



GEOTECHNICAL INVESTIGATION

PROJECT NO. 1-26299

JULY, 2023

**BLIGH TANNER CONSULTING
ENGINEERS**

FLAGSTONE COMMUNITY HUB

PARKLAND DRIVE, FLAGSTONE

**PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL**

Approval no: DEV2024/1523

Date: 25 September 2024



OFFICES IN BRISBANE AND GOLD COAST

Soil Surveys Engineering Pty Limited

A.B.N. 70 054 043 631

www.soilsurveys.com.au

Ph +617 3369 6000

info@soilsurveys.com.au

Brisbane

Level 1, 87 Schneider Road, Eagle Farm, QLD, 4009 Australia

Gold Coast

Unit 8, 140 Millaroo Drive, Helensvale, QLD, 4212 Australia

Document Information

Project Number	1-26299
Document Title	Geotechnical Investigation - Flagstone Community Hub
Site Address	Parkland Drive, Flagstone
Client	Bligh Tanner Consulting Engineers
File ref	1-26299 BR 1.1
Author	Cameron Johnson

Review

Ver No.	Document Type	Reviewed By	Approved for Issue	
			Name	Date
1	Final	Shane Cottle	Cameron Johnson	27/07/2023

Distribution List

Ver No.	Organisation	Contact	Email	Date Sent
1	Bligh Tanner Consulting Engineers	Meaghan Farahnakian	meaghan.farahnakian@blightanner.com.au	27/07/2023

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 General	1
1.2 Proposed Development	1
1.3 Scope of Geotechnical Services	1
2.0 SITE DESCRIPTION	1
3.0 GEOTECHNICAL INVESTIGATION	3
3.1 Field Investigation	3
3.2 Laboratory Testing	4
4.0 GEOTECHNICAL MODEL	4
4.1 Local Geology	4
4.2 Subsurface Profile	4
4.3 Groundwater	5
5.0 ENGINEERING ASSESSMENT	6
5.1 Trafficability	6
5.2 Earthworks	6
5.3 Excavation Characteristics	7
5.4 Site Classification	8
5.4.1 AS 2870 'Residential Slabs and Footings'	8
5.4.2 Plumbing, Drainage and Onsite Sewerage Works	8
5.5 Site Reactivity	8
5.6 Building Foundations	8
5.6.1 Stiffened Raft	8
5.6.2 Adjacent Feature/Excavation Considerations	9
5.6.3 Inspections	10
5.7 Site Management	10
5.8 Pavements	10
6.0 LIMITATIONS	11

Appendices

Appendix A

Notes Relating to this report

Appendix B

Borehole Record Sheets

Appendix C

Laboratory Test Certificates

Appendix D

Site Plan

1.0 INTRODUCTION

1.1 General

This report presents the results of the geotechnical investigation carried out by Soil Surveys Engineering Pty. Limited for the Flagstone Community Hub at Parkland Drive, Flagstone.

The investigation was carried out in accordance with Soil Surveys Engineering Pty Limited proposal 1-26299, 2023-02-27, PR VER 1, as requested by Bligh Tanner Consulting Engineers. Authorisation to proceed with the investigation was received from Bligh Tanner Consulting Engineers on the 21st of June, 2023.

1.2 Proposed Development

It is understood that the proposed development will comprise the construction of a district community centre comprising a single storey building with a ground bearing slab. A car parking area is also proposed.

1.3 Scope of Geotechnical Services

The objective of this study was to identify materials and material properties and groundwater conditions to enable geotechnical assessment of the following:-

- Earthworks recommendations
 - trafficability
 - subgrade preparation
 - compaction standards
 - excavatability
 - safe batter angles
- Foundation recommendations
 - recommended foundation type (high & deep support)
 - bearing capacity
 - skin friction
 - site classification (AS 2870)
 - predicted ground surface movement
- Construction recommendations (where applicable)
- Site management recommendations
- Pavement recommendations - subgrade CBR.

2.0 SITE DESCRIPTION

The site is located at Parkland Drive, Flagstone (refer Figure 1).



FIGURE 1 – SITE LOCATION IMAGERY, DATED 11/04/2023 ON NEARMAP

At the time of the investigation, this site was vacant with a surface covering of patchy grass. There was a shallow water channel running along the western boundary of the site.

Photographs 1 and 2 indicate existing site conditions.



PHOTOGRAPH 1 – BH01 LOCATION, FACING EAST ACROSS THE SITE



PHOTOGRAPH 2 – BH02 LOCATION, FACING NORTH INTO THE SITE

3.0 GEOTECHNICAL INVESTIGATION

3.1 Field Investigation

Subsurface conditions at the site were investigated by drilling and sampling five boreholes to depths of 1.80m and 2.90m using a 4WD mounted Jacro 105 drilling rig. All boreholes terminated at 'TC' bit refusal depth.

In addition, dynamic cone penetrometer (DCP) tests were carried out adjacent to each borehole.

The field work was carried out on the 13th of July, 2023.

The soil classification descriptions, field and laboratory testing were carried out in general accordance with the following Australian Standards:-

- AS 1726-2017 - Geotechnical Site Investigations
- AS 1289 - Methods of Testing Soils for Engineering Purposes.

A description of the investigation method, borehole records and a site plan showing the location of the boreholes are included in the Appendices.

Borehole coordinates were recorded using a hand held GPS device, with accuracy consistent with such devices.

3.2 Laboratory Testing

Laboratory testing was carried out on selected samples retrieved from the field investigation programs and was directed towards assessing the following:-

- Atterberg Limits
- Particle Size Distribution
- Soaked CBR

Laboratory testing was carried out in accordance with AS 1289 “Methods of Testing Soils for Engineering Purposes”.

Laboratory test certificates are contained in Appendix C.

The results of the above laboratory testing are summarised in Table 1.

TABLE 1 SUMMARY OF LABORATORY TESTING

Borehole No.	Sample Depth (m)	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Percent Passing 0.075mm Sieve (%)	CBR Value (%)
BH03	0.20-0.50	27	14	7	34	-
BH05	0.20-0.50	28	14	7	-	-
BH01	0.20-0.60	-	-	-	-	19

4.0 GEOTECHNICAL MODEL

4.1 Local Geology

Reference to the Geological Survey of Queensland 1:100 000 series Geological Map (Ipswich 100K) indicate that the site is underlain by Marburg Formation (Jbm) typically comprising of lithic or feldspathic, labile to sublabile sandstone, siltstone, shale, and coal.

4.2 Subsurface Profile

The subsurface profile intersected during the drilling program consisted of:-

- Fill - Encountered in each borehole to the depths of between 1.70m and 2.40m. The fill comprised predominantly Clayey SAND (SC).

A provided report prepared by ASCT “Report on Level 1 Earthworks Inspection and Testing” (ref no. 1279_SEE Civil_Level 1_Flagstone City DCC dated 4th of July, 2023) indicates that:-

“The structural fill placed between the 26th of July, 2022 and the 11th of October, 2022, is considered to have been carried out in accordance with AS3798-2007 ‘Guidelines on Earthworks for Commercial and Residential Developments’”.

