Pacific Link Housing

Geotechnical Assessment

Proposed Multistorey Apartment Building Development

23-25 Ashton Avenue, The Entrance NSW

Report No. RGS50080.2 - AD

5 December 2023

REGIONAL GEOTECHNICAL SOLUTIONS

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Manning-Great Lakes
Port Macquarie
Coffs Harbour

RGS50080.2 - AD

5 December 2023

Pacific Link Housing
Suite G02, 280 Mann Street
GOSFORD NSW 2250

Attention: Mark Glew

Dear Mark,

RE: Proposed Multistorey Apartment Building Development – 23-25 Ashton Avenue, The Entrance NSW

Geotechnical Assessment

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken geotechnical investigations and assessment for the proposed residential apartment development to be constructed at 23-25 Ashton Avenue, The Entrance NSW.

The development will involve a seven storey apartment complex with a portion of two storey townhouses and an on grade carpark.

Presented herein are comments and recommendations regarding site and subsurface conditions, footing options and foundation design parameters, and soil aggressivity.

This report was internally reviewed by a Principal Geotechnical Engineer from RGS registered on the Design and Building Practitioner Scheme as a Professional Engineer for Class 2 buildings.

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

For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by

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Senior Geotechnical Engineer

Reviewed by

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Principal Geotechnical Engineer

Design and Building Practitioner Registration PRE0001152

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1 INTRODUCTION

This report presents the results of the geotechnical investigations and assessment undertaken by Regional Geotechnical Solutions Pty Ltd (RGS) for the proposed residential apartment development to be constructed at 23-25 Ashton Avenue, The Entrance NSW.

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

- General site conditions and geology including:
    - Soil profile;
    - Presence of fill;
    - Depth to rock; and
    - Groundwater levels.
- Site earthworks including:
    - General site preparation;
    - Excavation conditions;
    - Fill placement and compaction control;
    - Dewatering;
    - Batters; and
    - Material disposal requirements.
- Excavation retention including:
    - Retaining wall options; and
    - Retaining wall design parameters.
- Alternative footing types and foundation design parameters including:
    - Shallow footings - allowable bearing pressures;
    - Piles - ultimate bearing pressures, including end bearing, skin friction and uplift loads;
    - Estimate of expected settlement; and
    - Geotechnical reduction factor.
- Assessment of site subsoil classification for earthquake design in accordance with AS1170.4-2007.
- Pavement design parameters (CBR values), flexible pavement thickness designs for carpark and pavement construction recommendations.
- Assessment of durability requirements (aggressivity) for buried steel and concrete elements.
- Acid Sulfate Soil Assessment.

2 PROPOSED DEVELOPMENT

The development will involve a seven storey apartment complex with a portion of two storey townhouses and an on grade carpark. The proposed development is illustrated below.

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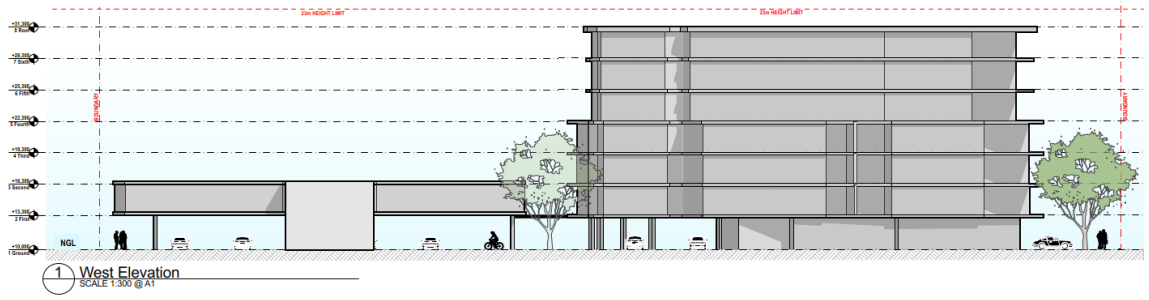


Diagram 1: *Proposed development comprising a seven storey apartment complex and two storey townhouses.*

3 METHODOLOGY

Field work for the assessment was undertaken by a Senior Geotechnical Engineering from RGS on 7 and 8 November 2023 and included the following:

- Observation of site features and surrounding features relevant to the geotechnical conditions of the site;
- The drilling of boreholes with a truck mounted drill rig. Standard Penetrometer Tests (SPTs) were undertaken at about 1.5m intervals to assist in assessing the strength of the materials. The boreholes included:
    - Four boreholes (BH101 to BH104) as part of a preliminary assessment to depths of up to 4.45m; and
    - Four boreholes (BH201 to BH202) as part of the detailed investigation to depths of up to 10m.
- Two boreholes were extended with NMLC coring techniques to recover rock core; and
- Collection of samples for subsequent laboratory testing.

Laboratory testing was conducted on soil samples collected from the boreholes. The testing included:

- Two soil aggressivity test suite to assesses durability requirements in accordance with AS2159 – 2009.
- Two shrink swell test for site classification in accordance with AS2870-2011.
- Point load testing was undertaken on 11 samples of core recovered from BH201 and BH202.
- 20 acid sulfate screens.

- 10 net acidity and S_{kcl} test suites.
- Two 4 day soak CBR test for pavement design.

Engineering logs of the boreholes are attached. Test locations are shown on the attached Figure 1 and were obtained by measurements to prominent site features.

4 SITE CONDITIONS

4.1 Surface Conditions

The site is situated within gently sloping terrain in a near coastal area between Tuggerah Lake and The Entrance Beach. A satellite photograph that shows the location of the site and the site setting is reproduced below.

Diagram 2: *Satellite photograph obtained from Google Earth that illustrates the site location and setting. The site boundary is outline in red.*

The site is made up of three lots including Lot 24, Lot 36, and Lot 37 DP14230. The southern portion of the site (lot 24) falls to the north at grades of approximately 3°. The northern lotion of the site (Lot 36 & 37) falls to the west at grades of approximately 3°.

The site is currently vacant and sealed with a bitumen hardstand. The seal is in poor condition with various defects including large potholes.

Vegetation comprises a tree approximately 5m tall near the centre point of the western boundary and grass along the eastern and western boundaries of the site. There are tall trees on the neighbouring properties to the west.

The northern lots are accessed via Ashton Avenue that comprises a sealed road with curb and gutter, and the southern lot is accessed via Campbell Avenue that also comprises a sealed road with curb and gutter.

The site features are illustrated in the site photographs presented below.

Looking north over Lot 24. Most of the lot is sealed with grass along the boundaries.

Looking southeast over Lot 36 and 37. The majority of the lot is sealed with grass along the boundaries.

Large pothole located in the existing seal on Lot 24.

Curb and gutter off the entrance to Lot 37.

4.2 Subsurface Conditions

The NSW Seamless Geology Map indicates that the site is underlain by coastal sand deposits.

Materials encountered during the investigation are summarised in Table 1. Further details are presented on the attached engineering logs.

Table 1: Summary of Subsurface Materials

Material Name	Material Description	Depth to Base of Material Layer (m)							
		BH101	BH102	BH103	BH104	BH201	BH202	BH203	BH204
Fill	Sandy GRAVEL, fine grained gravel, fine to coarse grained sand	0.25	--	0.1	--	0.3	0.5	--	--
Fill	Sandy Gravelly CLAY, medium plasticity, fine grained sand, fine grained, angular gravel	0.5	0.3	--	0.2	0.6	0.8	0.4	0.4
Alluvial Soil	Sandy SILT, fine to medium grained sand, soft to stiff	1.4	1.5	0.8	0.8	1.8	--	1.1	0.7
Residual Soil	Sandy CLAY and Silty CLAY, medium plasticity, stiff to hard	≥ 4.45	≥ 4.2	3.5	2.2	5.5	2.8	2.4	2.2
Extremely Weathered Sandstone	Sandy CLAY, medium plasticity, hard / friable	--	--	≥ 4.15	≥ 4.05*	6.8	4.1	≥4.0*	≥4.0*
Highly to Moderately Weathered Sandstone	SANDTONE, fine grained, laminated, very low to low strength	--	--	--	--	7.25	4.6	--	--
Slightly Weathered to Fresh Sandstone	SANDTONE, fine grained, laminated, medium to high strength	--	--	--	--	≥10.0	≥7.55	--	--

Note: ≥ *Indicates that base of material layer was not encountered*
-- Indicates the material was not encountered.
* Indicates practical auger refusal was encountered

Groundwater was encountered in BH101 at a depth of 1.0m and BH202 at a depth of 2.2m, however, not encountered in any of the other boreholes. Groundwater levels do fluctuate due to inclement weather, tidal influence, seasonal variations, or due to reasons that may not have been apparent at the time of the site investigation.

A summary of the laboratory test results is presented in Table 2. Soil aggressivity and Acid Sulfate Soil results are discussed in the relevant sections of the report Laboratory test result sheets are presented in Appendix B.

