Pacific Geotech
Consulting Geotechnical Engineers

GEOTECHNICAL REPORT: Proposed Residential Development

1 Phillip Street

Goonellabah

Social Futures

January 2024

PG-10643

VERSION 2

E: info@pacgeo.com.au
www.pacgeo.com.au ABN: 62 615 248 952

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Author: Tony Lee

15th January, 2024

Social Futures
Email: david@davcam.net.au

ATTN: DAVID MCGRATH

Dear Sir,

GEOTECHNICAL INVESTIGATION – PROPOSED RESIDENTIAL DEVELOPMENT
1 PHILLIP STREET, GOONELLABAH

Enclosed is a copy of our report for the above project dated January 2024. An electronic copy of the report has been issued.

Should you have any queries regarding this report, please do not hesitate to contact Tony Lee or Ben Elsmore at this office.

Yours faithfully,

B. ELSMORE (RPEQ 19656)

For and on behalf of
PACIFIC GEOTECH PTY LTD

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1.0 INTRODUCTION

This report contains the results of the geotechnical investigation and provides advice and recommendations relating to the following:

- Subsurface conditions in accordance with AS 1726-2017
- Groundwater conditions
- Foundation Recommendations
    - High level & deep support options (rafts and piling)
    - Bearing capacity and skin friction design values
    - Predicted settlements
    - Preliminary raft design parameters
- Site Classification in accordance with AS 2870-2011
- Earthworks considerations
    - Suitability of cut for use as fill
    - Compaction standards
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- Earthquake considerations in accordance with AS 1170.4-2007
- Retention considerations
- Retaining wall design considerations
- Indicative pavement design parameters
- Construction Considerations

Proposed Development

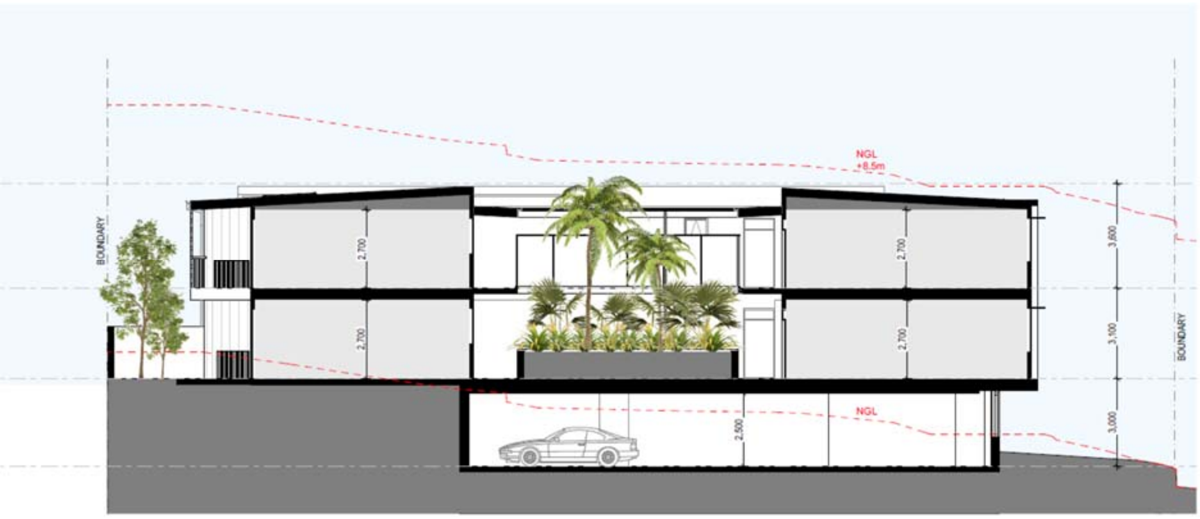
It is understood that the proposed development is to comprise the construction of a residential building comprising 2 levels of units above a partial basement carparking at the above site.

Earthworks are envisaged to consist of cuts up to 3.0m for the proposed partial basement carparking.

The proposed development is indicated below.

PROPOSED LAYOUT

PROPOSED SECTION



2.0 METHODOLOGY

The geotechnical investigation comprised the drilling and sampling of six (6) boreholes, to depths of between 0.3m and 1.85m, using a Compac 018 drilling rig across the proposed building areas. Dynamic Cone Penetrometer (DCP) testing was conducted adjacent to the boreholes.

The soil classification descriptions and field tests were carried out in general accordance with Australian Standards.

AS 1726	Geotechnical Site Investigations
AS 1289	Methods of Testing Soils for Engineering Purposes

Borehole records, Dynamic Cone Penetrometer test results and a site plan showing the test locations are appended to the report.

3.0 SITE DESCRIPTION

The site of the proposed development is located at 1 Phillip Street, Goonellabah and is bound by residential developments to the south and west, McDermott Ave to the north and Phillip Street to the east.

At the time of the investigation, the site was occupied by two, detached two storey unit developments and associated paved undercover carparking.

Vegetation comprised short grass cover, garden beds and small to medium sized shrubs and trees.

The site slopes gently downwards from south to north at an approximate angle of 5 degrees. Drainage was considered to be poor to fair.

Refer following aerial and site photographs for typical site conditions.

AERIAL IMAGE

SITE PHOTOGRAPH

4.0 GEOTECHNICAL MODEL

The subsurface profile encountered in the boreholes generally consisted of bitumen pavement and granular fill material at the ground surface, overlying stiff to hard natural clay of medium to high plasticity. Underlying the natural clay, extremely weathered (XW) and highly weathered (HW) basalt was encountered and extends to the borehole termination depths.

Table 1 presents a summary of the encountered subsurface profile. Detailed borehole record sheets are appended to this report.

TABLE 1 SUBSURFACE PROFILE SUMMARY

BH No.	FILL	NATURAL			BH TD
		Clay		Basalt	
		Stiff/Very Stiff	Hard	XW/HW	
BH01	0.0-0.3	0.3-0.7*	NE	0.7-TD	0.75 3)
BH02	0.0-0.1	0.1-1.3	NE	1.3-TD	1.65 3)
BH03	0.0-0.2	0.2-0.6	0.6-TD	NE	1.1 3)
BH04	0.0-0.3	0.3-1.3	NE	1.3-TD	1.85 3)
BH05	0.0-0.1	0.1-0.8	NE	0.8-TD	0.85 3)
BH06	0.0-0.1	0.1-TD	NE	NE	0.3 3)

Notes:
1. All depths in metres below ground level at time of investigation.
2. NE - Not Encountered; TD - Termination Depth; *- Firm clays encountered.
3. Maximum TC bit; drill rig refusal.

Groundwater or subsurface seepage was not encountered in the boreholes at the time of drilling. Seepage could be expected through the surficial soils and along the fill/natural soil and natural soil/rock interface following periods of rainfall.

5.0 LABORATORY TESTING

Laboratory testing was conducted on selected samples recovered during the site investigation program and addressed the reactivity of the subsurface material.

The results of the laboratory testing are attached to this report.

6.0 POTENTIAL GROUND SURFACE MOVEMENTS

The final site classification will be dependant on the bulk earthworks undertaken and treatment of the extremely reactive soils. From a reactivity perspective, the laboratory test results indicate that the site classification will vary to possibly as high as Class 'H2' in accordance with AS 2870-2011.

Following cut operations to achieve design levels, it is expected that extremely weathered (XW) and highly weathered (HW) basalt rock may be exposed across the site. Where weathered rock is exposed at or near the surface, the development site would be considered equivalent to a Class 'S' in accordance with AS 2870-2011.

