Geotechnical Investigation Report
Precinct A Subdivision
Mountain Ridge Road, New Beith

Prepared for:
Frasers Property New Beith Pty Ltd
Attention: Mr Dale Scotcher
Level 3, 154 Melbourne Street
South Melbourne QLD 4101

Email: dale.scotcher@fraserspropery.com.au

Report Number: J001800-002-R-Rev0

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2024/1549

Date: 23 October 2025

Queensland Government

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Core Consultants Pty Ltd (Core) for a proposed subdivision (Precinct A) at Mountain Ridge Road, New Beith.

The work was carried out for Frasers Property New Beith Pty Ltd, in accordance with our proposal Q003848-001-L-Rev1, dated 9 December 2022.

Presented in this report is a summary of the site conditions and method of investigation; along with comments and recommendations regarding site preparation, excavatability, groundwater, trafficability, filling, reuse of materials, batter slopes, erosion control, suitable footing types, foundation and retaining wall design parameters and reduction factors, estimated settlements, site classification to AS2870-2011, and pavement (CBR) design parameters.

2.0 OUR UNDERSTANDING OF THE PROJECT

The proposed 'Precinct A' subdivision comprises approximately 500 residential lots within a greater master planned community. The precinct will also include both school and commercial spaces, together with open green space (which we understand will remain undisturbed/vegetated). Large volumes of cut to fill earthworks are proposed, with cuts of up to about 6 m and filling up to 6 m depth anticipated to develop level platforms. Figure 1 in Appendix A shows the contour shading of the current proposed cut to fill earthworks. The subdivision will be accessed from the western end of Mountain Ridge Road, which includes a new rail overpass bridge structure.

3.0 SITE DESCRIPTION

At the time of our investigation, the 'Precinct A' and greater Master Planned Community area was mostly covered with dense native vegetation. Several unsealed tracks traversed randomly through the vegetation which were marginally trafficable in parts during our initial site visit due to heavy erosion. The eastern boundary is adjoined by the ARTC rail corridor, while to the south another residential subdivision was under construction (ref. Image 1).

The topography of the site is characterised by two distinct ridge spurs, one approximately through the centre of the site and the other along the northern boundary of Precinct A. The central spur trends to the southeast, while the northern spur trends from southwest to northeast. A gully line intersects the central parts, generally traversing in a northwest to southeast direction. A second gully line is also present in the southwestern parts, generally traversing in a north to south direction.

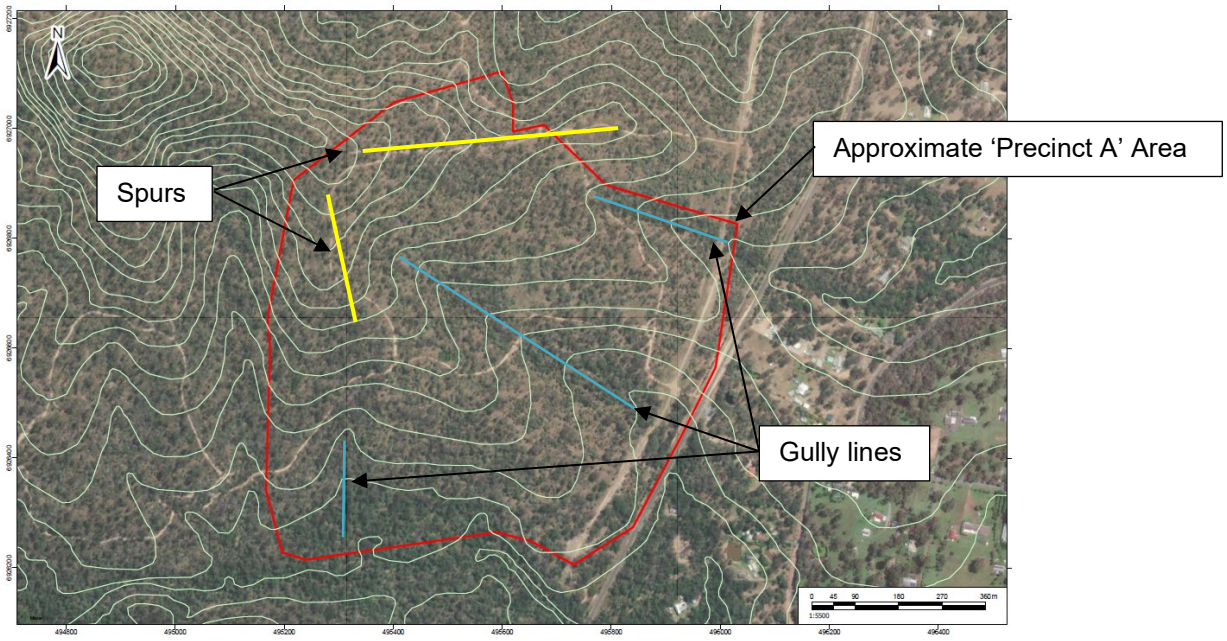

Image 1: Aerial image of the site

General site conditions during our investigation are shown in Photographs 1 to 4.

Photograph 1: General site conditions (aerial drone view looking northwest from southeast corner)

Photograph 2: General site conditions (view looking towards borehole BH22)

Photograph 3: General site conditions (view looking towards borehole BH4)

Photograph 4: Unsealed track in western parts of Precinct A displaying signs of significant erosion.

4.0 METHOD OF INVESTIGATION

4.1 Review of Available Information

To assess likely ground conditions a review of the published geological maps and available geotechnical information was initially undertaken (refer Section 5.1).

4.2 Fieldwork

The fieldwork was carried out between December 2022 and January 2023. The investigation comprised a combination of borehole drilling and geophysical testing across the site. The deeper borehole drilling and geophysical testing targeted the higher elevated areas of the site, where proposed cut excavations are deeper.

Test locations are shown on Figure 1, Test Location Plan attached in Appendix A. Further detail is provided below.

4.2.1 Borehole Drilling

Borehole drilling was carried out in the presence of geotechnical engineers from Core, who logged subsurface conditions encountered in accordance with AS1726-2017 *Geotechnical Site Investigations*. The borehole drilling comprised:

- **Fill Areas & 'Shallow Cut' Areas:** Fifteen (15 No.) boreholes drilled to depths of between 0.45 m and 3 m below ground level (BGL) using 4WD mounted auger rig. Practical auger refusal was encountered in some boreholes. Dynamic cone penetrometer (DCP) testing was undertaken from the surface at each test location to assess the soil density/consistency.
- **'Deep Cut' Areas:** Four (4 No.) boreholes drilled to depths of 8 m BGL using a specialised track-mounted investigation drill rig, using a combination of augering in soils and NMLC coring in weathered rock. DCP testing was undertaken from the surface at each test location to assess the near surface soil density/consistency.

Groundwater seepage/inflow observations were made during auger drilling. Groundwater could not be observed once wash boring and/or NMLC coring commenced due to the introduction of drilling fluids.

Reports of Boreholes, including core photographs, are attached in Appendix B together with explanatory notes. Subsurface conditions are discussed in Section 5.3.

Point load index (PLI) strength testing was carried out on recovered NMLC core at approximately one test per metre. PLI test results are shown on the Report of Boreholes in Appendix B and test certificates are attached in Appendix C.

4.2.1 Geophysical Testing

Geophysical testing in the form of seismic refraction tomography (SRT) was undertaken on 17 January 2023 by an engineering geophysicist from Core.

Seismic refraction comprises measuring the travel times of seismic compressional waves (known as P-Waves). Seismic waves are generated at the ground surface, propagate through the ground, refract at the interface of layers with varying seismic velocities, and then return to the surface.

A total of seven SRT survey alignments (denoted Line 1 to Line 7) were carried out, as shown on the attached Figure 1.

The seismic refraction data was acquired using a 24-channel array with 4.5 Hz vertical geophones spaced horizontally at 2 m (total line length of 46 m), coupled to the ground with spikes. The array was connected to a Geometrics Geode, with data recorded using the Geometrics *Seismodule Controller Software* (SCS).

The seismic source was a 7.25 kg sledgehammer striking a metal plate on the ground surface. A sampling rate of 20.833 μs and sample record length of 0.3 seconds was adopted to record the seismic response.

Seismic data was recorded at five locations within each array and one shot offset from each end of the array. This method of acquisition is consistent with the American Society of Testing Manuals (ASTM) "*D5777-18 Standard Guide for Using the Seismic Refraction Method for Subsurface Investigation"*, along with recommendations for acquisition from the developers of the seismic processing software Intelligent Resources Inc *Rayfract V4.03.*

Lines 1 to 6 were of 46 m length each (i.e., one array length) and Line 7 was 84 m in length, achieved by overlapping the array to produce a continuous survey.

At each source point, the sledgehammer strikes were stacked (typically up to six strikes) to minimise ambient noise (i.e., wind) and enhance the refracted wave signal.

Elevations along each of the SRT alignments were recorded by Core using a GNSS device.

On completion of the data acquisition, and in accordance with industry accepted practice, the seismic data was processed using *Rayfract V4.03*.

Rayfract was used to graphically pick first arrival times (i.e., first breaks) for refracted waves travelling through the surface layer and into higher velocity layers with depth. Only clearly defined first arrival times were picked. A smooth minimum structure 1D initial model was then generated from the first arrival picks, using the Delta-t-V (improved Wiechert-Herglotz) method. The initial model was then refined to produce a closer fit to the first arrival time data, using the Wavepath Eikonal Traveltime (WET) tomographic inversions methods. The WET tomography was run with between 20 and 100 iterations to ensure that adequate convergence between the initial model and the inverted data occurred.

The WET inversion tomographic analysis relies on the assumption that seismic velocities increase continuously in a linear manner with depth (i.e., continuous refraction along the seismic wavepath). This method is considered appropriate for the geology of the site, considering the sedimentary formation generally has a weathering profile consistent with seismic velocity increasing with depth.

During the processing, the picking of first breaks were checked for consistency regarding reciprocal travel times. First breaks were adjusted until the Root Mean Square (RMS) error associated with reciprocal travel time errors were typically below 2%.

The final P-Wave SRT profiles generated within Rayfract were gridded using Golden Software's *Surfer 22*. The resultant profiles are shown on the attached Figures 2 to 8, and the inferred subsurface conditions discussed in Section 5.3.

Wavepath coverage diagrams (produced from Rayfract for each processed survey) are provided with the SRT profiles attached. These diagrams show the subsurface coverage by WET wavepaths (i.e., the number of wavepaths per pixel of a particular finite-difference solution to the seismic eikonal equation). Higher coverage means a more reliable analysis for that subsurface region, as shown in Diagram 1. Regions of low wavepath coverage are indicative of less reliable analysis of subsurface regions.

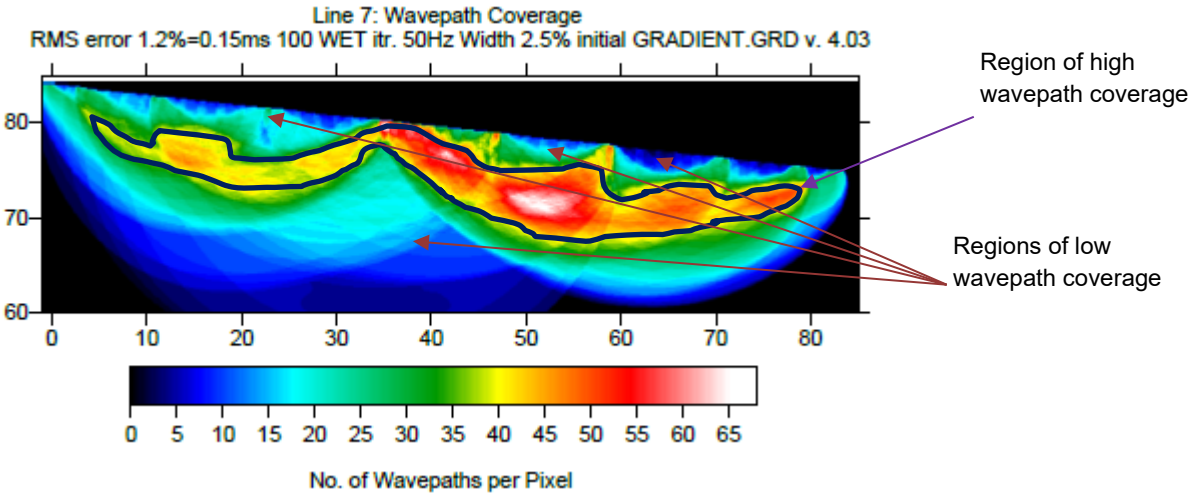

Diagram 1: Wavepath Coverage Diagram for Line 7

4.3 Geotechnical Laboratory Testing

Samples collected from the boreholes were dispatched to NATA accredited laboratories for the following testing:

- Atterberg limits (for soil classification purposes) (2 No.)
- Particle size distribution (for soil classification purposes) (8 No.)
- Emerson Class Number for soil dispersion (8 No.)
- pH, exchangeable cations (EC), cation exchange capacity (CEC), exchangeable sodium percentage (ESP), and Ca/Mg ratio (8 No.)
- 4-Day-Soaked California Bearing Ratio (CBR) (Single point) on subgrade materials (4 No.)

Subgrade CBR testing was undertaken on remoulded samples compacted to 95% Dry Density Ratio (DDR) (standard). The results are provided in Section 5.2.

5.0 RESULTS OF INVESTIGATION

5.1 Published Geological Information

Published information[1] indicates that the majority of the site is underlain by Early Jurassic Age Gatton Sandstone comprising '*Lithic labile and feldspathic labile sandstone'*. An extract of the geological map is shown in Image 2. The subsurface conditions encountered in the boreholes (described below) generally confirm the published geology.

[1] Queensland Geotechnical Database Website

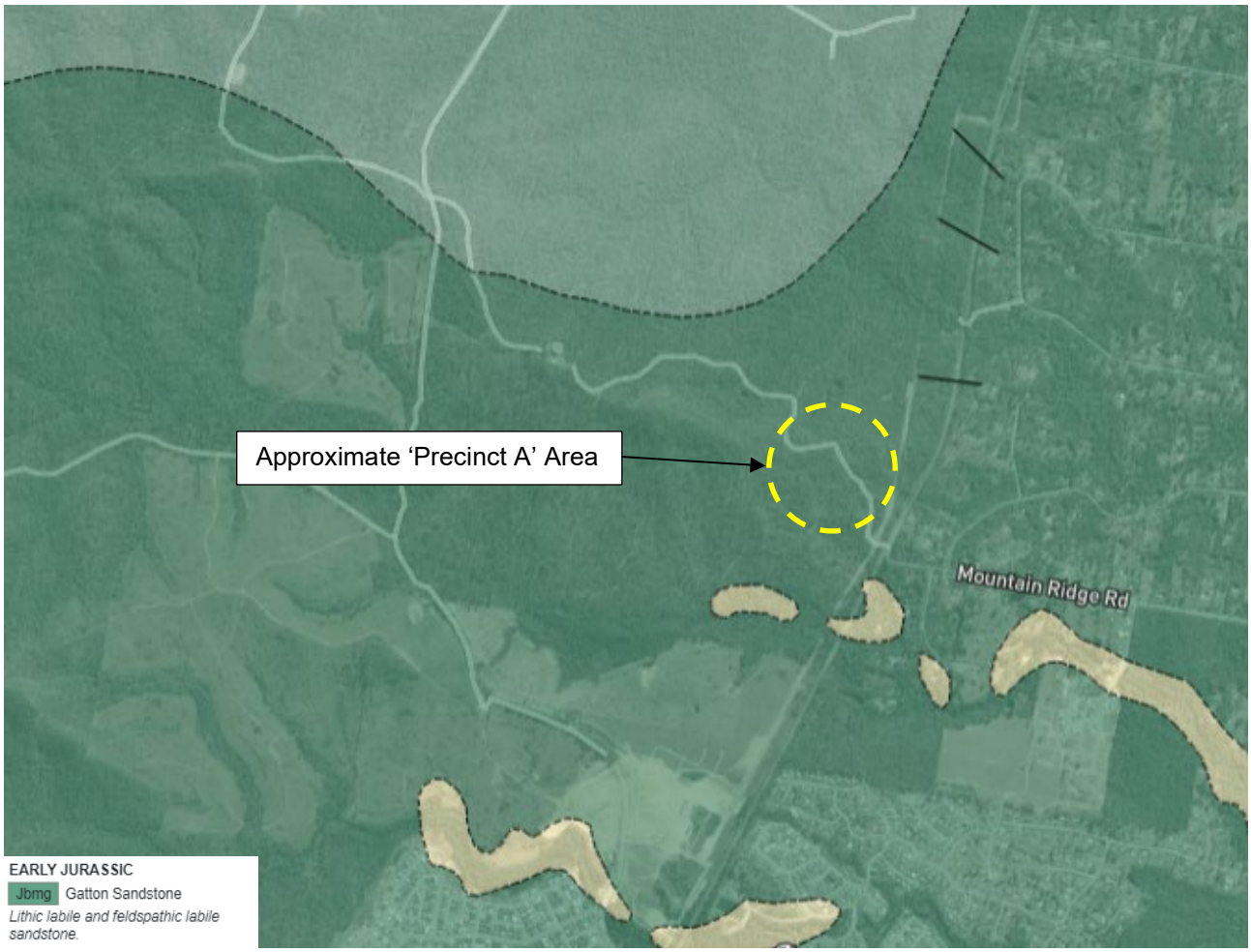

Image 2: Extract from geology mapping

5.2 Geotechnical Laboratory Testing

Laboratory results are summarised in Tables 1 to 2. Laboratory test certificates are attached in Appendix C.

Table 1: Summary of geotechnical laboratory test results

Test ID	Sample Depth (m BGL)	Material Type (Origin)	Field Moisture Content (%)	Optimum Moisture Content (%)	Particle Size Distribution			Atterberg Limits			Soaked CBR(note 1)		Emerson Class Number
					% Fines (Silt/Clay)	Sand (%)	Gravel (%)	Liquid Limit (%)	Plastic Index (%)	Linear Shrinkage (%)	Swell (%)	CBR Value (%)	
BH10	0.2 – 0.4	Silty SAND (Residual Soil)	-		23	77	-	-			-		5
BH11	0.2 – 0.4	Silty SAND (Residual Soil)			24	76	-						5
BH15	0.2 – 0.4	Silty SAND (Residual Soil)			17	82	1						5
BH16	0.1 – 0.3	Silty SAND (Residual Soil)	6.7	10.0	21	78	1				0.0	17	5
BH18	0.3 – 0.7	Silty SAND (Residual Soil)	3.7	9.0	22	78	-				-0.5	13	2
BH20	0.4 – 0.6	Sandy CLAY (Residual Soil)	-	-	43	-	-	34	19	8.5	-	-	3
BH23	0.2 – 0.5	Silty SAND (Residual Soil)	9.6	10.5	20	76	4	18	NP	1.0	-0.5	3.5	5
BH25	0.1 – 0.4	Silty SAND (Residual Soil)	4.3	10.5	19	81	-	-	-	-	-0.5	15	3

Notes:
CBR testing was undertaken on samples remoulded to 95% DDR (standard) at optimum moisture content.
NP denotes Not Plastic

The results of the Emerson class number (ECN) testing indicate that the residual silty sand soils tested range from dispersive (ECN 2) to slightly dispersive (ECN 5), while the single sandy clay residual soil is also dispersive (ECN 3). ECN results are further discussed in Section 6.1.4.

The test results indicate that the clay fraction of the residual soil is of low plasticity.

The laboratory CBR values were achieved on samples compacted at optimum moisture content (OMC) and the field moisture contents in the near surface residual silty sand soils were up to 6% dry of the OMC. Variation of soil moisture content from the OMC typically results in lower CBR results. Laboratory CBR testing represent ideal laboratory conditions and can over-estimate in situ CBR values for sandy materials. Recommended design CBR values are discussed in Section 6.5.

Table 2: Summary of laboratory test results

Test Parameter	Test ID	BH2	BH4	BH8	BH14	BH20	BH23	BH23	BH25
	Sample Depth (m BGL)	0.8-1.1	1.2-1.5	0.8-1.0	0.1-0.3	0.2-0.4	0.2-0.4	0.8-1.0	0.4-0.5
	Units								
pH (1:5 in H20)	pH units	5.25	5.57	5.63	5.50	5.88	5.85	5.62	5.47
Electrical Conductivity	dS/m	0.25	0.08	0.03	0.02	0.02	0.07	0.08	0.16
Exchangeable Potassium	mg/kg	44.8	95.0	139	74.1	59.8	62.9	98.8	126
Exchangeable Calcium	mg/kg	2398	2082	194	369	109	198	89.3	285
Exchangeable Magnesium	mg/kg	553	612	605	159	51.8	44.4	397	909
Exchangeable Sodium	mg/kg	433	480	218	27.7	32.1	45.5	364	756
Exchangeable Potassium	cmol/kg	0.11	0.24	0.36	0.19	0.15	0.16	0.25	0.32
Exchangeable Calcium	cmol/kg	12.0	10.4	0.97	1.85	0.55	0.99	0.45	1.43
Exchangeable Magnesium	cmol/kg	4.61	5.10	5.04	1.33	0.43	0.37	3.31	7.58
Exchangeable Sodium	cmol/kg	1.88	2.09	0.95	0.12	0.14	0.20	1.58	3.29
ECEC	cmol/kg	18.6	17.8	7.32	3.48	1.27	1.72	5.59	12.6
Ca/Mg Ratio	cmol/kg	2.60	2.04	0.19	1.39	1.26	2.68	0.13	0.19
K/Mg Ratio	cmol/kg	0.02	0.05	0.07	0.14	0.36	0.44	0.08	0.04
Exchangeable Potassium %	%	0.62	1.37	4.87	5.46	12.1	9.38	4.53	2.56
Exchangeable Calcium %	%	64.5	58.4	13.3	53.0	42.9	57.6	7.99	11.3
Exchangeable Magnesium %	%	24.8	28.6	68.9	38.1	34.0	21.5	59.2	60.1
Exchangeable Sodium %	%	10.1	11.7	13.0	3.46	11.0	11.5	28.3	26.1

5.3 Subsurface Conditions

The subsurface conditions encountered in the observed boreholes are summarised in Table 3, with further description of the strata below that.

Table 3: Summary of subsurface conditions.

Proposed Earthworks	Borehole No.	Material Depth Range (m)					
		Topsoil	Possible Alluvial Soil	Residual Soil	Extremely Weathered (XW) Material	Sandstone (Very Low to Low Strength)	Sandstone (Medium to High Strength, or stronger)
'Deep' Cuts (2-6 m)	BH2	0 – 0.1	NE	0.1 – 0.4	0.4 – 0.5	0.5 – 1.55	1.55 – 8.0 (TD)
	BH4	0 – 0.1		0.1 – 0.75	NE	0.75 – 1.5	1.5 – 8.0 (TD)
	BH6	0 – 0.1		0.1 – 0.3	0.3 – 0.5	0.5 – 1.3	1.5 – 8.0 (TD)
	BH8	0 – 0.1		0.1 – 0.5	NE	0.5 – 1.5	1.5 – 8.0 (TD)
'Shallow' Cuts (up to 2 m)	BH10	0 – 0.1		0.15 – 0.4		0.4 – 3.0 (TD)	NE
	BH11	NE		0 – 0.5*		0.5 – 0.7 (TD)	R
	BH14	0 – 0.1		0.1 – 0.3		0.3 – 0.65 (TD)	
	BH15	0 – 0.15		0.15 – 0.5		NE	
	BH16	0 – 0.1		0.1 – 0.35		0.35 – 0.45 (TD)	
	BH18	0 – 0.2		0.2 – 1.1		1.1 – 1.15 (TD)	
	BH20	0 – 0.1		0.1 – 0.6		0.6 – 1.0 (TD)	
	BH23	0 – 0.1		0.1 – 0.7		0.7 – 1.5 (TD)	
Fill	BH9	NE		0 – 0.15*	0.15 – 1.2	1.2 – 3.0 (TD)	NE
	BH13	NE		0 – 0.2	NE	0.2 – 1.4 (TD)	R
	BH17	0 – 0.05	0.05 – 0.5	NE	2.0 – 2.4	0.5 – 3.0 (TD)	NE
	BH19	0 – 0.1	NE	0.1 – 0.8	NE	0.8 – 0.85 (TD)	R
	BH22	0 – 0.1	0.1 – 0.6	0.6 – 3.0 (TD)		NE	NE
	BH24	0 – 0.1	NE	0.1 – 0.8		0.8 – 3.0 (TD)	

Notes:
* denotes 'Reworked Residual Soil' present on unsealed graded tracks
NE denotes not encountered.
TD denotes termination depth
R denotes practical auger refusal on inferred low to medium strength (or stronger) sandstone

- **Topsoil:** generally comprising silty sand with grass rootlets. During the fieldwork, observations of the scraped topsoil along survey alignments indicate that large fibrous roots from old tree systems are present throughout the site. These tree roots may extend deeper into the underlying strata. Note that some of the boreholes were undertaken following scraping of the topsoil, therefore, topsoil depths at these locations may not be representative of actual topsoil thicknesses. Cobbles and boulders of inferred high strength (or stronger) sandstone, up to approximately 1 m diameter, were observed at the surface at some locations across the site.
- **Possible Alluvial Soil:** encountered in two boreholes in the southwest parts of the development area, comprising medium dense to very dense silty sand.
- **Residual Soil:** mostly comprising silty sand, medium dense to very dense. Very stiff to hard, medium to high plasticity, silty/sandy clay was also encountered below the silty sand layer at some test locations.
- **XW Sandstone:** generally classified as hard silty/sandy clay.
- **Sandstone (VL-L Strength):** typically highly weathered (i.e., distinctly weathered), fine to medium grained, grey-brown, orange brown, grey, brown and pale brown.
- **Sandstone (M-H Strength):** mostly moderately to slightly weathered with some extremely to highly weathered zones, fine to medium grained, and brown and blue grey in colour. Generally massive in structure with defect spacings ranging up to about 3.5 m encountered within the investigation depths.

Groundwater seepage was not encountered during auger drilling. Groundwater levels are likely to vary depending on rainfall conditions and also with climate, changes to surface and subsurface drainage conditions and human activity.

