Design Worldwide Partnership (DWP)

Geotechnical Assessment

Manning Rise Development

Marie Avenue, Kolodong

Report No. RGS02310.1-AB_Rev1

30 August 2024

REGIONAL GEOTECHNICAL SOLUTIONS

REGIONAL GEOTECHNICAL SOLUTIONS

Manning-Great Lakes
Port Macquarie
Coffs Harbour

RGS02310.1-AB_Rev1

30 August 2024

Design Worldwide Partnership (DWP)
16 Telford Street
NEWCASTLE NSW 2300

Attention: Marly Swanson Wood

Dear Marly

RE: Manning Rise Development – Marie Avenue, Kolodong
Geotechnical Assessment

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken geotechnical assessment for proposed Manning Rise development located off Wingham Road and Marie Avenue, Kolodong (Lot 343 DP1118417).

Surface and subsurface conditions are presented in the attached report, as well as comments and recommendations on site classifications and foundation conditions, internal pavement thickness design, suitability of the site soils for re-use, soil aggressivity and soil erodibility.

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

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Prepared by

Champak Nag

Geotechnical Engineer

Reviewed by

Steve Morton

Principal Engineer

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1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the proposed Bushland Health, Manning Rise project located off Wingham Road and Marie Avenue, Kolodong (Lot 343 DP1118417).

The proposed works involve a retirement village comprising:

- 207 villas and associated access roads
- Access roads off Marie Avenue, with associated intersections
- Green space
- Community centre facilities
- Associated infrastructure including water, sewer and stormwater services.

A previous geotechnical report by Coffey Geosciences in 2003, (Report TA01489/01-AB, 19 July 2004) included excavation of test pits, sampling, laboratory testing and reporting to provide pavement thickness design, site classification, and soil erodibility assessment. A contamination assessment for the site was also undertaken by Coffey Geosciences in 2004, (Report TA01489/02-AD, 13 December 2004). Information from those reports has been incorporated herein.

The purpose of the work described herein was to address the following:

- Review of previous report;
- General geotechnical conditions, soil and rock profiles;
- Foundation conditions for the proposed villas including site classification to AS2870-2011 *Residential Slabs and Footings;*
- Pavement subgrade conditions and pavement thickness designs for the proposed roads;
- Soil properties and requirements or suitability of the site soils for re-use as fill;
- Erodibility of site soils and soil properties for erosion control and stormwater design;
- Suitability of the site soils for re-use; and
- Chemical aggressivity of site soils to buried concrete and steel structures.

2 METHODOLOGY

Fieldwork for the geotechnical assessment was undertaken in the presence of a Geotechnical Engineer from RGS and included the following:

- Observation of site features and surrounding features relevant to the geotechnical conditions of the site;
- Excavation of twelve test pits (TP101 to TP112) to assess road subgrade conditions and foundation conditions for residential houses.

Engineering logs of the test pits are presented in Appendix A. The locations of the boreholes are shown on Figure 1. They were obtained on site by measurement relative to existing site features.

3 LABORATORY TESTING

Samples retrieved during fieldwork were submitted to NATA accredited laboratories for the following tests:

- Shrink-swell index (Iss) to assess the soil volume change over an extreme range of moisture content;
- California Bearing Ratio (CBR) tests for proposed internal road subgrade conditions; and
- Aggressivity tests to assess chemical aggressivity of soils to buried structural element.

Test results are presented in Appendix B.

4 PREVIOUS GEOTECHNICAL REPORT

A previous geotechnical assessment undertaken by Coffey Geosciences in 2004, (Report TA01489/01-AB, 19 July 2004) involved the following:

- The excavation of forty (40) test pits across the site up to 2.0m deep;
- Collection of samples for laboratory testing comprising;
    - CBR for pavement subgrade strength,
    - Shrink-swell index test for site classification,
    - Erodibility suite tests for stormwater management;
- Providing site classification to *AS2870-1996;*
- Providing pavement thickness design for internal roads and roundabout; and
- Commenting on soil erodibility, excavation conditions and suitability of site soils for reuse.

The investigation generally encountered consistent profiles across the majority of the site comprising topsoil/ slopewash to 0.4m overlying residual clay to 0.5 - 0.6m which was underlain by extremely to highly weathered siltstone. The siltstone and interbedded mudstone was excavated to depths of up to1.0m before backhoe bucket refusal occurred.

The northwest corner revealed different conditions to the remainder of the site, with topsoil/ slopewash to 0.2m overlying colluvial clay to >1.6m. Deeper soils were also encountered in a southwest trending gully that separated the northwest corner from the remainder of the site where residual clay extended to the depth of investigation at 2.0m.

Laboratory testing undertaken on residual clay soils across the site indicated variable shrink-swell index value ranging from 0.3 to 4.5%.

CBR tests undertaken on samples of the residual clay subgrade revealed CBR values from 2 to 25. The higher values are likely to be due to weathered rock or associated gravel within the clay.

The locations of the previous Coffey test pits are included in Figure 1.

5 SITE CONDITIONS

5.1 Surface Conditions

The site is situated within gently to moderately undulating terrain bounded by Wingham Road and residential houses to the south, Marie Avenue to the east, grazing land to the west and undeveloped bushland to the north.

An aerial photograph that shows the location of the site and the site setting is reproduced below.

Aerial image obtained from the NSW 'SIX Maps'' that illustrates the site location and setting. The site boundary is outlined in red.

Topographically the site comprises broad, generally south-facing hillsides separated by broad, shallow drainage gullies. The main drainage gully drains in a south-westerly direction through the western half of the site. A smaller gully in the eastern half of the site flows towards the south-southeast.

Some small farm dams were observed in the existing drainage gullies. One large farm dam was located on the northern boundary in an area where seepage or 'spring' has been observed in the past.

The site is vegetated with well-established grass cover with scattered large trees observed mostly in the south west and north east corner. A brick house with associated swimming pool, several sheds, storage sheds and shipping containers was observed in the north eastern corner of the site.

The site was vacant and trafficability of the site was good with a 2WD vehicle during the site investigation. Drainage of the site occurs via minor infiltration to the soil and overland flow to the ephemeral drainage gullies.

Typical site photographs are presented below.

Looking south west from north east corner of the site on Marie Avenue. This area of the site slopes at 5° to 6° towards the south west

Looking west from TP107 showing the higher central part of site slopes at 2° to 3°

Looking south from TP111 showing the western boundary of the site. This area slopes at 3° to 5°

Looking east from the north west corner of the site. This area slopes at 3° to 5° towards the south east

Looking towards north east from TP103. This area slopes at 3° to 4° towards east and south east

Looking west from TP106 showing the residential area near Wingham Road.

5.2 Subsurface Conditions

The Hastings 1:250,000 Geology map indicates the site is underlain by Lower Permian to Upper Carboniferous aged Giro beds comprising pebbly mudstone, mudstone conglomerate, siltstone, shale, sandstone and limestone.

The materials encountered within the boreholes are summarised in Table 1 and Table 2 below:

Table 1: Summary of Geotechnical Materials

Unit	Material	Material Description
1	Topsoil	Sandy SILT, low plasticity, some clay of medium plasticity,
2	Slope wash	Gravely Sandy CLAY, medium plasticity, gravel fine to medium grained, sand fine to medium grained
3	Residual - CLAY	CLAY, high plasticity, stiff to very stiff
4	Extremely to Highly Weathered Siltstone	SILTSTONE, hard, fractured

Table 2: Summary of Subsurface Profile

TP	Depth of Material Layer (m)			
	UNIT 1 Topsoil	UNIT 2 Slopewash	UNIT 3 Residual- CLAY	UNIT 4 EW-HW SILTSTONE
101	0.0 - 0.15	0.15 – 0.35	0.35 – 0.5	0.5 – ≥ 0.55*
102	0.0 - 0.15	0.15 – 0.3	0.3 – 1.0	1.0 – ≥ 1.25*
103	0.0 - 0.15	0.15 – 0.35	0.35 – 0.55	0.55 – ≥ 1.1*
104	0.0 - 0.15	0.15 – 0.35	0.35 – 0.55	0.55 – ≥ 0.65*
105	0.0 - 0.15	0.15 – 0.3	0.3 – 0.45	0.45 – ≥ 0.65*
106	0.0 - 0.15	0.15 – 0.25	0.25 – 0.35	0.35 – ≥ 0.6*
107	0.0 - 0.15	0.15 – 0.35	0.35 – 0.6	0.6 – ≥ 0.65*
108	0.0 - 0.15	0.15 – 0.35	0.35 – 0.6	0.6 – ≥ 0.85*
109	0.0 - 0.15	0.15 – 0.35	0.35 – 1.1	1.1 – ≥ 1.2*
110	0.0 - 0.2	0.2 – 0.35	0.35 – 1.1	1.1 – ≥ 1.25*
111	0.0 - 0.15	0.15 – 0.25	0.25 – 0.5	0.5 – ≥ 0.6*
112	0.0 - 0.15	0.15 – 0.3	0.3 – 0.5	0.5 – ≥ 1.05*

Note: ≥ Indicates that base of material layer was not encountered
* Indicates excavator tooth bucket refusal
^ indicates Clay fill, high plasticity

No groundwater was encountered in any of the boreholes within the depth of investigation. 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.