If the natural clays are excavated and reused as upper-level structural fill, characteristic ground surface movements of up to 120mm could be expected if suitable control of the material placement is not maintained during the bulk earthworks.

It is strongly recommended that Pacific Geotech be engaged during the bulk earthworks planning to ensure that the earthworks are designed to an optimal site classification result following the bulk earthworks operation.

It is recommended that the readers satisfy themselves that the use of AS 2870-2011 is applicable for the proposed design and the above site classification re-confirmed following the completion of the bulk earthworks operation.

7.0 EARTHQUAKE SITE CLASSIFICATION

Reference to Section 4.2 in AS1170.4-2007, it is recommended that a site classification of "Class Ce – shallow soil site" be adopted, in accordance with the definitions presented in "Section 4.2 – Class Definitions".

8.0 EARTHWORKS AND SITE PREPARATION CONSIDERATIONS

Earthworks are envisaged to consist of cuts up to 3.0m for the partial basement.

It is recommended that the following site preparation and earthworks procedures be carried out as part of the earthwork's procedures during development.

- All earthworks operations should be carried out in general accordance with AS 3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments".
- Trafficability across the site at the time of the investigation was assessed to be fair to good with no difficulties encountered. Although if significant rainfall events occur during the earthwork's operation, some difficulties could be experienced in trafficking the exposed surface, particularly where the natural clays are exposed which will soften when saturated.
- All topsoil (i.e. soil containing organic matter) and soils containing deleterious matter should be stripped from the construction area at the commencement of the earthworks operation.
- The stripped surface should be proof rolled under Pacific Geotech's supervision using a suitably sized vibrating roller to identify areas of weak surficial soils and to compact the upper-level material.
- The majority of the soils on site will be suitable for re-use as structural fill, provided material is free of organic matter and deleterious material. It is likely that the soils require conditioning to bring the soils to optimum. If the clays are overly moist, difficulty in achieving compaction of the materials will be encountered and moisture conditioning will be required.
- The natural clays are expected to be extremely reactive if reused as structural fill. These clays typically also require a placement moisture content very close to Optimum Moisture Content (OMC) to achieve adequate compaction. A placement moisture content of ±2% of OMC is recommended.
- Imported fill should be of fair to good quality with a minimum Soaked CBR value of 10%, a maximum Iss=1.0% and a maximum particle size of 75mm.
- The weathered rock, where broken down on extraction would be suitable for reuse providing the rock can be broken down to a maximum particle size of 75mm. Additionally, particles between 50mm and 75mm in size should not make up more than 15% of the total fill volume.
- All filling should be undertaken in layer thicknesses of approximately 250mm (or as appropriate for the compaction equipment being used). Fill should be compacted to a minimum dry density ratio of 95% Standard in accordance with AS1289 5.1.1 at a placement moisture content of ±2% of OMC.
- Field density testing should be carried out to check the standard of compaction achieved and the placement moisture content. The frequency and extent of testing should be as per guidelines in AS.3798-2007.
- All earthworks operations should be performed under appropriate supervision by Pacific Geotech, in general accordance with the requirements of AS3798.

9.0 EXCAVATION CHARACTERISTICS

Minor cuts and fills across the building footprints as well as cuts of up to 3.0m in depth for the proposed partial basement carparking are anticipated.

Excavations to the required depths are expected to expose natural very stiff to hard clay soils, and localised areas of extremely and highly weathered (XW-HW) basalt rock.

Excavations to the borehole termination depths should be achievable using conventional earthmoving machinery such as a drott or small dozer (D4) in bulk earthworks and small to medium sized excavators (~5-20t) fitted with general purpose and toothed buckets in confined excavations.

Where excavations extend into weathered rock and beyond the termination depth of testing, the use of heavier equipment and ripper attachments fitted to the above plant may be required to achieve economical excavation rates.

No significant groundwater issues are expected to be encountered under dry weather conditions.

10.0 BATTERS

It is understood that cut batters to 3.0m in height will be required for the proposed basement carpark. It is expected that the profile in the batter excavation will consist of existing fill, residual clays and weathered rock.

Considering the materials encountered, maximum short-term batter slopes within the fill and natural soils of 45 degrees in the soil and 60 degrees in the weathered rock and maximum long-term batter slopes of 26 degrees in the soil and 45 degrees in weathered rock are recommended, subject to detailed assessments of individual locations. Steeper batters are possible by use of retaining structures.

For excavations of a very short term nature, and subject to assessment of factors such as the surcharge conditions, conditions at the time of excavation, length of time excavations are to remain open, working conditions/requirements, etc., steeper excavations could be possible. Pacific Geotech should be contacted to determine an appropriate profile when construction details have been finalised.

It is essential that batters be suitably protected from erosion and scour. Runoff should not be allowed to discharge directly across the batters.

11.0 EXCAVATION SUPPORT SYSTEMS

Where space does not permit the excavations to be battered to a stable angle stated in Section 10.0 above, temporary basement excavation support systems will be required. Possible support system options include, but are not limited to:

Possible support system options include, but are not limited to:

- Soldier Pile Wall – Appropriately designed cantilevered soldier pile wall may be the most appropriate retention system. In-fill panels may be required to support the soil between the piles, depending on soil parameters, seepage inflows and length of time the excavation will be open for.

- Post and Panel Wall – A post and panel wall system, possibly comprising of bored piles with suitably sized UB installed into the per holes, with either sleepers or pre cast or panels slotted into the UB's could be considered.
- Contiguous Piles – A contiguous wall may be considered. It is likely a more expensive solution, however this system may be required to provide suitable support to the adjacent structures and services.

Consideration must be given to the proximity of existing services along site boundaries. It is also noted that structural loads associated with adjacent buildings will have to be taken into account in the design of excavations below the existing surface level.

It should be noted that lateral deflection of the retention system will occur, irrespective of the retention system adopted. In additional to lateral movements, vertical movement of the soils behind the retention system will result. The effects of the vertical and horizontal movements may be seen at a distance equal to 2 or 3 times the height of the excavation.

Detailed assessment of the wall deflections should be undertaken as part of the retention design works.

Subject to detailed design and construction, movements as much as 1% to 2% of the depth of the excavation could occur behind a cantilevered pile wall.

Where natural clay soils are retained, shoring pressures should be based on the lateral earth pressure coefficients given in Table 3 provided the excavation is not surcharged by adjacent buildings/services and some tolerance of movement exists.

11.1 Soldier Pile and Shotcrete Infill Facing

An appropriate system for the site may be anchored, soldier piles (bored piers), in turn, retaining shotcrete or mesh facing between the piles, as required, could be considered. It will be essential to obtain details of all adjacent services/structures and approval to install anchors beyond the property boundary. Additionally, it will be necessary to obtain permission from adjoining property owners as anchors may penetrate beyond the property boundary.

An indicative layout of this option is indicated in Figure 1.