The filling was placed as outlined in the above report has been place in controlled conditions in accordance with AS 3798-2007 and is considered to be “controlled”.

- Natural Soils - Clayey SAND (SC) was encountered beneath the fill at a depth of 1.70m in borehole BH01 only and was described as medium dense to dense.

- Weathered Rock - Weathered Sandstone was encountered in each of the boreholes at the depths of between 1.70m and 2.40m. Assessed as initially extremely weathered (XW) becoming distinctly weathered (DW), low strength with increased depth.

All boreholes terminated at drilling rig refusal depth within the distinctly weathered Sandstone.

Note AS 1726-2017 “Geotechnical Site Investigations” requires that extremely weathered (XW) rock be described using soil terms.

A summary of the subsurface profile is presented in Table 2 with detailed borehole records included in Appendix B.

TABLE 2 SUMMARY OF THE SUBSURFACE PROFILE

Borehole No.	Fill (m)	Clayey Sand (m)	Weathered Rock (m)		Termination Depth (m)
			XW ⁴	DW	
BH01	0.00-1.70	1.70-1.90	1.90-2.70	2.70-TD	2.90 ³
BH02	0.00-1.80	NE	1.80-2.20	2.20-TD	2.40 ³
BH03	0.00-2.40	NE	NE	2.40-TD	2.50 ³
BH04	0.00-1.70	NE	NE	1.70-TD	1.80 ³
BH05	0.00-2.10	NE	NE	2.10-TD	2.30 ³
Notes:-					
1. NE = Not Encountered; TD = Termination Depth.					
2. All depths below existing ground level at date of drilling.					
3. ‘TC’ bit refusal.					
4. Note AS 1726-2017 ‘Geotechnical Site Investigations’ requires that XW rock be described using soil terms.					

4.3 Groundwater

Groundwater was not encountered at borehole locations at the time of the investigation. Whilst groundwater was not encountered in the boreholes, it should be noted that groundwater may be present; please note that the period of time available (during the drilling of boreholes) is relatively short, and hence, the opportunity to observe the presence (or otherwise) of groundwater is limited.

However, seepage may be encountered, particularly within the fill material and at the fill/natural and soil/rock interfaces, following rain. It should also be noted that groundwater levels can vary both seasonally and with prevailing weather conditions and, if construction is to be undertaken at a “significant” time following this investigation, or following ‘wet’ weather, then it would be prudent to confirm groundwater levels prior to construction.

5.0 ENGINEERING ASSESSMENT

5.1 Trafficability

Trafficability conditions were considered to be good during the investigation however the fieldwork for this investigation was carried out following dry weather conditions with a 4WD mounted drilling rig. However, some problems may be anticipated during wet weather for even light weight 4WD vehicles.

The soils on site are sensitive to repetitive vehicle loading and water (i.e., they will lose strength through repetitive vehicle loading or if they become overly moist or wet). Further, seepage may also result in a subsequent loss of strength. This may limit trafficability and create difficulties for earthworks operations.

It is recommended that after stripping the exposed surface in the construction area be proof rolled (where appropriate) to assist in identifying weak areas and to improve trafficability. In areas of cut, proof rolling may be deferred until after the cut operation.

Maintaining adequate drainage conditions is essential. It should be ensured that runoff is diverted away from the construction area to prevent ponding of water. In addition, the construction area should be "sealed" at the completion of each day and in the event of rain.

Potential trafficability problems with this site should not be underestimated. The site will very quickly become untrafficable if appropriate seepage and drainage control measures, along with construction practices appropriate for site conditions, are not maintained.

The contractor should fully inform himself of the ground conditions on site prior to commencement of earthworks. This requirement should be explicit in any earthworks specifications or contract.

5.2 Earthworks

Earthworks are unknown at the time of the investigation. The following provides general recommendations with respect to earthworks and should be reviewed once the earthworks extent has been established.

Earthwork procedures should be carried out in a responsible manner in accordance with AS 3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments" and include the following:-

- Clearing, stripping and grubbing should be carried out in areas subject to earthworks (as trafficability conditions allow). Also, all soils containing organic matter should be stripped from the construction area; this material is not considered suitable for use as structural fill.
- Depressions formed by the removal of vegetation, underground elements etc. should have all disturbed weakened soil cleaned out and be backfilled with compacted select material.
- The subgrade should be proof rolled (where appropriate) under the supervision of Soil Surveys Engineering in accordance with methods and equipment as per Clause 5.5 of AS 3798-2007. In areas of cut, proof rolling may be deferred until after the cut operation. Areas demonstrating excessive movement should be treated (dried and recompacted) or removed and replaced with compacted fill. Treatment should be to a standard sufficient so that the subgrade passes proof rolling and that compaction can be achieved in the first layer of fill.

- The insitu soils, where free of organic and deleterious material, may be used for structural fill provided the moisture content of the soils on placement approximates the optimum moisture content required for compaction. This will require conditioning to bring the soils to optimum. However, it should be noted that the on site soils could be expected to present difficulties in handling, placement and compaction if the appropriate moisture content could not be achieved, particularly if the soils were overly moist.
- Imported general fill material (if required) should be cohesive in nature and be a good quality low plasticity (Liquid Limit of less than 45%, Plasticity Index of less than 15%, Shrink/Swell Index of less than 1.0%) select fill material with a Soaked CBR >10% and a maximum particle size of 75mm.
- Pavements gravels should comply with appropriate local council quality specifications for base, sub-base and blanket materials.
- Provided the placement moisture content of the imported fill or select insitu material approximates the optimum moisture content for compaction, suitable compaction should be achievable using typical compaction machinery. The fill material should be compacted in layers not exceeding 250mm, loose thickness. However, layer thicknesses will be dependent on the compaction plant type and size, use of vibration, material type and condition. Final maximum placement layer thicknesses will need to be determined when compaction plant as well as material type and conditions are known. Fill batters should be overfilled and cut-back to design batter angles.
- Guidelines for minimum relative compaction values for insitu soils and imported general fill for the building and pavements are presented in Table 3.

TABLE 3 MINIMUM RELATIVE COMPACTION

Location	Minimum Dry Density Ratio (%)
General Fill/Subgrade	98 ⁽¹⁾
Base Course	98 ⁽²⁾
Subbase	98 ⁽²⁾
Notes:	
1. The recommended compactions are percentages of the maximum dry density determined by Australian Standard 1289 (Standard Compaction).	
2. For processed pavement gravels, minimum density requirements should be a percentage of maximum dry density in accordance with AS 1289 5.2.1, Modified Compaction.	

- 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, Section 8.0.
- Backfilling for service trenches, etc. should use good quality material. The backfill should be placed in uniform layers over the full width of the excavations with the layers not exceeding 200mm thickness, loosely placed using wheeled plant and 100mm loose thickness using hand held vibrating plates. The backfill material should be compacted to the specifications outlined above for insitu or imported cohesive material.

5.3 Excavation Characteristics

The assessment of excavation characteristics of soil and weathered rock is normally based on the depth of penetration of the drilling rig using the 'TC' bit attachment. These depths are recorded on the Borehole Record Sheets (Appendix B).

