

Rise Developments

Proposed Residential Development

Lot 2 Phillip Drive, South West Rocks

Preliminary Geotechnical Assessment

Report No. RGS32813.1 – AB

16 September 2021



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Rise Developments
C/O De Groot and Benson
PO Box 1908
Coffs Harbour NSW 2450

Attention: Daniel Pszczonka

Dear Daniel

**RE: Proposed Residential Development – Lot 2 Phillip Drive, South West Rocks
Preliminary Geotechnical Assessment**

Regional Geotechnical Solutions Pty Ltd (RGS) has completed geotechnical investigations and assessment for a proposed residential development located at Lot 2 Phillip Drive, South West Rocks.

The investigation encountered a deep soil profile mainly comprising medium dense to very dense sand to more than 30m depth with some localised interbedded units of soft to stiff clay. Recommendations and advice on foundation conditions and earthworks are presented in the attached report. If you have any questions regarding this project, or require any further assistance, please do not hesitate to contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd



Matt Rowbotham

Associate Engineering Geologist



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1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd have undertaken a geotechnical assessment for a proposed residential development at Lot 2 Phillip Drive, South West Rocks. Based on the drawings provided, it is proposed to:

- Develop the elevated southern parts of the site with townhouses and dual occupancy flats and
- Develop the lower lying northern parts of the site with medium density residential buildings.

As part of the development it is anticipated that the lower lying northern parts of the site will require filling to raise the area above flood levels.

The site is located in an area of gently undulating topography, the Coastal Quaternary Geology map of Kempsey indicates the site is underlain by Holocene age inter-barrier creek deposits (northern low lying area) and pleistocene dune deposits (southern elevated area). Reference to the South West Rocks ASS Risk Map (DLWC, 2000) indicates the southern area of the site is located in an area of "no known occurrence of ASS" and the northern area of the site is located in an area of "high probability" at or within 1m of the ground surface.

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

- A description of the subsurface conditions encountered, including soil / rock profile, groundwater.
- Preliminary advice on foundation options and foundation design parameters including appropriate geotechnical strength reduction factors and founding materials for both shallow and piled footings as appropriate.
- Young's modulus values for the assessment of settlements.
- Aggressivity assessment of the soils to buried structural elements in accordance with AS2159-2009.
- Recommendations on excavatability and earthworks recommendations including trafficability, stripping, earthworks compaction control.
- Retaining wall design parameters.
- Preliminary advice on dewatering of excavations.
- Assessment of acid sulfate soils.
- Recommendations on subgrade design parameters for pavements.
- Geotechnical issues that are found to be relevant during the investigations.

The work was commissioned by Daniel Pszczonka and was undertaken in accordance with proposal number RGS32813.1-AA dated 2 August 2021.



2 METHODOLOGY

Field work for the assessment was undertaken between 26th June and 2nd August 2021 and included:

- A site walkover and mapping of the relevant site and surrounding surface features.
- Excavation of 18 test pits across the site. The test pits were excavated to depths of up to 2.2m. Perth Sand Penetrometer (PSP) testing was undertaken adjacent to each of the test pit.
- Drilling of 4 boreholes using a combination of drilling methods including, auger and wash boring appropriate to the site conditions. The boreholes were drilled to between 10.26m and 30.0m to assess subsurface conditions. Standard Penetration Tests (SPT) were undertaken at approximately 1.5m intervals in the upper 15m of the boreholes and extended to approximately 3m intervals below 15m.
- Installation of three piezometers to assess groundwater levels; and
- Collection of samples for laboratory analysis.

3 LABORATORY TESTING

Samples retrieved during field work were returned to NATA accredited laboratories for testing which included the following:

- 60 Acid Sulfate Soil (ASS) screening;
- 15 Chromium reducible sulphur analysis for Potential ASS; and
- Soil aggressivity testing.

The results are presented in Appendix B.

4 SITE CONDITIONS

4.1 Surface Conditions

The site is located in an area of gently undulating topography with surface elevations of less than 10m AHD and is situated on the northern side of Phillip Drive approximately 200m west of the Big 4 Caravan Park.

The eastern parts of the site have not been affected by earthworks, the north western part of the site appears to have had some minor modification of the surface soils comprising minor cut to fill works up to 0.3m. The northern half of the site has been affected by clearing with the southern area comprising open coastal bushland. Heading north from Phillip Drive the ground surface comprises an elevated terrace of sand dune deposits. Approximately 80m north of Phillip Drive the ground surface drops in elevation by about 1m to 2m onto a low lying alluvial deposits.



Drainage of the site is via a combination of overland flow to the north and surface infiltration into the sand soils. An area of surface seepage was observed along the boundary of the dune and alluvial deposits.

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



Plate 1: Aerial Image of Site

Typical site photographs are presented below.



Plate 2: View of the elevated open bushland in the south of the site



Plate 3: View to the north east across the low lying area

4.2 Subsurface Conditions

The Kempsey 1:25,000 Coastal Quaternary Geology Map indicates the site is underlain by Holocene age interbarrier creek deposits comprising marine sand, silt, clay and peat (northern low lying area) and pleistocene dune deposits comprising aeolian and marine sand and indurated sand (southern elevated area).

The subsurface conditions can be separated into two areas being:

- The elevated sand dune areas; and
- The low lying alluvial sand areas.

Subsurface Conditions Below the Elevated Sand Dune Areas

The elevated areas generally encountered the following subsurface conditions:

- Topsoil: Comprising Silty SAND, fine to medium grained, dark brown / grey to 0.2m; overlying
- Aeolian Sand: fine to medium grained, pale grey / white, loose to medium dense root affected to 0.9m; overlying
- Aeolian Sand: fine to medium grained, pale grey / white, medium dense to 2.4m; overlying



- Marine Sand: fine to medium grained, dark brown, very dense (indurated) to at least 10m.

Table 1 provides a summary of the conditions encountered. Further details are presented below and on the Engineering Logs in Appendix A.

Groundwater was encountered between 0.8m and 2.2m depth and appears to be perched above the dense (indurated) sand layer.



Table 1: Summary of Subsurface Conditions in the Southern Elevated Areas

Unit	Material Name	Material Description	Depth to Base of Unit Below Ground Level													
			TP1	TP2	TP7	TP8	TP9	TP10	TP11	TP12	TP13	TP16	TP17	TP18	BH4	
1	Topsoil	Silty Sand, fine to medium grained, dark brown, some organics	0.3	0.15	0.15	0.2	0.2	0.2	0.2	0.2	0.15	0.15	0.15	0.2	0.15	0.2
2	Aeolian Sand	Sand, fine to medium grained, pale grey / white, loose to medium dense	≥1.8*	≥1.9*	≥2.2*	≥2.2*	≥2.0*	≥1.75*	≥2.0*	≥2.0*	≥2.0*	≥2.2*	≥1.8*	2.2*	2.4	
3	Marine Sand	Fine to medium grained, dark brown, very dense (indurated)	--	--	--	--	--	--	--	--	--	--	--	--	≥10.26	
Water Level			1.0	0.8	--	--	--	--	--	1.1	1.3	1.4	--	1.5	2.2	

Notes:

- Material unit not encountered.
- ≥ Base of the material layer was not encountered.
- * Hole collapsing due to sands.



Subsurface Conditions Below the Low Lying Areas

The low lying areas generally encountered the following subsurface conditions:

- Topsoil: Comprising Silty SAND, fine to medium grained, grey and root affected to 0.2m; overlying
- Marine / Aeolian Sand: fine to medium grained, pale grey, dark grey and orange/brown, medium to very dense to about 11m and 16m; overlying
- Marine Sandy Clay: high plasticity, pale grey, firm to stiff (about 1m to 2m in thickness); overlying
- Marine Sand: fine to medium grained, pale grey, medium dense to very dense to about 28m; overlying
- Estuarine Clay: high plasticity, dark grey, stiff to 30m.

Groundwater was encountered at about 0.5 to 1.0m depth.

Table 2 provides a summary of the conditions encountered. Further details are presented below and on the Engineering Logs in Appendix A.