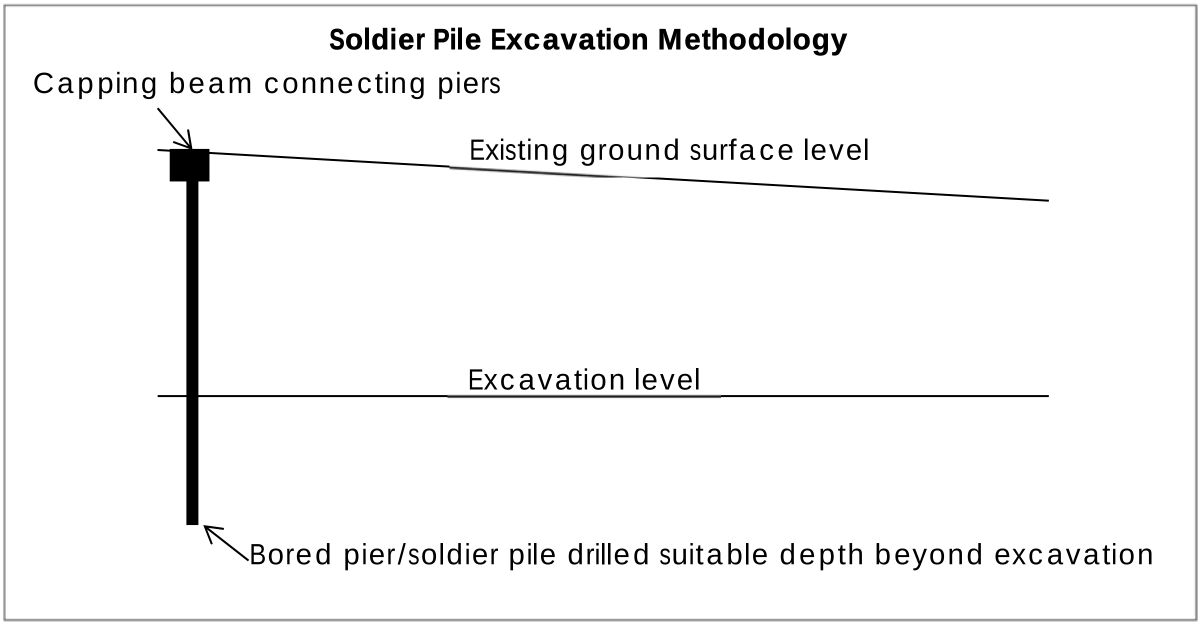


FIGURE 1

Significant difficulties in achieving the penetration of the bored piers into the soil or underlying rock are not expected. Whist it is expected that full penetration of the piers below the excavation depths will be possible, if sufficient penetration is not able to be achieved, an anchored panel system may be required beyond the toe of the soldier piles.

11.2 Pile and Panel Wall

The use of a post and panel system could be considered and could involve the use of steel I-beams supported in bored piles with infill panels between the piles.

The size of the steel beams would depend on the span between piles and soil parameters.

The construction is achieved by excavating the bored piles out in narrow slots, pouring the pile and setting the I-beams panel leaving a soil buttress either side. Once the piles are set, the soil in between is excavated and the panels/sleepers installed. The construction process would normally be conducted in either a hit and miss or a progressive sequence to minimise the time that temporary excavations are exposed for.

An indicative layout of this option is indicated in Figure 2.

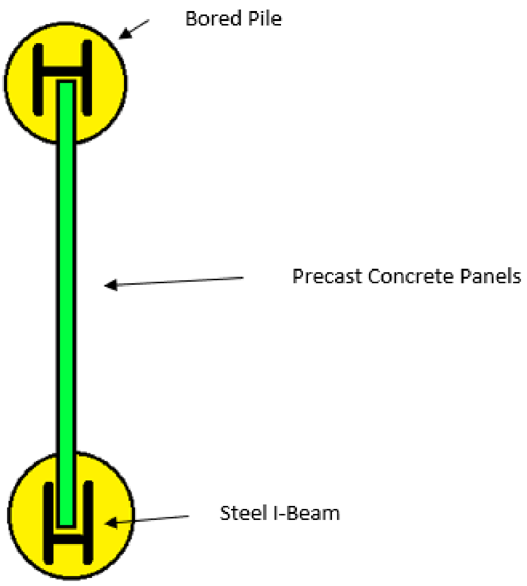


FIGURE 2

Hit and Miss Construction

Subject to ground conditions actually encountered and the retention system adopted, it may be necessary to adopt a 'hit and miss' excavation approach along parts of the site boundaries. On-site supervision during excavation may enable the hit and miss approach to be deleted, however this cannot be determined in advance of excavation.

11.3 Contiguous Piers

A contiguous wall may be considered. It is likely a more expensive solution, however this system may be required to provide suitable support to the adjacent structures and services.

An indicative layout of this option is indicated in Figure 3.

Contiguous Pier Methodology

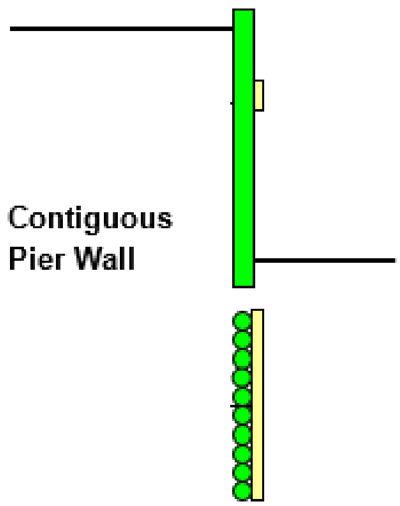


FIGURE 3

11.4 Temporary Excavation Support Design Recommendations

11.4.1 Soil Pressures

For short-term support (i.e. during the construction period), the trapezoidal lateral earth pressure distribution described below would be suitable for the preliminary design of anchors/props for fully drained walls unsurcharged by building loads; however, it is suggested that a ‘better’ approach to the design of temporary and permanent shoring would be to utilise detailed analysis.

Suggested Design Pressures

- a linear increase in pressure from 0 kPa at the top of the vertical cut to a maximum of 6H kPa at a depth equal to 25% of the vertically cut slope height;
- uniform pressure of 6H kPa from this depth to a depth equal to 75% total vertically cut slope height; and
- linear decrease in pressure to 0 kPa at the base of the vertical cut slope.

  (where H = total vertical cut slope height)

If required, Pacific Geotech are able to undertake analysis of the excavation profile.

11.4.1 Groundwater Control

Temporary groundwater control is not expected to be significant but may be required to enable satisfactory completion of construction and to enable economic sizing of temporary support works.

It will be essential to ensure that all services connecting into the site that are to be terminated are properly sealed off (including trench backfill) to prevent them becoming water conduits to the site and causing water pressure surcharging of excavation support works.

If a deep, temporarily battered excavation is to be adopted (refer Section 7) it may be necessary (subject to the results of detailed stability assessment) to undertake temporary dewatering of the surficial soils using a well point system if groundwater is encountered.

11.4.2 Wall Drainage

In order to control the groundwater level behind the walls, it will be necessary to install drainage behind shotcrete facing, typically comprising full height strips of 'Core Drain' (or equivalent) of 20mm minimum thickness, spaced horizontally at not more than approximately 1.8m centres.

11.4.3 Under Slab Drainage

Groundwater seepage will occur through the floor of the excavation that could adversely affect floor slab performance and building amenity, unless a fully tanked basement is adopted. In order to control seepage flows for a 'non-tanked' floor slab, the slab should be cast over a free draining layer (incorporating agricultural drains) graded to sumps so that groundwater is removed and pressure does not build-up under the slab; 'normal' slab joint spacing could be adopted with this option. The drainage system would need to be properly analysed and designed, however, for initial costing a 150mm thick layer of single sized aggregate could be allowed for, together with 100mm diameter geotextile wrapped agricultural drains laid one way at 6m to 8m centres and connected to sumps. It may be necessary to place the drainage layer over a geotextile to prevent 'contamination' by the underlying subgrade.