Table 2: Summary of Laboratory Test Results

Sample Location	Sample Depth (m)	Material	Shrink-Swell Index (%)	Field MC (%)	OMC (%)	MDD (t/m3)	CBR Swell (%)	CBR (%)
BH102	0.3 – 0.5	Alluvial Soil	--	12.9	13.0	1.87	-0.5	16
BH102	1.5 – 1.8	Residual Soil	1.9	--	--	--	--	--
BH104	0.5 – 0.9	Alluvial Soil	--	17.7	19.5	1.71	0.0	3.5
BH202	1.0 – 1.3	Residual Soil	1.6	--	--	--	--	--

5 EARTHWORKS

5.1 Geotechnical Considerations

Bulk earthworks plans for the proposed development have not been provided, however, in consideration of the gently sloping site earthworks are likely to be minor.

The site is underlain by fill that extends to depths of up to 0.8m. There are no records that document the manner of fill placement (i.e., a Level 1 report prepared in accordance with AS3798-2007), therefore in accordance with AS2870-2011 'Residential slabs and footings' the fill is classified as 'uncontrolled fill'. In consideration of this and the presence of soft to firm alluvial soils that extend to depths of up to 1.8m, remove and replace treatments may be considered. Alternatively, a piled foundation system may be considered.

Some foundation treatments will likely be required for the proposed pavement areas.

5.2 General Site Preparation and Site Drainage

Earthwork requirements will vary significantly depending on the proposed development details. Site preparations will generally require stripping of the topsoil and existing uncontrolled fill, root affected material and any soft or disturbed areas. The uncontrolled fill may remain onsite, however, any foundation systems would be required to extend below the depth of the uncontrolled fill layers.

All topsoil and root affected excavated materials should be stockpiled on site where appropriate for later reuse in landscaping areas only or disposed of offsite. These materials are not considered suitable for reuse as engineered fill. Any deleterious or obviously contaminated materials should also be stripped and disposed of in consideration of the comments and recommendations provided in Section 5.6.

The existing fill and soft to firm alluvial soils may be suitable for reuse as engineered fill, however, significant moisture conditioning will be required in some areas.

Site runoff should be controlled by appropriate measures including silt fencing and the construction of table drains and diversion mounds along the low side of the site. The drains should be directed to discharge in a controlled manner to an approved disposal point.

5.3 Excavation Conditions

Based on the supplied drawings deep excavations (e.g., for a basement) are not being considered at this point, as such bulk earthworks are not expected to require excavations beyond stripping of unsuitable material as described above. Some localised deeper excavations may be required for the installation of services.

Excavations of these materials are likely be achievable with small to medium sized excavators. Ripping tynes or rock hammers may be required where deeper excavations into the weathered sandstone profile are required. Groundwater seepage is anticipated to be minor and controllable using conventional gravity drainage to discharge directly into the existing stormwater system or into a sump where it can be pumped into the stormwater system.

5.4 Retention

Batters

Temporary batters and / or benching may be feasible for the temporary support of excavations where required provided there is sufficient setback from boundaries and nearby structures. Batters should be constructed as outlined in Table3.

Table 3: Temporary & Permanent Batter Geometry

Maximum Vertical Batter Height (m)	Material Type	Temporary Batters	Permanent Batters
1.5	Alluvial Soil/Uncontrolled fill	2H:1V	3H:1V
2	Residual Soils / Extremely Weathered Rock	1H:1V	1.5H:1V
3		2H:1V	2H:1V[1]

NOTES: *1 Incorporating a minimum 1m wide bench mid height*

Flatter batters may be required if seepage is encountered during excavation and during rainfall and should be assessed by a Geotechnical Engineer on completion of excavation to assess batter requirements.

Batters should be protected from erosion by constructing surface drains along the crest of the up-slope batters that divert water away from the slope face. The batter face should also be trimmed smooth. Vegetation or other means of protection should be rapidly established on permanent batters. Such measures could include proprietary products such as Grassroots or other similar products.

Trench excavations up to 0.6m depth may stand vertical for short durations while the services are laid and backfilled. Trenches should only be excavated in short sections that enable backfilling within several hours of opening. Entry into unsupported excavations should be avoided. All surcharge loads, such as traffic, stockpiles, equipment should be kept at least 1.5 times the depth of the excavation from the edge of the exaction.

Excavation work should be undertaken in accordance with the Safe Work Australia '*Excavation Code of Practice (January 2020)*'.

Retaining Walls

Permanent retaining walls may be required over some parts of the site. Conventional gravity retaining walls, such as reinforced concrete filled block walls, or cantilevered retaining walls would be feasible for permanent support of cuts and fill.

Gravity or cantilever retaining walls should be designed based on a triangular lateral earth pressure distribution using the parameters provided in Table 3.

Table 3: Retaining Wall Design Parameters

Material Type	Material Unit Weight Y (kN/m³)	Effective Friction Angle – Ø' (°)	Effective Cohesion - C' (kPa)	Active Earth Coefficient K_a	At Rest Earth Pressure Coefficient, k_o	Passive Earth Coefficient K_p
Alluvial Soil	18	25	1	0.41	0.58	2.46
Residual Soil	18	25	5	0.41	0.58	2.46
Extremely Weathered Rock	20	30	5	0.33	0.5	3
Highly Weathered to Fresh Rock	24	36	15	0.26	0.41	3.85

The earth pressure coefficients in Table 3 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.

Any surcharge affecting the walls should be allowed for in the design. Appropriate drainage should be installed behind the walls that provide complete and permanent drainage. The wall backfill should comprise free draining granular material. Subsoil drains should comprise a geocomposite drain or geotextile (Bidim A34 or similar) wrapped gravel drain at the toe of the back of the wall. The drains should discharge to the stormwater system.

5.5 Subgrade Preparation, Fill Placement and Compaction Control

The following general comments and recommendations are provided as a guide for the preparation of filling:

- All root affected material, topsoil, and uncontrolled fill (where excavation is appropriate) should be fully stripped and stockpiled for later reuse for landscaping purposes over the site. Topsoil and root affected materials are not considered suitable for reuse as engineered fill, the uncontrolled fill may be reused as engineered fill but should be assessed by a suitably qualified geotechnical engineer as required;
- Following excavation to an appropriate foundation level, the exposed subgrade materials should be proof rolled to identify any wet, excessively deflecting or other deleterious material. Any such areas should be over-excavated down to a stiff base and backfilled

with an approved select fill with similar engineering characteristics to the surrounding soils. The stripped foundation should be observed by a geotechnical engineer to assess appropriate foundation treatment requirements;

- Approved fill (refer below) should be placed in layers not exceeding 300mm loose thickness and be compacted to a minimum dry density ratio of not less than 98% Standard Compaction or 75% density index for cohesionless material (sand). Clay fill is not recommended as discussed below;
- Typically filling below structures should be carried out in accordance with Level 1 inspection and testing as defined in AS3798 – 2007. Fill placed below pavements should be placed under Level 2 conditions; and
- In pavement areas, the upper 300mm of the subgrade materials should be compacted to a minimum density ratio of 100% Standard compaction.

5.6 Fill Materials and Offsite Disposal

Materials recommended for use as engineered fill include good quality well graded granular materials (such as DGB20 / DGS40), free of deleterious materials and having a maximum particle size of 200mm, or a locally sourced or site won ripped weathered rock.

Site won alluvial and residual soil may be reused as controlled fill at the site. However, the use of reactive clay soils will result in higher foundation costs due to the shrink-swell potential and subsequent increase in characteristic free surface movement (ys) values.

Where offsite disposal of material, or reuse of material at an alternative site is proposed it should be assessed in accordance with the requirements of the '*Department of Environment and Climate Change NSW Waste Classification* Guidelines *Part 1 Classifying Waste*' (July 2009) and / or the EPA Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014. As a preliminary guide based on the site contamination testing undertaken, the existing upper gravel fill, would likely meet the requirements of the Recovered Aggregate Order 2014, however could not be classified as ENM due to elevated Total Petroleum Hydrocarbon levels. Further testing would be required in order to provide an appropriate classification for these materials. The natural alluvial and residual soils would likely be classified as VENM in most areas, however, the material identified as actual or potential Acid Sulfate Soils as discussed in Section 4 can-not be classified as ENM or VENM and must be disposed of at a licenced landfill facility following treatment if it can not remain onsite.

It is recommended that following topsoil stripping that a Geotechnical Engineer be engaged to assess that the material across the site has not previously been disturbed.

6 FOUNDATIONS

6.1 Site Classification

The site classification presented herein is provided on the basis that the performance expectations of AS2870-2011 are acceptable.

The site is classified as **Class 'P'** in accordance with AS2870-2011 due to the presence of uncontrolled fill and firm soils to depths of up to 1.5m and due to the presence of trees and their potential influence on soil moisture conditions. In accordance with AS2870-2011, Class 'P' sites must be designed based on engineering principles.

An estimate of the characteristic surface movement has been undertaken based on the following:

- Depth of design suction change of H_s=1.5m;
- Crack depth multiplication factor of 0.5;
- Change in suction at design surface level of Δu=1.2;
- Shrink-swell index of 1.9% for the residual soil that extends beyond the depth of suction; and
- Single trees are located closer than half the mature height of the tree from the proposed structure.