The limit of the 'TC' bit is indicative of the limit of excavations using a small dozer in bulk excavations (Cat D 6) or a medium sized backhoe in trenches (Case 580 or M.F. 50).

Generally, below the 'TC' bit limit, large excavators (say 30 tonne) possibly with hydraulic rock breakers are required for excavation.

Ripping depths can be significantly increased when the rock is bedded, laminated and highly jointed. The nature of the rock and inherent planes of weakness therefore plays an important part in rock excavation assessment.

It should be noted that the ability to drill piers in the weathered rock material is not only dependent on material characteristics but also the type (power and size) of the bored pier drilling rig, drilling teeth, size of pier, etc. It is recommended that the drilling contractors are consulted on this matter.

5.4 Site Classification

5.4.1 AS 2870 'Residential Slabs and Footings'

In assessing the site classification in accordance with AS 2870 'Residential Slabs and Footings', the following has been considered:-

- The subsurface profile (as per borehole records)
- Laboratory test results
- Geotechnical data held by Soil Surveys Engineering
- The presence of fill deeper than 0.4m
- Likely future development.

Considering the above, and other factors, the site is classified Class 'P'.

5.4.2 Plumbing, Drainage and Onsite Sewerage Works

The soil classification to AS 2870 for the purpose of design of plumbing, drainage and onsite sewerage works (Form 1 Section 5 - Permit Work Application) is Class 'S'.

5.5 Site Reactivity

If this site is assessed to be subject to ground surface movement predominantly due to soil reactivity **under normal moisture conditions**, a characteristic surface movement (y_s) within the Class 'S' range ($y_s = \leq 20\text{mm}$) could be calculated (considering the proposed development, existing subsurface profile as per boreholes records, laboratory test results, and taking into account other relevant geotechnical data held by Soil Surveys Engineering).

5.6 Building Foundations

5.6.1 Stiffened Raft

Given the depth of fill encountered across the site, it is recommended that a stiffened raft foundation system be adopted to accommodate the potential differential settlement of the existing fill.

It is recommended that a high level raft footing system designed to suit Class 'M' conditions and founded in the competent controlled fill be adopted.

Our recommendation is that all perimeter footings, footings under isolated columns and strip footings below internal load bearing walls be founded at a minimum depth of 500mm below platform level and at least 200mm into the controlled fill.

Footings founded in the controlled fill (medium dense clayey sand) may be dimensioned for an allowable bearing pressure of 150kPa.

Settlements (due to footing loading) of less than 10mm would be expected, adopting the above allowable bearing capacity values and considering typical footing dimensions, however, settlement of the order of 5mm per metre of compacted fill should also be allowed for.

Field and laboratory test results indicate that the existing natural soils, along with any controlled fill, are suitable for slab on ground construction provided that any additional earthworks/subgrade preparation are carried out in accordance with Section 5.2.

5.6.2 Adjacent Feature/Excavation Considerations

Where proposed footings are located adjacent to proposed or existing feature/excavations (e.g., retaining walls, underground service trenches, unsupported batters, etc.), the effect of the feature/excavation on proposed or existing footings/piers must be carefully considered. Deepening of proposed footings/piers is expected to be required in such circumstances.

Soil Surveys Engineering and the Structural Engineer should be consulted on this matter prior to construction.

For underground service trenches (as a general guide) proposed footings should extend to base a minimum of 300mm below the feature/excavation base level for a distance of 1.0m out from the feature/excavation. Beyond 1.0m the footings should be taken a minimum of 300mm below an imaginary line (influence line) drawn up at 45° (1H:1V) from the feature/excavation base level. Note that actual depths (Soil Surveys Engineering should be consulted on this matter prior to construction) below the influence line will depend on footing capacity. Figure 2 refers.

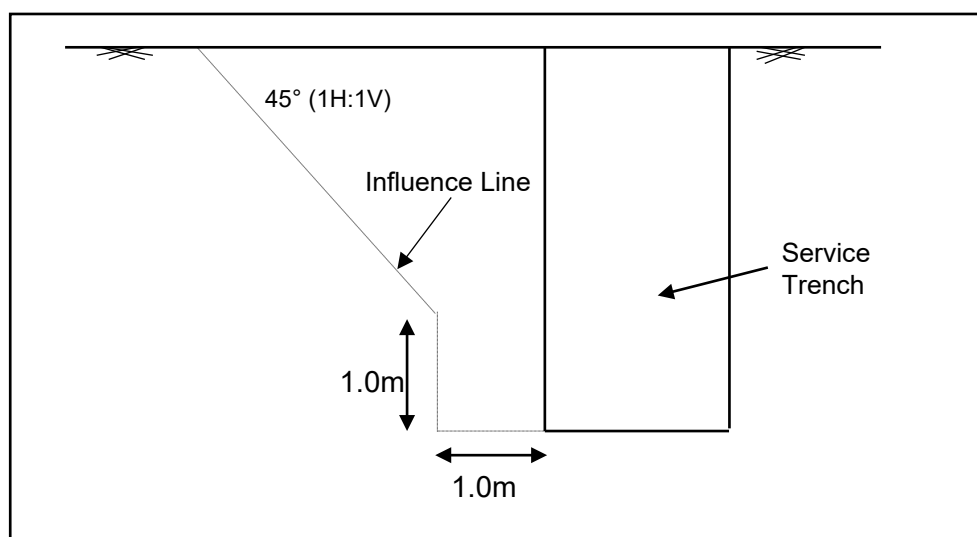


FIGURE 2

For all other feature types, Soil Surveys Engineering and the Structural Engineer should be consulted prior to construction.

5.6.3 Inspections

It is recommended that inspections be undertaken by an experienced and qualified geotechnical engineer from Soil Surveys Engineering following footing and during pier excavations to confirm the adequacy of the founding soils. Inspections should be carried out prior to placement of reinforcing steel and ordering of concrete.

5.7 Site Management

It is important that proper site management methods be observed for the existing soil conditions by both the builder at the time of the construction and the owner(s) throughout the life of the proposed development.

Particular reference to site management matters is set out in AS 2870-2011. It should be noted that where proper site management, particularly with respect to change in moisture conditions, is not followed, the foundation recommendations contained in this report could be considered void.

The following are some specific comments with respect to site management and the reader is also directed to CSIRO publication, "Foundation Maintenance and Footing Performance: A Homeowners Guide" (Building Technology File 18) for further information:-

- It is important that the site be well drained. The ground around the structures should slope away at 1 in 50 for 3 metres and then fall to the stormwater system to prevent ponding of water adjacent to the structures.
- Roof downpipes and garden taps should not be allowed to saturate founding soils.
- It is recommended that service trenches under the building be minimised, as disruption or breakage of these service lines could lead to saturation of the under slab material resulting in an increase to moisture condition. If this were to occur, all footing recommendations contained within this report would be void.
- Footings should be placed with minimal delay after excavation to avoid desiccation or wetting of the founding soils. If footings cannot be poured on the same day as excavation, a blinding layer of 75mm thickness is recommended. Piers should be poured immediately.
- Do not let the slab subgrade "dry out" prior to casting.
- Future shrubs and trees should be planted at a distance at least equivalent to three quarter times their mature height away from the building to avoid shrinkage movement in the potentially expansive founding soils. Existing trees that may encroach this restriction should be removed as soon as possible prior to commencement of construction. Replenishment of soil moisture to equilibrium conditions after tree removal can result in soil heave.