If a non-tanked basement is to be adopted, assessment of the seepage inflow and groundwater levels should be made to allow the drainage/pumping system to be appropriately sized. Alternatively, a tanked basement, held down with an appropriate ground anchor system should be considered. It is expected that hold down would be achievable through the use of rock bolts or anchors.

11.5 Construction Monitoring

11.5.1 Soil Strength and Structure

It is suggested that all excavation and support works at the site be conducted under the supervision of Pacific Geotech so that ground conditions as exposed can be compared to the ground conditions assumed for excavation support analysis, etc., enabling design modifications to be (if required).

11.5.2 Vibration

Vibration will be caused by excavation work at the site. Vibration restrictions should be set with a realistic appreciation for the normal operational environment of the site and the type of plant/methods to be used for excavation.

Unless very heavy and sustained hydraulic rock breaker excavation is undertaken in close proximity to site boundaries, it is considered unlikely that excavation induced vibration will pose any significant threat to properly constructed/adjacent structures. However, a dilapidation survey of adjacent buildings (and services) is strongly recommended prior to commencement of site work.

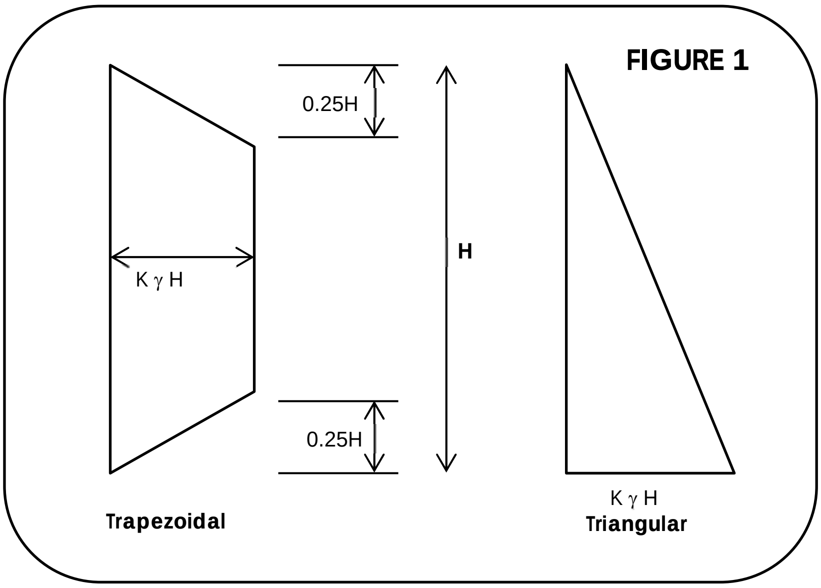
11.5.3 Boundary Movement

Boundary movements will occur as a consequence of the excavation process; such movements are not possible to prevent and are difficult to predict with great accuracy. However, estimates can be calculated as part of the detailed design analysis. Vertical movement of the ground and structures adjacent the excavation could also result. It is considered essential than an accurate survey monitoring program of the excavation boundary be put in place for the duration of the excavation works. The monitoring should be to not less than 1mm (horizontal and vertical) accuracy, so that any movement trends can be readily identified.

12.0 RETAINING WALLS

Retaining walls should be specifically engineer designed in accordance with AS 4678-2002 (Ref 9).

The design of flexible and rigid retaining walls could be undertaken using a triangular pressure distribution and the earth pressure parameters given in Table 3. Flexible walls are those which are free to rotate or tilt (such as cantilevered walls) and should be designed using active (Ka) earth pressure coefficient. Rigid walls are those which are restrained against rotation or tilt (i.e. single anchored/propped walls) and should be designed using the at-rest earth pressure (Ko) and a trapezoidal pressure distribution as per Figure 1.



Passive resistance (Kp) at the toe of the wall should be ignored in the zone where future disturbance (e.g. services trenches) could occur.

The effects of surcharge in the retained zone should be included by multiplying the vertical pressure developed by the surcharge by the appropriate lateral earth pressure coefficient. Allowance should also be made for the surcharge due to sloping crests if applicable.

TABLE 2 EARTH PRESSURE COEFFICIENTS (NON-STOPPING CREST BACKFILL)

Material	Unit Weight (kN/m^3)	Friction Angle (degrees)	Active Ka	At Rest Ko	Passive Kp
Controlled Fill*	19	24	0.45	0.60	2.40
Clays – Stiff to Hard	20	26	0.39	0.56	2.56
Basalt – XW/HW	22	35	0.27	0.43	4.50

Notes: * Depends on fill material type and level of compaction. Assumes material compacted under 'Level 1' supervision.

Preference should be given to adopting thin soil layers and using small hand-controlled compaction equipment during backfilling against retaining walls. This is in order to limit the stress applied to the walls during construction. Should heavy compaction be required, then wall stresses will be well in excess of Ko and temporary propping should be used.

Clay backfill should not be placed dry of optimum moisture content, as this can lead to increased future swelling with changes to moisture content or inundation from water creating additional load on the back of the wall.

It is recommended that all retaining walls be drained for full height in order to minimise hydrostatic pressure build-up behind the wall. Additional guidelines on wall drainage are provided in Appendix G of AS 4678-2002.

13.0 BUILDING FOUNDATIONS

Following bulk earthworks on site for the proposed basement carpark, weathered rock is expected to be exposed in the southern portion of the site, whilst stiff to hard clays are expected to be encountered in the northern portion. It is recommended a high-level foundation system into the residual clays or weathered rock be adopted with due consideration of potential ground surface movements and construction considerations.

In the south portion of the site where residual clays and shallow weathered rock was encountered, a high-level footing system may be appropriate. An allowable bearing pressure of 100kPa in the natural stiff clay, 250kPa in the very stiff or better clay and 500kPa in the weathered rock would be available, subject to inspection at the time of excavation.

It is recommended that footing inspections be undertaken by Pacific Geotech, following excavation, to confirm the specified founding strata has been reached. If the founding strata across the individual structures varies, particular attention should be paid to ensuring adequate articulation of the structure is achieved. When details of the location and loading under the structures has been finalised, Pacific Geotech should provide advice as to the suitability of the founding systems for each structure.

Where footings are located adjacent to excavations such as underground service trenches, it is recommended that the footings be deepened to found at least 200mm below a line drawn up at 45 degrees from the base of the trench.

13.1 Deep Foundations

Bored piers or possbily timber push or screw piles could be considered for the support of the proposed structure.

The deep foundation system should be designed in accordance with the recommendations of AS 2159-2009 'Piling - Design and Installation'.

The ultimate geotechnical strength ($R_{d,ug}$) of piles can be calculated using the unfactored, ultimate shaft adhesion and end bearing values given in Table 3. The $R_{d,ug}$ values given in Table 3 will need to be multiplied by a suitable geotechnical strength reduction factor ($ø_g$) to obtain the design geotechnical strength ($R_{d,g}$) of piles. In accordance with AS2159-2009, the $ø_g$ value must be determined by the designer, but based on the anticipated site, design and installation risk factors, a $ø_g$ value of 0.48 is recommended. Higher values may be applicable with suitable supervision.

If working stress methods are used in the pile design, the $R_{d,ug}$ values given in Table 3 will need to be divided by a factor of safety of 2.5 to caluculate the maximum single pile working load.

