JOB NO ME18/065DECEMBER 2020PARKER PROPERTY NINGI PTY LTDREPORT ON GEOTECHNICAL INVESTIGATION41 GLENBROOK DRIVENAMBOUR





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22nd December 2020

Parker Property Ningi Pty Ltd PO Box 5608 MAROOCHYDORE BC QLD 4558

ATTENTION: MR MATTHEW CLARKE

Email: <u>matthew@parkerpropertygroup.com</u> CC: <u>amontgomery@mnce.com.au</u>

Dear Sir

RE: <u>REPORT ON GEOTECHNICAL INVESTIGATION</u> 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.



Solid thinking. Grounded results.

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.

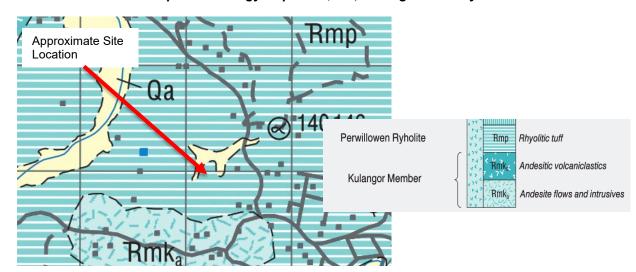


Image 1 – Extract of Nambour Special Geology Map 1:100,000, Geological Survey of Queensland

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 verv 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.

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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:						

Table 1 – Geotechnical Sum	mary of the Subsurface Profile
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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.

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	

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.

Test Pit	Donth	Soi	I Fractio	on	Liquid	Plasticity	Linear	
Location	Depth (m)	Clay/Silt (%)	Sand (%)	Gravel (%)	Limit (%)	Index	Shrinkage	Material
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)

Table 3– Quality of Materials

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.

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

Table 4 – Shrink/Swell Index Test Results

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

Test Pit Location	Depth (m)	Standard Maximum Dry Density (t/m³)	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.

Test Pit Location	Depth (m)	Emerson Class No.	рН	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	

Table 6– Emerson Class Number, pH, and EC

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.

Location/Depth	ls (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

Table 7 – Point Load Index Test Results

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.

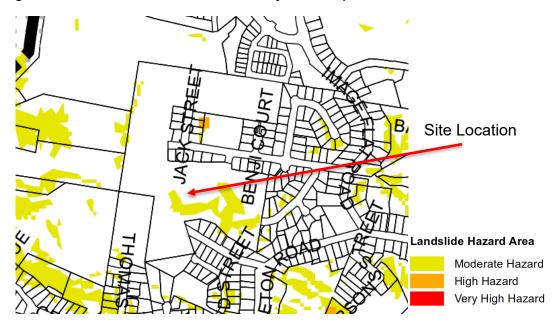


Image 2 – Council's Landslide Hazard Overlay Code Map

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)

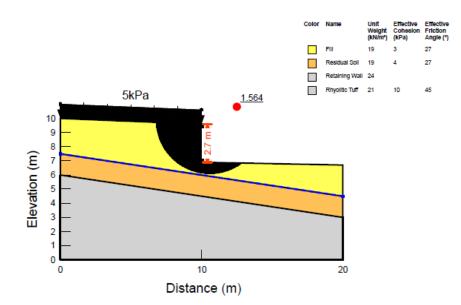
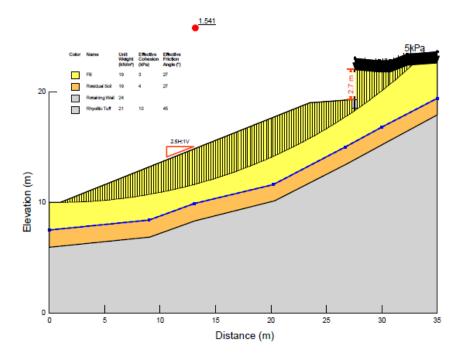


Image 4 – SlopeW Analysis for 2.7m high Retaining Wall (DRG C3602 – CE302 A Section C)



4.3 Global Slope Stability of Batter Slopes

A slope stability analysis 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.



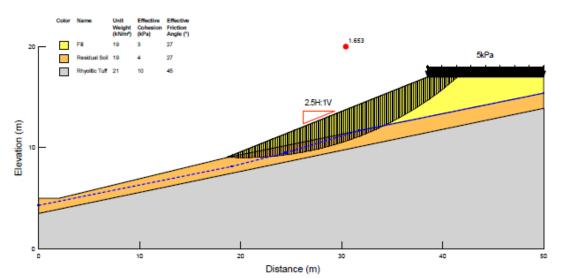
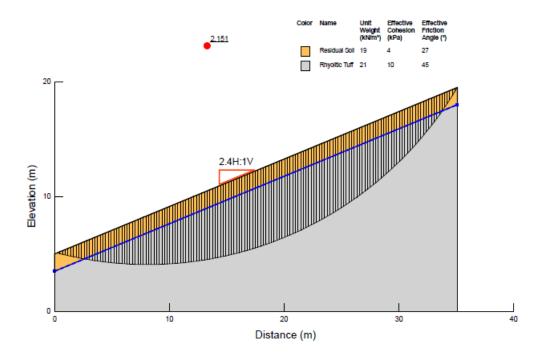


Image 6 – SlopeW Analysis for Cut Slope At Maximum Batter Slope of 2.4H:1V



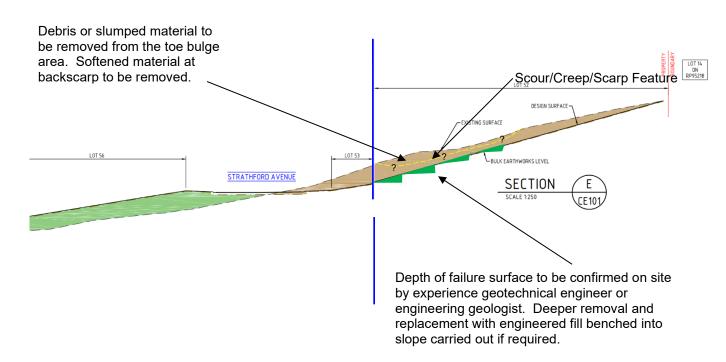
Where deeper cuttings are proposed there is the potential to expose competent, self-supporting rock faces along the retaining wall alignments. In these cases, it may be possible to form battered rock slopes at angles of say 45° from the horizontal and provide support with a "hard" surface protection 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 possible 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).

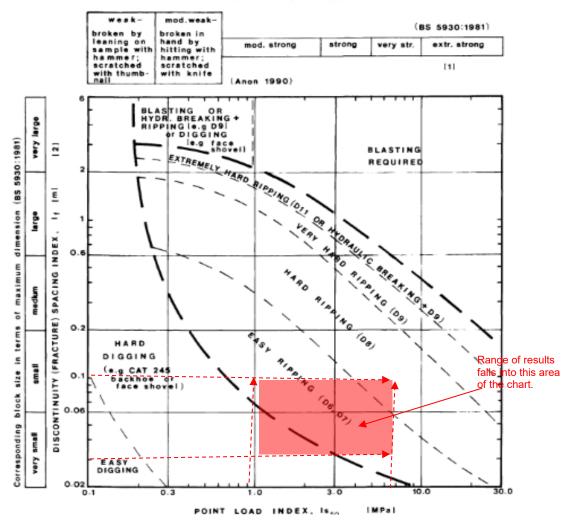
Assessment of estimated rock excavation conditions has been carried out by the methods derived by Pettifer & Fookes (1994)¹ (P&F).

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

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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 northwestern 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.

Material	Short Term (°)	Long Term (°)		
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 assume	ed to have no significant se	epage.		

Table 8 – Safe Batter Angles for Cut and Fill Slopes

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:

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

In the above equation, H(m) is the distance down from the top of the wall, γ (kN/m³) 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.

		Earth P	Long									
Material	Bulk Density γ (t/m³)	Density		Passive K_p	Term Effective Friction Angle (Degrees)							
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											

Table 9 – Retaining Wall Design Parameters

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.

- 16 -

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
- Site Investigation
 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)

1 10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁴	10 ⁻⁵	10-6	10-7	10 ⁻⁸	10 ⁻⁹	10 ⁻¹⁰
Clean gravels	Clean s and sar gravel r	nd-			ssured cl -silts (>20	-			
	Desic	cated a							

Coefficient of Permeability (m/s)

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) 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.

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- (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



Historical Aerial Image – 2003





Historical Aerial Image – 1998



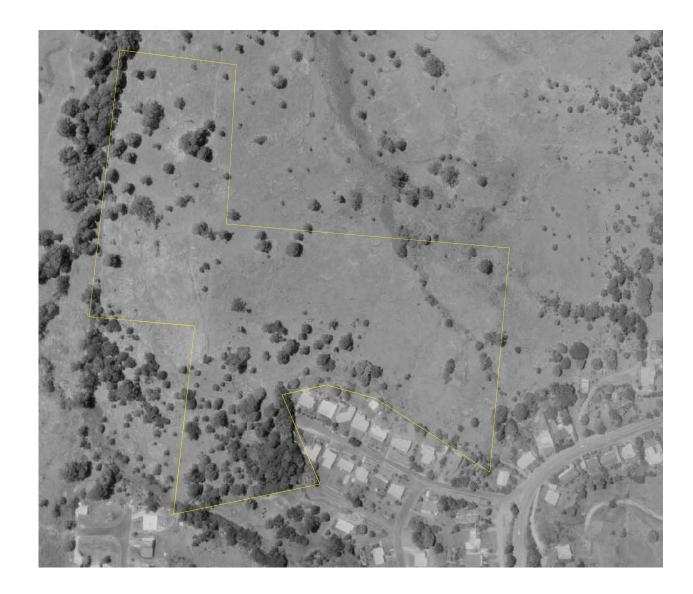


Historical Aerial Image – 1993





Historical Aerial Image – 1985





Historical Aerial Image – 1979

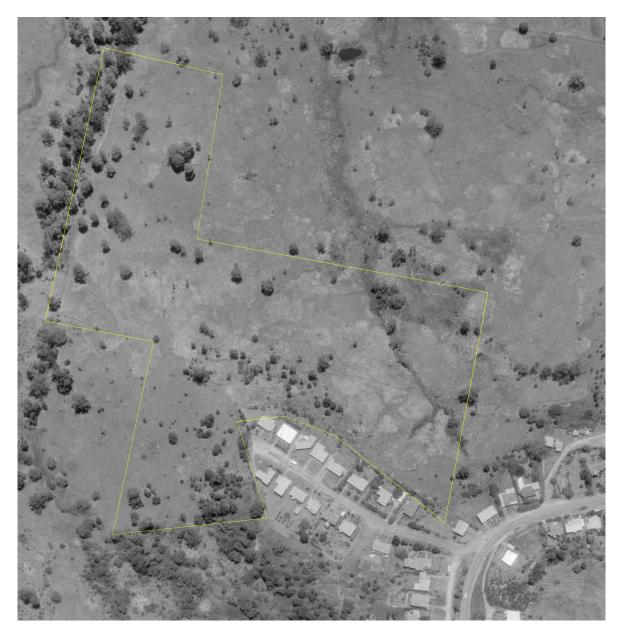
Images sourced from Queensland State Government QImagery Website



Solid minking Grounded results



Historical Aerial Image – 1973





Client: Parker Property Ningi Pty Ltd Site: Glenbrook Drive, Nambour Date: December 2017

MORRISON GEOTECHNIC Sald thining Deconder results

Historical Aerial Image – 1967





Historical Aerial Image – 1958

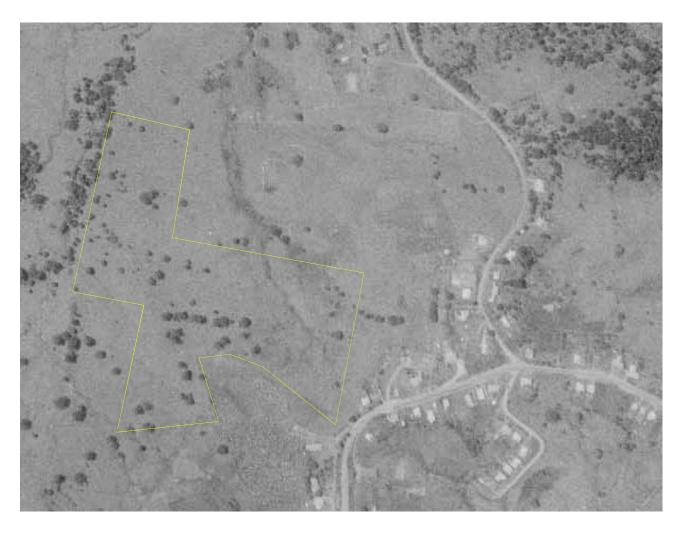
Images sourced from Queensland State Government QImagery Website



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



Historical Aerial Image – 1953



APPENDIX B

Site Plan



\sim
MORRISON
GEOLECHNIC

MORRISON GEOTECHNIC PTY LTD ABN: 51 009 878 899

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

Baseplan Copyright Queensland Government Qld Globe Webmap

 Client
 Parker Property Ningi Pty Ltd

 Project:
 Glenbrook Drive, Nambour

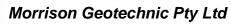
 Project No:
 ME17/023
 Drawing No:
 ME17/023 - 1

 Legend:
 Approximate Test Pit Location
 Date: 11th December, 2017

 Slope direction and angle
 Client

APPENDIX C

Test Pit Record Sheets & Photograph



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



Test Pit No.: TP1

Page: 1 of 1

G	GEOTECHNIC Job Number: ME17/023														
						nt: P	nt: Parker Property Ningi P/L								
	I	Northing: RL:	7055 79 89.6	Proje					ct: P	t: Proposed Subdivision					
	Tot	al Depth:		4.00 Date: 07/12/2017 Location: 41 Glenbrook Drive Nambo							bour				
0	Drilli	ng Infor	mation				Material Description					Tes	st Sam	nples	
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	
	>		(iii)	-		CI	Silty CLAY:		M	F		Deptil	16313	Gampie/Result	
			0.3 -	Topsoil			Firm, medium plasticity, dark brown, trace of fine root matter							_	
		89.0	-	Residual Soil		СН	Silty CLAY: High plasticity, orange, trace of fine gravel		М	VSt				-	
		-	0.7 -	Soil		СН	Silty CLAY: As above, some fine to medium sand		М	VSt					
			1.0	Residual Soil										-	
			1.3 -											F	
			-	Residual Soil		SC	Clayey SAND: Fine to medium grained, orange yellow, medium plasticity fines		М	VD				-	
et		88.0	2.0	Res										-	
Toothed Bucket														ļ	
Toothe														-	
														-	
		87.0												-	
			3.0											-	
														-	
		86.0												-	
		_	3.7 -			RHY	RHYOLITE : Very low strength, extremely weathered, dark brown	XW		VLS				-	
			4.0		447	-									
Co	mm	ents:					4.00m: TEST PIT TERMINATED NEAR PRACTICAL BUCKET REFUSAL			sed by					
Wa	ter		Weatherin	-	Consist			sts & Res							
▼	−ono _Wa	ter level date shown ter inflow	Weat DW Disti	emely hered nctly	S S F F St S VSt V	Yery soft Soft Tirm Stiff Yery stiff lard	VL Very loose ELS Extremely U5(L Loose low D MD Medium VLS Very low SP' dense LS Low D D D Dense MS Medium PP VD Very dense High S	Distur T Stand 300m Hand	bed sar ard Per m with a penetro	etration a 63.6kg meter es	Test, N = r hammer fa stimate of u	alling 762mm	า.	rive 50mm sampler sive strength, kPa.	
Water outflow SW Slightly Water outflow SW Slightly weathered FR Fresh				ntly hered	VHS Very high DC Dynamic Cone test, 9.09kg EHS Extremely taper cone fitted to rods of				9.09kg hammer, fall 508mm, driving 20mm, 30 deg						

