JOB NO ME18/065 **DECEMBER 2020**

PARKER PROPERTY NINGI PTY LTD

REPORT ON GEOTECHNICAL INVESTIGATION

41 GLENBROOK DRIVE

NAMBOUR

MORRISON GEOTECHNIC

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22nd December 2020

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ATTENTION: **MR MATTHEW CLARKE**
Email: matthew@parkerpropertygroup.com
CC: amontgomery@mnce.com.au

Dear Sir

RE: **REPORT ON GEOTECHNICAL INVESTIGATION**
41 GLENBROOK DRIVE, NAMBOUR

1.0 INTRODUCTION

This report presents the findings of the geotechnical investigation at Glenbrook Drive, Nambour. The work was commissioned by Mr Matthew Clarke, representing Parker Property Ningi Pty Ltd (the 'Client').

This report incorporates the earthworks details contained on the Revised DA issue to council plans and sections as indicated below: -

- C3602 -CA100 A Coversheet.
- C3602 -CE100 A Bulk Earthworks Overall Layout
- C3602 -CE200 A to CE203 A Bulk Earthworks Detail Layout Plan Sheets 1 to 4.
- C3602 -CE300 A to CE304 A Bulk Earthworks Sections Sheets 1 to 5.
- C3602 -CE400 A Retaining Wal Layout Plan Rear of Lots 28 - 43 and 50 - 53.
- C3602 -CE401 A Retaining Wall Longitudinal Section Rear of Lots 28 – 43 and 50 – 53.
- C3602 -CE402 A to CE409 A Retaining Wall Cross Section Sheets 1 to 8.

From the information provided, it is understood that the new development will comprise a residential subdivision of 51 lots. The current design layout indicates that earthworks are to comprise cut and fill typically in the order of up to about 7m depth of fill and cuts up to 10m deep.

A series of retaining walls are proposed across the site to support both cut and fill earthworks enabling grade separation and form flatter slopes for roadways and allotments. These retaining wall heights are typically up to a maximum of 2.7m. The previous double tiered retaining wall located along the central part of the site has been removed from the scheme and replaced with earthworks comprising of fill and cut batter slopes.

This report provides a summary of the fieldwork findings and comments on:

- Subsurface conditions.
- Landslide risk assessment.
- Site preparation.
- Excavatability.
- Re-use of site materials.
- Earthworks.
- Batter Slopes.
- Retaining wall design.
- Footing design.
- Erosion and sediment control.
- Presumptive permeability of materials for basin design.

Our assessment concludes there is a ***Low Risk*** of slope instability for the proposed development provided usual "good" design and construction practices are adhered to.

The main geotechnical constraints to earthworks and civil works will be associated with the presence of "hard" rock with test pit excavator refusal encountered at relatively shallow depths. The upper residual soils included some clays which were relatively high plasticity and moderately to highly reactive. Careful moisture conditioning of high plasticity clays during earthworks will be required and these materials may exhibit low strength properties requiring "stronger" pavements where present in road subgrade areas.

Further comments are provided herein.

2.0 OVERVIEW/SUMMARY OF SITE CONDITIONS AND INVESTIGATION FINDINGS

2.1 Site Description

The site generally slopes from higher ground in the south down towards to the north with topography comprising a central ridgeline running south to north with incised drainage and gully lines as well as secondary ridges off the flanks of the central dominant ridge.

Review of historical aerial photographs indicates that the site was extensively cleared prior to the 1950's with the residential lots to the south developed in the 1960's and further residential development to the east occurring progressively from the 1990's. A series of historical aerial photographs from Queensland Government's *QImagery* Website is attached (Appendix A).

There are no obvious signs of previous large-scale instability. Similarly, no large-scale scouring or erosion is generally noted. Gully and drainage lines that have been incised through the hillside appear to generally follow the same alignment over the period of the available aerial photographs that were reviewed (from 1953).

Signs of minor, shallow creep movement were noted on the steeper ground in the head of the drainage line in the southern part of the site (ref. Site Plan, Appendix B - Dwg ME17/023-1). In this area some of the trees were noted to be slightly "bowed" which could be an indication of some ground movement. Similarly, there is an indication of possible creep or slumping in the head/flank of the drainage line in the south-eastern part (ref. Site Plan, Appendix B - Dwg ME17/023-1). Key features and slope angles measured with an inclinometer are shown on the Site Plan which is attached (Appendix B- Dwg ME17/023-1).

2.2 Method of Investigation

The geotechnical investigation comprised a site terrain assessment and excavation of twelve (12) test pits to depths of between 2.5m and 4.0m at selected locations across the site. Test pits were designated TP1 to TP7 and TP9 to TP13. Proposed test pit TP8 was not completed as access across the gully line was not possible at the time of the investigation (i.e. excavator got "bogged" whilst attempting to cross the gully line). The test pits were excavated with a 23-tonne excavator with a 1200mm wide toothed bucket. Upon nearing practical excavator bucket refusal, a ripping tyne was used to further advance the test pits.

Further subsurface investigation was carried out comprising of three boreholes, designated BH1 to BH3, located along the central part of the site. These boreholes were drilled using a specialised, track mounted rotary drill rig and drilled to depths of 4.5m to 6.5m below ground level (bgl). The boreholes were advanced using a combination of solid flight augering, wash boring and NMLC rock coring. Borehole BH2 was able to be advanced to a depth of 4.5m by means of auger drilling, whereas practical drilling refusal was encountered in BH1 and BH3 at depths of 3.0m and 2.5m, respectively, where NMLC rock coring techniques were employed below these depths.

Standard Penetration Tests (SPTs) were carried out at regular depth intervals in soils and weathered rock encountered in the boreholes.

The subsurface conditions encountered in the boreholes were logged by a Registered, Senior Geotechnical Engineer. The boreholes were drilled on 1st November 2018.

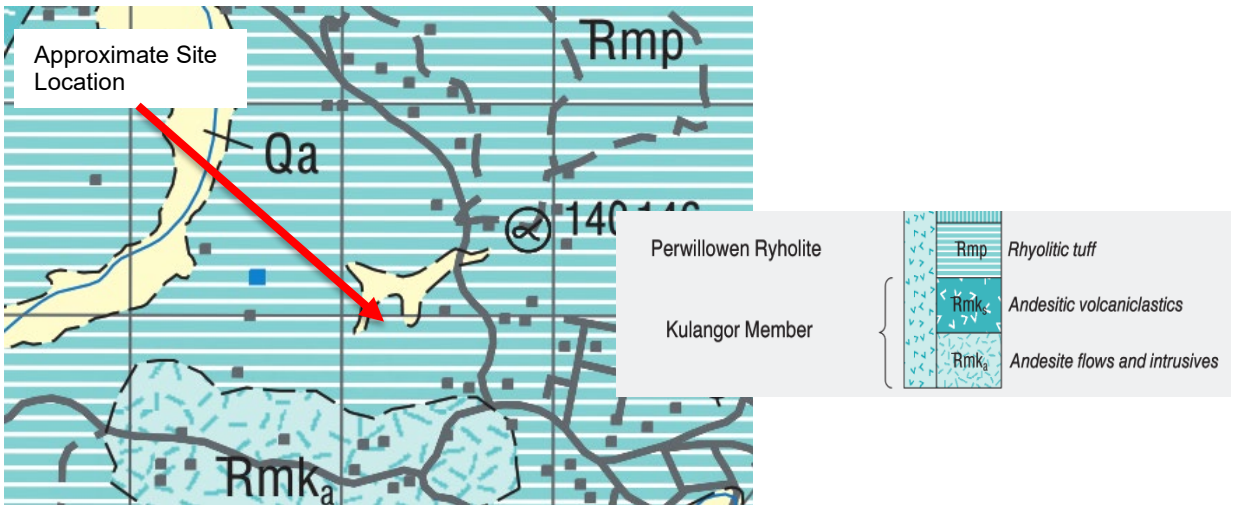
Rock core samples collected during the field investigation were tested in Morrison Geotechnic's laboratory at Maroochydore for Point Load Index to assess the rock strength.

The test pit and borehole locations were set out on site by ONF Surveyors and the locations are shown on the attached Site Plan presented in Appendix B - Dwg ME17/023-1. Site observations from the terrain assessment are also given on the Site Plan, Appendix B - Dwg ME17/023-1. Engineering logs of the boreholes and test pits as well as photographs of the test pits are attached in Appendix C. A summary of the investigation findings is given below in Section 2.4.

2.3 Regional Geology

Regional geology mapping indicates the site is underlain by *North Arm Volcanics* comprising of *Perwillowen Ryholite*: *Rhyolitic Tuff and Kulangor Member: Andesite flows and intrusive*. Minor alluvium is shown associated with the creek line in the north western part. An extract of the geology map is given below.

Image 1 – Extract of *Nambour Special Geology Map 1:100,000*, Geological Survey of Queensland



2.4 Subsurface Conditions

Subsurface conditions encountered in the test pits typically comprised:

- 100mm to 300mm thick layer of silty clay topsoil with root matter and organics; overlying
- Residual, stiff to very stiff, medium to high plasticity silty clay with gravel, tending to clayey gravel/sand in places, to depths of 0.5m to 3.7m; underlain by
- Rhyolitic Tuff, which was described as extremely weathered, dark grey and brown, fractured and very low strength to depths of 1.1m to 4.5m.
- Rhyolitic Tuff then typically increased in strength with depth in BH1 and BH3, coring was carried out to advance the boreholes to further depths in medium to high strength, highly to moderately weathered rock.

A general decrease in weathering and increase in rock strength was noted with depth. Highly weathered, grey, and brown, low strength or stronger rock was encountered below depths of 1.1m to 2.6m in all the test pits except TP1. Some moderately weathered, purple coloured rhyolitic tuff was encountered at depth in the test pits. This material was generally considered to be approaching an "*unrippable*" state with excavation refusal being encountered soon after having exposed this material.

Excavation was described as nearing practical bucket refusal in the test pits at depths of 1.4m to 4.0m. A ripper attachment was used to advance the test pits below these depths.

Groundwater seepage was encountered in test pits TP1 to TP3, TP6, TP9, TP10 and TP13 at depths ranging from 0.5m to 3.5m. The seepage was typically encountered within "*pockets*" near the soil/rock interface. Some surface water and possible seepage was noted within the drainage and gully lines during our site visit. It is noted that the fieldwork was carried out following a period of reasonably heavy rainfall. Groundwater levels are expected to fluctuate in response to seasonal conditions and rainfall.

The test pits findings are summarised in Table 1 below.

Table 1 – Geotechnical Summary of the Subsurface Profile

Test Pit No.	Topsoil Thickness (mm)	Residual silty clay with gravel (m)	Very low strength Rhyolite (m)	Low strength (or stronger) Rhyolite (m)	Bucket Refusal (m)	Termination Depth (m)
TP1	300	0.3-3.7	3.7-TD	NE	4.0	4.0
TP2	200	0.2-1.3	1.3-2.2	2.2-TD	2.2	2.5
TP3	150	0.15-2.1	2.1-2.5	2.5-TD	2.5	3.3
TP4	180	0.18-1.7	1.7-2.1 2.4-2.6	2.1-2.4 2.6-TD	2.1 2.6	3.4
TP5	100	0.1-1.0	1.0-1.7	1.7-TD	2.0	3.0
TP6	250	0.25-1.0	1.0-1.8	1.8-TD	1.8	3.4
TP7	150	0.15-0.5	0.5-2.5	2.5-TD	2.5	3.6
TP9	250	0.25-1.3	1.3-1.4	1.4-TD	1.4	3.0
TP10	200	0.2-0.6	0.6-1.1	1.1-TD	1.8	3.5
TP11	200	0.2-0.9	0.9-1.8	1.8-TD	1.8	3.0
TP12	100	0.1-0.5 1.5-2.1	0.5-1.5	2.1-TD	2.4	2.7
TP13	150	0.15-0.5	0.5-2.0	2.0-TD	2.0	3.8

Notes:
1.) NE – Not encountered; TD – Termination Depth.
2.) All depths below existing surface levels as at date of investigation.

Borehole findings are summarised in Table 2.

Table 2 – Geotechnical Summary of the Subsurface Profile

Test Pit No.	Topsoil Thickness (mm)	Silty Clay with gravel (m)	Very low to low strength Rhyolite (m)	Medium strength (or stronger) Rhyolite (m)	Refusal (m)	Termination Depth (m)
BH1	150	0.15-0.7	0.7-2.7	2.7-TD	2.7	5.3
BH2	200	0.2-2.1	2.1-TD	NE	NE	4.5
BH3	150	0.15-1.5	1.5-2.5	2.5-TD	2.5	6.5

Notes:
1.) NE – Not encountered; TD – Termination Depth.
2.) All depths below existing surface levels as at date of investigation.

3.0 LABORATORY TEST RESULTS

The laboratory test results are contained in Appendix D to this report and are summarised in the following tables.

The results of the Quality of Materials tests carried out by Morrison Geotechnic are summarised in Table 3.

Table 3– Quality of Materials

Test Pit Location	Depth (m)	Soil Fraction			Liquid Limit (%)	Plasticity Index	Linear Shrinkage	Material
		Clay/Silt (%)	Sand (%)	Gravel (%)				
TP3	0.2-0.5	84	13	3	72	45	15.5	Silty CLAY (CH)
TP5	0.2-0.5	2	36	62	40	16	7.0	Sandy GRAVEL (GP)
TP6	0.2-0.3	54	30	16	65	27	13.0	Sandy CLAY (CH)
TP9	0.3-0.6	70	16	14	76	44	18.5	Silty CLAY (CH)
TP10	0.2-0.5	73	23	4	65	39	17.0	Silty CLAY (CH)
TP11	0.5-0.6	61	31	8	70	39	16.0	Silty Sandy CLAY (CH)

Undisturbed samples of the natural clay soils taken in thin wall 50mm diameter steel tubes from selected boreholes were tested to assess volume change capability in the Shrink/Swell Index test (*AS1289 7.1.1*). The results are summarised as follows in Table 4.

Table 4 – Shrink/Swell Index Test Results

Test Pit Location	Depth (m)	Shrink (%)	Swell (%)	Shrink Swell Index (I_{ss} %)
TP3	0.4-0.6	2.5	0.1	1.4
TP5	0.2-0.5	2.1	0.0	1.2
TP10	0.2-0.5	3.1	0.7	1.9
TP11	0.3-0.5	3.5	0.2	2.0
TP11	0.2-0.4	6.8	1.8	4.3
TP12	0.1-0.24	4.3	0.3	2.5

The results of the Standard Compaction and Soaked CBR tests carried out by Morrison Geotechnic are summarised in Table 5.

Table 5 – Standard Compaction and Soaked CBR Results

Test Pit Location	Depth (m)	Standard Maximum Dry Density (t/m^3)	Optimum Moisture Content (%)	Field Moisture Content (%)	Swell after Soak (%)	Soaked CBR (%)
TP3	0.2-0.5	1.438	27.1	26.7	5.0	2.0
TP5	0.2-0.5	1.684	21.4	19.2	0.0	10.0
TP9	0.3-0.6	1.368	35.5	33.4	1.3	6.0
TP10	0.2-0.5	1.400	31.0	29.4	1.7	5.0

The results of Emerson Class Number (ECN), pH, Electrical Conductivity (EC) and Exchangeable Sodium Percentage tests are summarised in Table 6.

Table 6– Emerson Class Number, pH, and EC

Test Pit Location	Depth (m)	Emerson Class No.	pH	EC (uS/cm)	Exchanagable Sodium %
TP2	0.1-0.2	8	5.9	53.7	
TP2	0.4-0.5	5	6.2	34.7	
TP3	0.1-0.2	5	6.3	16.7	3.5
TP3	0.2-0.5	3	5.5	50.5	4.1
TP5	0.1-0.2	5	6.2	19.5	2.2
TP6	0.2-0.3	5	6.3	15.3	
TP6	0.5-0.6	3	5.8	33.2	5.2
TP7	0.1-0.2	8	5.9	31.1	
TP7	0.4-0.5	3	6.1	23.1	4.8
TP9	0.1-0.2	8	6.0	47.4	
TP10	0.1-0.2	8	5.3	191.8	
TP10	0.2-0.5	5	5.8	55.3	
TP11	0.2-0.3	5	5.8	31.5	
TP11	0.5-0.6	3	6.0	31.8	
TP12	0.05-0.2	8	5.9	54.6	
TP12	0.5-0.6	3	5.6	43.6	9.2
TP13	0.05-0.2	8	6.0	97.3	
TP13	0.5-0.6	8	6.0	59.5	

Notes:
Class 3 – Slightly Dispersive (from moist state)
Cass 5 – Slightly Dispersive (from soil/water suspension)
Class 8 – Non-Dispersive

The results of the Point Load Index tests carried out by Morrison Geotechnic are summarised in Table 7.

Table 7 – Point Load Index Test Results

Location/Depth	Is (50) (MPa)	Loading Direction	Strength Term	Note
BH1 3.25m	0.09	Diametral	Very Low	Fractured
BH1 4.11m	0.07	Diametral	Very Low	Fractured
BH1 4.55m	0.10	Diametral	Low	Fractured
BH3 2.80m	0.33	Diametral	Medium	
BH3 5.05m	1.37	Diametral	High	
BH3 6.35m	6.03	Diametral	Very High	
BH1 3.25m	0.04	Axial	Very Low	Fractured

BH1 4.55m	0.07	Axial	Very Low	Fractured
BH3 2.8m	0.09	Axial	Very Low	Fractured
BH3 3.21m	1.00	Axial	Low	Fractured
BH3 3.80m	0.03	Axial	Very Low	Fractured
BH3 5.05m	0.72	Axial	Medium	
BH3 6.35m	5.91	Axial	Very High	

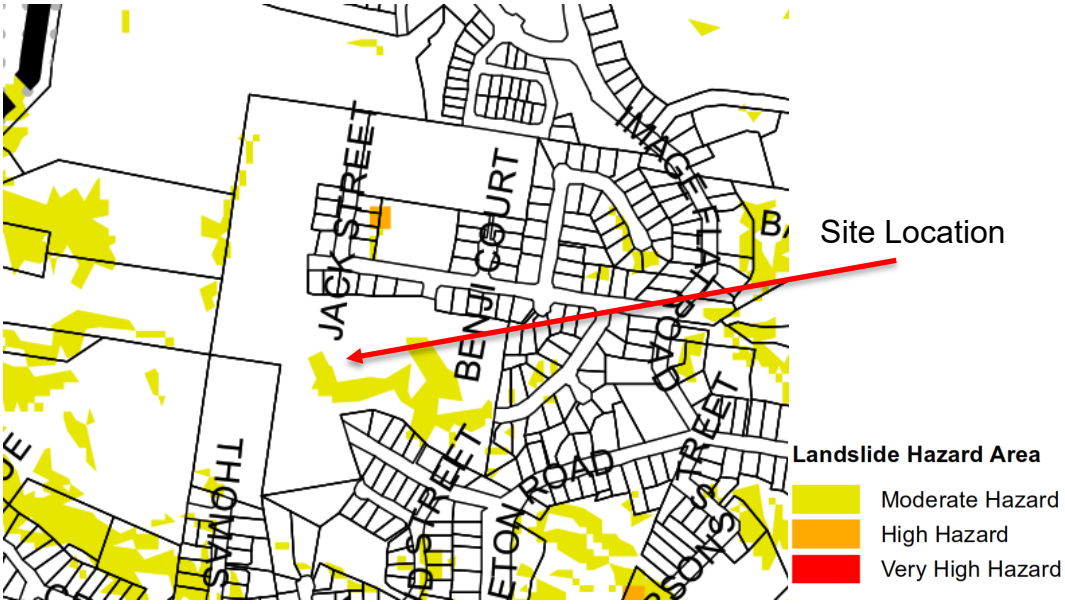
Note: Lower results returned in fractured rock with Very Low to Low Strength rock inferred from test results whereas rock mass logged as Medium Strength from tactile assessment of core.