5.3 Subgrade Properties

Samples of materials from likely road subgrade levels were returned to a NATA accredited laboratory for CBR testing. The results are summarised in Table 3 together with the results of CBR testing presented in the previous Coffey report.

Table 3: Summary of Laboratory CBR Test Results

Location	Test Depth (m)	Materials	CBR Swell (%)	CBR* (%)
RGS Testing – this investigation				
TP102	0.45 – 0.8	Unit 3 – Residual Clay	1.4	4
TP103	0.7 – 0.9	Unit 4 – EW-HW Siltstone	0.1	8
TP109	0.4 – 0.8	Unit 3 – Residual Clay	1.7	4
Results from Coffey Report TA1489/01-AB				
TP3	0.3 – 0.65	Gravelly Sandy Clay		6/8*
TP4	0.55 – 1.0	Clay		3.5/4
TP7	0.2 – 0.7	Clay		2/1.5
TP11	0.2 – 0.5	Clay		3/3
TP13	0.3 – 0.5	Gravelly Sandy Clay		25/30
TP23	0.35 – 1.0	Gravelly Sandy Clay		19/25
TP29	0.1 – 0.6	Sandy Clay		6/4.5
TP30	0.3 – 0.7	Gravelly Sandy Clay		4.5/5

Location	Test Depth (m)	Materials	CBR Swell (%)	CBR* (%)
TP31	0.15 – 0.75	Clay		2/2.5
TP33	0.2 – 0.5	Sandy Clayey Gravel		8/10
TP35	0.25 – 1.0	Clayey Sand		25/30

*Note: * indicates 2.5mm/5mm penetration*

Table 4: Summary of Laboratory Shrink/Swell Test Results

Location	Test Depth (m)	Materials	Shrink-swell Index (Iss)
RGS Testing – this investigation			
TP109	0.5 – 1.0	Unit 3 – Residual Clay	4.3
TP110	0.6 – 1.1	Unit 3 – Residual Clay	5.0
Results from Coffey Report TA1489/01-AB			
TP1	0.4 – 0.75	Gravelly Clay	1.3
TP4	0.55 – 0.8	Sandy Clay	0.7
TP5	0.3 – 0.7	Sandy Clay	2.2
TP6	0.5 – 0.8	Clay	4.5
TP7	0.2 – 0.5	Clay	3.2
TP11	0.2 – 0.5	Sandy Clay	1.3
TP14	0.2 – 0.5	Sandy Clay	0.3
TP15	0.2 – 0.5	Gravelly Clay	1.3
TP20	0.3 – 0.6	Gravelly Clay	3.7
TP23	0.3 – 0.7	Gravelly Silty Clay	1.7
TP27	0.1 – 0.35	Sandy Clay	2.6
TP28	0.3 – 0.7	Sandy Clay	0.3
TP30	0.3 – 0.7	Clay	3.1
TP32	0.2 – 0.6	Sandy Clay	1.7

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6 SITE CLASSIFICATION AND FOUNDATION DESIGN PARAMETERS

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. The standard can also be used for other forms of construction, including some light industrial, commercial and institutional buildings if they are similar in size, loading and performance expectation to a typical domestic structure.

Based on the laboratory shrink swell results and test pit profiles encountered in this investigation and the previous investigation undertaken by Coffey, the majority of the site is classified as Class M (Moderately Reactive) with estimated characteristic free surface movement of approximately 30mm. Two zones encountered deeper soil profiles and clays of higher reactivity than the general site condition. These zones, located near the northwestern corner and the southern boundary of the site, are delineated on Figure 2. Within these zones the foundation conditions in their condition at the time of the investigations classify as Class H1, Highly reactive, with estimated characteristic free surface movements of up to 50mm.

The site classifications provided herein exclude the effects of future trees planted near the footings, as the type of development proposed is likely to preclude the planting of large trees or groups of trees close to the building areas.

Within both classification areas, footings founded within stiff clay or better can be designed for an allowable base bearing pressure of 100 kPa.

If rock is encountered at shallow depth or if footings are deepened to be founded on weathered rock, the site classifications can be revised to Class S (Slightly Reactive) and the footings designed for characteristic surface movements of up to 20mm and an allowable base bearing capacity of 300 kPa.

If further site regrading works are undertaken for the development, reclassification may be required once final cut and fill depths and fill material types are known.

All footings, edge beams and internal beams should be entirely founded on similar material and outside or below the zones of influence resulting from existing or future service trenches and other subsurface structures.

Prior to the placement of concrete we recommend that footings be observed and assessed by a suitably experienced geotechnical engineer to assess that the correct founding material has been achieved.

Site maintenance must comply with the recommendations and advice provided in CSIRO Sheet BTF18 "*Foundation Maintenance and Footing Performance: A Homeowners Guide*" a copy of which is which is available from the CSIRO website http://www.publish.csiro.au/pid/7076.htm

Shrink-swell related movements can be affected by alterations to the soil profile by cutting and filling, and by the suction related effects of trees close to the building area. The effects of any such cutting, filling, tree planting, or tree removal should be taken into account when selecting design values for differential movement across the building. Where trees are to be removed to allow construction this should be undertaken as soon as possible to allow soil moisture to reach equilibrium prior to placement of footings.

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.

7 PAVEMENT THICKNESS DESIGN

7.1 Proposed Roads

The details of internal roads have not been provided at this stage. Based on preliminary layouts provided, and the topography of the site, it is expected that internal roads will be on natural grade, shallow cut or on shallow fill through the gully areas.

7.2 Design Considerations

The materials at subgrade level will vary from residual clay, extremely to highly weathered siltstone or approved fill materials. It is likely that any fill used beneath the roads will comprise site won materials and therefore the CBR values obtained on site will be appropriate for the assessment of pavement requirements over filled areas.

CBR values obtained during this investigation and the Coffey investigation are summarised in Table 3 of this report. Laboratory CBR testing on residual clay samples over the site reveals CBR swell ranging from 1.4 to 1.7 which indicates the residual clay is low to moderately expansive. With reference to Midcoast Council Aus-Spec, design traffic for the proposed roads, based on road classification and a 40 year design life, are summarised in Table 5.

Table 5: Adopted Design Traffic

Road Type	Design Traffic Adopted (ESA)
Collector Road	2×10^6
Local Street	9×10^4

Adopting the above information, Figure 3 presents three pavement design and subgrade CBR categories for the proposed development.

7.3 Pavement Thickness Design

The development could incorporate asphalt sealed flexible pavements, rigid concrete pavements, or a combination of the two.

Recommended material properties, layer thicknesses, and compaction requirements for different pavement types are presented on the Pavement Thickness Design Sheets in Appendix C.

It is noted that from discussions during previous site meetings one of the options under consideration could be a composite pavement in some areas, with either rigid pavement down the centre with asphalt pavement on each side, or vice versa. As a guide, the pavement thickness designs provided herein could be adopted for planning and budgeting purposes in these composite pavements, however, it is recommended that where such pavements are proposed, RGS be contacted for specific design and drainage requirements depending on the location and the expected conditions.

7.4 Construction and Drainage

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

- A geotechnical assessment of the road footprint 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 paid to cut/ fill boundaries, zones of moisture concentration and the presence of high plasticity clay soils at subgrade level;
- 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 to design subgrade level;
- 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 upper 300mm of fill beneath pavements should be compacted to 100% Standard Compaction;
- Care will be required to promote subsurface drainage to avoid accumulation of water in the pavement profile. To achieve this, we recommend that the subsoil drains be placed around the upslope perimeter of cross slope pavements to 300mm below the underside of pavement and drain freely to the site stormwater system or other appropriate drainage location;
- Road subgrades in the northwestern quarter of the site should be assessed for the need for subsoil drains on both sides of the road due to seepage previously observed in the area;
- For roads directed down slope, subsoil drains on both sides of the road are recommended. Subsoil drains are also recommended on both sides of all Collector Roads;
- Where weathered rock is encountered at subgrade level it should be ripped to 300mm and re-compacted to break up preferential seepage paths;
- Select Fill and pavement gravels should be placed and maintained at 60% to 90% of Optimum Moisture Content;
- 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;
- Where new construction joins onto existing pavements the existing pavement layers should be benched to avoid a vertical joint extending through the pavements at the interface.