TABLE 3 ULTIMATE (UNFACTORED) PILE DESIGN PARAMETERS

Material	Ultimate Unfactored End Bearing* (kPa)		Ultimate Unfactored Shaft Adhesion* (kPa)
	L<4D	L>4D	
Existing Fill	NR	NR	15
Very Stiff Clays	600	900	35
Hard Clays	1200	1800	50
Basalt - HW	1800	2700	100

Notes:
*Geotechnical strength reduction factor needs to be applied to these parameters.
1. NR – Not Recommended.
2. L – pile length; D – pile diameter.

Construction Considerations

The bases of bored pile holes must be thoroughly cleaned of all loose soil and rock debris using a proper cleaning tool. The practice of adding water and spinning the auger is generally not acceptable.

Groundwater was not encountered in the boreholes during the investigation at this site and is not expected to be encountered in bored pile holes drilled under dry weather conditions. An allowance for the use of steel liners, which will likely have to be socketed into rock to achieve an impermeable seal against any water charged soils above, should be made. The groundwater seepages may be controllable by pumping. Shaft adhesion must be ignored for the portion of the pile that is permanently lined.

Drilling piles is not only dependent on the subsurface profile characteristics, but also the type (power and size) of the bored pile drilling rig, drilling teeth, size of pile, etc. It is recommended that a specialist drilling contractor be consulted to be able to manage the above conditions and materials encountered.

During construction, all bored piles must be inspected by a geotechnical engineer to confirm the geotechnical strength parameters presented in Table 3 and to check the capacity of the piles.

14.0 PAVEMENT DESIGN CONSIDERATIONS

Considering the nature of the natural clays and the results of laboratory testing on this and both adjoining sites, a design CBR value of 2% and a modulus of subgrade reaction of 20kPa/mm are recommended for the pavement design. This value should be confirmed with additional on-site sampling and testing following the bulk earthworks operation on site.

Specific additional construction considerations are offered in regard to the construction of the pavements on the site:-

- Suitable subsurface drainage should be installed around the perimeter of the pavements.
- It should be ensured that the subgrade of the pavement is suitably graded to allow any seepage to flow from under the pavement to the perimeter drains.
- Pavement materials should comply with MRS 11.05 specifications and the corresponding minimum dry density ratios are recommended:

i)	Lower Sub-base	(Type 2.5)	95% (Modified)
ii)	Sub-base	(Type 2.3)	95% (Modified)
iii)	Base	(Type 2.1)	98% (Modified)

- Inspections and testing should be carried out by Pacific Geotech following the completion of the bulk earthworks to confirm subgrade conditions across the pavement areas.

15.0 SITE MANAGEMENT

To maintain the long term performance of the structure, good management of the soil conditions and the development is vital throughout the life of the development.

The following are some specific comments with respect to site management.

- The ground surface around the perimeter of the buildings should slope away from the structure and fall to the stormwater system. Water should not be allowed to pond adjacent to the buildings.
- Founding soils should not be allowed to become saturated. Saturation of the on-site material will result in an increase in potential ground surface movements.
- Service trenches under the buildings should be kept to a minimum.
- Footings should be poured immediately after excavation. If footings cannot be poured on the same day as excavation, a blinding layer of 50mm thickness is recommended.
- Trees, garden beds and other vegetation should be planted at a distance at least equivalent to their mature height away from the structures. This will assist in minimising shrinkage movements in the expansive on-soils.

16.0 LIMITATIONS

We have prepared this report for the Proposed Residential Development at 1 Phillip Street, Goonellabah. The report is provided for the exclusive use of Social Futures, for this project only and for the purposes outlined in the report. It should not be used by, or relied upon, for other projects on the same or different sites or by a third party. In preparing this report, we have relied upon information provided by the client or their agents.

The results are indicative of the subsurface conditions on site only at the specific testing locations. Subsurface conditions can change between test locations and the design and construction should take the spacing of the testing and testing methods adopted and the potential for variation between the test locations.

It is recommended that Pacific Geotech be engaged to provide advice and ensure the development is undertaken in accordance with the assumptions made in writing this report.

This is not to reduce the level of responsibility accepted by Pacific Geotech, but rather to ensure that the parties who may rely on the information contained in this report are aware of the responsibilities they assume in doing so.

T. LEE **B. ELSMORE (RPEQ 19656)**

For and on behalf of
PACIFIC GEOTECH PTY LTD

APPENDICES

APPENDIX A

NOTES RELATING TO THIS REPORT

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis.

Every care has been taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical conditions and contains recommendations or suggestions for design and construction. However, unexpected variations in ground conditions will occur. The potential for this will depend partly on testing, spacing and sampling frequency.

If variations are identified, Pacific Geotech would be pleased to assist with additional investigations or advice to resolve the matter.

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Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Description and Classification Methods

The description and classification of soils and rocks used in this report are based on AS 1726.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the percent of other particles present (e.g. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	less than 0.002mm
Silty	0.002 to 0.06mm
Sand	0.06 to 2mm
Gravel	2 to 60mm

Non-cohesive soils are classified on the basis of relative density which can be correlated from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very Loose	less than 4
Loose	4 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) and can be quantified by the Pocket Penetrometer test, Vane Shear test, laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 - 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 - 400
Hard	greater than 400
Friable	strength not attainable – soil crumbles

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc.

Planarity	
CU	Curved
DIS	Discontinuous
IR	Irregular
PR	Planar
ST	Stepped
UN	Undulose

Roughness	
POL	Polished
RJ	Rough
S	Smooth
SL	Slickened
VR	Very Rough

Defects	Type
BP	Bedding Parting
CL	Cleavage
CO	Contact
CS	Crushed Seam
CZ	Crushed Zone
DB	Drilling Break
DK	Dyke
DL	Drill Lift
DZ	Decomposed Zone
FC	Fracture
FL	Foliation
FZ	Fracture Zone
HB	Handling Break
IS	Infilled Seam
JT	Joint
H	Schistosity
SI	Sill
SM	Seam
SS	Shear Seam
SZ	Shear Zone
VN	Vein
VO	Void

Sampling

Sampling is undertaken during the fieldwork to allow examination of the soil or rock and to allow laboratory testing to be undertaken.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content and minor constituents. Bulk samples are similar but of greater volume required for some test procedures such as CBR testing.

Undisturbed samples are taken by pushing a thin-walled sample tube, usually 50mm diameter (known as a U50), into the soil and collecting a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

Investigation Methods

Test Pits: These are typically undertaken with a backhoe or a tracked excavator, allowing examination of the insitu soils. Limitations of test pits are the problems associated with collapse of the pits, disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of typical diameter of between 50mm to 75mm advance manually operated equipment. Premature refusal of the hand augers can occur on a variety of materials such as fill, gravel, hard clays and collapse of the borehole (typically in non-cohesive soil).

Continuous Spiral flight Augers: The borehole is advanced using 65mm to 100mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. Augers of up to 300mm in diameter are used to recover larger volumes of sample. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights. Samples can be disturbed and layers may become mixed. Augering below the groundwater table can be less reliable than augering above the water table.

A Tungsten Carbide (TC) bit for auger drilling into rock can be used to indicate rock strength and continuity by variation in drilling resistance and from examination of recovered rock fragments but provides only an indication of the likely rock strength. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is advanced by a bit attached to the end of a hollow rod string, with water being pumped down the drill rods and returned up the annulus of the borehole, carrying the drill cuttings. Changes in stratification can be determined from the return, together with information from "feel" and rate of penetration.