4.0 GEOTECHNICAL ENGINEERING COMMENTS AND RECOMMENDATIONS

4.1 Slope Stability & Landslide Risk Assessment

Sunshine Coast Council's Landslide Hazard and Steep Land Overlay Code map indicates the site has areas of *Moderate* landslide hazard. A slope stability assessment is therefore required as part of the development application process. An extract of the Council overlay map is given below. It should be noted that the mapping is a broadscale indication of landslide susceptibility only. The hazard rating is superseded by this site-specific assessment.

Image 2 – Council's Landslide Hazard Overlay Code Map



The proposed development area and the greater Site area exhibits no evidence of existing or recent past slope instability involving large scale movements of significant quantities of soil or rock in a short duration event such as a slip or landslide. There are no visible signs of existing or recent past instability, such as uneven or hummocky ground. There is no evidence of erosion or any other soil instability mechanisms within the proposed development area.

However, there is some evidence of minor shallow creep movement of the surficial soil and such movement may occur in future, but this is not expected to significantly impact on the development once surface drainage is formalised.

Currently, the general alignment and approval issue drawings adopt fill slopes with a maximum batter angle of 2.5H:1V, cut slopes with a maximum 2.4H:1V and retaining walls of up to 2.7m splitting the fill sites.

4.2 Global Slope Stability of Retaining Walls

The earthworks and retaining wall layout are considered geotechnically feasible provided that the retaining walls comprise of concrete sleeper walls with their posts adequately embedded to provide a sufficient factor of safety for both global and structural stability.

Stability of embedded retaining walls will depend on the adequacy of the retaining wall designs to withstand internal structural forces and as such these walls must be designed against base sliding, overturning and bearing capacity failure. This is the responsibility of the retaining wall designer.

The computer software program SlopeW has been utilised to check the global stability of the proposed retaining wall sections on Drawing C3602 – CE300 A Section A (Image 3) and Drawing C3602 – CE302 A Section C (Image 4) using typical engineering strength parameters for fill materials of the materials exposed in the cuttings behind Lots 101 to 106 and a 5kPa surcharge.

Image 3 – SlopeW Analysis for 2.7m high Retaining Wall (DRG C3602 – CE300 A Section A)

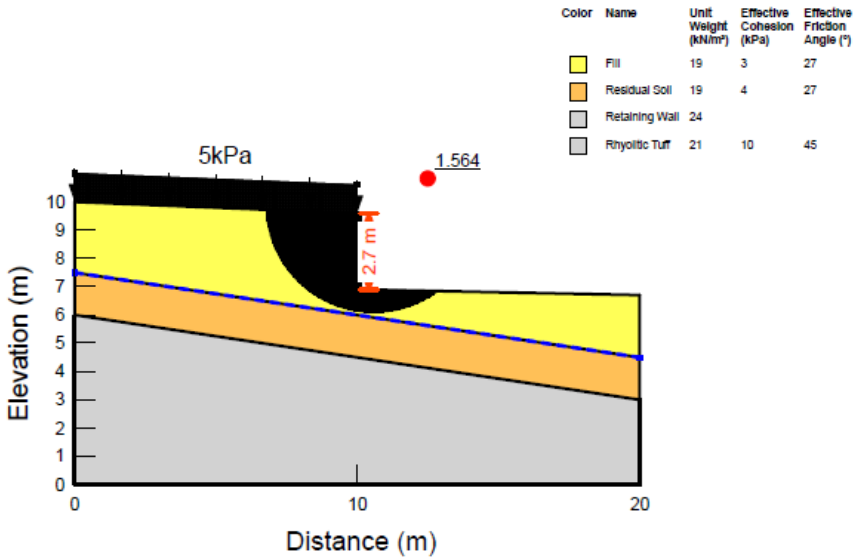
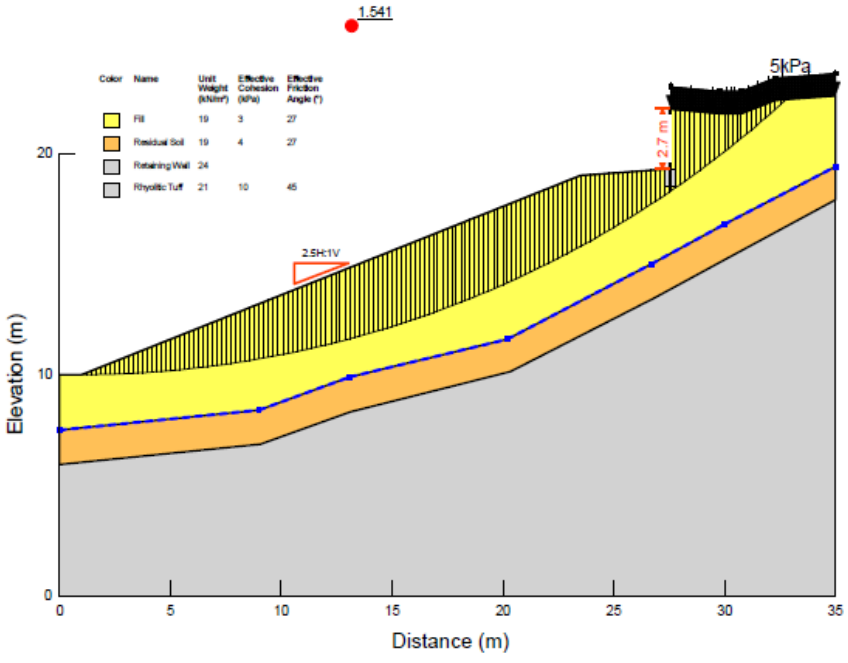


Image 4 – SlopeW Analysis for 2.7m high Retaining Wall (DRG C3602 – CE302 A Section C)



4.3 Global Slope Stability of Batter Slopes

A slope stability anslysis using the computer software program SlopeW has been utilised to check the global stability of the proposed fill and cut slopes indicvated on the provided drawings. The most onerous fill slopes are reperesented on Drawing C3602- CE302 Section C with a 2.5H : 1V slope within Lot 52 or Section A on drwawing C3602 – CE300.

Significant cut slopes are also present within Lots 50 and 31 as indicated on Drawing C3602 – CE303 A with batter slopes up to 2.4H:1V.

The analysis uses typically derived engineering design parameters and indicate that an adequate factor of safety for global stability greater than 1.5 is achievable for both the indicated fill and cut slopes.

Image 5 – SlopeW Analysis for Fill Slope At Maximum Batter Slope of 2.5H:1V

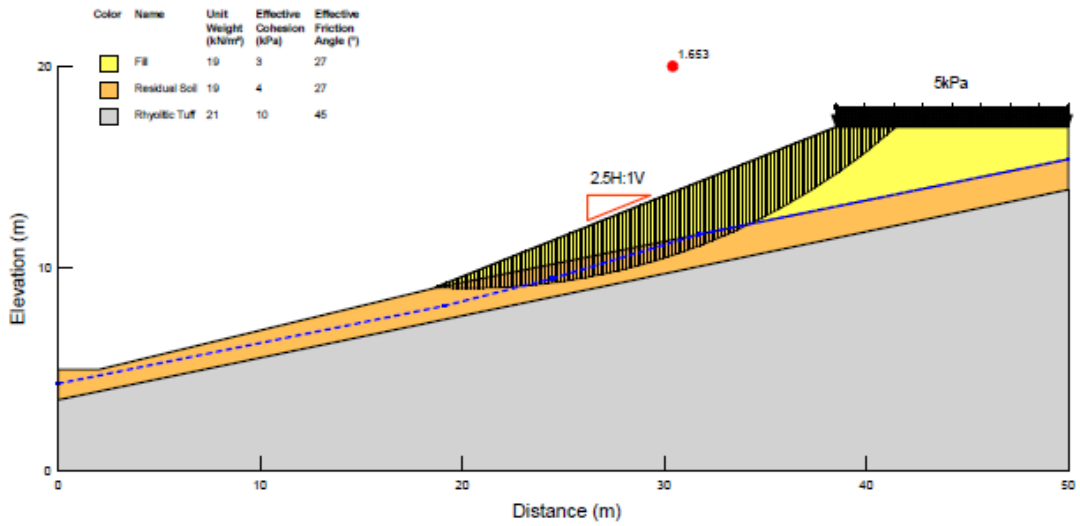
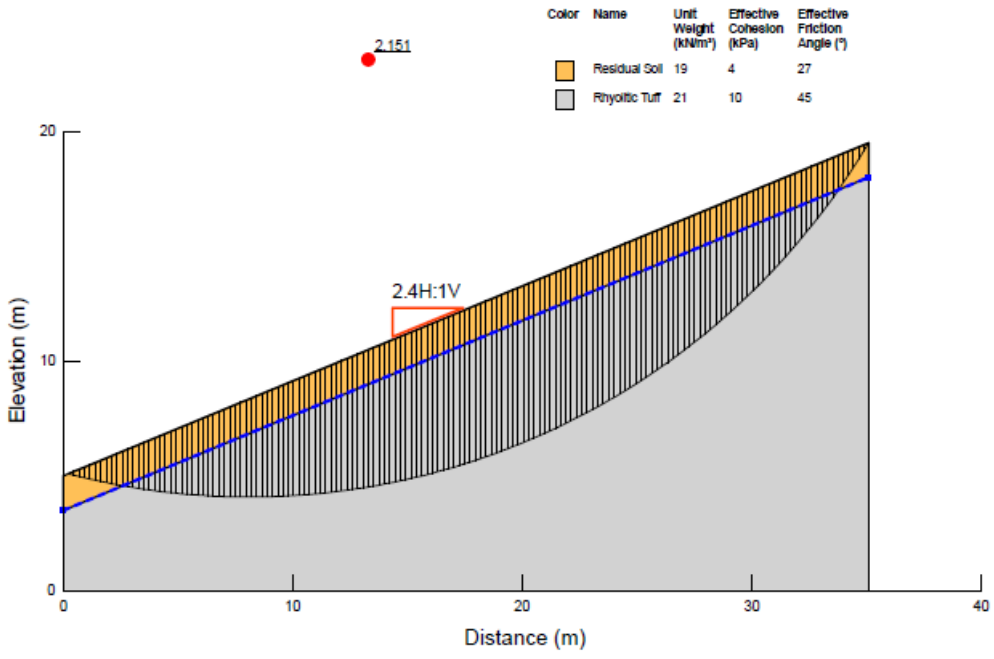


Image 6 – SlopeW Analysis for Cut Slope At Maximum Batter Slope of 2.4H:1V



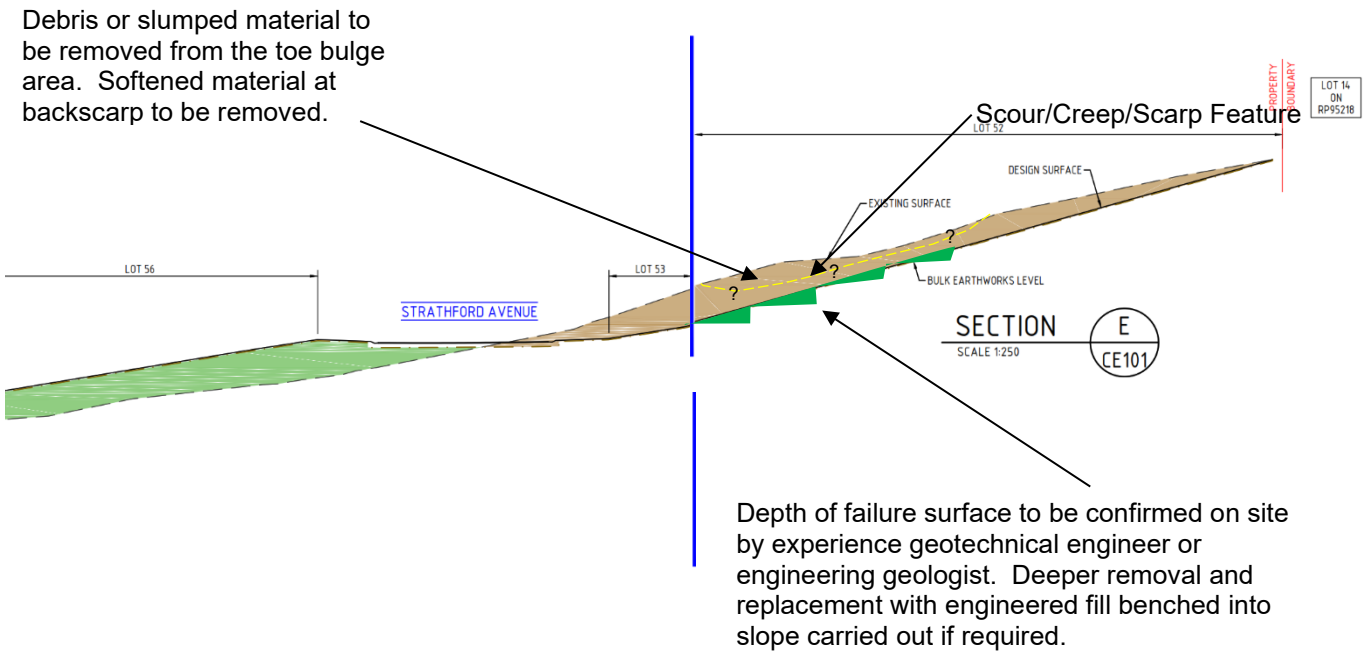
Where deeper cuttings are proposed there is the potential to expose competent, self-supporting rock faces along the retaining wall alignments. In these cases, it may be possible to form battered rock slopes at angles of say 45° from the horizontal and provide support with a "hard" surface protection layer to prevent erosion and unravelling (e.g. shotcrete surface cover with supported on the face with short dowels drilled into the rock face). This would be subject to detailed assessment during earthworks by an experienced geotechnical engineer/engineering geologist. Presence of unfavourable orientation of joints or defects in the rock mass may necessitate flatter battering or retention.

4.4 Landslide Hazard Risk Assessment

It will be important to develop a comprehensive construction methodology during the design stage of the proposed development, and for all parties involved to liaise closely with Morrison Geotechnic. Morrison Geotechnic must carry out inspections during earthworks and construction to confirm the geotechnical comments and recommendations given, and if geotechnical 'certification' is required following construction.

There is possilble creep/slump movement noted at the head of the gulley and some concave landforms where some signs of creep / slumping are present (ref. Appendix B - Dwg ME17/023-1). Proposed earthworks in these area comprises bulk cuts and fills to form the extension to Nichols Street. These works should act to remove any debris or slumped material from within this creep/scour feature. An expereinced geotechnical engineer or engineernig geologist should assess the area at the time of earthowrks to ensure the adequacy or site preparation in this area. If suspected debris or slumped materials remain insitu after excavation to the design levels, it will be necessary to further remove any such material to expose a stiff compentent foundation material and replace with engineered fill "keyed/benched" into the slope. This requirement is sketched in Image 7 below.

Image 7 – Remedial Works to Creep/Slump Feature



Given the typically moderately sloping topography, the local geology and the site observations described above, we would expect the most likely mode of future instability would be translational creep of the shallow surface soils or cut and fill batters if not supported. These events, which would require a trigger of heavy, prolonged rainfall, would have a likelihood descriptor of Unlikely, meaning that the event might occur under very adverse circumstances over the design life, with an indicative annual probability of 10^{-4}.

Large scale mass movements of the deeper weathered rock are less likely, with an indicative annual probability of less than 10^{-5}. If the recommendations in our report are implemented and maintained, the consequence of damage to property resulting from a shallow or translational soil slides is assessed to be Minor.

On this basis, the risk can be assessed as ***"Low***" if the earthworks and site treatment are carried out in accordance with our recommendations. This level of risk is Acceptable and managed by normal slope maintenance procedures.

4.5 Site Preparation

Organic matter was present in superficial soils across the site. During construction, stripping of materials containing organics will be required across the development area. This stripping depth is anticipated to be typically between 0.1 m and 0.3 m. Most of the test pits were excavated in clear, lightly vegetated areas, avoiding larger saplings and trees.

Deeper stripping is likely to be required in some areas where deeper root affected materials are encountered. Removal of unsuitable materials may be required across the drainage or gully lines if soft/loose sediments have accumulated in these areas.

4.6 Excavations

Variations in both soil and rock strength were observed between the test locations.

Excavation of the soil materials and very low to low strength rock is anticipated to be achievable utilising the large conventional earthworks equipment that would typically be anticipated to be employed on this site. Rock ripper (rock pick) or pneumatic rock breaking attachments will likely be required for excavations into medium strength (or stronger) rock.

High to very high strength rock may be present at depth and prove to be un-rippable (depending on defect orientation and spacing within the rock mass). Alternative excavation methods may need to be employed to 'break' out this material (i.e. pneumatic rock breaking attachments, expansive grouts, or low-level explosives).