Based on the above, a characteristic surface movement of y_s = 20mm is predicted when assessed in accordance with AS2870-2011. Due to the presence of trees the site will be subjected to potential additional surface movement from tree induced suction change. The potential surface movement due to tree-induced suction change (i.e. $y_s + y_t$) is estimated to be 30mm which is equivalent to a Class M site.

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 or tree planting should be considered when selecting design values for differential movement across the slab.

6.2 Foundation Options

The site is underlain by uncontrolled fill to depths of up to 0.8m that is underlain by soft to firm alluvial soils that extend to depths of up to 1.8m. As such, shallow footings would not be considered appropriate for the site in its current state.

On this basis it is recommended to support any structures on controlled fill placed in accordance with Section 5 of this report or piles that extend below the uncontrolled fill and low strength alluvial soil.

6.3 Shallow Foundations

Shallow footings would only be considered appropriate where the existing fill and alluvial soils are removed and replaced with controlled fill as per the recommendations in Section 5 of this report.

Shallow footings comprising pad and/or strip footings, a raft slab or short bored piles would then be feasible for the support of lightweight structures. The footings must be founded as follows:

- All footings including slab thickenings should be founded within fill placed under Level 1 construction monitoring and testing (AS3798-2007), below all topsoil, any uncontrolled fill materials, or disturbed ground.
- All footings should be entirely founded on similar material and outside or below all zones of influence resulting from existing or future service trenches, cut/fill batters, or adjacent footings.
- Footings founded as described above can be designed based on an allowable base bearing pressure of **100kPa**.
- Prior to the placement of concrete, it is recommended that footings be observed and assessed by an experienced Geotechnical Practitioner to assess that the correct founding material has been achieved.
- Concrete should be placed immediately after the excavation and assessment of the footings.

6.4 Piles

Piles would be considered appropriate for the proposed structures and likely required for the seven storey apartment building.

Due to the vicinity of nearby structures driven piles are not recommended due to vibration during installation which is likely to affect neighbouring buildings.

Screw piles are likely to refuse on the upper weathered rock profile and may not be appropriate due to anticipated high loads from the seven storey structure.

Open bored piles or Grout Injected/Continuous Flight Auger (CFA) piles would be considered appropriate. Due to the upper low strength profile and water inflows an allowance of temporary or permanent casing should be made.

The design parameters in Table 4 could be adopted for either bored or CFA piles.

For pile design in accordance with AS2159-2009, 'Piling Design and Installation', the ultimate geotechnical strength ($Rd,_{ug}$) can be calculated using the ultimate bearing capacity values provided in Table 4. Calculation of the design geotechnical strength (Rd,g) requires an assessment of the geotechnical strength reduction factor (Φg), which is based on a series of project specific variables. In assessing a suitable geotechnical strength reduction factor for this project, the following assumptions have been made:

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report;
- Full time geotechnical supervision will occur during pile installation;
- Some performance monitoring of the supported structure would be undertaken during or after construction;
- No load testing will be undertaken on the piles;
- The foundations will be designed by a designer experienced in similar geotechnical profiles and pile design; and
- Established pile design methods will be used.

In accordance with AS2159-2009 a risk rating of 2.45 is estimated. Therefore, assuming the pile configuration will have low redundancy a Geotechnical Strength Reduction Factor of Φ_g=0.52 or Φ_g=0.56 for a low redundancy system would be appropriate for the site. If static load testing is undertaken the Geotechnical Strength Reduction Factor can be reviewed.

If any of the assumptions outlined above are not correct, the Geotechnical Strength Reduction Factor may change, and further advice should be sought.

Table 4: Summary of Pile Design Parameters

Founding Material	Ultimate End Bearing Capacity[1,2] (MPa)	Ultimate Shaft Adhesion, f_s[3,4] (kPa)	Ultimate Lateral Capacity [5] (kPa)	Young's Modulus, E (MPa)
Residual Soil	--	35	225 (<3D) 450 (>3D)	E_v – 20 E_h – 15
EW Sandstone	3	60	750 (Upper 1.5m of layer) 1,500 (Below 1.5m of layer)	E_v – 100 E_h – 75
HW – MW Sandstone	5	220	1,250 (Upper 1.5m of layer) 2,500 (Below 1.5m of layer)	E_v – 200 E_h – 150
SW – FR Sandstone	15	650	3,550 (Upper 1.5m of layer) 7,500 (Below 1.5m of layer)	E_v – 500 E_h – 375

NOTES:

1. *Ultimate end bearing values occur at large displacements (approx. 5% of pile diameter).*
2. *Serviceability end bearing values should be based on limiting settlements to 1% of footing diameter.*
3. *Assumes pile walls have adequate roughness (Roughness Class ≥ R2). This could be affected by using temporary liners and must be taken as zero over the cased length of pile where permanent casing is used.*
4. *Upper 1.0m of shaft adhesion should be ignored, uplift should be taken as 0.5 times f_s.*
5. *Lateral capacity for pile lengths within 4.5 pile diameters of the surface must be taken to be zero. Assumes pile centre to centre spacing of at least 5 pile diameters.*

7 PAVEMENT THICKNESS DESIGN

7.1 Design Traffic

Traffic data from the proposed pavement is not available. A design traffic has been calculated for the proposed pavement based on assumptions as indicated in Table 5.

Table 5: Design Traffic Assumptions & Calculation Summary

Parameter	Assumptions
Design Life	40 Years
Average Daily Annual Traffic (Based on 45 carpark spaces)	90
Percentage of Heavy Vehicles	1%
Directional Factor	1
Annual Growth Rate	1%
Adopted Design Traffic	*3.2 x 10^4 HVAG*
	2.2 x 10^4 ESA

7.2 Subgrade

The laboratory test results indicate that the alluvial clay subgrade soils have a 4 day soaked CBR of 3.5% and a swell in the CBR mould of 0%.

7.3 Pavement Thickness Design

The pavement thickness designs presented herein have been prepared in accordance with Austroads '*Guide to Pavement Technology Part 2: Pavement Structural Design*' (2017).

The designs assume that the pavements satisfy the 'with shoulders' criteria and a project reliability of 85% has been adopted.

The recommended pavement thickness designs are presented on the Pavement Thickness Design Sheet in Appendix C and a summary is shown below.

Table 6: Summary of Pavement Thickness Designs

Pavement Layer	Rigid Pavement	Flexible Pavement
Wearing Coarse	--	30 mm Asphalt (DG10 AR450)
Base	170mm JRCP (4MPa Flexural Strength)	100mm DGB20
Subbase	150mm DGS40	185mm DGS40
Total Thickness	*320mm*	*315mm*

The pavement design above is based on the assumptions presented in Section 4.1. If accurate traffic movement data is available, the pavement thickness design should be revised.

7.4 Pavement Construction & Drainage

Following stripping of vegetation, topsoil and any organic or deleterious materials, or excavation to design subgrade level, the exposed foundation should be proof rolled to identify any soft, heaving or deleterious materials. If the subgrade fails proof roll then one of the following is likely to be appropriate pending geotechnical assessment:

- Place a heavy duty geofabric (TfNSW Class C) and a triaxial geogrid (such as TX160 or similar) over the exposed subgrade and place a 250mm granular select layer. The select layer must have a minimum CBR of 15%, maximum PI of about 12% and a maximum particle size of about 100mm and can comprise ripped weathered rock, reclaimed pavement materials, DGS40 or angular rockfill. This layer can be included as part of the required selected subgrade thickness;
- Place a heavy duty geofabric (RMC Class D) and a triaxial geogrid (such as TX160 or similar) over the exposed subgrade and place 400mm of clean angular high strength rockfill that has a maximum particle size of about 120mm. The rockfill should be fully wrapped in the geofabric. Place a select layer (CBR of 15%, maximum PI of about 12% and a maximum particle size of about 100mm) in a single lift as a capping layer over the rockfill. Rock bridging layers must be allowed to drain to avoid trapping water beneath the pavement.

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

- 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. Pavement seals must extend at least 0.3m over the existing seal.
- 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.
- Geofabric wrapped subsoil drains should be installed on all sides of the pavement and must extend a depth of 300mm below the underside of subbase.
- Traffic should be prevented from travelling on partially completed pavement sections.
- Where final sealing cannot be undertaken within a few days of completion of the base course, a primer seal should be used to protect the pavement and maintain equilibrium moisture content. Traffic should not be allowed on a primer seal for more than a few days prior to final sealing.

8 EARTHQUAKE SITE SUBCLASS

Based on the ground conditions encountered and the Australian Standard "*AS1170.4-2007 Part 4 Earthquake Actions in Australia*" the following should be adopted:

- Site hazard factor (Z) of 0.09; and
- Site Subclass of Class Ce – Shallow soil site.