5.8 Pavements

Final pavement levels are not known at the present time, however, it is likely the pavement subgrade will comprise Controlled Fill - Clayey SAND (SC).

Laboratory testing was carried out on the subgrade material sampled from Borehole BH01 to determine this material's California Bearing Ratio (CBR); the CBR value represents the 'strength' of this material, compacted to 100% standard density ratio, under saturation. The Soaked CBR test produced a value of 19%.

Given the possible variation in the fill material, a maximum design subgrade CBR value of 10% is recommended for design.

The following general pavement construction recommendations are made:-

- i) Incorporate a perimeter drain at the pavement edges to prevent possible deterioration under wet weather.
- ii) Pavements should be well drained both during and upon completion of construction. Water should not be allowed to pond on or near pavement surfaces.
- iii) Pavement gravel should comply with the Local Council quality specifications for sub base and base course material.
- iv) Subgrades should be compacted to achieve the minimum density ratios as outlined in Section 6.2 'Civil Works'.
- v) **It is recommended that inspection and testing be carried out following general earthworks to confirm subgrade conditions.**

6.0 LIMITATIONS

We have prepared this report for the use of **Bligh Tanner Consulting Engineers**, for design purposes in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has not been prepared for use by parties other than **Bligh Tanner Consulting Engineers**; it may not contain sufficient information for purposes of other parties or for other uses. Please note that any third party relying on the information contained in this report for any purpose whatsoever does so entirely at its own risk, and any duty of care to that third party is excluded.

Any interpretation or recommendation given by Soil Surveys Engineering shall be understood to be based on judgement and experience and not on greater knowledge of the facts than the reported investigations would imply. The interpretation and recommendations are therefore opinions provided for our Client's sole use in accordance with the specific brief. As such they do not necessarily address all aspects of ground behaviour on the subject site. Information provided by others has been taken in good faith, but no liability can be accepted for information provided by others.

Your attention is drawn to 'Appendix A', 'Notes Relating to this Report'. Interpretation of factual data given in this report is based on judgement, not a greater knowledge of facts other than those reported.

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

In the event that conditions encountered on site during construction appear to vary from those expected from the information contained in the report, the Company strongly recommends that it immediately be notified. Most problems are more readily resolved when conditions are exposed than at some later stage, after the event. Should Soil Surveys Engineering not be notified or if this notification is delayed, then Soil Surveys can not be held responsible for the effect that any variation has on any aspect of the development.

Soil Surveys Engineering consider that a documentation review service (during the design phase and prior to construction) to verify that the intent of geotechnical recommendations is properly reflected in the design, along with construction inspections, forms a very important component of the geotechnical engineering design service/process.

The geotechnical review ensures geotechnical risks to our client and their project are minimised at the design and tender stage of the project. Further, with Soil Surveys Engineering being commissioned to carry out geotechnical construction inspections, an opportunity at the time of construction to confirm any assumptions made in the preparation of the report and allow the effect of any normally occurring variation in ground conditions to be assessed with respect to construction becomes available.

The above statements are not intended to reduce the level of responsibility accepted by Soil Surveys Engineering in accordance with our commission, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in doing so and the risks they accept should they decline to have Soil Surveys Engineering carry out a geotechnical documentation review and geotechnical construction inspections.

It is highly recommended that the Client avail themselves of these review and inspection services; our standard rates will apply.



C.P. JOHNSON (RPEQ 7052)

PRINCIPAL GEOTECHNICAL ENGINEER

For and on behalf of

SOIL SURVEYS ENGINEERING PTY LIMITED

APPENDICES

APPENDIX A

NOTES RELATING TO THIS REPORT

NOTES RELATING TO THIS REPORT

September, 2019

INTRODUCTION

These notes are provided by Soil Surveys Engineering Pty Limited (the Company) to complement the geotechnical report in regard to classification methods and field procedures. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited information about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such information obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and at the time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

Soils - The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726-2017 (Geotechnical Site Investigations), where appropriate. In general, descriptions cover the following properties - soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the dominant particle size and behaviour as set out in AS 1726-2017.

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, shear vane, laboratory testing or engineering examination. The strength terms are defined in AS 1726-2017 Table 11.

Non-cohesive soils are classified on the basis of relative density usually based on insitu testing or engineering examination (see AS 1726-2017 Table 12).

Rocks - Rock types are classified by their geological names (AS 1726-2017 Tables 15 to 18), together with descriptive terms regarding weathering (AS 1726-2017 Table 20), strength (AS 1726-2017 Table 19), defects (AS 1726-2017 Table 22), etc.

SAMPLING

Sampling is carried out during drilling or from other excavations to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon sample disturbance, (information on strength and structure).

Undisturbed samples are taken by pushing a thin walled sample tube, usually 50mm diameter (U50), into the soil and withdrawing it with 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, volume change potential 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.

SAMPLE STORAGE – SOIL, ROCK AND WATER

SAMPLES

Soil samples (not subject to testing) are not stored beyond a period of 90 days of taking or receiving said soil sample. Rock core (not subject to testing) is not stored beyond a period of six months of taking or receiving said rock core.

Should any party require that soil samples (not subject to testing) be stored beyond 90 days, or rock core (not subject to testing) be stored beyond six months, please contact Soil Surveys Engineering.

Water samples (not subject to testing) are not stored beyond a period of seven days of taking or receiving water samples.

TEST LOCATIONS

Test locations (e.g. boreholes, CPT's, test pits etc.) were based on available access at the time of testing. Test locations may have been shifted if access was not suitable.

Unless noted otherwise, accuracy of test locations are to the accuracy of hand held GPS equipment.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application.

Test Pits - These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to approximately 3.0m for a backhoe and up to 6.0m for an excavator. Limitations of test pits are the problems associated with 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 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the augers can occur on a variety of materials such as hard clay, gravel or rock fragments and does not necessarily indicate rock level.

Continuous Spiral Flight Augers - The borehole is advanced using 75mm to 300 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the augers. Information from the drilling (as distinct from specific sampling) is of relatively lower reliability due to remoulding, inclusion of cuttings from above or softening of samples by groundwater, or

NOTES RELATING TO THIS REPORT

September, 2019

uncertainties as to the original depth of the samples. Augering below the groundwater table has a lower reliability than augering above the water table. Various drill bits are attached to the base of the augers during the drilling. The depth of refusal of the different bit types can provide information as to the strength of the material encountered. Generally the 'TC' bit (a tungsten carbide tipped screw type bit) is used.