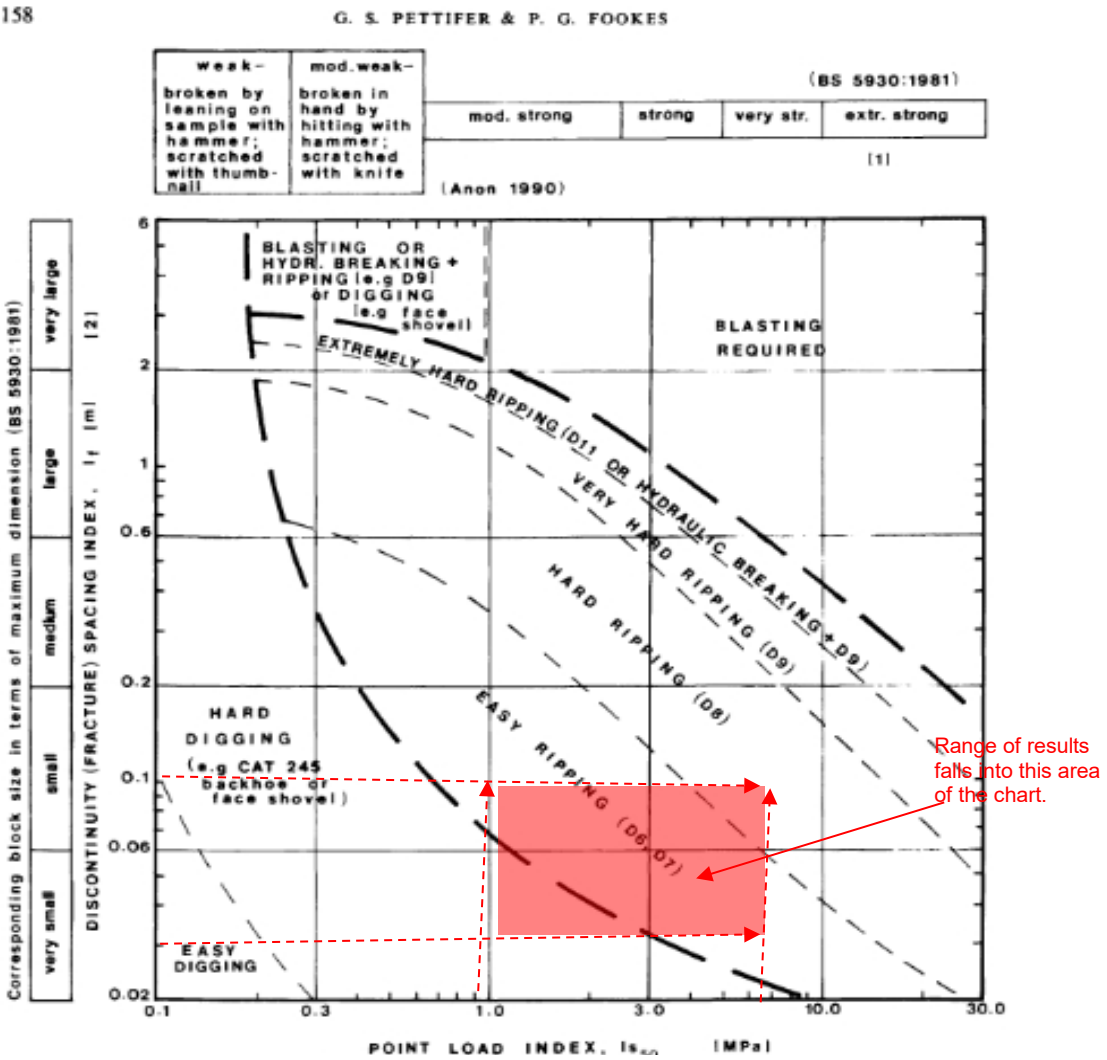
Assessment of estimated rock excavation conditions has been carried out by the methods derived by Pettifer & Fookes (1994)[1] (P&F).

The P&F methodology involves measurement of rock strength to be made by Point Load Index testing and discontinuity spacing from logging the intact core specimens recovered from the boreholes. These two rock properties are used to estimate excavation conditions using P&F's charts.

Investigation results indicate Point Load Index ($Is_{(50)}$) values range from 0.3 MPa to 6 MPa. Discontinuity spacing ranges from 30mm up to about 100mm.

The image below presents a plot of the excavatability assessment using the P&F method. Results are also shown together with an interpretation of likely excavation conditions on the rock core photographs in Figure 2. Point load index test results ranged from Assessment by this means indicates excavations into the medium to high strength fractured rock should be classified as "*Hard Digging"*, "*Easy Ripping (D6, D7)"* or "*Hard Ripping (D8)".*

[1] A revision to the graphical method for assessing the excavatability of rock, G. S. Pettifer & P. G. Fookes, 1994.



If excavations are proposed below the depth of investigation of the test pits, it would be prudent to carry out further investigation by borehole drilling or seismic methods prior to carrying out the works to further assess excavation characteristics.

4.7 Re-use of Materials

The insitu soils and rock obtained from site cuttings, where free of organic and deleterious material, may be used for structural fill provided the moisture content of the soils on placement approximates the Optimum Moisture Content required for compaction. This may require conditioning to bring the soils to OMC. However, it should be noted that the high plasticity clay soils could be expected to present difficulties in handling, placement, and compaction if the appropriate moisture content cannot be achieved, particularly if the clays are overly moist.

With use of reactive clay soils, close control of moisture content during placement and compaction is required to minimise the potential for swelling and shrinkage movement. Moisture content within the range of OMC (Standard Optimum Moisture Content) to OMC +2% is recommended. Foundation design must reflect the use of the potentially reactive clays if they are used as structural fill.

The very low to low strength rock was noted to generally have a particle size of less than 100mm upon excavation from the test pits. The low to medium (or stronger) rock was noted to have a larger particle size after ripping from the test pits (generally under 150mm but up to about 300mm). Medium strength (or stronger) rock won from excavations may contain significant oversize particles depending on the method of excavation together with defect orientation and spacing within the subject rock

mass. If compaction effort does not break down these larger particles during placement as fill, this material may not be suitable for re-use unless it is sorted and/or crushed to meet the required specification.

4.8 Earthworks

All earthworks procedures should be carried out in a responsible manner in accordance with AS.3798-2007 “Guidelines on Earthworks for Commercial and Residential Developments”. The earthworks contractor should make themselves familiar with the site conditions.

The following earthworks procedures are recommended: -

- Clearing and stripping should be carried out across the earthworks, building and pavement areas.

- The existing fill materials and upper weak natural soils (e.g. topsoil) should be excavated from the development areas to expose competent stiff or better natural soils. This excavation should extend for a distance beyond the perimeter of proposed building and pavement areas of at least 1.5m.

- Depressions formed by the removal of vegetation, underground elements, etc. should have all disturbed and weakened soil removed.

- After stripping and removal of the existing fill and weak natural soils, the competent exposed natural surface should be proof rolled under the supervision of Morrison Geotechnic using a static vehicle with a tare of at least 10 tonnes and then compacted to 95% Standard Maximum Dry Density (SMDD). Areas demonstrating excessive movement should be treated (dried and recompacted) or removed and replaced with compacted fill. Treatment should be to a standard sufficient so that the subgrade passes proof rolling, and that compaction can be achieved in the first layer of fill. Soft, wet subgrades are expected in the lower lying north-western part of the site where the excavator experience difficult trafficability during the investigation. Allowance for deeper subgrade removal and replacement or the use of rock mattress bridging/drainage layers incorporating geofabric separators should be allowed for in this area. Proof rolling in excavation areas can be deferred until excavations reach subgrade level.

- Provided the placement moisture content of any imported fill or select in-situ material approximates the Optimum Moisture Content for compaction, suitable compaction should be achievable using typical compaction machinery. The fill materials should be compacted in layers not exceeding 200mm loose thickness. However, layer thicknesses will be dependent on the compaction plant type and size, use of vibration, material type and condition. Final maximum placement layer thicknesses will need to be determined when compaction plant, as well as material type and conditions, are known.

- With use of reactive clay soils, close control of moisture content during placement and compaction is required to minimise the potential for swelling and shrinkage movement. Moisture content within the range of OMC (Standard Optimum Moisture Content) to OMC +2% is recommended. Foundation design must reflect the use of the potentially reactive clays if they are used as structural fill.

- Imported select fill material, if required, should be a good quality select fill material with a soaked CBR of at least 10%, a maximum aggregate size of 50mm and have a maximum Shrink/Swell Index of 1.0%.

- All fill placed to raise the ground surface should be compacted in 200mm thick layers to a density not less than 95% SMDD in accordance with AS.1290 5.1.1 (Standard Compaction). Where pavements are to be constructed, fill and natural soils within 0.3m of subgrade level should be compacted to a density not less than 100% SMDD.

- Fill must be “benched” into sloping ground.
- Pavement gravels should comply with DTMR quality specification for base, sub – base and blanket materials (DOT MRS11.05 Base Type 2.1, Sub – Base – Type 2.3 and Blanket – Type 2.5).
- Field density testing should be carried out in each fill lift placed to check the standard of compaction achieved and the placement moisture content if applicable. The frequency and extent of testing should be as per guidelines in AS.3798-2007, Section 8.0.
- It is recommended that all earthworks operations be supervised under Level 1 engineering supervision by Morrison Geotechnic. Engineering certification should be provided by a registered professional engineer (RPEQ).

4.9 Cut and Fill Batter Slopes

Maximum safe cut and fill batter angles in the different materials encountered on site are shown in Table 8. Where surcharges are located within H (height of the batter) of the top of the batter, some reduction in the design angle will be required.

Table 8 – Safe Batter Angles for Cut and Fill Slopes

Material	**Short Term (º)**	**Long Term (º)**
Natural Clays/Controlled Fill Benched into Slope	45(1)	23 (1) (2.3H:1V)
Rhyolitic Tuff (very low strength)	45(1/2)	23(1/2) (2.3H:1V)
Rhyolitic Tuff (medium strength)	55(1/2)	35(1/2)

Notes:

(1) Subject to inspection by an experienced geotechnical engineer/engineering geologist.

(2) Presence of unfavourable orientation of joints or defects in the rock mass may necessitate flatter battering or retention.

(3) Batter angles assumed to have no significant seepage.

Global stability checks have been undertaken based on the adoption of maximum 2.3H:1V cut and fill slopes. However, flatter slopes may be necessary to assist with maintenance.

Surface protection is essential to ensure ongoing batter stability. Soil slopes would require surface protection from erosion in the form of matting (e.g. jute matting) and revegetation or a combination of both. The rock was noted to be quite highly fractured with close defect spacing and as such it is expected to unravel somewhat during excavation and further deteriorate in the longer term. A “hard” surface protection layer to is prevent erosion and unravelling is recommended (e.g. shotcrete surface cover with supported on the face with short dowels drilled into the rock face).

4.10 Retaining Wall Design

This section provides advice and recommendations for free headed and fixed headed retaining walls constructed as part of the proposed development.

The design of fixed or free headed permanent retaining wall systems supporting fill or soil can be based on the lateral earth pressure distribution given by:

$$p = K\gamma H + Kq \text{ (kPa)}$$

In the above equation, H(m) is the distance down from the top of the wall, γ (kN/m^3) is the bulk density and q(kPa) is any uniform surface surcharge loading behind the wall. K is the appropriate earth pressure coefficient. Where adjacent footings apply line or point loads behind the retaining walls, further advice must be sought.

Free draining granular material connecting to slotted PVC pipes must be placed behind the permanent retaining walls to prevent the build-up of groundwater pressures.

Table 9 presents preliminary design parameters for retaining walls with a level ground surface behind the wall.

Table 9 – Retaining Wall Design Parameters

Material	Bulk Density γ (t/m^3)	Earth Pressure Coefficient (1)			Long Term Effective Friction Angle (Degrees)
		K_a	K_o	Passive K_p	
Controlled Fill	20	0.33	0.50	3.00	30
Natural Clays	19	0.41	0.58	2.46	25
Natural Medium Dense Sand	19	0.33	0.50	3.00	30
Weathered Rock	21	0.25	0.40	4.00	37

Notes:
(1) These values of earth pressure coefficient ignore the effect of wall friction.
(2) These values do not account for a slope in front or behind the retaining walls.

The active earth pressure coefficient, Ka, should be used for free headed walls which can rotate while the “at rest” earth pressure coefficient, Ko, should be used for stiff or propped walls which cannot rotate or accept movement.

Retaining wall footings should penetrate through any fill and natural soils to found in the underlying weathered rock. Excavation of footings should be considered in the design of the retaining wall system. For example, auger drilling refusal was encountered at depths of 2.5m to 3.0m in boreholes BH1 and BH3, if bored pier footings are proposed for certain wall types like post and pillar walls, shallow refusal may be encountered during construction of footings and could limit the effectiveness of this type of wall.

Footings for retaining walls should be designed in accordance with the comments and recommendations given below in Section 4.11.

4.11 Footing Design

Footing design, foundation reactivity, Site Classification and slope stability constraints should be assessed on each individual allotment prior to building works once development design details are developed by future owners. developers/builders.

In areas were slopes exceed 8° (>15%) after the bulk earthworks and subdivisional works, footings for future residential style buildings and retaining walls should penetrate through any fill and natural soils to found in the underlying weathered rock. Rock was typically encountered at relatively shallow depths and so thickened strip or pad footings or short bored piers could be utilised to enable penetration into weathered rock.

Where slopes are less steep, conventional high-level strip or pad footings founded in engineered fill or natural stiff (or stiffer) clay could be adopted.

The natural clays were noted to be relatively high plasticity and expected to have moderate potential for reactive movements when subjected to variations in moisture content. However, the clay profile includes some gravel content and depth to rock is relatively shallow. This being the case we would expect low to moderate Characteristic Reactive Surface Movements (y_s), in the order of say 25mm to 50mm for the natural profile under usual seasonal weather conditions. If the clay materials are used for filling in the upper 1.8m of the profile, higher movements may occur.

Deep fill could have an impact on the future performance of high-level footings as long-term ongoing creep consolidation of well compacted engineered fill to be expected in the order of about 0.5%H where H is the height of fill. Generally, for fill up to the order of say 7m in height, such settlement might be up to 35mm and this can usually be accommodated in conventional residential footing design. For deep fill, the order of magnitude of settlement increases and specially designed footings or piling would be required

4.12 General Erosion and Sediment Control Comments

Selected natural clay-based soil samples were tested for Emerson Class Dispersion number, and the test samples indicated that the clays were slightly dispersive or non-dispersive. There was no major evidence of active dispersion and erosion processes onsite.

Although active erosion processes were not observed onsite, excavation and filling onsite must be carried out in a manner so as not to create erosion and sediment control issues.

4.12.1 Construction Activities which Increase Erosion Risk

Construction activities which will increase the risk of erosion on this site include: -

- Removal of topsoil can initiate sheet and rill erosion.
- Cutting and filling may expose sands, silts and clays to rainfall and runoff, initiating erosion.
- Installation of in-ground services increases the risk of tunnel erosion, especially in dispersive soils (if encountered).
- Concentrations of rainfall runoff and stormwater, possibly exacerbated by changes in hydrology and site drainage, will initiate and promote sheet, rill, and tunnel erosion processes.
- Poor compaction of fill materials containing dispersive soil will result in the initiation of erosion.
- Haul roads and bare work areas will initiate erosion.

4.12.2 Erosion and Sediment Control Techniques

Erosion and sediment control on this site during construction is required to: -

- Reduce erosion potential.
- Intercept, divert and dispose of run-on water from upslope areas above disturbed work areas or allow clean water to pass through the site without mixing with sediment laden water.
- Allow progressive stabilising and revegetating of disturbed worked areas.

- Minimise sediment laden water leaving active construction areas and entering the main site drainage systems.

Measures to control erosion and sediment transport during construction include the following: -

Integration of Project Design and Site Constraints

The project design should be compatible with the site constraints, such as topography and drainage lines and hydrological constraints. Cut and fills should be limited where practical to reduce the areas of disturbance and hence the potential for erosion.

Erosion and Sediment Control Planning

An Erosion and Sediment Control (ESC) Plan is essential for this site so that control measures can be integrated into the construction sequence. The main components of an Erosion and Sediment Control Plan are: -

1. Planning
2. Site Assessment
3. Site Investigation
4. Evaluation of Work Sites
5. Identification and Documentation of Erosion and Sediment Control Practices
6. Implementation, Monitoring, Validation and Corrective Actions

Minimising Disturbance

Topsoil stripping and construction work areas should be sequenced and minimised within practical limits to reduce the potential for erosion. Small parcel construction with manageable sized areas is recommended and finished site areas must be stabilised as soon as practical.

Across the entire site, but especially near drainage lines, vegetation must be retained as far as practical.

Stormwater Control onto and Through Site and Works Areas

Run-on water must be intercepted above works areas and diverted to avoid contamination. Construction should include temporary drains and stormwater collection systems, including sediment ponds.

Use of Erosion Controls

Erosion controls must be incorporated into all construction phases. These include: -

- Maintain vegetation where practical
- Compost blankets
- Erosion control blankets
- Gravel platforms over exposed soils
- Mulching
- Revegetation
- Soil binders and surface stabilisers
- Surface roughening

Specific control measures will have to be selected, depending on site conditions.

Focal points for erosion control are entry and exit points to all areas of work where heavy vehicles transit frequently. These need to be covered with silty sandy gravel or clayey sandy gravel. These sites are characterised by soil fines due to constant vehicle movements.

Effective erosion control also means effective drainage control measures. Considerations should include: -

- Diversion of upslope stormwater runoff around soil disturbances.
- Division of work site into manageable drainage areas, with stabilised flow paths. Dirty water should be kept on site and disposed of appropriately, without entering the main drainage lines.
- Reduce flow velocity and therefore soil erosion within drainage channels and chutes, by incorporating mounds or check dams.

Stabilisation of Disturbed Areas

Disturbed areas must be promptly stabilised and revegetated as soon as earthworks are completed.

Sediment Control

Sediment control measures are secondary in preventing on-site and off-site erosion effects. These trap and retain sediment eroded from the works areas and prevent movement of sediment into the drainage lines.

Typical sediment control measures include: -

- Buffer zones, especially between drainage lines and development areas
- Construction exits
- Sediment fences
- Sediment basins/weirs
- Check dams
- Grass filter traps
- Rock filter traps
- Compost/mulch berms
- Drop inlet protection
- Flocculants

Specific control measures may need to be selected, depending on work area conditions.

Drainage control measures applicable to sediment control include: -

- Diverting upslope stormwater runoff away from excavations.
- Diversion of “clean” water around sediment traps, reducing total volume of water to be trapped and treated, and in turn reducing the size of the sediment control measure.

It is important to remember that with proper erosion control in place before the earthworks for the proposed drainage channel development begin, sediment control demands will be greatly reduced.

In general: -

- Erosion control methods should be favoured over sediment control measures.
- Drainage control is an effective means of erosion control.
- Protect and stabilise excavated/exposed soils.
- Stabilise excavation and construction traffic routes.
- Control dust.

Stockpiled soils should be covered, with external water flows diverted around or away from the stockpile areas and draining to holding tanks where required. Sediment fences surrounding the perimeter of all temporary soil stockpiles and the site boundary are recommended. The pH of the excavated material should be considered when using any chemical treatments. The pH of the tested soils ranged between approximately pH 5 and pH 6. The pH of the soils should also be reviewed for areas of revegetation and landscaping works where soil fertilisation is required.

The laboratory testing revealed that dispersive soils are present within the tested clay soil samples.