8 EXCAVATION CONDITIONS AND REUSE OF SITE SOILS

The site is expected to be regraded by minor cut and fill.

Excavation of the existing topsoil/slopewash, residual clay and extremely weathered rock to the depth of refusal encountered by this investigation should be achievable with a medium size excavator of at least 8 to 12 tonne. If less weathered or higher strength rock is encountered the use of a larger excavator and/or bulk ripping may be required.

Some use of hydraulic rock breakers may be required if hard bands are encountered in confined of detailed excavations such as service trenches excavations. Hard bands are known to occur within the profile in the vicinity of the site and therefore some localised difficult rock excavation should be allowed for.

The existing topsoil will not be suitable for reuse as controlled fill and will be suitable for landscaping purposes only. If the material is to be disposed of offsite, it would require testing in accordance with the Excavated Natural Material Exemption 2014 (ENM Exemption) or the NSW EPA Waste Classification Guidelines as appropriate.

The residual clay soils on or near the gully in the west and north west part of the site are highly reactive and are not recommended for reuse as controlled fill due to their significant shrink-swell potential unless they can be blended with weathered rock.

The residual clay in the other parts of site, and the extremely weathered rock will be suitable for reuse as engineered fill at the site to support structural footings or pavements provided that they are designed and constructed accordingly. If the material is to be disposed of offsite it would require waste classification, following which it is likely to be classified as Virgin Excavated Natural Material (VENM) The clay soils on site should, where possible, be separated from the weathered rock and used in the lower fill profile

9 SEDIMENTATION AND DRAINAGE

The erodibility suite testing results presented in Table 5 of the Coffey report (Ref TA01489/01-AB, 19 July 2004), are reproduced below. The results indicate moderate to high erosion potential.

TABLE 5: SUMMARY OF ERODIBILITY TEST RESULTS & PARTICLE SIZE ANALYSIS

TEST PIT LOCATION	SAMPLE DEPTH (m)	MATERIAL DESCRIPTION	SOIL ERODIBILITY FACTOR		ORGANIC CONTENT
			K Factor	Rating	OC (%)
TP1	0.10 - 0.20	CLAY	0.026	Moderate	0.86
TP6	0.20 - 0.40	Gravelly Sandy CLAY	0.046	High	1.21
TP8	0.20 - 0.40	Sandy CLAY	0.040	Moderate	1.59
TP11	0.20 - 0.40	Gravelly Sandy CLAY	0.022	Moderate	0.60
TP14	0.20 - 0.40	Gravelly Sandy CLAY	0.040	Moderate	0.89
TP19	0.15 - 0.30	Gravelly Sandy CLAY	0.052	High	1.81
TP29	0.20 - 0.40	Gravelly Sandy CLAY	0.022	Moderate	0.81
TP31	0.15 - 0.35	Gravelly Sandy CLAY	0.047	High	1.23

During the initial stages of earthworks at the site it is recommended that drainage improvement measures be undertaken to limit the effect of surface waters at the site and to allow water to drain away from the site. Such measures may include but not be limited to:

- Minor clearing of some of the existing vegetation and removal of structures;
- Grading of the site surface towards water management structures;
- Installation of silt fences and implementation of a stormwater runoff and sediment control plan with the works.

10 SOIL AGGRESSIVITY

Two samples were submitted for soil pH and conductivity analysis. The results are presented in Appendix B.

In accordance with the aggressivity and exposure classifications provided in *AS2159-2009* the soil would be considered non aggressive to concrete and steel.

11 LIMITATIONS

The findings presented in the report and used as the basis for 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. 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