The borehole can be stabilised through the use of drilling mud as a circulating fluid. The term 'mud' encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. This technique provides a reliable (but relatively expensive) method of investigation. In rocks, an NMLC triple tube core barrel is used, which gives a core of about 50mm diameter. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils as a means of indicating density or strength and also of obtaining a disturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposed", Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63kg hammer, with a free fall of 760mm. The sample is driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense soils, hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of , say, 4, 6 and 7 blows, as
  N = 13
  4, 6, 7
- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as
  N > 30
  15, 30/40mm

Cone Penetrometer Testing (CPT): Cone Penetrometer Testing with or without pore pressure measurement (CPTu) is carried out using a Cone Penetrometer in general accordance with AS 1289 6.5.1, 1999.

In the tests, a 36mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the fractional resistance on a separate 135mm long sleeve, immediately behind the cone. Pore Pressure is recovered through a pore ring located either within, or more usually immediately behind the cone/tip.

As penetration occurs (at a rate of approximately 20mm per second) and data is recorded every 20mm of penetration, the results are presented graphically.

The information provided on the plot comprises:

- Cone resistance – expressed in mPa
- Sleeve friction – expressed in kPa
- Friction ratio – the ratio of sleeve friction to cone resistance expressed as a percentage.
- Pore pressure in kPa
- Tilt of probe (in degrees).

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and rising to 2% to as high as 8%, and higher in organic soils. Soil descriptions based on cone resistance and friction ratios are only inferred and must not be considered as exact.

Stratification can be inferred from the cone and friction traces and from experience and information from nearby boreholes, etc. Where shown, this information is presented for general guidance, but must be regarded as interpretive.

Dynamic Cone Penetrometers:

Dynamic Cone Penetrometer (DCP) tests are carried out by driving a 16mm diameter rod into the ground with a 9kg sliding hammer dropping 510mm and counting the blows for successive 100mm increments of penetration.

Logs

The borehole or test pit logs are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of the boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than "straight line" variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

Groundwater

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be flushed from the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes from which ongoing monitoring can be undertaken.

Fill

The present of fill materials can often be determined only by the inclusion of foreign objects (e.g. bricks, steel ,etc.) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult to reliably determine the extent of the fill.

Laboratory Testing

Laboratory testing is carried out in general accordance with Australian Standard 1289 'Methods of Testing Soil for Engineering Purposes'.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage.

Review of Design

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/constraints are quite complex, it is prudent to have a design review.

Site Inspection

Pacific Geotech would be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related:

Requirements could range from:

i. a site visit to confirm that conditions exposed are no worse than those interpreted, to
ii. a visit to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, or
iii. full time engineering present on site.

APPENDIX B

BOREHOLE RECORD SHEETS

Pacific Geotech
Consulting Geotechnical Engineers

Borehole No.
BH01
Page 1 of 1

Project No.: PG-10643

Client:	Social Future	Commenced:	31/08/2023
Project Name:	Proposed Residential Development	Logged By:	RR
Hole Location:	1 Phillip Street, Goonellabah	Checked By:	
Hole Position:			
Drill Model and Mounting:	Compac 018	RL Surface:	No survey
Hole Diameter:		Datum:	AHD
		Operator:	RR

Drilling Information / Soil Description / DCP

Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Classification Symbol	Material Description (Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional)	DCP TEST (AS 1289.6.3.2-1997) Blows per 100 mm
AD/T						0.03		Bitumen (PAV)	Drilled
						0.30	GM	FILL Silty Sandy GRAVEL (GM) Medium dense, fine to medium sized, grey, fine to medium grained sand, low plasticity fines, dry.	
			U50 0.50-0.60 m						
			D 0.60-0.70 m			0.70	CH	NATURAL Silty CLAY (CH) Firm, high plasticity, pale grey mottled pale red brown and pale orange brown, with fine sized gravel, with fine grained sand, moist to wet.	
						0.75		BASALT (HW) Highly weathered, low strength, pale yellow brown and pale grey white.	
								Hole Terminated at 0.75 m	

DCP scale: 0, 5, 10, 15, 20, 25

Depth scale (m): 0.5, 1.0, 1.5, 2.0, 2.5

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Support
C - Casing

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Remarks
1. Groundwater not encountered.
2. DCP refusal met at 0.63m.
3. Maximum 'TC' bit refusal met at 0.75m.

Pacific Geotech
Consulting Geotechnical Engineers

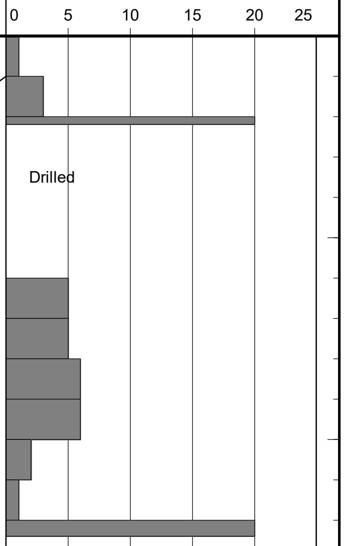
Borehole No.
BH02
Page 1 of 1

Project No.: PG-10643

Client:	Social Future	Commenced:	31/08/2023
Project Name:	Proposed Residential Development	Logged By:	RR
Hole Location:	1 Phillip Street, Goonellabah	Checked By:	
Hole Position:			

Drill Model and Mounting:	Compac 018	RL Surface:	No survey		
Hole Diameter:		Datum:	AHD	Operator:	RR

Drilling Information							***Soil Description***			***DCP***
Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	DCP TEST (AS 1289.6.3.2-1997) Blows per 100 mm
AD/T						0.10		SM	FILL Silty SAND (SM) Loose, fine to medium grained, brown, low plasticity fines, with fine sized gravel, dry to moist (with organics).	
								CI-CH	NATURAL Silty CLAY (CI-CH) Stiff, medium to high plasticity, pale red brown, with fine sized gravel, with fine to medium grained sand, moist (with cobbles throughout).	Drilled
			D 0.70-1.00 m			1.30				
			D 1.30-1.60 m			1.60			BASALT (XW) Extremely weathered, very low strength, pale yellow brown and pale grey.	
						1.65			BASALT (HW) Highly weathered, low strength, pale yellow brown and pale grey white.	
									Hole Terminated at 1.65 m	



Method
AS - Auger
RR - Rock Roller
WB - Washbore

Support
C - Casing

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Remarks
1. Groundwater not encountered.
2. DCP refusal met at 0.22m and 1.24m.
3. Maximum 'TC' bit refusal met at 1.65m.
4. Borehole collapsed at 0.7m.