Table 2: Summary of Subsurface Conditions in the Southern Elevated Areas

Unit	Material Name	Material Description	Depth to Base of Unit Below Ground Level									
			TP3	TP4	TP5	TP6	TP14	TP15	BH1	BH2	BH3	
1	Topsoil	Silty Sand, fine to medium grained, dark brown, some organics	0.2	0.15	0.2	0.15	0.2	0.2	0.2	0.2	0.1	0.2
2	Aeolian Sand	Sand, fine to medium grained, pale grey / white, loose to medium dense	0.7*	≥2.0*	0.6	0.7*	2.0*	0.6	1.6	2.0	2.0	
3	Marine Sand	Fine to medium grained, dark brown, medium dense to very dense (indurated)	≥1.8	--	≥2.0*	≥2.2	--	≥2.2*	12.8	11.6	14.4	
4	Marine Clay	High plasticity, pale grey, firm to stiff	--	--	--	--	--	--	14.0	12.2	16.0	
5	Marine Sand	Fine to medium grained, dark brown grey, medium dense to very dense (indurated)	--	--	--	--	--	--	≥22.0	≥28.0	≥17.95	
6	Estuarine Clay	High plasticity, dark grey, stiff	--	--	--	--	--	--	--	30.0	--	



Unit	Material Name	Material Description	Depth to Base of Unit Below Ground Level								
			TP3	TP4	TP5	TP6	TP14	TP15	BH1	BH2	BH3
		Water Level	0.7	0.7	0.7	0.6	0.7	0.7	0.9	0.5	1.0

Notes:

- Material unit not encountered.
- ≥ Base of the material layer was not encountered.
- * Hole collapsing due to sands.

The field work was undertaken during a period of prolonged dry weather. It is anticipated that groundwater levels will rise during periods of wet weather.

5 GEOTECHNICAL CONSTRAINTS AND CONSIDERATION

The key geotechnical issues identified that require consideration during the planning, design, construction include:

1. Earthworks (site preparation etc.). Planning of earthworks will need to address the treatment of loose sands and shallow groundwater;
2. Excavation conditions in sand soils and areas of shallow water table;
3. Dewatering of Excavations;
4. Presence of ASS;
5. Consideration of vibration induced damage to nearby structures.
6. Presence of soft to firm clays beneath the at depth and the potential affect on settlement to heavily loaded structures.

Provided the comments and recommendations within this report are adhered to the site is considered suitable for the proposed residential development from a geotechnical perspective.

6 FOUNDATIONS

Depending on the final design of the development, options considered appropriate for the foundations for the proposed structures forming the development at the site include:

- Shallow footings founded within the Unit 2 loose to medium dense sand and silty sand materials which are encountered up to about 2.4m depth;
- Pile foundations within the Unit 2, Unit 3 and Unit 5 sand materials; or
- A combination of shallow footings and pile foundations (e.g. piled raft).

The decision as to the adopted foundation systems will depend on the applied loads and the settlement that can be tolerated by each structure. It is possible that the options indicated above may be adopted at different locations and for different structures at the site. Preliminary design parameters for the relevant geotechnical units are provided in the following sections.



6.1 Shallow Foundations

The profile encountered in the elevated dune areas comprised up to 0.2m of sand topsoil / fill and up to 1m of loose to medium dense root affected sand. Once the site is stripped and grubbed of roots, the upper profile is expected to be loose and therefore unsuitable for support of high level footings. The preferred option on sites containing loose sand is to extend structural foundations through the fill to found on a suitable underlying founding stratum such as the medium dense to dense sand. Alternatively, the loose sand fill can be removed and then replaced under Level One supervision and testing as defined in AS3798- 2007. High level footings may then be founded on the replaced sand fill material. Recommendations for site preparation and placement and compaction of the sand fill are provided in Section 7.

For shallow footings founded, the allowable bearing pressure may be assessed using the equation below, depending on the minimum dimension of the footing.

$$\mathbf{ABP = 100B + 80kPa \leq 250kPa}$$

Where:

ABP = Allowable Bearing Pressure

B = Minimum Footing Width

Note: Assumes minimum footing depth of 0.3m

For the assessment of settlements, a Youngs Modulus value of 20MPa should be adopted.

Detailed footing excavations should be undertaken using a sand or mud bucket to minimise disturbance of the sand profile. Shallow footings must be founded outside or below the zone of influence of existing or proposed service trenches. At least the initial stages of footing excavation should be observed by a suitably experienced Geotechnical Engineer to assess that the recommended founding material has been reached and to check initial assumptions about foundation conditions and possible variations between investigation locations.

6.2 Piled Foundations

Where footing loads are higher than can be supported by shallow footings, or settlements under shallow footings are excessive, pile foundations could be adopted.

Options for piles include grout injected continuous flyte auger (CFA) piles which may be designed based on the design parameters presented in Tables 3 and 4. Open bored piles are not recommended due to problems associated with groundwater inflows and collapsing sand soils. Driven piles could also be adopted however consideration would need to be given to the relatively high noise and vibration during installation which may affect nearby developments. Driven pile options would require dilapidation studies for adjacent structures and vibration monitoring during construction.



Table 3: Preliminary Pile Design Parameters for Elevated Areas

Material Name	Ultimate End Bearing Pressure, fb	Serviceability End Bearing Pressure	Ultimate Skin Friction (Compression), fm,s	Effective Vertical Young's Modulus, E'v	Effective Horizontal Young's Modulus, E'h
Unit 2 - Loose to Medium Dense Sand	--	--	15kPa	20MPa	15MPa
Unit - 3 Medium Dense to Very Dense Marine Sand	7MPa	3MPa	90kPa	70MPa	55MPa

Table 4: Preliminary Pile Design Parameters for Low Lying Areas

Material Name	Ultimate End Bearing Pressure, fb	Serviceability End Bearing Pressure	Ultimate Skin Friction (Compression), fm,s	Effective Vertical Young's Modulus, E'v	Effective Horizontal Young's Modulus, E'h
Unit 2 - Loose to Medium Dense Sand	--	--	15kPa	20MPa	15MPa
Unit - 3 Medium Dense to Very Dense Marine Sand	7MPa	3MPa	90kPa	70MPa	55MPa
Unit 4 - Marine Clay	--	0.15MPa	50kPa	8MPa	6MPa
Unit 5 - Very Dense Marine Sand	9MPa	4MPa	100kPa	80MPa	60MPa

Piles founded in the Unit 3 sand layers should be founded into the sand at a depth of 3 times the diameter of the pile. The piles must be terminated not less than five pile diameters above the base of the sand layer. For more heavily loaded structures of 2 storeys or greater there is the potential for greater load transferred from the piles into the Unit 4 or Unit 6 Clay. Therefore, it is recommended that a settlement analysis be undertaken as part of the design process.

The following points are noted in relation to the parameters provided in Tables 3 and 4:

- Loading a pile to the ultimate capacities provided will incur large settlements, typically of the order of 5% of pile diameter;
- Limit state design requires the piles to be designed for an acceptable level of serviceability, which typically assumes a maximum settlement of not more than 1% of pile diameter. If the structure is more sensitive or less sensitive to settlement than this value assumes, serviceability criteria should be re-assessed;
- If CFA piles are adopted, effective diameter assumed in shaft adhesion should be reduced by 50mm to allow for the disturbed or smeared zone at the edge of the pile;



- It is recommended that a geotechnical engineer be on site at least during the initial stages of pile installations to assess the founding materials encountered and confirm required founding depths.

In accordance with AS2159-2009 Piling Design and Installation, a geotechnical reduction factor (Φ_g) should be applied to the ultimate values shown in Tables 3 and 4 to derive ultimate geotechnical strengths ($R_{d,g}$) for limit state design. This factor is dependent on assignment of an Average Risk Rating (ARR) which requires some assumptions to be made regarding the design and construction methodology. To derive a geotechnical strength reduction factor for this project the following assumptions are considered reasonable:

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report;
- Investigation comprised boreholes with limited in situ testing;
- Limited geotechnical involvement will occur during pile installation;
- Some performance monitoring of the supported structure during or after construction;
- No static testing of the piles will be undertaken;
- The foundations will be designed by a designer of at least moderate experience in similar geotechnical profiles and pile design; and
- Well established pile design methods will be adopted.

Assuming the pile configuration will have low redundancy a Geotechnical Strength Reduction Factor of $\Phi_g=0.5$ would be appropriate for the site.

6.3 Soil Aggressivity

The aggressivity test results presented in Table 5 were compared to the exposure classifications provided in Australian Standard AS2159-2009, *Piling Design and Installation*.

Table 5: Results of Soil Aggressivity Testing

Sample Location	Sample Depth (m)	Sample Type	pH	Soluble Sulfate (mg/kg)	Chloride (mg/kg)	Resistivity (ohm.cm)
TP1	1.5 to 1.75	Sand	4.96	57	30	44,803
BH1	5.5 to 5.6	Sand	5.16	83	33	11,514
BH3	7.0 to 7.45	Sand	5.46	160	34	14,691

In accordance with AS2159-2009 the site soils are considered to be moderate towards concrete elements above and below the water table.