Champak Nag

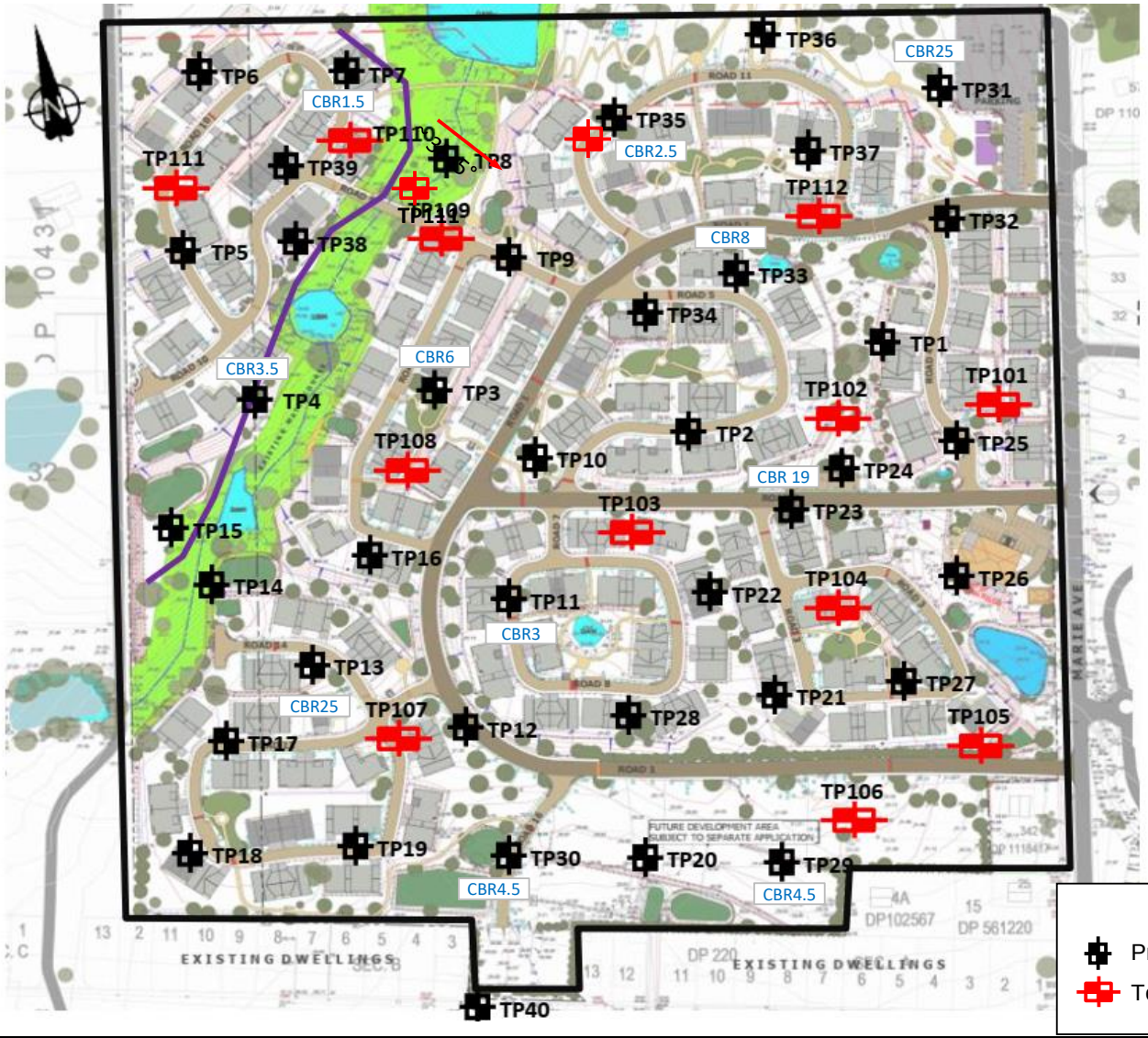
Geotechnical Engineer

Reviewed by

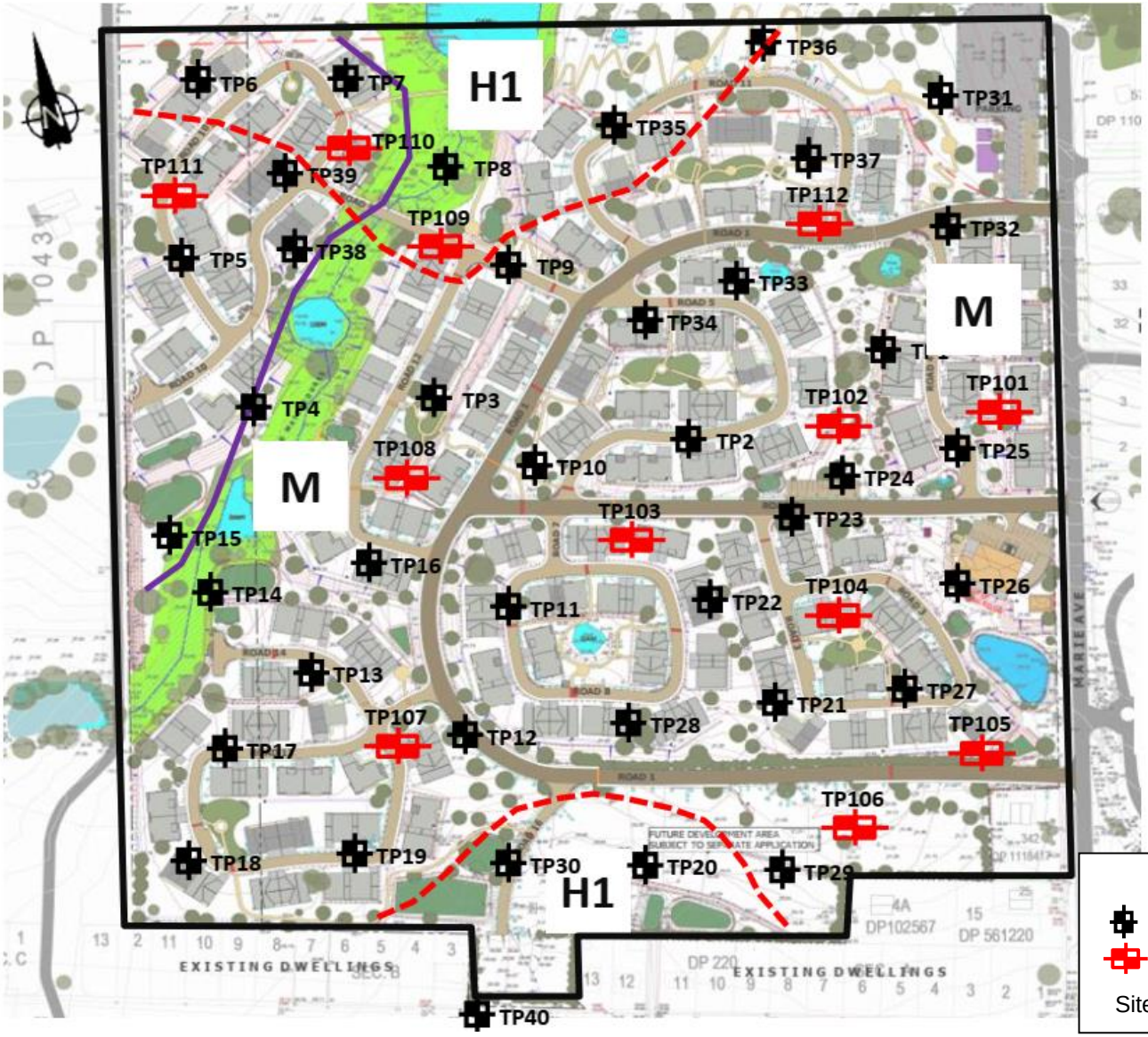
Steve Morton

Principal Engineer

Figures



REGIONAL GEOTECHNICAL SOLUTIONS	**Client:**	DWP	Job No.	RGS02310.1
	Project:	Manning Rise Development	Drawn By:	SRM
			Scale:	NTS
		Marie Avenue, Kolodong	Date:	30-Aug-24
	Title:	Test Location Plan and Subgrade CBRs	Drawing No.	**Figure 1**



Legend

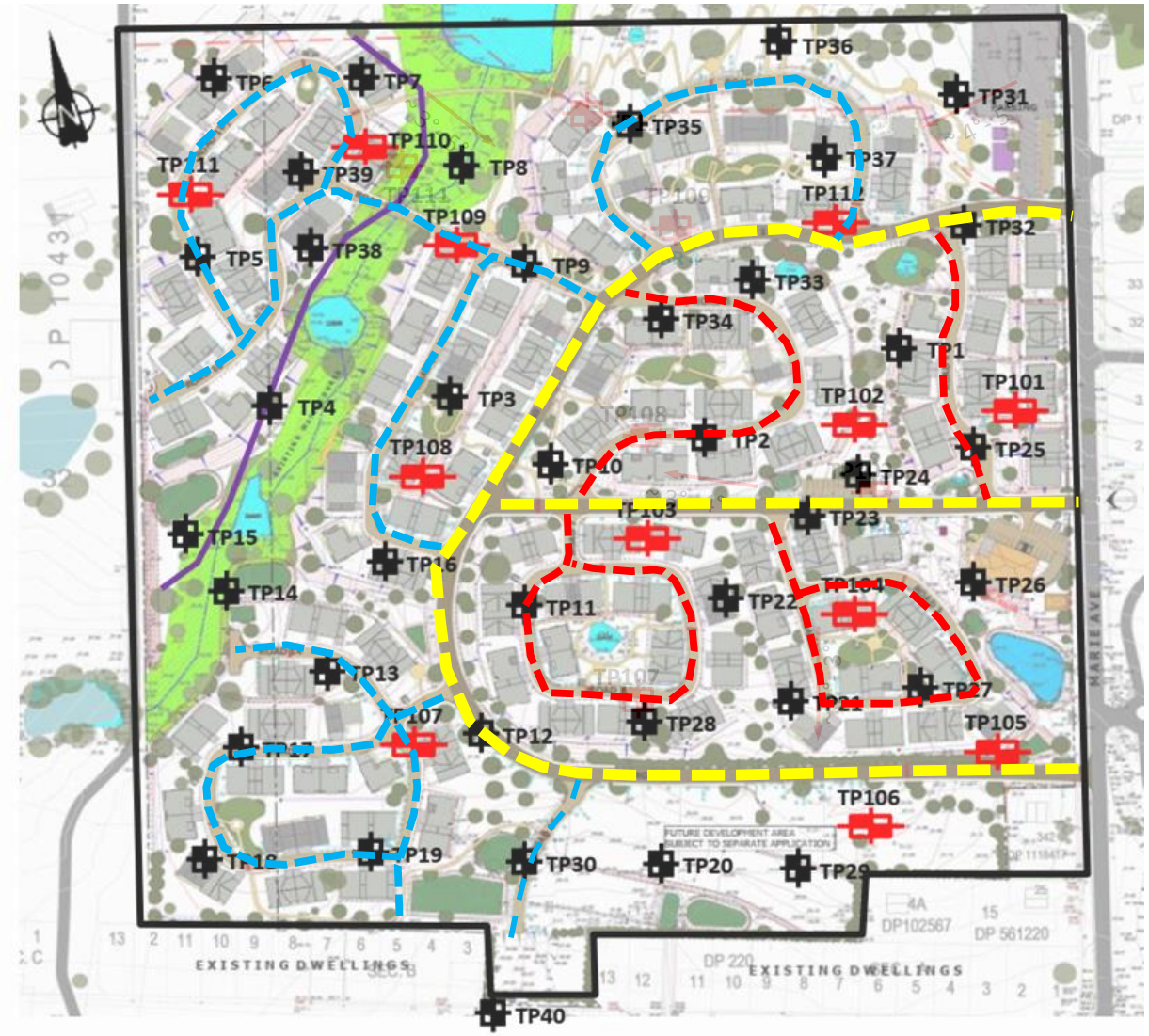
Previous Test Location (Coffey, 2003)

Test pit, this Investigation (RGS, 2020)

Site Classification Zones shown by yellow lines

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	DWP	Job No.	RGS02310.1
Project:	Manning Rise Development	Drawn By:	SRM
		Scale:	NTS
	Marie Avenue, Kolodong	Date:	30-Aug-24
Title:	Test Location Plan and Site Classification	Drawing No.	**Figure 2**



Legend

- Previous Test Location (Coffey, 2003)
- Test pit, this Investigation (RGS, 2020)

Road Class and Subgrade:

Yellow = Collector CBR 3.5

Red = Local Street CBR 8

Blue = Local Street CBR 4

REGIONAL GEOTECHNICAL SOLUTIONS	**Client:**	DWP	Job No. RGS02310.1
	Project:	Manning Rise Development	Drawn By: SRM
			Scale: NTS
		Marie Avenue, Kolodong	Date: 30-Aug-24
	Title:	Subgrade CBR and Road Classification	Drawing No. **Figure 3**