Pacific Geotech
Consulting Geotechnical Engineers

Borehole No.
BH03

Project No.: PG-10643

Client: Social Future
Project Name: Proposed Residential Development
Hole Location: 1 Phillip Street, Goonellabah
Hole Position:

Commenced: 31/08/2023
Logged By: RR
Checked By:

Drill Model and Mounting: Compac 018
Hole Diameter:

RL Surface: No survey
Datum: AHD
Operator: RR

Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Classification Symbol	Material Description (Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional)	DCP TEST (AS 1289.6.3.2-1997) Blows per 100 mm
AD/T						0.02		Bitumen (PAV)	Drilled
						0.20	GM	FILL Silty Sandy GRAVEL (GM) Dense, fine to medium sized, grey, fine to medium grained sand, low plasticity fines, dry.	
			U50 0.40-0.48 m PP=>600kPa			0.60	CI-CH	NATURAL Silty CLAY (CI-CH) Stiff, medium to high plasticity, pale red brown mottled pale grey pale orange brown, with fine sized gravel, with fine grained sand, moist.	
						1.10	CI	Silty CLAY (CI) Hard, medium plasticity, pale grey mottled pale orange brown and dark grey, with fine sized gravel, with fine grained sand, moist.	
								Hole Terminated at 1.10 m	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5
DCP scale: 0, 5, 10, 15, 20, 25

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Support
C - Casing

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Remarks
1. Groundwater not encountered.
2. DCP refusal met at 0.86m.
3. Maximum 'TC' bit refusal met at 1.1m.

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Project No.: PG-10643

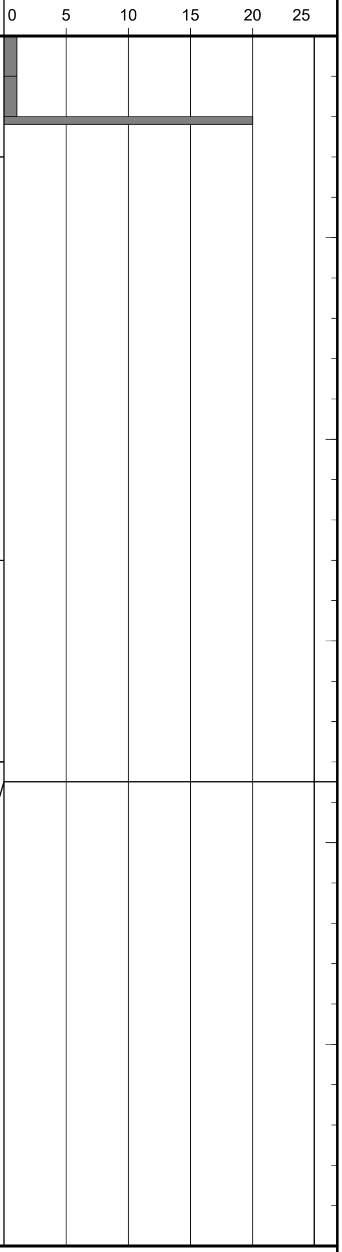
Client:	Social Future	Commenced:	31/08/2023
Project Name:	Proposed Residential Development	Logged By:	RR
Hole Location:	1 Phillip Street, Goonellabah	Checked By:	
Hole Position:			

Drill Model and Mounting:	Compac 018	RL Surface:	No survey		
Hole Diameter:		Datum:	AHD	Operator:	RR

Drilling Information | **Soil Description** | **DCP**

Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional
AD/T			D 0.10-0.30 m			0.30		SM	FILL Silty SAND (SM) Very loose to loose, fine to medium grained, pale orange brown, low plasticity fines, dry (with organics and cobbles)
						1.30		CI	NATURAL Silty CLAY (CI) Stiff, medium plasticity, pale orange brown, with fine sized gravel, with fine grained sand, moist. (with basalt boulders)
						1.80			BASALT (XW) Extremely weathered, very low strength, pale yellow brown and pale grey white, dry.
						1.85			BASALT (HW) Highly weathered, low strength, pale yellow brown and pale grey white, dry.
									Hole Terminated at 1.85 m

DCP TEST
(AS 1289.6.3.2-1997)
Blows per 100 mm



Method
AS - Auger
RR - Rock Roller
WB - Washbore

Support
C - Casing

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Remarks
1. Groundwater not encountered.
2. DCP refusal met at 0.22m.
3. Maximum 'TC' bit refusal met at 1.85m.

Pacific Geotech
Consulting Geotechnical Engineers

Borehole No.
BH05

Project No.: PG-10643

Client:	Social Future	Commenced:	31/08/2023
Project Name:	Proposed Residential Development	Logged By:	RR
Hole Location:	1 Phillip Street, Goonellabah	Checked By:	
Hole Position:			

Drill Model and Mounting:	Compac 018	RL Surface:	No survey		
Hole Diameter:		Datum:	AHD	Operator:	RR

Drilling Information | **Soil Description** | **DCP**

Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	DCP TEST (AS 1289.6.3.2-1997) Blows per 100 mm
AD/T						0.10		SM	FILL Silty SAND (SM) Loose, fine to medium grained, dark brown, low plasticity fines, with fine sized gravel, dry to moist (with organics).	
						0.30		CI	NATURAL Silty CLAY (CI) Very stiff, medium plasticity, pale grey mottled pale red brown pale orange brown, with fine sized gravel, with fine grained sand, moist.	
						0.60		CI	Silty CLAY (CI) Very stiff, medium plasticity, pale grey mottled pale red brown pale orange brown, with fine sized gravel, with fine grained sand, moist (with cobbles).	
						0.80		CI-CH	Silty CLAY (CI-CH) Stiff, medium to high plasticity, pale grey mottled pale yellow brown pale orange brown pale red brown, with fine sized gravel, with fine grained sand, moist.	
						0.85			BASALT (HW) Highly weathered, low strength, pale yellow brown and pale grey white.	
									Hole Terminated at 0.85 m	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5. DCP scale: 0, 5, 10, 15, 20, 25.

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Support
C - Casing

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Remarks
1. Groundwater not encountered.
2. DCP refusal met at 0.22m.
3. Maximum 'TC' bit refusal met at 0.85m.

Borehole No.

BH06

Project No.: PG-10643

Client:	Social Future	Commenced:	31/08/2023
Project Name:	Proposed Residential Development	Logged By:	RR
Hole Location:	1 Phillip Street, Goonellabah	Checked By:	
Hole Position:			

Drill Model and Mounting:	Compac 018	RL Surface:	No survey
Hole Diameter:		Datum:	AHD
		Operator:	RR

Method	Casing	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	DCP TEST (AS 1289.6.3.2-1997) Blows per 100 mm
AD/T						0.10		SM	FILL Silty SAND (SM) Loose, fine to medium grained, dark brown, low plasticity fines, with fine sized gravel, dry (with organics).	
						0.30		CI	NATURAL Silty CLAY (CI) Stiff, medium plasticity, pale red brown mottled pale grey, with fine sized gravel, with fine grained sand, moist (with cobbles throughout).	
									Hole Terminated at 0.30 m	

Method
AS - Auger
RR - Rock Roller
WB - Washbore

Support
C - Casing

Water
Level (Date)
Inflow

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
B - Bulk Sample

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Remarks
1. Groundwater not encountered.
2. DCP refusal met at 0.22m.
3. Maximum 'TC' bit refusal met at 0.3m.