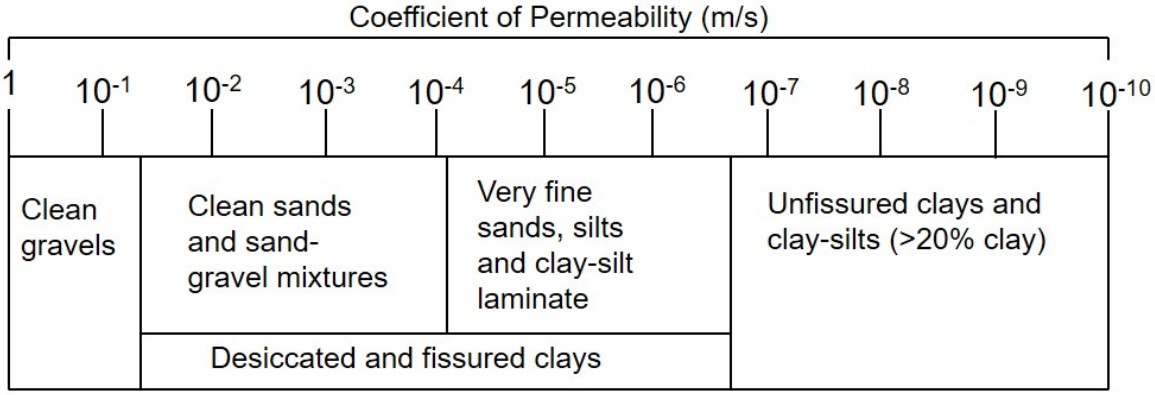
Typically, soil stockpiles should not be left for long periods of time, unless properly covered and protected from wind and rainfall.

Watering trucks should be frequently used on site during excavations to limit the production of dust.

4.13 Presumptive Permeability Values for Basin Design

Presumptive permeability values for the typical soil materials encountered are given in Table 10 below.

Table 10: Presumptive Soil Permeability Values (BS8004: 1986)



Note: From *Soils Mechanics,* R.F Craig, 5th Edition, 1992.

Further insitu field or laboratory permeability testing is recommended to assess design values once the design and layout of basin(s) is further advanced.

5.0 LIMITATIONS OF GEOTECHNICAL INVESTIGATION

This Report has been prepared by Morrison Geotechnic Pty Ltd (**Morrison Geotechnic**), and may include contributions from Morrison Geotechnic's officers and employees, sub-contractors, sub-consultants, or agents (**Contributors**).

This Report is for the sole benefit and use of Parker Property Ningi Pty Ltd (**Client**) for the sole purpose of providing geotechnical information in respect of the development at Glenbrook Drive, Nambour **(Project)**. The Report is only intended to address those issues expressly described in the scope of work in the Proposal Letter and this Report.

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(b) used or relied upon by any other party; or
(c) filed with any Governmental agency or other person or quoted or referred to in any public document.

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(a) have relied upon and presumed the accuracy of this information.

(b) have not verified the accuracy or reliability of this information (other than as expressly stated in this Report).
(c) have not made any independent investigations or enquiries in respect of those matters of which it has no actual knowledge at the time of giving this Report to the Client; and
(d) make no warranty or guarantee, expressed or implied, as to the accuracy or reliability of this information.

Morrison Geotechnic and the Contributors do not accept responsibility or liability for any incorrect assumptions related to this Report. For the avoidance of doubt, this Report:

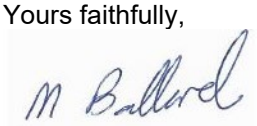
(a) contains information from widely spread test locations.
(b) cannot predict the ground conditions encountered at any untested location because the ground conditions surrounding test sampling locations, (or between any two test sampling locations) may be different from the test samples we have obtained.
(c) is not an environmental, contamination or hazardous materials assessment; may be invalid, incomplete, or inaccurate (including errors in the scope of work, investigation methodology, observations, opinions, and advice) where the information provided to Morrison Geotechnic was invalid, incomplete, or inaccurate.
(d) is limited to observations of those parts of the site that were accessible at the time of the field investigation and is not based on observations about areas of the site which were inaccessible to the investigation equipment (including slopes, heavily vegetated areas, or service corridors); and
(e) is not a comprehensive representation of the actual site conditions and may only show a reasonable interpretation of conditions encountered at discrete, widely spaced test locations, as selected by the Client, along with general site observations?

A lot-by-lot sampling and testing investigation will be required to determine the site classifications for individual lots, after the earthworks have been completed. Further testing will be required to confirm all other parameters and information presented in this report.

No warranty or guarantee, whether express or implied, is made in respect of the geotechnical data, information, advice, opinions, and recommendations present in this Report. In recognition of the limited use to be made by the Client of this Report, the Client agrees that, to the maximum extent permitted by law, Morrison Geotechnic and the Contributors shall not be liable for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by the Client or any third party as a result of or in connection with the information, findings, opinions, estimates, recommendations and conclusions provided in the course of this Report.

If further information becomes available, or additional assumptions need to be made, Morrison Geotechnic reserves its right to amend this Report.

Yours faithfully,



M BALLARD (RPEQ 10223)

For and on behalf of
MORRISON GEOTECHNIC PTY LIMITED

Encl Appendix A – Historical Photographs
Appendix B – Site Plan
Appendix C – Test Pit Record Sheets and Photographs
Appendix D – Borehole Record Sheets and Rock Core Photographs
Appendix E – Laboratory Test Certificates
Appendix F – Point Load Index Test Results
Appendix G – Some Guidelines for Hillside Construction
"Important Information about your Geotechnical Engineering Report"

APPENDIX A

Historical Photographs

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 2003

Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1998

Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1993

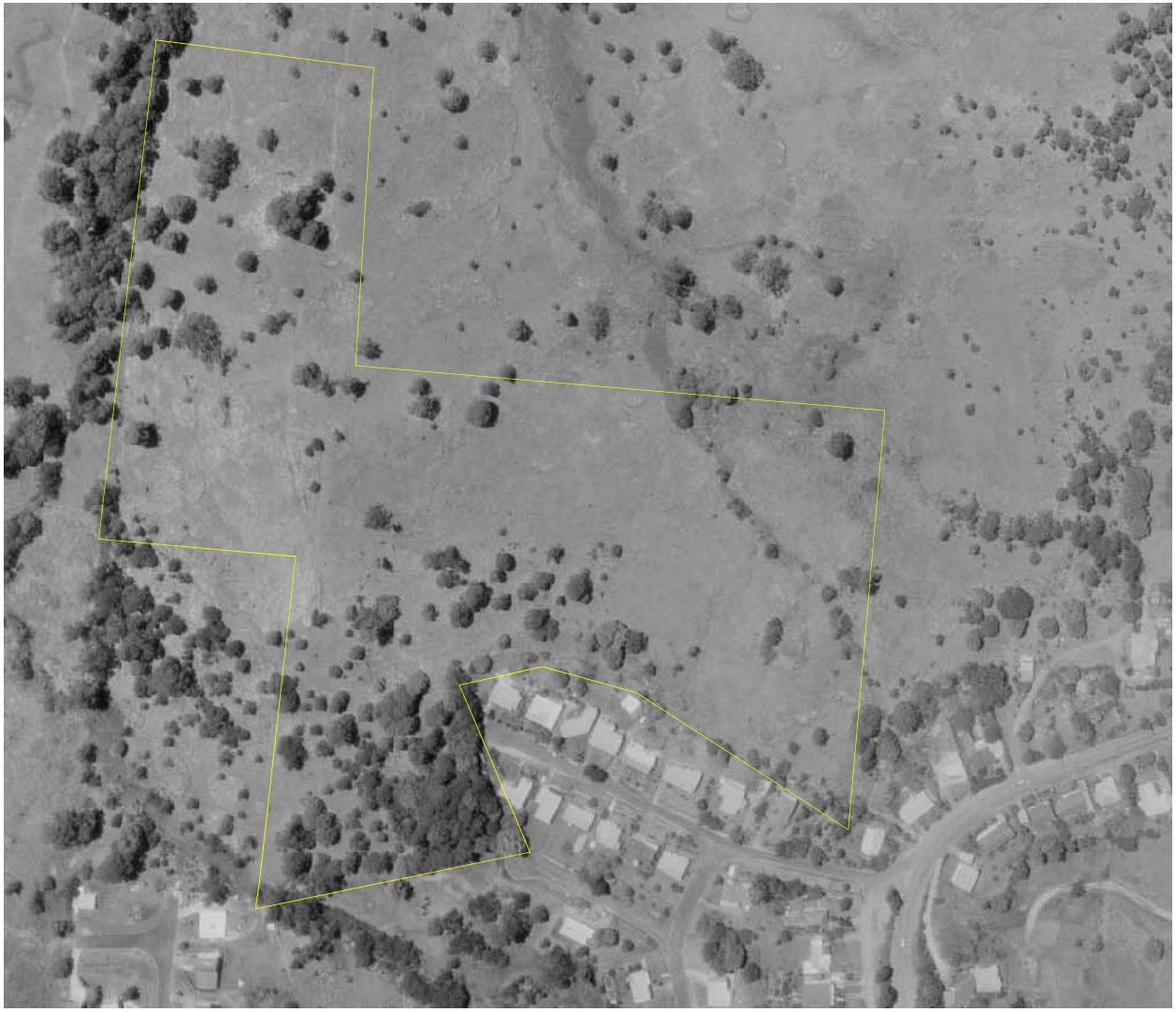
Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1985

Images sourced from Queensland State Government QImagery Website

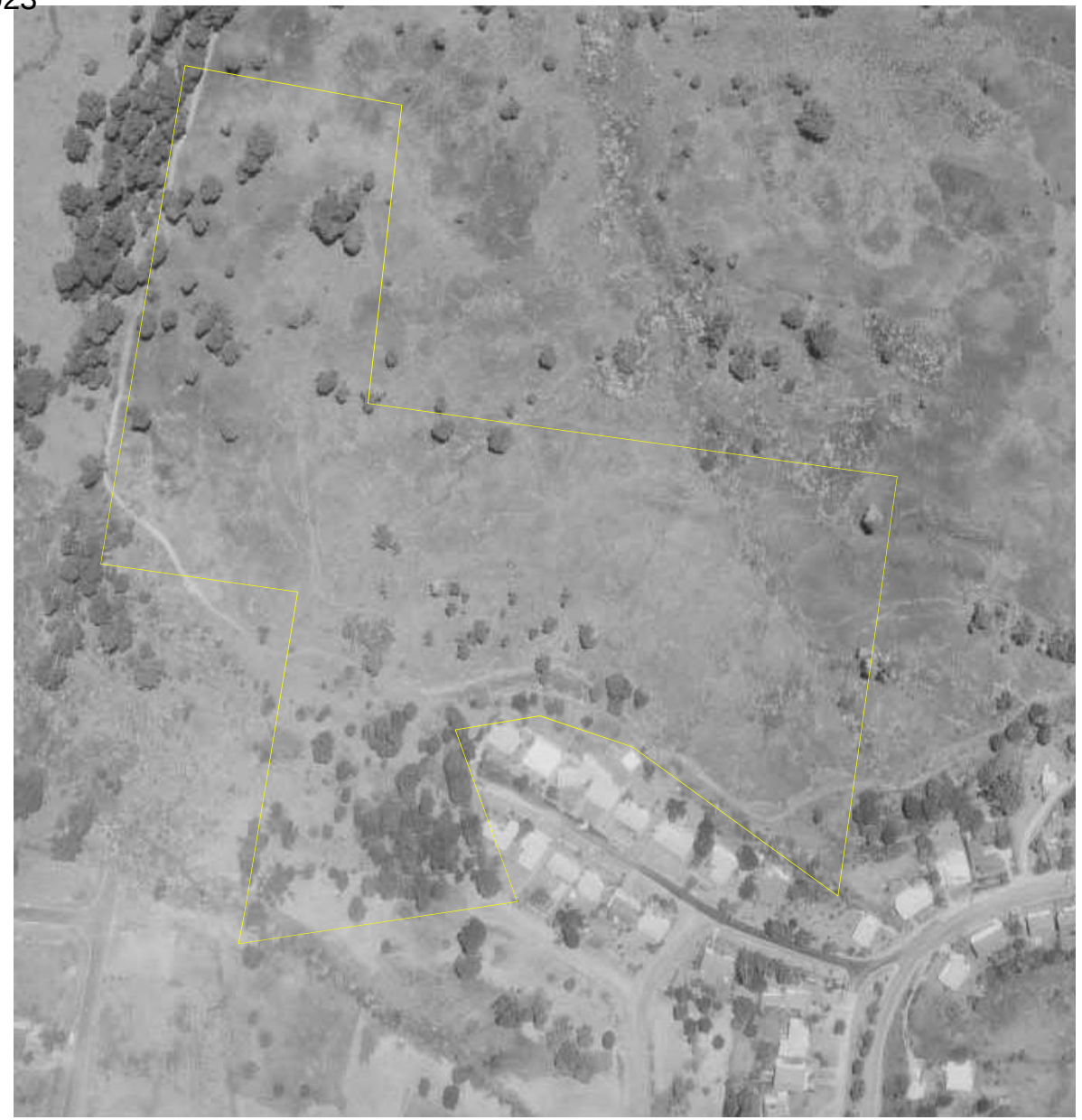


Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1979

Images sourced from Queensland State Government QImagery Website



Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1973

Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1967

Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1958

Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

Client: Parker Property Ningi Pty Ltd
Site: Glenbrook Drive, Nambour
Date: December 2017
Project No.: ME17-023

Historical Aerial Image – 1953

Images sourced from Queensland State Government QImagery Website

Note: Mark up is only a general approximation of where site layout may be.

APPENDIX B

Site Plan

View from Ridgeline across Eastern Part

View from Lower part across gully to Western Part

Concave landform possible creep/slumping

"Bowed" Trees in Head of Gully in Southern Part

MORRISON GEOTECHNIC PTY LTD
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Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 1
Legend:	Approximate Test Pit Location TP1 Slope direction and angle 8°		*Date: 11th December, 2017* **Drawing not to Scale**

APPENDIX C

Test Pit Record Sheets & Photograph

Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Test Pit

Test Pit No.: TP1

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 506
Northing: 7055 790
RL: 89.69
Total Depth: 4.00
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		89.0	0.0	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F				
			0.3	Residual Soil		CH	**Silty CLAY**: High plasticity, orange, trace of fine gravel		M	VSt				
			0.7	Residual Soil		CH	**Silty CLAY**: As above, some fine to medium sand		M	VSt				
			1.0											
			1.3	Residual Soil		SC	**Clayey SAND**: Fine to medium grained, orange yellow, medium plasticity fines		M	VD				
		88.0												
			2.0											
		87.0												
			3.0											
		86.0												
			3.7			RHY	**RHYOLITE**: Very low strength, extremely weathered, dark brown	XW		VLS				
			4.0											

Comments: **4.00m: TEST PIT TERMINATED NEAR PRACTICAL BUCKET REFUSAL**

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Test Pit

Test Pit No.: TP2

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 442
Northing: 7055 851
RL: 86.02
Total Depth: 2.50
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		86.0	0.0	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F				
			0.2	Residual Soil		CI	**Gravelly CLAY**: Stiff to very stiff, medium plasticity, brown, fine to coarse gravel		M	St-VSt				
		85.0	1.0											
			1.3			RHY	**RHYOLITE**: Very low strength, dark brown, extremely weathered, nearing practical bucket refusal at 2.2m	XW		VLS				
		84.0	2.0											
Ripper			2.2			RHY	**RHYOLITE**: Low strength, brown, highly weathered	HW		LS				
			2.5				**2.50m: TEST PIT TERMINATED PRACTICAL BUCKET REFUSAL**							
		83.0	3.0											
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP3

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 367
Northing: 7055 859
RL: 89.23
Total Depth: 3.30
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		89.0	0.15	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown		M	F				
				Residual Soil		GP	**Clayey GRAVEL**: Very dense, fine to coarse gravel, brown, medium plasticity clay fines		M	VD				
			1.0											
		88.0												
			2.0											
			2.1			RHY	**RHYOLITE**: Very low strength, extremely weathered, dark brown, nearing practical bucket refusal at 2.5m	XW		VLS				
		87.0												
Ripper			2.5			RHY	**RHYOLITE**: Low strength, brown, highly weathered	HW		LS				
			3.0											
		86.0												
			3.3				**3.30m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP4

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 329
Northing: 7055 830
RL: 93.56
Total Depth: 3.40
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		93.0	0.18	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F		0.18	D	
				Residual Soil		GP	**Clayey GRAVEL**: Very dense, fine to coarse gravel, brown, medium plasticity clay fines		M	VD				
			1.0											
		92.0	1.7			RHY	**RHYOLITE**: Very low strength, dark brown, extremely weathered	XW		VLS				
Ripper			2.0											
			2.1			RHY	**RHYOLITE**: Low strength, brown, highly weathered	HW		LS				
Toot		91.0	2.4			RHY	**RHYOLITE**: Very low strength, dark brown, extremely weathered	XW		VLS				
			2.6			RHY	**RHYOLITE**: Low strength, brown, highly weathered	HW		LS				
Ripper			3.0											
			3.4				**3.40m: TEST PIT TERMINATED SLOW RIPPING**							
		90.0	4.0											

Comments:
Groundwater not encountered

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP5

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 468
Northing: 7055 879
RL: 76.03
Total Depth: 3.00
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		76.0	0.1	Topsoil		CI	**Silty CLAY**: Stiff, medium to high plasticity, dark brown, trace of root matter		M	St				
						CH			M	St				
				Residual Soil			**Silty CLAY**: Stiff, high plasticity, pale brown							
		75.0	1.0			RHY	**RHYOLITE**: Very low strength, dark grey & purple, extremely weathered	XW		VLS				
			1.7			RHY	**RHYOLITE**: Becoming low strength, highly weathered, nearly practical bucket refusal at 2.0m depth	HW		LS				
Ripper		74.0	2.0											
		73.0	3.0				**3.00m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP6

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 371
Northing: 7055 927
RL: 72.07
Total Depth: 3.40
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		72.0	0.25	Topsoil		CI	**Silty CLAY**: Stiff, high plasticity, brown, trace of root matter		M	St		0.25	D	
			0.9	Residual Soil		CH	**Silty CLAY**: Stiff, high plasticity, orange brown		M	St				
		71.0	1.0			RHY	**RHYOLITE**: Very low strength, purple white, nearing practical bucket refusal at 1.8m depth	XW		VLS				
Ripper		70.0	1.8			RHY	**RHYOLITE**: Low strenth, highly weathered	HW		LS				
		69.0	2.0											
			3.0											
			3.4				**3.40m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP7

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 286
Northing: 7055 894
RL: 86.82
Total Depth: 3.60
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		86.0	0.15	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F		0	D	
				Residual Soil		CH	**Silty CLAY**: Firm, high plasticity, orange brown, trace of fine gravel		M	F		0.15	D	
			0.5			RHY	**RHYOLITE**: Very slow strength, brown, extremely weathered, nearing practical bucket refusal at 2.5m depth'	XW		VLS				
		85.0	1.0											
			2.0											
Ripper		84.0	2.5			RHY	**RHYOLITE**: Low strength, highly weathered	HW		LS				
			3.0											
		83.0	3.6				**3.60m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:
Groundwater not encontered