Appendix A

Results of Field Investigations

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP101

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine grained, trace to some clay of medium plasticity	M < w_P				TOPSOIL
							0.15m					
						CI	**Gravelly Sandy CLAY:** Medium plasticity, grey, gravel fine to medium grained, sand fine to medium grained		St			SLOPEWASH
		0.35m					0.35m					
		B				CH	**CLAY:** High plasticity, grey, trace pale brown, pale orange	M > w_P	VSt			RESIDUAL SOIL HP=350kPa
		0.50m		0.5			0.50m					HP=350kPa
							0.55m **SILTSTONE:** Grey, pale brown, pale orange, highly weathered, fractured	M	H			HIGHLY WEATHERED SILTSTONE
							Hole Terminated at 0.55 m due to bucket refusal					
				1.0								
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP102

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Silty CLAY, medium plasticity, dark brown, silt of low plasticity	M > w_P				TOPSOIL
							0.15m					
						CI	**CLAY:** Medium plasticity, grey, with gravel fine to medium grained	M ~ w_P	St			SLOPEWASH
							0.30m					
						CH	**CLAY:** High plasticity, grey, pale orange, pale brown	M > w_P	St			RESIDUAL SOIL
		0.45m										HP=150kPa
				0.5								
		B										
		0.80m										HP=170kPa
				1.0								
							1.00m					
							SILTSTONE: Grey, pale orange, orange	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							1.25m					
							Hole Terminated at 1.25 m due to refusal					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP103

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to medium grained	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace to some sand fine to medium grained		St			SLOPEWASH
							0.35m					
						CH	**CLAY:** High plasticity, grey, trace gravel fine to medium grained	M > w_P	St - VSt			RESIDUAL SOIL HP=150kPa
				0.5			0.55m					
		0.70m					**SILTSTONE:** Grey, fractured	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
		B					Pale orange, grey, yellow					
		0.90m		1.0			1.10m					
							Hole Terminated at 1.10 m due to refusal					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP104

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to medium grained, trace to some clay of medium plasticity	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace to some sand fine to medium grained		St			SLOPEWASH
							0.35m					
						CH	**CLAY:** High plasticity, grey, pale brown	M > w_P	St			RESIDUAL SOIL
				0.5								HP=200kPa
							0.55m					
							SILTSTONE: Grey, pale brown, fractured, excavated as Sandy GRAVEL, medium to coarse grained, cobbles, boulders	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							0.65m					
							Hole Terminated at 0.65 m due to refusal					HP=170kPa
				1.0								
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP105

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to medium grained	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace to some sand fine to medium grained		St			SLOPEWASH
		0.30m					0.30m					
		D 0.40m				CH	**CLAY:** High plasticity, grey	M > w_P	St			RESIDUAL SOIL
							0.45m					
				0.5			**SILTSTONE:** Orange, grey, pale orange, fractured, trace clay seams, excavated as Sandy GRAVEL, medium to coarse grained, cobbles, boulders	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							0.65m					
							Hole Terminated at 0.65 m due to refusal					
				1.0								
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP106

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to coarse grained, trace to some clay of medium plasticity	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace to some sand fine to medium grained		St			SLOPEWASH
							0.25m					
						CH	**CLAY:** High plasticity, grey	M > w_P	St - VSt			RESIDUAL SOIL HP=250kPa
							0.35m					
				0.5			**SILTSTONE:** Grey, pale brown, yellow, fractured, excavated as Sandy GRAVEL, medium to coarse grained, cobbles, boulders, sand fine to coarse grained, trace clay seams	M	H			HIGHLY WEATHERED SILTSTONE
							0.60m					
							Hole Terminated at 0.60 m due to refusal					
				1.0								
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP107

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to medium grained, trace clay of medium plasticity, trace gravel	M < w_P				TOPSOIL
							0.15m					
						CI	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace to some sand, fine to medium grained		St			SLOPEWASH
		0.35m					0.35m					
		B		0.5		CH	**CLAY:** High plasticity, grey	M > w_P	VSt			RESIDUAL SOIL HP=250kPa
		0.55m					0.60m					
							0.65m **SILTSTONE:** Orange, pale grey, pale orange, extremely to highly weathered	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
				1.0			Hole Terminated at 0.65 m due to refusal					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP108

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy Clayey SILT, low plasticity, grey, dark brown, sand fine to medium grained, clay of medium plasticity, trace gravel fine grained	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly Sandy CLAY:** Medium plasticity, grey, gravel fine to medium grained, sand fine to medium grained		St			SLOPEWASH
							0.35m					
				0.5		CH	**CLAY:** High plasticity, grey, trace pale brown, pale orange	M > w_P	St - VSt			RESIDUAL SOIL HP=150kPa HP=250kPa
							0.60m					
							SILTSTONE: Grey, pale orange, extremely to highly weathered, fractured	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							0.85m					
							Hole Terminated at 0.85 m due to refusal					
				1.0								
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP109

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**Sandy SILT:** Low plasticity, grey, dark brown, sand fine to medium grained, trace to some clay of medium plasticity	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly Sandy CLAY:** Medium plasticity, grey, gravel fine to medium grained, sand fine to medium grained					SLOPEWASH
							0.35m					
		0.40m				CH	**CLAY:** High plasticity, pale orange, pale brown, grey	M > w_P	St			RESIDUAL HP=130kPa
				0.5								
		B										HP=150kPa
							Grey					
		0.80m										HP=200kPa
				1.0								
												HP=220kPa
							1.10m					
							SILTSTONE: Grey, pale brown, pale orange, fractured	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							1.20m					
							Hole Terminated at 1.20 m due to refusal					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT:	DWP	**TEST PIT NO:**	**TP110**
PROJECT NAME:	Bushland Health Group, Kolodong	**PAGE:**	1 of 1
SITE LOCATION:	Marie Avenue, Kolodong	**JOB NO:**	RGS02310.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	CN
		DATE:	17/4/20

EQUIPMENT TYPE: 6T Excavator **EASTING:** **SURFACE RL:**

TEST PIT LENGTH: 3.0 m **WIDTH:** 0.6 m **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to medium grained, trace clay of medium plasticity	$M < w_P$				TOPSOIL
							0.20m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, with sand fine to medium grained		St			SLOPEWASH
							0.35m					
						CH	**CLAY:** High plasticity, grey, pale orange, pale brown	$M > w_P$	St			RESIDUAL SOIL
				0.5								HP=120kPa
		0.60m										
												HP=170kPa
		U50										HP=200kPa
				1.0								
		1.10m					1.10m					
							SILTSTONE: Grey, pale brown, pale orange, yellow, fractured	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							1.25m					
							Hole Terminated at 1.25 m due to refusal					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT:	DWP	**TEST PIT NO:**	**TP111**
PROJECT NAME:	Bushland Health Group, Kolodong	**PAGE:**	1 of 1
SITE LOCATION:	Marie Avenue, Kolodong	**JOB NO:**	RGS02310.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	CN
		DATE:	17/4/20

EQUIPMENT TYPE: 6T Excavator **EASTING:** **SURFACE RL:**

TEST PIT LENGTH: 3.0 m **WIDTH:** 0.6 m **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, low plasticity, grey, dark brown, sand fine to medium grained, trace clay of medium plasticity, trace gravel fine grained	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace sand fine to medium grained		St			SLOPEWASH
							0.25m					
		0.30m				CH	**CLAY:** High plasticity, grey, pale brown	M > w_P	St - VSt			RESIDUAL HP=200kPa
		D										HP=250kPa
		0.45m		0.5								
							0.50m					
							SILTSTONE: Grey, pale orange, yellow, fractured	M	H			EXTREMELY TO HIGHLY WEATHERED SILTSTONE
							0.60m					
							Hole Terminated at 0.60 m due to refusal					
				1.0								
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP112

CLIENT: DWP
PAGE: 1 of 1
PROJECT NAME: Bushland Health Group, Kolodong
JOB NO: RGS02310.1
SITE LOCATION: Marie Avenue, Kolodong
LOGGED BY: CN
TEST LOCATION: Refer to Figure 1
DATE: 17/4/20

EQUIPMENT TYPE: 6T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.6 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
600mm Tooth Bucket	Not Encountered					ML	**TOPSOIL:** Sandy SILT, dark brown, sand fine to medium grained, trace to some clay of medium plasticity	M < w_P				TOPSOIL
							0.15m					
						Cl	**Gravelly CLAY:** Medium plasticity, grey, gravel fine to medium grained, trace to some clay of medium plasticity		St			SLOPEWASH
							0.30m					
						CH	**CLAY:** High plasticity, grey	M > w_P	St			RESIDUAL SOIL HP=170kPa
				0.5			0.50m					
							SILTSTONE: Grey, trace pale brown, pale orange, fractured, excavated as Sandy GRAVEL, medium to coarse grained, cobbles, boulders, trace clay seams	M	H			HIGHLY WEATHERED SILTSTONE Moisture at clay seams
				1.0			1.05m					
							Hole Terminated at 1.05 m due to refusal					
				1.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Appendix B