The results of the geophysical testing (refer Figures 2 to 8) indicate some variability in the P (compression) wave velocity profiles, with velocities of up to approximately 2,000 m/s in the upper 1 m to 8 m, increasing to around 2,500 m/s from depths of approximately 2 m to 12 m. The variability and troughs of lower velocity materials shown on some of the lines are possibly indicative of a more weathered profile in parts of the site or could be due to the prevalence of joint sets impeding the compression wave transmission and it is important that these results not be viewed or relied on in isolation from the geological conditions and the other parts of the investigation.

6.0 GEOTECHNICAL COMMENTS & RECOMMENDATIONS

6.1 Earthworks

Earthworks in the Precinct area is expected to comprise stripping of topsoil and rootlets, removal of trees and vegetation and cut to fill bulk earthworks. Cuts of up to about 6 m and filling up to 6 m depth are anticipated.

6.1.1 Excavatability & Rock Rippability Assessment

Excavations within the overlying residual soils, extremely weathered material, and very low to low strength sandstone should be achievable using conventional medium to large earthmoving equipment (i.e., 30 tonne excavators and D8 dozers). Alternatively, larger machinery could be used to improve production/efficiency rates, and in confined excavations such as trenching; a ripping tyne or hydraulic rock breakers may be required.

To provide an indication of the rippability/excavatability of the underlying moderately to slightly weathered, medium to high strength sandstone, an assessment has been carried out based on the work by Pettifer and Fookes (1994)[2].

This assessment is based on the results of point load index testing, together with rock mass fracture spacing (i.e., fracture/defect spacing of the rock mass) as denoted on the attached borehole reports.

Figure 9 in Appendix E presents a Pettifer and Fookes rock excavatability chart for the sandstone recovered as NMLC core from the drilled boreholes. Equivalent UCS values have been estimated from the point load index (PLI) values using the commonly used correlation of UCS_{equiv} = 24 x PLI. Comparison of the point load index and UCS test results carried out by Core and DP for the rail overpass bridge investigation generally supports this correlation.

This empirical estimate of rock excavatability indicates that the medium to high strength sandstone within the proposed cut excavation depths is mostly within the ‘Hard to Extremely Hard Ripping’ ranges and D11 dozers are recommended. Smaller dozers (e.g. D10) could be considered however productivity and efficiency rates will likely be impacted and some of the rock will most likely be ‘Marginal’ to ‘Non-Rippable’. As fracture frequencies decrease (i.e., fracture spacings and block sizes increase), the sandstone is assessed to fall within the ‘Blasting’ range.

The SRT profiles (ref. Appendix C, Figures 2 to 8) generally agree with the above assessment that the majority of the proposed cut earthworks are within the ‘Rippable’ (up to about 3,000 m/s) range based on the rippability chart for a D11 dozer as published in the Catepillar Handbook of Ripping. A small zone was identified on one SRT profile (ref. Figure 4) to be within the ‘marginal’ range, and the rippability of such materials will depend on the fracture frequencies and orientation. Ripping direction should also be oriented to take best advantage of the fracturing/bedding.

[2] Pettifer, G.S., and Fookes, P.G., A Revision of the Graphical Method for Assessing the Excavatability of Rock, Quarterly Journal of Engineering Geology, Vol 27, pp 145-164.

Note that WET tomography used to produce our P-wave velocity profiles is not the method that was used to produce the Caterpillar charts. Therefore, our inferred rippability profiles produced using the Catepillar P-wave velocity categories should only be used as a general guide.

6.1.2 Site Preparation & Trafficability

Prior to the placement of fill or construction at-grade, the following works are recommended:

- Strip the surface of existing vegetation (grass and weeds) and root affected soils (expected to be about 0.1 m thick based on the results of the investigation). Localised deeper stripping/excavation (i.e. grubbing) would be required where larger tree root systems need to be removed. Any organic rich topsoil must not be used as fill in proposed building and/or pavement areas, however it may be used for non-structural purposes (i.e. landscaping).
- Any oversize, high strength, cobbles and boulders present at the surface will need to be removed and either used for landscaping, erosion protection (after breaking down in size) or crushed and used for fill or be removed from site.
- Tree clearing and removal of stumps should be carried out some time (weeks) before bulk earthworks to allow the ground moisture contents to stabilise. Similarly, wet materials in gully areas in particular will need time to dry out before using in fill.
- Benching of sloping surfaces. Also note that to control differential settlements across house pads to acceptable levels may need additional benching to reduce the gradient of differential fill thicknesses.
- 'Proof roll' the stripped surface by several passes of a minimum 10 tonne smooth drum roller to identify loose/soft areas. The silty/clayey subgrade materials will undergo strength loss if they become wet, and trafficability may be poor during and following periods of wet weather. Where weathered bedrock is exposed at the cut surface level, proof rolling may not be required but should be assessed by a suitably qualified and experienced geotechnical engineer.
- To reduce the risk of 'hard spots' below buildings and pavements, and to allow for future construction of shallow footings and underground services, the cut areas of the bulk excavation should be over excavated by at least 0.6 m below platform level (and ripped and compacted below that) and replaced with controlled fill.
- A suitably qualified and experienced geotechnical engineer should carry out inspections of the subgrade to help identify any areas of unsuitable material or weak subgrade that may be present following stripping. Loose/soft or wet material will require moisture adjustment and compaction, or removal and replacement.
- Loose/soft areas identified by proof rolling could be treated by either of the following methods:
    - Over-excavation and replacement with clean granular fill (i.e. containing less than 5% fines) compacted in layers; or
    - Tyning, drying and re-compaction of the loose/soft material provided that it does not contain substantial organic matter. It should be noted that tyning, drying and re-compaction of loose/soft areas requires more time than excavation and replacement with granular fill and is more prone to be affected by wet weather.

6.1.3 Material Re-use as Fill

Based on the subsurface conditions encountered, soil/rock from potential excavation areas will generally be suitable for reuse as structural fill provided materials are free from deleterious material, oversize particles (>150 mm size), and organic matter. The following issues should also be considered with regard to re-use of the site materials for structural fill:

- Material containing significant organics (i.e. > 3%) must not be used for structural fill.
- The clay component of the residual soil tested in the laboratory was generally low reactive. Only limited testing was carried out on the clays due to the mostly silty sand profile and shallow rock.

However, based on our experience in this area, moderately to highly reactive soils may be encountered during bulk earthworks and may present difficulties with handling, placement, and compaction if they become too moist. It is recommended that this material be moisture conditioned to within 2% of optimum moisture content (OMC) for compaction. Blending with less reactive (i.e. relatively inert material) and/or granular soils should produce a more workable material.

- Site-won materials will likely need to be moisture conditioned to achieve adequate compaction. It is recommended that moisture density relationship testing (i.e. laboratory compaction test) be undertaken to help assess the extent of moisture conditioning required. The laboratory testing generally indicates that the field moisture contents of the overlying sandy residual soils ranged up to about 6% dry of OMC in the Precinct area, however this will be subject to weather conditions leading up to, and during the earthworks.
- Where clayey soils are proposed to be re-used in fill embankments, it is recommended that cohesive materials be placed at depth and granular materials be placed in the upper parts of the profile. This will reduce the effects of seasonal moisture change and foundation soil reactivity and will improve pavement subgrade conditions and surface trafficability during construction. Re-use of sands will require blending with clay to improve workability.
- Excavation spoil from the underlying medium to high strength sandstone may contain a significant proportion of 'oversize' particles. Whilst the larger particles will break down somewhat with handling and tracking with a larger dozer, the material would overall be considered a 'rock fill'. Such oversize particles will need to be crushed or screened and removed from excavation spoil prior to re-using as structural fill. This may be costly and time-consuming. This also includes the larger high strength boulders observed at the surface in some parts of the site.
- It would be prudent to consider carrying out a trial excavation prior to the bulk earthworks stage using a large (minimum 40 tonne) excavator to assess the general particle size distribution of the recovered rock. If significant volumes of oversize material are being recovered which doesn't break down under track rolling, consideration could be given to using the oversize material as 'rock fill' placed in the lower parts of the proposed deeper fills, below areas such as parks and commercial spaces (but not below residential lots).

6.1.4 Filling and Compaction

It is recommended that filling is carried out with Level 1 supervision and testing in accordance with Australian Standard AS 3798-2007.

Where filling is proposed, the following measures should be adopted:

- Fill should be compacted at moisture contents within the range of 2% of optimum moisture content for Standard Compaction.
- Confirmatory compaction testing must be carried out at regular intervals. Guidance on testing frequency is provided in AS 3798-2007 Table 8.1.
- Fill should have a maximum particle size of 150 mm.
- Fill should be compacted in layers, typically not more than 300 mm thick (loose thickness) for large scale earthworks operations. However, layer thickness will be dependent upon the type/size of compaction plant, use of vibration, material type and condition.
- Fill shall be compacted by repeated rolling to achieve a dry density ratio (DDR) of at least 98% of the Maximum Standard Dry Density for cohesive soils, or 75% Dry Density Index for cohesionless soils. Higher degrees of compaction will be required for pavement sub-bases and base courses. A maximum DDR of 103% is recommended for any clayey fill particularly if dry of optimum to reduce swell potential of the reactive clays.
- Imported fill should be cohesive in nature and have a plasticity index of < 15%, a maximum particle size of 150 mm, a minimum fines content of 15%, and a soaked CBR of > 10%.

- Slopes exceeding 1V:8H and existing drainage channels should be benched to assist with fill placement and compaction.
- Fill embankment final slopes should be 'over built' then trimmed back to the well compacted material.

Further details for control and testing of fill are given in Australian Standard *AS 3798-2007 Guidelines on Earthworks for Commercial and Residential Developments*.

The settlement of well compacted fill derived from screened excavation spoil is unlikely to exceed 0.5% to 1% of fill thickness (i.e. about 30 mm to 60 mm for a 6 m thickness of fill).

In poor subgrade areas (e.g. potentially in gully lines etc.) the use of geotextiles and/or rock/gravel bridging layers may be required.

6.1.5 Soil Dispersion & Erosion Protection

The existing subsurface profile generally comprised a silty sand layer overlying residual clay soils and/or weathered rock. When undisturbed (i.e. vegetation remaining intact) only minor erosion is observed. However, once these sandy surface soils and subsoil layers are exposed to water and disturbed, erosion is likely to become a significant issue, as exemplified earlier in Photograph 4.

Any excavations or disturbance of materials should be carefully monitored and managed during the construction phase to minimise potential for scour/erosion and sediment run off. The results of the Emerson class number (ECN) (i.e. soil dispersion) testing indicate that the overlying near surface residual silty sand soils tested range from highly dispersive (ECN 2) to slightly dispersive (ECN 5), while the single sandy clay residual soil is also dispersive (ECN 3)

The exchangeable sodium percentages (ESP) mostly ranged from approximately ESP 10% (*sodic)* to ESP 28% (*very strongly sodic)* consistent with the findings of the ECN testing (sodic soils are mostly dispersive). Three of the samples also reported Ca:Mg ratios between 0.1 and 0.4, which supports the assessment that highly dispersive soils are present in the area.

Based on the results of field and laboratory testing, it is assessed that there is a moderate to high potential for erosion if the subgrade soils are exposed during or following construction. A Dispersive Soil Management Plan (DSMP) will likely be required by Council for this proposed development and the soil types encountered.

The DSMP is to address protection measures to be implemented to reduce the risk of soil erosion, such as:

- Exposed soil (i.e. on batters or drains etc.) should be protected from erosion by appropriate measures such as topsoil at least 150 mm deep, re-vegetation and hydro-seeding, protective matting, or hard facings.
- Temporary sediment control should be adopted during construction where surface water will flow offsite.
- Concentrating surface runoff should be avoided unless adequate erosion protection and flow dissipation structures are constructed. Captured runoff is to be dissipated and spread over as wide an area as possible.
- Capping upper part of stormwater trenches with non-cracking/non-reactive and non-dispersive soils.
- Mixing of gypsum into soils (subject to close control of pH levels when in close proximity to waterways and other sensitive environments).
- Use of subsoil drains in major stormwater trench backfill to collect and carry seepage in a controlled manner into stormwater collection systems.

6.1.6 Batter Slopes

For short-term construction periods, excavated unsurcharged faces up to 3 m in vertical height in the residual soils and extremely weathered rock could be battered at 1V:1H or benched to an equivalent slope with bench heights not exceeding 1.5 m.

Near vertical excavations in the medium to high strength sandstone up to 3 m high should be stable in the short term subject to absence of adverse conditions (e.g. a combination of subvertical joints that could result in toppling wedges, or groundwater) and provided there are no surcharges on the crest areas. Specific assessment of safe batter slopes would be required at time of construction.

Flatter batters or temporary support systems (e.g. ‘shields’ or ‘shoring boxes’ for trenches) may be required if significant groundwater seepage is encountered or if exposed faces are not protected from erosion by rainfall. Flatter batters may also be required where fissuring is observed within the clay soils. Shoring would be required to enable safe personnel entry into trenches (with vertical sides) deeper than 1 m.

Permanent fill embankment and excavation batters not more than 3 m high can be formed no steeper than:

- 1V:2H in controlled fill, medium dense (or denser) sands, stiff (or stronger) residual soils and extremely weathered rock.
- 1V:1H in the highly weathered (or fresher), medium to high strength rock (possibly steeper subject to inspection and assessment by a geotechnical engineer).

Fill batters should be ‘overfilled’ then trimmed back to the compacted materials.

Permanent batters in soils and extremely weathered rock that are not retained should be protected from erosion with some form of surface protection (e.g. revegetation or geotextile matting) and drainage.

The following general recommendations should be considered in the design:

- Batters should be vegetated as soon as possible after construction with quickly establishing vegetation suitable for the expected climate. This could possibly be carried out by hydroseeding. Alternatively, batters could be covered with Geoweb or Grassroots (or equivalent) erosion control matting.
- Construct cut-off drainage at the crest of cuts and fill embankments to intercept any surface water flow and direct it away from the slope.
- In embankments, incorporate an outer verge material with low erosion potential in the construction of ponds/basins/lakes and embankments. Laboratory testing carried out indicates the site won residual soils are generally dispersive, and probably unsuitable. Some of the crushed sandstone might however be suitable. Imported fill could be used providing that it is non-dispersive.

Notwithstanding the above, routine maintenance of the batters may be required, particularly after heavy rainfall events.

Positive support by engineer designed retained structures will be required where space restrictions prevent trimming of batters to safe slopes and where slopes are surcharged or near movement sensitive structures.

The above recommendations do not supersede any existing safety regulations or legislation applicable to excavations (e.g. limits on personnel entry into trenches).

6.2 Retaining Wall Design Parameters

Due to the presence of shallow rock, mass gravity boulder/cut sandstone type walls are likely to be suitable to retain fills and cuts; the use of concrete sleeper walls could encounter difficulties associated with drilling piers into the medium to high (or stronger) rock.

The design of retaining walls may be undertaken using a triangular pressure distribution and the earth pressure coefficients given below in Table 4.

Where the walls are rigid and cannot rotate or tilt, then an 'at-rest' earth pressure coefficient (K_0) should be used. Passive pressure should be ignored where there is potential for in-ground services trenches (or similar) in front of the wall.

Table 4: Lateral Earth Pressure Coefficients.

Retained Material	Bulk Density (kN/m³)	Ø' (degrees)	c' (kPa)	Cohesion c_u (kPa)	Lateral Earth Pressure Coefficients		
					K_a	K_p	K_o
Stiff clay	18	20	5	50	0.41	2.46	0.58
Very stiff clay	19	23	5	100	0.36	2.77	0.53
Hard clay	20	27	5	200	0.31	3.25	0.47
Dense sand	19	32	-	-	0.31	3.26	0.47
Very dense sand	20	34	-	-	0.28	3.54	0.44
Very low to low strength rock	21	40	-	-	0.22	4.5	0.35
Medium to high strength rock	24	45	-	-	0.17	5.8	0.29
Fill (future)	*	*		*	*	*	*

Notes:

** Depends on fill material type and level of compaction*

K_a - active; K_o - at rest; K_p – passive

For yielding walls active state develops when: Deflection > 0.001H to 0.004H (granular soil), or deflection > 0.01H to 0.04H (cohesive soil)

Apply ±2°to Ø' and ±3 kPa to c'

Active earth pressure coefficients are calculated based on Coulomb earth pressure theory; with the assumption that there is zero friction between the wall and the backfill material.

If appropriate, an allowance of 10 kPa should be made for lateral stresses induced by compaction plant operating behind the walls. The effects of surcharge should be included by multiplying the vertical pressure developed by the surcharge by the appropriate lateral earth pressure coefficient from Table 4. Allowance should be made for sloping backfill if applicable.

Drainage material behind the wall should be installed for the full height of the wall, for a width of at least 0.3 m with a geotextile separator for mass gravity walls. The material must be free draining and granular and have a perforated or slotted drainage pipe at the heel of the wall to rapidly remove the water into the stormwater system. Alternatively, the wall will need to be designed for full hydrostatic pressure.

Footings for retaining walls should be founded following the recommendations in Section 6.3. It should be noted that each footing should have geotechnical inspection/testing to confirm the required design bearing pressure has been achieved.

6.3 Foundation Design

6.3.1 Shrink-Swell Potential

The site classification is derived in accordance with Australian Standard AS 2870-2011 *Residential slabs and footings* and provides an indication of the likely magnitude of reactive (shrink and swell) movements associated with normal seasonal soil moisture variations (y_s).

The estimated range of y_s is calculated in accordance with the methodology presented in AS2870-2011, by assessment of the soil suction change, factored for lateral restraint multiplied by the soil layer thickness and the instability index (estimated from Shrink-Swell index (I_{ss})).

For the New Beith region AS2870-2011 recommends a depth of design suction change H_s of 1.8 m.

Based on the Atterberg Limits and PSD results, estimated Iss values in the order of 1% to 2 % could be adopted for the residual clay materials. The previous DP report prepared for the rail overpass suggests values in the order of 1% to 1.7% for the residual soils. The underlying sandstone materials in this area

contain varying amounts of clay content which are generally reactive to moisture variations. Laboratory testing has not been carried out on the reactivity of the underlying weathered rock materials, however based on our experience with similar materials, we have allowed for a Shrink-Swell Index (I_{ss}) value of 0.5% in our calculated characteristic ground surface movements (Ys) which the DP report agrees with.

Bulk earthworks are proposed to achieve the design levels across the site. The earthworks methodology and depth of cut and fill will affect the I_{ss} value, and subsequent y_s. Further testing and assessment should be carried out in the building footprints following bulk earthworks.

Based on the above information we have carried out several calculations using the maximum I_{ss} value and natural/cut/fill soil profile scenarios to estimate y_s. Allowance for the effect of the existing tree groups was made for the existing soil profile using the methods set out AS2870-2011.

The range of results and the conditions for which those results were calculated are presented in Table 5.

Table 5: Estimated Characteristic Ground Surface Movements (y_s)

Adopted I_{ss} Value	Estimated characteristic ground surface movement y_s (mm)*		
	Existing Residual Silty Sand/Clay Profile	After cut/fill earthworks with min. 0.5 m of select granular fill upper layer	After cut/fill earthworks (full depth clay profile)
2%	50 (Class H1)	25 (Class M)	40 (Class H1)

Note: * - due to normal seasonal moisture change alone, additional movements for fill settlements where applicable

The fill scenarios have been included to demonstrate that where site won clayey materials are re-used alone to construct fill embankments, higher ground surface movements should be anticipated. Selective reuse of materials to cap building areas would provide a reduction in site movements, as well as more weather tolerant working surface. It is also noted that where fill is present allowance for fill settlement will be required in the design of foundations, and these movements would increase.

In cut areas, where weathered sandstone is present at the cut level, and the structures are wholly founded in the rock, then a 'Class A' classification could be adopted with y_s values expected to be less than 10 mm.

Individual 'soil tests' will be required in each building envelope for footing design purposes following bulk earthworks.

Recommendations to minimise reactive movements are provided in Section 6.3.2.

Further information regarding design of houses on reactive soils are found in the Queensland Building and Construction Commission document in Appendix F.

6.3.2 Recommendations to Reduce Reactive Movements

To minimise potential reactive movements across the construction area where clays are present, the following measures should be considered in the design, construction and general maintenance of the development:

- Blending moderately to highly reactive soils (if encountered) with imported non-reactive fill. This may, however, increase the handling required of such material, which may be uneconomical, and the high plasticity may make this very difficult to achieve. This should be verified through lab trials prior to construction if this approach is to be adopted.
- Removing the clay soils from the upper profile in cut areas and replacing them with less reactive (i.e. inert) materials will reduce the characteristic ground surface movements. It is important that the fill contains some fines (i.e. between approximately 15% and 20%) to prevent / reduce moisture ingress to the existing natural profile below.
- Sealed pavements around ground slabs or footings should act to reduce seasonal variations in moisture content and resultant reactive ground surface movements.

- Relatively high variations in subgrade moisture content could potentially result in adverse, non-uniform reactive movements that are significantly greater than those estimated above for 'normal' seasonal moisture changes. The risk of these high variations in moisture content occurring could be minimised by ensuring that ponding of water, leaking pipes, planting trees/shrubs close to structures, etc. is avoided.
- The construction area should be graded to shed surface water runoff and prevent ponding around footings and other movement sensitive areas. Surface gradients should be confirmed during earthworks design, however, a gradient of not less than 1V:20H is suggested to prevent ponding.
- Services should be designed to be flexible to help maintain their serviceability.
- Any vegetation should not remain (or be planted) closer than twice their mature height to movement sensitive structures unless significantly greater reactive movements than those nominated above are allowed for in design.

6.3.3 High Level Footings

Conventional high-level strip and pad footings could be considered with slab stiffening to suit the characteristic ground surface movements (y_s). High level footings could be founded in controlled certified fill, residual soil or weathered rock. Such footings could be designed using the allowable bearing capacity values presented in Table 6.

Table 6: Allowable Bearing Capacity Design Values

Material Type	Compaction/Consistency/Strength	Allowable Bearing Capacity* (kPa)
Level 1 Certified Fill	98% Standard MDD (Minimum)	100
Residual/XW	Stiff clays/medium dense sands	100
	Very Stiff clays/dense sands	200
	Hard clays/very dense sands	400
Sandstone	Very Low to Low	600
	Medium to High	1500

Note:* Allowable Bearing Capacities for soils presented are based on a factor of safety of 3.0 from ultimate values. The values provided are based on the assumption that suitable foundation preparation has been carried out and that the ground strength profile is uniform through each layer (with no underlying lower strength material).

At the pressures nominated above, footing settlements would not be expected to exceed around 1 % of footing width for strips and pads, under serviceability loads. Differential settlements between adjacent footings would not be expected to exceed approximately 50 % of the total settlement for individual footings. Additional stiffening may be required where footings are founded in both soil and rock.

A geotechnical engineer must confirm the design bearing pressures during subdivisional construction.

6.3.4 Piles

If higher dead and/or live loads are expected, structures could alternatively be supported by piled foundations.

Bored or screw piles founded in the stiff (or stronger) residual soils or sandstone could be considered.

Ultimate geotechnical capacities ($R_{d,ug}$) determined from the parameters provided in Table 7 must be multiplied by a geotechnical strength reduction factor ($ø_g$) in accordance with Section 4 of AS 2159-2009 *Piling – Design and installation*, to determine the design geotechnical strength ($R_{d,g}$). The geotechnical strength reduction factor should be determined in accordance with AS 2159-2009 and is expected to be in the range of 0.45 to 0.55. An upper bound value may be adopted if supervision and certification of pile construction is carried out by a geotechnical engineer. Settlement of piled footings are expected to be in the order of 0.5% to 1% of the pile diameter.

The soils to a depth 1.5 times the pile diameter below the excavated surface should be ignored in the assessment of lateral capacity. The lateral capacity of piles may be determined using various methods, and which generally require an estimation of the Young's modulus (Es) of the founding stratum.

Specialist piling contractors should be consulted with respect to selection of suitable pile types, detailed design of piles, and suitable dynamic pile testing methods and testing frequency. Table 7 shows representative values of ultimate (unfactored) geotechnical parameters for pile design.

Table 7: Design values for pile design

Material type	Unit weight Y (kN/m^3)	ϕ (degrees)	C_u (kPa)	Elastic Modulus (MPa)	Ultimate skin friction (kPa)	Ultimate base resistance (kPa)
Stiff Clay	18	-	50	8	10	450
Very Stiff Clay	19	-	100	15	30	900
Hard Clay	20	-	200	40	50	1,800
Dense Sand	19	32	-	50	50	2,000
Very Dense Sand	20	34	-	80	80	
Very Low to Low Strength Sandstone	21	40	-	150	100	4,500
Medium to High Strength Sandstone	24	45	-	500	600	10,000

Notes:

1) *N/R denotes not recommended*
2) *Skin friction should be discounted for sections of pile shafts where liners are in place.*
3) *Indicative values taken from published paper, Site Characterisation, Terence Wiesner, Australian Geomechanics – Dec 1999 and 'Foundation Analysis & Design (Bowles, 4th Edition)*

Due to potential shrinkage of the clay stratum away from pile shafts in dry weather conditions, the skin friction and fixity over the upper 0.9 m depth on the pile should be neglected when assessing uplift and lateral restraint capacity. Similarly, potential swell over the soil profile (up to 0.9 m depth) will need to be allowed for when assessing pile tensile force requirements.

6.3.5 General Comments on Footings

All proposed footings should found such that they are not adversely affected by any adjacent excavations, batter slopes, trenches, or retaining walls that are not designed to support structure/equipment loads. To minimise the potential for any adverse interaction effects, footings should found at least below a plane extending 1 m horizontally from the base of trenches/batter slopes/excavations/retaining walls, then rising up at 1V:1H, as illustrated in Diagram 2.