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP9

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 411
Northing: 7055 976
RL: 63.29
Total Depth: 3.00
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		63.0	0.25	Topsoil		CI	**Silty CLAY**: Stiff, medium to high plasticity, dark brown, trace fine gravel & fine root matter		M	St		0.25	D	
			0.7	Residual Soil		CH	**Silty CLAY**: Stiff, high plasticity, orange, trace of fine gravel		M	St				
			1.0	Residual Soil		CH	**Silty Gravelly CLAY**: Very stiff, medium to high plasticity, fine to medium size gravel, orange grey		M	VSt				
		62.0	1.3			RHY	**RHYOLITE**: Very low strength, grey, extremely weather, nearing bucket refusal at 1.4m	XW		VLS				
Ripper			1.4			RHY	**RHYOLITE**: Low strength, highly weathered	HW		LS				
			2.0											
		61.0	2.1			RHY	**RHYOLITE**: Purple grey	HW		LS				
			3.0				**3.00m: TEST PIT TERMINATED SLOW RIPPING**							
		60.0												
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP10

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 273
Northing: 7056 064
RL: 75.17
Total Depth: 3.50

Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		75.0	0.0	Topsoil		CI	**Silty CLAY**: Soft, medium to high plasticity, dark brown, trace of fine gravel and root matter		M	S		0	D	
			0.2	Residual Soil		CH	**Gravelly CLAY**: Very stiff, high plasticity, brown, fine to coarse gravel, some pockets of seepage at 0.6m, root affected to 0.3m		M-W	VSt		0.2	D	
			0.6			RHY	**RHYOLITE**: Very low strength, brown grey, extremely weathered	XW		VLS				
			1.0											
		74.0	1.1			RHY	**RHYOLITE**: Low strength, highly weathered, nearing practical bucket refusal at 1.8m depth	HW		LS				
Ripper			2.0											
		73.0												
			3.0											
		72.0												
			3.4			RHY	**RHYOLITE**: Becoming low to medium strength, purple, highly weathered	HW		LS-				
			3.5											
							3.50m: TEST PIT TERMINATED SLOW RIPPING							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP11

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 255
Northing: 7055 965
RL: 79.26
Total Depth: 3.00
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		79.0	0.2	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F		0	D	
				Residual Soil		CH	**Silty CLAY**: Stiff, high plasticity, orange brown		M	St		0.2	D U50	
			0.8	Residual Soil		CH	**Silty CLAY**: As above, becoming grey, trace of fine gravel		M	St				
			0.9 1.0			RHY	**RHYOLITE**: Very low strength, brown, extremely weathered, nearing practical bucket refusal at 1.8m depth	XW		VLS				
		78.0												
Ripper			1.8 2.0			RHY	**RHYOLITE**: Becoming low strength, highly weathered,	HW		LS				
		77.0	2.4			RHY	**RHYOLITE**: As above, becoming low to medium strength, purple	HW		LS-MS				
			3.0 3				**3.00m: TEST PIT TERMINATED NEARING RIPPER REFUSAL**							
		76.0												
			4.0											

Comments:
Groundwater not encontered

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP12

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 230
Northing: 7056 119
RL: 65.43
Total Depth: 2.70
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket / Ripper		65.0	0.1	Topsoil		CI	**Silty CLAY**: Soft, medium plasticity, dark brown, organics		W	S		0 / 0.1 –	D	D50
				Residual Soil		CH	**Silty CLAY**: Stiff, high plasticity, grey		W	St				
			0.5			RHY	**RHYOLITE**: Very low strength, pale green-grey, extremely weathered	XW		VLS				
		64.0	1.0											
			1.5	Residual Soil		CH	**Silty CLAY**: Very stiff, high plasticity, white-orange		M	VSt				
			2.0											
		63.0	2.1			RHY	**RHYOLITE**: Low strength, green-grey, highly weathered, nearing practical bucket refusal at 2.4m depth	HW		LS				
			2.7				**2.70m: TEST PIT TERMINATED SLOW RIPPING**							
		62.0	3.0											
			4.0											

Comments:
Groundwater not encontered

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Test Pit

Test Pit No.: TP13

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 196
Northing: 7056 005
RL: 67.93
Total Depth: 3.80
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description								Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength		DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		67.0	0.15	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F			0	D	
				Residual Soil		CH	**Silty CLAY**: Firm, high plasticity, orange brown, trace of fine gravel		M	F					
			0.5			RHY	**RHYOLITE**: Very low strength, brown grey, highly weathered	XW		VLS					
		66.0	1.0												
			2.0												
Ripper		65.0	2			RHY	**RHYOLITE**: As above, becoming low strength, highly weathered	HW		LS					
			3.0				**3.80m: TEST PIT TERMINATED SLOW RIPPING**								
		64.0	3.8												
			4.0												

Comments:

Authorised by: ……

Date: …11/12/17.

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

TEST PIT TP1

TEST PIT TP3

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP1 & TP3**		*Date: 11th December, 2017*
			Drawing not to Scale

TEST PIT TP4

TEST PIT TP5

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP4 & TP5**		*Date: 11th December, 2017*
			Drawing not to Scale

TEST PIT TP6

TEST PIT TP7

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP6 & TP7**		*Date: 11th December, 2017*
			Drawing not to Scale

TEST PIT TP9

TEST PIT TP10

MORRISON GEOTECHNIC PTY LTD
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Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP9 & TP10**		*Date: 11th December, 2017*
			Drawing not to Scale

TEST PIT TP11

TEST PIT TP12

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP11 & TP12**		*Date: 11th December, 2017*
			Drawing not to Scale

TEST PIT TP13

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP13**		*Date: 11th December, 2017*
			Drawing not to Scale

APPENDIX D

Borehole Record Sheets & Rock Core Photographs

Morrison Geotechnic Pty Ltd
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PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Borehole

Borehole No.: BH1

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site Plan
Northing:
RL: 84.00
Total Depth: 3.00
Drilling Rig: Hydrapower Scout
Driller: Drillsure
Logged By: D.Pollock
Date: 01/11/2008

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger		84.0	0.1	Topsoil		CI	**Silty CLAY**: Stiff, medium plasticity, dark grey, trace of fine root matter		M	St				
				Residual Soil		CH	**Silty CLAY**: Stiff to very stiff, high plasticity, grey brown, trace of fine to coarse sand and fine gravel		M	St-VSt				
			0.7			RHY	**Rhyolitic TUFF**: Very low to low strength, brown grey orange brown, extremely weathered	XW		VL-VLS		1	SPT	30/140mm
		83.0	1.0											
		82.0	2.0									2.5	SPT	30/120mm
Washbore			2.7			RHY	**Rhyolitic TUFF**: As above, becoming medium strength, highly weathered	HW		MS				
		81.0	3.0				**3.00m: REFER TO ROCK CORE LOG ON PAGE 2**							
		80.0	4.0											
		79.0	5.0											

Comments:
GROUNDWATER NOT ENCOUNTERED

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Cored Borehole

Borehole No.: BH1

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site
Northing:
RL: 84.00
Total Depth: 5.30
Drilling Rig: Hydrapower Scout
Driller: Drillsure
Logged By: D.POLLOCK
Date: 01/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
		84.0											
		83.5	0.5										
		83.0	1.0										
		82.5	1.5										
		82.0	2.0				**START NMLC CORING AT 3M**						
		81.5	2.5										
		81.0	3.0										Numerous defects difficult to distinguish exact details and orientation as highly weathered
NMLC						RHY	**Rhyolitic TUFF**: Highly weathered, fine to coarse grained, brown grey, pale grey orange brown, strength varies and rock matrix is brittle, crumbles and is remouldable once broken down	HW			100%		Crushed zone to 3.16m, possible drilling/handling break
		80.5	3.5										Crushed zone to 3.6m
		80.0	4.0										Crushed zone to 3.83m
		79.5	4.5										
		79.0	5.0										Crushed zone to 5.04m

Comments:
GROUNDWATER NOT OBSERVED DUE TO INTRODUCTION OF DRILLING FLUID BELOW 2.5M

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Defects
- JT Joint
- PT Parting
- SM Seam
- PL Planar
- CV Curved
- IR Irregular
- RO Rough
- SO Smooth
- SL Slickensided

Morrison Geotechnic Pty Ltd
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Engineering Log - Cored Borehole

Borehole No.: BH1

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site Plan
Northing:
RL: 84.00
Total Depth: 5.30
Drilling Rig: Hydrapower Scout
Driller: Drillsure
Logged By: D.POLLOCK
Date: 01/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC		79.0											
			5.3			RHY	**Rhyolitic TUFF**: Highly weathered, fine to coarse grained, brown grey, pale grey orange brown, strength varies and rock matrix is brittle, crumbles and is remouldable once broken down	HW			100%		Handling break Cone loss to 5.3m
		78.5	5.5										
		78.0	6.0				**5.30m: BOREHOLE TERMINATED**						
		77.5	6.5										
		77.0	7.0										
		76.5	7.5										
		76.0	8.0										
		75.5	8.5										
		75.0	9.0										
		74.5	9.5										
		74.0	10.0										

Comments:
GROUNDWATER NOT OBSERVED DUE TO INTRODUCTION OF DRILLING FLUID BELOW 2.5M

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Defects
- JT Joint
- PT Parting
- SM Seam
- PL Planar
- CV Curved
- IR Irregular
- RO Rough
- SO Smooth
- SL Slickensided

Borehole BH1 – NMLC Core 3.0m to 5.2m

MORRISON GEOTECHNIC PTY LTD
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Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME18/065	Drawing No:	ME18/065 - 2
Legend:	**Core Photographs**		*Date: November, 2018*
			Drawing not to Scale

Morrison Geotechnic Pty Ltd
A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Borehole

Borehole No.: BH2

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site Plan
Northing:
RL: 75.50
Total Depth: 4.50

Drilling Rig: Hydrapower Scout
Driller: Drillsure
Logged By: D.Pollock
Date: 01/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger		75.0	0.2	Topsoil		CI	**Silty CLAY**: Stiff, medium plasticity, dark grey, trace of fine root matter		M	St				
				Slopewash		CH	**Silty CLAY**: High plasticity, grey brown, trace of fine to coarse sand		M					
			0.8	Residual Soil		CH	**Silty CLAY**: Very stiff to hard, high plasticity, orange brown, trace of fine to coarse sand and gravel, tending to weathered rock		M	-Vst H		1	U50	PP >600kPa
		74.0	1.0											
			2.0											
			2.1			RHY	**Rhyolitic TUFF**: Very low to low strength, grey brown orange brown pale grey, extremely weathered	XW		VL-VLS				
		73.0										2.5	SPT	30/70mm
			3.0											
		72.0												
			4.0											
		71.0	4.5				**4.50m: BOREHOLE TERMINATED**							
			5.0											

Comments:
GROUNDWATER NOT ENCOUNTERED

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Borehole

Borehole No.: BH3

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site Plan
Northing:
RL: 76.50
Total Depth: 2.40

Drilling Rig: Hydrapower Scout
Driller: Drillsure
Logged By: D.Pollock
Date: 01/11/2018

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
100mm Auger		76.0	0.15	Topsoil		CI	**Silty CLAY**: Stiff, medium plasticity, dark grey, trace of fine root matter		M	St				
				Residual Soil		CH	**Silty CLAY**: Stiff to very stiff, high plasticity, grey brown, trace of fine to coarse sand and fine gravel		M	St-VSt				
			1.0 0.9	Residual Soil		CH	**Silty CLAY**: As above, tending to weathered rock		M	St-H		1	SPT	9,26,24 N=50
		75.0	1.5			RHY	**Rhyolitic TUFF**: Very low strength, orange brown grey, dark grey, extremely weathered	XW		VLS				
			2.0											
		74.0	2.4				**2.40m:REFER TO ROCK CORE LOG ON PAGE 2**					2.5	SPT	10, 30/70mm
			3.0											
		73.0												
			4.0											
		72.0												
			5.0											

Comments:
GROUNDWATER NOT ENCOUNTERED

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Cored Borehole

Borehole No.: BH3

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site
Northing:
RL: 76.80
Total Depth: 6.50
Drilling Rig: Hydrapower Scout
Driller: Drillsure
Logged By: D.POLLOCK
Date: 01/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
		76.5	0.5										
		76.0	1.0										
		75.5	1.5				**START MNLC CORING AT 2.4M**						
		75.0	2.0										
		74.5	2.5			RHY	**Rhyolitic TUFF**: Highly weathered, fine to coarse grained, brown grey, pale grey orange brown, strength varies and rock matrix is brittle, crumbles and is remouldable once broken down	HW			100%		Numerous defects difficult to distinguish exact details and orientation as highly weathered
NMLC		74.0	3.0										
		73.5	3.5										
		73.0	4.0										
		72.5	4.5										
		72.0	5.0										

Comments:
GROUNDWATER NOT OBSERVED DUE TO INTRODUCTION OF DRILLING FLUID BELOW 2.5M

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Defects
- JT Joint
- PT Parting
- SM Seam
- PL Planar
- CV Curved
- IR Irregular
- RO Rough
- SO Smooth
- SL Slickensided

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Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Cored Borehole

Borehole No.: BH3

Job Number: ME18/065
Client: Parker Property Pty Ltd
Project: Proposed Retaining Walls
Location: 41 Glenbrook Drive Nambour

Easting: Refer to Site
Northing:
RL: 76.80
Total Depth: 6.50
Drilling Rig: Hydropower Scout
Driller: Drillsure
Logged By: D.POLLOCK
Date: 01/11/2018

Drilling Information				Material Description							Rock Mass Defects		
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength (ELS VLS LS MS HS VHS EHS)	$IS_{(50)}$ MPa	RQD %	Defect Spacing (mm) (30 100 300 1000 3000)	Defect Description (type, inclination, planarity, roughness, coating, thickness)
NMLC		71.5	5.5			RHY	**Rhyolitic TUFF**: Highly weathered, fine to coarse grained, brown grey, pale grey orange brown, strength varies and rock matrix is brittle, crumbles and is remouldable once broken down	HW			100%		
		71.0	5.9										
			6.0			RHY	**Rhyolitic TUFF**: high to very high strength, slightly weathered, becoming brown purple red brown and pale grey	SW					
		70.5	6.5										
			6.5				**6.50m: BOREHOLE TERMINATED**						
		70.0	7.0										
		69.5	7.5										
		69.0	8.0										
		68.5	8.5										
		68.0	9.0										
		67.5	9.5										
		67.0	10.0										

Comments:
GROUNDWATER NOT OBSERVED DUE TO INTRODUCTION OF DRILLING FLUID BELOW 2.5M

Authorised by:

Date: 19/11/18

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Defects
- JT Joint
- PT Parting
- SM Seam
- PL Planar
- CV Curved
- IR Irregular
- RO Rough
- SO Smooth
- SL Slickensided

Borehole BH3 – NMLC Core 2.4m to 6.5m

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME18/065	Drawing No:	ME18/065 - 2
Legend:	**Core Photographs**		*Date: November, 2018*
			Drawing not to Scale

Morrison Geotechnic Pty Ltd
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Engineering Log - Test Pit

Test Pit No.: TP2

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 442
Northing: 7055 851
RL: 86.02
Total Depth: 2.50
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		86.0	0.0	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F				
			0.2	Residual Soil		CI	**Gravelly CLAY**: Stiff to very stiff, medium plasticity, brown, fine to coarse gravel		M	St-VSt				
		85.0	1.0											
			1.3			RHY	**RHYOLITE**: Very low strength, dark brown, extremely weathered, nearing practical bucket refusal at 2.2m	XW		VLS				
		84.0	2.0											
Ripper			2.2			RHY	**RHYOLITE**: Low strength, brown, highly weathered	HW		LS				
			2.5				**2.50m: TEST PIT TERMINATED PRACTICAL BUCKET REFUSAL**							
		83.0	3.0											
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP3

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 367
Northing: 7055 859
RL: 89.23
Total Depth: 3.30
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		89.0	0.15	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown		M	F				
				Residual Soil		GP	**Clayey GRAVEL**: Very dense, fine to coarse gravel, brown, medium plasticity clay fines		M	VD				
			1.0											
		88.0												
			2.0											
			2.1			RHY	**RHYOLITE**: Very low strength, extremely weathered, dark brown, nearing practical bucket refusal at 2.5m	XW		VLS				
		87.0												
Ripper			2.5			RHY	**RHYOLITE**: Low strength, brown, highly weathered	HW		LS				
			3.0											
		86.0												
			3.3				**3.30m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP5

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 468
Northing: 7055 879
RL: 76.03
Total Depth: 3.00
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		76.0	0.1	Topsoil		CI	**Silty CLAY**: Stiff, medium to high plasticity, dark brown, trace of root matter		M	St				
						CH			M	St				
				Residual Soil			**Silty CLAY**: Stiff, high plasticity, pale brown							
		75.0	1.0			RHY	**RHYOLITE**: Very low strength, dark grey & purple, extremely weathered	XW		VLS				
			1.7			RHY	**RHYOLITE**: Becoming low strength, highly weathered, nearly practical bucket refusal at 2.0m depth	HW		LS				
Ripper		74.0	2.0											
		73.0	3.0				**3.00m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP6

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 371
Northing: 7055 927
RL: 72.07
Total Depth: 3.40
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		72.0	0.25	Topsoil		CI	**Silty CLAY**: Stiff, high plasticity, brown, trace of root matter		M	St		0.25	D	
			0.9	Residual Soil		CH	**Silty CLAY**: Stiff, high plasticity, orange brown		M	St				
		71.0	1.0			RHY	**RHYOLITE**: Very low strength, purple white, nearing practical bucket refusal at 1.8m depth	XW		VLS				
Ripper		70.0	1.8			RHY	**RHYOLITE**: Low strenth, highly weathered	HW		LS				
		69.0	2.0											
			3.0											
			3.4				**3.40m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

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Engineering Log - Test Pit

Test Pit No.: TP7

Job Number: ME17/023
Client: Parker Property Ningi P/L
Project: Proposed Subdivision
Location: 41 Glenbrook Drive Nambour

Easting: 494 286
Northing: 7055 894
RL: 86.82
Total Depth: 3.60
Machine: 23t Excavator
Driller: Carruthers Contracting
Logged By: GF
Date: 07/12/2017

Drilling Information				Material Description							Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
Toothed Bucket		86.0	0.15	Topsoil		CI	**Silty CLAY**: Firm, medium plasticity, dark brown, trace of fine root matter		M	F		0	D	
				Residual Soil		CH	**Silty CLAY**: Firm, high plasticity, orange brown, trace of fine gravel		M	F		0.15	D	
			0.5			RHY	**RHYOLITE**: Very slow strength, brown, extremely weathered, nearing practical bucket refusal at 2.5m depth'	XW		VLS				
		85.0	1.0											
			2.0											
Ripper		84.0	2.5			RHY	**RHYOLITE**: Low strength, highly weathered	HW		LS				
			3.0											
		83.0	3.6				**3.60m: TEST PIT TERMINATED SLOW RIPPING**							
			4.0											