Laboratory Test Result Sheets

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Shrink Swell Index Report

Report No: SSI:NEW20W-1427--S01
Issue No: 1

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 6/05/2020

Sample Details

Sample ID:	NEW20W-1427--S01	**Client Sample ID:**	
Test Request No.:	RGS02310.1	**Sampling Method:**	Sample Submitted By Client
Material:	Clay	**Date Sampled:**	17/04/2020
Source:	On Site	**Date Submitted:**	20/04/2020
Specification:	No Specification		
Project Location:	Marie Avenue, Kolodong, NSW		
Sample Location:	TP109 - (0.5 - 1.0m)		
Borehole Number:	TP109		
Borehole Depth (m):	0.5 - 1.0		

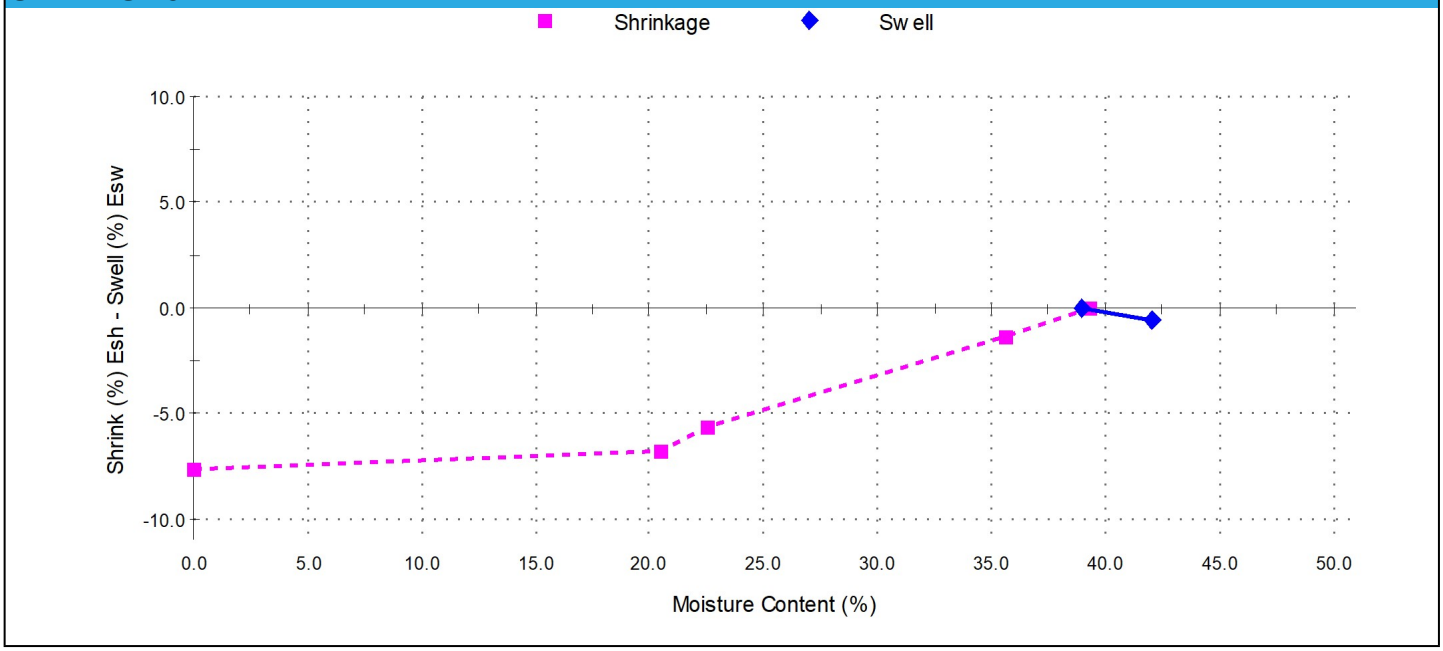
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	38.9
Moisture Content after (%):	42.1
Est. Unc. Comp. Strength before (kPa):	80
Est. Unc. Comp. Strength after (kPa):	180

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	7.7
Shrinkage Moisture Content (%):	39.3
Est. inert material (%):	1
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 4.3

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Shrink Swell Index Report

Report No: SSI:NEW20W-1427--S02
Issue No: 1

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 6/05/2020

Sample Details

Sample ID:	NEW20W-1427--S02	**Client Sample ID:**	
Test Request No.:	RGS02310.1	**Sampling Method:**	Sample Submitted By Client
Material:	Clay	**Date Sampled:**	17/04/2020
Source:	On Site	**Date Submitted:**	20/04/2020
Specification:	No Specification		
Project Location:	Marie Avenue, Kolodong, NSW		
Sample Location:	TP110 - (0.6 - 1.1m)		
Borehole Number:	TP110		
Borehole Depth (m):	0.6 - 1.1		

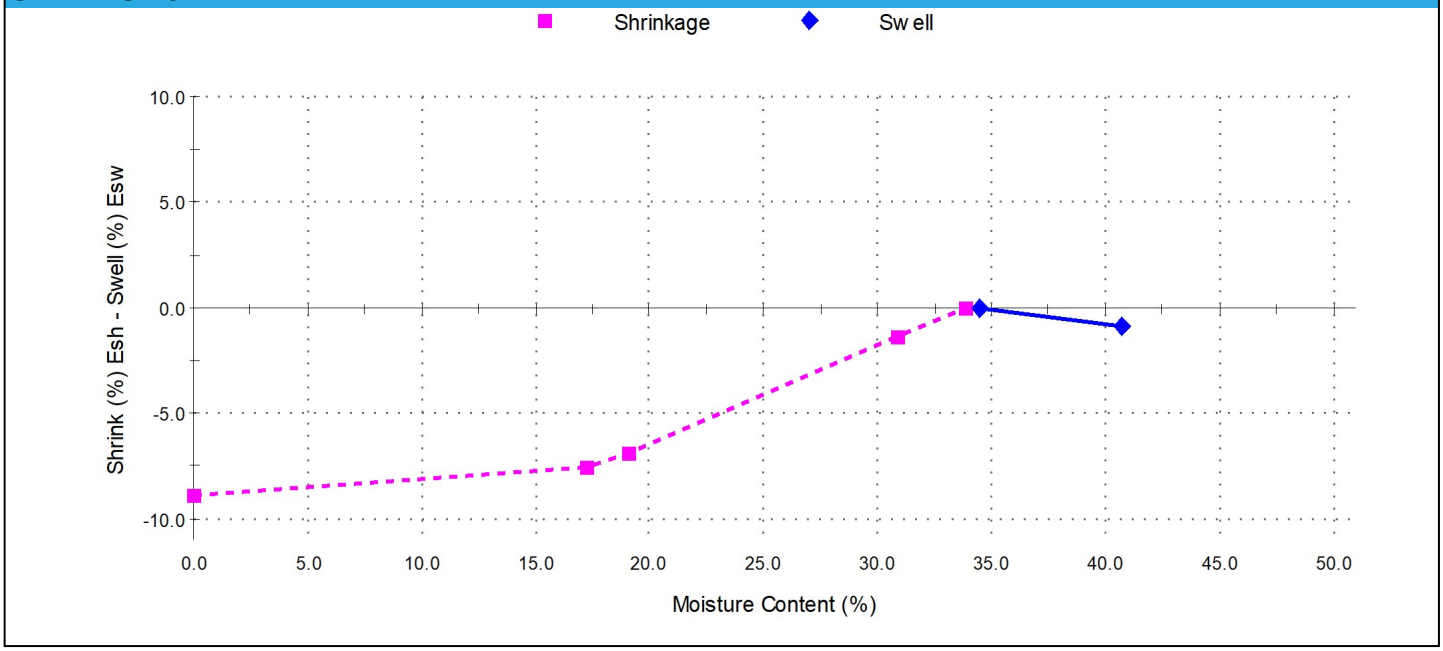
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.9
Moisture Content before (%):	34.4
Moisture Content after (%):	40.7
Est. Unc. Comp. Strength before (kPa):	180
Est. Unc. Comp. Strength after (kPa):	150

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	8.9
Shrinkage Moisture Content (%):	33.8
Est. inert material (%):	5
Crumbling during shrinkage:	NIL
Cracking during shrinkage:	NIL