7 EARTHWORKS

7.1 Site Preparation

The site is currently vegetated with grass and scattered trees. Areas of the site that are to support foundations or pavements should be stripped to remove all topsoil, root affected, ground disturbed by removal of trees, heavily root affected or other potentially deleterious material which can be retained on site for re-use in landscaping, or, removed from the site. Uncontrolled sand fill and areas disturbed by tree removal should be stripped and stockpiled for potential reuse following geotechnical assessment.

7.2 Shallow Excavations

The depth of groundwater varies across the site but is typically 0.5m below ground level in the low lying northern areas and within 0.8 to 2m depth in the elevated southern areas. Battering of excavations that extend more than 0.5m into the natural profile within the low lying areas is not feasible due to the likelihood of the profile collapsing from loose sand or groundwater inflows, and such excavations will therefore require dewatering and shoring.

Battering of excavations within fill that is to be placed above the groundwater table would be feasible, pending the use appropriate materials and good engineering construction practices. Excavations in Controlled Fill above the water table can be battered at 1V:1H or flatter for temporary excavations, or 1V:2H for permanent batters.

Temporary batters should be trimmed smooth to reduce erosion. Permanent cut or fill batter slopes should be protected against erosion by rapidly establishing vegetation cover or covering with a proprietary product such as Enviromat, Jute Mesh, Grassroots, Trinter or other similar products.

7.3 Deep Excavations for Basements and Services

Where deeper excavations of up to 3m are required for the development then excavations could be conducted using backhoes and hydraulic excavators to at least the depth of groundwater. Excavations beneath the groundwater level would require dewatering with the use of spear points around the perimeter of the excavations. If dewatering is required for the site then a geotechnical assessment should be undertaken to assess the potential impact dewatering may have on adjacent infrastructure and stability of excavations.

7.4 Retaining Wall Design Parameters

Temporary or permanent retaining walls are likely to require the use of cantilevered wall arrangements. Cantilevered retaining walls founded up to 10m depth may be designed on the basis of a triangular stress distribution using the following parameters:

- Unit Weight, γ = 20kN/m³
- Effective Friction Angle, ϕ' = 29°
- Effective Cohesion, C' = 0kPa



Design of the walls must take into account any surcharge from loadings behind the wall. Drainage measures as described above, if properly maintained, should reduce pore pressures at the back of the wall to zero, however, pore pressures may still be generated at other points behind the wall. The design should incorporate an allowance for such pressures. A typical allowance of potential water pressure build-up equivalent to one-third the wall height is considered to be reasonable with such drainage measures installed.

7.5 Reuse of Site Won Materials

The site won Unit 2 sand is likely to be suitable for use as engineering fill provided it is free from coarse root materials and is placed in accordance with the recommendations presented in this report.

7.6 Fill Placement and Compaction Control

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

- After unsuitable material (including topsoil and tree roots) have been stripped the exposed natural sand subgrade should be assessed by a suitably experienced geotechnical practitioner to highlight any loose, soft, wet or excessively deflecting areas which are to be removed and replaced with compacted fill. Based on the subsurface conditions encountered, it is expected that the upper 0.6m of the loose sand will need to be removed and recompacted.
- Stripped sand fill should be assessed for suitability prior to reuse as engineering fill by a suitably experienced geotechnical practitioner. Use of cohesive soils in the fill platform is not recommended.
- Where surface slopes are more than 7° the existing surface should be benched prior to placement of fill to provide a level surface suitable for compaction. Each bench will require a minimum width of 3m to allow access for compaction equipment.
- Where filling is required beneath structures, approved sand fill should be placed in layers not exceeding 200mm loose thickness and compacted to a minimum 75% Density Index with a smooth drum vibratory roller and addition of water to assist compaction.
- All fill for the support of structures should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 Guidelines on Earthworks for Residential and Commercial Developments, under Level 1 supervision. Areas of the site that are filled to support pavements should be filled under Level 2 supervision and testing.



7.7 Effect of Vibrations on Nearby Developments

Due to the deep profile of sand at the site careful consideration should be given to the use of plant and equipment which generate vibrations which can cause damage to nearby structures.

Activities which generate vibrations which could cause damage include:

- Installing driven or vibrated piles; and
- Roller compactors using heavy vibration near existing buildings.

Should these activities be planned as part of the works then it is recommended that dilapidation studies of adjacent structures be undertaken and that vibration monitoring be undertaken during construction.

7.8 Considerations for Earthworks in Low Lying Areas

The site investigation was undertaken following a period of dry weather and encountered sand underlain by firm clays and silts at depth, and a shallow water table. Should the earthworks be undertaken during a period of normal weather conditions or wet weather then the subsurface conditions may be more problematic and could require the use of ground improvement techniques (rockfill bridging layers) to provide suitable working platforms.

Raising of the site levels across the zone of seepage will require the use of rockfill bridging layers. Long term management of seepage will also require the construction of rockfill drains.

7.9 Site Trafficability

As the site is underlain by granular soils, site trafficability could be problematic for wheeled plant once vegetation is cleared. Trafficability is expected to be good for tracked plant. In the areas of surface seepage and following wet weather the site trafficability conditions in the low lying areas is expected to be poor. To manage this localised area of the site, the area could require a working platform comprising a 300mm crushed concrete layer or a granular high strength rock fill with a low percentage of fines (i.e. less than 5% passing 75 micron sieve), or similar.

7.10 Preliminary Pavement Design Parameters

The majority of the site is underlain by sand with a groundwater table at a depth of 0.4m to 2.2m below ground level. Based on the presence of the sand materials, a preliminary design subgrade CBR value of 8% should be adopted for the design of pavements. In areas of seepage site specific advice will need to be provided at the time of construction.



8 ACID SULFATE SOILS (ASS)

8.1 Presence of ASS

Presence of ASS Acid Sulfate Soils (ASS) produce sulphuric acid when exposed to oxygen from iron sulphides in the form of pyrite within the soil matrix. These soils form when iron-rich sediments are deposited in saltwater or brackish water environments. Prior to oxidation, these pyritic soils are referred to as Potential ASS. ASS that have produced acid as a result of oxidation are referred to as Actual ASS. They typically occur in natural, low-lying coastal depositional environments below approximately 5m AHD. In the field ASS are generally identified as saline sediments such as alluvial or estuarine soils or bottom sediments in creeks and estuaries.

8.2 Sampling

18 test pits and 4 boreholes were undertaken within the proposed development area. Excavations of up to 2.5m deep are proposed for services and deeper excavations for piled excavations or basement car parks. As such, sampling was extended to depths of 13.45m below the ground surface. The attached test pit and borehole logs indicate the soil profiles encountered at the sampled locations. Figure 1 illustrates the approximate test pit and borehole locations.

8.3 Laboratory Analysis

Samples collected from the test pits and boreholes were transported to a NATA registered laboratory for analysis. ASS screening tests were undertaken on 60 samples. The findings from the screening tests are discussed below.

- The samples revealed pH_F values between 3.92 and 6.47 in distilled water. pH_F less than 4 is an indicator of Actual ASS;
- The samples revealed pH_{FOX} values between 1.47 and 6.11 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;
- A pH change of more than 1 unit was recorded between pH_F and pH_{FOX} in 39 samples. A pH change of more than 1 unit is an indicator of PASS.

To provide a more comprehensive assessment, fifteen (15) samples were submitted for Chromium Reducible Sulphur (CRS) analysis. A summary of the test results is presented in Table 6.



Table 6: Summary of CRS Results

Location	Depth	Texture	Net Acidity (mol H ⁺ /t)	Lime Calculation (kg CaCO ₃ /t DW)
TP3	1.0 to 1.2	Coarse	34	3
TP3	1.5 to 1.7	Coarse	28	2
TP4	1.0 to 1.2	Coarse	4	0
TP4	2.0 to 2.2	Coarse	3	0
TP5	0.5 to 0.7	Coarse	52	4
TP5	1.5 to 1.7	Coarse	62	5
TP6	2.0 to 2.2	Coarse	58	4
TP14	1.5 to 1.7	Coarse	10	1
TP18	2.0 to 2.2	Coarse	5	0
BH1	4.0 to 4.45	Coarse	48	4
BH1	5.5 to 5.6	Coarse	130	10
BH1	7.0 to 7.07	Coarse	170	13
BH3	5.5 to 5.95	Coarse	107	8
BH3	7.0 to 7.45	Coarse	59	4
BH3	11.5 to 11.95	Coarse	34	3

8.4 ASS Assessment Summary

An appraisal of the laboratory test results presented in Table 6 is provided below:

- The net acidity concentration's exceeded the ASS Assessment Guidelines Action Criteria of 18 moles H⁺/ tonne for both the test pits and boreholes undertaken in the low lying areas of the site.