9 SOIL AGGRESSIVITY

The aggressivity test results presented in Table 7 below were compared to the exposure classifications provided in Australian Standard AS2159-2009, *Piling Design and Installation.*

Table 7: Results of Soil Aggressivity Testing

Borehole	Sample Depth (m)	Texture/Condition	pH	Soluble Sulfate (mg/kg)	Chloride (mg/kg)	Resistivity (ohm.cm)
BH201	5.5 – 5.6	Fine (B)	6.47	58.7	85.5	12,048
BH203	1 – 1.45	Fine (B)	6.00	191.1	155	5,000

The testing indicates the soil is non-aggressive towards concrete and streel elements.

10 ACID SULFATE SOILS

10.1 Formation of Acid Sulfate Soils

Acid Sulfate Soils (ASS) contain significant concentrations of pyrite which, when exposed to oxygen in the presence of sufficient moisture, oxidises, resulting in the generation of sulfuric acid. Unoxidised pyritic soils are referred to as Potential ASS (PASS). When the soils are exposed, the oxidation of pyrite occurs and sulfuric acids are generated, the soils are said to be Actual ASS (AASS).

10.2 ASS Risk Maps

The Acid Sulfate Soil Risk Mapping of The Entrance area indicates the proposed development is situated approximately 200m west of an area mapped as having a low probability of ASS between a depth of 1m and 3m and within an area of marine and aeolian sand deposits. An extract of the map is reproduced below in Diagram 3.

Diagram 3: *Acid Sulfate Soils Risk map of The Entrance area is reproduced with NSW Government website "Espade v2.2" the lot boundaries are outlined red.*

10.3 Laboratory Testing

Samples collected from the boreholes were transported to a NATA registered laboratory for analysis. ASS screening tests were undertaken on 20 samples. The findings from the screening tests are discussed below.

- The samples revealed pH_F values between 5.19 and 7.64 in distilled water. pH_F less than 4 is an indicator of Actual ASS; and
- The samples revealed pH_{FOX} values between 2.48 and 5.84 in hydrogen peroxide. Values less than 3 can be an indicator of Potential ASS (PASS) but can also be the result of high organic content in the soil.

To provide a more comprehensive assessment, ten samples were submitted for Chromium Reducible Sulphur (CRS) analysis. A summary of the test results is presented in Table 8.

Table 8: Summary of ASS CRS Test Results

Test location	Depth (m)	Texture	Action Criteria[1] (mol H^+ / t)	Actual Acidity – TAA (mol H^+ / t)	Potential Sulfidic Acidity – CRS (mol H^+ / t)	KCL-Extractable Sulfur (mol H+/t)	Net Acidity (mol H^+ / t)
BH101	0.9 – 1.0	Coarse	18	12	4	1	16
BH101	1.9 – 2.0	Fine	62	41	6	6	47
BH101	2.9 – 3.0	Fine	62	41	0	**415**	41
BH102	0.9 – 1.0	Medium	36	33	9	3	**43**
BH102	1.4 – 1.5	Fine	62	30	5	15	35
BH102	1.9 – 2.0	Fine	62	18	0	6	18
BH103	0.9 – 1.0	Fine	62	14	5	1	19
BH103	2.9 – 3.0	Fine	62	8	0	3	8
BH104	0.9 – 1.0	Fine	62	6	0	3	6
BH104	1.9 – 2.0	Fine	62	1	0	0	1

NOTE:

1. *Action criteria is based on less than 1000 tonnes of soil being disturbed*
2. *Values in **Bold** exceed the action criteria.*

10.4 Analysis of ASS Results

The results of the analysis were compared against the action criteria as presented in Table 5.4 of the Water Quality Australia *National Acid Sulfate Soils Guidance National acid sulfate soils sampling and identification methods manual June 2018.*

The assessment is based on less than 1,000 tonnes of soil disturbance. Table 5.4 indicates that for less than 1,000 tonnes of soil disturbance the following action criteria are applicable:

- Fine grained soil - ≥ 62 mol/tonne net acidity
- Medium grained soil - ≥ 36 mol/tonne net acidity
- Coarse grained soil - ≥ 18 mol/tonne net acidity

The laboratory test results presented in Table 8 indicate:

- The net acidity in the samples tested from BH101 to BH104 is below the adopted action criteria except for sample BH102 - 0.9 to 1.0m;
- KCL-extractable sulfur was present in sample BH101 2.9 to 3.0m at a level well above the adopted action criteria indicting high levels of sulfuric acidity;
- Sulfuric acidity is present in nine of the ten samples tested, but net acidity is below the adopted action criteria for the respective grain size apart from sample BH102 - 0.9 to 1.0m;

The results have been evaluated against volume and grain size-based thresholds, considering volumes of less than 1,000 tonnes disturbance based on the assumption that disturbance would be limited to excavation of piles and service trenches. If greater volumes are expected, the results must be reassessed.

10.5 Conclusions Regarding Acid Sulfate Soils

Due to the presence of sulfuric acidity and BH102 - 0.9 to 1.0m being PASS an Acid Sulfate Soils Management Plan (ASSMP) is required for the proposed works where these soils will be impacted.

The management plan should be prepared once details of the proposed development are known.

11 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

Louis Davison

Senior Geotechnical Engineer

Reviewed by

Adam Holzhauser

Principal Geotechnical Engineer

Design and Building Practitioner Registration PRE0001152

Figures

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Pacific Link Housing	Job No.	RGS50080.2
Project:	Proposed Multistorey Apartment Building Development 23-25 Ashton Avenue, The Entrance	Drawn By:	LD
		Scale:	NTS
		Date:	6-Dec-23
Title:	Site Layout Plan	Drawing No.	**Figure 1**

Appendix A

Results of Field Investigations

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH101

CLIENT:	Central Coast Council	**PAGE:**	1 of 1
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	8/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T		0.30m 0.40m ES				GP	0.01m **BITUMEN**	D					WEARING SURFACE
						CI	0.25m **FILL:** Sandy GRAVEL, fine grained, grey, fine to coarse grained sand, with some clay, medium plasticity	M < w_P					FILL
						ML	0.50m **FILL:** Sandy CLAY, medium plasticity, orange-brown, fine grained sand, with some gravel, fine to medium grained, angular	M > w_P	S - F				ALLUVIUM
		0.90m 1.00m ES SPT 2,2,0 N=2		1.0			**Sandy SILT:** Low plasticity, black, fine to medium grained sand						
		1.40m 1.50m 1.45m ES				CI	1.40m **Sandy CLAY:** Medium plasticity, grey, fine to medium grained sand		F - St		HP	100	RESIDUAL
				2.0		CH	2.00m **Silty CLAY:** Medium to high plasticity, pale grey, pale brown, with some sand, fine to medium grained	M < w_P	St - VSt		HP	250	
		2.50m SPT 2,5,6 N=11									HP	200	
		2.95m		3.0									
						CI	3.60m **Silty CLAY:** Medium plasticity, red-brown, with a trace of sand, fine grained		H				
		4.00m SPT 7,10,11 N=21		4.0							HP	550	
							4.45m				HP	>600	
		4.45m					Hole Terminated at 4.45 m						
				5.0									

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 - BOREHOLE

BOREHOLE NO: BH102

CLIENT:	Central Coast Council	**PAGE:**	1 of 1
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	8/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered	0.90m 1.00m ES SPT 1,2,2 N=4 1.50m 1.45m U 1.80m 2.00m 2.10m ES 2.50m SPT 2,3,6 N=9 2.95m 3.00m ES 4.00m SPT 18,25/50mm N=R 4.20m		1.0 2.0 3.0 4.0 5.0		CI	**FILL:** Sandy Gravelly CLAY, medium plasticity, fine to medium grained sand, with gravel, fine grained, angular						FILL
					0.30m	ML	**Sandy SILT:** Low plasticity, black	M > w_P	F				ALLUVIUM
					1.10m	CI	**Silty CLAY:** Medium plasticity, grey, pale brown		F - St		HP HP	120 110	
					1.50m	CH	**Silty CLAY:** Medium to high plasticity, pale grey, pale brown, with a trace of sand, fine grained	M < w_P	St				RESIDUAL
									St - VSt		HP HP	220 300	
					3.40m	CI	**Sandy CLAY:** Medium plasticity, grey, orange-brown		H / Fr		HP	>600	
					4.20m		Hole Terminated at 4.20 m						

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 - BOREHOLE

BOREHOLE NO: BH103

CLIENT:	Central Coast Council	**PAGE:**	1 of 1
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	8/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered	0.10m 0.20m ES				CI ML	0.10m **FILL:** Sandy Gravelly CLAY, medium plasticity, pale brown, fine to coarse grained sand, fine grained angular gravel **Sandy Clayey SILT:** Low plasticity, black	M > w_P	F				FILL ALLUVIUM
		1.00m SPT 3,3,6 N=9 1.45m		1.0		CH	0.80m **Silty CLAY:** Medium to high plasticity, pale grey, red-brown, pale brown		St - VSt		HP HP	190 270	RESIDUAL
		2.00m 2.10m ES		2.0									
		2.50m SPT 10,18,17 N=35 2.95m		3.0		CI	2.40m **Sandy CLAY:** Medium plasticity, orange-brown, grey	M < w_P	H / Fr		HP	>600	
		4.00m SPT 25 N=R 4.15m		4.0		CI	3.50m **Sandy CLAY:** Medium plasticity, grey						EXTREMELY WEATHERED SANDSTONE
				5.0			4.15m Hole Terminated at 4.15 m						