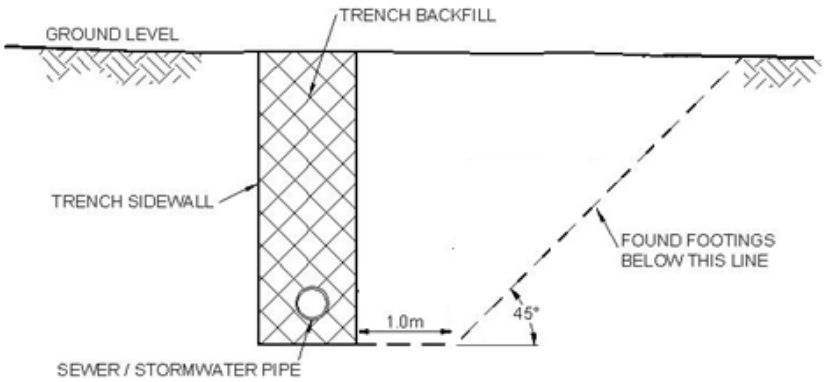

Diagram 2

Excavations adjacent to existing structures/equipment must be careful not to undermine existing footings.

Any high-level footing excavations should be cleaned following mechanical excavation to expose undisturbed materials over the full base area. It is recommended that footings be inspected by a suitably

qualified and experienced geotechnical engineer prior to placement of blinding/mass concrete or steel reinforcement to confirm allowable bearing pressures and cleanliness of excavations.

If any soil conditions encountered during construction are found to differ from those noted in the geotechnical investigation, Core should be notified immediately, and an inspection carried out to determine if changes to footing design are required.

Adequate site drainage should be carried out to ensure that natural runoff is directed off construction area platforms and away from any footings. If water is allowed to pond on the platform, associated softening of the soil may occur, and the allowable bearing capacity is likely to be less than those values given above. Increased soil reactivity may also result.

6.4 Preliminary Pavement Design (CBR) Parameters

Design parameters for pavements will be dependent upon the subgrade materials present after earthworks and the type, depth and quality of any fill used to bring the site to design levels. If subgrade conditions exposed following earthworks differ from those encountered in the boreholes, further subgrade evaluation (including further testing) should be undertaken during the construction stage.

The anticipated subgrades are expected to comprise a combination of residual silty sand or silty/sandy clay materials, weathered sandstone, and re-used site-won sandy/clayey/crushed sandstone fill materials.

Laboratory test results generally indicate a soaked CBR range of 13% to 17% for the near surface silty sand materials encountered in the boreholes. One test returned a CBR value of 3.5%, however we understand from the laboratory that the lower value could be associated with the type of material and the compaction rate (i.e. 95% Dry Density Ratio (DDR) (standard)) adopted.

Based on our experience with such materials it is recommended that a subgrade CBR value of 10% be adopted for the residual sandy materials. If clay materials are present at the subgrade level following cut to fill earthworks, lower CBR values are anticipated and a preliminary value of 5% could be adopted but will be subject to further assessment and testing. Where low strength (or stronger), moderately weathered (or fresher) sandstone is present at the subgrade level following cut earthworks, higher CBR values may be available but will be subject to further assessment and testing.

The preliminary pavement design value given above is applicable for properly drained subgrades only and should be confirmed by further CBR testing and inspection during earthworks. Properly drained subgrades should allow for open graded drains that shed water and prevent ponding.

Rolling of the subgrade materials must be carried out prior to any fill placement. If subgrade materials are allowed to ‘dry out’, significant softening (and resulting subgrade strength less than nominated above) could occur on ‘wetting up’.

Compaction testing should be carried out on pavement subgrades to confirm in situ densities prior to pavement construction. Areas of subgrade not compacted to the minimum relative dry density ratio should be moisture conditioned and recompacted to achieve performance in line with that inferred from recommended CBR design values (i.e. CBR value at 97% DDR).

7.0 LIMITATIONS

Should you require any further information please contact the undersigned. We draw your attention to the document, Limitations, which is included in Appendix G.

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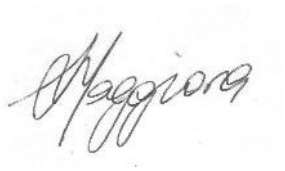


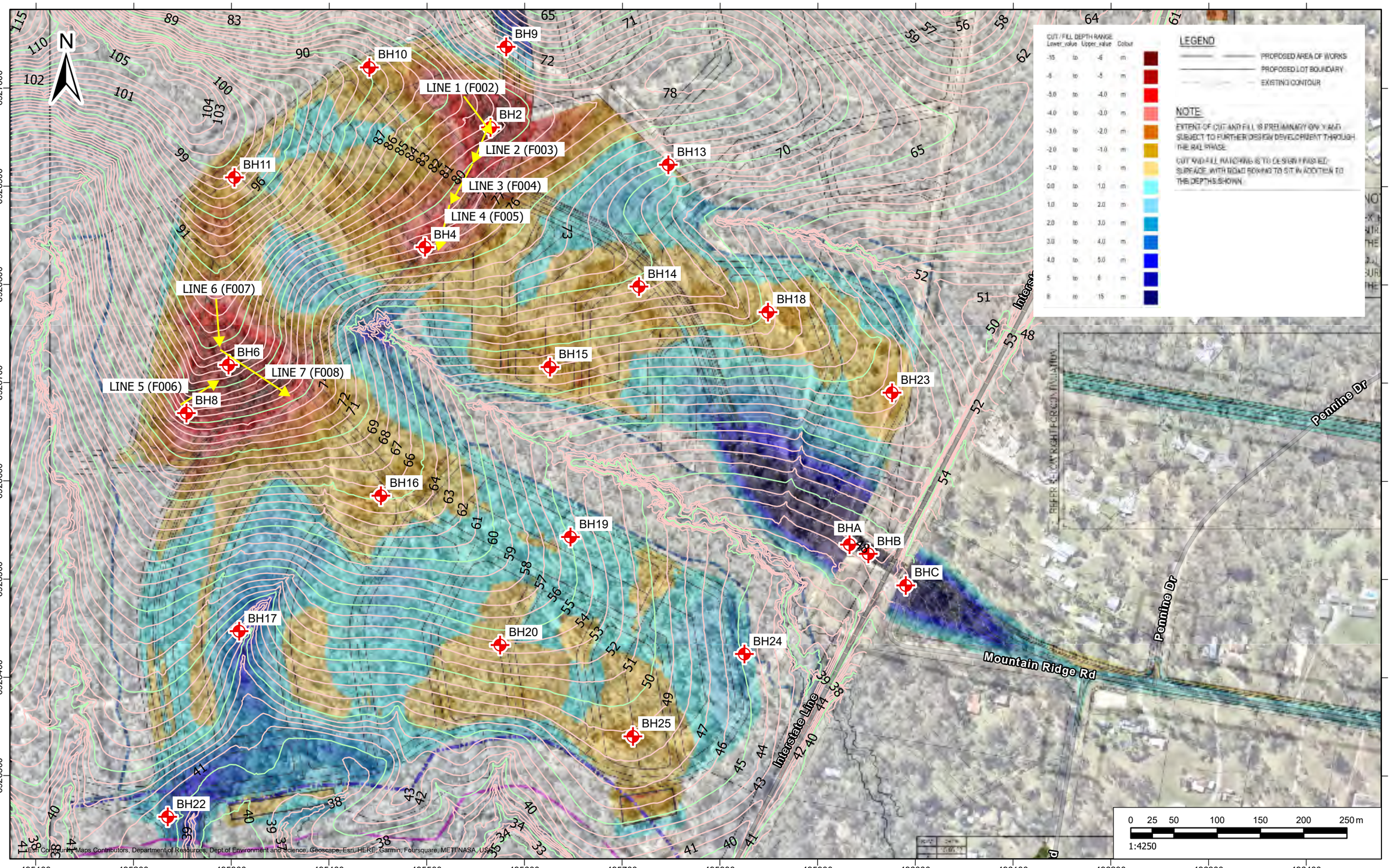
Simon Maggiora
BE(Civil) CPEng NER RPEQ 12467
Associate/Senior Geotechnical Engineer

Andrew Middleton
BE(Civil) FIEAust EngExec CPEng NER RPEQ 4366
Associate/Principal Geotechnical Engineer

SM/AM/sm

A.B.N. 75 603 384 050

Appendix A
Figure 1: Site Plan



Esri Community Maps Contributors, Department of Resources, Dept.of Environment and Science, Geoscape, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

Legend

- Countour Lines (Department of Resources)
  - 1 m Countour
  - 5 m Countour
  - <all other values>
- Approximate Borehole Location
- Approximate Seismic Line Location

Base plan drawn by Peak Urban. Drawing Title - Precinct A Cut Fill Depth Analysis. Drawing No.- 20-0181. Revision No.- 1. Dated 13 July 2021.
Aerial image sourced from Nearmap Pty Ltd, image dated 16 August 2022. Annotations by Core Consultants Pty Ltd.

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www.coreconsultants.com.au

CLIENT: FRASERS PROPERTY NEW BEITH PTY LTD				PROJECT: PROPOSED 'PRECINCT A' SUBDIVISION - MOUNTAIN RIDGE ROAD, NEW BEITH			
DRAWN BY: MD	DATE: 21/02/2023			DRAWING TITLE: TEST LOCATION PLAN			
CHECKED BY: SM	DATE: 21/02/2023						
SCALE: 1:4250	SHEET SIZE: A3	PROJECT No: J001800	DOC No: 002	DOC TYPE: R	FIGURE No: F001	REVISION: 1	SHEET 1 OF 1

Plot Date: 14 February 2023 Time: 11:15 AM By: CAD Path: J:\2022 - J1479\J001800 - Frasers-Subdiv-New Beith\PHASE 1000\Figures Drawings\J001800-GIS\J001800.aprx

Appendix B
Reports of Boreholes, Core Photographs & Explanatory Notes

REPORT OF BOREHOLE: BH2

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Client	Frasers Property New Beith Pty Ltd	East	495565.0 m	Sheet	1 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926960.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	12/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0	0.10				SM	Silty SAND (TOPSOIL) trace rootlets: fine to medium grained, brown.		L	Augered to this depth before commencing test
				0.40				SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale brown.		D	
				0.50					Tending to very low strength Sandstone.		VD	
	H		1		DS 0.80-1.10 m				SANDSTONE: fine to medium grained, pale brown, very low to low strength.	D		>20
				1.55					Continued as Cored Borehole			
			2									
			3									
			4									
			5									
			6									
			7									
			8									

REPORT OF BOREHOLE: BH2

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Client	Frasers Property New Beith Pty Ltd	East	495565.0 m	Sheet	2 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926960.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	12/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
					1.55		Continuation from non-cored borehole				
NMLC		100	100	2			SANDSTONE: fine to medium grained, brown, massive.	HW - MW		1.59: DB, 0°, Pl, Ro	
		100	98	3						3.05-3.24: J, 15°, Fe Sn, Pl, Ro, closely spaced	
										3.56-3.72: J, 20°, Clay In, Pl, Ro, closely spaced	
		100	97	4				MW			
					4.82					4.65-4.69: IS, 5°, Clay, Pl	
				5			Blue grey.	SW			
					5.43						
		100	99				Brown.	MW			
								HW		5.73-5.75: J, 0°, Fe Sn, Pl, Ro, extremely closely spaced	
					5.90			MW			
				6			Blue grey with brown.	MW - SW		6.19: J, 5°, Fe Sn, Pl, Ro	
		100	100	7							
					8.00						
				8			Hole Terminated at 8.00 m Target depth Backfilled				

PointID : BH2 Depth Range: 1.5 - 8.0 m

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TITLE

PROPOSED 'PRECINCT A' SUBDIVISION,
MOUNTAIN RIDGE ROAD, NEW BEITH

BH2
Core Photo

DRAWN	KB	DATE	14/02/2023
CHECKED	SM	DATE	22/02/2023
SCALE	Not To Scale		A4
PROJECT No	J001800	FIGURE No	1/1

REPORT OF BOREHOLE: BH4

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495498.0 m	Sheet	1 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926838.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	12/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS 1289.6.3.2-1997) Blows per 100 mm
ADT	L	Not Encountered	0	0.10				SM	Silty SAND (TOPSOIL) trace rootlets: fine to medium grained, brown.		L / MD	Augered to this depth before commecning test
								SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale brown.	D	MD	
				0.60								
	M			0.75				CI	Sandy CLAY (RESIDUAL SOIL) with silt: medium plasticity, brown and grey; sand fine to medium grained.	w < PL	VSt	
	H			1.00							H	>20
			1						SANDSTONE: fine to medium grained, pale brown, very low strength, highly weathered.			
	H-R				DS 1.20-1.50 m				Low strength.	D		
				1.50					Continued as Cored Borehole			
			2									
			3									
			4									
			5									
			6									
			7									
			8									

REPORT OF BOREHOLE: BH4

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495498.0 m	Sheet	2 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926838.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	12/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH 10)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
					1.50		Continuation from non-cored borehole				
NMLC		100	(86)	2			SANDSTONE: fine to medium grained, brown, massive.	HW MW		1.60: HB 1.95: J, 20°, Fe Sn, Pl, Ro 2.05: EWS, 10°, Clay, Pl	
					2.23			XW MW			
					2.40		Blue grey. Brown.	SW MW		2.40-2.52: J, 5°, Ro, closely spaced, Coal-Clay	
		100	(99)	3	3.14		Blue grey.	SW		3.02-3.03: J, 5°, Fe Sn, Pl, Ro, extremely closely spaced	
				4				MW			
		100	(100)		4.67		Fine to coarse grained, brown, occasional fine to medium grained, sub-angular clasts.				
				5						5.33: J, 20°, Fe Sn, Pl-Un, Ro 5.67: J, 5°, Fe Sn, Pl, Ro	
				6						6.05-6.09: J, 0°, Fe Sn, Pl, Ro, very closely spaced 6.21: J, 0°, Fe Sn, Pl, Ro	
		100	(97)		6.43		Fine to medium grained, without clasts.	MW - SW		6.43-7.78: J, 0 - 5°, Fe Sn, Pl, Ro, closely spaced	
				7							
		100	(100)								
				8	8.00		Hole Terminated at 8.00 m Target depth Backfilled				

PointID : BH4 Depth Range: 1.5 - 8.0 m

core consultants pty ltd

TITLE

PROPOSED 'PRECINCT A' SUBDIVISION,
MOUNTAIN RIDGE ROAD, NEW BEITH

BH4
Core Photo

DRAWN	KB	DATE	14/02/2023
CHECKED	SM	DATE	22/02/2023
SCALE	Not To Scale		A4
PROJECT No	J001800	FIGURE No	1/1

REPORT OF BOREHOLE: BH6

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495297.0 m	Sheet	1 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926718.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	12/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0	0.10				SM	Silty SAND (TOPSOIL) trace rootlets: fine to medium grained, brown.		L	Augered to this depth before commencing test
				0.30				SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale brown.		D	
				0.50					Tending to very low strength Sandstone.		VD	
	H		1						SANDSTONE: fine to medium grained, pale brown, very low strength, highly weathered.	D		
				1.30					Continued as Cored Borehole			
			2									
			3									
			4									
			5									
			6									
			7									
			8									

REPORT OF BOREHOLE: BH6

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495297.0 m	Sheet	2 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926718.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	12/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
					1.30		Continuation from non-cored borehole				
NMLC		100	74	2	1.59		SANDSTONE: fine to medium grained, brown and pale brown, massive.	HW		1.32: J, 0°, Clay Ct, Pl, Ro	
								XW			
							Silty Sandy CLAY (EXTREMELY WEATHERED MATERIAL): low to medium plasticity, pale brown; sand fine to medium grained.	HW		1.60-1.71: J, 20 - 25°, Clay Ct, Pl, Ro, closely spaced	
							SANDSTONE: fine to medium grained, brown and pale brown, massive.			1.92-2.65: J, 0 - 5°, Clay Ct, Ro, closely spaced <<	
					2.17						
					2.27		Occasional very low to low strength seams up to 10 mm wide. Without very low to low strength seams.			2.38: J, 5°, Fe, Pl, Ro	
										2.71: J, 0°, Fe, Pl, Ro 2.78: DB	
				3	3.00						
		100	90		3.21		MUDSTONE: fine grained, blue grey, dark blue grey and pale brown, thinly laminated, tending to extremely weathered material.			3.10: J, 0°, Fe, St, Ro 3.18-3.20: J, 0°, Fe, Pl, Ro, extremely closely spaced	
							SANDSTONE: fine to medium grained, blue grey and pale brown, massive.	MW		3.49-3.72: J, 0 - 5°, Fe, Pl, Ro, closely spaced	
				4	4.10						
							Tending to mudstone.	HW		4.05-4.10: J, 5°, Fe, Pl, Ro, very closely spaced 4.17: DB	
					4.47					4.36: DB	
		100	83				Without mudstone.	MW		4.43: J, 0°, Fe, Pl, Ro	
								HW		4.65-4.67: J, 0 - 10°, Fe, Pl, Ro, extremely closely spaced 4.71-4.82: J, 10 - 25°, Fe, Pl, Ro, closely spaced	
				5				SW		4.93-4.95: J, 10°, Fe, Pl, Ro, extremely closely spaced	
								HW		5.19-5.40: J, 10 - 15°, Fe, Pl, Ro, closely spaced	
								MW			
					5.86					5.72: J, 0°, Cn, Pl, Ro 5.84-5.86: FZ, 10 - 30°, Fe, Pl, Ro	
				6			Fine grained, becoming dark blue grey, possibly coal.	HW		5.90-5.92: J, 5°, Cn, Pl, Ro, extremely closely spaced 5.92-6.36: J, 0°, Cn, Pl, Ro, closely spaced	
		100	85		6.47			SW			
							Fine to medium grained, blue grey.				
					6.89						
				7			Fine to coarse grained.				
		100	94							7.15: J, 0°, Cn, Pl, Ro	
										7.41: J, 0°, Cn, Pl, Ro	
										7.70-7.76: J, 0°, Cn, Pl, Ro	
				8	8.00						
							Hole Terminated at 8.00 m Target depth Backfilled				

PointID : BH6 Depth Range: 1.3 - 8.0 m

core consultants pty ltd

TITLE

PROPOSED 'PRECINCT A' SUBDIVISION,
MOUNTAIN RIDGE ROAD, NEW BEITH

BH6
Core Photo

DRAWN	KB	DATE	14/02/2023
CHECKED	SM	DATE	22/02/2023
SCALE	Not To Scale		A4
PROJECT No	J001800	FIGURE No	1/1

REPORT OF BOREHOLE: BH8

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495254.0 m	Sheet	1 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926669.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	13/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0	0.10				SM	Silty SAND (TOPSOIL): fine to coarse grained, brown; frequent cobbles and boulders up to 500 mm in size at surface.		L	Augered to this depth before commencing test
								SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale brown.		MD	
				0.50							D	
	H			0.80	DS 0.80-1.00 m				SANDSTONE: fine to medium grained, pale brown, very low strength, highly weathered.	D		>20 Hammer Bouncing
			1						Tending to low strength.			
				1.50					Continued as Cored Borehole			
			2									
			3									
			4									
			5									
			6									
			7									
			8									

REPORT OF BOREHOLE: BH8

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495254.0 m	Sheet	2 OF 2
Project	Proposed 'Precinct A' Subdivision	North	6926669.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Drillsure Geotechnical	Logged Date:	13/01/23
Job No.	J001800	Drill Rig	Tracked Hydrapower Scout	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH 10)	DEFECT DESCRIPTION & Additional Observations	Average Defect Spacing (mm) (30, 100, 300, 1000, 3000)
				0							
				1							
					1.50		Continuation from non-cored borehole				
NMLC		100	100	2			SANDSTONE: fine to medium grained, brown, massive.	MW		1.70: J, 0°, Fe, Pl, Ro 2.07-2.23: J, 0 - 5°, Fe, Pl, Ro, closely spaced	
		100	100	3						2.80: J, 0°, Fe, Pl, Ro	
					3.95			HW		3.87: J, 0°, Fe, Pl, Ro 3.90-3.95: EWS, 0°, Clay, Pl	<
		100	45	4			Mudstone seam, fine grained, dark blue grey and pale brown, thinly laminated. Fine to medium grained, brown and pale brown, without Mudstone.	XW HW XW MW		4.00-4.10: EWS, 10°, Clay, Pl 4.30-4.74: J, 70 - 90°, Fe, Un, Ro 4.30-4.93: J, 0 - 20°, Fe, Pl, Ro, closely spaced	<
				5				SW - MW			
					5.24			HW		5.25: J, 5°, Fe, Pl, Ro	<
					5.36		Mudstone seam, fine grained, dark blue grey, thinly laminated. Fine to coarse grained, brown, without Mudstone.	XW SW - MW		5.32-5.36: EWS, 0°, Clay, Pl	
		100	99	6				MW		6.06-6.30: J, 5 - 15°, Fe, Pl, Ro, moderately widely spaced	
					6.56						
					6.68		Fine grained, dark blue grey. Fine to medium grained, brown.	HW MW		6.56-6.68: J, 10 - 30°, Fe, Pl, Ro, closely spaced	
				7	7.10						
		100	100				Pale brown, dark grey and brown, tending towards extremely weathered material.	HW		7.22-8.00: DB	
				8	8.00						
							Hole Terminated at 8.00 m Target depth Backfilled				

PointID : BH8 Depth Range: 1.5 - 8.0 m

core consultants pty ltd

TITLE

PROPOSED 'PRECINCT A' SUBDIVISION,
MOUNTAIN RIDGE ROAD, NEW BEITH

BH8
Core Photo

DRAWN	KB	DATE	14/02/2023
CHECKED	SM	DATE	22/02/2023
SCALE	Not To Scale		A4
PROJECT No	J001800	FIGURE No	1/1

REPORT OF BOREHOLE: BH9

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495581.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6927042.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm 0 5 10 15 20 25
ADT	M	Not Encountered	0.0	0.15				SM	Silty SAND (REWORKED NATURAL SOIL) with gravel trace cobbles: fine to coarse grained, brown, pale brown and dark grey; gravel fine to coarse grained, sub-angular; sandstone boulders up to 1.0 m in size observed in track cutting.	D	VD	>20
								Cl	Sandy CLAY (EXTREMELY WEATHERED MATERIAL) with silt: medium plasticity, grey brown with pale brown; sand fine to medium grained; lenses of very low strength sandstone.	w < PL	H	>20
			1.0	1.20					SANDSTONE: fine to medium grained, grey brown and pale brown, very low strength, highly weathered.			
			1.5	1.60					Becoming grey, tending to possible mudstone, silty slickened surface.			
	M-H		2.0		DS 2.00-2.20 m					D		
			2.5									
			3.0	3.00					Hole Terminated at 3.00 m Target depth Backfilled			
			3.5									

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REPORT OF BOREHOLE: BH10

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495441.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6977021.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm
ADT	L	Not Encountered	0.0	0.15				SM	Silty SAND (TOPSOIL): fine to medium grained, grey brown; organics and rootlets.		L - MD	
	L-M			0.40	DS 0.20-0.40 m			SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale grey brown; tending to extremely weathered material.		VD	
	H		0.5						SANDSTONE: fine to medium grained, pale brown, very low to low strength, highly weathered.			
			1.0	1.10					Becoming brown, very low strength.			
	M-H		1.5							D		
			2.0									
			2.5	2.50					Orange brown, very low to low strength.			
	H		3.0	3.00					Hole Terminated at 3.00 m Target depth Backfilled			
			3.5									

DCP TEST Blows per 100 mm: 0 5 10 15 20 25

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REPORT OF BOREHOLE: BH11

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495303.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926909.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/23
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 350/100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm
ADT	L-M	Not Encountered	0.0	0.15	DS 0.20-0.40 m			SM	FILL Silty SAND (REWORKED NATURAL SOIL) with gravel: fine to coarse grained, grey brown and dark grey; gravel fine to coarse grained, sub-angular; occasional cobbles up to 80 mm in size, high strength boulders observed in track cuttings.	D	VD	0 5 10 15 20 25
								SM	Silty SAND (RESIDUAL SOIL) with gravel: fine to coarse grained, pale brown; gravel fine to medium grained, sub-rounded.			
	H		0.5	0.50					SANDSTONE: fine to medium grained, pale brown, low strength highly weathered.			>20
				0.70					Hole Terminated at 0.70 m Auger Refusal on inferred low to medium or higher strength Sandstone Backfilled			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

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REPORT OF BOREHOLE: BH13

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495747.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926922.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	14/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	M	Not Encountered	0.0					SM	Silty SAND (RESIDUAL SOIL) with gravel: fine to coarse grained, brown; gravel fine to medium grained, sub-angular.	D	L	
				0.20					SANDSTONE: fine to medium grained, pale brown, very low to low strength, highly weathered.			>20
	H		0.5									
				0.80					Pale brown and orange brown, very low strength.			
	M-H		1.0									
				1.10					Pale brown, very low to low strength.			
	H			1.40								
			1.5						Hole Terminated at 1.40 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: BH14

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495717.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926798.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	14/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 350/100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0.0	0.10	BDS 0.00-0.30 m			SM	Silty SAND (TOPSOIL) trace gravel: fine to coarse grained, grey brown; gravel fine to medium grained, sub-angular; organics and rootlets.	D	L	
								SM	Silty SAND (RESIDUAL SOIL) with gravel: fine to coarse grained, grey brown; gravel fine to coarse grained, sub-angular; gravel is very low to low strength Sandstone.		VD	
				0.30					SANDSTONE: fine to medium grained, pale brown, very low strength, highly weathered.			>20 Hammer Bouncing
	M-H		0.5									
				0.60								
	H			0.65					Low strength.			
									Hole Terminated at 0.65 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: BH15

consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495626.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926716.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	0 5 10 15 20 25
ADT	L	Not Encountered	0.0					SM	Silty SAND (TOPSOIL): fine to medium grained, brown and grey brown; organics and rootlets.		L - MD	
				0.15								
					DS 0.20-0.40 m			SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, brown and grey brown.	D	MD	
			0.5	0.50					Hole Terminated at 0.50 m Auger Refusal on inferred low to medium or higher strength Sandstone Backfilled			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

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REPORT OF BOREHOLE: BH16

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495453.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926585.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 350/100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0.0	0.10	BDS 0.10-0.30 m			SM	Silty SAND (TOPSOIL): fine to medium grained, grey brown; organics and rootlets.	D	MD	
								SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, grey brown.		D	
	H			0.35					SANDSTONE: fine to medium grained, pale grey brown, low strength, highly weathered.		VD	>20 Hammer Bouncing
			0.5	0.45					Hole Terminated at 0.45 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