Wash Boring - The borehole is usually advanced by a rotary bit with water or fluid pumped down the hollow drill rods and returned up in the space between the rods and the soil or casing, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from "feel" and rate of penetration. More accurate information on soil strata is gained by regular testing and sampling using the Standard Penetration Test (SPT) and undisturbed thin walled tube samples (U50).

Mud Stabilized Drilling - Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilize the borehole. The term "mud" encompasses a range of products ranging from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from regular intact sampling (e.g. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling - A continuous core sample is obtained using a diamond or tungsten carbide tipped core barrel. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable method of investigation. In rocks, NMLC coring (nominal 52 mm diameter) is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as CORE LOSS. The location of losses is determined on site by the supervisor. If the location of the loss is uncertain, it is placed at the top end of the run, when the core is placed in a storage tray and recorded on the log.

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. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" - 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 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm, the upper 150 mm being neglected due to possible disturbance from the drilling method. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued at a reduced penetration.

In the case where full penetration is obtained with successive blow counts for each 150 mm of, say 4, 6 and 7 blows, the record shows,

4, 6, 7

N = 13

In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm, the record shows:

15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, it is noted on the borehole logs.

A modification to the SPT test is where the same driving system is used with a solid 600 tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid SPT are shown as "N_c" on the borehole logs, together with the number of blows per 150 mm penetration.

Cone Penetration Tests - Test Method - Cone Penetration Tests (CPT) are carried out in accordance with AS 1289 Test 6.5.1-1999, using an electrical friction-cone penetrometer.

The test essentially comprises the measurement of resistance to penetration of a cone of 35.7 mm diameter pushed into the soil at a rate of 10-20 mm per second by hydraulic force. The resistance to penetration is recorded in terms of pressure on the end area of the cone (cone resistance, q_c , in MPa) and friction on the side of the 135 mm long sleeve immediately above the top of the cone (friction resistance, f_s , in kPa). These forces are measured by electrical transducers (strain gauges) within the cone device. The ratio between friction resistance and cone resistance is also calculated as a percentage, i.e.-

$$\text{Friction Ratio (FR)} = \frac{\text{Friction Resistance, } f_s \text{ (kPa)} \times 100}{\text{cone resistance, } q_c \text{ (kPa)}}$$

The friction ratio, FR, is generally low in sands (less than 1% or 2%) and generally higher in clays (say 3% or more). The interpretation of sandy clays, clayey sands and material with a high silt content is more difficult, but intermediate values (between 1% and 3%) would be expected. Highly organic clays and peats generally have a friction ratio in excess of 5%.

Static cone data is recorded in the field on disc for later presentation using computer aided drafting.

The equipment can be operated from any conventional drill rig. A total applied load in the range of 4 to 10 tonnes is required for practical purposes, although lighter loads may be used. The cone penetrometers are available with various capacities of cone resistance ranging up to 100 MPa for general purpose investigations, while a range of 0 to 10 MPa can be used where more sensitive investigations of soft clay are required.

The cone resistance value provides a continuous measure of soil strength or density, and together with the friction ratio, provide very useful indications of the presence of narrow bands of geotechnically significant layers such as thin, soft clay layers or lenses of sand which might otherwise be missed using conventional drilling methods.

NOTES RELATING TO THIS REPORT

September, 2019

The lithology of the encountered soils is interpreted from static cone data and is generally presented on the static cone log sheets.

It is important to note that the lithology is interpreted information and is based on research by Schmertmann (1970), Sanglerat (1972), Robinson and Campinalli (1986), modified to suit local conditions as indicated by borehole information and laboratory testing.

As soils generally change gradually it is sometimes difficult to accurately describe depths of strata changes, although greater accuracy is obtained with the static cone compared with conventional drilling. In addition, friction ratios decrease in accuracy with low cone resistance values, and in desiccated soils. As a result, some overlap and minor discrepancies may exist between static cone and nearby borehole information.

Portable Dynamic Cone Penetrometers - Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 100mm increments of penetration.

The DCP comprises a Cone of 20 mm diameter with 30 degree taper attached to steel rods of smaller section.

The cone end is driven with a 9 kg hammer falling 510 mm (AS 1289 Test 6.3.2). The test was developed initially for pavement subgrade investigations, and empirical correlations of the test results with California Bearing Ratio have been published by various Road Authorities. The Company has developed their own correlations with Standard Penetration tests and Density Index tests in sands.

LOGS

The borehole or test pit logs presented herein are an engineering and/or geological 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. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The attached explanatory notes define the terms and symbols used in preparation of the logs.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of 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 lower permeability soils, it may enter the hole slowly or perhaps not at all during the time the hole is open.
- A localized 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 bailed out of the bore and mud must be washed out of the hole or "reverted" if water observations are to be made.

More reliable measurements can be made by use of standpipes which are read after stabilizing at periods ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence 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 with limited testing and sampling to reliably determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is important to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing is normally carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms and the attached explanatory notes summarize important aspects of the Laboratory Test Procedures adopted.

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. The information provided in Soil Surveys Engineering reports is opinion and interpretation and not factual. The client/contractor increases their risk by not retaining the person who authored the geotechnical report, to carry out site inspection and review (overseeing role) during construction, to confirm opinion and interpretation expressed in the report is accurate. Where the report has been prepared for a specific design proposal the information and interpretation may not be relevant if the design proposal is changed. If this happens, the Company will be pleased to

NOTES RELATING TO THIS REPORT

September, 2019

review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical aspects and recommendations or suggestions for design and construction. Since the test sites in any exploration represent a very small proportion of the total site and since the exploration only identifies actual ground conditions at the test sites, even under the best circumstances actual conditions may vary from those inferred to exist. No responsibility is taken for:-

- Unexpected variations in ground and/or groundwater conditions.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of other persons.
- Any work where the company is not given the opportunity to supervise the construction using the Companies designs/recommendations.

If differences occur, the Company will be pleased to assist with investigation or advice to resolve any problems occurring.

SITE ANOMALIES

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

Extreme events including but not limited to the results of climate change, e.g. flood levels above previously identified levels, beach scour or erosion beyond normal expectations (as identified by local authorities) extreme rainfall events, war, espionage, sabotage may result in different conditions between time of investigation and time of construction.

REPRODUCTION OF INFORMATION FOR

CONTRACTUAL PURPOSES

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Construction Contracts (1987)", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances, where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

REVIEW OF DESIGN

Where major civil or structural developments are propose or where only a limited investigation has been completed or where the geotechnical conditions/ constraints are quite

complex, it is prudent to have a joint design review which involves a senior geotechnical engineer. We would be happy to assist in this regard as an extension of our investigation commission. Construction drawings should be reviewed by Soil Surveys Engineering, with sufficient time to allow changes if required, prior to inspections. Otherwise Soil Surveys Engineering reserves the right to refuse to carry out inspections.

SITE INSPECTION

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

- i. Site visits during construction to confirm reported ground conditions
- ii. Site visits to assist the contractor or other site personnel in identifying various soil/rock types such as appropriate footing or pier founding depths, the stability of a filled or excavated slope; or
- iii. Full-time engineering presence on site.