Comments:
Groundwater not encontered

Authorised by: ……

Date: 11/12/17

Water
- Water level on date shown
- Water inflow
- Water outflow

Weathering
- RS Residual soil
- XW Extremely weathered
- DW Distinctly weathered
- SW Slightly weathered
- FR Fresh

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Moisture
D Dry M Moist W Wet

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Rock Strength
- ELS Extremely low
- VLS Very low
- LS Low
- MS Medium
- HS High
- VHS Very high
- EHS Extremely high

Tests & Results
- U50 Undisturbed 50mm diam tube.
- D Disturbed sample.
- SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP Hand penetrometer estimate of unconfined compressive strength, kPa.
- S Vane shear value kPa
- DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section. From AS1289-1993 Methods of Testing Soils for Engineering Purposes

TEST PIT TP3

TEST PIT TP5

MORRISON GEOTECHNIC PTY LTD
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Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP3 & TP**		*Date: 11th December, 2017*
			Drawing not to Scale

TEST PIT TP6

TEST PIT TP7

MORRISON GEOTECHNIC PTY LTD
ABN: 51 009 878 899

Unit 4/81 Wises Rd, Maroochydore Qld 4558
Ph: 5443 9522 Fax: 5479 1633
Email: caboolturelab@morrisongeo.com.au

Client	Parker Property Ningi Pty Ltd		
Project:	Glenbrook Drive, Nambour		
Project No:	ME17/023	Drawing No:	ME17/023 - 2
Legend:	**Test Pit TP6 & TP7**		*Date: 11th December, 2017*
			Drawing not to Scale

APPENDIX E

Laboratory Test Certificates

MORRISON GEOTECHNIC

Brisbane | Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 **P** (07) 5443 9522 **F** (07) 5479 1633
ABN 51 009 878 899
www.morrisongeo.com.au

Report for

Determination of Soil pH/EC

Test Method: *Refer to TPS WP-81 pH probe handbook*

Job No	ME17/023	Report No	ME17/023-1
Client	Parker Property Group	Date Sampled	08/02/2018
Project	Proposed Subdivision	Tested By	GF
Location	41 Glenbrook Drive	Date Tested	9/2/18 & 12/2/18
	Nambour	Date Reported	19/02/2018

Soil Results

Borehole No/Sample No.	Sample Depth (m)	pH	EC* (µS/cm)
TP2 (# 38821)	0.1 - 0.2	5.9	53.7
TP2 (# 38822)	0. 4 - 0.5	6.2	34.7
TP3 (# 38823)	0.1 - 0.2	6.3	16.7
TP3 (# 38824)	0.2 - 0.5	5.5	50.5
TP5 (# 38826)	0.1 - 0.2	6.2	19.5
TP6 (# 38829)	0.2 - 0.3	6.3	15.3
TP6 (# 38830)	0.5 - 0.6	5.8	33.2
TP7 (# 38831)	0.1 - 0.2	5.9	31.1

* EC = Electrical Conductivity

Remarks/Variation To Test Method

Approved Signatory

MORRISON GEOTECHNIC

Brisbane | Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 **P** (07) 5443 9522 **F** (07) 5479 1633
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www.morrisongeo.com.au

Report for

Determination of Soil pH/EC

Test Method: *Refer to TPS WP-81 pH probe handbook*

Job No	ME17/023	Report No	ME17/023-2
Client	Parker Property Group	Date Sampled	08/02/2018
Project	Proposed Subdivision	Tested By	GF
Location	41 Glenbrook Drive	Date Tested	12/02/18 & 13/2/18
	Nambour	Date Reported	19/02/2018

Soil Results

Borehole No/Sample No.	Sample Depth (m)	pH	EC* (µS/cm)
TP7 (# 38832)	0.4 - 0.5	6.1	23.1
TP9 (# 38833)	0.1 - 0.2	6	47.4
TP10 (# 38835)	0.1 - 0.2	5.3	191.8
TP10 (# 38836)	0.2 - 0.5	5.8	55.3
TP11 (# 38837)	0.2 - 0.3	5.8	31.5
TP11 (# 38838)	0.5 - 0.6	6	31.8
TP12 (# 38839)	0.05 - 0.2	5.9	54.6

* EC = Electrical Conductivity

Remarks/Variation To Test Method

Approved Signatory

MORRISON GEOTECHNIC

Brisbane | Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 **P** (07) 5443 9522 **F** (07) 5479 1633
ABN 51 009 878 899
www.morrisongeo.com.au

Report for

Determination of Soil pH/EC

Test Method: *Refer to TPS WP-81 pH probe handbook*

Job No	ME17/023	Report No	ME17/023-3
Client	Parker Property Group	Date Sampled	08/02/2018
Project	Proposed Subdivision	Tested By	GF
Location	41 Glenbrook Drive	Date Tested	20/02/2018
	Nambour	Date Reported	27/02/2018

Soil Results

Borehole No/Sample No.	Sample Depth (m)	pH	EC* (µS/cm)
TP12 (# 38840)	0.3 - 0.4	5.6	43.56
TP13 (# 38841)	0.05 - 0.2	5.99	97.32
TP13 (# 38842)	0.5 - 0.6	6.01	59.48

* EC = Electrical Conductivity

Remarks/Variation To Test Method

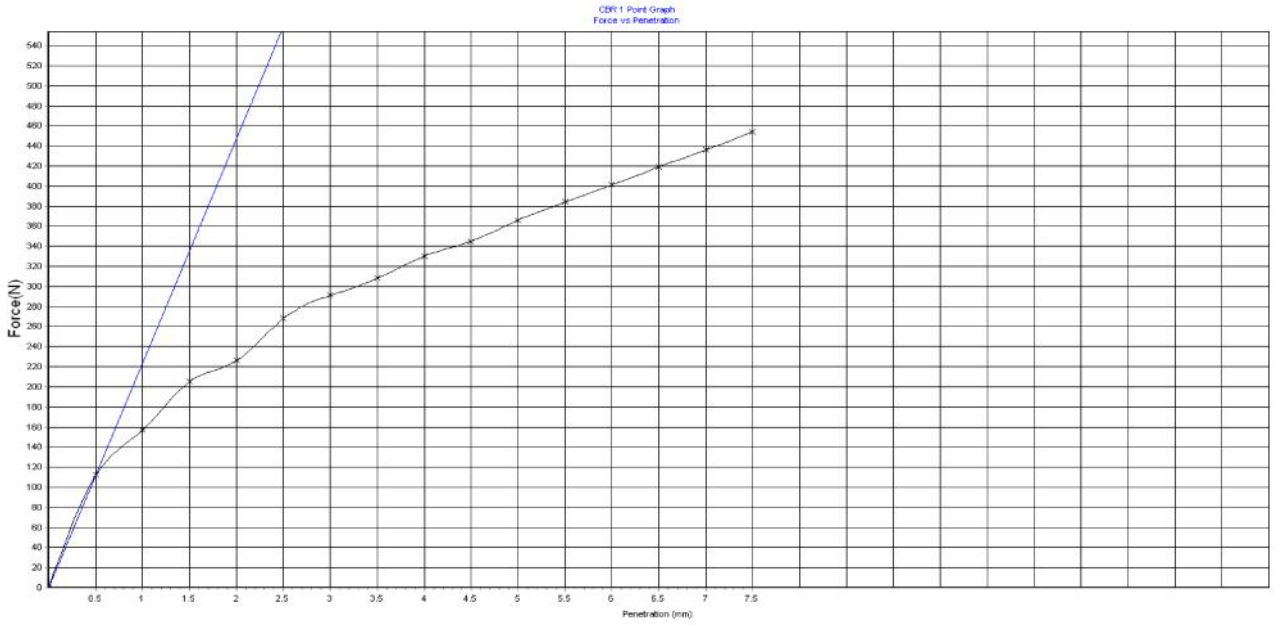
Approved Signatory

MORRISON GEOTECHNIC

Brisbane | Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 **P** (07) 5443 9522 **F** (07) 5479 1633
ABN 51 009 878 899
www.morrisongeo.com.au

California Bearing Ratio Report (1 Point)

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 11
Client address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	21/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41 Glenbrook** Street , Nambour		Page 1 of 1
Lab No:	38824	Sample Location	
Date Sampled:	7/02/2018	TP3	
Date Tested:	20/02/2018	0.2 - 0.5m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU	Test Method :	AS1289.6.1.1
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	Liquid Limit Determination (iii) Curing Duration 4 days	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	1.438	Dry Density after Soak (t/m³) :	1.401
Optimum Moisture Content - OMC (%) :	27.1	Moisture Content after Soak (%) :	31.3
Compactive Effort :	Standard	Density Ratio after Soak (%) :	97
Nominated % Maximum Dry Density Compaction :	100	Field Moisture Content (%) :	26.7
Nominated % Optimum Moisture Content Compaction :	100	Moisture Content (Top) after Penetration (%) :	37.3
Achieved Dry Density before Soak (t/m³) :	1.472	Moisture Content (Total) after Penetration (%) :	29.7
Achieved Percentage of Maximum Dry Density (%) :	102	CBR 2.5mm (%) :	2
Achieved Moisture Content (%) :	27.1	CBR 5.0mm (%) :	2
Achieved Percentage of Optimum Moisture Content (%) :	100	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	Soaked / 4 days	CBR Value (%) :	2.0
Swell (%) / Surcharge (kg):	5.0 / 4.5 kg		
Soil Description :	CLAY		

Approved Signatory
GINA FLETT
NATA Accred No:1169

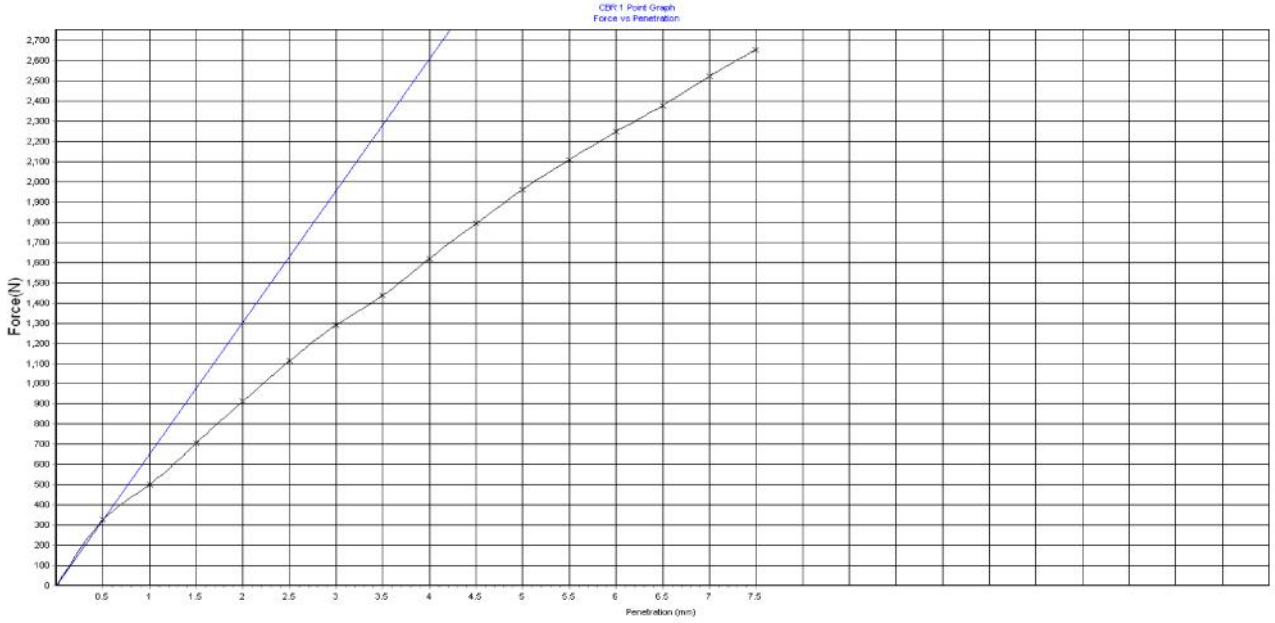
Form Number
REP ACBR_1_3-9

MORRISON GEOTECHNIC

Brisbane | Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 **P** (07) 5443 9522 **F** (07) 5479 1633
ABN 51 009 878 899
www.morrisongeo.com.au

California Bearing Ratio Report (1 Point)

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 12
Client address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	21/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41 G**lenbrook Street , Nambour		Page 1 of 1
Lab No:	38827	Sample Location	
Date Sampled:	7/02/2018	TP5	
Date Tested:	20/02/2018	0.2 - 0.5m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU	Test Method :	AS1289.6.1.1
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	Liquid Limit Determination (iii) Curing Duration 4 days	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	1.684	Dry Density after Soak (t/m³) :	1.683
Optimum Moisture Content - OMC (%) :	21.4	Moisture Content after Soak (%) :	22.5
Compactive Effort :	Standard	Density Ratio after Soak (%) :	100
Nominated % Maximum Dry Density Compaction :	100	Field Moisture Content (%) :	19.2
Nominated % Optimum Moisture Content Compaction :	100	Moisture Content (Top) after Penetration (%) :	22.7
Achieved Dry Density before Soak (t/m³) :	1.682	Moisture Content (Total) after Penetration (%) :	22.4
Achieved Percentage of Maximum Dry Density (%) :	100	CBR 2.5mm (%) :	8
Achieved Moisture Content (%) :	21.5	CBR 5.0mm (%) :	10
Achieved Percentage of Optimum Moisture Content (%) :	100	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	Soaked / 4 days	CBR Value (%) :	10.0
Swell (%) / Surcharge (kg):	0.0 / 4.5 kg		

Soil Description :

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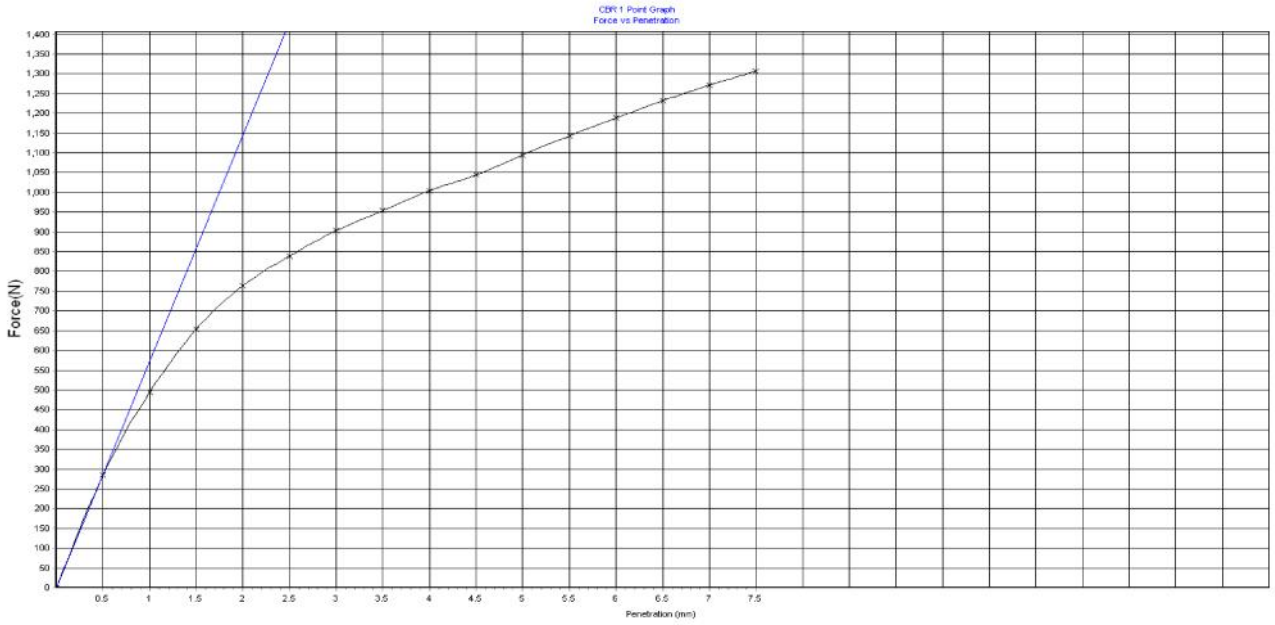
California Bearing Ratio Report (1 Point)

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 13
Client address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	21/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour		Page 1 of 1
Lab No:	38834	Sample Location	
Date Sampled:	7/02/2018	TP9	
Date Tested:	20/02/2018	0.3 - 0.6m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU	Test Method :	AS1289.6.1.1
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	Liquid Limit Determination (iii) Curing Duration 4 days	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	1.368	Dry Density after Soak (t/m³) :	1.339
Optimum Moisture Content - OMC (%) :	35.5	Moisture Content after Soak (%) :	38.3
Compactive Effort :	Standard	Density Ratio after Soak (%) :	98
Nominated % Maximum Dry Density Compaction :	100	Field Moisture Content (%) :	33.4
Nominated % Optimum Moisture Content Compaction :	100	Moisture Content (Top) after Penetration (%) :	38.5
Achieved Dry Density before Soak (t/m³) :	1.355	Moisture Content (Total) after Penetration (%) :	36
Achieved Percentage of Maximum Dry Density (%) :	99	CBR 2.5mm (%) :	6
Achieved Moisture Content (%) :	35.6	CBR 5.0mm (%) :	6
Achieved Percentage of Optimum Moisture Content (%) :	100	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	Soaked / 4 days	CBR Value (%) :	6.0
Swell (%) / Surcharge (kg):	1.3 / 4.5 kg		
Soil Description :	CLAY		

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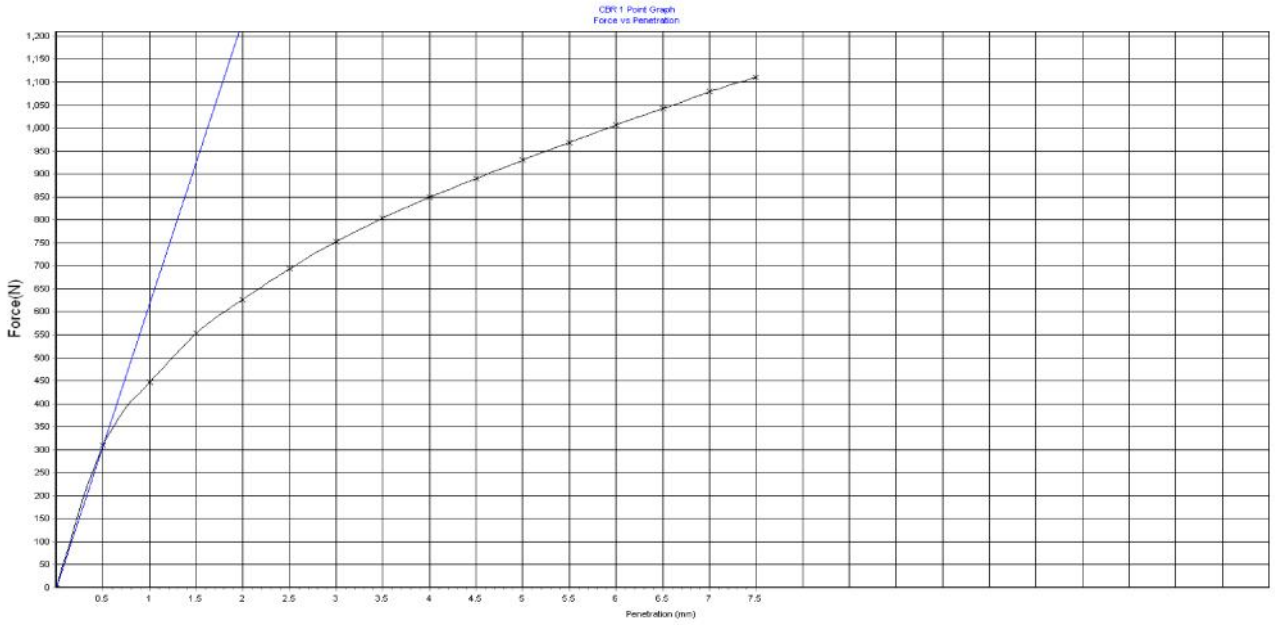
California Bearing Ratio Report (1 Point)

