight removed and replaced with approved rength loss during wet weather. Adopt a re, and reduce overall pavement thicknes: de subgrade towards road edge to assist	
	Pav	ement Design		
Recommended Pavement Layer Th	nickness:	Recommended Material requirements	Required Compaction	
Wearing course thickness (mm):	25	AC7 as Per PMHC requirements*		
Base thickness (mm):	140	DGB20 material complying to PMHC AUSPEC	98% Modified Compaction	
Sub-base thickness (mm):	270	DGS20 or DGS40 complying to PMHC AUSPEC	95% Modified Compaction	
Select thickness (mm):		CBR>15; PI<12; Max Particle size 100mm	100% Standard Compaction	
Total thickness (mm):	435	*Note: AC layer to be underlai	n by 7mm primer seal	
	[	Definitions:		
Design traffic loading:	The anticipated number of equivalent standard	d axles (ESA), as defined by AUSTROADS, in the design lane	during the design life of the pavement.	
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.			
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.8.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.			
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.8.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent			
Note: Pavement designs as recommendations re	ssume appropriate drainage is installed egarding drainage.	and maintained. Refer to Regional Geotechnica	I Solutions Report No. RGS21087.1-AB for	