This report must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to consider possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

REPORT OF BOREHOLE: BH17

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495308.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926447.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/23
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0.0	0.05				SM	Silty SAND (TOPSOIL): fine to medium grained, grey brown; organics and rootlets.	D	L	
								SM	Silty SAND (POSSIBLE ALLUVIAL SOIL) trace gravel: fine to medium grained, brown and orange brown; gravel fine to medium grained, sub-rounded; occasional rootlets.	D - M	MD	
					DS 0.20-0.40 m						D / VD	
			0.5	0.50					SANDSTONE: fine to coarse grained, dark orange brown, very low strength, highly weathered.			20/90
	M-H		1.0									Augered to this depth before recommencing test
			1.5	1.50					Zones of extremely weathered material.	D		>20
			2.0	2.00				CI-CH	Sandy CLAY (EXTREMELY WEATHERED MATERIAL): medium to high plasticity, pale brown; sand fine to medium grained.		H	
	H		2.5	2.40					SANDSTONE: fine to coarse grained, pale brown, very low to low strength, highly weathered.			
			3.0	3.00					Hole Terminated at 3.00 m Target depth Backfilled			
			3.5									

REPORT OF BOREHOLE: BH18

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495849.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926772.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 350/100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L-M	Not Encountered	0.0	0.20	BDS 0.30-0.70 m			SM	Silty SAND (TOPSOIL) trace gravel: fine to medium grained, pale brown; gravel fine to medium grained, sub-angular to sub-rounded; organics and rootlets, occasional roots up to 20mm in diameter.	D	MD	
			0.5	0.70				SM	Silty SAND (RESIDUAL SOIL) trace gravel: fine to medium grained, pale brown; gravel fine to medium grained, sub-angular to sub-rounded.		D	
	M		1.0	0.90				CI	Silty Sandy CLAY (RESIDUAL SOIL): medium plasticity, pale brown and orange brown; sand fine to medium grained.	w < PL	VSt	
				1.10					Tending to extremely weathered material and Silty SAND in parts.			
	H			1.15					SANDSTONE: fine to medium grained, pale brown and orange brown, very low to low strength, highly weathered.	D	H	>20
			1.5						Hole Terminated at 1.15 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: BH19

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495647.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926543.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	14/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0.0	0.10				SM	Silty SAND (TOPSOIL): fine to medium grained, grey brown and brown; organics and rootlets.		L - MD	
								SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, brown.	D	MD	
			0.5	0.50				CI	Sandy CLAY (RESIDUAL SOIL) with silt: medium plasticity, pale brown, brown and blue grey; sand fine to medium grained.	w < PL	H	
	M				BDS 0.60-0.80 m							
				0.80								
	H			0.85					SANDSTONE: fine to medium grained, pale brown, low strength, highly weathered.	D		
			1.0						Hole Terminated at 0.85 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: BH20

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495575.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926433.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	14/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm
ADT	L	Not Encountered	0.0	0.10				SM	Silty SAND (TOPSOIL): fine to medium grained, pale grey brown; high silt content, organics and rootlets.	D	L	
	L-M				DS 0.20-0.40 m			SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale grey brown; high silt content.		D	
				0.40							VSt	
	M		0.5	0.60	DS 0.40-0.60 m			CL	Sandy CLAY (RESIDUAL SOIL) with silt: low plasticity, brown and pale brown; sand fine to medium grained.	w < PL	H	
	H								SANDSTONE: fine to medium grained, pale brown, very low to low strength, highly weathered.	D		>20
				0.90					Low strength.			
			1.0	1.00					Hole Terminated at 1.00 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: BH22

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495255.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926258.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm
ADT	L	Not Encountered	0.0	0.10				SM	Silty SAND (TOPSOIL) trace gravel: fine to medium grained, grey brown; gravel fine to medium grained, sub-angular to sub-rounded; organics and rootlets.	D	MD	
								SM	Silty SAND (POSSIBLE ALLUVIAL SOIL) trace gravel: fine to medium grained, pale grey brown; gravel fine to medium grained, sub-rounded.		D - VD	
			0.5	0.60	DS 0.30-0.50 m			Cl-CH	Sandy CLAY (RESIDUAL SOIL) with silt: medium to high plasticity, brown, pale brown and grey; sand fine to medium grained.		St	
	M		1.0	1.30	DS 0.80-1.00 m				Becoming grey brown.		VSt	
	M-H		1.5	1.80	DS 1.50-1.70 m				Grey.	w < PL	H	
			2.0	2.30					Grey brown; tending to extremely weathered material.			
			2.5	3.00					Hole Terminated at 3.00 m Target depth Backfilled			
			3.0									
			3.5									

REPORT OF BOREHOLE: BH23

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495976.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926690.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADV		Not Encountered	0.0	0.10				SM	Silty SAND (TOPSOIL): fine to medium grained, grey brown; organics and rootlets.		MD	
	L-M				BDS 0.20-0.50 m DS 0.20-0.40 m			SM	Silty SAND (RESIDUAL SOIL) trace clay trace gravel: fine to medium grained, grey brown.	D	D	
			0.5	0.60				CI	Sandy CLAY (RESIDUAL SOIL) with silt: medium plasticity, grey brown; sand fine to medium grained.	w < PL	St / VSt	
				0.70					SANDSTONE: fine to medium grained, pale orange brown, very low strength, highly weathered.			>20 Hammer Bouncing
	M-H		1.0		DS 0.80-1.00 m					D		
				1.20					Very low to low strength.			
ADT	H			1.40					Pale brown, tending to low strength.			
			1.5	1.50					Hole Terminated at 1.50 m Auger Refusal on inferred low to medium or higher strength Sandstone Backfilled			
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: BH24

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495825.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926424.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	13/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L-M	Not Encountered	0.0	0.10				SM	Silty SAND (TOPSOIL): fine to medium grained, grey brown; organics and rootlets.		L	
								SM	Silty SAND (RESIDUAL SOIL) trace gravel: fine to medium grained, grey brown; gravel fine to medium grained, sub-angular.	D	MD	
			0.5	0.50	DS 0.30-0.50 m			CI-CH	Sandy CLAY (RESIDUAL SOIL) with silt: medium to high plasticity, grey and orange brown; sand fine to medium grained.	w < PL	F / St	
	M			0.80	DS 0.60-0.80 m							>20
	H		1.0						SANDSTONE: fine to medium grained, pale grey brown, low strength, highly weathered.			Hammer Bouncing
				1.20					Pale orange brown, very low to low strength.	D		
	M-H		2.0									
			2.5	2.50					Orange brown, tending to low strength in parts.			
			3.0	3.00					Hole Terminated at 3.00 m Target depth Backfilled			
			3.5									

REPORT OF BOREHOLE: BH25

core consultants pty ltd

Client	Frasers Property New Beith Pty Ltd	East	495711.0 m	Sheet	1 OF 1
Project	Proposed 'Precinct A' Subdivision	North	6926340.0 m MGA94 Zone 56	Logged:	MD
Location	Mountain Ridge Road, New Beith	Contractor	Core Consultants Pty Ltd	Logged Date:	14/12/22
Job No.	J001800	Drill Rig	Eziprobe	Checked:	SM
		Inclination	-90° Hole Dia. 350/100 mm	Checked Date:	16/02/23

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST Blows per 100 mm (0 5 10 15 20 25)
ADT	L	Not Encountered	0.0	0.10				SM	Silty SAND (TOPSOIL) trace gravel: fine to medium grained, grey brown; gravel fine to medium grained, sub-angular; organics and rootlets.		L	
					BDS 0.10-0.40 m			SM	Silty SAND (RESIDUAL SOIL): fine to medium grained, pale brown, grey brown.	D	MD / D	
				0.40							VD	
	M			0.50	DS 0.40-0.50 m			CL-CI	Silty Sandy CLAY (EXTREMELY WEATHERED MATERIAL): low to medium plasticity, brown and grey brown; sand fine to medium grained.	w < PL	H	>20
			0.5						Hole Terminated at 0.50 m Auger Refusal on inferred low to medium strength Sandstone Backfilled			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

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EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS	Auger Screwing	RD	Rotary blade or drag bit	NQ	Diamond Core - 47 mm
AD	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V - Bit	RAB	Rotary Air Blast	HQ	Diamond Core - 63 mm
T	TC - Bit, e.g. ADT	RC	Reverse Circulation	HMLC	Diamond Core – 63mm
HA	Hand Auger	PT	Push Tube	BH	Tractor Mounted Backhoe
ADH	Hollow Auger	CT	Cable Tool Rig	EX	Tracked Hydraulic Excavator
DTC	Diatubre Coring	JET	Jetting	EE	Existing Excavation
WB	Washbore or Bailer	NDD	Non-destructive digging	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance** . Rapid penetration possible with little effort from the equipment used

M **Medium resistance.** Excavation possible at an acceptable rate with moderate effort from equipment used

H **High resistance to penetration/excavation**. Further penetration is possible at a slow rate

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

▽	Water level shown at date	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUND WATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11 N=18	4,7,11 = Blows per 150mm N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed Sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength (sv = peak value)
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres
WPT	Water pressure tests
DCP	Dynamic cone penetration test
CPT	Dynamic cone penetration test
CPTu	Static cone penetration test with pore pressure (u) measurement

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100$$

RQD = Rock Quantity Designation (%)

$$= \frac{\sum \text{Axial lengths of core} > 100\text{ mm}}{\text{Length of core run}} \times 100$$

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

	FILL		CLAY (CL,CI, or CH)
	GRAVEL (GP or SW)		ORGANIC SOILS (OL or OH or Pt)
	SAND (SP or SW)		COBBLES or BOULDERS
	SILT (ML or MH)		

Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

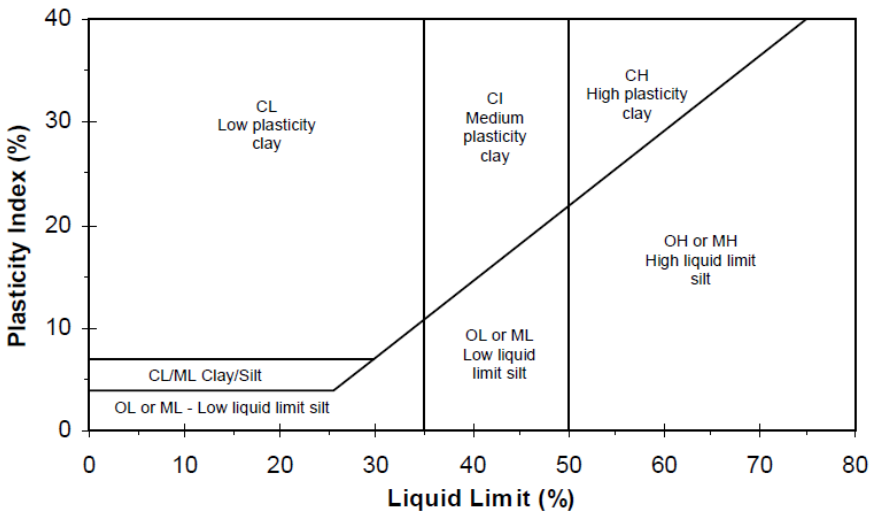
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS 1726 - 2017. The material properties are assessed in the field by visual/tactile methods.

PARTICLE SIZE

Major Division	Sub Division	Particle Size
Boulders		>200 mm
Cobbles		63 - 200 mm
Gravel	Coarse	20 - 63 mm
Gravel	Medium	6.7 - 20 mm
Gravel	Fine	2.36 - 6.7 mm
Sand	Coarse	0.6 - 2.36 mm
Sand	Medium	0.21 - 0.6 mm
Sand	Fine	0.075 - 0.21 mm
Silt		0.002 - 0.075 mm
Clay		<0.002 mm

PLASTIC PROPERTIES



MOISTURE CONDITION FOR COARSE GRAINED SOIL — AS 1726 - 2017

Symbol	Term	Description
D	Dry	Non-cohesive and free running
M	Moist	Soil feels cool, darkened in colour, tends to stick together
W	Wet	Soil feels cool, darkened in colour, soil sticks together, free water forms when handling

MOISTURE CONDITION FOR FINE GRAINED SOIL — AS1726 - 2017

Symbol	Term	Description
W<PL	Moist dry of liquid limit	Hard and friable or powdery
W = PL	Moist near plastic limit	Soils can be molded at a moisture condition approximately equal to the plastic limit
W >PL	Moist, wet of plastic limit	Soils usually weakened and free water forms on hands when handling
W = LL	Wet near plastic limit	
W > LL	Wet, wet of liquid limit	

CONSISTENCY TERMS FOR COHESIVE SOILS — AS1726—2017

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	Above 200 kPa

RELATIVE DENSITY OF COARSE GRAINED SOILS — AS1726—2017

Symbol	Term	Density Index %	SPT 'N' #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	Above 85	Above 50

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

ROCK MATERIAL STRENGTH CLASSIFICATION				AS1726—2017
Symbol	**Term**	**Uniaxial Compressive Strength (MPa)**	**Point Load Strength $I_{s\ (50)}$ (MPa)**	**Field Guide**
VL	Very Low Strength	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick. Pieces up to 30 mm thick can be broken with finger pressure.
L	Low Strength	2 to 6	0.1 to 0.3	Easily scored with knife. Indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point. A piece of core 150 mm by 50 mm may be broken by hand. Sharp edges of core are friable and break during handling.
M	Medium Strength	6 to 20	0.3 to 1	Readily scored with a knife. A piece of core 150 mm by 50 mm can be broken by hand with difficulty.
H	High Strength	20 to 60	1 to 3	A piece of core 150 mm by 50 mm cannot be broken by hand but can be broken by a pick with a single firm blow. Rock rings under hammer.
VH	Very High Strength	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow. Rock rings under hammer.
EH	Extremely High Strength	Above 200	Above 10	Specimen requires many blows with geological pick to break through intact material. Rock rings under hammer.

● = Diametral Point Load Test ▼ = Axial Point Load Test

CLASSIFICATION OF MATERIAL WEATHERING		AS1726—2017
Symbol	**Term**	**Field Guide**
RS	Residual Soil *(Note 1)*	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible but the soil has not been significantly transported.
XW	Extremely Weathered *(Note 1)*	Material is weathered to such an extent that is has soil properties. Mass structure and material texture and fabric of original rock are still visible.
HW	Highly Weathered *(Note 2)*	The whole rock mass is discoloured, usually by iron staining or beaching to the extent that the colour of the original rock is not recognizable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
MH	Moderately Weathered *(Note 2)*	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognizable, but shows little or no change in strength from fresh rock.
SW	Slightly Weathered	Pock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
FR	Fresh	Rock shows no signs of decomposition of individual minerals or colour change.
Note 1	The term 'Extremely Weathered rock' is misleading as the material has soil properties. The word 'rock' should be replaced with the name of the original rock of the word 'material', eg. Extremely Weathered granite or Extremely Weathered material.	
Note 2	Where it is not possible to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock the term 'Distinctly Weathered' may be used.	

DEFECT TYPE/DESCRIPTION			
B	Bedding Parting	V	Vein
J	Joint	HB/DB	Handling/Drilling Break
EW	Extremely Weathered Seam	C	Contact
FZ	Fracture Zone	L	Cleavage
CZ/S	Crushed Zone/Seam	X	Foliation
IS	Infilled Seam	S	Schistocity
SZ/S	Sheared Zone/Seam		

DEFECT PROFILE	
Symbol	**Description**
PL	Planar
St	Stepped
Un	Undulating

DEFECT INFILL DESCRIPTION	
Symbol	**Description**
Cn	Clean: No visible coating
Sn	Stain: Coated 1 to 3 mm
Vr	Veneer: < 1 mm
Ct	Coating: 1 to 3 mm

DEFECT ROUGHNESS DESCRIPTION	
Symbol	**Description**
Sl	Slickenside
Sm	Smooth
Ro	Rough

Vertical Boreholes - The dip (inclination from horizontal) for the defect is given.

Inclined Boreholes - The inclination is measured as the acute angle to the core axis.

Appendix C
Laboratory Test Certificates

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sunshine Coast Laboratory
1/28 Kessling Avenue Kunda Park QLD 4556
Phone: (07) 5351 0400
Email: Shae.Harry@douglaspartners.com.au

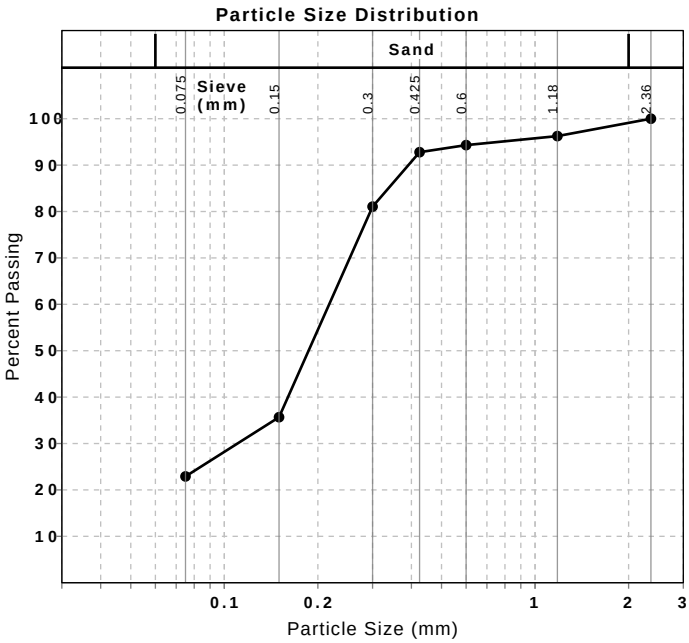
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Shae Harry
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956A
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 14/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH10, Depth: 0.2 - 0.4 m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
2.36 mm	**100**		
1.18 mm	**96**		
0.6 mm	**94**		
0.425 mm	**93**		
0.3 mm	**81**		
0.15 mm	**36**		
0.075 mm	**23**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (^{o}C)	24		



Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sunshine Coast Laboratory
1/28 Kessling Avenue Kunda Park QLD 4556
Phone: (07) 5351 0400
Email: Shae.Harry@douglaspartners.com.au

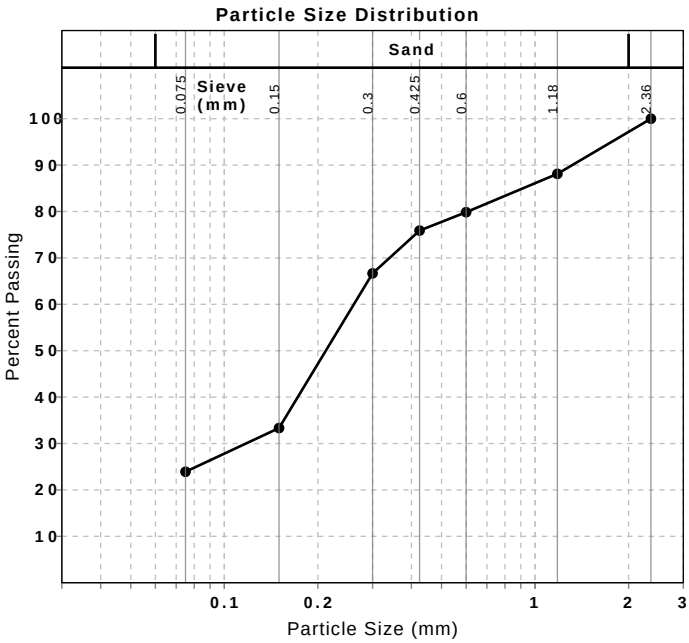
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Shae Harry
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956B
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 14/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH11, Depth: 0.2 - 0.4 m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
2.36 mm	**100**		
1.18 mm	**88**		
0.6 mm	**80**		
0.425 mm	**76**		
0.3 mm	**67**		
0.15 mm	**33**		
0.075 mm	**24**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description			
Nature of Water	Distiled		
Temperature of Water (^{o}C)	24		



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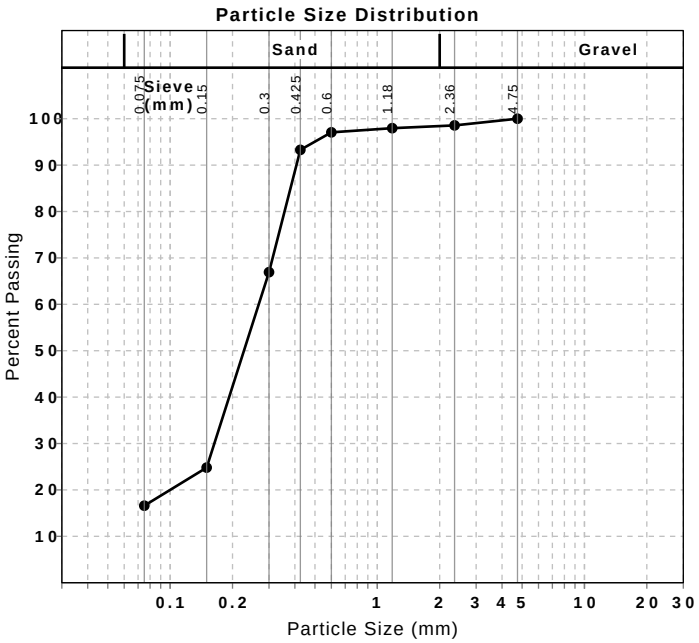
Laboratory Accreditation Number: 828

Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956C
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 14/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH15, Depth: 0.2 - 0.4 m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
4.75 mm	**100**		
2.36 mm	**99**		
1.18 mm	**98**		
0.6 mm	**97**		
0.425 mm	**93**		
0.3 mm	**67**		
0.15 mm	**25**		
0.075 mm	**17**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (^{o}C)	24		



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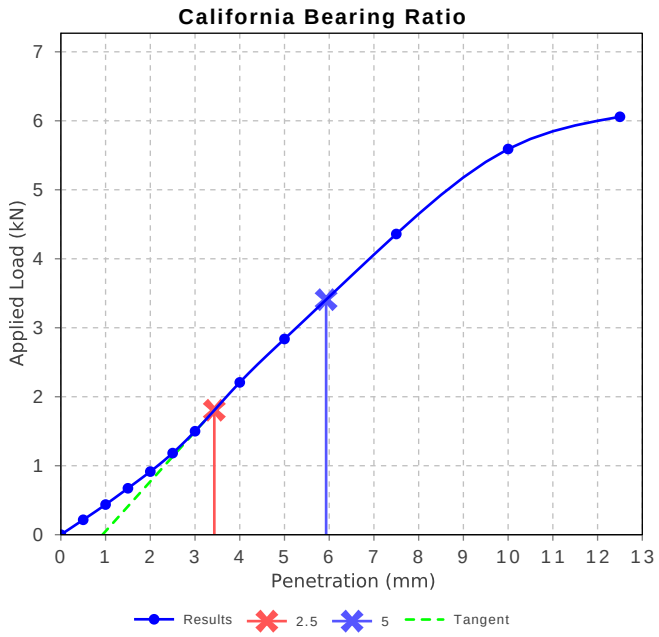
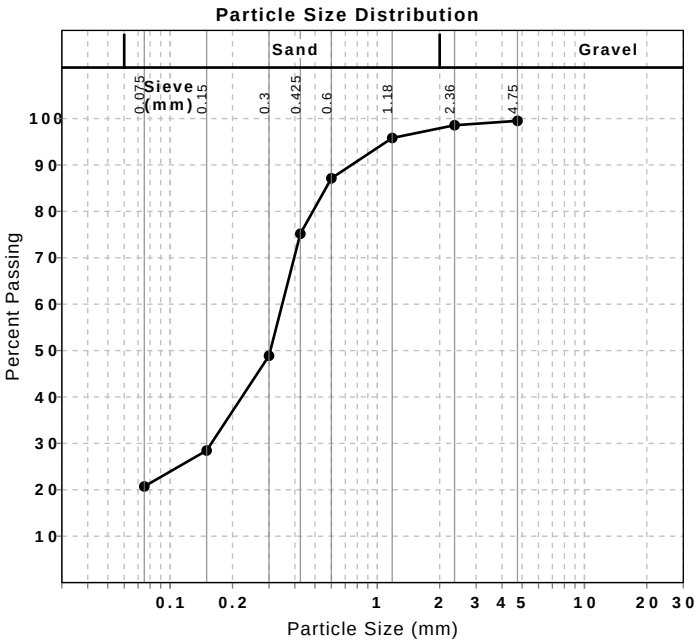
Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956D
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 14/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH16, Depth: 0.1 - 0.3 m**

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**17**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.96		
Optimum Moisture Content (%)	10.0		
Laboratory Density Ratio (%)	95.0		
Laboratory Moisture Ratio (%)	98.5		
Dry Density after Soaking (t/m^3)	1.87		
Field Moisture Content (%)	6.7		
Moisture Content at Placement (%)	9.9		
Moisture Content Top 30mm (%)	11.6		
Moisture Content Rest of Sample (%)	11.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	2.0		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
4.75 mm	**100**		
2.36 mm	**99**		
1.18 mm	**96**		
0.6 mm	**87**		
0.425 mm	**75**		
0.3 mm	**49**		
0.15 mm	**28**		
0.075 mm	**21**		



Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (°C)	24		

Material Test Report

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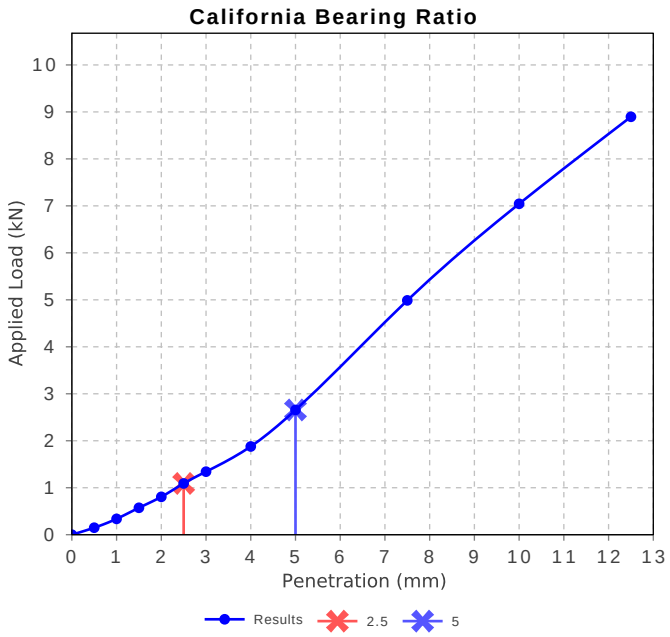
Approved Signatory: Shae Harry
Laboratory Manager
Laboratory Accreditation Number: 828