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 - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH104

CLIENT:	Central Coast Council	**PAGE:**	1 of 1
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	8/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered	0.20m				CI	**FILL:** Sandy Gravelly CLAY, medium plasticity, pale brown, fine to coarse grained sand, fine grained angular gravel	D					FILL
		0.30m ES				ML	**Sandy Clayey SILT:** Low plasticity, black, fine to medium grained sand	M > w_P	F				ALLUVIUM
		0.50m											
		B											
		0.90m											
		1.00m		1.0		CI	**Silty CLAY:** Medium plasticity, grey, red-brown, pale brown, with a trace of sand, fine grained	M < w_P	St - VSt				RESIDUAL
		SPT 3,3,6 N=9									HP	300	
											HP	220	
		1.45m											
		2.00m		2.0									
		2.10m ES											
		2.50m				CI	**Sandy CLAY:** Medium plasticity, orange-brown		H / Fr				EXTREMELY WEATHERED SANDSTONE
		SPT 10,18,17 N=35											SPT bouncing froom first blow
		2.95m		3.0									
		4.00m		4.0		CI	**Sandy CLAY:** Medium plasticity, pale grey						EXTREMELY TO HIGHLY WEATHERED SANDSTONE
		SPT 25 N=R					Hole Terminated at 4.00 m Refusal						SPT instantly bouncing at 4.0m
		4.15m		5.0									

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 - BOREHOLE

BOREHOLE NO: BH201

CLIENT:	Central Coast Council	**PAGE:**	1 of 3
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	7/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered	0.20m 0.30m ES 0.50m B 0.90m 1.00m SPT 1,2,3 N=5 1.45m 2.00m 2.10m ES 2.50m SPT 3,4,5 N=9 2.95m 4.00m SPT 4,9,13 N=22 4.45m 5.50m SPT 25/90mm N=R 5.59m		1.0 2.0 3.0 4.0 5.0		SP ML Cl Cl Cl Cl Cl	**FILL:** Gravelly SAND, fine to coarse grained, orange-brown, fine to medium grained, subangular gravel, with a trace of clay 0.30m **FILL:** Silty SAND, fine to medium grained, black 0.60m **Silty CLAY:** Medium plasticity, pale grey, pale brown, with a trace of sand, fine grained 0.60m **Silty CLAY:** Medium plasticity, pale grey, pale brown, with a trace of sand, fine grained 3.50m **Silty CLAY:** Medium plasticity, red-brown, with a trace of gravel, fine to medium grained, angular 4.10m **Silty CLAY:** Medium plasticity, pale grey, pale brown, with red-brown bands 4.40m **Sandy CLAY:** Medium plasticity 5.50m **Sandy CLAY:** Medium plasticity, grey	M M > w_P M < w_P	F - St St - VSt VSt - H H / Fr	HP HP HP HP	120 - 150 250 450 320	FILL ALLUVIAL RESIDUAL SPT bouncing in last 50mm EXTREMELY WEATHERED SANDSTONE

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 - BOREHOLE

BOREHOLE NO: BH201

CLIENT: Central Coast Council
PAGE: 2 of 3
PROJECT NAME: Proposed Multi-Storey Apartment Building Development
JOB NO: RGS50080.2
SITE LOCATION: 23-25 Ashton Avenue, The Entrance
LOGGED BY: LD
TEST LOCATION: Refer to Figure 1
DATE: 7/11/23

DRILL TYPE: Truck Mounted
EASTING:
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered					CI	**Sandy CLAY:** Medium plasticity, grey *(continued)*	M < w_P	H / Fr			
							6.90m Auger refusal at 6.8m Continued as Cored Drill Hole					
				7.0								
				8.0								
				9.0								
				10.0								
				11.0								

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 - CORED BOREHOLE

BOREHOLE NO: BH201

CLIENT:	Central Coast Council	**PAGE:**	Page 3 of 3
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	7/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL Not measured	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
					START CORING AT 6.90m						
NMLC			7.0		**SANDSTONE:** Fine grained, grey, indistinctly bedded	HW	VL		100		
					SANDSTONE: Fine grained, grey, laminated	SW	M				
			8.0						100		
			9.0								
									100		PT RO PL CN SM EW SANDSTONE 25mm PT RO PL CN SM EW SANDSTONE 45mm
			10.0								
					Hole Terminated at 10.00 m						
			11.0								

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer(<1mm)
CO	Coating(1-5mm)

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH202

CLIENT:	Central Coast Council	**PAGE:**	1 of 3
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	7/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T						SM	**FILL:** Silty SAND, fine to coarse grained, black, fine to coarse grained	M					FILL
							0.50m						
						CH	**FILL:** Sandy CLAY, medium to high plasticity, dark brown, fine grained sand	M > w_P	F				
							0.80m						
		1.00m		1.0		CI	**Silty CLAY:** Medium plasticity, pale grey, pale brown		St - VSt				RESIDUAL
		1.10m U											
		1.40m									HP	380	
							1.50m						
		SPT 3,6,6 N=12				CI	**Sandy CLAY:** Medium plasticity, grey, pale brown, fine grained sand	M < w_P	H / Fr		HP	>600	
	7/11/2023	1.85m		2.0									
		2.50m											
		SPT 4,3,22 N=25											
		2.95m		3.0									
							2.80m						
						CI	**Sandy CLAY:** Medium plasticity, grey, fine grained sand						EXTREMELY WEATHERED SANDSTONE SPT bouncing from 2.85m
		4.00m		4.0									
		SPT 25/10mm N=R 4.01m					4.10m						
							Continued as Cored Drill Hole						
				5.0									

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 - CORED BOREHOLE

BOREHOLE NO: BH202

CLIENT: Central Coast Council
PAGE: Page 2 of 3
PROJECT NAME: Proposed Multi-Storey Apartment Building Development
JOB NO: RGS50080.2
SITE LOCATION: 23-25 Ashton Avenue, The Entrance
LOGGED BY: LD
TEST LOCATION: Refer to Figure 1
DATE: 7/11/23

DRILL TYPE: Truck Mounted
EASTING:
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING:
DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL Not measured	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
			1.0								
			2.0								
			3.0								
			4.0		START CORING AT 4.10m						
NMLC					**SANDSTONE:** Fine grained, grey, pale grey, laminated	MW	L		73		PT PL CO Clay SM Clay 30mm PT RO PL SN Iron PT RO PL SN Iron PT RO PL SN Iron
						SW	M - H				
			5.0		**SANDSTONE:** Fine grained, grey, laminated	FR	H		100		

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer(<1mm)
CO	Coating(1-5mm)

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH202

CLIENT:	Central Coast Council	**PAGE:**	Page 3 of 3
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	7/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL Not measured	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC	10% LOSS		7.0		**SANDSTONE:** Fine grained, grey, laminated *(continued)*	FR	H		100		PT RO PL CN
			8.0		Hole Terminated at 7.55 m						
			9.0								
			10.0								
			11.0								

LEGEND:

Method

WB	Wash Bore
RR	Rock Roller
CB	Claw or Blad Bit
NMLC	NMLC Core
NQ,HQ,PQ	Wireline Coring

Bedding

Laminated	<20mm
Thinnly Bedded	20-200mm
Medium Bedded	200-600mm
Thickly Bedded	600-2000mm
Very Thickly Bedded	2000mm
Massive	No Visible Bedding

Degree of Fracturing

Fragmented	<20mm
Highly Fractured	20mm to 40mm
Fractured	40mm to 200mm
Slightly Fractured	200mm to 1000mm

Weathering

EW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
SW	Slightly Weathered
FR	Fresh

Strength

		$I_{s(50)}$
VL	Very Low	<0.1
L	Low	0.1 - 0.3
M	Medium	0.3 - 1
H	High	1 - 3
VH	Very High	3 - 10
EH	Extremely High	>10

Defect Type

JT	Joint
PT	Parting
SM	Seam
SZ	Shear Zone
CS	Crushed Seam

Roughness

VR	Very Rough
RO	Rough
SO	Smooth
SL	Slickensided

Coating

CN	Clean
SN	Stained
VN	Veneer(<1mm)
CO	Coating(1-5mm)

Planarity

PL	Planar
CU	Curved
ST	Stepped
IR	Irregular

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH203

CLIENT:	Central Coast Council	**PAGE:**	1 of 1
PROJECT NAME:	Proposed Multi-Storey Apartment Building Development	**JOB NO:**	RGS50080.2
SITE LOCATION:	23-25 Ashton Avenue, The Entrance	**LOGGED BY:**	LD
TEST LOCATION:	Refer to Figure 1	**DATE:**	7/11/23