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 14
Client address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	21/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41 G**lenbrook Street , Nambour		Page 1 of 1
Lab No:	38836	Sample Location	
Date Sampled:	7/02/2018	TP10	
Date Tested:	20/02/2018	0.2 - 0.5m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU	Test Method :	AS1289.6.1.1
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	Liquid Limit Determination (iii) Curing Duration 4 days	Item Number :	-



Maximum Dry Density - MDD (t/m³) :	1.400	Dry Density after Soak (t/m³) :	1.388
Optimum Moisture Content - OMC (%) :	31.0	Moisture Content after Soak (%) :	34.2
Compactive Effort :	Standard	Density Ratio after Soak (%) :	99
Nominated % Maximum Dry Density Compaction :	100	Field Moisture Content (%) :	29.4
Nominated % Optimum Moisture Content Compaction :	100	Moisture Content (Top) after Penetration (%) :	35.2
Achieved Dry Density before Soak (t/m³) :	1.411	Moisture Content (Total) after Penetration (%) :	31.3
Achieved Percentage of Maximum Dry Density (%) :	101	CBR 2.5mm (%) :	5
Achieved Moisture Content (%) :	31.2	CBR 5.0mm (%) :	4.5
Achieved Percentage of Optimum Moisture Content (%) :	101	Minimum Specified CBR Value (%) :	-
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :	Soaked / 4 days	CBR Value (%) :	5.0
Swell (%) / Surcharge (kg):	1.7 / 4.5 kg		
Soil Description :	CLAY		

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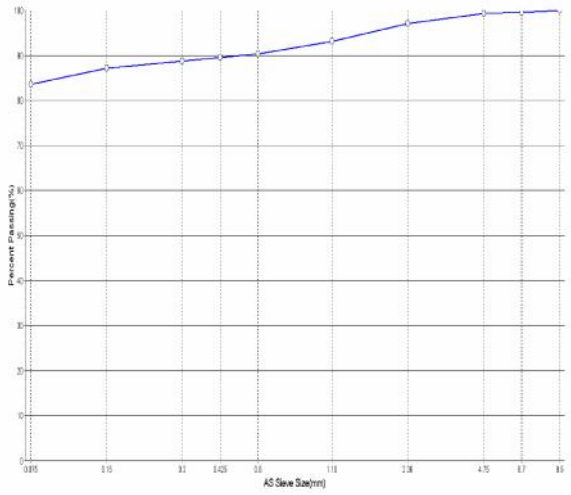
Quality of Materials Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 15
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	27/02/2018
Project:	Geotechnical Investigation	Order Number:	-
Location	**41 G**lenbrook Street , Nambour	Page 1 of 1	
Lab No:	38824	Sample Location	
Date Sampled:	7/02/2018	TP3	
Date Tested:	14/02/2018	0.2 - 0.5m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU	Spec Description:	-
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Spec Number:	-

Test Method: AS1289.3.6.1



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm			
13.2 mm			
9.50 mm		100	
6.7 mm		100	
4.75 mm		99	
2.36 mm		97	
1.18 mm		93	
0.600 mm		90	
0.425 mm		90	
0.300 mm		89	
0.150 mm		87	
0.075 mm		84	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		72	
Plastic Limit (%)	AS1289.3.2.1		27	
Plasticity Index	AS1289.3.3.1		45	
Linear Shrinkage (%)	AS1289.3.4.1		15.5	

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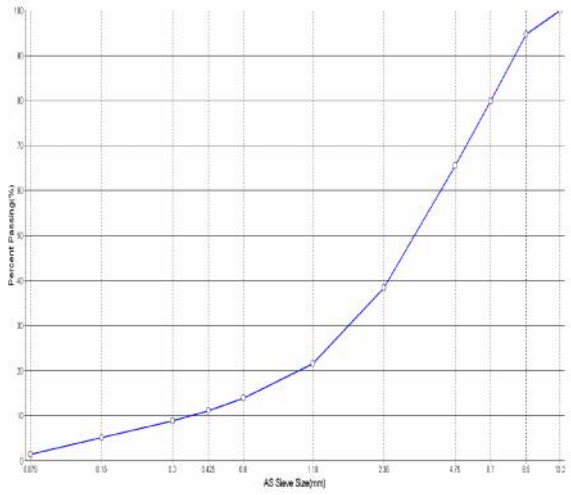
Quality of Materials Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 16
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	27/02/2018
Project:	Geotechnical Investigation	Order Number:	-
Location	**41** Glenbrook Street , Nambour		Page 1 of 1
Lab No:	38827		Sample Location
Date Sampled:	7/02/2018		TP5
Date Tested:	22/02/2018		0.2 - 0.5m
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU	Spec Description:	-
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Spec Number:	-

Test Method: AS1289.3.6.1



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm			
13.2 mm		100	
9.50 mm		95	
6.7 mm		80	
4.75 mm		65	
2.36 mm		38	
1.18 mm		22	
0.600 mm		14	
0.425 mm		11	
0.300 mm		9	
0.150 mm		5	
0.075 mm		2	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		40	
Plastic Limit (%)	AS1289.3.2.1		24	
Plasticity Index	AS1289.3.3.1		16	
Linear Shrinkage (%)	AS1289.3.4.1		7.0	

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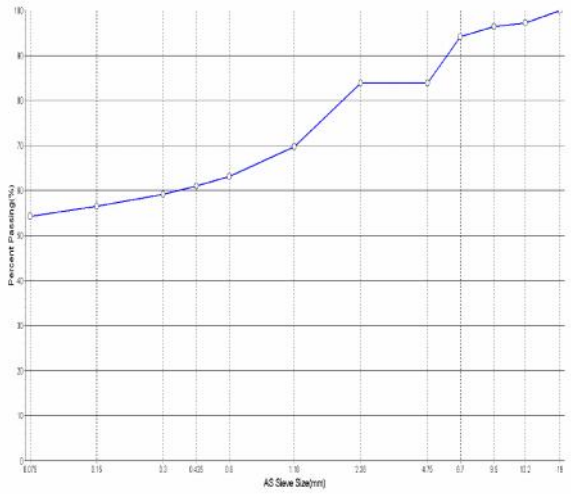
Quality of Materials Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 17
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	27/02/2018
Project:	Geotechnical Investigation	Order Number:	-
Location	**41** Glenbrook Street , Nambour		Page 1 of 1

Lab No:	38829	Sample Location
Date Sampled:	7/02/2018	TP6
Date Tested:	14/02/2018	0.2 - 0.3m
Sampled By:	David Pollock	
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)	
Material Source:	INSITU	Spec Description:-
For Use As:	FOUNDATION	Lot Number: -
Remarks:	-	Spec Number: -

Test Method: AS1289.3.6.1



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		100	
13.2 mm		97	
9.50 mm		96	
6.7 mm		94	
4.75 mm		84	
2.36 mm		84	
1.18 mm		70	
0.600 mm		63	
0.425 mm		61	
0.300 mm		59	
0.150 mm		56	
0.075 mm		54	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		65	
Plastic Limit (%)	AS1289.3.2.1		38	
Plasticity Index	AS1289.3.3.1		27	
Linear Shrinkage (%)	AS1289.3.4.1		13.0	

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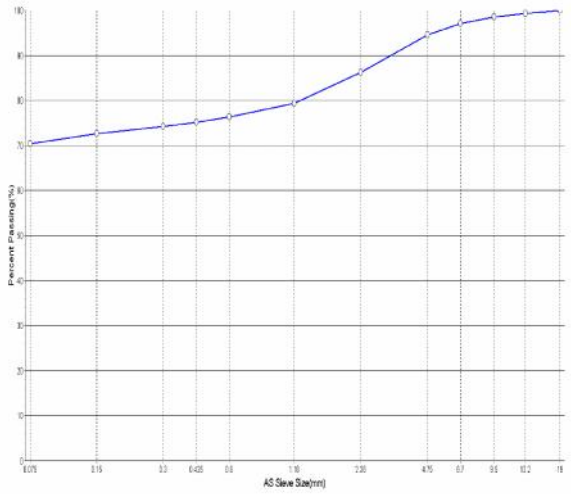
Quality of Materials Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 18
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	27/02/2018
Project:	Geotechnical Investigation	Order Number:	-
Location	**41** Glenbrook Street , Nambour		Page 1 of 1

Lab No:	38834	Sample Location
Date Sampled:	7/02/2018	TP9
Date Tested:	14/02/2018	0.3 - 0.6m
Sampled By:	David Pollock	
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)	
Material Source:	INSITU	Spec Description: -
For Use As:	FOUNDATION	Lot Number: -
Remarks:	-	Spec Number: -

Test Method: AS1289.3.6.1



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		100	
13.2 mm		99	
9.50 mm		99	
6.7 mm		97	
4.75 mm		95	
2.36 mm		86	
1.18 mm		79	
0.600 mm		76	
0.425 mm		75	
0.300 mm		74	
0.150 mm		73	
0.075 mm		70	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		76	
Plastic Limit (%)	AS1289.3.2.1		32	
Plasticity Index	AS1289.3.3.1		44	
Linear Shrinkage (%)	AS1289.3.4.1		18.5	

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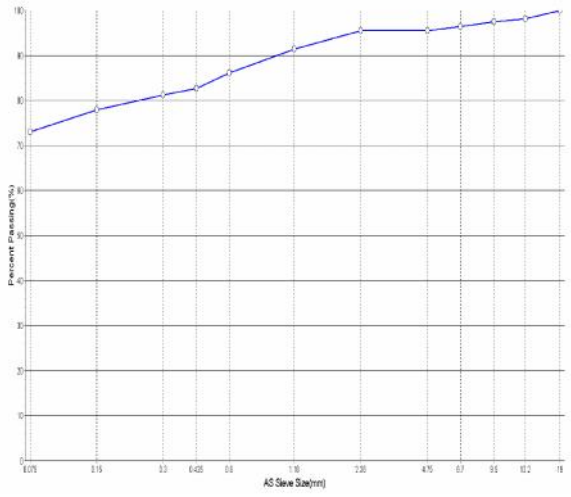
Quality of Materials Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 19
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	27/02/2018
Project:	Geotechnical Investigation	Order Number:	-
Location	**41** Glenbrook Street , Nambour		Page 1 of 1

Lab No:	38836	Sample Location
Date Sampled:	7/02/2018	TP10
Date Tested:	14/02/2018	0.2 - 0.5m
Sampled By:	David Pollock	
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)	
Material Source:	INSITU	Spec Description: -
For Use As:	FOUNDATION	Lot Number: -
Remarks:	-	Spec Number: -

Test Method: AS1289.3.6.1



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		100	
13.2 mm		98	
9.50 mm		98	
6.7 mm		96	
4.75 mm		96	
2.36 mm		96	
1.18 mm		91	
0.600 mm		86	
0.425 mm		83	
0.300 mm		81	
0.150 mm		78	
0.075 mm		73	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		65	
Plastic Limit (%)	AS1289.3.2.1		26	
Plasticity Index	AS1289.3.3.1		39	
Linear Shrinkage (%)	AS1289.3.4.1		17.0	

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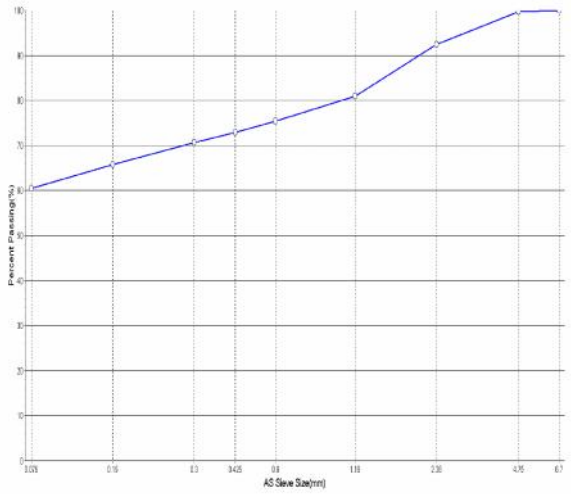
Quality of Materials Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 20
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	27/02/2018
Project:	Geotechnical Investigation	Order Number:	-
Location	**41** Glenbrook Street , Nambour		Page 1 of 1

Lab No:	38838	Sample Location
Date Sampled:	7/02/2018	TP11
Date Tested:	14/02/2018	0.5 - 0.6m
Sampled By:	David Pollock	
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)	
Material Source:	INSITU	Spec Description:-
For Use As:	FOUNDATION	Lot Number: -
Remarks:	-	Spec Number: -

Test Method: AS1289.3.6.1



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm			
13.2 mm			
9.50 mm			
6.7 mm		100	
4.75 mm		100	
2.36 mm		92	
1.18 mm		81	
0.600 mm		75	
0.425 mm		73	
0.300 mm		71	
0.150 mm		66	
0.075 mm		61	

Atterberg Tests	Test Method	Specification Minimum	Result	Specification Maximum
Liquid Limit (%)	AS1289.3.1.2		70	
Plastic Limit (%)	AS1289.3.2.1		31	
Plasticity Index	AS1289.3.3.1		39	
Linear Shrinkage (%)	AS1289.3.4.1		16.0	

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Shrink Swell Index Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 1
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	13/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour	Test Method :	AS1289.7.1.1
Lab No:	38769	Sample Location	
Date Sampled:	07/12/2017	TP11	
Date Tested:	12/12/2017	0.2 - 0.4m	
Sampled By:	David Pollock		
Sample Method:	Unknown		
Material Source:	INSITU		
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Item Number :	-

Shrinkage Moisture Content (%) :	43.68	Swell MC Before(%):	39.3
Shrinkage (%) :	6.8	Swell MC After(%) :	46.7
Unit Weight (t/m³) :	1.74	PP Before (kPa):	290
Swell (%) :	1.8	PP After (kPa):	220
Shrink Swell Index (Iss %):	4.3		

Visual Classification :	-
Inert Material Estimate(%):	-
Cracking :	-
Crumbling :	-

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REP ASS-1-4

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Shrink Swell Index Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 2
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	13/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour	Test Method :	AS1289.7.1.1
Lab No:	38770	Sample Location	
Date Sampled:	07/12/2017	TP12	
Date Tested:	12/12/2017	0.1 - 0.24m	
Sampled By:	David Pollock		
Sample Method:	Unknown		
Material Source:	INSITU		
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Item Number :	-

Shrinkage Moisture Content (%) :	33.1	Swell MC Before(%):	37.1
Shrinkage (%) :	4.3	Swell MC After(%) :	42.2
Unit Weight (t/m³) :	1.7	PP Before (kPa):	190
Swell (%) :	0.3	PP After (kPa):	120
Shrink Swell Index (Iss %):	2.5		

Visual Classification :	-
Inert Material Estimate(%):	-
Cracking :	-
Crumbling :	-

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ABN 51 009 878 899
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Shrink Swell Index Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 3
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	19/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour	Test Method :	AS1289.7.1.1
Lab No:	38825	Sample Location	
Date Sampled:	07/02/2018	TP3	
Date Tested:	12/02/2018	0.4 - 0.6m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU		
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Item Number :	-

Shrinkage Moisture Content (%) :	29.99	Swell MC Before(%):	31.3
Shrinkage (%) :	2.5	Swell MC After(%) :	35.1
Unit Weight (t/m³) :	1.82	PP Before (kPa):	
Swell (%) :	0.1	PP After (kPa):	230
Shrink Swell Index (Iss %):	1.4		

Visual Classification :	-
Inert Material Estimate(%):	-
Cracking :	-
Crumbling :	-

NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025. Corporate Site No: 17071 Maroochydore.