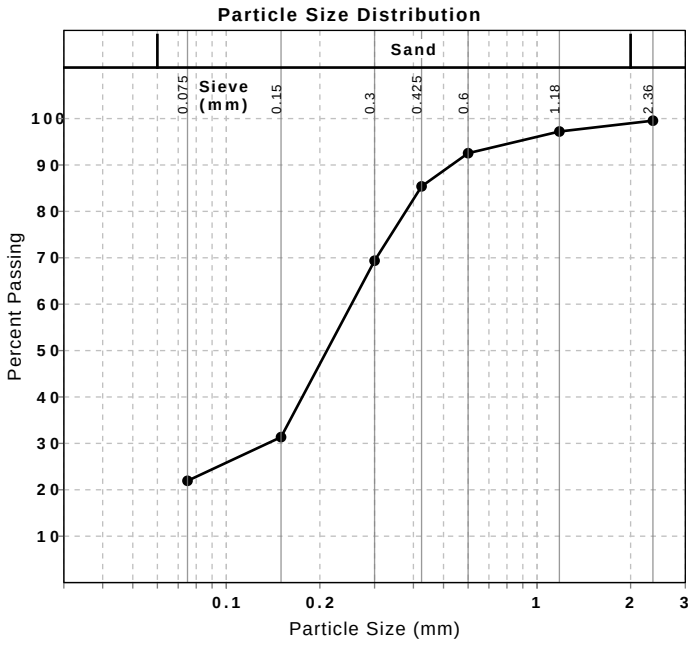
Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956E
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 14/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH18, Depth: 0.3 - 0.7 m**

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**13**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.91		
Optimum Moisture Content (%)	9.0		
Laboratory Density Ratio (%)	94.5		
Laboratory Moisture Ratio (%)	104.0		
Dry Density after Soaking (t/m^3)	1.82		
Field Moisture Content (%)	3.7		
Moisture Content at Placement (%)	9.6		
Moisture Content Top 30mm (%)	11.2		
Moisture Content Rest of Sample (%)	12.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	2.0		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
2.36 mm	**100**		
1.18 mm	**97**		
0.6 mm	**93**		
0.425 mm	**85**		
0.3 mm	**69**		
0.15 mm	**31**		
0.075 mm	**22**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**2**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (°C)	24		





Material Test Report

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Approved Signatory: Shae Harry
Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956F
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 15/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH20, Depth: 0.4 - 0.6 m**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
0.075 mm	**43**		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	34		
Plastic Limit (%)	15		
Plasticity Index (%)	**19**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**8.5**		
Cracking Crumbling Curling	None		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (^{o}C)	24		

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Approved Signatory: Shae Harry
Laboratory Manager
Laboratory Accreditation Number: 828

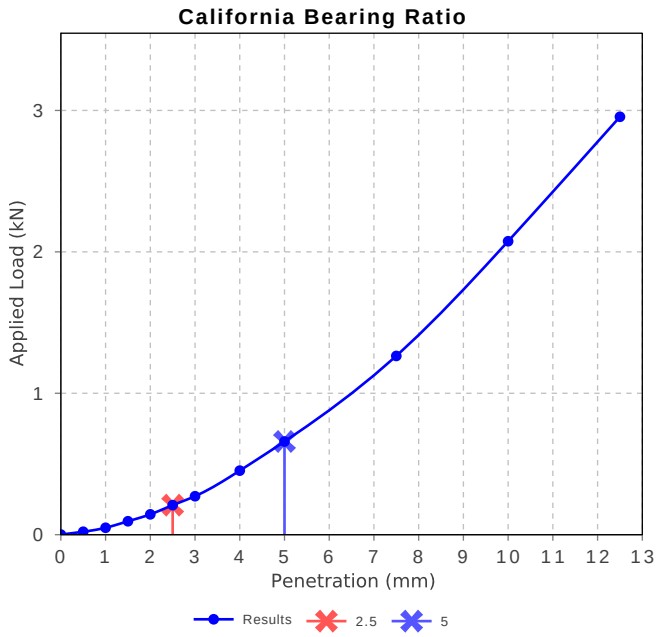
Report Number: **202937.00-143**
Issue Number: 1
Date Issued: 16/02/2023
Client: Core Consultants Pty Ltd
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956G
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 15/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH23, Depth: 0.2 - 0.5 m**

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**3.5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.96		
Optimum Moisture Content (%)	10.5		
Laboratory Density Ratio (%)	95.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.87		
Field Moisture Content (%)	9.6		
Moisture Content at Placement (%)	10.7		
Moisture Content Top 30mm (%)	12.2		
Moisture Content Rest of Sample (%)	12.8		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	2.0		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
2.36 mm	**96**		
0.075 mm	**20**		

Atterberg Limit (AS1289 3.9.2 & 3.2.1 & 3.3.2)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)			
Liquid Limit (%)	18		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	**Non Plastic**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.9.2		
Linear Shrinkage (%)	**1.0**		
Cracking Crumbling Curling	None		



Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (^{o}C)	24		

Material Test Report

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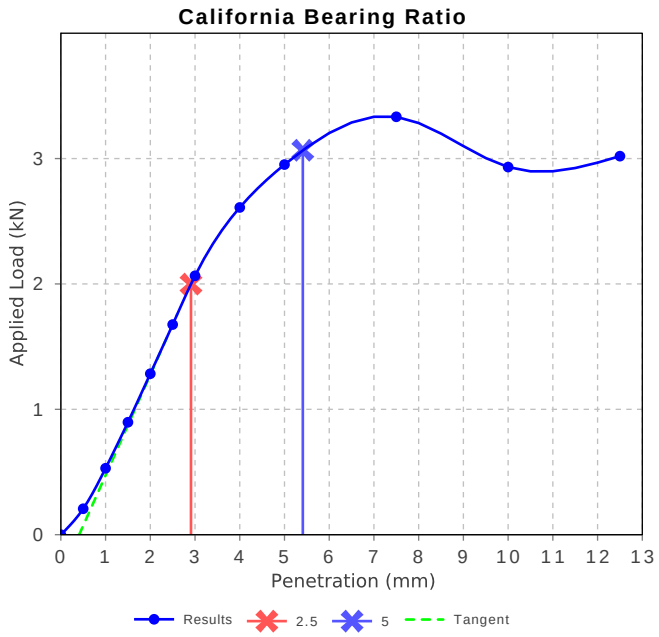
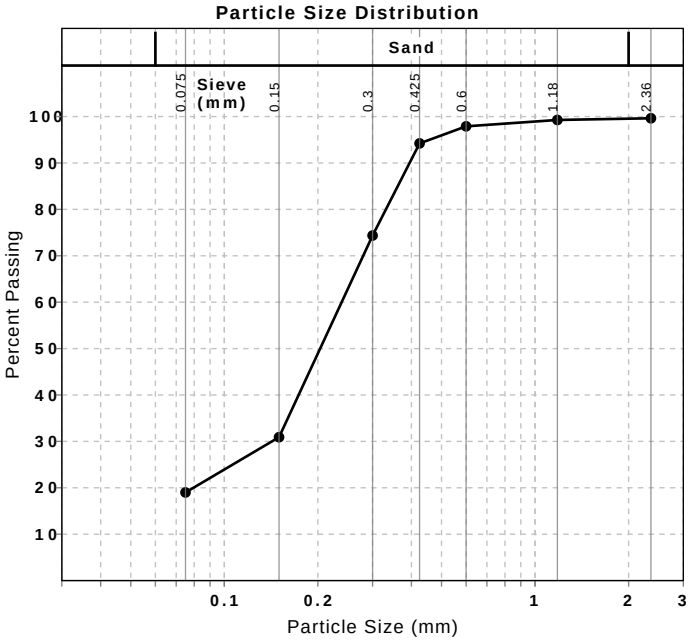
Unit 1/18 Lysaght Street, Coolum Beach QLD 4573
Contact: Simon Maggiora
Project Number: 202937.00
Project Name: Proposed Development
Project Location: Material Testing, Maroochydore QLD
Client Reference: J001800
Work Request: 21956
Sample Number: SS-21956H
Date Sampled: 13/12/2022
Dates Tested: 30/01/2023 - 15/02/2023
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BH25, Depth: 0.1 - 0.4 m**

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**15**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.83		
Optimum Moisture Content (%)	10.5		
Laboratory Density Ratio (%)	95.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	1.74		
Field Moisture Content (%)	4.3		
Moisture Content at Placement (%)	10.2		
Moisture Content Top 30mm (%)	15.3		
Moisture Content Rest of Sample (%)	15.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	2.0		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
2.36 mm	**100**		
1.18 mm	**99**		
0.6 mm	**98**		
0.425 mm	**94**		
0.3 mm	**74**		
0.15 mm	**31**		
0.075 mm	**19**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description			
Nature of Water	Distilled		
Temperature of Water (°C)	24		





core consultants

AS 4133.4.1 - 2007 Rock Strength Tests

AXIAL TEST

CLIENT : Frasers Property New Beith Pty Ltd

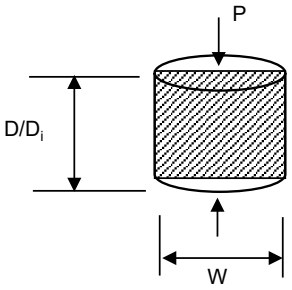
PROJECT : Proposed Precinct A Subdivision

LOCATION Mountain Ridge Road, New Beith

JOB NO : J001800

Point Load Testing Device EL No. : 611

Sample Moisture Condition and Storage History : Dry



$0.6W < D_i < W$

i.e. if W = 52mm
31mm < D_i < 52mm

Borehole Number	Depth (m)	Width (W) (mm)	Length (D_i) /Width (W) Ratio	Platen Sep. **at Failure (D)** (mm)	Gauge Load (P) (kN)	D_e^2 (mm^2)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	Strength Classification, Failure Type*, Rock Tested, Comment
BH2	1.64	42.00	1.24	40.0	1.99	2139.0	0.93	0.97	**0.90**	**M**
BH2	2.66	47.00	1.11	45.0	1.68	2692.9	0.62	1.02	**0.63**	**M**
BH2	3.54	43.00	1.21	40.0	2.13	2190.0	0.97	0.97	**0.94**	**M**
BH2	4.62	36.00	1.44	33.0	5.22	1512.6	3.45	0.89	**3.08**	**VH**
BH2	5.54	41.00	1.27	39.0	5.59	2035.9	2.75	0.95	**2.62**	**H**
BH2	6.41	48.00	1.08	45.0	3.60	2750.2	1.31	1.02	**1.34**	**H**
BH2	7.35	44.00	1.18	40.0	4.35	2240.9	1.94	0.98	**1.89**	**H**
BH8	1.56	44.00	1.18	40.0	3.78	2240.9	1.69	0.98	**1.65**	**H**
BH8	2.51	44.00	1.18	41.0	3.88	2296.9	1.69	0.98	**1.66**	**H**
BH8	3.38	48.00	1.08	43.0	4.58	2628.0	1.74	1.01	**1.76**	**H**
BH8	4.25	35.00	1.49	29.0	3.21	1292.3	2.48	0.86	**2.14**	**H**
BH8	5.51	40.00	1.30	37.0	5.63	1884.4	2.99	0.94	**2.80**	**H**
BH8	7.37	51.00	1.02	46.0	0.06	2987.0	0.02	1.04	**0.02**	**VL**
BH6	1.66	33.00	1.58	29.0	2.62	1218.5	2.15	0.85	**1.83**	**H**
BH6	2.48	44.00	1.18	40.0	2.55	2240.9	1.14	0.98	**1.11**	**H**
BH6	3.69	43.00	1.21	38.0	3.50	2080.5	1.68	0.96	**1.61**	**H**
BH6	4.63	49.00	1.06	46.0	4.29	2869.9	1.49	1.03	**1.54**	**H**
BH6	5.51	45.00	1.16	40.0	3.33	2291.8	1.45	0.98	**1.42**	**H**
BH6	6.43	39.00	1.33	36.0	3.60	1787.6	2.01	0.93	**1.87**	**H**
BH6	7.46	35.00	1.49	30.0	2.32	1336.9	1.74	0.87	**1.51**	**H**
BH4	1.68	33.00	1.58	26.0	0.63	1092.4	0.58	0.83	**0.48**	**M**
BH4	2.60	38.00	1.37	35.0	5.06	1693.4	2.99	0.92	**2.74**	**H**
BH4	3.59	40.00	1.30	36.0	1.27	1833.5	0.69	0.93	**0.65**	**M**
BH4	4.57	42.00	1.24	38.0	1.38	2032.1	0.68	0.95	**0.65**	**M**
BH4	5.62	40.00	1.30	38.0	3.63	1935.3	1.88	0.94	**1.77**	**H**
BH4	6.47	36.00	1.44	34.0	5.28	1558.4	3.39	0.90	**3.05**	**VH**
BH4	7.3	37.0	1.4	34.0	3.61	**1601.74**	**2.25**	**0.90**	**2.04**	**H**

Borehole Number	Depth (m)	Width (W) (mm)	Length (D_i) /Width (W) Ratio	Platen Sep. **at Failure (D)** (mm)	Gauge Load (P) (kN)	D_e^2 (mm^2)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	Strength Classification, Failure Type*, Rock Tested, Comment

NOTES :

* 1 = Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.
2 = Fracture along bedding.
3 = Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.
4 = Chip or partial fracture.

Sampled By / Date : MD 11/01/2023 - 13/01/2023
Tested By / Date : KB 1/02/2023
Computed By / Date : KB 1/02/2023
Checked By / Date : SM 16/02/2023

Diametral Test FORMULA

$$D_e^2 = D^2$$

Equivalent Core Diameter (D_e)

$$I_s = \frac{1000\,P}{D_e^2}(MPa)$$

Uncorrected Point Load Strength (Is)

$$F = \left(\frac{D_e}{50}\right)^{0.45}$$

Size Correction Factor (F)

$$I_{s(50)} = I_s F$$

Point Load Strength Index ($I_{s(50)}$)

Symbol	Term	$I_{s(50)}$ (MPa)
VL	Very Low	>0.03 to 0.10
L	Low	>0.10 to 0.30
M	Medium	>0.30 to 1
H	High	>1 to 3
VH	Very High	>3 to 10
EH	Extremely High	> 10

core consultants

AS 4133.4.1 - 2007 Rock Strength Tests

DIAMETRAL TEST

CLIENT : Frasers Property New Beith Pty Ltd

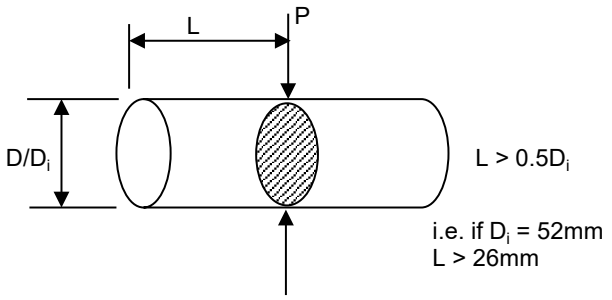
PROJECT : Proposed Precinct A Subdivision

LOCATION : Mountain Ridge Road, New Beith

JOB NO : J001800

Point Load Testing Device EL No. : 611

Sample Moisture Condition and Storage History : Dry



Borehole Number	Depth (m)	Lengh (L) (mm)	Length (L)/ Dia (D_i) Ratio	Platen Sep **at Failure (D)** (mm)	Gauge Load (P) (kN)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	Strength Classification, Failure Type*, Rock Tested, Comment
BH2	1.64	110.00	0.47	49.0	1.47	0.61	0.99	**0.61**	**M**
BH2	2.66	110.00	0.47	49.0	1.32	0.55	0.99	**0.54**	**M**
BH2	3.54	80.00	0.65	49.0	1.82	0.76	0.99	**0.75**	**M**
BH2	4.62	120.00	0.43	49.0	4.52	1.88	0.99	**1.87**	**H**
BH2	5.54	110.00	0.47	49.0	3.80	1.58	0.99	**1.57**	**H**
BH2	6.41	115.00	0.45	49.0	2.46	1.02	0.99	**1.02**	**H**
BH2	7.35	125.00	0.42	48.0	2.55	1.11	0.98	**1.09**	**H**
BH8	1.56	100.00	0.52	49.0	2.73	1.14	0.99	**1.13**	**H**
BH8	2.51	120.00	0.43	48.0	3.76	1.63	0.98	**1.60**	**H**
BH8	3.38	140.00	0.37	48.0	3.68	1.60	0.98	**1.57**	**H**
BH8	4.25	100.00	0.52	49.0	1.52	0.63	0.99	**0.63**	**M**
BH8	5.51	85.00	0.61	49.0	3.82	1.59	0.99	**1.58**	**H**
BH8	6.61	110.00	0.47	46.0	0.77	0.36	0.96	**0.35**	**M**
BH8	7.37	115.00	0.45	48.0	0.03	0.01	0.98	**0.01**	**VL**
BH6	1.66	120.00	0.43	50.0	3.74	1.50	1.00	**1.50**	**H**
BH6	2.48	110.00	0.47	49.0	1.59	0.66	0.99	**0.66**	**M**
BH6	3.69	80.00	0.65	50.0	1.75	0.70	1.00	**0.70**	**M**
BH6	4.63	80.00	0.65	49.0	3.03	1.26	0.99	**1.25**	**H**
BH6	5.51	100.00	0.52	48.0	1.87	0.81	0.98	**0.80**	**M**
BH6	6.43	120.00	0.43	48.0	2.14	0.93	0.98	**0.91**	**M**
BH6	7.46	90.00	0.58	48.0	2.16	0.94	0.98	**0.92**	**M**
BH4	1.68	105.00	0.50	48.0	2.24	0.97	0.98	**0.95**	**M**
BH4	2.60	100.00	0.52	50.0	4.47	1.79	1.00	**1.79**	**H**
BH4	3.59	90.00	0.58	49.0	0.99	0.41	0.99	**0.41**	**M**
BH4	4.57	95.00	0.55	50.0	1.10	0.44	1.00	**0.44**	**M**
BH4	5.62	90.00	0.58	49.0	3.80	1.58	0.99	**1.57**	**H**
BH4	6.47	80.00	0.65	49.0	4.95	2.06	0.99	**2.04**	**H**
BH4	7.28	95.00	0.55	49.0	4.10	1.71	0.99	**1.69**	**H**

Borehole Number	Depth (m)	Lengh (L) (mm)	Length (L)/ Dia (D_i) Ratio	Platen Sep **at Failure (D)** (mm)	Gauge Load (P) (kN)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	Strength Classification, Failure Type*, Rock Tested, Comment

NOTES :

* 1 = Fracture through fabric of specimen oblique to bedding, not influenced by weak plane
2 = Fracture along bedding.
3 = Fracture influenced by pre-existing plane, microfracture, vein or chemical alteration.
4 = Chip or partial fracture.

Sampled By / Date : MD 11/01/2023 - 13/01/2023
Tested By / Date : KB 1/02/2023
Computed By / Date : KB 1/02/2023
Checked By / Date : SM 16/02/2023

Diametral Test FORMULA

Equivalent Core Diameter (D_e) $$D_e^2 = D^2$$

Uncorrected Point Load Strength (Is) $$I_s = \frac{1000\,P}{D_e^2}(MPa)$$

Size Correction Factor (F) $$F = \left(\frac{D_e}{50}\right)^{0.45}$$

Point Load Strength Index ($I_{s(50)}$) $$I_{s(50)} = I_s F$$

Symbol	Term	$I_{s(50)}$ (MPa)
VL	Very Low	>0.03 to 0.10
L	Low	>0.10 to 0.30
M	Medium	>0.30 to 1
H	High	>1 to 3
VH	Very High	>3 to 10
EH	Extremely High	> 10

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geo ag enviro

82 Plain Street Tamworth NSW 2340
e admin@eastwestonline.com.au
t 02 6762 1733
f 02 6765 9109
abn 82 125 442 382

eastwestonline.com.au

ANALYSIS REPORT SOIL

PROJECT NO: EW230452		**Date of Issue:**	**10/02/2023**
Customer:	CORE CONSULTANTS	Report No:	1
Address:	UNIT 1/18 LYSAGHT COOLUM BEACH QLD 4573	Date Received:	1/02/2023
		Matrix:	Soil
Attention:	Simon Maggiora	Location:	J001800 - Frasers/Subdi
Phone:	0403 491 122	Sampler ID:	Client
Fax:		Date of Sampling:	15/12/2022
Email:	smaggiora@coreconsultants.com.au	Sample Condition:	Acceptable

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Signed: Anne Michie

NATA Accredited Laboratory 15708
Accredited for compliance with ISO/IEC 17025 - Testing

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.

WORLD RECOGNISED ACCREDITATION

results you can rely on

ANALYSIS REPORT

PROJECT NO: EW230452 Location: J001800 - Frasers/Subdiv/New Beith

					BH14	BH20	BH23	BH23
			CLIENT SAMPLE ID					
			DEPTH		0.1-0.3	0.2-0.4	0.2-0.4	0.8-1.0
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**230452-1**	**230452-2**	**230452-3**	**230452-4**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.50	5.88	5.85	5.62
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.02	0.02	0.07	0.08
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	74.1	59.8	62.9	98.8
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	369	109	198	89.3
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	159	51.8	44.4	397
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	27.7	32.1	45.5	364
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.19	0.15	0.16	0.25
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	1.85	0.55	0.99	0.45
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.33	0.43	0.37	3.31
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.12	0.14	0.20	1.58
ECEC	Calculation	PMS-15A1	cmol/kg	na	3.48	1.27	1.72	5.59
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.39	1.26	2.68	0.13
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.14	0.36	0.44	0.08
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	5.46	12.1	9.38	4.53
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	53.0	42.9	57.6	7.99
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	38.1	34.0	21.5	59.2
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	3.46	11.0	11.5	28.3

ANALYSIS REPORT

PROJECT NO: EW230452 **Location: J001800 - Frasers/Subdiv/New Beith**

				CLIENT SAMPLE ID	BH25	BH2	BH4	BH8
				DEPTH	0.4-0.5	0.8-1.1	1.2-1.5	0.8-1.0
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**230452-5**	**230452-6**	**230452-7**	**230452-8**
pH (1:5 in H20)	Electrode	R&L 4A2	pH units	na	5.47	5.25	5.57	5.63
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.16	0.25	0.08	0.03
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	126	44.8	95.0	139
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	285	2398	2082	194
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	909	553	612	605
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	756	433	480	218
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.32	0.11	0.24	0.36
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	1.43	12.0	10.4	0.97
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	7.58	4.61	5.10	5.04
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	3.29	1.88	2.09	0.95
ECEC	Calculation	PMS-15A1	cmol/kg	na	12.6	18.6	17.8	7.32
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.19	2.60	2.04	0.19
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.04	0.02	0.05	0.07
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	2.56	0.62	1.37	4.87
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	11.3	64.5	58.4	13.3
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	60.1	24.8	28.6	68.9
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	26.1	10.1	11.7	13.0

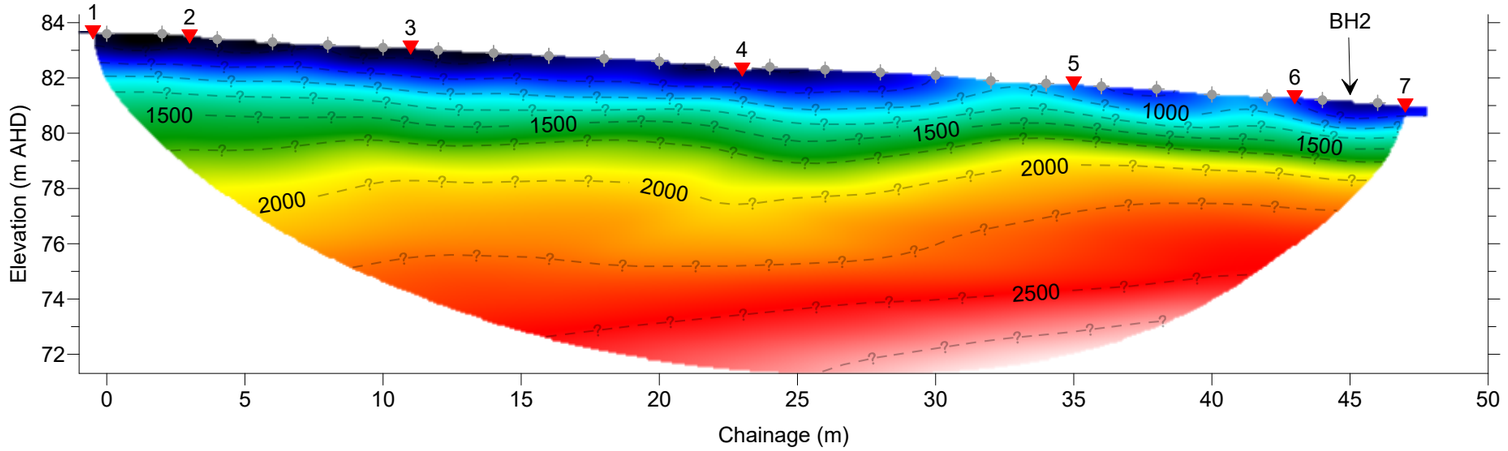
Soils are air dried at 40^{o}C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END