Morrison Geotechnic Pty Ltd

MORRISON GEOTECHNIC

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Engineering Log - Test Pit

Test Pit No.: TP2

Page: 1 of 1

	GEOTECHNIC Job Number: ME17/023															
		Easting: 494 442 Machine: 23t Excavator						0.0.1.			Parker Property Ningi P/L					
	ľ	Northing:	thing: 7055 851 Driller: Carruthers Contracting					Proposed Subdivision								
		RL:	86.02		Lo	gged By							Glenbrook Drive Nambour			
		al Depth:	2.50 mation)		Date	07/12/2017 Material De	escription	LC	Juano	11. 4	I Glen	Test Samples			
		ing inter	mation		1	Φ		sonption	ſ					ipieo		
Drill Method	Water	RL 86.0	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Descr	ription		Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
		-		ioso	////	CI	Silty CLAY: Firm, medium plasticity, dark	k brown, trace of fine roo	ot		М	F				
Toothed Bucket		85.0	0.2 -	Residual Soil Topsoil		CI	matter Gravelly CLAY: Stiff to very stiff, medium pla gravel		_		M	St- VSt				
Toothe		84.0	1.3 - 2.0 2.2 -			RHY	RHYOLITE: Very low strength, dark brow nearing practical bucket refu	vn, extremely weathered, ısal at 2.2m	,	xw		VLS				
Ripper						RHY	RHYOLITE: Low strength, brown, highly w		_	HW		LS				
		_ 83.0	3.0				2.50m: TEST PI PRACTICAL BU									
		ents:	Weathering	1	Consist	encv	Densitv R	Rock Strength	Tests	Da	ate: <i>'</i>	sed by 1/12/1				
Water Weathering Consistency Density Rock Strength Tests & Results ✓ Water level on date shown RS Sil Residual soil VS Soft Very soft L Loss VL Loss Very loss L Loss ELS Loss Extremely low U50 D Undisturbed 50mm diam tube. ✓ Water inflow XW Extremely weathered ND Medium VLS Very lows DF Standard Penetration Test, N = number of blows to drive 50mm sample. ✓ Water outflow DW Visit Very stiff weathered FR D Dense VSI Very lonse LS Low PP Hand penetrometer estimate of unconfined compressive strength, RP ✓ Water outflow SW Slightly weathered FR Fresh Moisture D Dense VB MS Medium PP Hand penetrometer estimate of unconfined compressive strength, RP Moisture D Dense MS Heigh HS S Vane shear value kPa VHS Very high FR D Dry M Moist W Wet From AS1289-1993 Methods of Testing Soils for Engineering Purpos								ive strength, kPa. /ing 20mm, 30 deg								

D Dry M Moist W Wet

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.: TP3

G	EOT	TECHN	IC						Job N	lumb	er: N	1E17/0	23				
		Easting:	494 36	7	I	Machine	23t Excavator			Clie	nt: P	arker l	Property	Ningi P/	L		
	ľ	Northing:	7055 85				Carruthers Contrac	ting					ed Subdi	-			
	Tot	RL: al Depth:	89.2 3.3		Lo	gged By: Date	: GF : 07/12/2017			-				rive Nam	bour		
C		ng Infor		-		2410		Description							st Sam	ples	
						e		•				_				•	
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	De	escription		Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
				oil	////	CI	Silty CLAY:				М	F					Π
		_ 89.0	0.15 -	Residual Soil Topsoil	0000000	GP	Firm, medium plasticity, Clayey GRAVEL: Very dense, fine to coars plasticity clay fines	dark brown se gravel, brown, medium	/		М	VD					
Toothed Bucket		88.0	1.0		00000000000000000000000000000000000000											-	
		_ 87.0	2.0			RHY	RHYOLITE: Very low strength, extren nearing practical bucket	mely weathered, dark brow refusal at 2.5m	m,	XW		VLS				-	
Ripper		_ 86.0	3.0			RHY	RHYOLITE: Low strength, brown, hig	phly weathered	ĒD	HW		LS				-	
			4.0					VRIPPING									
		ents:			0		Durali			D	ate: 1	sed by 1/12/1					-
Wa	′Wa ⁻on o _Wa	ter level date shown ter inflow ter outflow	DW Distin weat SW Sligh	dual emely hered nctly hered ttly hered	S Se F Fi St St VSt Ve	ery soft oft irm tiff ery stiff ard	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 U50 D SPT PP S DC	Distur Stand 300m Hand Vane Dynar taper	turbed sar bed sar ard Per m with a penetro shear v mic Con cone fit	netration a 63.6kg ometer es alue kPa le test, 9 ted to roo	Test, N = r hammer fa stimate of u 09kg hamr ds of smalle	Illing 762mm Inconfined c mer, fall 508 er section.	n. compress cmm, driv	rive 50mm sampler ive strength, kPa. /ing 20mm, 30 deg ineering Purposes	



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D Dry M Moist W Wet

Engineering Log - Test Pit

Test Pit No.: TP4

G	EO	TECHN	IC				Job	ο Νι	umb	er: №	1E17/0	23		•		
		Easting:	494 329	9		Machine	23t Excavator						/ Ningi P/	L		
	I	Northing:	7055 830				r: Carruthers Contracting					ed Subd	-			
	Tot	RL: al Depth:	93.50 3.40		Log	gged By							rive Nam	bour		
		ng Infor				Date	Material Description							st San	nples	٦
						e	•	Т			_					-
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	
				ioi	////	CI	Silty CLAY:			М	F					Π
Toothed Bucket		93.0	0.18 -	Residual Soli Topsol		GP	Firm, medium plasticity, dark brown, trace of fine root matter Clayey GRAVEL: Very dense, fine to coarse gravel, brown, medium plasticity clay fines	_		M	VD		0.18 -	- D	-	
					000											F
Ripper			1.7 - 2.0 2.1 -			RHY	RHYOLITE: Very low strength, dark brown, extremely weathered		xw		VLS				-	
			-		<i>t‡‡</i>	RHY	RHYOLITE: Low strength, brown, highly weathered		HW		LS					H
Toot		91.0	- 2.4 -		44	RHY	RHYOLITE: Very low strength, dark brown, extremely weathered	×	xw		VLS					
			2.6 -			RHY	RHYOLITE: Low strength, brown, highly weathered	F	HW		LS					
Ripper			3.0		<i>44</i>											
Rip															_	
		90.0	0.4				3.40m: TEST PIT TERMINATED SLOW RIPPING	Τ								ſ
		-	4.0				SLOW RIFFING									
Co	mm	ents:						Т								
Gro	undwa	ater not enc	ontered								sed by 11/12/1					
Wa	ter		Weathering	-	Consist		, ,		& Res							
	= on o _ Wa	ter level date shown ter inflow ter outflow	DW Distin weat SW Sligh	emely hered nctly hered ntly hered	S So F Fi St St VSt Ve	ery soft oft irm tiff ery stiff ard e	VL Very loose ELS Extremely US L Loose Iow D MD Medium VLS Very low SP dense LS Low D D Dense MS Medium PP VD Very dense HS High S VHS Very high DC EHS Extremely high	ידי איד	Distur Stand 300m Hand Vane Dynar taper	rbed sar lard Per m with a penetro shear v mic Con cone fitt	netration a 63.6kg ometer es value kPa ne test, 9 ted to roo	Test, N = 1 hammer fa stimate of 1 .09kg ham ds of small	alling 762mn unconfined c mer, fall 508 er section.	n. compress 3mm, driv	Irive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes	

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Test Pit No.: TP5

		RRISO FECHN		e: (07)	32790	900 Fa	ax: (07) 3279 0955					Pa	ge: 1	l of 1
GI	EŲ									/IE17/0				
	,	Easting: Northing:	494 468 7055 879				: 23t Excavator : Carruthers Contracting					Ningi P/	L	
		RL:	76.03		Lo	gged By		Proje	ect: F	Propose	ed Subd	ivision		
		al Depth:	3.00)		Date		ocati	on: 4	1 Glen	brook D	rive Nam		
D	rilli	ng Infor	mation		-		Material Description	1	1	-		Tes	st Sam	nples
Drill Method	Water	RL 76.0	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
		- 180	0.1 -	isoil		CI	Silty CLAY: Stiff, medium to high plasticity, dark brown, trace of root		М	St				
ucket			-	Residual Soil Topsoil		СН	matter Sitty CLAY: Stiff, high plasticity, pale brown		М	St				-
Toothed Bucket		75.0	1.0 ^{0.9 -}			RHY	RHYOLITE: Very low strength, dark grey & purple, extremely weathered	XW		VLS				
Ripper		74.0	2.0				Becoming low strength, highly weathered, nearly practical bucket refusal at 2.0m depth							-
		-	4.0				3.00m: TEST PIT TERMINATED SLOW RIPPING							-
		ents:	Woathoriza		Consist	0001	Donsity Book Strongth Tool	C)ate:	ised by 11/12/				
Wat	Wa on o Wa	ter level date shown ter inflow ter outflow	DW Distir weath SW Sligh	dual mely nered nctly nered tly nered	S S F F St S VSt V H H	ery soft oft irm tiff ery stiff ard e	Density Rock Strength Test: VL Very loose ELS Extremely U50 L Loose low D MD Medium VLS Very low SPT dense LS Low P D Dense MS Medium PP VD Very dense HS High S VHS Very high DC EHS Extremely high t W Wet High K	Distu Stand 300m Hand Vane Dyna taper	sturbed rbed sa dard Per m with I penetro shear v mic Cor cone fit	netration a 63.6kg ometer es value kPa ne test, 9 tted to roo	Test, N = r hammer fa stimate of u .09kg hamr ds of smalle	Illing 762mm Inconfined c mer, fall 508 er section.	n. compress smm, driv	rive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes

D Dry M Moist W Wet

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Test Pit No.: TP6

G	EO.	TECHN	IC					Job	Numb	er: N	ME17/0	23				
		Easting:	494 37		I		: 23t Excavator		Clie	nt: F	Parker	Property	Ningi P/	Ľ		
		Northing: RL:	7055 92 72.0		١٥	Driller gged By	: Carruthers Contract : GF	ting	Proje	ect: F	ropos	ed Subd	ivision			
	Tot	al Depth:	3.4		20		: 07/12/2017	I	Locatio	on: 4	11 Gler	nbrook D	rive Nam	nbour		
0	Drilli	ng Infor	mation				Material	Description					Te	st San	nples	
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	De	escription	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
		72.0		soil	///	CI	Silty CLAY: Stiff, high plasticity, brow	up, trace of root matter		м	St					Т
			0.25 -	il Topsoil		СН	Silty CLAY:		ļ	м	St		0.25 -	- D	-	╞
Toothed Bucket			-	Residual Soil		51	Stiff, high plasticity, oran	ge brown			J					
othed		71.0	1.0 ^{0.9}		<i>‡</i> 77	RHY	RHYOLITE: Very low strength, purple refusal at 1.8m depth	e white, nearing practical bucket	XW		VLS					╀
Ť					<i>‡‡‡</i>											
					<i>‡‡</i>											
					17 17											
			- 1.8 -		477 777											
			2.0		17	RHY	RHYOLITE: Low strenth, highly weath	hered	HW		LS					
		70.0	T		ŧŧ,											T
					<i>‡‡‡‡</i>											
er					<i>‡</i> ‡											F
Ripper			-		77 77											F
			-													┢
		69.0	3.0		÷‡‡											┽
					77											┝
			3.4		ŦŦ,		2 40	PIT TERMINATED			<u> </u>					\downarrow
								V RIPPING								
			4.0													
Co	mm	ents:	<u> </u>	. <u></u>	<u> </u>	·					ised by 11/12/ [/]			·		
Wa	- on _ Wa	ter level date shown ter inflow ter outflow	DW Disti weat SW Sligh	dual emely hered nctly hered ntly hered	S S F F St S VSt V	ery soft oft irm tiff ery stiff ard	Density VL Very loose L Loose MD Medium dense D Dense VD Very dense	Rock Strength Test ELS Extremely U50 low D D VLS Very low SP ⁺ LS Low MS Medium PP HS High S VHS Very high EHS Extremely high Network	Distu T Stand 300m Hand Vane Dyna taper	sturbed rbed sa dard Pe m with penetr shear mic Co cone fi	netration a 63.6kg ometer e value kPa ne test, 9 tted to ro	Test, N = 1 hammer fa stimate of 0 0.09kg ham ds of small	alling 762mr unconfined o mer, fall 508 er section.	n. compress 3mm, driv	rive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes	



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Test Pit No.: TP7

				e: (07) .	3279 0	900 Fa	ax: (07) 3279 095						Ра	ge: 1	l of 1
G	1	TECHNI Easting: Northing: RL: cal Depth:	494 280 7055 894 86.83 3.60	4 2		Driller: gged By:	23t Excavator Carruthers Contractin GF 07/12/2017	ng	Clie Proje	ent: ect:	Propose	Property ed Subo	y Ningi P/ livision Drive Narr		
0		ng Infor						Description						st Sam	nples
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Des	scription	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
		-	0.15 -	Residual Topsoil		СІ	matter Silty CLAY:	ark brown, trace of fine root		M	F		0 / 0.15 -	- D	-
Toothed Bucket		86.0	1.0			RHY	RHYOLITE: Very slow strength, brown practical bucket refusal at	, extremely weathered, nearing 2.5m depth'	XW		VLS				-
Too		_ 85.0	2.0												-
Ripper		84.0	2.5 -			RHY	RHYOLITE: Low strength, highly weath	hered	HW		LS				-
		83.0	2.6 4.0		<i>~~~</i>			PIT TERMINATED RIPPING							
Grou	undwa	ents: ater not enco							C	Date:	rised by 11/12/ <i>*</i>				
Wa	₩a -ono _Wa	ter level date shown ter inflow ter outflow	weat DW Distin weat SW Sligh	dual emely hered nctly hered itly hered	S So F Fi St St VSt Vo H Ha Moisture	ery soft oft rm iiff ery stiff ard e	Density VL Very loose L Loose MD Medium dense D Dense VD Very dense	Rock Strength Test ELS Extremely U50 Iow D D VLS Very Iow SPT LS Low MS Medium MS Migh S VHS Very high DC EHS Extremely high	Distu Stand 300m Hand Vane Dyna taper	sturbed irbed si dard Pe nm with I penet shear imic Co	enetration n a 63.6kg rometer es value kPa one test, 9 fitted to ro	Test, N = hammer f stimate of a .09kg ham ds of smal	alling 762mn unconfined c nmer, fall 508 ler section.	n. compress 8mm, driv	rive 50mm sampler sive strength, kPa. ring 20mm, 30 deg ineering Purposes



D Dry M Moist W Wet

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Engineering Log - Test Pit

Test Pit No.: TP9

G	EO	TECHN	IC					Job I	Numb	er: N	/IE17/0	23		•		
		Easting:	494 41	1	I	Machine	: 23t Excavator		Clie	nt: F	Parker I	Property	/ Ningi P/	L		
	I	Northing:	7055 97				: Carruthers Contracting					ed Subd	-			
	Tot	RL: al Depth:	63.2 3.0		Lo	gged By Date	: GF : 07/12/2017		-		•		vive Nam	nbour		
C		ng Infor				Duto	Material Desc			-				st San	ples	
						e		-								
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Descriptic	on	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
				oi	////	CI	Silty CLAY:			М	St					
		63.0	0.25 -	I Topsoil			Stiff, medium to high plasticity, da gravel & fine root matter	ark brown, trace fine			0		0.25 -	- D	_	
Bucket		-	0.7 -	Residual Soil		СН	Silty CLAY: Stiff, high plasticity, orange, trace	of fine gravel		м	St					_
Toothed Bucket		62.0	1.0	Residual Soil		СН	Sitly Gravelly CLAY: Very stiff, medium to high plastici gravel, orange grey	ity, fine to medium size		М	VSt					+
		- 02.0	1.3 -		<u> </u>	RHY	RHYOLITE:		xw		VLS					
		Ī	- 1.4 -		‡7 77	RHY	Very low strength, grey, extremel bucket refusal at 1.4m	ly weather, nearing	HW		LS					
		Ī			77 77		RHYOLITE: Low strength, highly weathered									ſ
		Ī	2.0		147 147											
Ripper			2.1 -		<i>‡‡</i> 77	RHY	RHYOLITE: Purple grey		HW		LS					
Rip		61.0					i dipic groy									
					177 777											
			3.0	<u> </u>	<i>‡‡‡</i>											
							3.00m: TEST PIT T SLOW RIP									
		60.0														
			1													
			4.0													
<u></u>		anto-	-							•				-		_
	nm	ents:														
											1/12/1	7				
Wa			Weathering RS Resi	-	Consist VS V	tency 'ery soft		k Strength Test Extremely U50	s & Res Undis		50mm di	am tube.				
▼	on o	ter level date shown ter inflow	XW Extre weat DW Disti weat	emely thered	S S F F St S VSt V	oft irm otiff ery stiff lard	L Loose	low D	Distu Stand 300m Hand	rbed sa dard Per m with penetro	mple. netration a 63.6kg	Test, N = hammer fa stimate of	alling 762mn	n.	rive 50mm sampler ive strength, kPa.	
	Wa	ter outflow	SW Sligh	ntly thered	Moistur		VHS	Very high DC Extremely high	Dyna taper	mic Cor cone fit	ne test, 9 tted to roo	.09kg ham ds of small	er section.		ving 20mm, 30 deg ineering Purposes	