- On the basis of the laboratory testing results summarised in Table 6, all of the materials within the low lying areas are considered ASS. The low lying areas are identified as areas where TP3 to TP6, TP14 and TP15 and BH1 to BH3 are located. An ASS Management Plan would therefore be required for works such as services installations and pile excavations that disturb the alluvial sand soils in this area at a rate of 10 kg/m³ in the soils within 2m of the ground surface and at a rate of 26 kg/m³ in soils below 2m from ground level.
- Based on site features and the lab testing, the upper aeolian sand profiles are not considered to be ASS.

The purpose of an ASS Management Plan is to consider both the potential on-site and off-site impacts of the disturbance of the soils present, with any potential acid leachate being managed appropriately. The preferred option for management of ASS is treatment and reuse on site. Off site disposal of ASS will require neutralisation to pH 7 prior to disposal at an appropriate licensed landfill facility in accordance with NSW EPA requirements.

9 FURTHER INVESTIGATION WORKS

Based on the presence of the deep sand soils with interbedded layers of soft to stiff clay to at least 30m depth and the proposal to construct medium density residential structures in this area. It is recommended that additional investigations be undertaken to assess the lateral extent and depth of the potentially compressible soil materials. This data can then be used to further assess the design of piles and potential settlements to structures.

10 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 acid sulfate soil management plan, or require any additional consultations, please contact the undersigned.