In the vast majority of cases it is advantageous to the principal for the geotechnical engineer who wrote the investigation report to be involved in the construction stage of the project.

The geotechnical engineer cannot take responsibility for variations in encountered conditions, where he is not given the opportunity to review plans for the proposed development with sufficient time to allow review and make changes to the proposed development if required, and where he is not given the opportunity to inspect the site and oversee construction methods with regard to site conditions with sufficient time to observe all relevant site conditions and operations.

RESPONSIBLE USE OF GEOTECHNICAL INFORMATION

Recommendations in our report are for design purposes only and provided on the basis that inspections are carried out to allow finalisation of opinions and recommendations contained in our report.

The geotechnical investigation consisting of field and laboratory testing has been carried out to indicate typical conditions by indicating conditions and parameters at the specific locations of boreholes/test pits. Subsurface conditions are indicated at these locations only and the inference of conditions between or away from these locations (interpolation and extrapolation) involves a certain degree of risk. Persons inferring such conditions or carrying out such inferences should do so with a degree of caution and conservatism which is commensurate with the consequences of the risk of error.

Estimates of volumes based on our findings require interpolation and extrapolation between test locations and as such may be significantly different from actual volumes.

APPENDIX B

BOREHOLE RECORD SHEETS



Soil Surveys Engineering Pty. Limited

Specialist in Applied Geotechnics

PO Box 317, Paddington, 4064

+61 7 3369 6000

info@soilsurveys.com.au

www.soilsurveys.com.au

SOIL SURVEYS

Easting: 494406.1

Northing: 6924408

RL:

Logger: TE

Operator: TE

Machine: J 105

BOREHOLE RECORD SHEET

Location Number: BH 01

Project Number: 1-26299

Project Name: Proposed Community Hub

Location: Parkland Drive, Flagstone

Client: Bligh Tanner Consulting Engineers

Date: 13/07/2023

Page: 1 OF 1

Drilling Method					Depth	Graphic	Description	DCP Test (blows/100mm)						Samples and Remarks
TC	WB	RR	NMLC	Casing				0	6	12	18	24	30	
					0.08		FILL Sandy SILT (ML): Stiff to very stiff, low plasticity, dark grey, fine to medium grained sand, trace low plasticity clay, trace fine to medium sized gravel, organic, w > pl							D
					0.5		FILL Clayey SAND (SC): Medium dense, fine to medium grained, dark grey with brown, trace low plasticity clay, trace fine to medium sized gravel, moist							D B
					0.70		FILL Clayey SAND (SC): Medium dense to dense, fine to medium grained, dark grey brown, low plasticity clay, with cobble, trace fine to medium sized gravel, moist							D
					1.0									
					1.5									
					1.70		NATURAL Clayey SAND (SC): Medium dense to dense, fine to medium grained, grey, low plasticity clay, trace fine sized gravel, moist							
					1.90		Extremely weathered Sandstone (XW) recovered as Clayey SAND (SC): Dense, fine to medium grained, yellow brown mottled light grey, low plasticity clay, moist							
					2.0									
					2.5									
					2.70		SANDSTONE (DW): Distinctly weathered, very low to low strength, fine to medium grained, light grey, moist							
					2.90									
					3.0		BOREHOLE BH 01 TERMINATED AT 2.90 m							
					3.5									

Comments:

- Groundwater not encountered during augering
- DCP refusal at 0.61m
- TC bit refusal at 2.90m

Water First Noted Water Steady Level

Weathering Grades

RS - Residual Soil
XW - Extremely weathered
HW - Highly weathered
DW - Distinctly weathered
MW - Moderately weathered
SW - Slightly weathered
FR - Fresh
Rock Strength
R0 - Residual Soil
VL - Very low
L - Low
M - Medium
H - High
VH - Very high
EH - Extremely high

Samples

U50
SPT
Disturbed Sample
Bulk Sample

Approved: CJ
Date: 27/07/2023

BOREHOLE RECORD SHEET

Location Number: BH 02

Project Number: 1-26299

Project Name: Proposed Community Hub

Location: Parkland Drive, Flagstone

Client: Bligh Tanner Consulting Engineers

Date: 13/07/2023

Page: 1 OF 1

Easting: 494392.9

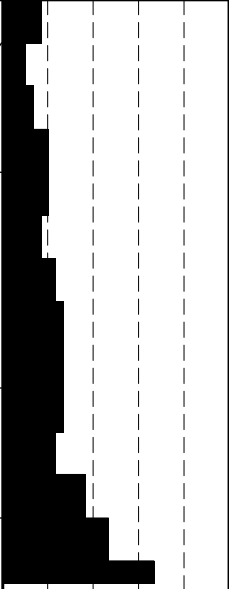
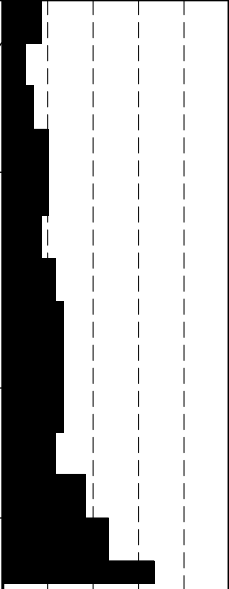
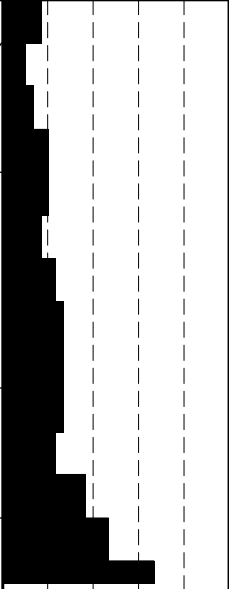
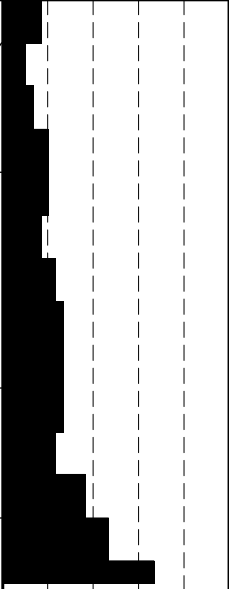
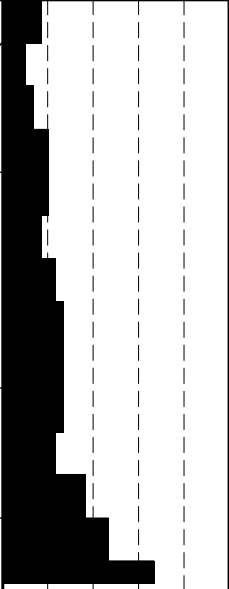
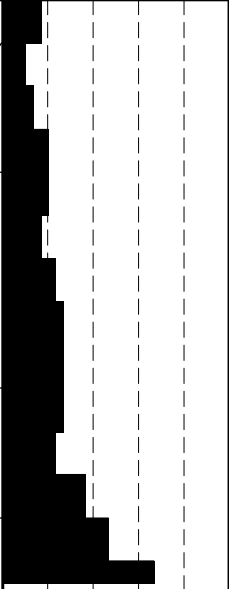
Northing: 6924399