Shrink Swell



Shrink Swell Index - Iss (%): 5.0

Comments

The results outlined above apply to the sample as received

Material Test Report

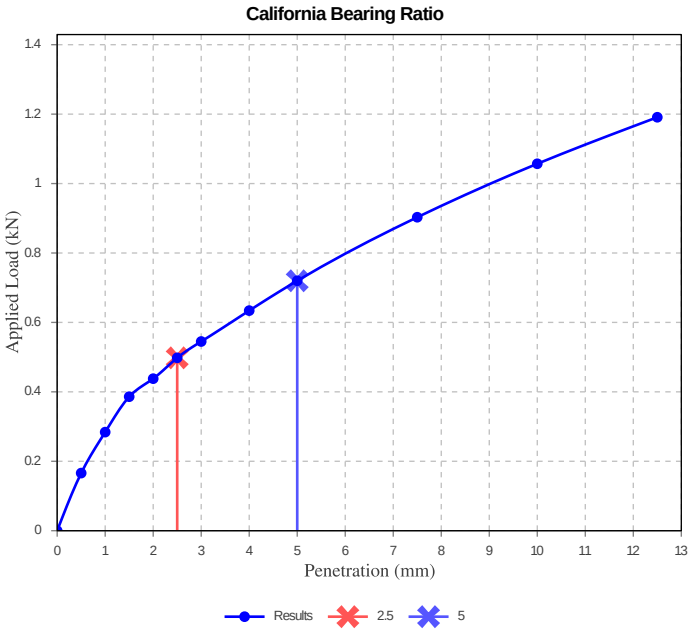
Report Number: **P20239-1**
Issue Number: 1
Date Issued: 07/05/2020
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Contact: Steve Morton
Project Number: P20239
Project Name: Bushland Health, Kolodong
Project Location: Marie Avenue
Client Reference: RGS02310.1
Work Request: 1618
Sample Number: 20-1618A
Date Sampled: 20/04/2020
Dates Tested: 20/04/2020 - 24/04/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **TP102 (0.45-0.8m)**
Material Source: Insitu

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: Ben Murray
pbm-ben
NATA Accredited Laboratory Number: 16993

California Bearing Ratio (RMS T117 & T120)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	RMS T111 & T120		
Maximum Dry Density (t/m^3)	1.545		
Optimum Moisture Content (%)	24.3		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100		
Moisture Content Top 30mm (%)	27.4		
Moisture Content Full Depth (%)	25.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	1.4		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

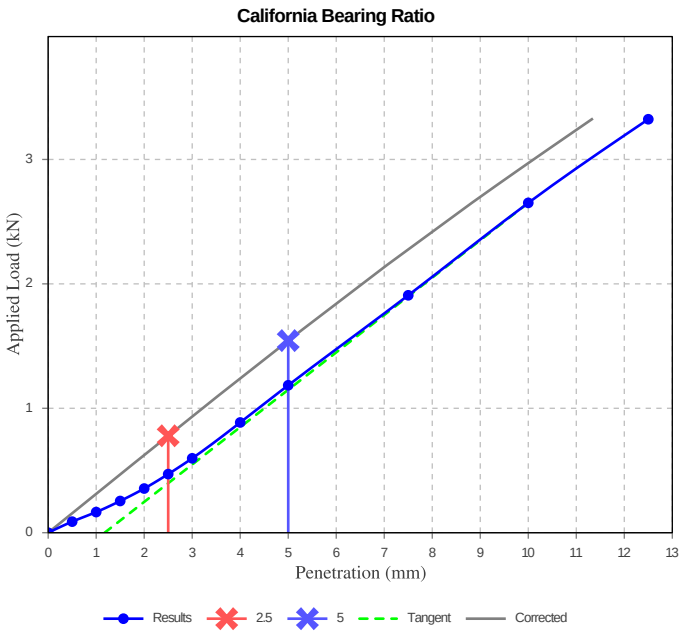
Report Number: **P20239-1**
Issue Number: 1
Date Issued: 07/05/2020
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Contact: Steve Morton
Project Number: P20239
Project Name: Bushland Health, Kolodong
Project Location: Marie Avenue
Client Reference: RGS02310.1
Work Request: 1618
Sample Number: 20-1618B
Date Sampled: 20/04/2020
Dates Tested: 20/04/2020 - 24/04/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **TP103 (0.7-0.9m)**
Material Source: Insitu

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: Ben Murray
pbm-ben
NATA Accredited Laboratory Number: 16993

California Bearing Ratio (RMS T117 & T120)		Min	Max
CBR taken at	5 mm		
CBR %	**8**		
Method of Compactive Effort	Standard / Modified		
Method used to Determine MDD	RMS T111 & T120		
Maximum Dry Density (t/m^3)	1.750		
Optimum Moisture Content (%)	16.5		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	99		
Moisture Content Top 30mm (%)	17.5		
Moisture Content Full Depth (%)	17.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.1		
Material Retained on 19mm (%)	9		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	9		



Material Test Report

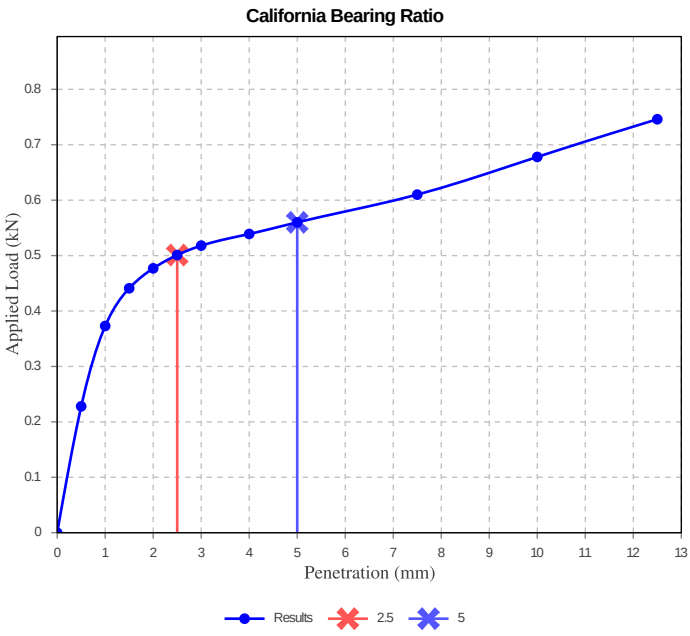
Report Number: **P20239-1**
Issue Number: 1
Date Issued: 07/05/2020
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Contact: Steve Morton
Project Number: P20239
Project Name: Bushland Health, Kolodong
Project Location: Marie Avenue
Client Reference: RGS02310.1
Work Request: 1618
Sample Number: 20-1618C
Date Sampled: 20/04/2020
Dates Tested: 20/04/2020 - 30/04/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **TP109 (0.4-0.8m)**
Material Source: Insitu

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: Ben Murray
pbm-ben
NATA Accredited Laboratory Number: 16993

California Bearing Ratio (RMS T117 & T120)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.0**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	RMS T111 & T120		
Maximum Dry Density (t/m^3)	1.365		
Optimum Moisture Content (%)	33.6		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	100		
Moisture Content Top 30mm (%)	38.5		
Moisture Content Full Depth (%)	35.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	1.7		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



RESULTS OF SOIL ANALYSIS

2 samples supplied by Regional Geotechnical Solutions Pty Ltd on 21/4/20 - Lab Job No. J2846
Analysis requested by Champak Nag. - **Your Project: RGS02310.1**
44 Bent Street WINGHAM NSW 2429

	Method	Sample 1 TP105 0.3-0.4	Sample 2 TP111 0.3-0.45
	EAL job No.	***J2846/1***	***J2846/2***
Moisture (%)	*inhouse*	17	23
Texture	*See note 2 below.*	Fine	Fine
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.89	5.14
Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.024	0.039
Resistivity (ohm.mm)	** Calculation	410,509	255,493
Chloride (mg/kg)	** Water Extract - ISE (1:5 Water)	50.1	61.2
Chloride **(as %)**	** Calculation	0.005	0.006
Sulfate (mg/kg)	** Water Extract-APHA 3120 ICPOES	37	59
Sulfate **(as % SO_4)**	** Calculation	0.003	0.005
Chloride / Sulfate Ratio	** Calculation	1.3	1.0

Notes:

1. ppm = mg/kg dried soil
2. For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
3. All results as dry weight DW - soils were dried at 60°C for 48hrs prior to crushing and analysis.
4. For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
5. Methods from Rayment and Lyons, 2011. Soil Chemical Methods - Australasia.CSIRO Publishing: Collingwood.
6. Based on Australian Standard AS: 2159-2009
7. Methods from Ahern, CR, McElnea AE , Sullivan LA (2004). *Acid Sulfate Soils Laboratory Methods Guidelines* . QLD DNRME.
8. Analysis conducted between sample arrival date and reporting date.
9. ** NATA accreditation does not cover the performance of this service.
10. .. Denotes not requested.
11. This report is not to be reproduced except in full.
12. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
13. Results relate only to the samples tested.
14. This report was issued on 06/05/2020 and replaces the report publsihed 29/04/2020. Sample names have been updated.