A.B.N. 051 009 878 899 PO Box 3063, Darra, QLD 4076 Phone: (07) 3279 0900 Fax: (07) 3279 0955 GEOTECHNIC **Engineering Log - Test Pit**

Test Pit No.: TP10

G	ΕQ	TEÇHN	IC					Job N	lumber	: ME	E17/0	23				
		Easting:	494 273		I		: 23t Excavator		Client	: Pa	rker F	Property	Ningi P/I	L		
	I	Northing: RL:	7056 06				: Carruthers Contracting	I	Project	: Pr	opose	d Subdi	vision			
	Tof	al Depth:	75.1 3.5		LO	gged By Date	: 07/12/2017	Lo	ocation	: 41	Glen	brook D	rive Nam	bour		
0		ng Infor		-			Material Description							st Sam	ples	
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	
				soil	///	CI	Silty CLAY: Soft, medium to high plasticity, dark brown, tra	ico of fino	Ν	4	S		0/	D		Т
		75.0	0.2 -	Residual Soil Topsoil		СН	gravel and root matter Gravelly CLAY: Very stiff, high plasticity, brown, fine to coarse some pockets of seepage at 0.6m, root affecte	gravel, ed to 0.3m		1-W	VSt		0.2 –	- D	-	
Toothed Bucket		74.0	1.0			RHY	RHYOLITE: Very low strength, brown grey, extremely weat		xw		VLS					
		74.0				RHY	RHYOLITE: Low strength, highly weathered, nearing practi refusal at 1.8m depth	cal bucket	HW		LS					
ler		_ 73.0	2.0												-	
Ripper		72.0	3.0 - 3.4 - 3.5 -			RHY	RHYOLITE: Becoming low to medium strength, purple, high weathered		HW		LS-				-	
			4.0				3.50m: TEST PIT TERMINA SLOW RIPPING	ATED								
		ents:						_	Dat	e: 11	ed by /12/1 ⁻					
Wa	^r Wa ─ono _Wa	ter level date showr ter inflow ter outflow	DW Distin weat SW Sligh	dual mely hered hctly hered tly hered	S Si F Fi St Si VSt V H H	ery soft oft irm tiff ery stiff ard e	t W Wet Very losse Construction	U50 D SPT PP S DC	300mm Hand pe Vane sh Dynamic taper co	bed 50 d sam d Pene with a netror ear va c Cone ne fitte	ple. etration 63.6kg neter es lue kPa test, 9. ed to roo	Test, N = r hammer fa stimate of u 09kg hamr ds of smalle	lling 762mm inconfined c mer, fall 508 er section.	n. compress 8mm, driv	rive 50mm sampler ive strength, kPa. ring 20mm, 30 deg ineering Purposes	

D Dry M Moist W Wet

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Engineering Log - Test Pit

Test Pit No.: TP11

G	EO	TECHN	IC				Job	Num	ber: I	ME17/0	23		•		
		Easting:	494 25	5	r	Machine	: 23t Excavator	Cli	ent:	Parker	Property	/ Ningi P/	Ľ		
	I	Northing: RL:	7055 96 79.2			Driller gged By	: Carruthers Contracting	Proj	ect:	Propose	ed Subd	ivision			
	Tot	al Depth:	3.0		LO			_ocat	ion: 4	11 Gler	nbrook D	rive Nam	ubour		
0	Drilli	ng Infor	mation				Material Description					Tes	st Sam	ples	
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	
	-				////	CI	Silty CLAY:		M	F		0/	\D		Ē
ucket		79.0	0.2 -	Residual Soil Topsoil		СН	Firm, medium plasticity, dark brown, trace of fine root matter Sitty CLAY: Stiff, high plasticity, orange brown		M	St		0.2 -	∇ D ₅₀	-	_
d Bi			1.0 ^{0.9}	Residual Soil	ЩЩ	CH	Silty CLAY: As above, becoming grey, trace of fine gravel		м	St					
Toothed Bucket		_ 78.0	-	Resi		RHY	RHYOLITE: Very low strength, brown, extremely weathered, nearing practical bucket refusal at 1.8m depth	, xw		VLS				_	
			1.8 -		+++	RHY	RHYOLITE:	HW	-	LS					Н
			2.0		±±‡		Becoming low strength, highly weathered,							_	
Ripper		_ 77.0	2.4 -			DIN								-	
ي <u>ت</u>					77	RHY	RHYOLITE: As above, becoming low to medium strength, purple	HW		LS- MS					
			3.0				3.00m: TEST PIT TERMINATED								
							NEARING RIPPER REFUSAL								
		76.0													ſ
			4												L
															F
			-												ŀ
			4.0												
	Indwa	ents: ater not enc	Weathering	-	Consist		, .	ts & Re	Date:	11/12/′	17				_
		ter level date shown	RS Resi soil		S So	ery soft oft	VL Very loose ELS Extremely U50 L Loose Iow D	Dist	urbed sa			aunak	leurs (hine EOmore	
	_Wa	date shown ter inflow ter outflow	DW Disti weat SW Sligh	hered nctly hered ntly hered	St St VSt Ve	irm tiff ery stiff ard e	MD Medium VLS Very Iow SPT dense LS Low Dense MS Medium PP VD Very dense HS High S VHS Very high DC EHS Extremely high	300 Han Van Dyn tape	mm with Id peneti Ie shear Iamic Co Pr cone f	a 63.6kg ometer e value kPa ne test, 9 tted to ro	hammer fa stimate of u .09kg ham ds of small	alling 762mn unconfined c mer, fall 508 er section.	m. compress 3mm, driv	Irive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes	

D Dry M Moist W Wet

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Test Pit No.: TP12

GE	OTECH	INI	С					Job	Numb	er: N	/IE17/0	23				
	Eastir	-	494 23		I		: 23t Excavator		Clie	nt: F	Parker I	Property	/ Ningi P/	L		
	Northir F	ng: RL:	7056 11 65.4		Lo	Driller gged By	: Carruthers Contrac : GF	ting	Proje	ect: F	Propose	ed Subd	ivision			
т	otal Dep		2.7		20,		: 07/12/2017	L	.ocatio	on: 4	1 Glen	brook D	rive Nam	bour		
Dri	lling In	for	mation				Material	Description		T			Tes	st Sam	nples	
Drill Method Water	RL		Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	De	escription	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
			1		////	CI	Silty CLAY:	·		w	S		0/	D		T
	65.0)	0.1 -	Residual Soil Topsoil		СН	Soft, medium plasticity, o Silty CLAY: Stiff, high plasticity, grey	/		w	St		0.1 -	- D 50	-	
Toothed Bucket	64.C	- - - -	1.0			RHY		green-grey, extremely weathered	xw		VLS					
			2.0	Residual Soil		CH	Silty CLAY: Very stiff, high plasticity, RHYOLITE: Low strength, green-grep practical bucket refusal a	y, highly weathered, nearing	HW	M	VSt LS					-
Ripper	_ 63.0)	2.7													
	62.0	-	3.0					PIT TERMINATED V RIPPING								
Ground Water	water not Vater leve on date sh Vater inflo Vater outf	enco el iown	Weatherin RS Resi soil XW Extre weat DW Disti weat SW Sligh	dual emely thered nctly thered ntly thered	S Se F Fi St St VSt Ve	ery soft oft irm tiff ery stiff ard	Density VL Very loose L Loose MD Medium dense D Dense VD Very dense	Rock Strength Test ELS Extremely U50 low D VLS Very low SPT LS Low MS MS Medium PP HS High S VHS Very high DC EHS Extremely high	s & Res Undis Distu Stanc 300m Hand Vane Dyna taper	Date: 1 sults sturbed sa dard Pe om with penetro shear v mic Con cone fii	50mm dia mple. netration a 63.6kg ometer es value kPa ne test, 9 tted to roo	7 am tube. Test, N = r hammer fa stimate of u a .09kg hami ds of small	alling 762mn unconfined c mer, fall 508 er section.	lows to d n. compress 8mm, driv	 rive 50mm sampler sive strength, kPa. ring 20mm, 30 deg ineering Purposes	

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Test Pit No.: TP13

G	EO	TECHN	IC				J	ob N	lumb	er: №	1E17/0	23		•	
		Easting:	494 19	6	ľ	Machine	: 23t Excavator		Clie	nt: P	arker l	Property	/ Ningi P/	Ľ	
	I	Northing:	7056 00				: Carruthers Contracting	F	Proje	ct: P	ropose	ed Subd	ivision		
	Tot	RL: al Depth:	67.9 3.8		LO	gged By Date	: 07/12/2017	Lc	ocatio	on: 4	1 Glen	brook D	rive Nam	nbour	
		ng Infor	mation			·	Material Description						Tes	st Sam	ples
Drill Method	ter		Hole Depth	Soil Origin	Graphic Log	Classification Code			Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test		
Dril	Water	RL	(m)	Soil	Gra	Cla	Description		We	Moi	Der Der	BC	Depth	Tests	Sample/Result
				Topsoil	///	CI	Silty CLAY: Firm, medium plasticity, dark brown, trace of fine roo	ot		М	F		0 /	۰ ^D	
			0.15 -	Residual Soil Top		СН	matter Sitty CLAY: Firm, high plasticity, orange brown, trace of fine grav	_/		м	F				-
			0.5 -	Rec		RHY	RHYOLITE: Very low strength, brown grey, highly weathered	-	XW		VLS				
															-
		67.0	1.0												+
sket		1	_												_
Toothed Bucket			-												-
Toot															
		66.0	2.0 2-			RHY	RHYOLITE:		HW		LS				+
							As above, becoming low strength, highly weathered								_
			-												_
			-												-
		65.0	3.0												
															-
Ripper															_
			-				3.80m: TEST PIT TERMINATEI SLOW RIPPING	D							H
		64.0	3.8 4.0												
Co	mm	ents:						Τ	А	uthori	sed bv				
187			W++'	~	Conclut	00001	Donoity Death Street with	Test	D	ate:					
Wa	Wa	ter level date shown		idual emely	S So F Fi	ery soft oft irm	VL Very loose ELS Extremely L Loose low MD Medium VLS Very low	Tests U50 D SPT	Distur Stand	turbed tbed sar lard Per	netration	Test, N = I			rive 50mm sampler
•		ter inflow ter outflow	DW Disti weat SW Sligh	thered	VSt Ve H Ha	tiff ery stiff ard	VD Very dense HS High	PP S DC	Hand Vane Dynai	penetro shear v mic Con	ometer es alue kPa ne test, 9	stimate of u u .09kg ham		compress	vive strength, kPa. ving 20mm, 30 deg
			FR Fres		Moisture D Dry		t W Wet							s for Eng	ineering Purposes







	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd	
MORRISON	ABN: 51 009 878 899	Project:	Glenbrook Drive	e, Nambour	
GEOTECHNIC	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	Drawing No:	ME17/023 - 2
	Email: caboolturelab@morrisongeo.com.au	Lanadi			Date: 11 th December, 2017
Baseplan Copy	right Queensland Government Qld Globe Webmap	Legend:	Test Pit TP1 & T	P3	Drawing not to Scale







	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd	
MORRISON	ABN: 51 009 878 899	Project:	Glenbrook Drive	e, Nambour	
GEOTECHNIC	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	Drawing No:	ME17/023 - 2
	Email: caboolturelab@morrisongeo.com.au	Lanardi			Date: 11 th December, 2017
Baseplan Cop	rright Queensland Government Qld Globe Webmap	Legend:	Test Pit TP4 & T	P5	Drawing not to Scale





MORRISON GEOTECHNIC	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd	
	ABN: 51 009 878 899	Project:	Glenbrook Drive	e, Nambour	
	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	Drawing No:	ME17/023 - 2
	Email: <u>caboolturelab@morrisongeo.com.au</u>	Lenendu			Date: 11 th December, 2017
Baseplan Cop	yright Queensland Government Qld Globe Webmap	Legend:	Test Pit TP6 & T	P7	Drawing not to Scale





MORRISON GEOTECHNIC	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd	
	ABN: 51 009 878 899	Project:	Glenbrook Drive	e, Nambour	
	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	Drawing No:	ME17/023 - 2
	Email: caboolturelab@morrisongeo.com.au	Logondy			Date: 11 th December, 2017
Baseplan Cop	vright Queensland Government Qld Globe Webmap	Legend:	Test Pit TP9 & T	P10	Drawing not to Scale





Baseplan Cop	yright Queensland Government Qld Globe Webmap	Legend:	Test Pit TP11 &	TP12	Drawing not to Scale
MORRISON GEOTECHNIC	Email: <u>caboolturelab@morrisongeo.com.au</u>	Lanandi			Date: 11 th December, 2017
	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	Drawing No:	ME17/023 - 2
	ABN: 51 009 878 899	Project:	Glenbrook Driv	e, Nambour	
	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd	





MORRISON GEOTECHNIC PTY LTD ABN: 51 009 878 899

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

Baseplan Copyright Queensland Government Qld Globe Webmap

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

APPENDIX D

Borehole Record Sheets & Rock Core Photographs

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

D Dry M Moist W Wet



Borehole No.: BH1

G									b Nun	nber:	ME18	/065				
		Easting:	Refer to Si Pla		Dril	00	Hydrapower Scout		С	lient:	Parke	r Property	y Pty Ltd			
	١	Northing: RL:	84.0				Drillsure		Pro	ject:	Propo	sed Reta	ining Wal	ls		
	Tot	al Depth:	3.0		LO		D.Pollock 01/11/2008		Loca	tion:	41 GI	enbrook [Drive Nam	bour		
0		ng Infor		Т				Description					Те	st Sam	nples	٦
						qe						_				
Drill Method	Water	RL 84.0	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Des	scription	Weathering	Moieturo	Consistency -	Density - Strengt DC Test Results	Test Depth	Tests	Sample/Result	
		-	0.1	soil		CI	Silty CLAY: Stiff, medium plasticity, da	ark arey, trace of fine root		М	St					Π
		-	0.7 -	Residual Soil Topsoil		СН	matter Silty CLAY: Stiff to very stiff, high plast to coarse sand and fine gr	ticity, grey brown, trace of fir		м	St- VSt					-
		-	4		27 27 7	RHY	Rhyolitic TUFF: Very low to low strength, b	brown grey orange brown,	XW		VL- VLS					Η
100mm Auger		83.0	1.0				extremely weathered						1}	- SPT	– 30/140mm	-
		82.0	2.0													
Washbore		-	2.7 -			RHY	Rhyolitic TUFF: As above, becoming medi	ium strength, highly weather	ed		MS	-	2.5 }	- SPT	– 30/120mm	-
-		81.0	3.0		-77											॑॑
		80.0	4.0					TO ROCK CORE N PAGE 2	Ξ							
			+													
	Ш	79.0	5.0													Ш
GRC	יסאטכ	ents: WATER NC	OT ENCOUN		Consist		Doneity	Pack Strangth	losts % F	Date		by: 11/18	Rth	mleir	Second second	
Wa	Wat on c Wat	ter level date shown ter inflow ter outflow	Soil XW Extr wea DW Dist wea SW Slig	sidual remely athered tinctly athered ghtly athered	S So F Fi St St VSt Ve	ery soft oft irm tiff ery stiff ard	VL Very loose L Loose MD Medium dense D Dense VD Very dense	ELS Extremely U low D VLS Very low S LS Low MS Medium P HS High S	D Dis SPT Sta 30 PP Ha S Va S Va DC Dy tap	idisturb sturbed andard 0mm w and pen ine shea namic (per cond	ed 50mm sample. Penetrati ith a 63.6 etrometer ar value k Cone test e fitted to	kg hammer f r estimate of Pa , 9.09kg ham rods of smal	alling 762mr unconfined o nmer, fall 508 ler section.	n. compress 3mm, driv	rive 50mm sampler sive strength, kPa. ving 20mm, 30 deg ineering Purposes	