DRILL TYPE: Truck Mounted **EASTING:** **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered					CI	0.02m **BITUMEN**	D				WEARING SURFACE
							FILL: Sandy Gravelly CLAY, medium plasticity, pale brown					FILL
							0.40m					
						ML	**Sandy Clayey SILT:** Low plasticity, black	M > w_P	F - St			ALLUVIUM
		1.00m		1.0								
		SPT 2,2,3 N=5					1.10m					
		1.45m				CH	**Silty CLAY:** Medium to high plasticity, grey, pale brown, with a trace of sand, fine grained			HP	130 - 160	RESIDUAL
				2.0								
		2.50m					2.40m					
		SPT 17,25/130mm N=R				CI	**Sandy CLAY:** Medium plasticity, red-brown, pale brown	M < w_P	H / Fr	HP	>600	EXTREMELY WEATHERED SANDSTONE
		2.78m		3.0			3.00m					
							Hole Terminated at 3.00 m					
				4.0								
				5.0								

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 - BOREHOLE

BOREHOLE NO: BH204

CLIENT: Central Coast Council
PAGE: 1 of 1
PROJECT NAME: Proposed Multi-Storey Apartment Building Development
JOB NO: RGS50080.2
SITE LOCATION: 23-25 Ashton Avenue, The Entrance
LOGGED BY: LD
TEST LOCATION: Refer to Figure 1
DATE: 7/11/23

DRILL TYPE: Truck Mounted
EASTING:
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information						Field Test		
METHOD	WATER	SAMPLES	RL (Not measured)	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
AD/T	Not Encountered					CI	**FILL:** Sandy Gravelly CLAY, medium plasticity, pale brown, fine to coarse grained sand, fine grained angular gravel						FILL
							0.40m						
						ML	**Sandy Clayey SILT:** Low plasticity, dark brown	$M > w_P$	F				ALLUVIUM
							0.70m						
						CI	**Sandy CLAY:** Medium plasticity, grey		St - VSt				RESIDUAL
		1.00m		1.0							HP	250	
		SPT 2,3,5 N=8											
		1.45m											
				2.0									
							2.20m						
						CI	**Sandy CLAY:** Medium plasticity, orange-brown, fine grained sand	$M < w_P$	H / Fr				EXTREMELY WEATHERED SANDSTONE
		2.50m									HP	>600	
		SPT 13,25/100mm N=R											
		2.75m											
				3.0									
		3.90m											
		SPT 25/100mm N=R		4.0			4.00m						
		4.00m					Hole Terminated at 4.00 m						
				5.0									

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

Material Test Report

Qualtest LABORATORY (NSW) PTY LTD
Newcastle Laboratory
2 Murray Dwyer Circuit Mayfield West NSW 2304
Phone: (02) 4968 4468
Email: brentcullen@qualtest.com.au

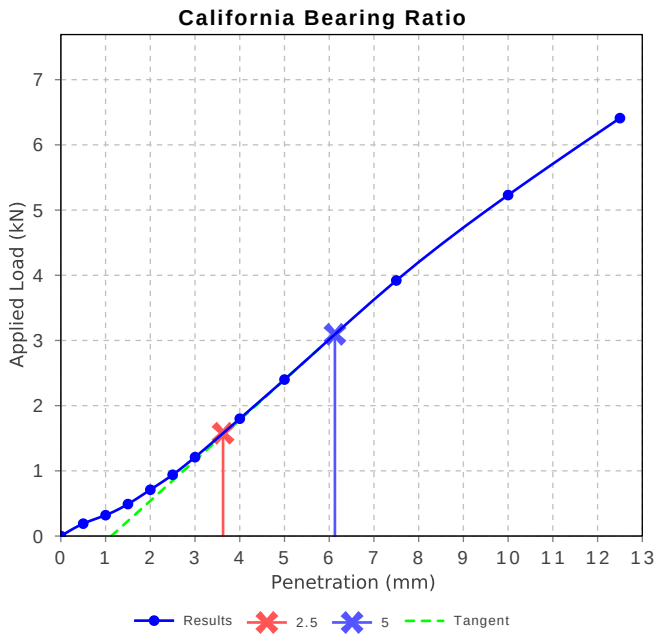
Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION

Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number: **MNC16P-0001-20**
Issue Number: 1
Date Issued: 27/11/2023
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Project Number: MNC16P-0001
Project Name: Various Testing
Project Location: The Entrance, NSW
Client Reference: RGS50080.1
Work Request: 547
Sample Number: NEW23S-547A
Date Sampled: 10/11/2023
Dates Tested: 13/11/2023 - 24/11/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH102 - (0.3 - 0.5m)**
Material: Insitu
Material Source: On-Site

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**16**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual / Tactile		
Maximum Dry Density (t/m^3)	1.87		
Optimum Moisture Content (%)	13.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	98.5		
Dry Density after Soaking (t/m^3)	1.88		
Field Moisture Content (%)	12.9		
Moisture Content at Placement (%)	12.7		
Moisture Content Top 30mm (%)	14.0		
Moisture Content Rest of Sample (%)	12.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	120.0		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Material Test Report

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Newcastle Laboratory
2 Murray Dwyer Circuit Mayfield West NSW 2304
Phone: (02) 4968 4468
Email: brentcullen@qualtest.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION

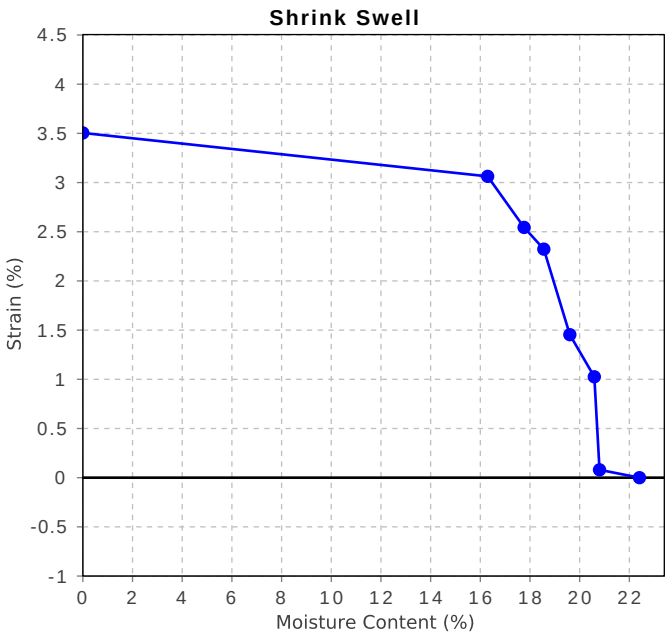
Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**MNC16P-0001-20**
Issue Number:	1
Date Issued:	27/11/2023
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Project Number:	MNC16P-0001
Project Name:	Various Testing
Project Location:	The Entrance, NSW
Client Reference:	RGS50080.1
Work Request:	547
Sample Number:	NEW23S-547B
Date Sampled:	10/11/2023
Dates Tested:	13/11/2023 - 14/11/2023
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	**BH102 - (1.5 - 1.8m)**
Material:	Insitu
Material Source:	On-Site

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**1.9**
Visual Description	Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**3.5**
Estimated % by volume of significant inert inclusions	1
Cracking	Moderately Cracked
Crumbling	No
Moisture Content (%)	22.4

Swell Test	
Initial Pocket Penetrometer (kPa)	200
Final Pocket Penetrometer (kPa)	190
Initial Moisture Content (%)	23.3
Final Moisture Content (%)	20.8
Swell (%)	**-0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

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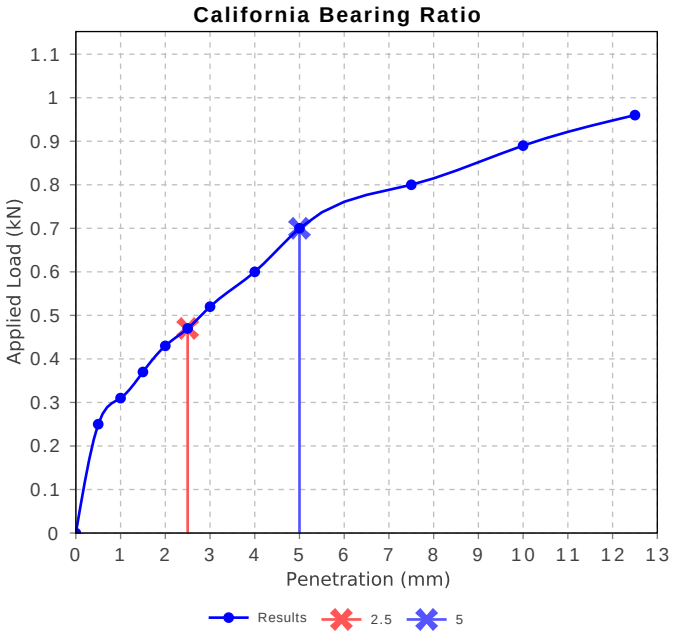
NATA WORLD RECOGNISED ACCREDITATION

Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number: **MNC16P-0001-20**
Issue Number: 1
Date Issued: 27/11/2023
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Project Number: MNC16P-0001
Project Name: Various Testing
Project Location: The Entrance, NSW
Client Reference: RGS50080.1
Work Request: 547
Sample Number: NEW23S-547C
Date Sampled: 10/11/2023
Dates Tested: 13/11/2023 - 24/11/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH104 - (0.5 - 0.9m)**
Material: Insitu
Material Source: On-Site

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**3.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual / Tactile		
Maximum Dry Density (t/m^3)	1.71		
Optimum Moisture Content (%)	19.5		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	98.0		
Dry Density after Soaking (t/m^3)	1.72		
Field Moisture Content (%)	17.7		
Moisture Content at Placement (%)	19.0		
Moisture Content Top 30mm (%)	19.1		
Moisture Content Rest of Sample (%)	18.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	113.8		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Material Test Report

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Newcastle Laboratory
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NATA WORLD RECOGNISED ACCREDITATION

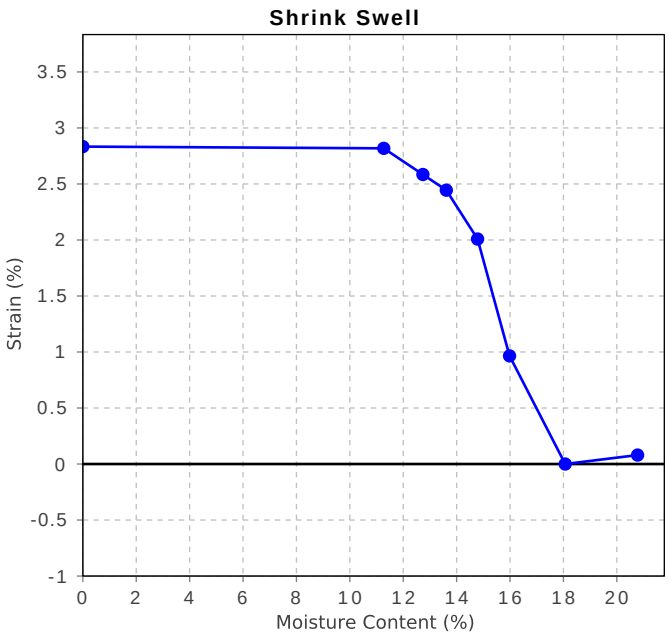
Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**MNC16P-0001-20**
Issue Number:	1
Date Issued:	27/11/2023
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Project Number:	MNC16P-0001
Project Name:	Various Testing
Project Location:	The Entrance, NSW
Client Reference:	RGS50080.1
Work Request:	547
Sample Number:	NEW23S-547D
Date Sampled:	10/11/2023
Dates Tested:	13/11/2023 - 14/11/2023
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	**BH202 - (1.0 - 1.3m)**
Material:	Insitu
Material Source:	On-Site

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**1.6**
Visual Description	Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**2.8**
Estimated % by volume of significant inert inclusions	1
Cracking	Moderately Cracked
Crumbling	No
Moisture Content (%)	18.1

Swell Test	
Initial Pocket Penetrometer (kPa)	250
Final Pocket Penetrometer (kPa)	170
Initial Moisture Content (%)	17.6
Final Moisture Content (%)	20.8
Swell (%)	**-0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



RESULTS OF SOIL ANALYSIS

2 samples supplied by Regional Geotechnical Solutions Pty Ltd on 13/11/2023 - Lab Job No. P7510
Analysis requested by Louis Davidson. - **Your Project: RGS50080.2**
1/21 Cook Drive COFFS HARBOUR NSW 2450

	Method	Sample 1 BH201 5.5-5.6	Sample 2 BH203 1-1.45
	EAL job No.	***P7510/1***	***P7510/2***
Moisture (%)	*inhouse*	32	22
Texture	*See note 2 below.*	FINE	FINE
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.47	6.00
Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.083	0.200
Resistivity (ohm.mm)	** Calculation	120,482	50,000
Resistivity (ohm.cm)	** Calculation (ohm.mm / 10)	12,048	5,000
Chloride (mg/kg)	** Water Extract - Colorimetric (1:5 Water)	85.5	155
Chloride **(as %)**	** Calculation	0.009	0.015
Sulfate (mg/kg)	** Water Extract-APHA 3120 ICPOES	58.7	191.1
Sulfate **(as % SO_4)**	** Calculation	0.0059	0.0191
Chloride / Sulfate Ratio	** Calculation	1.5	0.8

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 28/11/2023.

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

RESULTS OF ACID SULFATE SOIL ANALYSIS

20 samples supplied by Regional Geotechnical Solutions Pty Ltd on 13/11/2023. Lab Job No. P7508.
Analysis requested by Louis Davidson. Your Job: RGS50080.2 20 Samples.

1/21 Cook Drive COFFS HARBOUR NSW 2450

Sample Identification	EAL Lab Code	Texture	Moisture Content		pH_F and pH_{FOX}				KCl-extractable sulfur (S_{KCl})		Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)		pH_{KCl}	Actual Acidity (Titratable Actual Acidity - TAA)	Retained Acidity		Non-treated soil: Acid Neutralising Capacity (ANC_{BT})		Non-treated soil: Net Acidity	Lime Calculation
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH_F	pH_{FOX}	pH change	Reaction	(% S_{KCl})	(equiv. mol H^+/t)	(% S_{Cr})	(mol H^+/t)		(mol H^+/t)	(%S_{NAS})	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)	(mol H^+/t)	(kg $CaCO_3$/t DW)
Method Info.		**	**		*(In-house method S21)*				**		*(In-house method S20)*		*(In-house method 16b)*		**		*(In-house method ST4)*		**	**
BH 101 0.9 - 1.0	*P7508/1*	Coarse	11.1	0.12	6.05	2.71	-3.34	Medium	0.001	1	0.006	4	5.65	12	..	..	..	..	16	1
BH 101 1.4 -1.5	*P7508/2*	Medium	15.4	0.18	5.73	4.20	-1.53	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH 101 1.9 - 2.0	*P7508/3*	Fine	17.5	0.21	5.28	3.18	-2.10	Medium	0.010	6	0.010	6	4.85	41	..	..	..	..	47	4
BH 101 2.4 - 2.5	*P7508/4*	Fine	20.5	0.26	5.50	4.19	-1.31	High	..	..	..	..	..	..	..	..	..	..	..	..
BH 101 2.9 - 3.0	*P7508/5*	Fine	32.3	0.48	5.60	4.27	-1.33	High	0.665	415	<0.005	0	4.81	41	..	..	..	..	41	3
BH 102 0.9 - 1.0	*P7508/6*	Medium	14.0	0.16	5.19	2.48	-2.71	Medium	0.004	3	0.015	9	5.08	33	..	..	..	..	43	3
BH 102 1.4 -1.5	*P7508/7*	Fine	23.7	0.31	5.51	3.75	-1.76	Medium	0.023	15	0.008	5	5.10	30	..	..	..	..	35	3
BH 102 1.9 - 2.0	*P7508/8*	Fine	18.8	0.23	5.91	3.29	-2.62	Medium	0.010	6	<0.005	0	5.40	18	..	..	..	..	18	1
BH 102 2.4 - 2.5	*P7508/9*	Fine	29.5	0.42	5.82	4.63	-1.20	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH 102 2.9 - 3.0	*P7508/10*	Fine	20.7	0.26	5.95	4.77	-1.18	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH 103 0.9 - 1.0	*P7508/11*	Fine	19.1	0.24	5.77	2.77	-3.00	High	0.002	1	0.008	5	5.53	14	..	..	..	..	19	1
BH 103 1.4 - 1.5	*P7508/12*	Fine	22.3	0.29	5.89	4.45	-1.44	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH 103 1.9 - 2.0	*P7508/13*	Medium	16.5	0.20	6.15	4.56	-1.59	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH 103 2.4 - 2.5	*P7508/14*	Fine	28.1	0.39	6.99	5.39	-1.60	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH 103 2.9 - 3.0	*P7508/15*	Fine	14.0	0.16	6.54	5.32	-1.22	Medium	0.004	3	<0.005	0	5.76	8	..	..	..	..	8	1
BH 104 0.9 - 1.0	*P7508/16*	Fine	25.2	0.34	6.71	4.96	-1.75	Low	0.005	3	<0.005	0	5.93	6	..	..	..	..	6	0
BH 104 1.4 - 1.5	*P7508/17*	Fine	31.2	0.45	6.80	5.45	-1.35	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH 104 1.9 - 2.0	*P7508/18*	Fine	17.5	0.21	7.64	5.76	-1.88	Low	0.000	0	<0.005	0	6.46	1	..	..	..	..	1	0
BH 104 2.4 - 2.5	*P7508/19*	Fine	17.3	0.21	7.63	5.84	-1.79	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH 104 2.9 - 3.0	*P7508/20*	Fine	12.8	0.15	7.37	5.75	-1.62	Low	..	..	..	..	..	..	..	..	..	..	..	..