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster
Laboratory Manager

Appendix C

Pavement Thickness Design Sheets

FLEXIBLE PAVEMENT THICKNESS DESIGN- Collector over CBR 3.5

CLIENT: DWP **Job No.:** RGS02310.1-AB

PROJECT: Manning Rise Development

LOCATION: Marie Ave Kolodong **Date:** 22-Jun-20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:		**Refer to drawing:**	
Chainage Interval (m):	Full length	**Road classification ref:**	N/A
Road Classification:	Collector Road	**Design Traffic:**	2 x 10^6 ESA

Subgrade Conditions

Expected subgrade:	Residual Clay/imported fill		
Adopted Subgrade CBR value:	3.5	Required subgrade compaction:	100%
Potential construction or performance issues:	Strip existing topsoil and slopewash and excavate to design subgrade level. Proof roll exposed area and replace soft or excessively deflecting material. In fill areas , approved fill materials should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 95% standard compaction, with the upper 300mm of the subgrade being compacted to at least 100% standard compaction.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	50	DG10 Asphalt over 7mm primer seal	4 to 7% air voids
Base thickness (mm):	110	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	140	DGS40 or equivalent	95% Modified Compaction
Select thickness (mm):	250	CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	550		

Definitions:

Design 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 Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 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 5.3.1-2004 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 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS02310.1-AB for recommendations regarding drainage.

FLEXIBLE PAVEMENT THICKNESS DESIGN - Local Street over CBR 4

CLIENT: DWP **Job No.:** RGS02310.1-AB

PROJECT: Manning Rise Development

LOCATION: Marie Ave Kolodong **Date:** 22-Jun-20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Local Streets**	**Refer to drawing:**	
Chainage Interval (m):		**Road classification ref:**	N/A
Road Classification:	Local Street - no buses	**Design Traffic:**	9 x 10^4 ESA

Subgrade Conditions

Expected subgrade:	Residual Clay/imported fill		
Adopted Subgrade CBR value:	4	Required subgrade compaction:	100%
Potential construction or performance issues:	Strip existing topsoil and slopewash and excavate to design subgrade level. Proof roll exposed area and replace soft or excessively deflecting material. In fill areas , approved fill materials should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 95% standard compaction, with the upper 300mm of the subgrade being compacted to at least 100% standard compaction.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	40	DG10 AR450 over 7mm primer seal	4 to 7% air voids
Base thickness (mm):	110	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	180	DGS40 or equivalent	95% Modified Compaction
Select thickness (mm):		CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	330		

Definitions:

Design 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 Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 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 5.3.1-2004 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 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS02310.1-AB for recommendations regarding drainage.

FLEXIBLE PAVEMENT THICKNESS DESIGN- Local Street over EW-HW Siltstone

CLIENT: DWP **Job No.:** RGS02310.1-AB

PROJECT: Manning Rise Development

LOCATION: Marie Ave Kolodong **Date:** 22-Jun-20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Local Streets**	**Refer to drawing:**	
Chainage Interval (m):		**Road classification ref:**	N/A
Road Classification:	Local Street - no buses	**Design Traffic:**	9 x 10^4 ESA

Subgrade Conditions

Expected subgrade:	EW-HW Siltstone		
Adopted Subgrade CBR value:	8	Required subgrade compaction:	100%
Potential construction or performance issues:	Strip existing topsoil and slopewash and excavate to design subgrade level. Proof roll exposed area and replace soft or excessively deflecting material. In fill areas , approved fill materials should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 95% standard compaction, with the upper 300mm of the subgrade being compacted to at least 100% standard compaction.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	40	DG10 AR450 over 7mm primer seal	4 to 7% air voids
Base thickness (mm):	110	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	150	DGS40 or equivalent	95% Modified Compaction
Select thickness (mm):		CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	300		

Definitions:

Design 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 Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 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 5.3.1-2004 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 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS02310.1-AB for recommendations regarding drainage.

RIGID PAVEMENT THICKNESS DESIGN- Collector over CBR 3.5. No shoulders

CLIENT: DWP **Job No.:** RGS02310.1-AB

PROJECT: Manning Rise Development

LOCATION: Marie Ave Kolodong **Date:** 22-Jun-20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Collectors - Rigid Concrete**	**Refer to drawing:**	
Chainage Interval (m):	Full length	**Road classification ref:**	N/A
Road Classification:	Collector Road	**Design Traffic:**	2.5 x 10^6 HVAG

Subgrade Conditions

Expected subgrade:	Residual Clay/Controlled Fill		
Adopted Subgrade CBR value:	3.5	Required subgrade compaction:	100%
Potential construction or performance issues:	Strip existing topsoil and slopewash and excavate to design subgrade level. Proof roll exposed area and replace soft or excessively deflecting material. In fill areas , approved fill materials should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 95% standard compaction, with the upper 300mm of the subgrade being compacted to at least 100% standard compaction.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Base thickness (mm):	170	4MPa flexural strength concrete with Steel fibre reinforment or F82 mesh	
Sub-base thickness (mm):	125	Lean Mix	95% Modified Compaction
Select thickness (mm):	as required based on proof roll	CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	295		

Definitions:

Design 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 Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 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 5.3.1-2004 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 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS02310.1-AB for recommendations regarding drainage.

RIGID PAVEMENT THICKNESS DESIGN - Local Street over CBR 4. No shoulders

CLIENT: DWP **Job No.:** RGS02310.1-AB

PROJECT: Manning Rise Development

LOCATION: Marie Ave Kolodong **Date:** 22-Jun-20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Local Street - Rigid Concrete**	**Refer to drawing:**	
Chainage Interval (m):	Full length	**Road classification ref:**	N/A
Road Classification:	Collector Road	**Design Traffic:**	1.5×10^5 ESA

Subgrade Conditions

Expected subgrade:	Residual Clay/Controlled Fill		
Adopted Subgrade CBR value:	4	Required subgrade compaction:	100%
Potential construction or performance issues:	Strip existing topsoil and slopewash and excavate to design subgrade level. Proof roll exposed area and replace soft or excessively deflecting material. In fill areas , approved fill materials should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 95% standard compaction, with the upper 300mm of the subgrade being compacted to at least 100% standard compaction.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Base thickness (mm):	160	4MPa flexural strength concrete with Steel fibre reinforment or F72 mesh	
Sub-base thickness (mm):	120	DGB20 with 2% slag:lime	95% Modified Compaction
Select thickness (mm):	as required based on proof roll	CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	280		

Definitions:

Design 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 Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 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 5.3.1-2004 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 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS02310.1-AB for recommendations regarding drainage.

RIGID PAVEMENT THICKNESS DESIGN - Local Street over CBR 8. No shoulders

CLIENT: DWP **Job No.:** RGS02310.1-AB

PROJECT: Manning Rise Development

LOCATION: Marie Ave Kolodong **Date:** 22-Jun-20

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:	**Local Street - Rigid Concrete**	**Refer to drawing:**	
Chainage Interval (m):	Areas underlain by CBR 8 subgrade	**Road classification ref:**	N/A
Road Classification:	Local Street	**Design Traffic:**	1.5×10^5 ESA

Subgrade Conditions

Expected subgrade:	Residual Clay/Controlled Fill		
Adopted Subgrade CBR value:	8	Required subgrade compaction:	100%
Potential construction or performance issues:	Strip existing topsoil and slopewash and excavate to design subgrade level. Proof roll exposed area and replace soft or excessively deflecting material. In fill areas , approved fill materials should be placed in layers not exceeding 300 mm loose thickness and compact to a minimum dry density ratio of 95% standard compaction, with the upper 300mm of the subgrade being compacted to at least 100% standard compaction.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Base thickness (mm):	160	4MPa flexural strength concrete with Steel fibre reinforment or F72 mesh	
Sub-base thickness (mm):	100	DGB20 with 2% slag:lime	95% Modified Compaction
Select thickness (mm):	as required based on proof roll	CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	260		

Definitions:

Design 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 Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 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 5.3.1-2004 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 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS02310.1-AB for recommendations regarding drainage.