A.B.N. 051 009 878 899 PO Box 3063, Darra, QLD 4076 Phone: (07) 3279 0900 Fax: (07) 3279 0955 **Engineering Log - Cored Borehole**

Borehole No.: BH1

Page: 2 of 3

	GEC	IFCF	INIC					Job Numb	er:	ME18	8/06	5		
		Eastir	 Refer to 	Site		Dri	illing Rig: Hydrapower Scout		Clie	nt:	Parke	er Pr	operty Pt	y Ltd
		Northin	-	4.00		Lo	Driller: Drillsure Dogged By: D.POLLOCK		Proje	ct:	Propo	osec	Retainin	g Walls
	т	otal Dep		5.30			Date: 01/11/2018		Locatio	on:	41 GI	enb	rook Drive	e Nambour
[Drilli	ng Infe	ormation				Material Description						R	ock Mass Defects
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimated Strength STR SH SH SH		S ₍₅₀₎ MPa	RQD %	Defect Spacing (mm) 0000000000000000000000000000000000	Defect Description type, inclination,planarity, roughness, coating, thickness
		84.0 Г		<i></i>		-		-				-		
NMLC		83.5 83.0 82.5 82.0 81.5 81.0 80.5 80.0 79.5	0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			RHY	START NMLC CORING AT 3M 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	МН				100%		Numerous defects difficult to distinguish exact details and orientation as highly weathered Crushed zone to 3.16m, possible drilling/handling break -Crushed zone to 3.6m -Crushed zone to 3.83m
					44 44									-Crushed zone to 5.04m
		79.0	5.0		77									STUSHEU ZUHE (U 3.04111
		1ents: DWATE	R NOT OBSE	RVED	DUE TO) INTRO	ODUCTION OF DRILLING FLUID BELOW 2.5M				rised 19/1	-		uther-
٧	/ater				athering			sity			Roci	< Stre	ength	Defects
-	Water level R on date shown X Water inflow D Water outflow S			RS XW DW SW FR	weath	nely ered ctly ered y ered	VS Very soft VL S Soft L F Firm MD St Stiff VSt Very stiff D H Hard VD Moisture D Dry M Moist W Wet	Loo Me dei De	ry loose ose dium nse nse ry dense		VLS LS MS HS VHS	low Ver Low Med Higl	y low / dium h y high remely	JT Joint PT Parting SM Seam PL Planar CV Curved IR Irregular RO Rough SO Smooth SL Slickensided



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

Engineering Log - Cored Borehole

Borehole No.: BH1

Page: 3 of 3

(GEO	TECH	INIC						J	lob Nun	nber:	ME1	3/06	5		
		Eastin	-	o Site Plan		Dr	rilling Rig: Hydrapower Scout			C	lient:	: Parke	er P	roper	ty Pf	ty Ltd
		Northin	ng:	84.00		L	Driller: Drillsure ogged By: D.POLLOCK			Pro	oject:	Prop	osec	d Ret:	ainir	ng Walls
	Τc	ntal Dept		5.30		-	Date: 01/11/2018			Loca	ation:	41 G	lenb	rook	Driv	e Nambour
C			ormation				Material Description	n								Rock Mass Defects
Γ	Γ				Τ	\square				Estimat					fect	Defect Description
										Streng	,tn	ļ		Spac (mi		type, inclination,planarity, roughness,
thod	'	1 '		gin	Γοζ	Code			ring			I				coating, thickness
Drill Method	ter		Hole Depth	Soil Origin	Graphic Log	Class. Code			Weathering		ω φ	IS(50)	% О		<u>o o</u>	
D	Water	RL 79.0	(m)	Soi	Gra	Cla	Description		Ne.	LS NRS HS	S¥≞	MPa	RQD	30 300 300	3 <u>9</u> 8	
Ч		–	Ц	\square	F ≠7	RHY	Rhyolitic TUFF:		МН				<u> </u>			
NMLC	!	1 '	Д		$\overline{z}\overline{z}$	1	Highly weathered, fine to coarse grained brown grey, pale grey orange brown,	i,	Ξ			ļ	100%	1		Handling break
┣-	┿┷┙	┢────┘	<u> </u>	┢	-7-4	┢───	strength varies and rock matrix is brittle, crumbles and is remouldable once broke		-				\vdash	\vdash	+	Cone loss to 5.3m
	/	78.5	5.5				crumbles and is remouldable once broke down	en l				ŀ	'			<u>H</u>
	/	ſ'	П									ŀ	'			l H
	/	'	Н									ŀ	'			H H
	/	'	H .				5.30m: BOREHOLE					ŀ	'			l [
	/	78.0	6.0				TERMINATED					ļ	'			l 4
	/	'	H									ŀ	'			
	'	'	Н									ľ	'			l H
	'	'										ľ	'			
	1 /	77.5	6.5									ļ	'			
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	1 1	'	Ħ l		/							ľ	'			
	1 1	70 5	7.5		/							ľ	'			l H
	1 1	76.5	$H^{\prime.5}$		/							ľ	'			
	1 1	'	H		/							ľ	'			l H
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	1 1	'			/							ľ	'			l L
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	1 /	1 '	Д									l	'			I H
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	'	'	A									ľ	'			
	1 1	74.5	9.5									ľ	'			H H
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	1 /	1 '	П									ļ	'			
	'	'	H									ľ	'			
	/	74.0	10.0									ŀ	'			
-	<u> </u>			<u> </u>									_			-
		nents:					ODUCTION OF DRILLING FLUID BELOW	2 5M	ļ	1	A+k	'aad	- L . <i>u</i>	14	AP	ellen
Gr	OUNL	JVVAILI		KV LL	JDOLIN	UINTIN	JUCTION OF DRILLING I LOID BLOW	2.0Ivi	ļ	1	Auu	norised	by:	,	V.	and the second second
									ł		Date	ə: 19/	/11/1	18		
w	Vater			We	athering		Consistency	Dens	sity					ength		Defects
Ι_	_	ater leve	-	RS	Resid		VS Very soft	VL	Very	y loose			5 Exti	remely		JT Joint
-		n date sh		XW	soil / Extrer	mely	S Soft F Firm	L MD	Loo Mec	ise dium			low Ver	ry low		PT Parting SM Seam
	w	ater inflo	w	DW	weath	nered	St Stiff VSt Very stiff	D	den Den	se		LS MS	Low			PL Planar CV Curved
►		ater outfl			weath	nered	H Hard	VD		y dense		HS	Hig	jh		IR Irregular
-	–	ater oum	IOW	SW	/ Slightl weath									ry high tremely		RO Rough SO Smooth
				FR			Moisture						higł			SL Slickensided

D Dry M Moist W Wet



Borehole BH1 – NMLC Core 3.0m to 5.2m

	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd	
MORPICON	ABN: 51 009 878 899	Project:	Glenbrook Driv	e, Nambour	
MORRISON GEOTECHNIC	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME18/065	Drawing No:	ME18/065 - 2
	Email: <u>caboolturelab@morrisongeo.com.au</u>	Lanandi			Date: November, 2018
Baseplan Cop	yright Queensland Government Qld Globe Webmap	Legend:	Core Photograp	ns	Drawing not to Scale

MORRISON

Morrison Geotechnic Pty Ltd

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D Dry M Moist W Wet

Engineering Log - Borehole

Borehole No.: BH2

G	EÜ	TECHN	C					J	ob N	lumb	er: N	/IE18/0	65				
		Easting:	Refer to Site Plai			Dril	lling Rig	: Hydrapower Scout		Clie	nt: F	Parker I	Property	Pty Ltd			
		Northing:						r: Drillsure	I	Proje	ct: F	Propose	ed Retai	ning Wal	ls		
	Tot	RL: tal Depth:	75.50 4.50			LO		r: D.Pollock r: 01/11/2018						rive Nam			
D		ng Infor		-			Dute	Material Description							st Sam	ples	
				gin		c Log	Classification Code			ering	e	Consistency - Density - Strength	DC Test Results			·	
Drill Method	Water	RL	Hole Depth (m)	Soil Origin		Graphic Log	Classif	Description		Weathering	Moisture	Consis Density	DC Te	Test Depth	Tests	Sample/Result	
			0.2 -	Topsoil	K		CI	Silty CLAY: Stiff, medium plasticity, dark grey, trace of fine root matter			M	St					
		75.0	-	<u>_</u>	411		-	Silty CLAY:	_								
				Slopewash				High plasticity, grey brown, trace of fine to coarse sa	ind								H
			0.8 1.0				СН	Silty CLAY: Very stiff to hard, high plasticity, orange brown, trace	e of		М	-Vst H					H
				Residual Soil				fine to coarse sand and gravel, tending to weathered rock	1					1-}	- U50	- PP >600kPa	Ħ
				ш										J			
		74.0															
			-														H
100mm Auger			2.0													-	Η
тA		-	-		Ź	44	RHY	Rhyolitic TUFF: Very low to low strength, grey brown orange brown p grey, extremely weathered	oale	XW		VL- VLS					Η
100m		73.0	-		1414	144								2.5 -			H
						144								}	- SPT	– 30/70mm	H
			3.0		444	111											H
					111	47										-	Ľ
		72.0				44											
		12.0			144	44											H
						144											H
			4.0		11	4										-	Η
					11	44											H
		71.0	4.5		Ź	Ź											þ
								4.50m: BOREHOLE TERMINATI	ED								H
			5.0														
		ents: WATER NO	DT ENCOUNT	ERED								sed by 19/11/		Peebler	and a second second		
Wa	ter		Weathering	9	Cor	nsist	ency	Density Rock Strength	Tests	S & Resi		19/11/	10				
	─on	iter level date shown iter inflow	RS Resid soil XW Extre weat DW Distir	dual emely hered nctly	VS S F St VSt	Ve Se Si Si	ery soft oft rm tiff ery stiff	VL Veryloose ELS Extremely L Loose low MD Medium VLS Verylow dense LS Low D Dense MS Medium	U50 D SPT PP	Undis Distur Stand 300m Hand	turbed bed sa ard Pei m with penetro	netration a 63.6kg ometer e	Test, N = r hammer fa stimate of u	alling 762mm	า.	rive 50mm sampler ive strength, kPa.	
	Wa	ter outflow	SW Sligh	hered	H Moi	H: istur	e e		S DC	Dynar taper	nic Cor cone fit	ted to roo	.09kg ham ds of small	er section.		ring 20mm, 30 deg ineering Purposes	

MORRISON

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D Dry M Moist W Wet

Engineering Log - Borehole

Borehole No.: BH3

G	EO	TECHN	IC .				Jot	ว Num	ber:	ME18	8/065					
		Easting:	Refer to Sit Pla		Dri	lling Rig	Hydrapower Scout	CI	ient:	Parke	er Prop	erty	Pty Ltd			
	1	Northing:					Drillsure	Pro	ject:	Prop	osed Re	etair	ning Wal	ls		
	Tot	RL: tal Depth:	76.5 2.4		LO		: D.Pollock : 01/11/2018						rive Nam			
D		ing Infor				Date	Material Description							st San	noles	
		J				Ð		Т								-
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moieture	Consistency -	Density - Strength DC Test Results		Test Depth	Tests	Sample/Result	
				soil		CI	Silty CLAY: Stiff, medium plasticity, dark grey, trace of fine root	Т	М	St						Π
		76.0	0.15 -	Residual Soil Topsoil		СН	Suit, includin pasticity, data grey, date of fine root matter Sitty CLAY: Stiff to very stiff, high plasticity, grey brown, trace of fine to coarse sand and fine gravel	,	м	St- VSt	t					
Ľ			1.0 ^{0.9}	Soil		СН	Silty CLAY: As above, tending to weathered rock		м	St-ł	н		1-			Щ
100mm Auger		75.0	1.5 -	Residual Soil										- SPT	– 9,26,24 N=50	
Ì			-		ZZ,	RHY	Rhyolitic TUFF: Very low strength, orange brown grey, dark grey,	XW		VLS	5					Н
			2.0		477 477 477		extremely weathered									
			4		ZZ	1										Н
			2.4		77,											
		74.0	3.0				2.40m:REFER TO ROCK CORE LOG ON PAGE 2						2.5	- SPT	– 10, 30/70mm	
		73.0	1													Π
			1													Η
			4.0													
			1													Н
		72.0	1								1					H
		ſ	4													Н
		[5.0													Π
		ents: WATER NO	DT ENCOUN	TERED	<u> </u>	11				orised : 19/1		1205	Publin	Staffer et al second		
Wa	ter		Weatherin	-	Consist	-		ests & R		od 50						
	≕ono _Wa	iter level date shown iter inflow iter outflow	DW Disti weat	emely thered inctly thered ntly thered	S S F F St S VSt V	ery soft oft irm tiff ery stiff lard	VL Very loose ELS Extremely US L Loose Iow D MD Medium VLS Very low SF dense LS Low D Dense MS Medium PF VD Very dense HS High S VHS Very high DC EHS Extremely high	Dis PT Sta 300 P Hai Vai C Dyi tap	sturbed andard Omm w nd pen ne shea namic (er cond	sample. Penetrat ith a 63.6 etromete ar value Cone tes e fitted to	tion Test, I 6kg hamm er estimate kPa st, 9.09kg o rods of s	N = n ner fal e of u hamm smalle	lling 762mm nconfined c ner, fall 508 r section.	n. compress limm, driv	rive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes	



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

Engineering Log - Cored Borehole

Borehole No.: BH3

Page: 2 of 3

0	LO	TECH	INC						Job Nun	nber:	ME18	3/06	5	
		Eastir	-	Site		Dri	Iling Rig: Hydrapower Scout		С	lient:	Parke	ər Pı	roperty Pt	ty Ltd
		Northin	-	6.80		Lc	Driller: Drillsure ogged By: D.POLLOCK		Pro	oject:	Prop	osec	d Retainir	ng Walls
	Тс	otal Dep		6.50			Date: 01/11/2018		Loca	tion:	41 G	lenb	rook Driv	e Nambour
D	rilliı	ng Inf	ormation				Material Description						F	Rock Mass Defects
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Class. Code	Description	Weathering	Estimat Streng	th	IS ₍₅₀₎ MPa	RQD %	Defect Spacing (mm) 0000 0000 0000 0000 0000	Defect Description type, inclination,planarity, roughness, coating, thickness
			Ц					1						
NMLC		76.5 76.0 75.5 75.0 74.5 74.0 73.5 73.0 72.5 72.0	0.5 1.0 1.5 2.0 2.5 3.0 4.0 4.5 5.0			RHY	START MNLC CORING AT 2.4M	A MH				100%		Numerous defects difficult to distinguish exact details and orientation as highly weathered
				RVED	DUE TO) INTRO	DDUCTION OF DRILLING FLUID BELOW 2.5	Л		Auth	orised	by:	1437	Duthin
										Date	: 19/1	1/18	8	
Wa	Water level F on date shown X Water inflow C Water outflow S		Wea RS XW DW SW FR	athering Residu soil Extrer weath Disting weath Slightl weath Fresh	ual mely ered ctly ered ly ered	Consistency De VS Very soft VL S Soft L F Firm MI St Stiff VSt VSt Very stiff D H Hard VE Moisture D Dry M Moist W Wet	Loo Me der De	ry loose ose dium ose ose ose y dense		ELS VLS LS MS HS VHS	Extr low Ver Low Meo Hig	y low v dium h y high remely	Defects JT Joint PT Parting SM Seam PL Planar CV Curved IR Irregular RO Rough SO Smooth SL Slickensided	