APPENDIX C

LABORATORY TEST CERTIFICATES

SHRINK SWELL INDEX REPORT

CLIENT:	Social Futures	PROJECT NUMBER:	PG-10643
CLIENT ADDRESS:	c/o 3 Jowett Street, Coomera, Qld 4209	REPORT NUMBER:	PG-10643-BH01-0.5-SS
PROJECT NAME:	Proposed Residential Development	REPORT DATE:	1/12/2023
PROJECT LOCATION:	1 Phillip St Goonellabah	TEST METHOD:	AS 1289.7.1.1, 2.1.1 & 2.1.4

SAMPLE LOCATION:	**BH01, 0.5m**
SAMPLE NUMBER:	23-2019
SAMPLING METHOD:	SAMPLE AS SUPPLIED
SAMPLED BY:	PACIFIC GEOTECH
DATE SAMPLED:	31/08/2023
DATE TESTED:	8/09/2023
MATERIAL TYPE:	**Silty Clay**

SHRINKAGE MOISTURE CONTENT (%):	31.6
SHRINKAGE (%):	13.8
SWELL MOISTURE CONTENT INITIAL (%):	30.8
SWELL MOISTURE CONTENT FINAL (%):	36.5
SWELL (%):	0.0
UNIT WEIGHT (t/m³):	1.70
SHRINK SWELL INDEX Iss (%):	**7.6**
CRACKING:	Slight
CRUMBLING:	None
ESTIMATED PERCENTAGE OF INERT INCLUSIONS (%):	0.05

NATA WORLD RECOGNISED ACCREDITATION	**Accredited for Compliance with ISO/IEC 17025 - Testing** **Pacific Geotech Pty Ltd - Accreditation No. 21130** **Gold Coast Laboratory - Site No. 25487**	**Approved Signatory** **Sitha Bun** **Senior Laboratory Technician**	bsi ISO 9001 Quality Management Systems CERTIFIED
Report Remarks:	Variation to test method, Shrinkage specimen is outside of 1.5 to 2.0 Length/Diameter Ratio.		

ER 010.4

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SHRINK SWELL INDEX REPORT			
CLIENT:	Social Futures	PROJECT NUMBER:	PG-10643
CLIENT ADDRESS:	c/o 3 Jowett Street, Coomera, Qld 4209	REPORT NUMBER:	PG-10643-BH03-0.4-SS
PROJECT NAME:	Proposed Residential Development	REPORT DATE:	1/12/2023
PROJECT LOCATION:	1 Phillip St Goonellabah	TEST METHOD:	AS 1289.7.1.1, 2.1.1 & 2.1.4

SAMPLE LOCATION:	**BH03, 0.4m**
SAMPLE NUMBER:	23-2020
SAMPLING METHOD:	SAMPLE AS SUPPLIED
SAMPLED BY:	PACIFIC GEOTECH
DATE SAMPLED:	31/08/2023
DATE TESTED:	8/09/2023
MATERIAL TYPE:	**Sandy Clay**

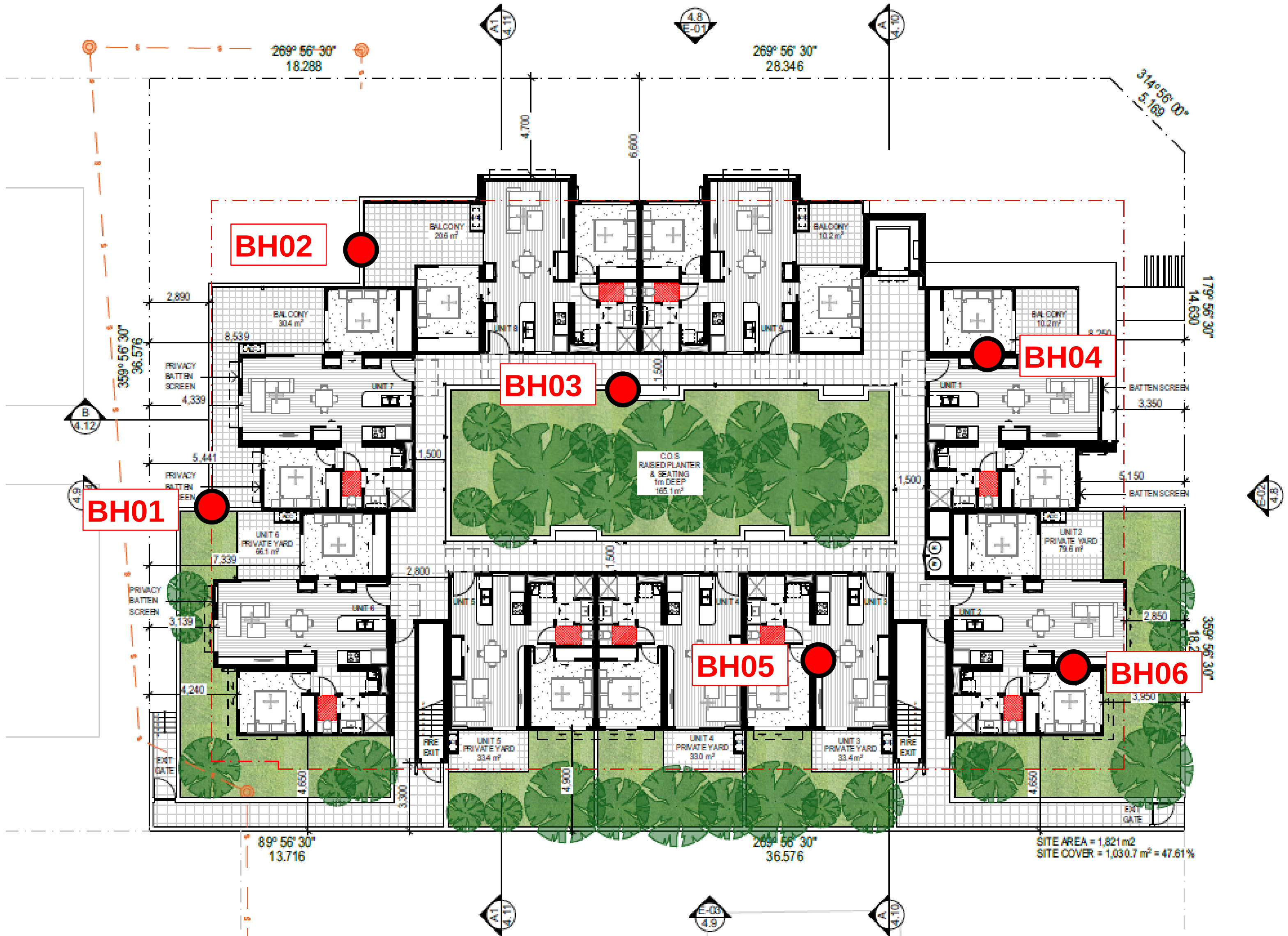
SHRINKAGE MOISTURE CONTENT (%):	14.0
SHRINKAGE (%):	0.5
SWELL MOISTURE CONTENT INITIAL (%):	14.6
SWELL MOISTURE CONTENT FINAL (%):	32.5
SWELL (%):	1.5
UNIT WEIGHT (t/m³):	1.77
SHRINK SWELL INDEX Iss (%):	**0.7**
CRACKING:	None
CRUMBLING:	None
ESTIMATED PERCENTAGE OF INERT INCLUSIONS (%):	0.05

NATA WORLD RECOGNISED ACCREDITATION	**Accredited for Compliance with ISO/IEC 17025 - Testing** **Pacific Geotech Pty Ltd - Accreditation No. 21130** **Gold Coast Laboratory - Site No. 25487**	**Approved Signatory** **Sitha Bun** **Senior Laboratory Technician**	bsi ISO 9001 Quality Management Systems CERTIFIED
Report Remarks:	Variation to test method, Shrinkage specimen is outside of 1.5 to 2.0 Length/Diameter Ratio.		

ER 010.4

APPENDIX D

SITE PLAN



Pacific Geotech
Consulting Geotechnical Engineers

Drawn BI	Project:	Proposed Residential Development	Drawing No. PG-10643-01	A4
Date JAN 2024	Location:	1 Phillip Street, Goonellabah		
Checked	Client:	Social Futures		