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity) (Eq. 3.3; Sullivan et al. 2018 - full reference above).
   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.
   The Inital Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pHKCl < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H+/t; medium texture ≥ 0.06% S or 36 mol H+/t; fine texture ≥ 0.1% S or 62 mol H+/t) (Table 1.1; Sullivan et al. 2018 – full reference a**
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H+/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pHKCl is < 4.5 or > 6.5, zero is reported for SNAS and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs or on request).
21. Results relate to the samples tested.
22. This final report was issued on 17/11/2023 and replaces the previous report issued on 15/11/2023. Net acidity for selected samples is now included.

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checked: .....
Graham Lancaster
Laboratory Manager

Appendix C

Pavement Thickness Design Sheets

FLEXIBLE PAVEMENT THICKNESS DESIGN - GWMF Deposition Area

CLIENT: Central Coast Council **Job No.:** RGS50080.2

PROJECT: Proposed Multistorey Apartment Building Development

LOCATION: 23-25 Ashton Avenue, The Entrance NSW **Date:** 6-Dec-23

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:		**Refer to drawing:**	
Chainage Interval (m):	Full Length	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	2.2×10^4 ESA

Subgrade Conditions

Expected subgrade:	Alluvial Soil		
Adopted Subgrade CBR value:	3.5	Required subgrade compaction:	100%
Potential construction or performance issues:	Subgrade will comprisealluvial soil. Proof roll to identify and remove excessively soft or heaving areas. Where identified, remove and replace with approved granular fill.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):	30	30mm Asphalt (DG10 AR450)	
Base thickness (mm):	100	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	185	DGS40 or equivalent	95% Modified Compaction
Select thickness (mm):	--	CBR>15%, PI<15%, max particle size 100mm	100% Standard Compaction
Total thickness (mm):	315		

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. RGS50080.2-AD for recommendations regarding drainage.

RIGID PAVEMENT THICKNESS DESIGN

CLIENT: Central Coast Council **Job No.:** RGS50080.2

PROJECT: Proposed Multistorey Apartment Building Development

LOCATION: 23-25 Ashton Avenue, The Entrance NSW` **Date:** 6-Dec-23

REGIONAL GEOTECHNICAL SOLUTIONS

ROAD NAME:		**Refer to drawing:**	
Chainage Interval (m):	Full Length	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	3.2×10^4 HVAG

Subgrade Conditions

Expected subgrade:	Alluvial Soil		
Adopted Subgrade CBR value:	3.5	Required subgrade compaction:	100%
Potential construction or performance issues:	Subgrade will comprise alluvial soil. Proof roll to identify and remove excessively soft or heaving areas. Where identified, remove and replace with approved granular fill.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):			
Concrete Base thickness (mm):	170	JRCP with 32MPa compressive strength (4MPa flexural strength)	
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):	320		

Definitions:

Design traffic loading:	The anticipated number of Heavy Vehicle Axle Groups (HVAG), 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. RGS50080.2.1-AA for recommendations regarding drainage.

Appendix D

Design Compliance Declaration

Fair Trading

Design compliance declaration - single regulated design

This form relates to obligations under the *Design and Building Practitioners Act 2020* and supporting Regulation.
This form is approved under clause 11(1) of the *Design and Building Practitioners Regulation 2021*.

Instructions for completing this form

You must complete all parts of this form.

Please note that under *s77 of the Design and Building Practitioners Act 2020*, Fair Trading has the power to request additional information or records from registered practitioners for an authorised purpose, such as an audit or investigation. You may therefore be requested to provide further information or records to support any declaration made on this form.

Where this form indicates that material must be attached to the form, you must number each attachment sequentially and identify the number of that attachment in the relevant answer.

The plan/drawing/specification/report title, number and revision should correspond with the detail in the title block for each design to which this declaration relates.

Part 1. Details

Please insert the building project address to which this declaration relates

23-25 Ashton Avenue, The Entrance NSW

For registered body corporates, give full names of registered individuals and the corporation on behalf of which the declaration is made.

Design practitioner name

Adam Holzhauser

Registration number of design practitioner

PRE0001152

Class of registration (applicable to this declaration)

Geotechnical

Body corporate name (if applicable)

Registration number of body corporate (if applicable)

Email address

adam.h@regionalgeotech.com.au

Contact number

02 6650 0010

ABN/ACN

51141848820

Part 1. Details (continued)

Q1. Is this a regulated design prepared for a Ⓟ performance solution for building work?

- ☐ Yes, (also includes a building element, proceed to Question 2)
- ☐ Yes, (only for a performance solution, proceed to Question 4)
- ☑ No, (proceed to Question 2)

Q2. Is this a regulated design prepared for a building element for building work? If yes, please select one

- ☐ Ⓕ Fire safety systems
- ☐ Ⓦ Waterproofing
- ☐ Ⓛ Load-bearing
- ☐ Ⓑ Building enclosure
- ☐ Ⓢ (Building) services

Q3. The design compliance declaration (DCD) number is made up of two parts:

a) the number (starting at DCD-001) is the number of DCD made. Subsequent numbers are DCD-002, DCD-003, etc.
b) the letter denotes what type of design the declaration relates to. Use one of the letters from above (P, F, W, L, B, S) e.g. DCD-001W

DCD-_ _ _◯(this is the DCD number)

Q4. Is this a regulated design prepared for an 'architectural / building design general' document by the design practitioner class of architectural for the building element of 'load-bearing' or 'building services?

Refer to Design Practitioners Handbook for explanation of 'architectural / building design general' design document.

- ☐ Yes
- ☑ No

Part 1. Details (continued)

Please group each type of document (e.g. plans/drawings/specifications/reports) together. Note that the information provided in the table should match the title block information.

If you have more than 30 items, please provide on a separate attachment using the same headings in the table below.

	Plan/drawing/specification/report title which is part of the "regulated design" being declared	Plan/drawing/specification/ report reference number	Revision number
1.	Geotechnical Assessment	RGS50080.2 - AD	0
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			

Number of attachments to the certificate (if applicable) 2

Part 2. Declaration matters

I, Adam Holzhauser

Insert full name acting on behalf of

Geotechnical

Insert registered body corporate name (if relevant)

Insert class of registration

have prepared the attached regulated design.
Declare:

1. The regulated design for which this design compliance declaration is being made complies with the requirements of the *Building Code of Australia*.

☐ Yes

☐ No

☑ There are no applicable *Building Code of Australia* requirements

If there are no applicable requirements BCA, please provide further details below

Geotechnical Investigation

2. The regulated design for which this design compliance declaration is being made integrates details of other aspects of building work to which the design relates, and other regulated designs for the work, as far as is reasonably practicable.

☐ Yes

☑ No

If yes, by providing a brief description, please list the other aspects of building work and the other regulated designs that have been integrated into the regulated design for which this design compliance declaration is being made.

3. Standards, codes and requirements (other than the requirements referenced in the B*uilding Code of Australia*) have been applied in preparing the regulated design for which this design compliance declaration is being made. E.g. a requirement under a development consent.

☐ Yes

☑ No

If yes, please list or attach information about the standards, codes or requirements that have been applied.

4. Any building product referred to in preparing the regulated design or which this design compliance declaration is being made would, if used in a manner consistent with the design, achieve compliance with the *Building Code of Australia*.

☐ Yes

☑ No

Part 2. Declaration matters (continued)

5. I have sought and considered specialist advice in preparing the regulated design.

- [ ] Yes
- [x] No

If yes, please provide a brief explanation of the parts of the regulated design which have been based on the specialist advice from another person other than the person making this declaration.

6. The regulated design involves a performance solution.

- [ ] Yes
- [x] No

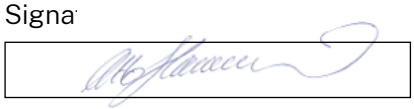
If yes, and the performance solution is not itself the regulated design identified in part 1 of this form, please provide a brief description of the performance solution, the performance solution report identifier (reference number, date and version), and the name and contact details of the person who prepared the performance solution report.

7. The regulated design accords with the Regulated Design Guidance Material relevant to the design, as per clause 9(1(c)) of the Design and Building Practitioners Regulation 2021.

- [ ] Yes
- [x] No

Part 3. Signature

Signa



Date

07/12/2023

This form relates to obligations under the *Design and Building Practitioners Act 2020* and supporting Regulation. For more information visit NSW Fair Trading

This form relates to obligations under the Design and Building Practitioners Act 2020 and supporting Regulation

Instructions for completing this form
You must complete all Parts of this form.

Use this form in designs that consist of independent schedules, specifications or reports.

Attach the completed form to the front of the schedule, specification or report as a separate page before uploading to the NSW Planning Portal. Do not insert this form as an image or resize the form.

Regulated Design Record				
Project Address: 23-25 Ashton Avenue, The Entrance NSW				
Project Title: Proposed Multi-Storey Apartment Development				
Consent No: Unknown			Body Corporate Reg No: Unknown	
Drawing Title: Not Applicable			Drawing No: Not Applicable	
Rev	Date (dd.mm.yy)	Description	DP Full Name	Reg No
0	5 December 2023	Geotechnical Report - RGS50080.2 - AD	Adam Holzhauser	PRE0001152