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

Engineering Log - Cored Borehole

Borehole No.: BH3

Page: 3 of 3

GEOTECHNIC										Job Nur	nber:	ME18	3/06	5				
			Eastin	-	Site		Dr	illing Rig: Hydropower Scout		С	lient:	Parke	ər Pr	roper	ty Pty	/ Ltd		
		N	Northin R	-	6.80		14	Driller: Drillsure ogged By: D.POLLOCK		Pro	oject:	Prop	osed	Reta	aining	g Walls		
	٦	Tota	al Dept		6.50			Date: 01/11/2018		Loca	ation:	41 G	lenb	rook	Drive	Nambour		
	Drill	in	g Info	ormation				Material Description							Ro	ock Mass E		
	Urili Method Water			Hole Depth	Soil Origin	Graphic Log	Class. Code		Weathering	Estima Streng	gth	IS ₍₅₀₎	RQD %	Spa (m	fect cing m)	type, inclinatio	ct Description n,planarity, rough ing, thickness	nness,
-			RL	(m)	ŝ	ษั		Description	Ň	LS VLS MS MS	ミンゴ	MPa	RO	30 100	868			
	NMIC		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	MH				100%					
		-	70.5	6.0 ^{5.9 -}			RHY	Rhyolitic TUFF: high to very high strength, slightly weathered, becoming brown purple red brown and pale grey	SW									
		-	70.0	7.0				6.50m: BOREHOLE TERMINATED										
		ŀ	69.5	7.5														
		ŀ	69.0	8.0														
			68.5	8.5														
		ŀ	68.0	9.0														
		F	67.5	9.5														
			67.0	10.0														
			ents: WATEF		۶VEC) DUE TO) INTRO	ODUCTION OF DRILLING FLUID BELOW 2.5M	Л			orised : 19/1			Theo	lan		
┢	Water					athering		-	nsity	·		Roc	k Stre	ength		Defec		
.	Water Water level on date shown Water inflow Water outflow			own ow	RS XW DW SW FR	soil Extren weath Disting weath	mely iered ctly iered ly iered	VS Very soft VL S Soft L F Firm MC St Stiff VSt Very stiff D H Hard VD Moisture D Dry M Moist W Wet	Loo Me der De	dium		VLS LS MS HS VHS	low Ver Low Meo Higl	y low / dium h y high remely		JT PT SM PL CV IR RO SO SL	Joint Parting Seam Planar Curved Irregular Rough Smooth Slickensided	



Borehole BH3 – NMLC Core 2.4m to 6.5m

UUU	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	v Ningi Pty Ltd					
MORRISON	ABN: 51 009 878 899	Project:	Glenbrook Drive	Glenbrook Drive, Nambour					
GEOTECHNIC	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME18/065	Drawing No:	ME18/065 - 2				
	Email: <u>caboolturelab@morrisongeo.com.au</u>	L			Date: November, 2018				
Baseplan Cop	right Queensland Government Qld Globe Webmap	Legend:	Core Photograp	hs	Drawing not to Scale				

MORRISON GEOTECHNIC

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

		TECHN			52100	000 1		.lo	b Ni	umbe	er- M	1E17/0	23	Гa	ye.	
		Easting:	494 442	2	I	Machine	: 23t Excavator							/ Ningi P/		
	ľ	Northing:	7055 85	1		Driller	: Carruthers Contracting						ed Subd	-	-	
		RL:	86.0		Lo	gged By									bour	
		al Depth:	2.5 mation	0		Date	Material Description			callo	11. 4	11 Glenbrook Drive Nambour Test Samples			nles	
		ing inter	mation			Φ	Material De	Sonption	Т							ipieo
Drill Method	Water	RL 86.0	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Descri	iption		Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
		-		osoil	///	CI	Silty CLAY: Firm, medium plasticity, dark	brown, trace of fine root			М	F				
Toothed Bucket		_ 85.0	0.2 -	Residual Soil Topsoil		CI	matter Gravelly CLAY: Stiff to very stiff, medium plas gravel		se		Μ	St- VSt				- - - - -
Toothe		84.0	1.3 - - - 2.0			RHY	RHYOLITE: Very low strength, dark brown nearing practical bucket refus	n, extremely weathered, sal at 2.2m		xw		VLS				
Ripper			- 2.5			RHY	RHYOLITE: Low strength, brown, highly v			HW		LS				
		_ 83.0	3.0				2.50m: TEST PIT PRACTICAL BUC									
Cor		ents:	Weathering	9	Consist	ency	Density R	ock Strength T	Authorised by: Date: 11/12/17							
∎	‴ Wa - on o _ Wa	ter level date showr ter inflow ter outflow	RS Resi soil XW Extre weat DW Disti weat SW Sligh	dual emely hered nctly hered tly hered	VS V S S F Fi St S VSt V H H	ery soft oft irm tiff ery stiff ard e	VL Very loose EI L Loose MD Medium VI dense LS D Dense M VD Very dense H	LS Extremely U low D LS Very low S S Low IS Medium P S High S	 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 							

D Dry M Moist W Wet

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.: TP3

G	EOT	TECHN	IC						Job N	lumb	er: N	1E17/0	23				
		Easting:	494 36	7	I	Machine	23t Excavator			Clie	nt: P	arker l	Property	Ningi P/	L		
	1	Northing:	7055 85				Carruthers Contrac	ting					ed Subdi	-			
	Tot	RL: al Depth:	89.2 3.3		Lo	gged By: Date	: GF : 07/12/2017			-				rive Nam	bour		
C		ng Infor		-		2410		Description							st Sam	ples	
						e		•				_				•	
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	De	escription		Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
				oil	////	CI	Silty CLAY:				М	F					Π
		_ 89.0	0.15 -	Residual Soil Topsoil	0000000	GP	Firm, medium plasticity, Clayey GRAVEL: Very dense, fine to coars plasticity clay fines	dark brown se gravel, brown, medium	/		М	VD					
Toothed Bucket		88.0	1.0		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0											-	
		_ 87.0	2.0			RHY	RHYOLITE: Very low strength, extren nearing practical bucket	mely weathered, dark brow refusal at 2.5m	m,	XW		VLS				-	
Ripper		_ 86.0	3.0			RHY	RHYOLITE: Low strength, brown, hig	phly weathered	ĒD	HW		LS				-	
			4.0					VRIPPING									
		ents:			0		Durali			D	ate: 1	sed by 1/12/1					-
Wa	′Wa ⁻on o _Wa	ter level date shown ter inflow ter outflow	DW Distin weat SW Sligh	dual emely hered nctly hered ttly hered	S So F Fi St St VSt Ve	ery soft oft irm tiff ery stiff ard	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 U50 D SPT PP S DC	Distur Stand 300m Hand Vane Dynar taper	turbed sar bed sar ard Per m with a penetro shear v mic Con cone fit	netration a 63.6kg ometer es alue kPa le test, 9 ted to roo	Test, N = r hammer fa stimate of u 09kg hamr ds of smalle	Illing 762mm Inconfined c mer, fall 508 er section.	n. compress cmm, driv	rive 50mm sampler ive strength, kPa. /ing 20mm, 30 deg ineering Purposes	

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.: TP5

		RRISO FECHN		e: (07)	32790	900 Fa	ax: (07) 3279 0955					Pa	ge: 1	l of 1
GI	EŲ									/IE17/0				
	,	Easting: Northing:	494 468 7055 879				: 23t Excavator : Carruthers Contracting					Ningi P/	L	
		RL:	76.03		Lo	gged By		Proje	ect: F	Propose	ed Subd	ivision		
		al Depth:	3.00)		Date		ocati	on: 4	1 Glen	brook D	rive Nam		
D	rilli	ng Infor	mation		-		Material Description	1	1	-		Tes	st Sam	nples
Drill Method	Water	RL 76.0	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
		- 180	0.1 -	isoil		CI	Silty CLAY: Stiff, medium to high plasticity, dark brown, trace of root		М	St				
ucket			-	Residual Soil Topsoil		СН	matter Sitty CLAY: Stiff, high plasticity, pale brown		М	St				-
Toothed Bucket		75.0	1.0 ^{0.9 -}			RHY	RHYOLITE: Very low strength, dark grey & purple, extremely weathered	XW		VLS				
Ripper		74.0	2.0				Becoming low strength, highly weathered, nearly practical bucket refusal at 2.0m depth							-
		-	4.0				3.00m: TEST PIT TERMINATED SLOW RIPPING							-
		ents:	Woathoriza		Consist	0001	Donsity Book Strongth Tool	C)ate:	ised by 11/12/				
Wat	Wa on o Wa	ter level date shown ter inflow ter outflow	DW Distir weath SW Sligh	dual mely nered nctly nered tly nered	S S F F St S VSt V H H	ery soft oft irm tiff ery stiff ard e	Density Rock Strength Test: VL Very loose ELS Extremely U50 L Loose low D MD Medium VLS Very low SPT dense LS Low P D Dense MS Medium PP VD Very dense HS High S VHS Very high DC EHS Extremely high t W Wet High K	Distu Stand 300m Hand Vane Dyna taper	sturbed rbed sa dard Per m with I penetro shear v mic Cor cone fit	netration a 63.6kg ometer es value kPa ne test, 9 tted to roo	Test, N = r hammer fa stimate of u .09kg hamr ds of smalle	Illing 762mm Inconfined c mer, fall 508 er section.	n. compress smm, driv	rive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes

D Dry M Moist W Wet

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.: TP6

G	EO.	TECHN	IC					Job	Numb	er: N	ME17/0	23				
		Easting:	494 37		I		: 23t Excavator		Clie	nt: F	Parker	Property	Ningi P/	Ľ		
		Northing: RL:	7055 92 72.0		١٥	Driller gged By	: Carruthers Contract : GF	ting	Proje	ect: F	ropos	ed Subd	ivision			
	Tot	al Depth:	3.4		20		: 07/12/2017	I	Locatio	on: 4	11 Gler	nbrook D	rive Nam	nbour		
0	Drilli	ng Infor	mation				Material	Description					Te	st San	nples	
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	De	escription	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result	
		72.0		soil	///	CI	Silty CLAY: Stiff, high plasticity, brow	up, trace of root matter		м	St					Т
			0.25 -	il Topsoil		СН	Silty CLAY:		ļ	м	St		0.25 -	- D	-	╞
Toothed Bucket			-	Residual Soil		51	Stiff, high plasticity, oran	ge brown			J					
othed		71.0	1.0 ^{0.9}		<i>‡</i> ‡ ₇	RHY	RHYOLITE: Very low strength, purple refusal at 1.8m depth	e white, nearing practical bucket	XW		VLS					╀
Ť					<i>‡‡‡</i>											
					<i>‡‡</i>											
					17 17											
			- 1.8 -		477 777											
			2.0		17	RHY	RHYOLITE: Low strenth, highly weath	hered	HW		LS					
		70.0	T		ŧŧ,											T
					<i>‡‡‡‡</i>											
er					<i>‡</i> ‡											F
Ripper			-		77 77											F
			-													┢
		69.0	3.0		÷‡‡											┽
					77											┝
			3.4		ŦŦ,		2 40	PIT TERMINATED			<u> </u>					\downarrow
								V RIPPING								
			4.0													
Co	mm	ents:	<u> </u>	. <u></u>	<u> </u>	·					ised by 11/12/ [/]			·····		
Wa	- on _ Wa	ter level date shown ter inflow ter outflow	DW Disti weat SW Sligh	dual emely hered nctly hered ntly hered	S S F F St S VSt V	ery soft oft irm tiff ery stiff ard	Density VL Very loose L Loose MD Medium dense D Dense VD Very dense	Rock Strength Test ELS Extremely U50 low D D VLS Very low SP ⁺ LS Low MS Medium PP HS High S VHS Very high EHS Extremely high Network	Distu T Stand 300m Hand Vane Dyna taper	sturbed rbed sa dard Pe m with penetr shear mic Co cone fi	netration a 63.6kg ometer e value kPa ne test, 9 tted to ro	Test, N = 1 hammer fa stimate of 0 0.09kg ham ds of small	alling 762mr unconfined o mer, fall 508 er section.	n. compress 3mm, driv	rive 50mm sampler sive strength, kPa. ving 20mm, 30 deg jineering Purposes	



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.: TP7

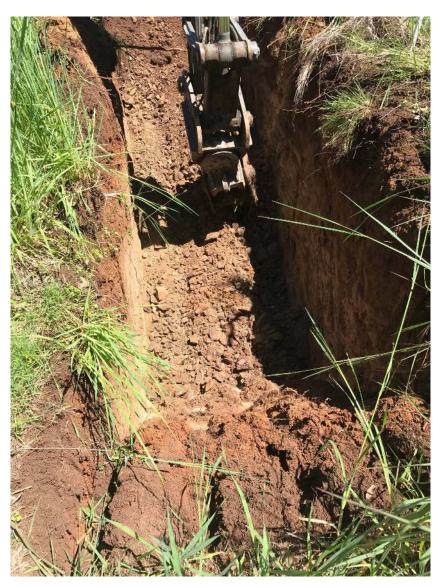
				e: (07) .	3279 0	900 Fa	ax: (07) 3279 095						Ра	ge: 1	l of 1
G	1	TECHNI Easting: Northing: RL: cal Depth:	494 280 7055 894 86.83 3.60	4 2		Driller: gged By:	23t Excavator Carruthers Contractin GF 07/12/2017	ng	Clie Proje	ent: ect:	Propose	Property ed Subo	y Ningi P/ livision Drive Narr		
0		ng Infor						Description						st Sam	nples
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Des	scription	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
		-	0.15 -	Residual Topsoil		СІ	matter Silty CLAY:	ark brown, trace of fine root		M	F		0 / 0.15 -	- D	-
Toothed Bucket		86.0	1.0			RHY	RHYOLITE: Very slow strength, brown practical bucket refusal at	, extremely weathered, nearing 2.5m depth'	XW		VLS				-
Too		_ 85.0	2.0												-
Ripper		84.0	2.5 -			RHY	RHYOLITE: Low strength, highly weath	hered	HW		LS				-
		83.0	2.6 4.0		<i>~~~</i>			PIT TERMINATED RIPPING							
Grou	undwa	ents: ater not enco							C	Date:	rised by 11/12/ <i>*</i>				
Wa	₩a -ono _Wa	ter level date shown ter inflow ter outflow	weat DW Distin weat SW Sligh	dual emely hered nctly hered itly hered	S So F Fi St St VSt Vo H Ha Moisture	ery soft oft rm iiff ery stiff ard e	Density VL Very loose L Loose MD Medium dense D Dense VD Very dense	Rock Strength Test ELS Extremely U50 Iow D D VLS Very Iow SPT LS Low MS Medium MS Migh S VHS Very high DC EHS Extremely high	 Disturbed sample. Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm. Hand penetrometer estimate of unconfined compressive strength, kPa. Vane shear value kPa 						





	MORRISON GEOTECHNIC PTY LTD		Parker Property	/ Ningi Pty Ltd					
MORRISON	ABN: 51 009 878 899	Project:	Glenbrook Drive	Glenbrook Drive, Nambour					
GEOTECHNIC	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	ME17/023 Drawing No: ME17/023 - 2					
	Email: <u>caboolturelab@morrisongeo.com.au</u>	Logond		_	Date: 11 th December, 2017				
Baseplan Copyright Queensland Government Qld Globe Webmap		Legend:	Test Pit TP3 & T	Ρ	Drawing not to Scale				





Baseplan Cop	yright Queensland Government Qld Globe Webmap	Legend: Test Pit TP6 & TP7		P7	Drawing not to Scale				
	Email: <u>caboolturelab@morrisongeo.com.au</u>				Date: 11 th December, 2017				
GEOTECHNIC	Unit 4/81 Wises Rd, Maroochydore Qld 4558 Ph: 5443 9522 Fax: 5479 1633	Project No:	ME17/023	Drawing No:	ME17/023 - 2				
MORRISON	ABN: 51 009 878 899	Project:	Glenbrook Drive	Glenbrook Drive, Nambour					
	MORRISON GEOTECHNIC PTY LTD	Client	Parker Property	/ Ningi Pty Ltd					

APPENDIX E

Laboratory Test Certificates



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	<u>19/02/2018</u>
		_	

Soil Results

Borehole No/Sample No.	Sample Depth (m)	рН	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

grutt



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**

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

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	<u>19/02/2018</u>

Soil Results

Borehole No/Sample No.	Sample Depth (m)	рН	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