Appendix D
Figures 2 to 8: SRT Profiles

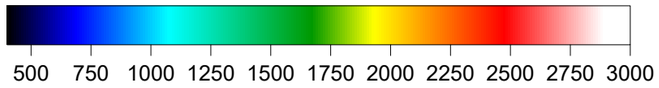
Line 1: P-Wave Velocity Profile



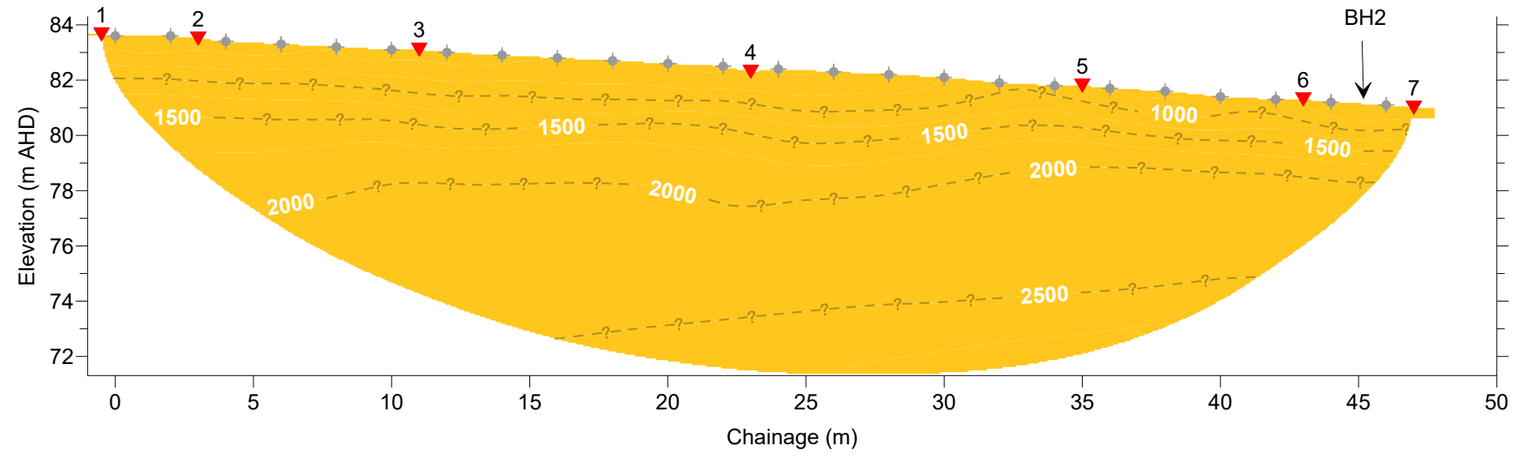
Legend

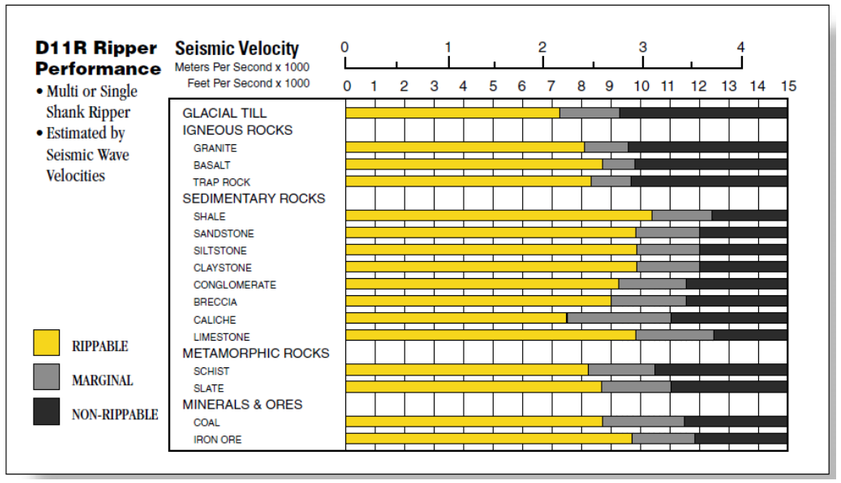
- Denotes seismic source shot location and number
- Denotes geophone location

P-Wave Velocity (m/s)

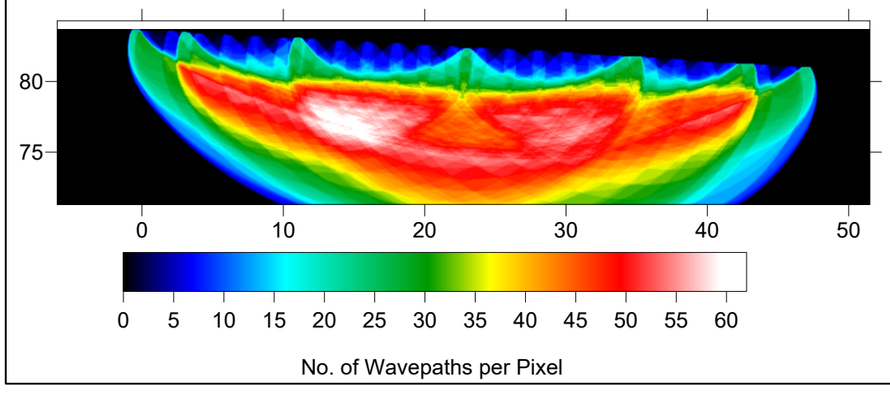


Line 1: Inferred Rippability Profile





Line 1: Wavepath Coverage
RMS error 1.2%=0.17ms 20 WET itr. 50Hz Width 2.5% initial GRADIENT.GRD v. 4.03



REFER TO FIGURE 1 FOR SECTION LOCATION
THIS DOCUMENT MUST BE READ IN CONJUCTION WITH CORE DOCUMENT J001800-002-R-Rev0.

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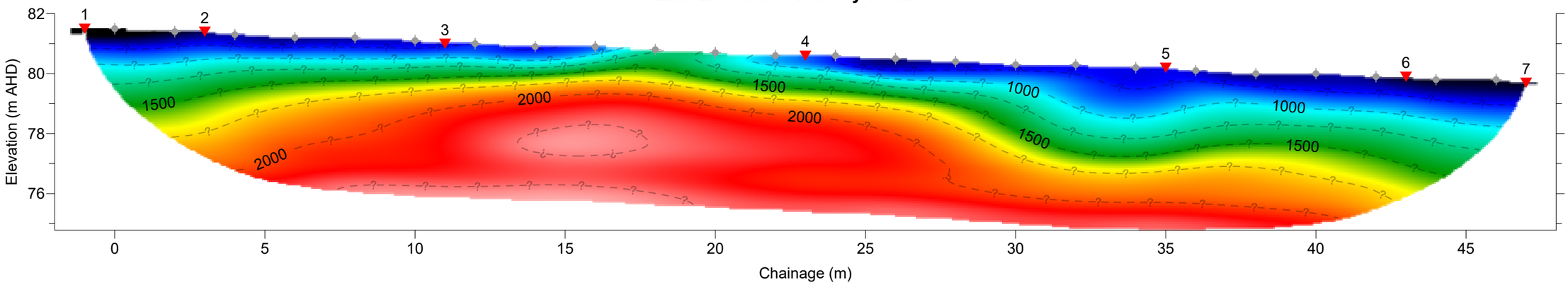
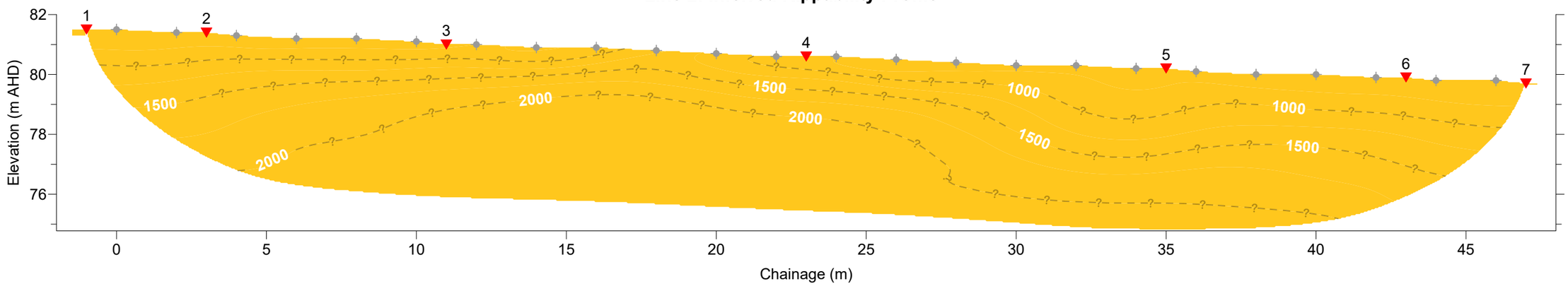
Scale (m)
0 2 4 6 8

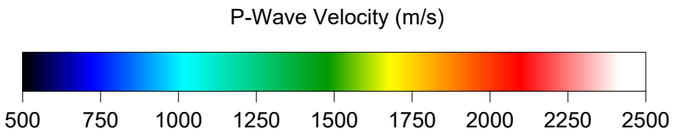
DRAWN	BH	CLIENT:	FRASERS PROPERTY NEW BEITH PTY LTD		
CHECKED	SM	PROJECT:	PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH		
DATE	30/01/2023				
SCALE	AS SHOWN	TITLE:	SRT PROFILES: LINE 1		
ORIGINAL SIZE	A3	PROJECT NO:	J001800	FIGURE NO: 002	REV: 0

Line 2: P-Wave Velocity Profile



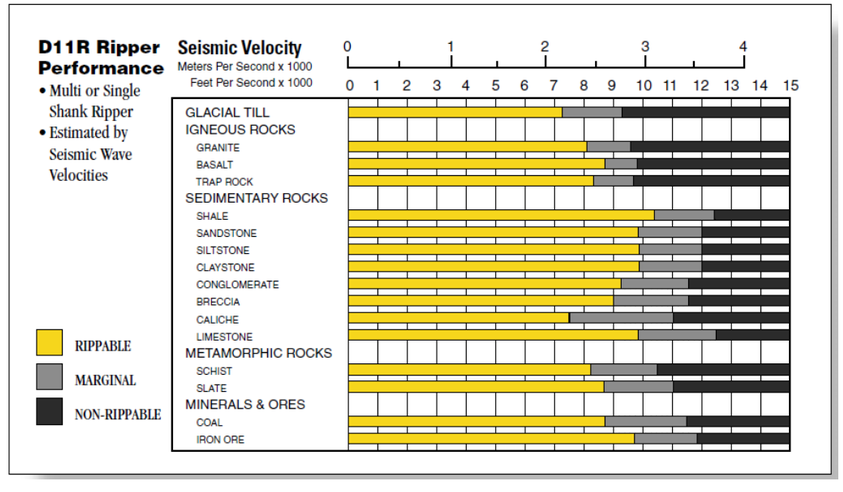
Line 2: Inferred Rippability Profile



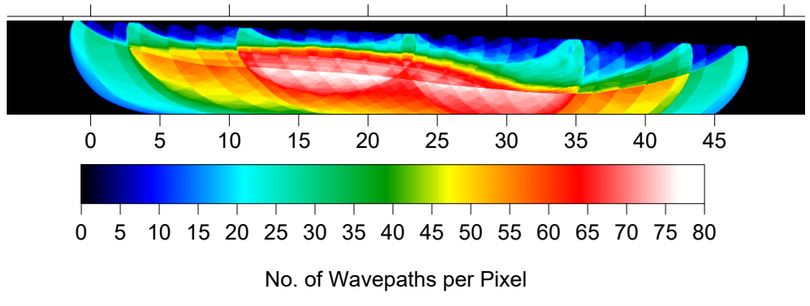


Legend

- Denotes seismic source shot location and number
- Denotes geophone location



Line 2: Wavepath Coverage
RMS error 1.4%=0.18ms 20 WET itr. 50Hz Width 2.5% initial GRADIENT.GRD v. 4.03



REFER TO FIGURE 1 FOR SECTION LOCATION

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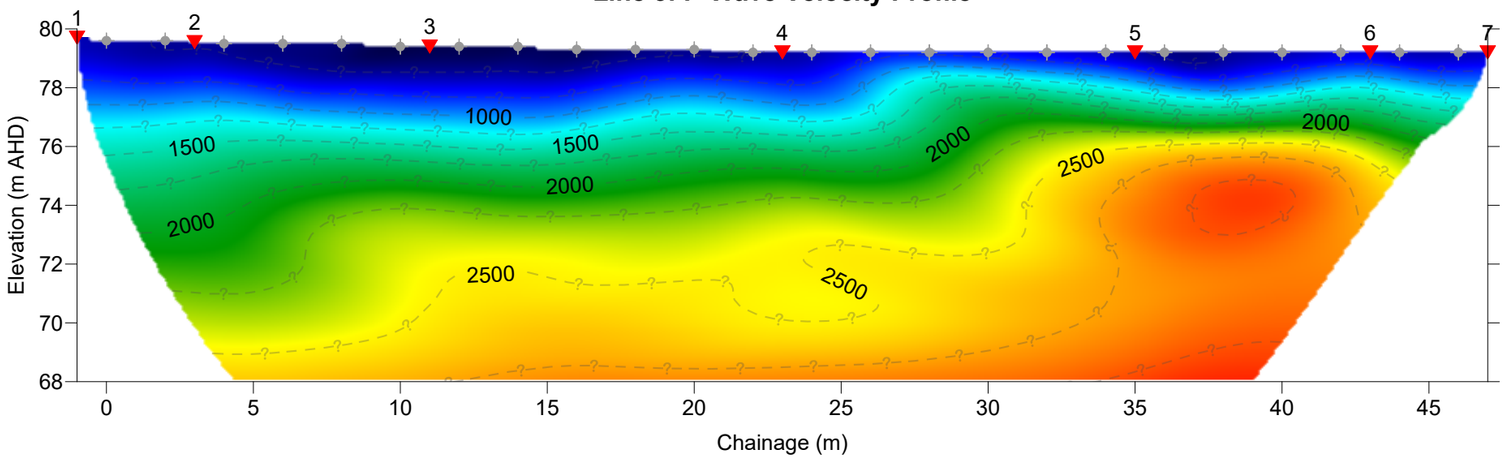
Scale (m)
0 2 4 6 8

DRAWN	BH	CLIENT:	FRASERS PROPERTY NEW BEITH PTY LTD		
CHECKED	SM	PROJECT:	PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH		
DATE	30/01/2023				
SCALE	AS SHOWN	TITLE:	SRT PROFILES: LINE 2		
ORIGINAL SIZE	A3	PROJECT NO:	J001800	FIGURE NO: 003	REV: 0

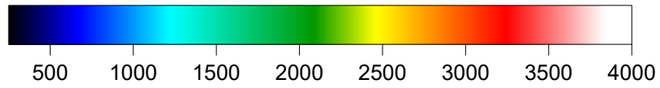
Line 3: P-Wave Velocity Profile



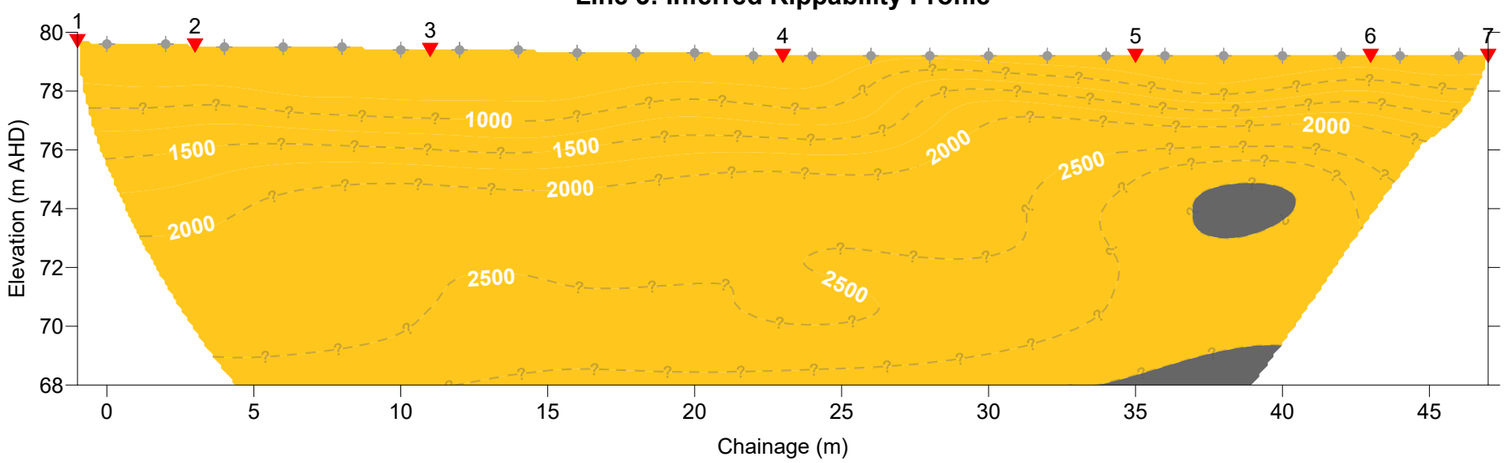
Legend

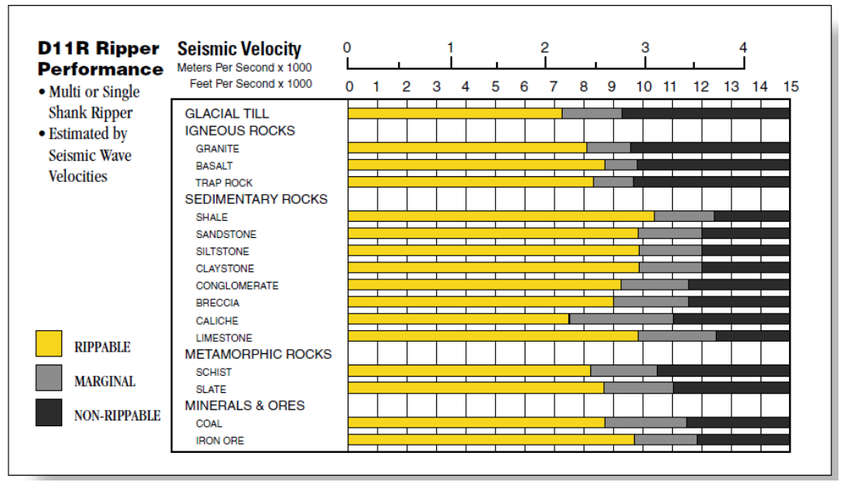
- Denotes seismic source shot location and number
- Denotes geophone location

P-Wave Velocity (m/s)

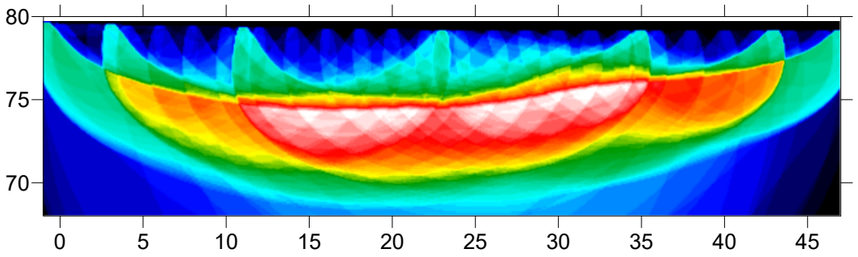


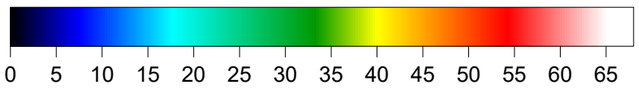
Line 3: Inferred Rippability Profile





Line 3: Wavepath Coverage
RMS error 1.1%=0.15ms 100 WET itr. 50Hz Width 2.5% initial GRADIENT.GRD v. 4.03





No. of Wavepaths per Pixel

REFER TO FIGURE 1 FOR SECTION LOCATION

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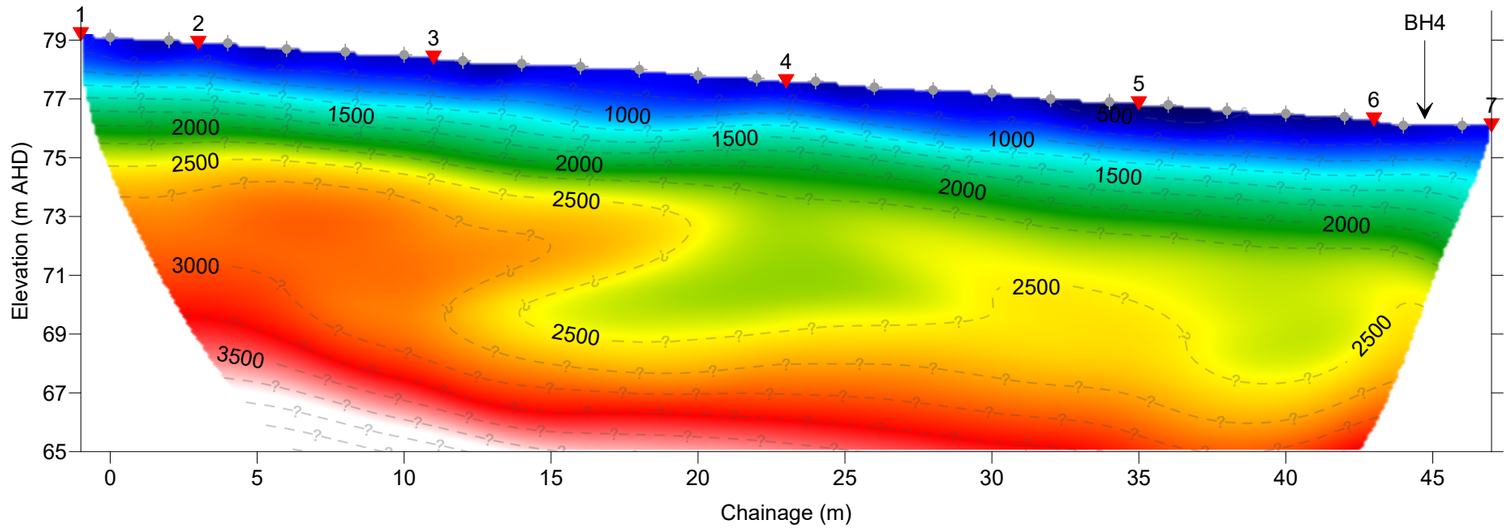
Scale (m)
0 2 4 6 8

DRAWN	BH	CLIENT: FRASERS PROPERTY NEW BEITH PTY LTD		
CHECKED	SM	PROJECT: PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH		
DATE	30/01/2023			
SCALE	AS SHOWN	TITLE: SRT PROFILES: LINE 3		
ORIGINAL SIZE	A3	PROJECT NO: J001800	FIGURE NO: 004	REV: 0

Line 4: P-Wave Velocity Profile



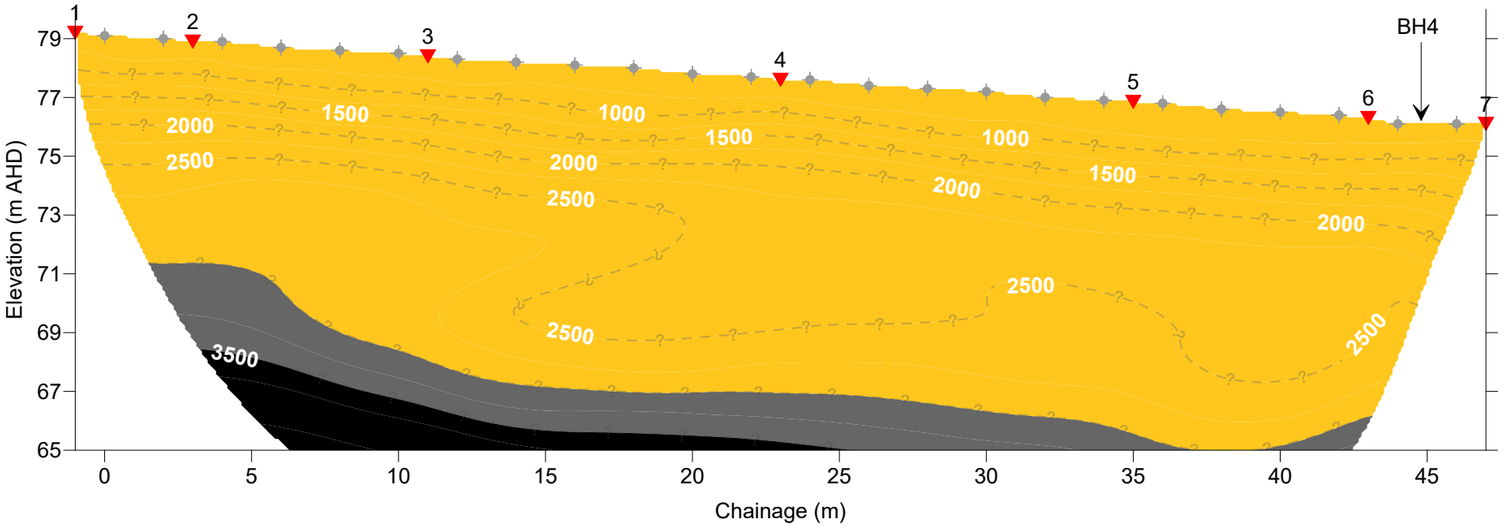
Legend

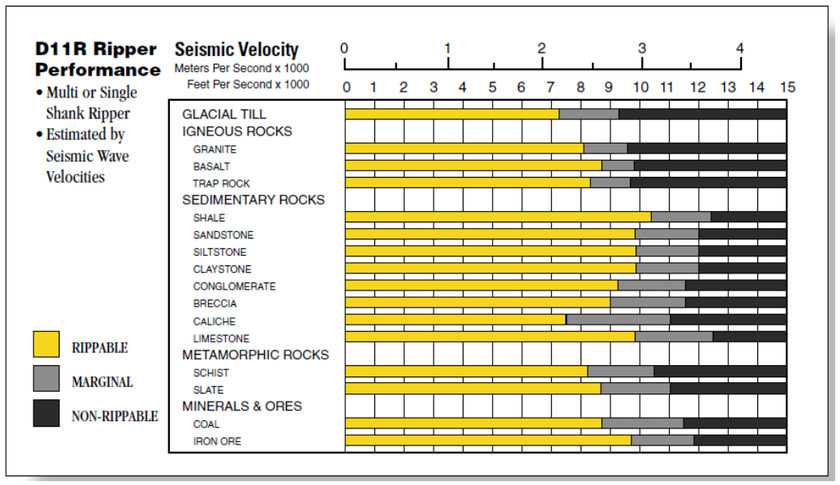
- Denotes seismic source shot location and number
- Denotes geophone location

P-Wave Velocity (m/s)

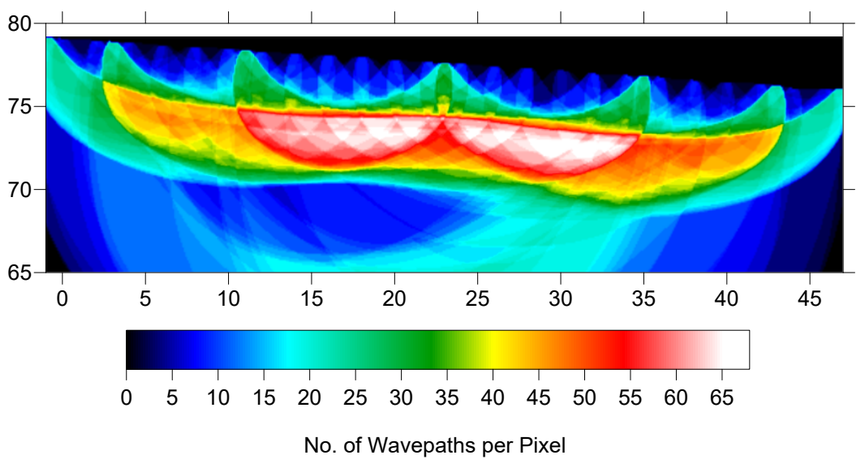
500 1000 1500 2000 2500 3000 3500 4000

Line 4: Interpreted Rippability Profile





Line 4 RMS error 1.2%=0.14ms 100 WET itr. 50Hz Width 2.2% initial GRADIENT.GRD v. 4.03



REFER TO FIGURE 1 FOR SECTION LOCATION

THIS DOCUMENT MUST BE READ IN CONJUCTION WITH CORE DOCUMENT J001800-002-R-Rev0.