RL:

Logger: TE

Operator: TE

Machine: J 105

Drilling Method					Depth	Graphic	Description	DCP Test (blows/100mm)	Samples and Remarks
TC	WB	RR	NMLC	Casing					
					0.10		FILL Silty Gravelly SAND (SM): Loose, fine to medium grained, brown with grey, fine to medium sized gravel, moist		D
					0.40		FILL Silty SAND (SM): Medium dense, fine to medium grained, brown dark grey, trace low plasticity clay, trace fine to medium sized gravel, moist		
					0.5		FILL Clayey SAND (SC): Medium dense, fine to medium grained, brown dark grey, low plasticity clay, trace fine to medium sized gravel, moist		D B
					0.90		FILL Clayey SAND (SC): Medium dense, fine to medium grained, dark grey, low plasticity clay, trace fine to medium sized gravel, moist		
					1.0		FILL Clayey SAND (SC): Medium dense, fine to medium grained, dark grey, low plasticity clay, trace fine to medium sized gravel, moist		
					1.20		FILL Clayey Gravelly SAND (SC): Medium dense, fine to medium grained, brown grey, low plasticity clay, fine to medium sized gravel, moist		
					1.5		FILL Clayey Gravelly SAND (SC): Medium dense, fine to medium grained, brown grey, low plasticity clay, fine to medium sized gravel, moist		
					1.80		SANDSTONE (DW): Distinctly weathered, very low strength, fine to medium grained, light grey, moist		
					2.0		SANDSTONE (DW): Distinctly weathered, very low strength, fine to medium grained, light grey, moist		
					2.20		SANDSTONE (DW): Distinctly weathered, very low to low strength, fine to medium grained, grey, moist		
					2.40		SANDSTONE (DW): Distinctly weathered, very low to low strength, fine to medium grained, grey, moist		
					2.5		BOREHOLE BH 02 TERMINATED AT 2.40 m		
					3.0				
					3.5				

Comments:

1. Groundwater not encountered during augering
2. DCP refusal at 1.35m
3. TC bit refusal at 2.40m

 Water First Noted Water Steady Level

Weathering Grades

RS - Residual Soil
 XW - Extremely weathered
 HW - Highly weathered
 DW - Distinctly weathered
 MW - Moderately weathered
 SW - Slightly weathered
 FR - Fresh

Rock Strength
 RS - Residual Soil
 VL - Very low
 L - Low
 M - Medium
 H - High
 VH - Very high
 FH - Extremely high

Samples		

U50
SPT
Disturbed
Sample
Bulk
Sample

Approved: CJ
Date: 27/07/2023



Soil Surveys Engineering Pty. Limited
Specialist in Applied Geotechnics
PO Box 317, Paddington, 4064
+61 7 3369 6000
info@soilsurveys.com.au
www.soilsurveys.com.au

BOREHOLE RECORD SHEET

Location Number: BH 03

Project Number: 1-26299

Project Name: Proposed Community Hub

Location: Parkland Drive, Flagstone

Client: Bligh Tanner Consulting Engineers

Date: 13/07/2023

Page: 1 OF 1

Easting: 494420.2 Northing: 6924379 RL:
Logger: TE Operator: TE Machine: J 105

Drilling Method				Depth	Graphic	Description	DCP Test (blows/100mm)						Samples and Remarks	
TC	WB	RR	NMLC				0	6	12	18	24	30		
					0.10	FILL Sandy SILT (ML): Very stiff, low plasticity, brown, fine to medium grained sand, trace fine to medium sized gravel, organic, w > pl								D
						FILL Clayey SAND (SC): Medium dense, fine to medium grained, brown, low plasticity clay, trace fine to medium sized gravel, moist								D
					0.5									
					0.70	FILL Clayey SAND (SC): Medium dense, fine to medium grained, brown, low plasticity clay, trace fine to medium sized gravel, moist								
					1.0									
					1.5									
					2.0									
					2.40									
					2.5	NATURAL SANDSTONE (DW): Distinctly weathered, very low to low strength, fine to medium grained, light brown mottled light grey, moist								
					2.50	BOREHOLE BH 03 TERMINATED AT 2.50 m								
					3.0									
					3.5									

Comments:

- Groundwater not encountered during augering
- DCP refusal at 1.16m
- TC bit refusal at 2.50m

Water First Noted Water Steady Level

Weathering Grades

RS - Residual Soil
XW - Extremely weathered
HW - Highly weathered
DW - Distinctly weathered
MW - Moderately weathered
SW - Slightly weathered
FR - Fresh

Rock Strength

RS - Residual Soil
VL - Very low
L - Low
M - Medium
H - High
VH - Very high
EH - Extremely high

Samples

U50

SPT

Disturbed Sample

Bulk Sample

Approved: CJ

Date: 27/07/2023



Soil Surveys Engineering Pty. Limited
Specialist in Applied Geotechnics
PO Box 317, Paddington, 4064
+61 7 3369 6000
info@soilsurveys.com.au
www.soilsurveys.com.au

BOREHOLE RECORD SHEET

Location Number: BH 05

Project Number: 1-26299

Project Name: Proposed Community Hub

Location: Parkland Drive, Flagstone

Client: Bligh Tanner Consulting Engineers

Date: 13/07/2023

Page: 1 OF 1

Easting: 494432.7 Northing: 6924360 RL:
Logger: TE Operator: TE Machine: J 105

Drilling Method				Depth	Graphic	Description	DCP Test (blows/100mm)	Samples and Remarks
TC	WB	RR	Casing					
				0.08		FILL Silty SAND (SM): Very loose, fine to medium grained, brown, trace fine to medium sized gravel, moist		D
						FILL Clayey SAND (SC): Loose, fine to medium grained, brown, low plasticity clay, trace fine to medium sized gravel, moist		D
				0.5				
				1.0				
				1.40				
				1.5		FILL Clayey Gravelly SAND (SC): Medium dense to dense, fine to medium grained, grey brown, low plasticity clay, fine to medium sized gravel, moist		
				2.0				
				2.10				
				2.30		NATURAL SANDSTONE (DW): Distinctly weathered, very low strength, fine to medium grained, light grey, moist		
						BOREHOLE BH 05 TERMINATED AT 2.30 m		
				2.5				
				3.0				
				3.5				

Comments:

- Groundwater not encountered during augering
- DCP refusal at 0.63m
- TC bit refusal at 2.30m

Weathering Grades

RS - Residual Soil
XW - Extremely weathered
HW - Highly weathered
DW - Distinctly weathered
MW - Moderately weathered
SW - Slightly weathered
FR - Fresh

Rock Strength

RS - Residual Soil
VL - Very low
L - Low
M - Medium
H - High
VH - Very high
EH - Extremely high

Samples

U50

SPT

Disturbed Sample

Bulk Sample

Approved: CJ

Date: 27/07/2023

Water First Noted Water Steady Level

APPENDIX C

LABORATORY TEST CERTIFICATES



SOIL SURVEYS ENGINEERING PTY LIMITED
Specialists in Applied Geotechnics
A.B.N. 70 054 043 631