Report for **Determination of Soil pH/EC**

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

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)	рН	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



		alifornia		0					`		/		
Client:	Parker Propery Ningi	Pty Ltd									Report N	lumber:	ME17/023 -
Client address:	PO Box 5608 Marooc	hydore QLD 4558									Demont	N -+-	21 (22 (22)
ob Number:	ME17/023	action									Report E Order Ni		21/02/207
roject: ocation	Geotechnical Investig	-									Order N		ge 1 of 1
ab No:	38824	, Nambour									Sample		gerori
ate Sampled:	7/02/2018										TP3		
ate Tested:	20/02/2018										0.2 - 0.5	ōm	
ampled By:	David Pollock												
ample Method:	AS 1289 1.2.1 (CI 6.5	5.4)											
laterial Source:	INSITU										Test Met		AS1289.6.1.1
or Use As:	FOUNDATION										Lot Num		-
emarks:	Liquid Limit Determin	nation (iii) Curing	Duration	4 days							Item Nu	mber :	-
				CBR	Point Graph	h							
540				Force	rs Penetratio	n							
520													
430													
460						-	*						
420				-	-								
300													
360													
320								-	-				
E 200 0 200 0 0 0 0 0 0 0 0 0 0 0 0						_							
940													
220				-									
200													
160					-	-							
140		I							-		-		
100													
60											-		
20													
0 K	0.5 1 1.5 2 2.5	3 3.5 4	4.5 5	5.5 6	6.5		.5						
					Penetration	(mm)							
Maximum Dry Dei	nsity - MDD (t/m³) :	1.	438			Drv	, Densit	v after	Soak (t/i	m³):			1.401
	Content - OMC (%) :		7.1					-	fter Soak				31.3
	tive Effort :		ndard						er Soak (97
Nominated % Ma	ximum Dry Density						-						
Nominated % Optin	num Moisture Content		00					nt (Top		enetration			26.7
Comp	baction :		00			Moisture	Conter	(%) it (Tota		enetration			37.3
	ty before Soak (t/m ³) : of Maximum Dry Density	1.	472					(%)	:				29.7
	%):	102					CBR	2.5mn	า (%) :				2
	ure Content (%) : e of Optimum Moisture	27.1					CBR	5.0mn	า (%) :				2
Conte	nt (%) :	1	00			Minimum Specified CBR Value (%) :					-		
	ed/Unsoaked) / Soaking (Days) :	Soaked	/ 4 days				CBR	Value	e (%) :				2.0
Swell (%) / 5	Surcharge (kg):	5.0 /	4.5 kg										
oil Description :							CLAY						
						C							



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



GINA FLETT



ent: ent address: b Number: oject: cation b No:	Parker Propery Ning PO Box 5608 Marood	-							Reno	t Numb	er:	ME17/023 - 1		
cation	ME17/023	chydore QLD 4558					21/02/2018							
cation	Geotechnical Invest	al Investigation								Order Number:				
h No.	41 Glenbrook Street	-								Page 1 of 1				
D NO:	38827								Samp	le Locat	-			
ite Sampled:	7/02/2018								TP5					
te Tested:	20/02/2018								0.2 -	0.5m				
mpled By:	David Pollock													
mple Method:	AS 1289 1.2.1 (CI 6.	5.4)												
aterial Source:	INSITU								Test I	Method	: ,	AS1289.6.1.1		
r Use As:	FOUNDATION								Lot N	umber:		-		
marks:	Liquid Limit Determ	ination (iii) Curing	g Duration	4 days					Item	Number	: •	-		
				CBR 1 Point G Force vs Pene	iraph tration									
2,700														
2,500						_								
2,400												_		
2,200						-						-		
2,100 -				\square								_		
1,900				+ +								-		
1,800			4											
1,600 -												-		
() 1,300 () 1,400 () 1,300 () 1,300 () 1,300 () 1,300 () 1,300 () 1,300 () 1,300 () 1,300 () 1,300 () 1,400 () 1,4														
5 1,300 1,200														
1,100		\times					_					_		
1,000												_		
800 -										_		_		
700														
500														
400														
200														
100									0.0	_				
	0.5 1 1.5 2	25 3 35 4	4.5 5		6.5 7 7.5 silian (mm)									
			() (Duri		fter Cerel	(+ (2)				22		
waximum Dry Der	nsity - MDD (t/m³) :		.684		Dry	Jensity a	iiter Soal	k (t/m³) :			1.6	53		
Optimum Moisture	Content - OMC (%) :		21.4		Moistu	ire Conte	ent after S	Soak (%) :			22.	5		
	ive Effort : ximum Dry Density	Sta	andard		Den	sity Ratio	o after Sc	oak (%) :			10	0		
Comp	action :		100				re Contei				19.	2		
	num Moisture Content action :		100				(%):	er Penetratio			22.	7		
	eved Dry Density before Soak (t/m ³) : 1.682				Moisture ((Total) afi (%) :	ter Penetratio	on		22.	4		
	eved Percentage of Maximum Dry Density (%): 100					CBR 2	.5mm (%	o) :			8			
	ure Content (%) :		21.5		CBR 5.0mm (%) :					10				
Conte	e of Optimum Moisture nt (%) :		100		Minimu	ım Speci	fied CBR	Value (%) :			-			
	ed/Unsoaked) / Soaking (Days) :	Soake	d / 4 days			CBR V	alue (%	6):			10.	0		
Swell (%) / S	Surcharge (kg):	0.0 /	/ 4.5 kg											



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Client address: PO Box 5608 Maroochydore QLD 4558		C	alifornia	Beari	ng R	atio I	Repo	ort (1 Poin	t)				
Lik Normality 1997 Der Kampel nur verscheinen der Sack (%): 98 Maximum Dry Density - MOD (fmr); 1.365 Optimum Makater Content - Odc (%): 35.5 Optimum Makate	Client address: Job Number: Project:	Parker Propery Ning PO Box 5608 Marood ME17/023 Geotechnical Invest	i Pty Ltd chydore QLD 4558 igation							Report Report	Date: lumber:		ME17/023 - 13 21/02/2018	
Maximum Dry Density - MDD (kmr): 1.368 Dry Density after Soak (kmr): 1.329 Optimum Motisure Content (Soc): 35.5 Motisure Content (Soc): 38.5 Congactive Effort: Standard Density fattor after Soak (kmr): 38.4 Nominated Standard Density fattor after Penetration 36.5 Achieved Norshity 00 Field Motistane Content (Soc): 36.5 Achieved Norshity Content (Soc): 36.5 Genetration 36.5 Achieved Norshity Content (Soc): 36.5 Genstor fort (Coc): 36.5 <th>Lab No: Date Sampled: Date Tested: Sampled By: Sample Method: Material Source:</th> <th>38834 7/02/2018 20/02/2018 David Pollock AS 1289 1.2.1 (CI 6. INSITU</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>TP9 0.3 - 0. Test Me</th> <th>Location 6m ethod :</th> <th>AS</th> <th></th>	Lab No: Date Sampled: Date Tested: Sampled By: Sample Method: Material Source:	38834 7/02/2018 20/02/2018 David Pollock AS 1289 1.2.1 (CI 6. INSITU								TP9 0.3 - 0. Test Me	Location 6m ethod :	AS		
Maximum Dry Density - MDD (vm'): 1.368 Dry Density fatter Soak (vm'): 1.339 Quinnam Moisture Content (%): 35.5 Meisture Content (%): 38.5 Compactive Effort : Standard Density Ratio after Soak (%): 98 Nominated % Optimum Moisture Content 100 Field Moisture Content (%): 33.4 Achieved Dry Density Lefore Soak (vm'): 1.355 Moisture Content (%): 36.5 Achieved Dry Density Lefore Soak (vm'): 1.355 Moisture Content (%): 36.5 Achieved Dry Density Lefore Soak (vm'): 1.355 Moisture Content (%): 36.5 Achieved Precentage of Maximum Dry Density (%): 99 CBR 2.5mm (%): 6 Achieved Precentage of Maximum Dry Density (%): 90 CBR 2.5mm (%): 6 Achieved Precentage of Maximum Dry Density (%): 90 CBR 2.5mm (%): 6 Achieved Precentage of Maximum Dry Density (%): 90 CBR 2.5mm (%): 6 Achieved Precentage of Maximum Dry Density (%): 90 CBR 2.5mm (%): 6 Achieved Precentage of Maximum Dry Density (%): 90 CBR 2.5mm (%): 6 Achieved Precentage of Maximum Dry Density (%): 90 CBR 2.	Remarks:	Liquid Limit Determi	nation (iii) Curing	Duration 4	1 days					Item N	umber :	-		
Maximum Dry Density - MDD (//m ⁻): 1.366 Dry Density after Soak (//m ⁻): 1.339 Optimum Moisture Content (-So): 35.5 Moisture Content (So): 38.6 Compactine: 1000 Field Moisture Content (So): 33.4 Nominated % Burnum Dry Density 1000 Field Moisture Content (So): 33.4 Nominated % Burnum Dry Density 1000 Field Moisture Content (So): 33.4 Nominated % Burnum Dry Density 1000 Field Moisture Content (So): 33.5 Achieved Dry Density before Soak (/m ⁻): 1.325 Moisture Content (So): 36.5 Achieved Procentage of Moisture Content (So): 36.5 36.5 36.5 Achieved Dry Density before Soak (/m ⁻): 1.325 Moisture Content (So): 33.4 Achieved Dry Density 99 CBR 2.5mm (%): 6 6 Achieved Dry Density 1000 Minimum Specified CBR Value (%): - - Achieved Dry Density 1000 Minimum Specified CBR Value (%): - - Achieved Dry Density 1000 Minimum Specified CBR Value (%): - - Achieved Dry Density 1000 Minimum Specified CB					CBR 1 Point /	Graph								
Water Molecure Effort: Standard Density Attro Stak (%): 98 Nominated % Optimum Dry Density 100 Field Molecure Content (%): 33.4 Nominated % Maximum Dry Density 100 Field Molecure Content (%): 38.5 Achieved Procenter (%): 1.355 Molecure Content (%): 38.5 Achieved Dry Density before Saak (I/m?): 1.355 Molecure Content (%): 38.5 Achieved Dry Density before Saak (I/m?): 1.355 Molecure Content (%): 38.5 Achieved Procenter (%): 1.355 Molecure Content (%): 36.5 Achieved Mischard Content (%): 1.355 Molecure Content (%): 36.5 Achieved Procenter (%): 1.355 Molecure Content (%): 36.5 Achieved Mischard Content (%): 1.355 Molecure Content (%): 36.5 Achieved Mischard Content (%): 35.6 CBR 9.5 mm (%): 6 Achieved Mischard Content (%): 1.00 Minimum Specified CBR Value (%): - Achieved Mischard Content (%): 1.00 Minimum Specified CBR Value (%): - Achieved Mischard Content (%): 1.00 Minimum Specified CBR Value (%): - <t< td=""><td>1,400</td><td></td><td></td><td></td><td>Earce vs Pene</td><td>araph tration</td><td></td><td>_</td><td></td><td></td><td></td><td>_</td><td></td></t<>	1,400				Earce vs Pene	araph tration		_				_		
Maximum Dry Density - MDD (t/m'): 1.368 Dry Density after Soak (t/m'): 1.359 Optimum Moisture Content - OMC (%): 35.5 Moisture Content (%): 38.5 Compactive Effort: Standard Density after Soak (%): 38.5 Nominated % Bursture Dry Density 100 Fleid Moisture Content (%): 33.4 Moisture Content (%): 1.355 Moisture Content (%): 38.5 Achieved Percentage of Maximum Dry Density 100 Fleid Moisture Content (%): 38.5 Achieved Dry Density for Soak (//m): 1.355 Moisture Content (%): 36.6 Achieved Dry Conset (%): 35.6 CER 2.5mn (%): 6 Achieved Dry Content (%): 35.6 CER 2.5mn (%): 6 Achieved Dry Content (%): 35.6 CER 2.5mn (%): 6 Achieved Dry Content (%): 35.6 CER 2.5mn (%): 6 Achieved Percentage of Optimum Moisture Content (%): 100 Minimum Specified CBR Value (%): . Achieved Dry Content (%): 35.6 CER 5.0mn (%): 6 . Achieved Dry Content (%): 35.6 CER 5.0mn (%): 6 . Achieved Notsture C										0				
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Maximum Dry Density - MDD (/m ⁻¹): 1.368 Dry Density after Soak (/m ⁻²): 1.339 Optimum Moisture Content - OAC (%): 35.5 Moisture Content after Soak (%): 98 Nemhated % Dry Density 100 Field Moisture Content (%): 33.4 Nemhated % Dry Density 100 Field Moisture Content (%): 38.5 Achieved Dry Density 00 Field Moisture Content (%): 36.6 Achieved Dry Density 00 Field Moisture Content (%): 36.6 Achieved Dry Density 00 Field Moisture Content (%): 36.6 Achieved Dry Density 00 Field Moisture Content (%): 36.6 Achieved Dry Density 99 CBR 2.5mm (%): 6 Achieved Dry Density 00 Minimum Specified CBR Value (%): . Achieved Dry Density 100 Minimum Specified CBR Value (%): . Achieved Dry Density 99 CBR 2.5mm (%): 6 Achieved Dry Density 100 Minimum Specified CBR Value (%): . Achieved Dry Density 100 Minimum Specified CBR Value (%): . Achieved Dry Density 99 CBR 2.5mm (%): <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>														
Maximum Dry Density - MDD (//m ²): 1.368 Dry Density after Soak (//m ³): 1.339 Optimum Maisture Content - OMC (%): 35.5 Moisture Content After Soak (%): 38.3 Compactive Effort : Standard Density After Soak (%): 38.3 Nominated % Kolinum Dry Density Compactive Effort : Standard Density Ratio after Soak (%): 38.3 Nominated % Kolinum Dry Density Compactive Effort : Standard Density Ratio after Soak (%): 38.5 Achieved Dry Density bfore Soak (//m ³): 1.355 Moisture Content (Top) after Penetration (%): 38.6 Achieved Dry Density bfore Soak (//m ³): 1.355 Moisture Content (Top) after Penetration (%): 36 Achieved Moisture Content (%): 35.6 CBR 5.0mm (%): 6 Achieved Moisture Content (%): 35.6 CBR 5.0mm (%): 6 Achieved Moisture Content (%): 35.6 CBR 5.0mm (%): 6 Achieved Moisture Content (%): 35.6 CBR Value (%): - Test Condition (Sosted) / Soaking Soaked // 4 days CBR Value (%): - Test Condition (Gays) : 6.0 - - - Swell (%) / Surcharge (bg): 1.3 / 4.5														
Maximum Dry Density - MDD (I/m ³): 1.368 Dry Density after Soak (I/m ³): 1.339 Optimum Moisture Content - OMC (%): 35.5 Moisture Content after Soak (%): 98 Nominated % Maximum Dry Density 1.00 Field Moisture Content (%): 33.4 Nominated % Optimum Moisture Content 100 Moisture Content (%): 33.4 Achieved Dry Density of Moisture Content (%): 36. 36. Achieved Dry Density of Moisture Content (%): 36. 6 Achieved Dry Density of Potenting of Maximum Noisture 100 (%): 36. Achieved Dry Density 99 CBR 2.5mm (%): 6 Achieved Dry Density 100 Moisture Content (%): 6 Achieved Dry Density 99 CBR 2.5mm (%): 6 Achieved Dry Density 100 Minimum Specified CBR Value (%): - Test Contint (%): 35.6 CBR 5.0mm (%): 6 Achieved Dry Density 99 CBR 2.5mm (%): 6 Achieved Dry Density 100 Minimum Specified CBR Value (%): - Test Contint (%): 35.6 CBR 2.5mm (%): 6 Achieved Procensake														
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W W						_								
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Maximum Dry Density - MDD (1/m ³): 1.368 Dry Density after Soak (1/m ³): 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 Field Moisture Content (%): 36.5 Achieved Percentage of Maximum Dry Density (%): 99 CBR 2.5mm (%): 6 Achieved Percentage of Maximum Dry Density (%): 35.6 CBR 2.5mm (%): 6 Achieved Percentage of Maximum Dry Density (%): 35.6 CBR 2.5mm (%): 6 Achieved Percentage of Maximum Dry Density (%): 99 CBR 2.5mm (%): 6 Achieved Percentage of Maximum Dry Density (%): 100 Minimum Specified CBR Value (%): - Test Condition (Soaked/Unsoaked) / Soaking Period (Days): 100 Minimum Specified CBR Value (%): - Test Condition (Soaked/Unsoaked) / Soaking Period (Days): 1.3 / 4.5 kg 6.0 -														
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 100 Field Moisture Content (%): 33.4 Nominated % Optimum Moisture Content Compaction: 100 Field Moisture Content (%): 38.5 Achieved Procentag of Maximum Dry Density 00 CBR 2.5mm (%): 6 Achieved Percentag of Maximum Dry Density 99 CBR 2.5mm (%): 6 Achieved Percentag of Optimum Moisture Content (%): 35.6 CBR 5.0mm (%): 6 Achieved Percentag of Optimum Moisture Content (%): 100 Minimum Specified CBR Value (%): - Achieved Moisture Content (%): 35.6 CBR Value (%): - - Achieved Percentag of Optimum Moisture Content (%): 100 Minimum Specified CBR Value (%): - - Achieved Moisture Content (%): 100 Minimum Specified CBR Value (%): - - Achieved Percentage of Optimum Moisture Content (%): 100 Minimum Specified CBR Value (%): - <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>_</td> <td></td>				-								_		
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$\frac{1}{100} + \frac{1}{100} + \frac{1}$	150											_		
Maximum Dry Density - MDD (t/m ³): 1.368 Dry Density after Soak (t/m ³): 1.339 Optimum Molsture 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 Field Moisture Content (%): 33.4 Achieved Dry Density before Soak (t/m ³): 1.355 Moisture Content (Total) after Penetration (%): 36 Achieved Percentage of Maximum Dry Density (%): 99 CBR 2.5mm (%): 6 Achieved Percentage of Maximum Dry Density (%): 100 Minimum Specified CBR Value (%): - Achieved Percentage of Maximum Dry Density (%): 99 CBR 2.5mm (%): 6 Achieved Percentage of Maximum Dry Density (%): 100 Minimum Specified CBR Value (%): - Achieved Percentage of Optimum 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								-			2 1			
Maximum Dry Density - MDD (1/m3) :1.368Dry Density after Soak (1/m3) :1.339Optimum Moisture Content - OMC (%) :35.5Moisture Content after Soak (%) :38.3Compactive Effort :StandardDensity Ratio after Soak (%) :98Nominated % Maximum Dry Density Compaction :100Field Moisture Content (%) :33.4Nominated % Optimum Moisture Content Compaction :100Moisture Content (%) :38.5Achieved Progration Stare Content (%) :1.355Moisture Content (Total) after Penetration (%) :36Achieved Percentage of Maximum Dry Density (%) :99CBR 2.5mm (%) :6Achieved Percentage of Optimum Moisture Content (%) :100Minimum Specified CBR Value (%) :-Test Condition (Soaked/1 Soaking Period (Days) :Soaked / 4 daysCBR Value (%) :-Swell (%) / Surcharge (kg):1.3 / 4.5 kg	0	V												
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 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 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 6.0 6.0		0.5 1 1.5 2	25 3 35 4	4.5 5 5			5							
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 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/ Jusoaked) / Soaking Period (Days) : Soaked / 4 days CBR Value (%) : 6.0 Swell (%) / Surcharge (kg): 1.3 / 4.5 kg - 6.0														
Compactive Effort :StandardDensity Ratio after Soak (%) :98Nominated % Maximum Dry Density Compaction :100Field Moisture Content (%) :33.4Nominated % Optimum Moisture Content Compaction :100Moisture Content (Top) after Penetration (%) :38.5Achieved Dry Density before Soak (t/m³) :1.355Moisture Content (Total) after Penetration (%) :36Achieved Percentage of Maximum Dry Density (%) :99CBR 2.5mm (%) :6Achieved Moisture Content (%) :35.6CBR 5.0mm (%) :6Achieved Percentage of Optimum Moisture Content (%) :100Minimum Specified CBR Value (%) :-Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :Soaked / 4 daysCBR Value (%) :6.0Swell (%) / Surcharge (kg):1.3 / 4.5 kg	Maximum Dry D	ensity - MDD (t/m³) :	1.3	868		Dry	Density	after Soa	ak (t/m³) :			1.339	9	
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/m ³) : 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 1.3 / 4.5 kg 6.0	Optimum Moistur	e Content - OMC (%) :	35	i.5		Moist	ure Cont	ent after	Soak (%) :			38.3		
Compaction :100Field Moisture Content (%) :33.4Nominated % Optimum Moisture Content Compaction :100Moisture Content (Top) after Penetration (%) :38.5Achieved Dry Density before Soak (t/m³) :1.355Moisture Content (Total) after Penetration (%) :36Achieved Dry Density before Soak (t/m³) :1.355CBR 2.5mm (%) :6Achieved Percentage of Maximum Dry Density (%) :99CBR 2.5mm (%) :6Achieved Moisture Content (%) :35.6CBR 5.0mm (%) :6Achieved Percentage of Optimum Moisture Content (%) :100Minimum Specified CBR Value (%) :-Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :Soaked / 4 daysCBR Value (%) :6.0Swell (%) / Surcharge (kg):1.3 / 4.5 kg-6.0	Compa	ctive Effort :	Stan	dard		De	nsity Rati	o after S	60ak (%) :			98		
Compaction :100(%) :38.5Achieved Dry Density before Soak (t/m³) :1.355Moisture Content (Total) after Penetration (%) :36Achieved Percentage of Maximum Dry Density (%) :99CBR 2.5mm (%) :6Achieved Moisture Content (%) :35.6CBR 5.0mm (%) :6Achieved Percentage of Optimum Moisture Content (%) :100Minimum Specified CBR Value (%) :-Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :Soaked / 4 daysCBR Value (%) :6.0Swell (%) / Surcharge (kg):1.3 / 4.5 kg			10	00		Fi	eld Moistu	ure Conte	ent (%) :			33.4		
Achieved Dry Density before Soak (t/m³) :1.355Moisture Content (Total) after Penetration (%) :36Achieved Percentage of Maximum Dry Density (%) :99CBR 2.5mm (%) :6Achieved Moisture Content (%) :35.6CBR 5.0mm (%) :6Achieved Percentage of Optimum Moisture Content (%) :100Minimum Specified CBR Value (%) :-Test Condition (Soaked/Unsoaked) / Soaking Period (Days) :Soaked / 4 daysCBR Value (%) :6.0Swell (%) / Surcharge (kg):1.3 / 4.5 kg-6.0	Nominated % Opt	imum Moisture Content						(Top) af		۱				
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 - -		·				Moisture	Content	(Total) a	fter Penetratio	n				
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	Achieved Percentage	Percentage of Maximum Dry Density					000 0		×) ·					
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 6.0										1				
Test Condition (Soaked/Unsoaked) / Soaking Period (Days) : Soaked / 4 days CBR Value (%) : 6.0 Swell (%) / Surcharge (kg): 1.3 / 4.5 kg 6.0	Achieved Percenta	ge of Optimum Moisture									6			
Swell (%) / Surcharge (kg): 1.3 / 4.5 kg 8.0						Minim								
							UDIX V	ande (,.,.,			6.0		
Soil Description : CLAY	Swell (%) /	/ Surcharge (kg):	1.3 /	4.5 kg										
	Soil Description :					С	LAY							
										0.1	A 1-10			