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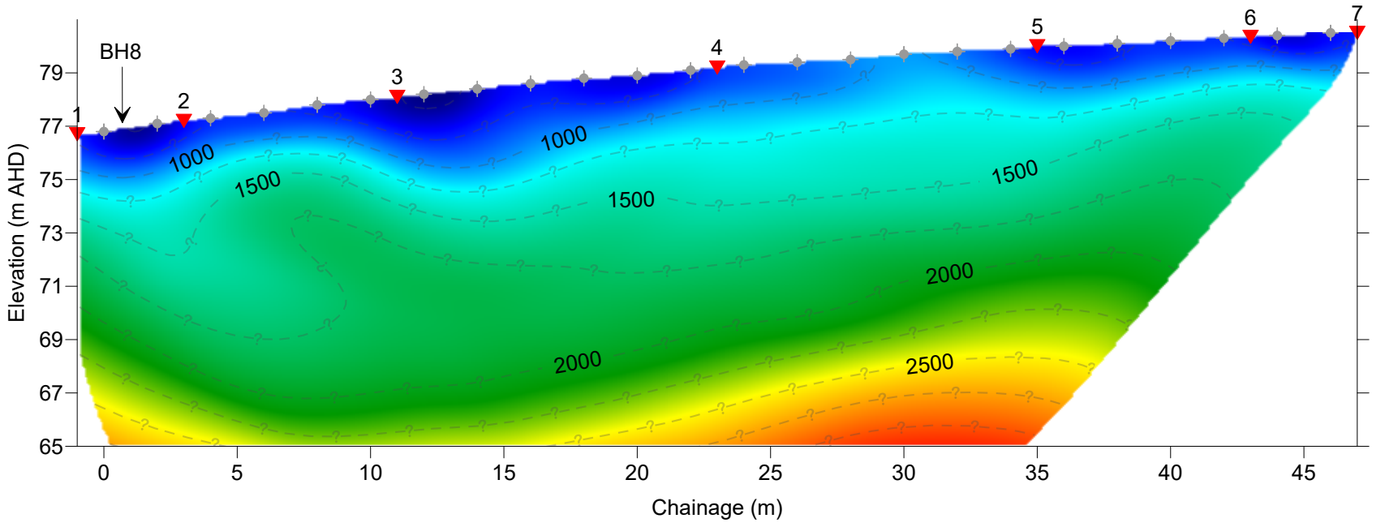
Scale (m)

0 2 4 6 8

DRAWN	BH	CLIENT: FRASERS PROPERTY NEW BEITH PTY LTD			
CHECKED	SM	PROJECT: PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH			
DATE	30/01/2023				
SCALE	AS SHOWN	TITLE: SRT PROFILES: LINE 4			
ORIGINAL SIZE	A3	PROJECT NO: J001800	FIGURE NO: 005	REV: 0	

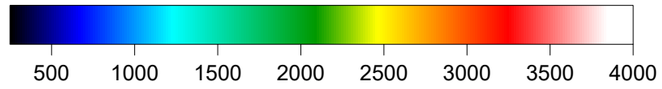
Line 5: P-Wave Velocity Profile



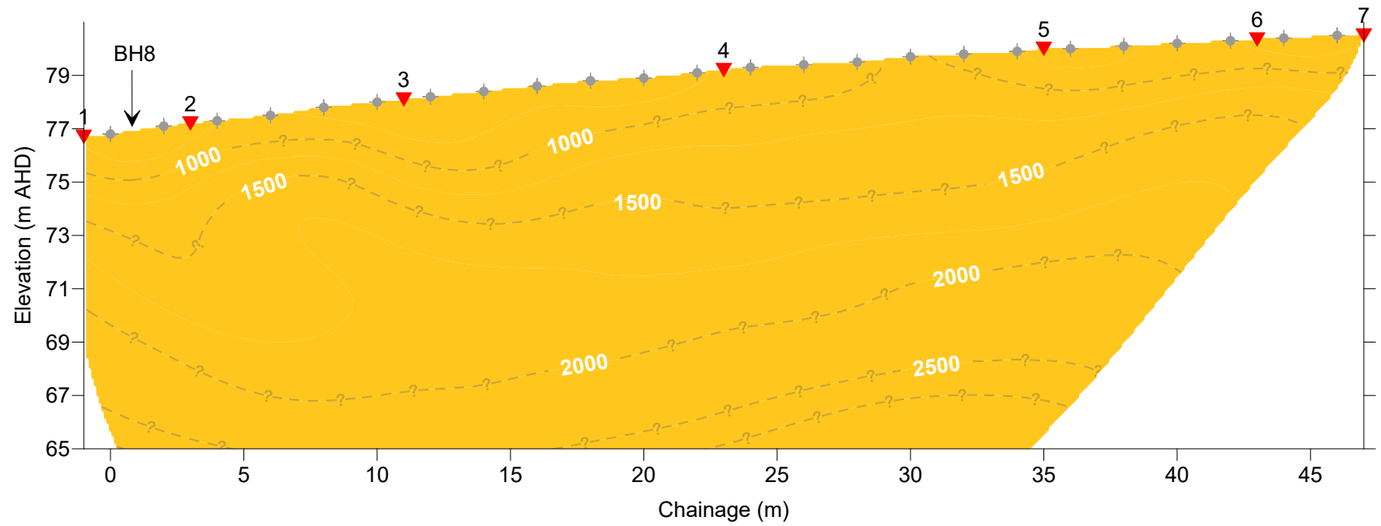
Legend

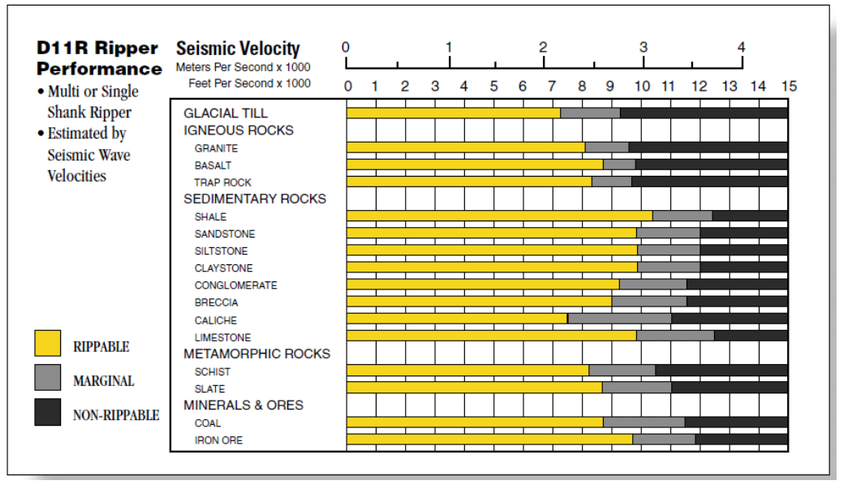
- Denotes seismic source shot location and number
- Denotes geophone location

P-Wave Velocity (m/s)



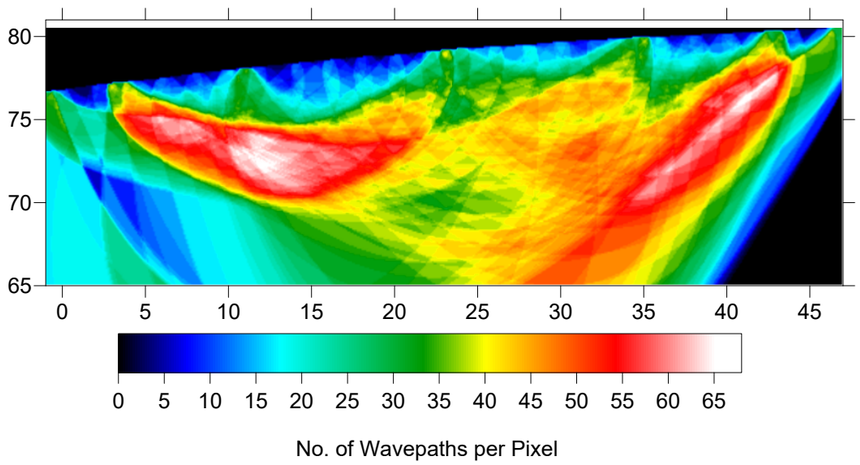
Line 5: Inferred Rippability Profile





Line 5: Wavepath Coverage

RMS error 1.5%=0.24ms 100 WET itr. 50Hz Width 3.0% initial GRADIENT.GRD v. 4.03



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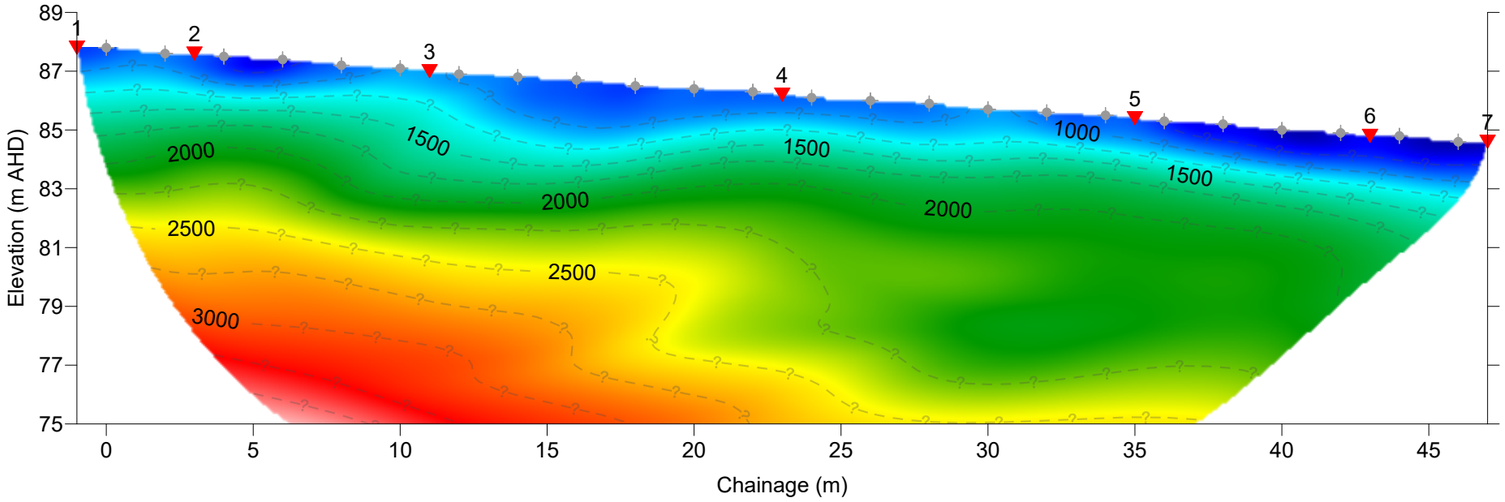
Scale (m)

0 2 4 6 8

DRAWN	BH	CLIENT:	FRASERS PROPERTY NEW BEITH PTY LTD		
CHECKED	SM	PROJECT:	PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH		
DATE	30/01/2023				
SCALE	AS SHOWN	TITLE:	SRT PROFILES: LINE 5		
ORIGINAL SIZE	A3	PROJECT NO:	J001800	FIGURE NO: 006	REV: 0

Line 6: P-Wave Velocity Profile



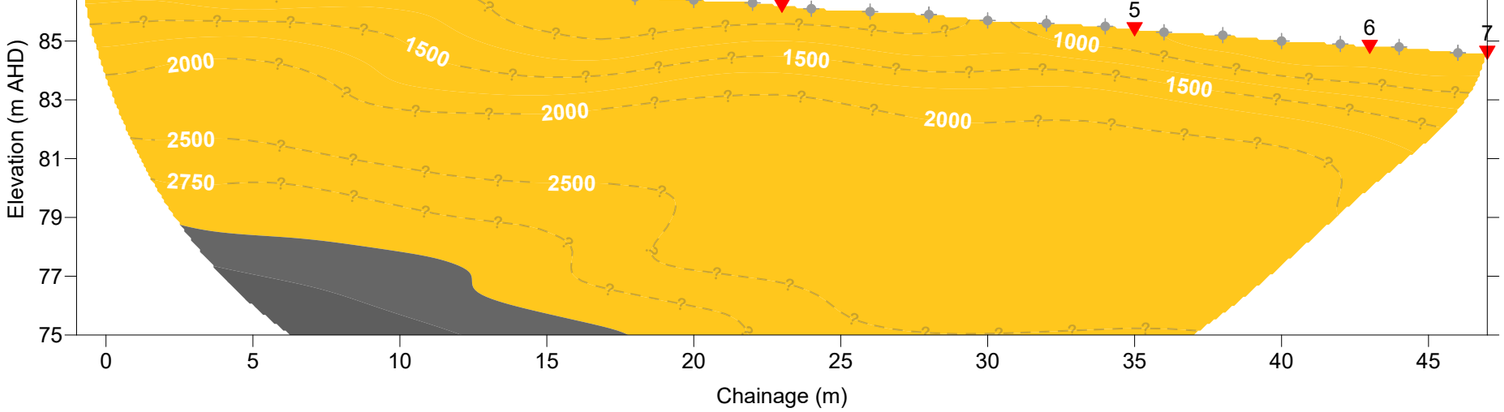
Legend

- Denotes seismic source shot location and number
- Denotes geophone location

P-Wave Velocity (m/s)

500 1000 1500 2000 2500 3000 3500 4000

Line 6: Inferred Rippability Profile



D11R Ripper Performance

- Multi or Single Shank Ripper
- Estimated by Seismic Wave Velocities

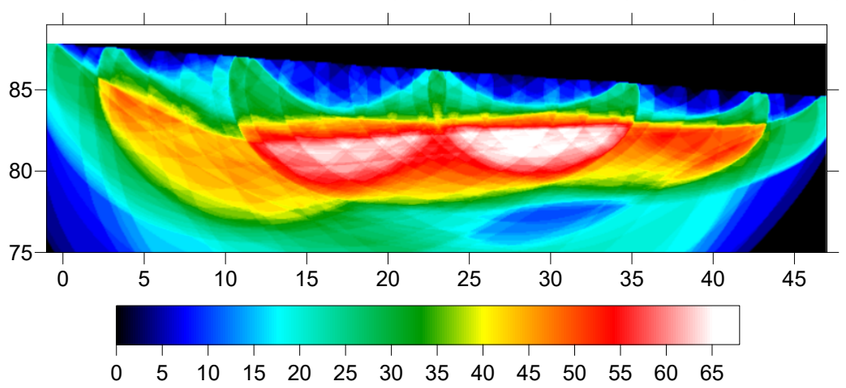
Seismic Velocity
Meters Per Second x 1000
Feet Per Second x 1000

GLACIAL TILL
IGNEOUS ROCKS
GRANITE
BASALT
TRAP ROCK
SEDIMENTARY ROCKS
SHALE
SANDSTONE
SILTSTONE
CLAYSTONE
CONGLOMERATE
BRECCIA
CALICHE
LIMESTONE
METAMORPHIC ROCKS
SCHIST
SLATE
MINERALS & ORES
COAL
IRON ORE

RIPPABLE
MARGINAL
NON-RIPPABLE

Line 6: Wavepath Coverage

RMS error 1.1%=0.14ms 100 WET itr. 50Hz Width 2.5% initial GRADIENT.GRD v. 4.03



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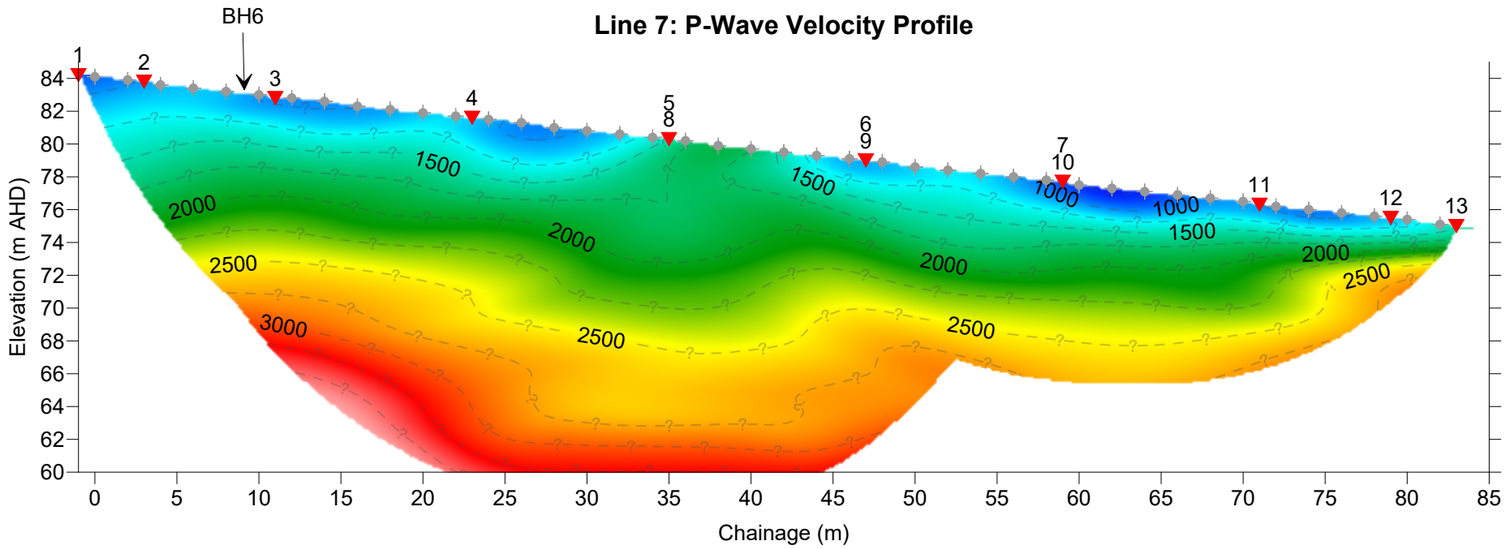
Scale (m) 0 2 4 6 8

DRAWN	BH	CLIENT: FRASERS PROPERTY NEW BEITH PTY LTD			
CHECKED	SM	PROJECT: PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH			
DATE	30/01/2023				
SCALE	AS SHOWN	TITLE: SRT PROFILES: LINE 6			
ORIGINAL SIZE	A3	PROJECT NO: J001800	FIGURE NO: 007	REV: 0	

Line 7: P-Wave Velocity Profile



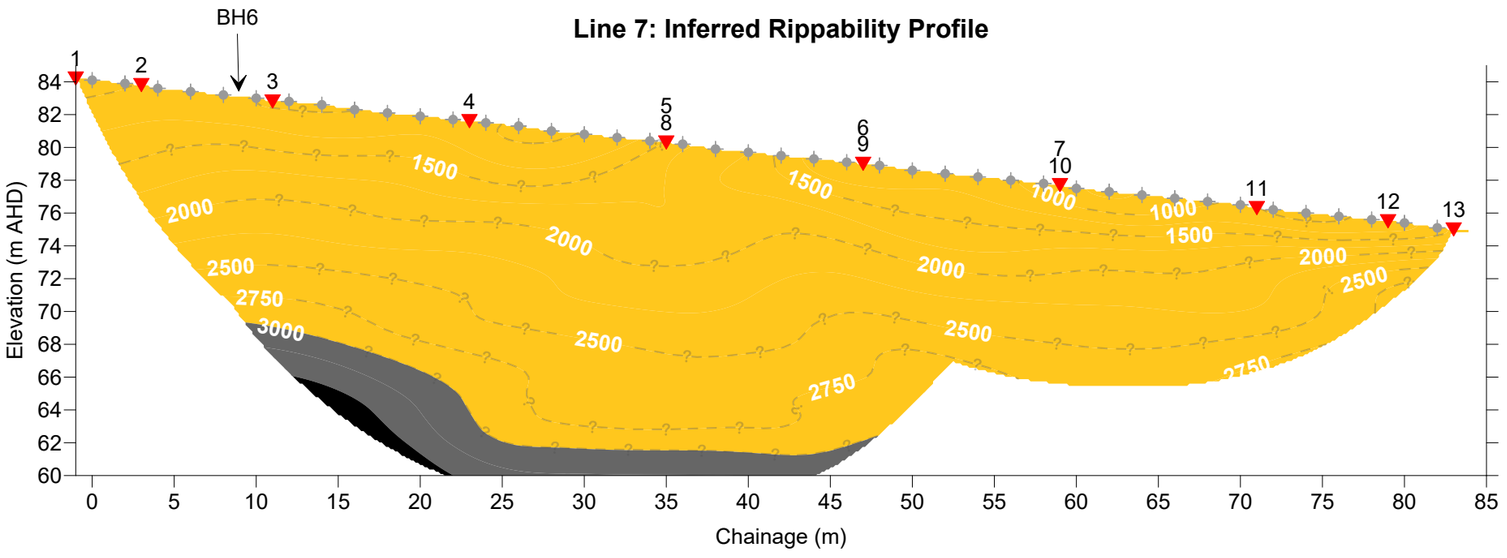
Legend

- Denotes seismic source shot location and number
- Denotes geophone location

P-Wave Velocity (m/s)

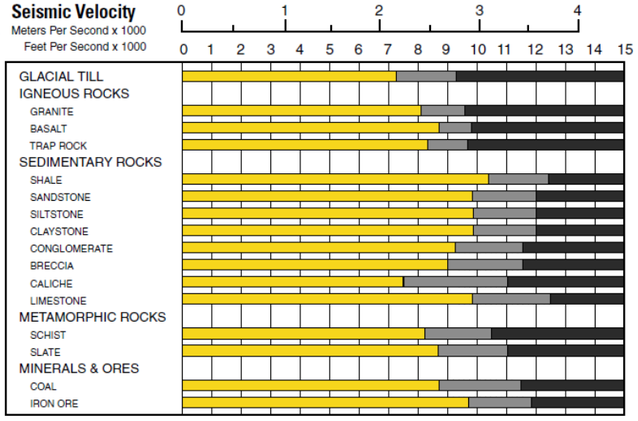
500 1000 1500 2000 2500 3000 3500 4000

Line 7: Inferred Rippability Profile

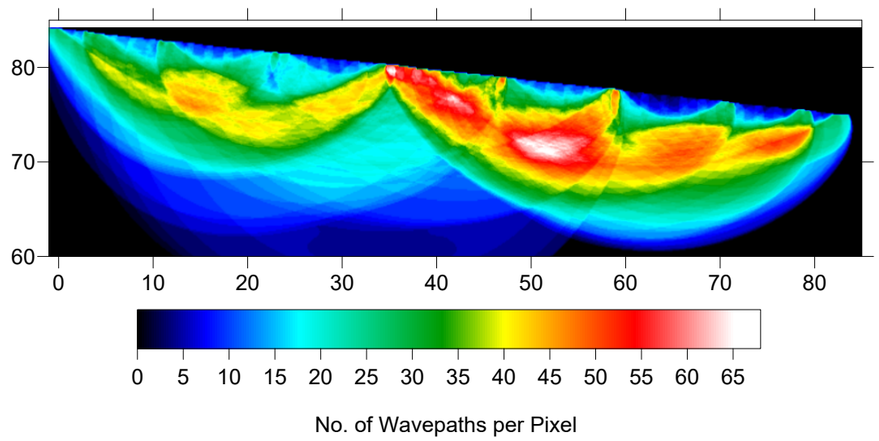


D11R Ripper Performance

- Multi or Single Shank Ripper
- Estimated by Seismic Wave Velocities



Line 7: Wavepath Coverage
RMS error 1.2%=0.15ms 100 WET itr. 50Hz Width 2.5% initial GRADIENT.GRD v. 4.03