HELENSVALE LAB
GOLD COAST
Unit 8, 140 Millaroo Drive
HELENSVALE QLD 4212
PH:07 55026795 FAX:0755026724

www.soilsurveys.com.au

info@soilsurveys.com.au

ATTERBERG LIMITS REPORT

Client :	Bligh Tanner Consulting Engineers	Report No:	WHL23-0707-S2-S3
Client Address :	C/O 1/87 Schneider Road, Eagle Farm, QLD 4009	Report Date:	24/07/2023
Project Number :	1-26299	Issue Number:	1
Project :	Flagstone Community Hub	Page 1 of 1	
Location :	Parkland Drive, Flagstone		

SAMPLE DETAILS:

Sample ID:	WHL23-0707-S2	WHL23-0707-S3			
Date Sampled:	13/07/2023	13/07/2023			
Date Tested:	20/07/2023	20/07/2023			
Soil Description:	Silty Sand (SM) Trace of Gravel, Grey Brown	Sand (SP-SM) With Silt, Trace of Gravel, Grey Brown			
Sampling Method:	As Supplied	As Supplied			
Sampled by:	SSE	SSE			
Sample Location:	BH03	BH05			
Depth (m):	0.2-0.5	0.2-0.5			
Source:	Borehole	Borehole			
Material:	Unknown	Unknown			

TEST RESULTS:

Sample Information					
Sample History (AS1289.1.1)	Air Dried	Air Dried			
Preparation (AS1289.1.1)	Dry Sieved	Dry Sieved			
Linear Shrinkage (AS1289.3.4.1)					
Linear Shrinkage (%):	7	7			
Mould Length (mm):	125	125			
Crumbing:	None	None			
Curling:	None	None			
Cracking:	None	None			
Liquid Limit (AS1289.3.1.2)					
Liquid Limit (%):	27	28			
Plastic Limit (AS1290.3.2.1)					
Plastic Limit (%):	13	14			
Plasticity Index (AS1289.3.3.1)					
Plasticity Index (%):	14	14			

Remarks :



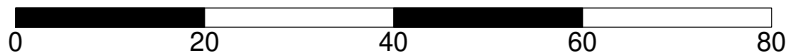
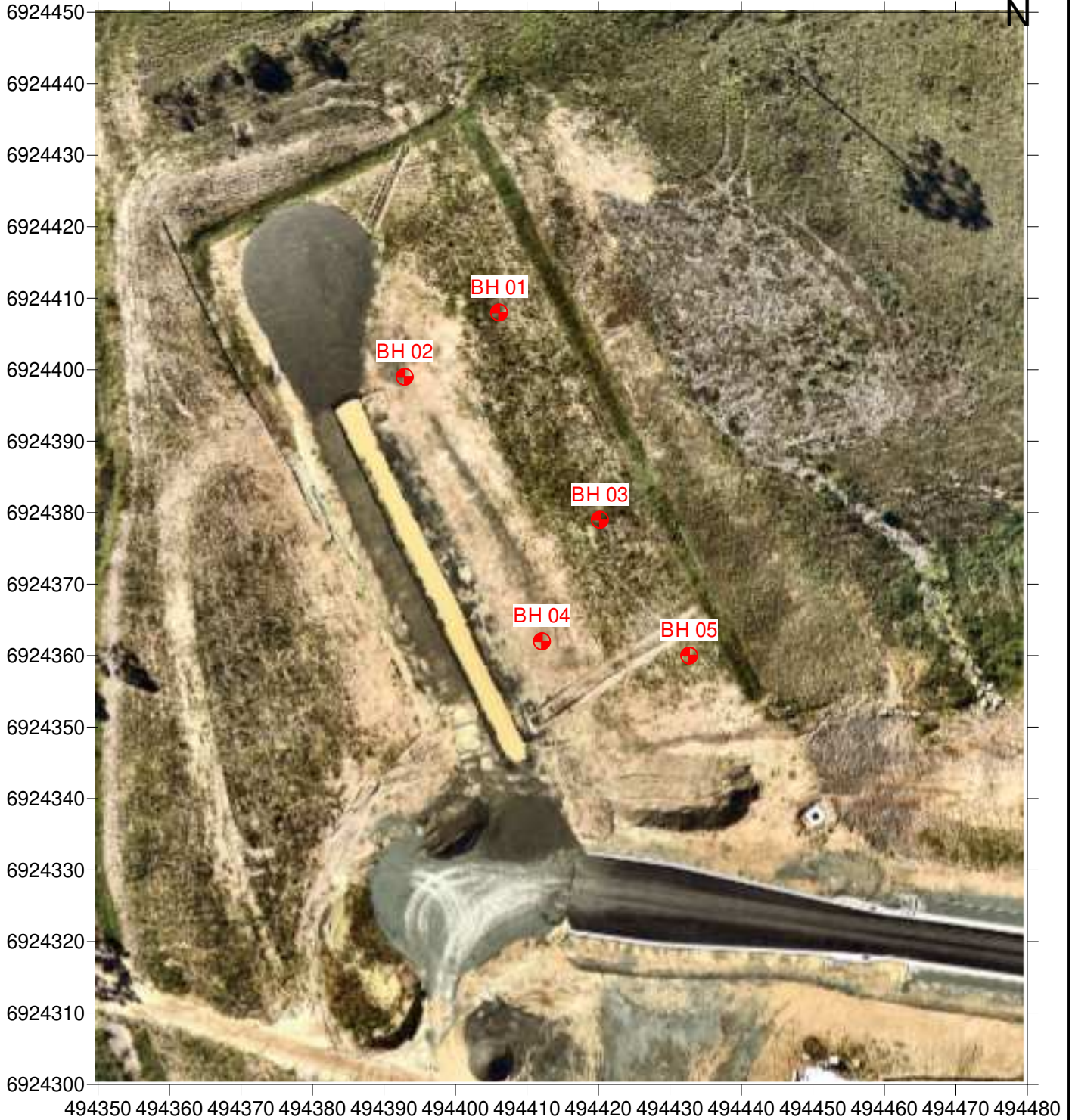
This document is issued in accordance with Soil Surveys Engineering quality requirements. Accredited for compliance with ISO/IEC 17025 - Testing. This document shall not be reproduced, except in full without the approval of Soil Surveys Engineering Pty Limited. Results Only apply to test items in this report

APPROVED SIGNATORY
C. Ferguson-Hannah

NATA Accred No:15301

APPENDIX D

SITE PLAN



LEGEND

 Borehole Locations

Image from Nearmap.com (11/04/2023)

SCALE
1:800 @ A4

DRAWING TITLE

BOREHOLE LOCATION PLAN
Flagstone Community Hub

DRAWING NO.	DATE	CHECKED BY	
A4	1-26299-01	13/07/2023	CJ

CLIENT
Bligh Tanner Consulting Engineers

LOCATION
Parkland Drive, Flagstone

 **SOIL SURVEYS
ENGINEERING**