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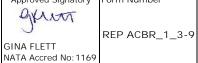




				Са	alifc	rn	ia E	Bea	ari	ng	Ra	ati	оF	Seb	201	٢t	(1	Poi	nt	:)					
Client: Client address: Job Number: Project:	Parker PO Box ME17/0 Geotec	5608 023	8 Mar	roochy	ydore (2LD 4	558													Repo	ort Nu ort Da er Nur	ite:			ME17/023 - 14 21/02/2018
Location	41 Gler	nbroc	vk Str	eet , I	Nambo	ur																	Pag	ge 1	of 1
Lab No: Date Sampled: Date Tested: Sampled By: Sample Method: Material Source:	38836 7/02/2 20/02/ David F AS 128 I NSI TU	/2018 Polloc 9 1.2	ck	I 6.5.4	4)																	n		AS	51289.6.1.1
For Use As:	FOUND	ATIC	N																	Lot N	lumb	er:		-	
Remarks:	Liquid I	Limit	Dete	rmina	nination (iii) Curing Duration 4 days									Item	Num	ber	:	-							
										CBR	1 Point Gra	ph													
1,200			_/			-	-			Force	vs Penetro	tion		_							_				
1,150 - 1,100 -																									
1,050 -			+	-	_		-		_					_					_		-	-			
1,000 - 950 -										~															
900 -		_/						_								_			_		_				
850 -																1						- Ô			
750 -		1			/	-													_			_			
700 - 		/		/					-					-					+						
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500 450		\angle					-																		
400 -			-+				+							-					-		-	-			
350																									
250 -					_	-	-		_					-					-						
200 -					÷.		1												-				-		
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so 7					-							-		-					+		_	-			
0 K	0.5 1	1.5	5 2	2.5	3	3.5	4 4	.5 S	5.	5 0	6 Penetrati		7.	5								-			
														_				(
Maximum Dry De Optimum Moisture	-						1.4 31						-		-			/ <u>m³):</u> k (%):						1.388 34.2	
	tive Effort :						Stand											(%) :						99	
Nominated % Ma			sity				10										tent (29.4	
Nominated % Optin	mum Moisti	ure Co	ontent	+			10					Moi			ent (1	Гор) а		Penetra	tion	1				35.2	
	paction :	/	- (+								Mois	ture	Conte	ent (T	%): otal)	after	Penetra	ation	1					
Achieved Percentage	ensity before Soak (t/m ³) : 1.411 age of Maximum Dry Density (%) : 101										%):								31.3						
-	%):			_								CBR 2.5mm (%) :						5							
Achieved Moist Achieved Percentag							31	.2							R 5.0									4.5	
	ent (%) :						10	1				N	linim					ue (%)	:					-	
	d (Days) :	.,				Soa	aked /	′ 4 da	iys					CRP	k va	iue	(%)	:						5.0	
Swell (%) /	Surcharge	(kg):				1	.7 / 4	1.5 kg	1																
Soil Description :													CI	AY											
																				App	provec	d Sig	nator	y Fo	orm Number



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





	Qualit	y of Materia	als Repo	rt	
Client:	Parker Propery Ningi F	Pty Ltd		Report Number:	ME17/023 - 15
Client Address:	PO Box 5608 Marooch	ydore QLD 4558			
Job Number:	ME17/023			Report Date:	27/02/2018
Project:	Geotechnical Investiga	ation		Order Number:	-
_ocation	41 Glenbrook Street, I			Page	1 of 1
Lab No:	38824			Sample L	
Date Sampled:	7/02/2018			TP3	
Date Tested:	14/02/2018			0.2 - 0.5m	
Sampled By:	David Pollock			0.2 0.511	
Sample Method:	AS 1289 1.2.1 (CI 6.5.4	1)			
Vaterial Source:	INSITU	*)		Spec Description:	
				Lot Number:	-
For Use As:	FOUNDATION				-
Remarks:	-			Spec Number:	-
		A.S. Sieve Sizes	Specification	Percent	Specification
			Minimum	Passing	Maximum
Test Method	: AS1289.3.6.1				
10		75.00 mm			
0		53.00 mm 37.50 mm			
		26.50 mm			
10		19.00 mm			
N		13.2 mm			
2		9.50 mm		100	
50-70 Lis		6.7 mm		100	
11 Pas		4.75 mm		99	
6 40		2.36 mm		97	
		1.18 mm		93	
E		0.600 mm		90	
2				90	
		0.300 mm		89	
		0.150 mm		87	
0006 016 01 0426	i i i 0.6 til 2.06 4.75 6.7 AS Sieve Szelynn)	0.075 mm		84	
Atterberg Tests		Test Method	Specification	Result	Specification
			Minimum		Maximum
iquid Limit (%)		AS1289.3.1.2		72	
Plastic Limit (%)		AS1289.3.2.1		27	
Plasticity Index		AS1289.3.3.1		45	
inear Shrinkage (%)		AS1289.3.4.1		15.5	
			A	d Signatory	Form Number





Client:	Parker Propery Ningi Pty			Report Number:	ME17/023 - 16
Client Address:	PO Box 5608 Maroochyd	lore QLD 4558			
Job Number:	ME17/023			Report Date:	27/02/2018
Project:	Geotechnical Investigati			Order Number:	-
ocation	41 Glenbrook Street, Na	ambour			e 1 of 1
_ab No:	38827			Sample I	ocation
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 (CI 6.5.4)				
Vaterial Source:	INSITU			Spec Description:	-
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-			Spec Number:	
		A.S. Sieve Sizes	Specification	Percent	Specification
			Minimum	Passing	Maximum
Test Meth	od: AS1289.3.6.1				
10 ₁ .		75.00 mm			
		53.00 mm			
10		37.50 mm			
.0		26.50 mm			
		19.00 mm			
		13.2 mm		100	
(j. 10) (j. 10)		9.50 mm 6.7 mm		95 80	
2 so		4.75 mm		65	
ercent		2.36 mm		38	
u. «		1.18 mm		22	
10		0.600 mm		14	
30		0.425 mm		11	
		0.300 mm		9	
0		0.150 mm		5	
000000000000000000000000000000000000000	66 1.0 236 4.15 8.7 9.6 10.2 AS Sieve Szejrm)	0.075 mm		2	
Atterberg Tests		Test Method	Specification	Result	Specification
			Minimum		Maximum
iquid Limit (%)		AS1289.3.1.2		40	
Plastic Limit (%)		AS1289.3.2.1		24	
Plasticity Index		AS1289.3.3.1		16	
inear Shrinkage (%).		AS1289.3.4.1		7.0	
			Approve	ed Signatory	Form Number



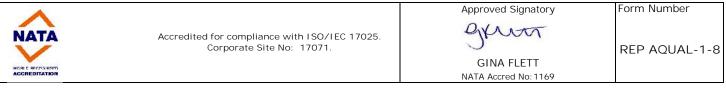


Client:	Parker Propery Ningi P	Pty Ltd		Report Number:	ME17/023 - 17
Client Address:	PO Box 5608 Maroochy	-		Report Number.	WE177023 - 17
Job Number:	ME17/023	yddie QLD 4330		Report Date:	27/02/2018
		tion		Order Number:	27/02/2018
Project:	Geotechnical Investiga				- 1 of 1
Location	41 Glenbrook Street , N	Vannoour			1 of 1
Lab No:	38829			Sample L	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 (CI 6.5.4	1)			
Material Source:	INSITU			Spec Description: -	
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-			Spec Number:	-
		A.S. Sieve Sizes	Specification	Percent	Specification
			Minimum	Passing	Maximum
Test Method:	AS1289.3.6.1				
10		75.00 mm			
10		53.00 mm			
		37.50 mm 26.50 mm			
.0		19.00 mm		100	
8		13.2 mm		97	
\$0		9.50 mm		96	
C.OUT		6.7 mm		94	
5 S		4.75 mm		84	
0 4		2.36 mm		84	
		1.18 mm		70	
		0.600 mm		63	
30		0.425 mm		61	
10		0.300 mm 0.150 mm		59 56	
		0.150 mm		54	
ECTS EIS 23 6-05 DB	116 126 475 67 95 112 AS Sieve Stae(mn)	0.073 mm		54	
Atterberg Tests		Test Method	Specification	Result	Specification
			Minimum		Maximum
_iquid Limit (%)		AS1289.3.1.2		65	
Plastic Limit (%)		AS1289.3.2.1		38	
Plasticity Index		AS1289.3.3.1		27	
_inear Shrinkage (%)		AS1289.3.4.1		13.0	
57.20			Approve	ed Signatory	Form Number





		ty of Materia			
Client:	Parker Propery Ningi	Pty Ltd		Report Number:	ME17/023 - 18
Client Address:	PO Box 5608 Marooch	ydore QLD 4558			
Job Number:	ME17/023			Report Date:	27/02/2018
Project:	Geotechnical Investig	ation		Order Number:	-
_ocation	41 Glenbrook Street ,	Nambour		Page	1 of 1
Lab No:	38834			Sample L	ocation
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 (CI 6.5.	4)			
Material Source:	INSITU	.,		Spec Description:	-
For Use As:	FOUNDATION			Lot Number:	_
Remarks:	-			Spec Number:	-
Norman No.	-	A.S. Sieve Sizes	Specification	Percent	- Specification
		A.S. SIEVE SIZES			
Test Meth			Minimum	Passing	Maximum
Test Metho	od: AS1289.3.6.1	75.00 mm			
10		53.00 mm			
10					
		26.50 mm			
		19.00 mm		100	
800		13.2 mm		99	
ĝ II		9.50 mm		99	
b cree		6.7 mm		97	
6 (1)		4.75 mm		95	
2 4		2.36 mm		86	
- 10		1.18 mm		79	
		0.600 mm		76	
20		0.425 mm		75	
0		0.300 mm 0.150 mm		74	
		0.150 mm 0.075 mm		73	
101 113 12 648 1	os 116 236 4% eð sta AS Sleve Slæymn)	0.073 1111		/0	1
Atterberg Tests		Test Method	Specification	Result	Specification
			Minimum		Maximum
iquid Limit (%)		AS1289.3.1.2		76	
Plastic Limit (%)		AS1289.3.2.1		32	
Plasticity Index		AS1289.3.3.1		44	
inear Shrinkage (%)		AS1289.3.4.1		18.5	
107 B.			Approve	ed Signatory	Form Number