APPROVED SIGNATORY

GINA FLETT

NATA Accred No:1169

FORM NUMBER

REP ASS-1-4

MORRISON GEOTECHNIC

Brisbane| Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 **P** (07) 5443 9522 **F** (07) 5479 1633
ABN 51 009 878 899
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Shrink Swell Index Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 4
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	19/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour	Test Method :	AS1289.7.1.1
Lab No:	38827	Sample Location	
Date Sampled:	07/02/2018	TP5	
Date Tested:	12/02/2018	0.2 - 0.5m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU		
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Item Number :	-

Shrinkage Moisture Content (%) :	28.94	Swell MC Before(%):	23.0
Shrinkage (%) :	2.1	Swell MC After(%) :	26.0
Unit Weight (t/m³) :	1.91	PP Before (kPa):	
Swell (%) :	0.0	PP After (kPa):	250
Shrink Swell Index (Iss %):	1.2		

Visual Classification :	-
Inert Material Estimate(%):	-
Cracking :	-
Crumbling :	-

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NATA Accred No:1169

FORM NUMBER

REP ASS-1-4

MORRISON GEOTECHNIC

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Shrink Swell Index Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 5
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	19/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour	Test Method :	AS1289.7.1.1
Lab No:	38843	Sample Location	
Date Sampled:	07/02/2018	TP11	
Date Tested:	12/02/2018	0.3- 0.5m	
Sampled By:	David Pollock		
Sample Method:	Unknown		
Material Source:	INSITU		
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Item Number :	-

Shrinkage Moisture Content (%) :	44.16	Swell MC Before(%):	31.5
Shrinkage (%) :	3.5	Swell MC After(%) :	41.7
Unit Weight (t/m³) :	1.68	PP Before (kPa):	200
Swell (%) :	0.2	PP After (kPa):	180
Shrink Swell Index (Iss %):	2.0		

Visual Classification :	-
Inert Material Estimate(%):	-
Cracking :	-
Crumbling :	-

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FORM NUMBER

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MORRISON GEOTECHNIC

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Shrink Swell Index Report

Client:	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 10
Client Address:	PO Box 5608 Maroochydore QLD 4558		
Job Number:	ME17/023	Report Date:	21/02/2018
Project:	Geotechnical Investigation	Order Number:	
Location	**41** Glenbrook Street , Nambour	Test Method :	AS1289.7.1.1
Lab No:	38836	Sample Location	
Date Sampled:	07/02/2018	TP10	
Date Tested:	19/02/2018	0.2 - 0.5m	
Sampled By:	David Pollock		
Sample Method:	AS 1289 1.2.1 (Cl 6.5.4)		
Material Source:	INSITU		
For Use As:	FOUNDATION	Lot Number:	-
Remarks:	-	Item Number :	-

Shrinkage Moisture Content (%) :	33.61	Swell MC Before(%):	36.5
Shrinkage (%) :	3.1	Swell MC After(%) :	40.5
Unit Weight (t/m³) :	1.74	PP Before (kPa):	290
Swell (%) :	0.7	PP After (kPa):	210
Shrink Swell Index (Iss %):	1.9		

Visual Classification :	-
Inert Material Estimate(%):	-
Cracking :	-
Crumbling :	-

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FORM NUMBER

REP ASS-1-4

MORRISON GEOTECHNIC

Brisbane| Gold Coast | **Maroochydore**
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Emerson Class Number Report

Client :	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 6
Client Address :	PO Box 5608 Maroochydore QLD 4558	Report Date:	19/02/2018
Job Number :	ME17/023	Order Number:	
Project :	Geotechnical Investigation	Test Method:	AS 1289.3.8.1
Location :	**41** Glenbrook Street , Nambour		

Lab No :	38821	38822	38823	38824
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)
Date Sampled :	7/2/2018	7/2/2018	7/2/2018	7/2/2018
Date Tested :	12/2/2018	12/2/2018	12/2/2018	12/2/2018
Material Source :	INSITU	INSITU	INSITU	INSITU
For Use As :	FOUNDATION	FOUNDATION	FOUNDATION	FOUNDATION
Sample Location :	TP2 0.1 - 0.2m	TP2 0.4 - 0.5m	TP3 0.1 - 0.2m	TP3 0.2 - 0.5m
Soil Description :	Silty Clay	Silty Clay	Silty Clay	Silty Clay
Type of Water Used :	Distilled Water	Distilled Water	Distilled Water	Distilled Water
Temperature of Water (°C) :	27.000	27.000	27.000	26.000
Emerson Class Number :	Class 8	Class 5	Class 5	Class 3
Remarks :				

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NATA Accred No:1169

FORM NUMBER

EMSN-REP-4

MORRISON GEOTECHNIC

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Emerson Class Number Report

Client :	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 7
Client Address :	PO Box 5608 Maroochydore QLD 4558	Report Date:	19/02/2018
Job Number :	ME17/023	Order Number:	
Project :	Geotechnical Investigation	Test Method:	AS 1289.3.8.1
Location :	**41** Glenbrook Street , Nambour		

Lab No :	38826	38829	38830	38831
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)
Date Sampled :	7/2/2018	7/2/2018	7/2/2018	7/2/2018
Date Tested :	13/2/2018	13/2/2018	13/2/2018	13/2/2018
Material Source :	INSITU	INSITU	INSITU	INSITU
For Use As :	FOUNDATION	FOUNDATION	FOUNDATION	FOUNDATION
Sample Location :	TP5 0.1 - 0.2m	TP6 0.2 - 0.3m	TP6 0.5 - 0.6m	TP7 0.1 - 0.2m
Soil Description :	Silty Clay	Silty Clay	Silty Clay	Silty Clay
Type of Water Used :	Distilled Water	Distilled Water	Distilled Water	Distilled Water
Temperature of Water (°C) :	26.000	26.000	27.000	27.000
Emerson Class Number :	Class 5	Class 8	Class 3	Class 8
Remarks :				

MORRISON GEOTECHNIC

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Emerson Class Number Report

Client :	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 8
Client Address :	PO Box 5608 Maroochydore QLD 4558	Report Date:	19/02/2018
Job Number :	ME17/023	Order Number:	
Project :	Geotechnical Investigation	Test Method:	AS 1289.3.8.1
Location :	**41** Glenbrook Street , Nambour		

Lab No :	38832	38833	38835	38836
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)
Date Sampled :	7/2/2018	7/2/2018	7/2/2018	7/2/2018
Date Tested :	13/2/2018	13/2/2018	13/2/2018	14/2/2018
Material Source :	INSITU	INSITU	INSITU	INSITU
For Use As :	FOUNDATION	FOUNDATION	FOUNDATION	FOUNDATION
Sample Location :	TP7 0.4 - 0.5m	TP9 0.1 - 0.2m	TP10 0.1 - 0.2m	TP10 0.2 - 0.5m
Soil Description :	Silty Clay	Silty Clay	Silty Clay	Silty Clay
Type of Water Used :	Distilled Water	Distilled Water	Distilled Water	Distilled Water
Temperature of Water (°C) :	27.000	27.000	27.000	27.000
Emerson Class Number :	Class 3	Class 8	Class 8	Class 5
Remarks :				

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Emerson Class Number Report

Client :	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 9
Client Address :	PO Box 5608 Maroochydore QLD 4558	Report Date:	19/02/2018
Job Number :	ME17/023	Order Number:	
Project :	Geotechnical Investigation	Test Method:	AS 1289.3.8.1
Location :	**41** Glenbrook Street , Nambour		

Lab No :	38837	38838	38839	38840
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)
Date Sampled :	7/2/2018	7/2/2018	7/2/2018	7/2/2018
Date Tested :	14/2/2018	14/2/2018	14/2/2018	14/2/2018
Material Source :	INSITU	INSITU	INSITU	INSITU
For Use As :	FOUNDATION	FOUNDATION	FOUNDATION	FOUNDATION
Sample Location :	TP11 0.2 - 0.3m	TP11 0.5 - 0.6m	TP12 0.05 - 0.2m	TP12 0.3 - 0.4m
Soil Description :	Silty Clay	Silty Clay	Silty Sandy Clay	Silty Sandy Clay
Type of Water Used :	Distilled Water	Distilled Water	Distilled Water	Distilled Water
Temperature of Water (°C) :	27.000	27.000	27.000	27.000
Emerson Class Number :	Class 5	Class 3	Class 8	Class 3
Remarks :				

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EMSN-REP-4

MORRISON GEOTECHNIC

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www.morrisongeo.com.au

Emerson Class Number Report

Client :	Parker Propery Ningi Pty Ltd	Report Number:	ME17/023 - 9
Client Address :	PO Box 5608 Maroochydore QLD 4558	Report Date:	19/02/2018
Job Number :	ME17/023	Order Number:	
Project :	Geotechnical Investigation	Test Method:	AS 1289.3.8.1
Location :	**41** Glenbrook Street , Nambour		

Lab No :	38841	38842		
ID No :	1	1		
Lot No :	-	-		
Item No :	-	-		
Sampling Method :	AS 1289 1.2.1 (Cl 6.5.4)	AS 1289 1.2.1 (Cl 6.5.4)		
Date Sampled :	7/2/2018	7/2/2018		
Date Tested :	14/2/2018	14/2/2018		
Material Source :	INSITU	INSITU		
For Use As :	FOUNDATION	FOUNDATION		
Sample Location :	TP13 0.05- 0.2m	TP13 0.5- 0.6m		
Soil Description :	Silty Sandy Clay	Silty Sandy Clay		
Type of Water Used :	Distilled Water	Distilled Water		
Temperature of Water (°C) :	27.000	27.000		
Emerson Class Number :	Class 8	Class 8		
Remarks :				

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EMSN-REP-4

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Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

Morrison Geotechnic Pty Ltd
1/35 Limestone St
Darra
QLD 4076

NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **David Pollock**

Report **584664-S**
Project name GLENBROOK DRIVE NAMBOUR
Project ID ME17/023
Received Date Feb 14, 2018

Client Sample ID			**TP3 0.1-0.2**	**TP3 0.2-0.5**	**TP5 0.1-0.2**	**TP6 0.5-0.6**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins | mgt Sample No.			**B18-Fe14728**	**B18-Fe14729**	**B18-Fe14730**	**B18-Fe14731**
Date Sampled			**Feb 08, 2018**	**Feb 08, 2018**	**Feb 08, 2018**	**Feb 08, 2018**
Test/Reference	LOR	Unit				
Exchangeable Sodium Percentage (ESP)	0.1	%	3.5	4.1	2.2	5.2
% Moisture	1	%	22	22	23	26

Client Sample ID			**TP7 0.4-0.5**	**TP12 0.3-0.4**
Sample Matrix			**Soil**	**Soil**
Eurofins | mgt Sample No.			**B18-Fe14732**	**B18-Fe14733**
Date Sampled			**Feb 08, 2018**	**Feb 08, 2018**
Test/Reference	LOR	Unit		
Exchangeable Sodium Percentage (ESP)	0.1	%	4.8	9.2
% Moisture	1	%	20	16

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Exchangeable Sodium Percentage (ESP)	Melbourne	Feb 16, 2018	28 Day
- Method: LTM-MET-3060 - Cation Exchange Capacity (CEC) & Exchangeable Sodium Percentage (ESP)			
% Moisture	Melbourne	Feb 14, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

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NATA # 1261
Site # 23736

Company Name: Morrison Geotechnic Pty Ltd
Address: 1/35 Limestone St
Darra
QLD 4076

Project Name: GLENBROOK DRIVE NAMBOUR
Project ID: ME17/023

Order No.: A18260
Report #: 584664
Phone: 0427 193 776
Fax:

Received: Feb 14, 2018 7:30 AM
Due: Feb 19, 2018
Priority: 3 Day
Contact Name: David Pollock

Eurofins | mgt Analytical Services Manager : Ryan Gilbert

Sample Detail						Exchangeable Sodium Percentage (ESP)	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	TP3 0.1-0.2	Feb 08, 2018		Soil	B18-Fe14728	X	X
2	TP3 0.2-0.5	Feb 08, 2018		Soil	B18-Fe14729	X	X
3	TP5 0.1-0.2	Feb 08, 2018		Soil	B18-Fe14730	X	X
4	TP6 0.5-0.6	Feb 08, 2018		Soil	B18-Fe14731	X	X
5	TP7 0.4-0.5	Feb 08, 2018		Soil	B18-Fe14732	X	X
6	TP12 0.3-0.4	Feb 08, 2018		Soil	B18-Fe14733	X	X
Test Counts						6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Exchangeable Sodium Percentage (ESP)			%	< 0.1			0.1	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M18-Fe14567	NCP	%	24	24	2.0	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Exchangeable Sodium Percentage (ESP)	B18-Fe14733	CP	%	9.2	8.5	8.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Comments

Authorised By

Ryan Gilbert	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Michael Brancati	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX F

Point Load Index Test Results

MORRISON GEOTECHNIC

Brisbane | Gold Coast | **Maroochydore**
Unit 4, 81 Wises Road, Maroochydore Q 4558 P (07) 5443 9522 F (07) 5479 1633
ABN 51 009 878 899
www.morrisongeo.com.au

POINT LOAD TEST REPORT

Client:	**Parker Property Ningi Pty Ltd**	**Report No:**	**N/A - Field Tests Only**
Client Address:	**PO Box 5608 Maroochydore QLD 4558**	**Report Date:**	**20/11/2018**
Job No:	**ME18-065**	**Sample Date:**	**1/11/2018**
Project:	**Proposed Retaining Wall**	**Order No:**	**N/A**
Location:	**Glenbrook Drive, Nambour**	**Test Method:**	**AS 4133.4.1**

Date of Test	Location Depth (m)	Sample Type	Is (50) (MPa)	Loading Direction	Strength Term	
20/11/2018	BH1 3.25m	NMLC	0.09	Diametral	Very Low	Fractured
20/11/2018	BH1 4.11m	NMLC	0.07	Diametral	Very Low	Fractured
20/11/2018	BH1 4.55m	NMLC	0.10	Diametral	Low	Fractured
20/11/2018	BH3 2.80m	NMLC	0.33	Diametral	Medium	
20/11/2018	BH3 3.21m	NMLC	Not Tested - Sample Fractured			
20/11/2018	BH3 3.80m	NMLC	Not Tested - Sample Fractured			
20/11/2018	BH3 5.05m	NMLC	1.37	Diametral	High	
20/11/2018	BH3 6.35m	NMLC	6.03	Diametral	Very High	
20/11/2018	BH1 3.25m	NMLC	0.04	Axial	Very Low	Fractured
20/11/2018	BH1 4.11m	NMLC	Not Tested - Sample Fractured			
20/11/2018	BH1 4.55m	NMLC	0.07	Axial	Very Low	Fractured
20/11/2018	BH3 2.8m	NMLC	0.09	Axial	Very Low	Fractured
20/11/2018	BH3 3.21m	NMLC	1.00	Axial	Low	Fractured
20/11/2018	BH3 3.80m	NMLC	0.03	Axial	Very Low	Fractured
20/11/2018	BH3 5.05	NMLC	0.72	Axial	Medium	
20/11/2018	BH3 6.35m	NMLC	5.91	Axial	Very High	

Note: Field test only not NATA.

***VL: Very Low, L: Low, M: Medium, H: High, VH: Very High, EH: Extremely High**

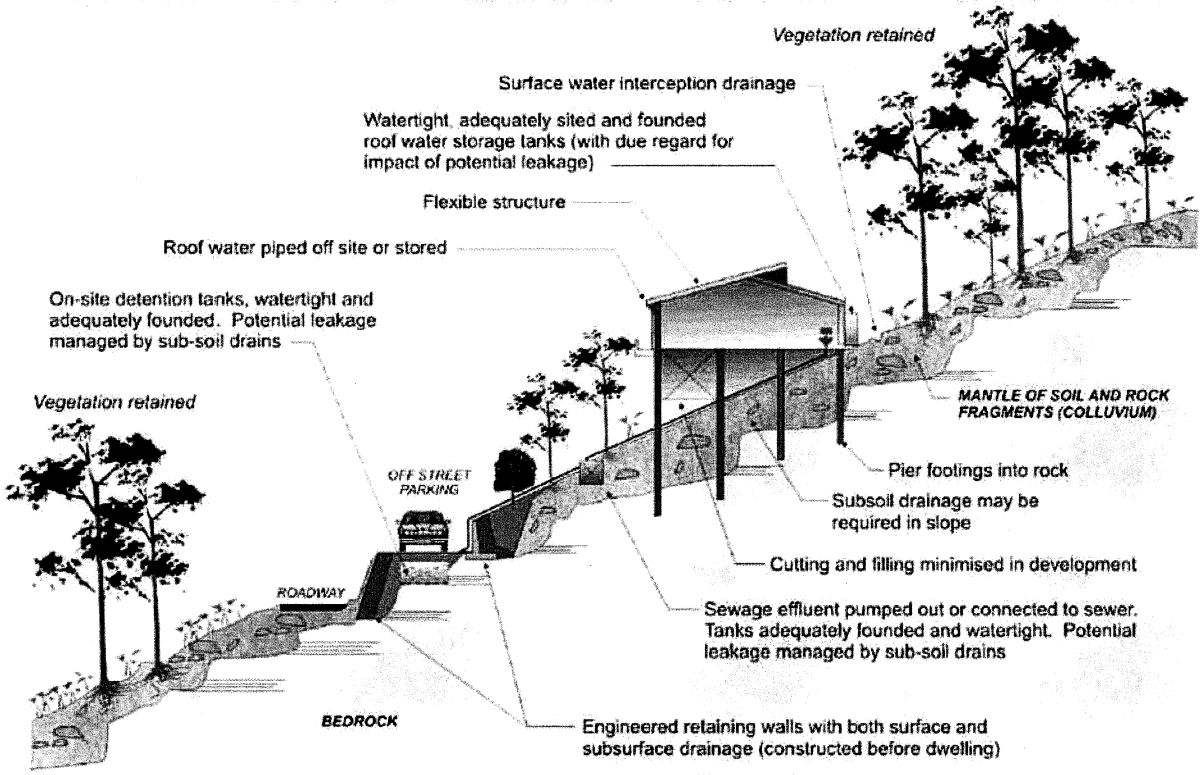
A P P E N D I X G

SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

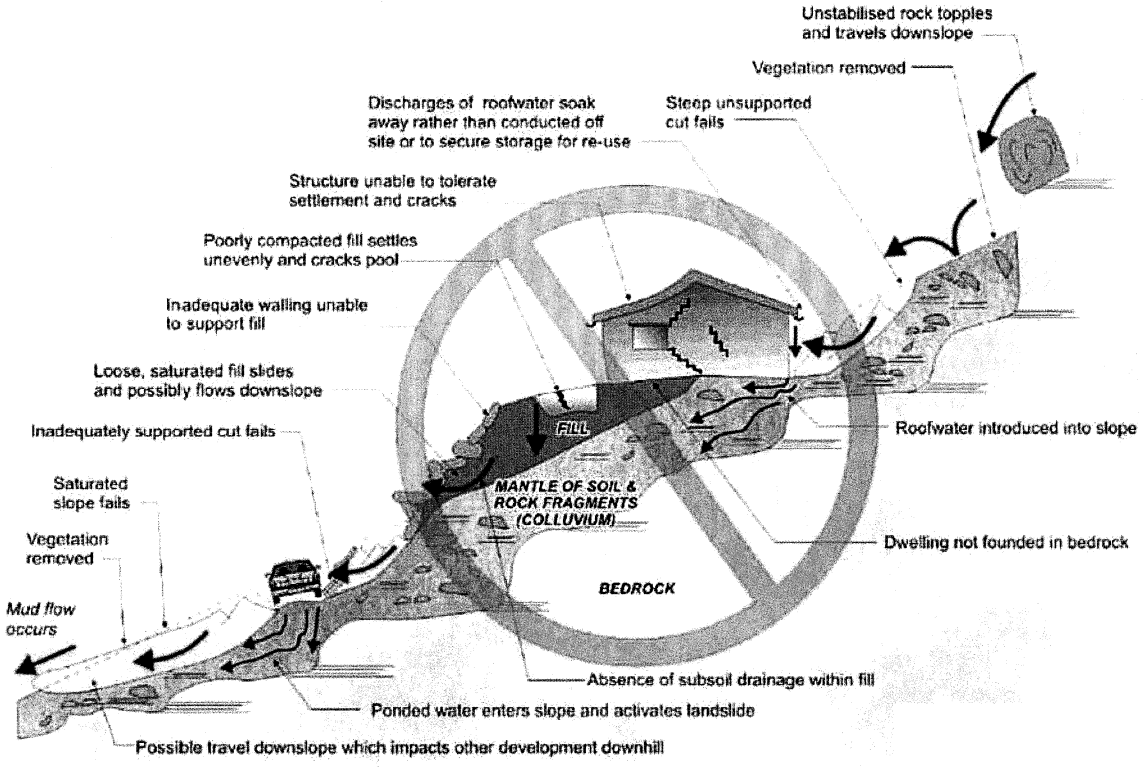
SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE



This figure is an extract from PRACTICE NOTE GUIDELINES FOR LAND SLIDE RISK MANAGEMENT as presented in Australian Geomechanics Journal and News, Volume 42, No 1, March 2007, which discusses the matter more fully.

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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