REFER TO FIGURE 1 FOR SECTION LOCATION

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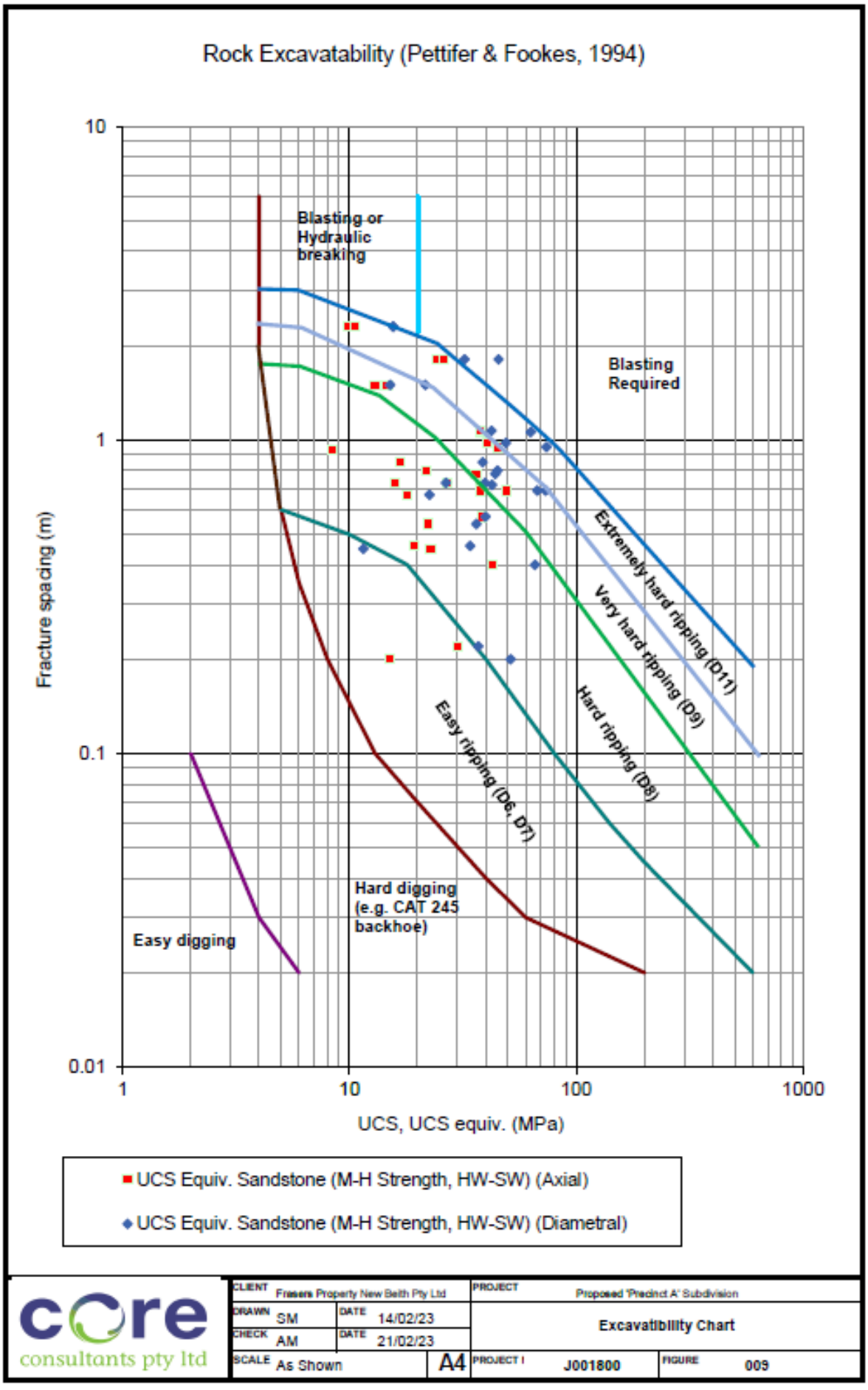
Scale (m)
0 4 8 12 16

DRAWN	BH	CLIENT:	FRASERS PROPERTY NEW BEITH PTY LTD
CHECKED	SM	PROJECT:	PROPOSED 'PRECINCT A' SUBDIVISION MOUNTAIN RIDGE ROAD, NEW BEITH
DATE	30/01/2023		
SCALE	AS SHOWN	TITLE:	SRT PROFILES: LINE 7
ORIGINAL SIZE	A3	PROJECT NO: J001800	FIGURE NO: 008 REV: 0

Appendix E
Figure 9: Pettifer and Fookes Rock Excavatability Chart



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CLIENT	Frasers Property New Beith Pty Ltd	PROJECT	Proposed 'Precinct A' Subdivision
DRAWN	SM	DATE	14/02/23
CHECK	AM	DATE	21/02/23
			Excavatibility Chart
SCALE	As Shown	A4	PROJECT I J001800 FIGURE 009

Appendix F
QBCC: A guide to preventing structural damage

qbcc
queensland building and construction commission

A guide to preventing structural damage

Build better.

Home owners guide to planning landscaping and maintenance of foundations

Structural damage can result from movement in clay soils caused by varying moisture conditions around the perimeter of homes.

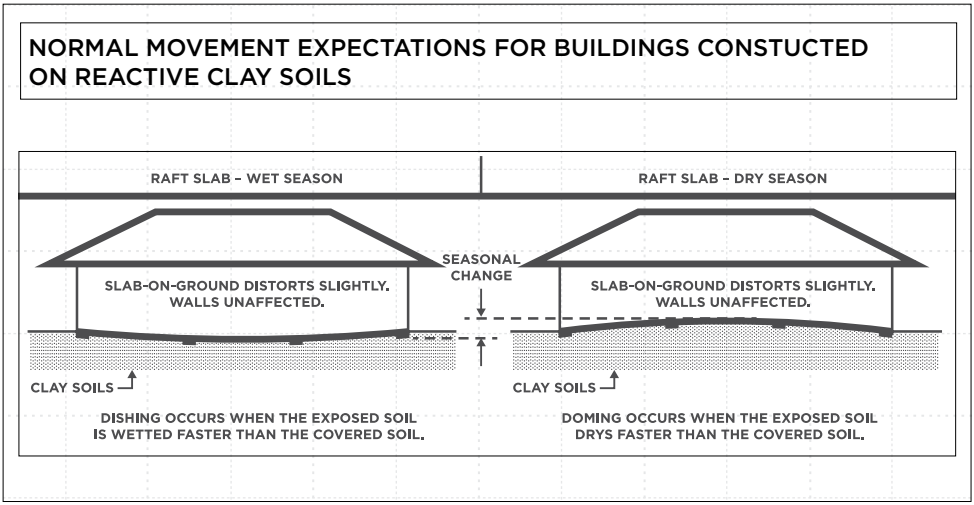
The majority of Queensland homes are situated on what are termed reactive clay soils. These soils are subject to expansion and contraction depending on seasonal weather and site conditions. Sandy sites and rocky terrain are usually not prone to this expansion and contraction.

In Queensland, engineers design footings to the **Australian Standard AS2870 – 2011 Residential slabs and footings**. Footings correctly designed to this standard are intended to accommodate the expected movements caused by seasonal volume changes in the soil (swelling when wet and shrinking when dry) - under **normal conditions**. The performance of footings under this standard requires **normal conditions** to be **maintained** around the house.

This guideline identifies **abnormal conditions** that should be avoided and/or corrected.

Dry seasons cause soils to dry out rapidly. Wet seasons cause soils to become wet quickly. This results in sudden extreme volume changes and movement in soil.

Abnormal conditions (other than seasonal changes), may include the effect of trees, poor surface drainage and/or leaking plumbing. If not allowed for in the engineer's design, these types of abnormal conditions may lead to movement and damage varying from minor to extreme.



How much can the soils under my house move?

The amount of movement that may occur depends on the site classification, which is defined under the **Australian Standard AS2870**.

The relevant classifications and expected movements under normal site conditions and seasonal influences are:

Site classification	Description of type of clay and reactivity	Expected range of movement
A	Mostly sand and rock with little or no ground movement from moisture changes.	0
S	Slightly reactive clays that do not present significant trouble. Very limited damage could be expected in the life of the building.	0 to 20mm
M	Moderately reactive clays that may cause minor movement and damage in the life of the building. Reasonable care is required in planning the site.	20 to 40mm
H **(H1 & H2)**	Highly reactive clays have potential to move more, and react to variable moisture change conditions. Some minor damage may occur in the life of the building under normal conditions. More significant damage may occur where site maintenance conditions are a problem e.g. influence of trees or leaking underground plumbing or poor drainage. Particular care is required in planning the site.	**H1** 40 to 60mm **H2** 60 to 75mm
E	Extremely reactive clays have the potential to react significantly to any variable moisture changes in the foundation clays and require significant attention to detail in planning the site works. Extreme movement and damage may occur if the site conditions and foundation maintenance requirements are not observed. Footing systems and site conditions on “E” sites require very detailed specification from an engineer.	>75mm (Note: Movements on **E** sites have been known to move up to and in excess of 100 to 150mm in SE Qld)

Is it normal to expect cracking to occur in brickwork, walls and ceilings?

Yes, damage in varying degrees can be expected in the life of the building depending on the relevant site classification.

If cracking becomes apparent the site maintenance conditions should be checked as noted under "key points to consider..."

Corrective action should be carried out immediately and may include regrading surface drainage, moving gardens and trees or repairing leaks in water supply, stormwater and/or sewer drainage.

A sound plan for a reactive clay site is to provide a consistent moisture regime around the building by installing paths and patios against the house. Locate lawns up against paths & patios. Garden beds, the most heavily watered parts of a garden, should be kept well away from the house.

If gardens must be placed in close proximity to the house, they should be sealed with plastic and contain only a few small plants. Take care not to trap water against the building if using garden edging.

Caution: Care should also be taken if placing filling against the house. Always ensure weep holes are not covered and that existing Termite Management Systems are not compromised.

Key points to consider when planning landscaping to avoid structural damage.

- Plan type and location of gardens, paths, driveways, lawns, filling and retaining walls
- Take care in selection of trees and shrubs. Do not over plant next to the house
- Keep trees with high water demand well away from buildings in reactive clay areas.
- Avoid variable conditions around the house and maintain adequate moisture/watering. Do not ***over*** water and avoid the use of unregulated sprinkler systems.
- Locate ponds and water features away from the house.
- Direct surface water away from the house. Do not allow water to be trapped or pond near the house.
- Repair leaking pipes and taps.

Note: these issues should be considered as part of planning and maintaining the home. Aim to provide a consistent moisture regime around the house. This will minimise soil moisture variations that may cause movement and result in structural damage.

Common sense guidelines for landscaping and gardens

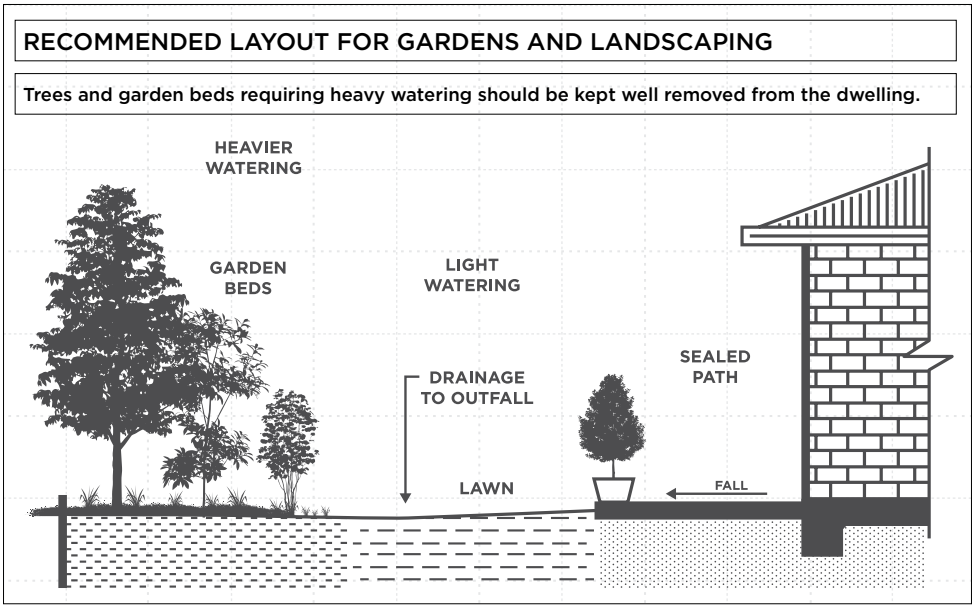
1. Gardens

Important: It is quite impractical to try to prevent gardening activities from increasing the moisture content around the foundations of your home. The only practical course is to keep such activities away from the immediate vicinity of the building and so minimise their effects.

A sound plan for a reactive clay site is to provide a consistent moisture regime around the building by installing paths and patios against the house. Locate lawns up against paths & patios. Garden beds, the most heavily watered parts of a garden, should be kept well away from the house.

If gardens must be placed in close proximity to the house, they should be sealed with plastic and contain only a few small plants. Take care not to trap water against the building if using garden edging.

Caution: Care should also be taken if placing filling against the house. Always ensure weep holes are not covered and that existing Termite Management Systems are not compromised.



2. Paths, patios and driveways

Paths should be laid hard against brickwork or footings with a fall away from the house to a stormwater discharge point.

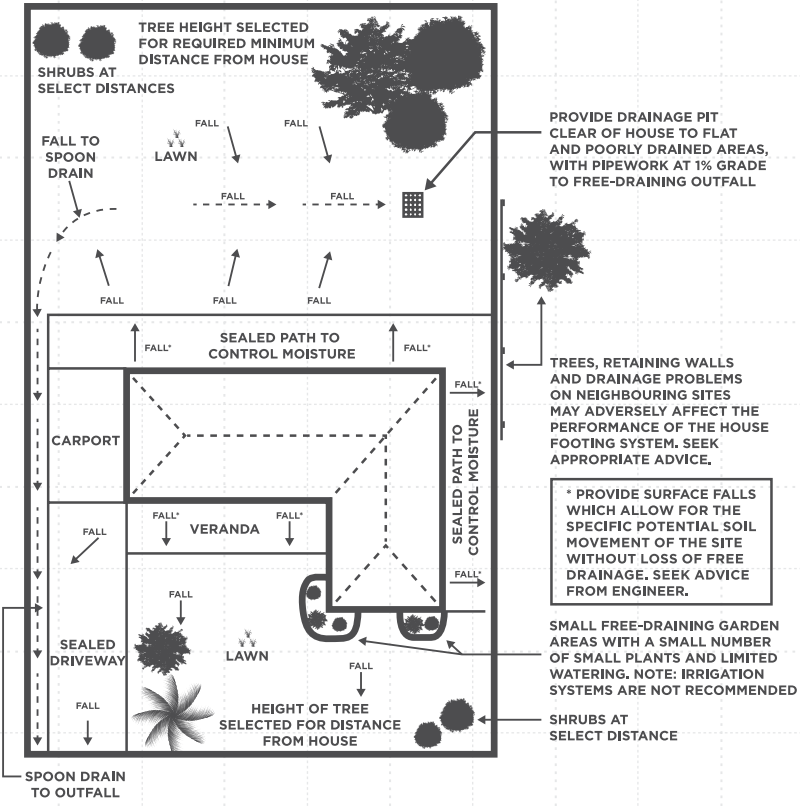
Avoid placing large expanses of concrete on one side of the house and heavily watered garden beds on the other.

The water saturated clay in the gardens will expand and swell while the soil under the concrete may not move. Structural damage can result from this unco-ordinated movement.

Concrete pavements should be constructed in a way that will not impede surface water flowing away from the building or cause water to pond adjacent to the footings causing clay foundations to swell.

On “H” & “E” site classifications, particular detail is required to prevent pavement from moving away from the building. Movement in paths could cause stress on pipes and inspection openings and/or breakages in pipes. Resulting leakages may cause movement and damage as a result of clay soils under the house swelling.

RECOMMENDED LANDSCAPING



3. Lawns

If placing lawn areas against the house, ensure that filling built up against the wall is graded away and will not allow ponding of water to occur. The filling should be impervious clay soil and not sandy loam.

REMEMBER: Do not cover weep holes.

4. Filling

Prior to preparing for gardens, lawns or filling as part of site works, care should be taken to ensure the sub-grade or ground level is graded or sloped away, especially when filling or top dressing with sandy loam. The sub-grade should consist of impervious natural site clay.

Where elevated floors exist ensure that the final finished ground level outside the house is not higher than the sub-floor area and that water cannot flow back under the house.

5. Excessive watering of gardens and lawns

The erection of a building also indirectly brings with it changes in the moisture content to the site. While it is normal to water gardens and lawns, excessive or over watering should be avoided. Consistent and adequate watering should be observed at all times.

The location of sprinkler systems next to houses should also be avoided on H and E sites.

Sprinkler systems should be as well controlled and maintained as practical, and only used in gardens and on lawns away from the building.

6. Site drainage and sloping sites

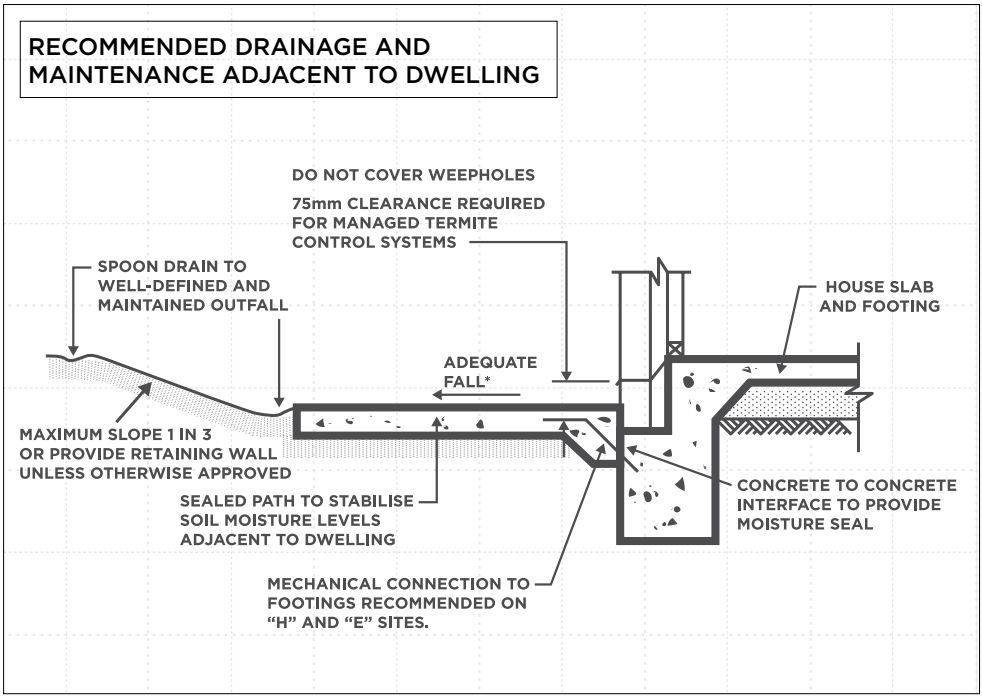
Design for site conditions, location of retaining walls, paths, swimming pools, future structures or proposed extensions etc. should all be considered when preparing the site for correct surface water flow.

If the ground slopes towards the house, paths with spoon drains should be provided.

It is also important to place drains uphill of the footings so as to direct water around the house and away from the footings. A stormwater and roof water drainage management plan should be considered and take into account water flowing from adjoining properties.

Seek advice from an engineer

1. To ascertain surface falls which allow for the specific potential soil movement of the site without loss of free drainage
2. To provide correct mechanical connection of perimeter paths of footings



7. Trees and shrubs

The roots of trees and shrubs can affect footings by removing moisture from clay soils immediately underneath the building causing subsidence as the clays shrink.

In its search for water, a tree root system can spread a lateral distance equal to the height of the tree. If in rows or grouped with other trees the roots may spread up to twice the height of the tree.

Care should be taken when selecting trees and, as a guide, the trees listed should not be planted within the distance of their mature height from the house depending on the site classification and whether they are to be planted in a line or in a group.

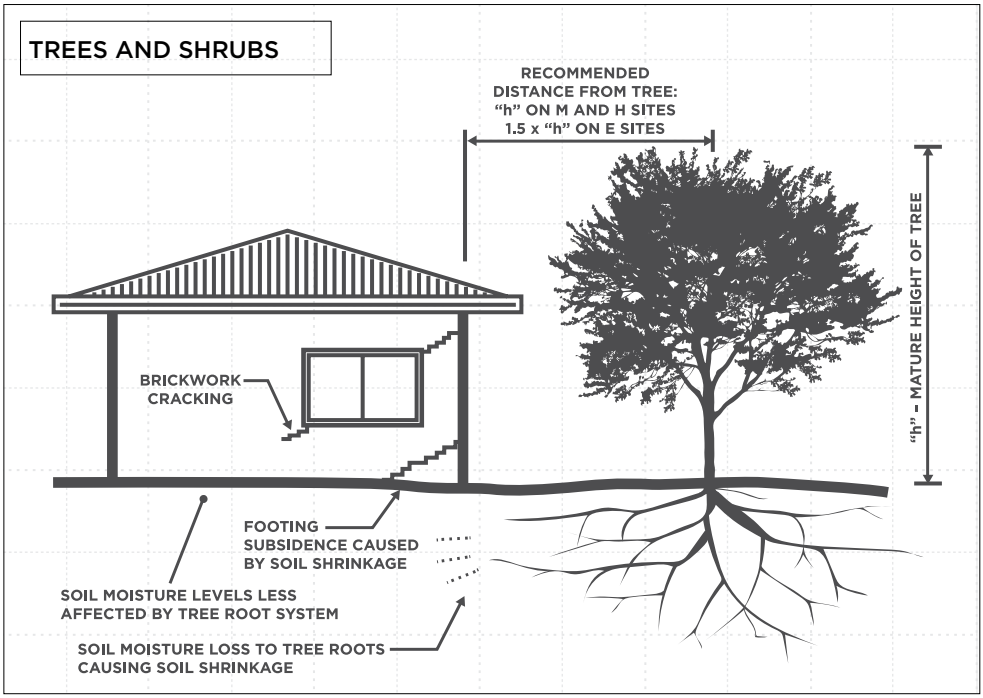
Height of Tree(h)
Distance from house (d)

d = 1 h for class **H** and **M** sites.

d = 1.5 h for class **E** sites.

d = 2 h for rows or groups of trees.

10 to 20 metres	20 to 30 metres	30 to 60 metres
Acacias	But-But	Blue Gum
Ash	Cedars	Cypress
Athel Tree	English Oak	English Elm
Candlebark	Lemon Gum	Figs
Manna Gum	Palms	Karri
Pepper tree	Planes	Pines
Willows	Sheoaks	Poplars
Yate	Silky Oak	River Gum
Yellow Gum	Spotted Gum	Sugar
	Casuarina	



Summary of owner responsibilities for houses under warranty

1. Maintain the site drainage at all times.

2. Do not alter the site drainage provided by the builder. Any changes to the site drainage should ensure that water will be directed away from the building and not pond adjacent to the footing and slab system. Care should also be taken to avoid directing water flow to adjoining properties.

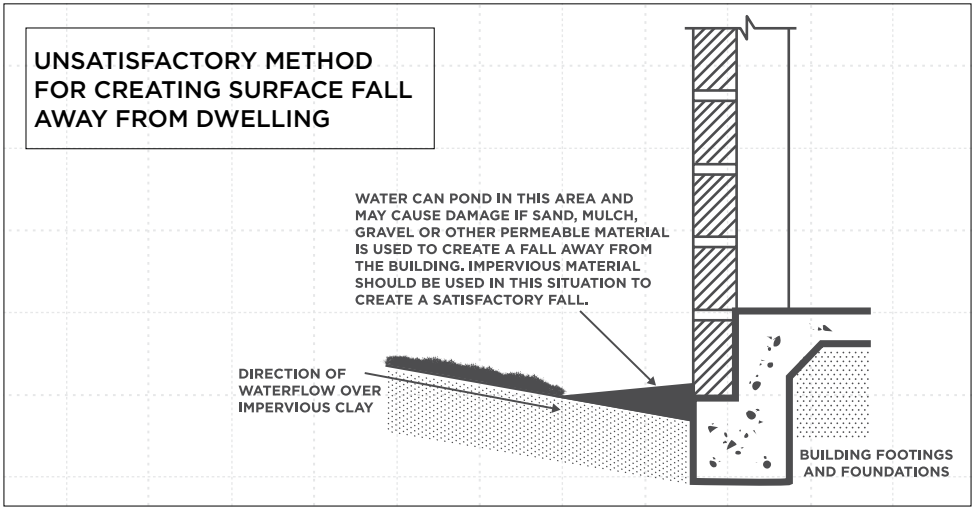
3. Where possible on reactive clay sites (Type M,H,E Classifications), avoid placing gardens or installing garden edging, gravel pavements etc next to the building. This may cause water retention and/or promote a greater variation in moisture conditions around the building.

4. Installation of sprinkler systems next to dwellings on highly and extremely reactive sites (Type H & E Classifications) should be avoided. Adequate and consistent watering only is recommended. Over watering should be avoided.

5. Do not plant trees within a distance from a building that equates to their mature height. Always plant in accordance with the requirements for the relevant site classification.

6. Regularly check and maintain plumbing, drainage and stormwater systems by immediately carrying out repairs to leakages or breakages when observed (usually displayed by seepage and/or greener lawns etc.), or when minor damage or cracking exceeding 3-5mm appears in walls or ceilings.

By observing these requirements, movement and damage which may be expected in the life of the building can be minimised and maintained within normal performance requirements.



Notes:

Note: this document has been developed to provide homeowners with general guidance on the maintenace of their homes. It does not purport to address site specific issues. Homeowners should seek professional advice from their builder or engineer when they experience movement in their home or need advice on issues which may affect their home.

Need more information?

Visit qbcc.qld.gov.au or call us on 139 333.

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qbcc | Build better.

299 Montague Road,
West End Qld 4101
GPO Box 5099,
Brisbane Qld 4001
T: 139 333
F: 07 3225 2999
W: qbcc.qld.gov.au

Appendix G
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core
consultants pty ltd

Head Office | **Sunshine Coast**
Unit 1 / 2 Neumann Court
Kunda Park Qld 4556

T 07 5475 5900

Brisbane
Suite 3.16, 433 Logan Road
Stones Corner Qld 4120

T 07 3394 8331

E info@coreconsultants.com.au

www.coreconsultants.com.au