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

For and on behalf of

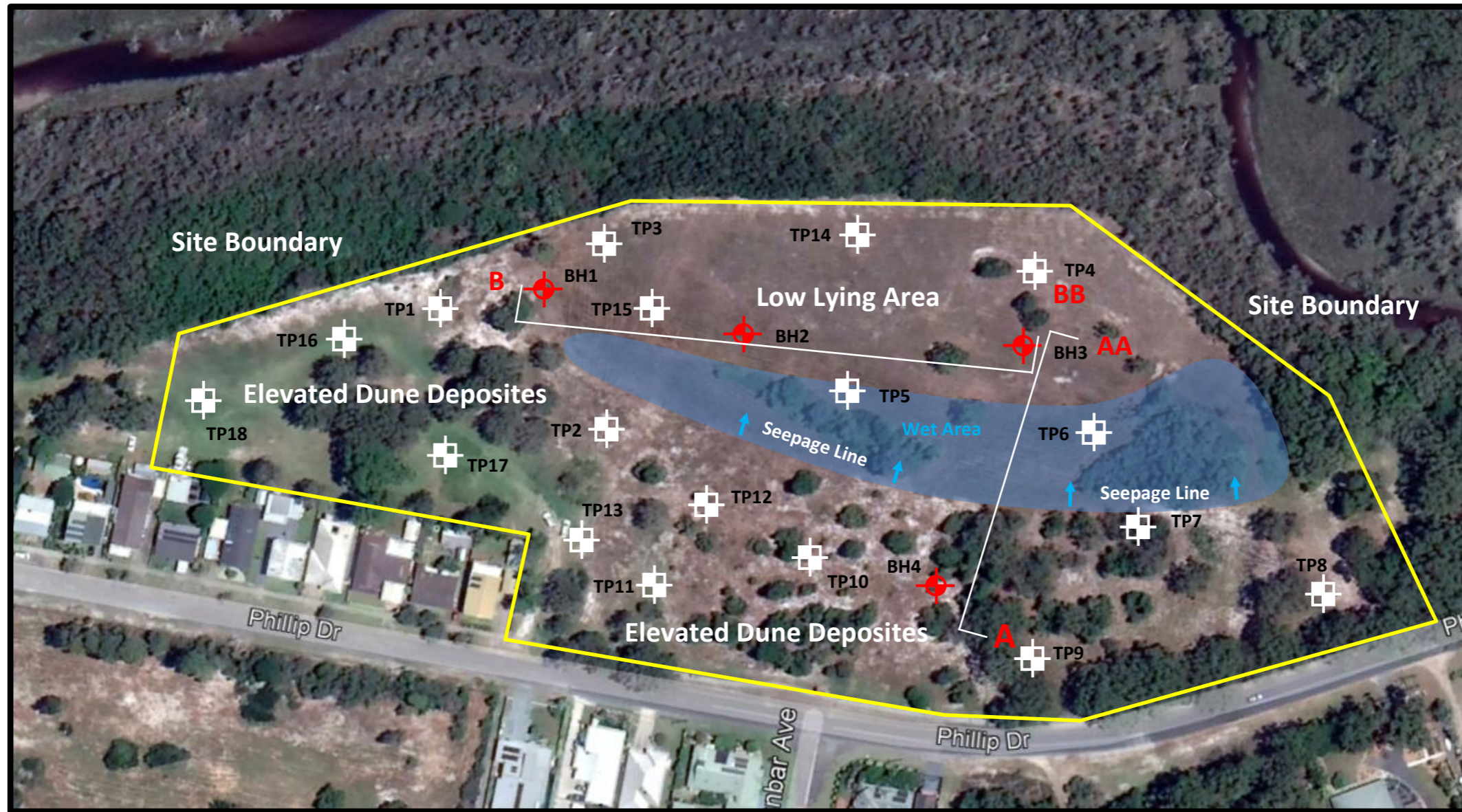
Regional Geotechnical Solutions Pty Ltd


Matt Rowbotham

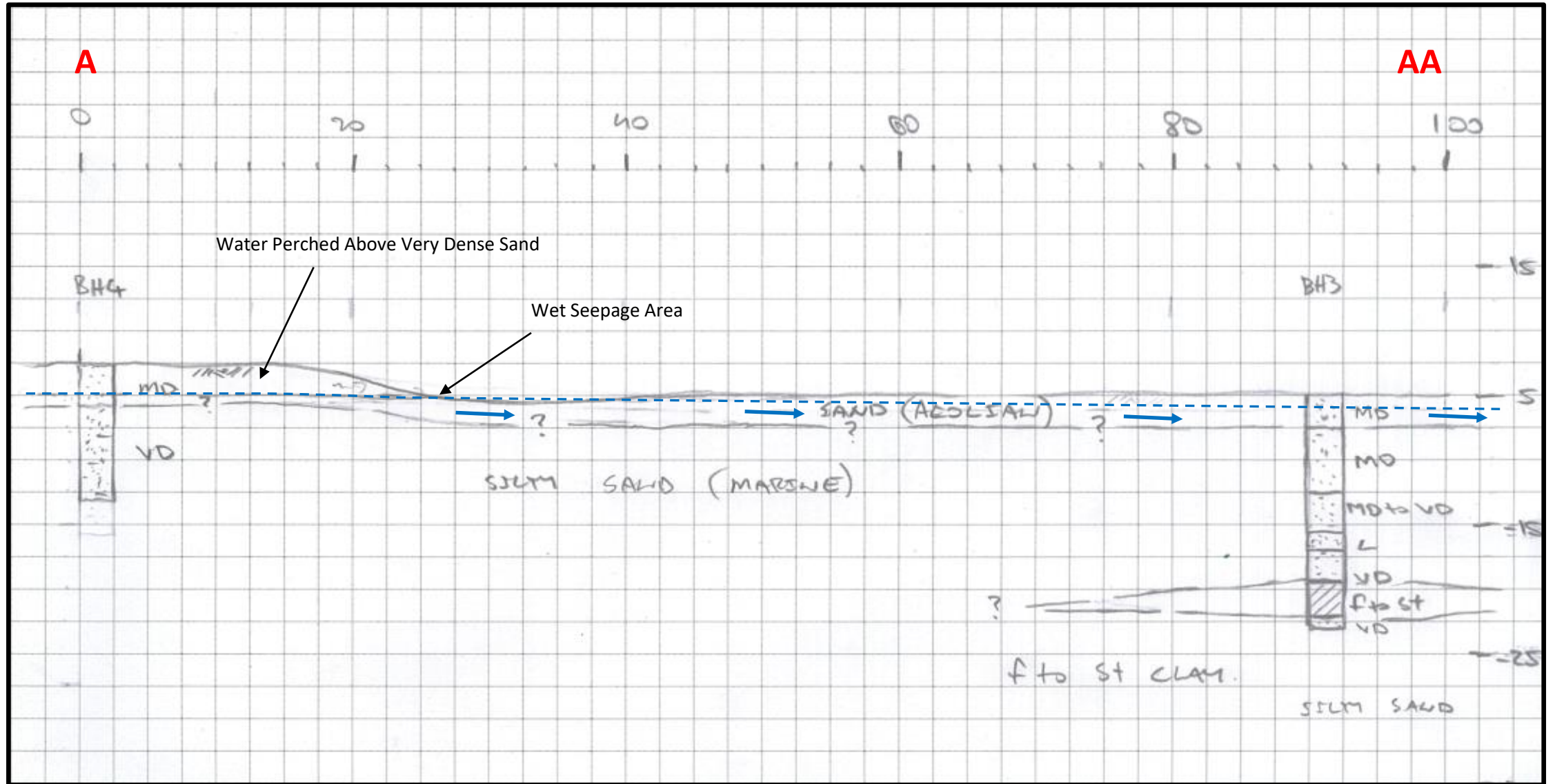
Associate Engineering Geologist



Figures



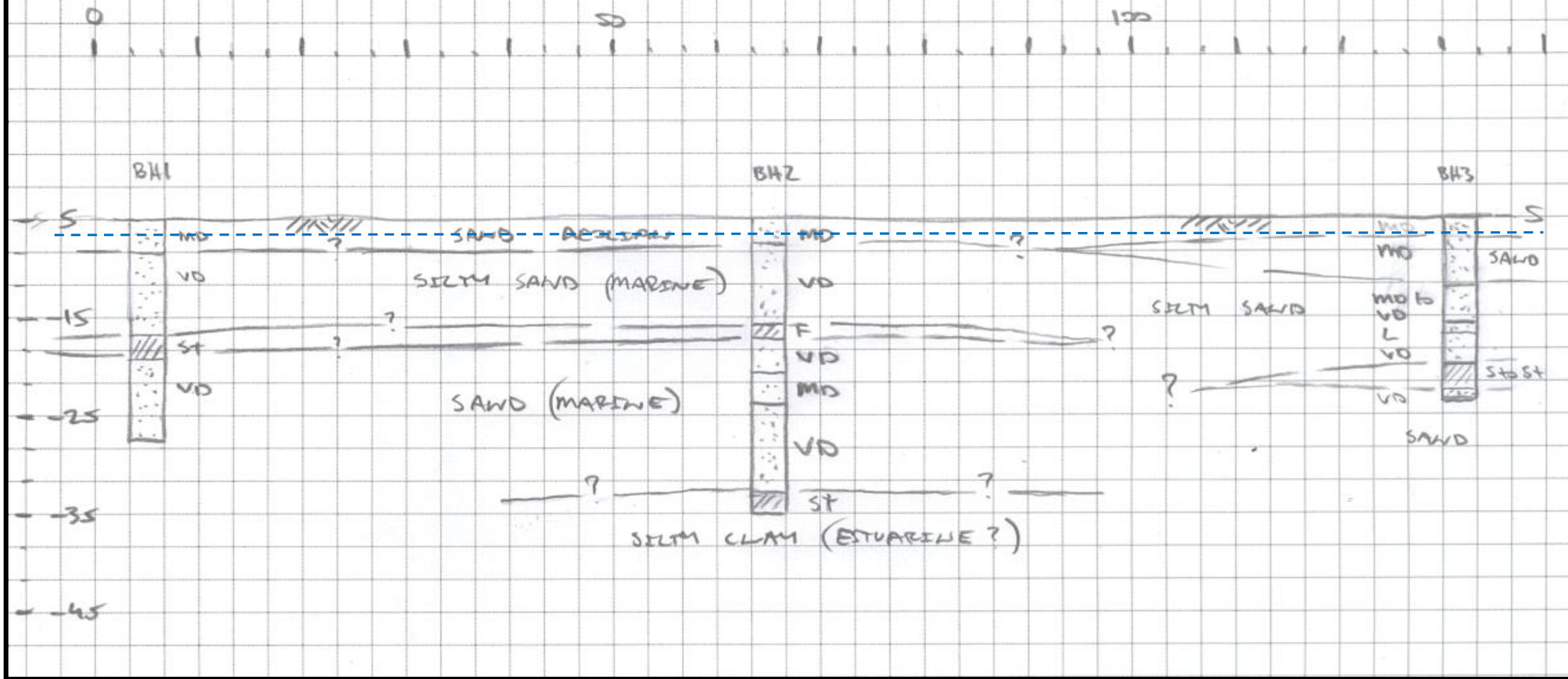
	Client:	Rise Projects	Job No.	RGS32813.1
	Project:	Residential Development Lot 2 Phillip Drive, South West Rocks	Drawn By:	MR
	Title:	Borehole and Test Pit Locations	Date:	10.9.21
			Drawing No.	Figure 1



REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Rise Projects	Job No.	RGS32813.1
	Project:	Residential Development Lot 2 Phillip Drive, South West Rocks	Drawn By:	MR
	Title:	Interpretive Geotechnical Section A-AA	Date:	10.9.21
			Drawing No.	Figure 2

B

BB



REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Rise Projects	Job No.	RGS32813.1
	Project:	Residential Development Lot 2 Phillip Drive, South West Rocks	Drawn By:	MR
	Title:	Interpretive Geotechnical Section B-BB	Date:	10.9.21
			Drawing No.	Figure 3



Appendix A

Results of Field Investigations



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP1
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505629 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582531 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
E	26/07/2021	B				SM	Silty SAND: fine to medium grained, grey, root affected.		MD	DCP (0-1.6m)	1	TOPSOIL	
			0.30m					1					
						0.30m	SP	SAND: fine to medium grained, pale grey/white.			W	2	AEOLIAN
			0.50m			0.5					2		
		B&E									2		
			0.90m			1.0					2		
			1.00m								2		
		B									3	COLLAPSING PIT WALLS @ 1.0M	
			1.40m			1.5					5		
			1.50m								4		
B&E						2							
	1.80m		1.80m			3	SULFUR SMELL						
				2.0			Due to Collapsing Pit Walls Hole Terminated at 1.80 m						
				2.5									

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

RG.LIB.1.05.0.GLB.Log.RG.NON-CORED.BOREHOLE.-TEST.PIT.LOGS.GPJ.<-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP2
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505661 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582479 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
E	26/07/2021	E		0.15m		SM	Silty SAND: fine to medium grained, dark brown/dark grey.		MD	DCP (0-1.7m)	1	TOPSOIL
						SP	SAND: fine to medium grained, pale grey/white.	M			1	AEOLIAN
											1	
				0.50m							2	
											1	
				B							2	
				0.90m							3	
				1.00m							3	COLLAPSING PIT WALLS @ 0.8M
											4	
				B							3	
				1.40m							4	
				1.50m							3	
											3	
				B&E							3	
				1.90m								
				2.0			Due to Collapsing Pit Walls Hole Terminated at 1.90 m					
				2.5								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%	

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <<DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP3
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505660 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582535 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
E	26/07/2021	E&B		0.20m		SM	Silty SAND: fine to medium grained, grey, root affected.		MD	DCP (0-1.8m)	0	TOPSOIL	
						0.20m	SP	SAND: fine to medium grained, grey.	M			1	MARINE/AEOLIAN
				0.50m		0.5						2	
		B		0.70m								1	
				1.00m		1.0						2	
												2	
				1.40m		1.4						3	COLLAPSING PIT WALLS @ 0.7M
				1.50m		1.5						4	
		B		1.70m		1.7						4	SULFUR SMELL
												4	
												6	
												3	
												4	
												4	
								4					
				2.0			Hole Terminated at 1.80 m						
				2.5									

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <<DrawingFile>> 10/09/2021 14:16 10:02:00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	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%		



ENGINEERING LOG - TEST PIT

TEST PIT NO: TP4
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

EQUIPMENT TYPE: 5 Tonne Excavator
TEST PIT LENGTH: WIDTH: 0.5 m
EASTING: 505801 m SURFACE RL:
NORTHING: 6582532 m DATUM: AHD

Table with columns: Drilling and Sampling (METHOD, WATER, SAMPLES, RL, DEPTH), Material description and profile information (GRAPHIC LOG, CLASSIFICATION SYMBOL, MATERIAL DESCRIPTION, MOISTURE CONDITION, CONSISTENCY DENSITY), Field Test (Test Type, Result), and Structure and additional observations.

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water symbols (Water Level, Inflow, Outflow), Strata Changes (Gradational, Definitive), Notes, Samples and Tests (U50, CBR, E, ASS, B), Field Tests (PID, DCP(x-y), HP)

Consistency table: VS (Very Soft), S (Soft), F (Firm), St (Stiff), VSt (Very Stiff), H (Hard), Fb (Friable). UCS (kPa) ranges: <25, 25-50, 50-100, 100-200, 200-400, >400. Moisture Condition table: D (Dry), M (Moist), W (Wet), Wp (Plastic Limit), Wl (Liquid Limit).

Density table: V (Very Loose), L (Loose), MD (Medium Dense), D (Dense), VD (Very Dense). Density Index ranges: <15%, 15-35%, 35-65%, 65-85%, 85-100%.



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP5
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505734 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582509 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations				
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result			
E	26/07/2021	E		0.20m		SM	Silty SAND: fine to medium grained, grey, root affected.	M	MD	DCP (0-1.3m)	1	TOPSOIL			
												2			
													2	MARINE/AEOLIAN	
													3		
				B			0.50m							3	
							0.60m							3	
							1.00m							7	
							1.20m							7	
				B&E			1.20m							7	
							2.00m							7	SULFUR SMELL
				2.00m			Hole Terminated at 2.00 m								
				2.50m											

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP6
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505822 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582487 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result		
E	26/07/2021 	E		0.15m		SM	Silty SAND: fine to medium grained, grey, root affected.		MD	DCP (0-1.6m)	1	TOPSOIL	
						0.15m	SM	SAND: fine to medium grained, grey.			M	1	MARINE/AEOLIAN
												2	
						0.50m						3	
				B			0.70m					3	
												6	
												6	
						1.00m						7	
				B&E			1.30m					5	SULFUR SMELL
												6	
												7	
						1.50m						7	
				B			1.70m					7	
												7	
						2.00m						7	
		B		2.20m					7	COLLAPSING PIT WALLS			
							Hole Terminated at 2.20 m						
				2.5									

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool


LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit	
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%		

ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP7
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505837 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582450 m **DATUM:** AHD

Drilling and Sampling			Material description and profile information							Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result		
0.45m Tooth Not Encountered		E		0.15m		SM	Silty SAND: fine to medium grained, grey, root affected.		VL	DCP (0-1.8m)	0	TOPSOIL	
		0.15m				SP	SAND: fine to medium grained, pale grey/white, root affected to 0.6m.		M		L	1	AEOLIAN
		0.50m									0		
											1		
											1		
											1		
		B									1		
		0.70m									2		
											2		
											3		
											2		
											2		
		1.00m									3	COLLAPSING PIT WALLS	
		B									2		
1.30m				3									
				2									
1.50m				3									
B				3									
1.70m				3									
2.00m													
B													
2.20m													
				2.5	Due to Collapsing Pit Hole Terminated at 2.20 m								

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10:02:00.04 Datasheet Lab and In Situ Tool

LEGEND:

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

Strata Changes

----	Gradational or transitional strata
---	Definitive or distinct 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

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

Density

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

Moisture Condition

D	Dry
M	Moist
W	Wet
W _p	Plastic Limit
W _L	Liquid Limit



ENGINEERING LOG - TEST PIT

TEST PIT NO: **TP8**
 PAGE: 1 of 1
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 26/7/21

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: Refer to Site Plan

EQUIPMENT TYPE: 5 Tonne Excavator EASTING: 505897 m SURFACE RL:
 TEST PIT LENGTH: WIDTH: 0.5 m NORTHING: 6582432 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations			
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result		
E	Not Encountered	E	0.15m			SM	Silty SAND: fine to medium grained, grey, some roots.	M	MD	DCP (0-1.0m)	1	TOPSOIL		
											2			
													1	AEOLIAN
													1	
													2	
													1	
													1	
													2	
													2	
													2	
													3	
													3	
									3					
							Hole Terminated at 2.20 m							

RG LIB 1.05.0.GLB_Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP9
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505801 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582409 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations				
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result			
E	Not Encountered	E		0.20m		SM	Silty SAND: fine to medium grained, grey, root affected.		L	DCP (0-1.6m)	0	TOPSOIL			
												1			
														1	AEOLIAN
														2	
							0.50m							1	
				B			0.70m							2	
														1	
														2	
							1.00m						MD	2	
														2	
				E			1.30m							3	
														3	
				1.50m						3					
										4					
		B		1.70m											
				2.0			Due to Collapsing Walls Hole Terminated at 2.00 m								
				2.5											

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <<DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP10
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505734 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582443 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations						
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result					
E	Not Encountered	E		0.20m		SM	Silty SAND: fine to medium grained, grey, some roots.		MD	DCP (0-1.6m)	0	TOPSOIL					
				1													
		0.50m		B		0.70m	0.5	SP			M	SAND: fine to medium grained, pale grey/white.			3	AEOLIAN	
															1		
		1.00m		B		1.30m	1.0								1		
															2		
		1.50m		B		1.70m	1.5								1		
															2		
		1.70m		B&E			1.75								3		
															3		
								2.0				Due to Collapsing Pit Hole Terminated at 1.75 m					
								2.5									

RG LIB 1.05.0.GLB_Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10:02:00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	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%		



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP11
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505677 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582432 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
0.45m Tooth Bucket	Not Encountered			0.5 1.0 1.5 2.0		SM	Silty SAND: fine to medium grained, grey, root affected.	M	L	DCP (0-1.9m)	0	TOPSOIL
											1	
						SP	SAND: fine to medium grained, pale grey/white, root affected to 0.6m (tree roots).	M			1	AEOLIAN
											1	
											2	
											1	
											1	
											1	
											1	
											1	
											1	
											2	
											2	COLLAPSING PIT WALLS
											2	
											2	
				3								
				3								
				4								
				4								
				3								
				4								
				2.0								
				2.5			Hole Terminated at 2.00 m					

RG LIB 1.05.0.GLB_Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	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%		



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP12
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505696 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582454 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
E	26/07/2021	E		0.15m		SM	Silty SAND: fine to medium grained, grey, root affected.		MD	DCP (0-1.7m)	1	TOPSOIL
				0.15m		SP	SAND: fine to medium grained, pale grey/white.	M			2	AEOLIAN
				0.50m							1	
				0.80m							2	
				1.00m							1	
				1.30m							2	
				1.50m							1	
				1.80m							2	
											3	
											4	
											4	
											4	COLLAPSING PIT WALLS @ 1.1M
											3	
											4	
											4	
							4					
							5					
				2.00m								
							Hole Terminated at 2.00 m					

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <<DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP13
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505658 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582443 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
E	26/07/2021 	E			0.15m	SM	Silty SAND: fine to medium grained, dark grey/dark brown, root affected.	M	MD	DCP (0-1.0m)	1	TOPSOIL
					0.15m	SP	SAND: fine to medium grained, pale grey/white.				2	AEOLIAN
											2	
					0.50m						1	
					B&E						2	
					0.70m						1	
											2	
											2	
											3	
											2	
					1.50m						2	
					B						3	
					1.70m							
				2.0								
							Hole Terminated at 2.00 m					

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP14
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505744 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582543 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
E	26/07/2021	E&B 0.20m		0.20		SM	Silty SAND: fine to medium grained, grey, root affected.	M	MD	DCP (0-1.8m)	1	TOPSOIL	
						SP	SAND: fine to medium grained, pale grey and orange mottle.	M			1	MARINE/AEOLIAN	
				0.50								2	
												2	
			B&E 0.70m									2	
												2	
				1.00m								2	COLLAPSING PIT WALLS @ 0.7M
			B 1.20m									3	
												3	
				1.50m								3	
												3	
												3	
				B 1.70m								4	
												3	
							2.0				Hole Terminated at 2.00 m		

RG LIB 1.05.0.GLB_Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	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%		



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP15
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505687 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582521 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations			
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result		
E	26/07/2021	E/B		0.20m		SM	Silty SAND: fine to medium grained, grey, root affected.	M	MD	DCP (0-1.6m)	0	TOPSOIL		
						0.20m	SP	SAND: fine to medium grained, grey.	M			1	MARINE/AEOLIAN	
				0.50m		0.5						2		
							0.60m	SM	Silty SAND fine to medium grained, brown.				3	
		B		0.70m								3		
				1.00m		1.0						5		
												4		SULFUR SMELL
				1.20m								3		
												3		
				1.50m		1.5						1		
												2		
				1.70m								5		
												6		
				2.00m		2.0								
		B		2.20m										
							Hole Terminated at 2.20 m							
				2.5										

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

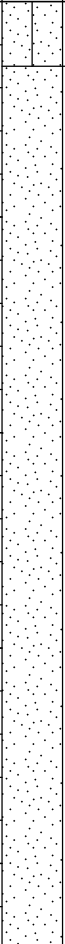
RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool






ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP16
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator
TEST PIT LENGTH: **WIDTH:** 0.5 m
EASTING: 505582 m **SURFACE RL:**
NORTHING: 6582510 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	
E	26/07/2021	E&B 0.15m			SM	Silty SAND: fine to medium grained, dark grey, root affected.	M	L	DCP (0-2.5m)	1	TOPSOIL
		0.50m B 0.70m 1.00m B 1.20m 1.50m B&E 1.70m 2.00m B 2.20m	SP		SAND: fine to medium grained, pale grey/white.	M	MD	1		AEOLIAN	
			1								
			2								
			1								
			2								
			2								
			2								
			1								
			1								
			2								
			1								
			1								
			1								
			1								
						Colour change to dark grey/dark brown, some silt				1	COLLAPSING PIT WALLS @ 1.2M
										1	
										1	
										1	SULFUR SMELL
										1	
										2	
										2	
										2	
										3	
										5	
							Hole Terminated at 2.20 m			4	
										4	
										5	

LEGEND: Water  Water Level (Date and time shown)  Water Inflow  Water Outflow Strata Changes  Gradational or transitional strata  Definitive or distinct 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	Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP17
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator **EASTING:** 505620 m **SURFACE RL:**
TEST PIT LENGTH: **WIDTH:** 0.5 m **NORTHING:** 6582476 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations						
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result					
E	Not Encountered	E&B 0.20m			SM	0.20m	Silty SAND: fine to medium grained, dark brown/dark grey, root affected.		MD	DCP (0-1.7m)	1	TOPSOIL					
											3						
		0.50m			B 0.70m	SP	Silty SAND: fine to medium grained, pale grey.	M						3	AEOLIAN		
														3			
		1.00m			B 1.20m										2		
															2		
		1.50m			B 1.70m											2	
																2	
		1.70m														2	
																2	
																3	
																4	
																3	
																4	
											3	COLLAPSING PIT WALLS @ 1.5M					
											4						

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10:02:00.04 Datagel Lab and In Situ Tool



ENGINEERING LOG - TEST PIT

CLIENT: De Groot and Benson
PROJECT NAME: Proposed Development
SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
TEST LOCATION: Refer to Site Plan

TEST PIT NO: TP18
PAGE: 1 of 1
JOB NO: RGS32813.1
LOGGED BY: MR
DATE: 26/7/21

EQUIPMENT TYPE: 5 Tonne Excavator
TEST PIT LENGTH: **WIDTH:** 0.5 m
EASTING: 505537 m **SURFACE RL:**
NORTHING: 6582495 m **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
E	26/07/2021	E&B 0.15m				SM	Silty SAND: fine to medium grained, dark brown, root affected.	M	MD	DCP (0-1.6m)	2	TOPSOIL	
						SP	SAND: fine to medium grained, pale grey/white.	M			2	AEOLIAN	
												2	
												4	
				0.50m		0.5						4	
				B 0.70m								4	
												3	
												2	
				1.00m		1.0						3	
				B 1.20m								4	
												3	
												4	
				1.50m		1.5						4	COLLAPSING PIT WALLS @ 1.3M
				B 1.70m								4	SULFUR SMELL
		2.00m		2.0									
		B 2.20m		2.20m			Hole Terminated at 2.20 m						
				2.5									

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFile>> 10/09/2021 14:16 10.02.00.04 Datagel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

BOREHOLE NO: **BH1**
 PAGE: 1 of 5
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505651 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582533 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
AD/T				0.0		SM	Silty SAND fine to medium grained, grey, root affected.	M	L			TOPSOIL	
				0.20m		SM	Silty SAND fine to medium grained, grey.				AEOLIAN		
				0.5									
				1.0									
WB				1.00m									
				SPT 3,4,5 N=9	1.45m								
				1.45m									
				1.5									
				1.60m		SP	SAND fine to medium grained, pale grey.					MARINE	
				2.0									
				2.50m									
				SPT 2,6,7 N=13	2.95m								
				3.0									
				3.40m									
				3.5									
				3.40m	SM	Silty SAND fine to medium grained, dark brown.			VD				
				4.0									
				SPT N=R	4.5								
				4.5									
				5.00m									

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT - RGS32813.1 LOGS.GPJ <-DrawingFile>> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool

LEGEND: <u>Water</u> Water Level (Date and time shown) Water Inflow Water Outflow <u>Strata Changes</u> Gradational or transitional strata Definitive or distinct 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		Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)		Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 2 of 5
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505651 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582533 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
WB		5.50m N=R		5.5		SM	Silty Sand fine to medium grained, dark brown (weakly cemented)	W	VD			MARINE	
		7.00m N=R		7.0									
		8.50m N=R		8.5									
				9.0				Becoming Silty SAND, fine to medium grained (not indurated)					
				9.5									
				10.00m									

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32813.1 LOGS.GPJ <-DrawingFile>> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: De Groot and Benson

PAGE: 3 of 5

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505651 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582533 m

DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations			
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result		
WB		SPT 20,29,15/50mm N=44/200mm		10.35m		SM	Silty Sand fine to medium grained, dark brown (weakly cemented) (<i>continued</i>)	W	VD			MARINE		
				11.50m		SC	Sandy Clay/Clayey SAND interbedded, fine to medium grained, high plasticity pale grey							
		SPT 9,12,11 N=23		11.95m										
				13.00m						M > W _p	St		HP	100
		SPT 3,4,7 N=11		13.45m										
				14.50m							VD			
		SPT 9,14,17 N=31				14.50m								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%	

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 4 of 5
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505651 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582533 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
WB		14.95m				SC	<p>Sandy Clay/Clayey SAND interbedded, fine to medium grained, high plasticity pale grey (<i>continued</i>) Becoming SAND, fine to medium grained, pale grey, some silt.</p> <p>Becoming Silty SAND, dark brown.</p>	M > WP	VD		MARINE	
		16.00m		15.5								
		SPT 12,20,20 N=40		16.0								
		16.45m		16.5								
		17.50m		17.0								
		SPT 3,3,6 N=9		17.5								
	17.95m		18.0									
		19.50m N=R		18.5								
				19.0								
				19.5								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 5 of 5
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505651 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582533 m DATUM: AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
WB				20.5 21.0 21.5 22.0		SC	Sandy Clay/Clayey SAND interbedded, fine to medium grained, high plasticity pale grey (<i>continued</i>)	W	VD			MARINE
				22.0 22.5 23.0 23.5 24.0 24.5			Hole Terminated at 22.00 m					

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32813.1 LOGS.GPJ <-DrawingFile>> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: De Groot and Benson

PAGE: 1 of 6

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505715 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582516 m

DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
AD/T				0.10m		SM	Silty SAND fine to medium grained, grey, dark brown root affected.	M	MD			TOPSOIL	
				SP		SAND fine to medium grained, grey, some silt.						AEOLIAN	
WB		SPT 6,6,6 N=12		0.60m		SP	Silty SAND fine to medium grained, grey, orange brown.	W					
				1.00m		1.45m							
WB		SPT 11,15,30 N=45		2.00m		SM	Silty SAND medium to coarse grained, grey, brown, some gravel, fine grained, subrounded.	VD					MARINE
				2.50m		2.95m							
WB		SPT 23,33,2 N=35/225mm		4.00m			Becoming fine to medium grained, dark brown/black						
				4.38m									

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 2 of 6
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505715 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582516 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
WB		5.50m SPT N=R		5.5		SM	Silty SAND medium to coarse grained, grey, brown, some gravel, fine grained, subrounded. <i>(continued)</i> Becoming indurated, weakly cemented.	W	VD			MARINE	
		7.00m SPT N=R		7.0									
		8.50m		8.5				Becoming medium to coarse grained, (not indurated)					
		SPT 18,29,20 N=49/230mm		9.0									
		8.88m		9.0									
		10.00m		9.5									

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%	

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32813.1 LOGS.GPJ <-DrawingFiles> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: De Groot and Benson

PAGE: 3 of 6

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505715 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582516 m

DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
WB		SPT N=R		10.35m		SM	Silty SAND medium to coarse grained, grey, brown, some gravel, fine grained, subrounded. <i>(continued)</i>	W	VD			MARINE
				11.50m		CH	Sandy Clay high plasticity pale grey.	M > W _p	F	HP	70	
		SPT 7,2,2 N=4		11.95m		SP	SAND fine to medium grained, pale grey		VD			
				13.00m								
		SPT 17,25,29 N=54		13.45m								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32813.1 LOGS.GPJ <-DrawingFile>> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 4 of 6
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505715 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582516 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
WB						SP	SAND fine to medium grained, pale grey <i>(continued)</i>	M > WP	VD			MARINE
		16.00m		16.0			Medium to coarse grained, with some to a trace of clay		MD			
		SPT 7,8,12 N=20		16.5								
		16.45m		17.0								
				17.5								
				18.0								
				18.5								
				19.0			Becoming fine to medium grained		VD			
		19.00m		19.5								
		SPT N=R										
		19.45m										

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32813.1 LOGS.GPJ <-DrawingFile>> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 5 of 6
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505715 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582516 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
WB						SP	SAND fine to medium grained, pale grey (continued) Becoming coarse grained	M > WP	VD			MARINE
				20.5								
				21.0								
				21.5								
				22.0								
				22.45								
				23.0								
				23.5								
				24.0								
				24.5								
				25.00								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32813.1 LOGS.GPJ <-DrawingFile>> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: De Groot and Benson

PAGE: 6 of 6

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505715 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582516 m

DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
WB		SPT N=R				SP	SAND fine to medium grained, pale grey <i>(continued)</i>	M > Wp	VD			MARINE
			28.00m	28.0		CH	Sandy Clay high plasticity dark grey, some gravel lenses. fine grained.		St			ESTUARINE
		D	28.70m	28.7								
				29.5								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests Hole Terminated at 30.00 m

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH3

CLIENT: De Groot and Benson

PAGE: 1 of 4

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505795 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582513 m

DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations																
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result															
AD/T				0.20m	[Symbol]	SM	Silty SAND fine to medium grained, dark brown, root affected.	M	MD			TOPSOIL															
						SP	SAND fine to medium grained, grey, some silt					AEOLIAN															
WB	▽	SPT 3,3,5 N=8	1.00m	1.0	[Symbol]			W				MARINE															
													1.45m	1.5	[Symbol]												
																					2.50m	2.0	[Symbol]				
4.00m	3.0	[Symbol]																									
												4.43m	3.5	[Symbol]													

LEGEND:

Water

- ▽ Water Level (Date and time shown)
- ▶ Water Inflow
- ◀ Water Outflow

Strata Changes

- - - Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
H Hard	>400	
Fb Friable		
Density	V Very Loose	Density Index <15%
L Loose	MD Medium Dense	Density Index 15 - 35%
D Dense	D Dense	Density Index 35 - 65%
VD Very Dense	D Dense	Density Index 65 - 85%
		Density Index 85 - 100%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 2 of 4
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 29/7/21

DRILL TYPE: P160 EASTING: 505795 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582513 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
WB						SP	SAND fine to medium grained, grey, some silt <i>(continued)</i>	W	MD			MARINE	
		5.50m		5.5									
		SPT 3.5,7 N=12		6.0									
		5.90m		6.5				Becoming dark brown					
		7.00m		7.0									
		SPT 6.7,6 N=13		7.5						MD to VD			
		7.37m		8.0									
		8.50m		8.5									
		SPT 6.8,9 N=17		9.0									
		8.95m		9.5									
		10.00m											

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: De Groot and Benson

PAGE: 3 of 4

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505795 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582513 m

DATUM:

AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations				
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result			
WB		SPT 5,5,6 N=11		10.5		SP	SAND fine to medium grained, grey, some silt <i>(continued)</i>	W	MD to VD	HP	100	MARINE			
		10.45m		11.0											
		11.50m		11.5											
		SPT 1,0,5 N=5		12.0									L		
		11.95m		12.5									VD		
		13.00m		13.0											
		SPT N=R		13.5											
	13.45m		14.0												
	14.50m		14.5												
		SPT 0,0,0 N=0					Silty CLAY medium plasticity, grey.	M > Wp	S - F			Iron Indurated			

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition	
VS	Very Soft	<25	D	Dry
S	Soft	25 - 50	M	Moist
F	Firm	50 - 100	W	Wet
St	Stiff	100 - 200	W _p	Plastic Limit
VSt	Very Stiff	200 - 400	W _L	Liquid Limit
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%	

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: De Groot and Benson

PAGE: 4 of 4

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 29/7/21

DRILL TYPE: P160

EASTING: 505795 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582513 m

DATUM:

AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
WB		14.95m		14.95			Silty CLAY medium plasticity, grey. <i>(continued)</i>	M > WP	S - F			MARINE	
		16.00m		16.00		SC	Sandy Clay/Clayey SAND interbedded, fine to medium grained, medium plasticity, grey and orange brown.		St				
		SPT 5,5,5 N=10		16.45m									
		17.50m		17.50				SAND fine to medium grained, brown.	W	VD			
		SPT 6,7,2 N=9		17.95m				Hole Terminated at 17.95 m					

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH4

CLIENT: De Groot and Benson

PAGE: 1 of 3

PROJECT NAME: Proposed Development

JOB NO: RGS32813.1

SITE LOCATION: Lot 2 Phillip Drive, South West Rocks

LOGGED BY: MR

TEST LOCATION: See Figure

DATE: 2/8/21

DRILL TYPE: P160

EASTING: 505769 m

SURFACE RL:

BOREHOLE DIAMETER: 100 mm

INCLINATION: 90°

NORTHING: 6582431 m

DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/T				0.20m		SM	Silty SAND fine to medium grained, grey, root affected.	M	MD			TOPSOIL
						SP	SAND fine to medium grained, pale grey/white					AEOLIAN
WB	▲	SPT 2,3,3 N=6	1.00m	1.00m								Perched water above indurated sand
		SPT 30/40mm N>50	1.45m	1.45m								
		SPT 17 30,30/100mm N>50	2.50m	2.50m								MARINE
			2.94m	2.94m								
			4.00m	4.00m								
			4.38m	4.38m								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
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%

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ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH4**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 2 of 3
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 2/8/21

DRILL TYPE: P160 EASTING: 505769 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582431 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
WB				5.50m	5.5	SM	Silty SAND medium to coarse grained, dark brown, some gravel, fine grained, white. <i>(continued)</i>	M	VD			MARINE
		SPT 17,30/140mm N>50		5.85m	6.0							
				7.00m	7.0							
		SPT 14,30/130mm N>50		7.40m	7.5							
				8.50m	8.5							
		SPT 30/140mm N>50		8.94m	9.0							
					9.5							
				10.00m								

RG LIB 1.05.0.GLB Log RG NON-CORED BOREHOLE - TEST PIT LOGS.GPJ <-DrawingFiles> 10/09/2021 14:17 10.02.00.04 Dajgel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct 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	Consistency 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	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH4**

CLIENT: De Groot and Benson
 PROJECT NAME: Proposed Development
 SITE LOCATION: Lot 2 Phillip Drive, South West Rocks
 TEST LOCATION: See Figure

PAGE: 3 of 3
 JOB NO: RGS32813.1
 LOGGED BY: MR
 DATE: 2/8/21

DRILL TYPE: P160 EASTING: 505769 m SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6582431 m DATUM: AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
WB		SPT 30,30/110mm N>50				SM	Silty SAND fine to medium grained, dark orange/dark brown. <i>(continued)</i>	M	VD			MARINE
		10.31m		10.5			Hole Terminated at 10.26 m					
				11.0								
				11.5								
				12.0								
				12.5								
				13.0						HP	100	
				13.5								
				14.0								
				14.5								

LEGEND:

Water

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

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 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)	Moisture Condition
VS	Very Soft	<25	D Dry
S	Soft	25 - 50	M Moist
F	Firm	50 - 100	W Wet
St	Stiff	100 - 200	W _p Plastic Limit
VSt	Very Stiff	200 - 400	W _L Liquid Limit
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%

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Appendix B

Laboratory Test Results

RESULTS OF SOIL ANALYSIS

60(3) samples supplied by Regional Geotechnical Solutions Pty Ltd on 20/08/2021 - Lab Job No. M0509
 Analysis requested by Matt Rowbotham. - **Your Project: RGS21813.1**
 1/21 Cook Drive COFFS HARBOUR NSW 2450

		Sample 1	Sample 2	Sample 3
	Method	TP1 1.5-1.7	BH1 5.5-5.6	BH3 7.0-7.45
	EAL job No.	M0509/2	M0509/54	M0509/60
Moisture (%)	inhouse	16	17	21
Texture	See note 2 below.	COARSE	MEDIUM	COARSE
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	4.96	5.16	5.46
Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.022	0.087	0.068
Resistivity (ohm.mm)	** Calculation	448,029	115,141	146,908
Resistivity (ohm.cm)	** Calculation (ohm.mm / 10)	44,803	11,514	14,691
Chloride (mg/kg)	** Water Extract - ISE (1:5 Water)	30.3	32.9	33.7
Chloride (as %)	** Calculation	0.003	0.003	0.003
Sulfate (mg/kg)	** Water Extract-APHA 3120 ICPOES	57	83	160
Sulfate (as % SO ₄)	** Calculation	0.006	0.008	0.016
Chloride / Sulfate Ratio	** Calculation	0.5	0.4	0.2

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 27/8/2021.