	Qualit	y of Materia	als Repo	rt	
Client:	Parker Propery Ningi P	'ty Ltd		Report Number:	ME17/023 - 19
Client Address:	PO Box 5608 Maroochy	/dore QLD 4558			
Job Number:	ME17/023			Report Date:	27/02/2018
Project:	Geotechnical Investiga	ition		Order Number:	-
_ocation	41 Glenbrook Street, N			Page	1 of 1
Lab No:	38836			Sample L	
Date Sampled:	7/02/2018			TP10	
Date Tested:	14/02/2018			0.2 - 0.5m	
Sampled By:	David Pollock			0.2 - 0.511	
Sample Method:	AS 1289 1.2.1 (CI 6.5.4	•)			
Material Source:	INSITU			Spec Description:	-
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-	I		Spec Number:	-
		A.S. Sieve Sizes	Specification	Percent	Specification
			Minimum	Passing	Maximum
Test Method:	AS1289.3.6.1				
10		75.00 mm			
		53.00 mm			
		37.50 mm			
R		26.50 mm		100	
N		19.00 mm 13.2 mm		100 98	
		9.50 mm		98	
() () ()		6.7 mm		96	
2 D		4.75 mm		96	
		2.36 mm		96	
		1.18 mm		91	
15		0.600 mm		86	
5		0.425 mm		83	
		0.300 mm		81	
0		0.150 mm		78	
0 E015 818 82 6425 88	10 226 4.15 67 95 112 AS Sieve Szejmnj	0.075 mm		73	
Atterberg Tests		Test Method	Specification	Result	Specification
~			Minimum		' Maximum
_iquid Limit (%)		AS1289.3.1.2	-	65	
Plastic Limit (%)		AS1289.3.2.1		26	
Plasticity Index		AS1289.3.3.1		39	
_inear Shrinkage (%)		AS1289.3.4.1		17.0	
127 36			Anne	ed Signatory	Form Number
			ADD: OVE		





Client:	Parker Propery Ningi P	Ptyltd		Report Number:	ME17/023 - 20
Client Address:	PO Box 5608 Maroochy	-		Report Number.	IVIE 177023 - 20
Job Number:	ME17/023	VUOI E QLD 4330		Doport Dato	27 (02 (2010
		tion		Report Date: Order Number:	27/02/2018
Project:	Geotechnical Investiga				-
	41 Glenbrook Street , I	Nambour			1 of 1
Lab No:	38838			Sample L	ocation
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 (CI 6.5.4	ł)			
Material Source:	INSITU			Spec Description: -	
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-	•		Spec Number:	-
		A.S. Sieve Sizes	Specification	Percent	Specification
			Minimum	Passing	Maximum
Test Method	d: AS1289.3.6.1				
10,		75.00 mm			
		53.00 mm			
10		37.50 mm			
10		26.50 mm			
8		19.00 mm			
		13.2 mm 9.50 mm			
300		6.7 mm		100	
5 S		4.75 mm		100	
a recent		2.36 mm		92	
		1.18 mm		81	
10		0.600 mm		75	
20		– 0.425 mm		73	
		0.300 mm		71	
		0.150 mm		66	
0 103 0.16 13 342	5 08 118 238 425 AS Sleve Size(mm)	0.075 mm		61	
···· · · · ·					0
Atterberg Tests		Test Method	Specification	Result	Specification
			Minimum		Maximum
iquid Limit (%)		AS1289.3.1.2		70	
Plastic Limit (%)		AS1289.3.2.1		31	
Plasticity Index		AS1289.3.3.1		39	
inear Shrinkage (%)		AS1289.3.4.1		16.0	
					Form Number
200			Annrous	ed Signatory	U orm Number





Client:	Parker Propery Ningi Pty	Ltd	Report Number: ME17/02	3 - 1
Client Address:	PO Box 5608 Maroochydd	ore QLD 4558		
Job Number:	ME17/023		Report Date: 13/02/2	:018
Project:	Geotechnical Investigation	n	Order Number:	
Location	41 Glenbrook Street , Nar	mbour	Test Method : AS1289.7	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 : -	
			Page 1 of 1	
Shrir	nkage Moisture Content (%) :	43.68	Swell MC Before(%): 39.3	
	Shrinkage (%) :	6.8	Swell MC After(%): 46.7	
	Unit Weight (t/m ³) :	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 :	-			

~		APPROVED SIGNATORY	FORM NUMBER
WURLE RESOLUTION	Accredited for compliance with ISO/IEC 17025-Testing. Corporate Site No: 17071	GINA FLETT NATA Accred No: 1169	REP ASS-1-4



Client:	Parker Propery Ningi Pty	/ Ltd	Report Number:	ME17/023 - 2
Client Address:	PO Box 5608 Maroochyd	ore QLD 4558		
Job Number:	ME17/023		Report Date:	13/02/2018
Project:	Geotechnical Investigati	on	Order Number:	
Location	41 Glenbrook Street, Na	imbour	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 :	-
			Page 1 of 1	
Shrink	age 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 :	-			

~		APPROVED SIGNATORY	FORM NUMBER
VURLE RECORDERE	Accredited for compliance with ISO/IEC 17025-Testing. Corporate Site	GINA FLETT	REP ASS-1-4
ACCREDITATION	No: 17071	NATA Accred No: 1169	



Client:	Parker Propery Ningi Pty	/ I td		Report Number:	ME17/023 - 3
Client Address:	PO Box 5608 Maroochydore QLD 4558				
Job Number:	ME17/023		Report Date:	19/02/2018	
Project:	Geotechnical Investigati	on		Order Number:	
Location	41 Glenbrook Street , Na	ambour		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 (CI 6.5.4)				
Material Source:	INSITU				
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-			Item Number :	-
				Page 1 of 1	
Shrink	kage 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 :	-				

A	APPROVED SIGNATORY	FORM NUMBER
Accredited for compliance with ISO/IEC 17025. Corpora Maroochydore.	te Site No: 17071 GINA FLETT NATA Accred No: 1169	REP ASS-1-4



Client:	Darker Dropeny Ningi Dt	(L t d		Depart Number	ME17/023 - 4
	Parker Propery Ningi Pty Ltd		Report Number:	IVIE 177023 - 4	
Client Address:	PO Box 5608 Maroochydore QLD 4558				
Job Number:	ME17/023		Report Date:	19/02/2018	
Project:	Geotechnical Investigat	ion		Order Number:	
Location	41 Glenbrook Street, Na	ambour		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 (CI 6.5.4)				
Material Source:	INSITU				
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-			Item Number :	-
				Page 1 of 1	
Shrink	kage 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 :	-				

^		APPROVED SIGNATORY	FORM NUMBER
Accredited for compliance with ISO/IEC 170 Maroochydore.	25. Corporate Site No: 1707	1 GINA FLETT NATA Accred No: 1169	REP ASS-1-4



Client:	Parker Propery Ningi Pty	v l td		Report Number:	ME17/023 - 5
Client Address:	PO Box 5608 Maroochydore QLD 4558				
Job Number:	ME17/023		Report Date:	19/02/2018	
Project:	Geotechnical Investigat	ion		Order Number:	
Location	41 Glenbrook Street , Na	ambour		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 :	-
				Page 1 of 1	
Shrink	age 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 :	-				

~	APPROVED SIGNATORY	FORM NUMBER
WORLD REDCANJED	GINA FLETT NATA Accred No: 1169	REP ASS-1-4



Client:	Parker Propery Ningi Pt			Report Number:	ME17/023 - 10
Client Address:	PO Box 5608 Maroochydore QLD 4558				
Job Number:	ME17/023		Report Date:	21/02/2018	
Project:	Geotechnical Investigat	Geotechnical Investigation		Order Number:	
Location	41 Glenbrook Street, Na	ambour		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 (CI 6.5.4)				
Material Source:	INSITU				
For Use As:	FOUNDATION			Lot Number:	-
Remarks:	-			Item Number :	-
				Page 1 of 1	
Shrink	kage Moisture Content (%) :	33.61		Swell MC Before(%):	36.5
	Shrinkage (%) :	3.1		Swell MC After(%) :	40.5
	Unit Weight (t/m ³) :	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 :	-				

	APPROVED SIGNATORY	FORM NUMBER
edited for compliance with ISO/IEC 17025. Corporate Site No: 17071 bochydore.	GINA FLETT NATA Accred No: 1169	REP ASS-1-4



	Emerso	n Class Numbe	r Report	
Client :	Parker Propery Ningi Pty Ltd		Report Number:	ME17/023 - 6
Client Address :	PO Box 5608 Maroochydore Q	LD 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 , Nambou	ur		
				Page 1 of 1
Lab No :	38821	38822	38823	38824
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 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	TP2	TP3	TP3
	0.1 - 0.2m	0.4 - 0.5m	0.1 - 0.2m	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 :				



	APPROVED SIGNATORY	FORM NUMBER
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	GINA FLETT	
	NATA Accred No: 1169	



	Emerso	n Class Numbe	r Report	
Client : Client Address :			Report Number: Report Date:	ME17/023 - 7 19/02/2018
Job Number : Project : Location :	ME17/023		Order Number: Test Method:	AS 1289.3.8.1
		JI		Page 1 of 1
Lab No :	38826	38829	38830	38831
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 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	TP6	TP6	TP7
	0.1 - 0.2m	0.2 - 0.3m	0.5 - 0.6m	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 :				



APPROVED SIGNATORY	FORM NUMBER
GINA FLETT NATA Accred No: 1169	EMSN-REP-4



	Emerso	n Class Numbe	r Report	
Client : Client Address :	Parker Propery Ningi Pty Ltd PO Box 5608 Maroochydore Q	LD 4558	Report Number: Report Date:	ME17/023 - 8 19/02/2018
Job Number : Project :	ME17/023 Geotechnical Investigation	ME17/023		AS 1289.3.8.1
Location :	41 Glenbrook Street , Nambou	٦r		Daga 1 of 1
Lab No :	38832	38833	38835	Page 1 of 1 38836
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 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	TP9	TP10	TP10
	0.4 - 0.5m	0.1 - 0.2m	0.1 - 0.2m	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 :				



APPROVED SIGNATORY	FORM NUMBER
GINA FLETT NATA Accred No: 1169	EMSN-REP-4



	Emerso	n Class Numbe	r Report	
Client : Client Address :	Parker Propery Ningi Pty Ltd PO Box 5608 Maroochydore C	2LD 4558	Report Number: Report Date:	ME17/023 - 9 19/02/2018
Job Number : Project : Location :	ME17/023 Geotechnical Investigation 41 Glenbrook Street , Nambo	ur	Order Number: Test Method:	AS 1289.3.8.1
		- -	1	Page 1 of 2
Lab No :	38837	38838	38839	38840
ID No :	1	1	1	1
Lot No :	-	-	-	-
Item No :	-	-	-	-
Sampling Method :	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 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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Accredited for compliance with ISO/IEC 17025. Corporate Site No: 17071 Maroochydore.	GINA FLETT	EMSN-REP-4
	NATA Accred No: 1169	



	Emerso	n Class Numbe	r Report	
Client :	Parker Propery Ningi Pty Ltd		Report Number:	ME17/023 - 9
Client Address :	PO Box 5608 Maroochydore Q	LD 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 , Nambou	ır		
	1	1	1	Page 2 of 2
Lab No :	38841	38842		
ID No :	1	1		
Lot No :	-	-		
Item No :	-	-		
Sampling Method :	AS 1289 1.2.1 (CI 6.5.4)	AS 1289 1.2.1 (CI 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	TP13		
	0.05- 0.2m	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 :				



	APPROVED SIGNATORY	FORM NUMBER
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	NATA Accred No: 1169	





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.

-	-	
Atte	ntin	n
Alle	muo	

David Pollock

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

Client Sample ID Sample Matrix			TP3 0.1-0.2 Soil	TP3 0.2-0.5 Soil	TP5 0.1-0.2 Soil	TP6 0.5-0.6 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 Sample Matrix Eurofins mgt Sample No. Date Sampled			TP7 0.4-0.5 Soil B18-Fe14732 Feb 08, 2018	TP12 0.3-0.4 Soil B18-Fe14733 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.

mgt

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			

	🔅 eur	rofins	mgt		ABN- 50 005 e.mail : Enviro web : www.eu	Sales@	eurofins.	Melbourne 2-5 Kingston Town Close Oakleigh VIC 3166 Phone : +61 3 8564 5000 NATA # 1261 Site # 1254 & 14271	Sydney Unit F3, Building F 16 Mars Road Lane Cove West NSW 2066 Phone : +61 2 9900 8400 NATA # 1261 Site # 18217	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Phone : +61 7 3902 4600 NATA # 1261 Site # 2079	Perth 2/91 Leach Highway Kewdale WA 6105 Phone : +61 8 9251 9600 4 NATA # 1261 Site # 23736
	mpany Name: Idress:	Morrison Ge 1/35 Limesto Darra QLD 4076	otechnic Pty L one St	_td			Ord Rep Pho Fax			Due:	Feb 14, 2018 7:30 AM Feb 19, 2018 3 Day David Pollock
	oject Name: oject ID:	GLENBROC ME17/023	K DRIVE NAI	MBOUR					Eurofi	ns mgt Analytical Se	rvices Manager : Ryan Gilbert
		Sa	mple Detail			Exchangeable Sodium Percentage (ESP)	Moisture Set				
Melb	ourne Laborat	ory - NATA Site	# 1254 & 142	271		Х	Х				
		- NATA Site # 1									
		ry - NATA Site #									
		NATA Site # 237	36				$\left - \right $				
No	rnal Laborator 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	х	x				
4	TP6 0.5-0.6	Feb 08, 2018		Soil	B18-Fe14731	х	x				
5	TP7 0.4-0.5	Feb 08, 2018		Soil	B18-Fe14732	Х	Х				
6	TP12 0.3-0.4	Feb 08, 2018		Soil	B18-Fe14733	Х	Х				
Toot	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.

mg/L: milligrams per litre

NTU: Nephelometric Turbidity Units

ppm: Parts per million

%: Percentage

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 ug/L: micrograms per litre ppb: Parts per billion org/100mL: Organisms per 100 millilitres MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

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.
- 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	СР	%	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 Alex Petridis Michael Brancati Analytical Services Manager Senior Analyst-Metal (VIC) 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.

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APPENDIX F

Point Load Index Test Results



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

Client:	Parker Property Ningi Pty Ltd		Report No:	N/A - Field Tests Only			
lient Address:	PO Box 5608 Maroochydore Q	LD 4558	Report Date:	20/11/2018			
lob No:	ME18-065		Sample Date:	1/11/2018			
Project: Proposed Retaining Wall			Order No:				
ocation:	Olaulau di Balan Manukaan		Test Method:	AS 4133.4.1			
						Page 1 of ²	
Date of Test	Location Depth (m)	Sample Type	ls (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 - S	ample 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		

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

APPENDIX G

SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

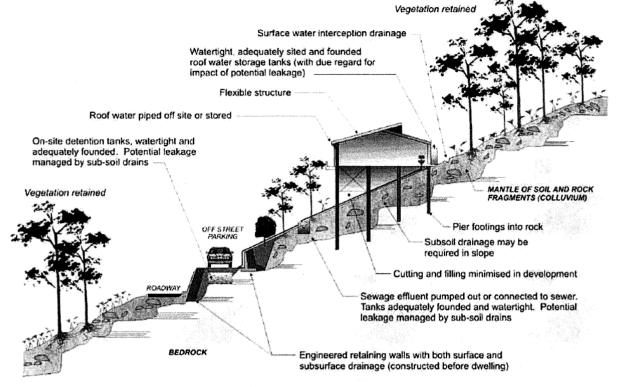
SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

GOOD ENGINEERING PRACTICE

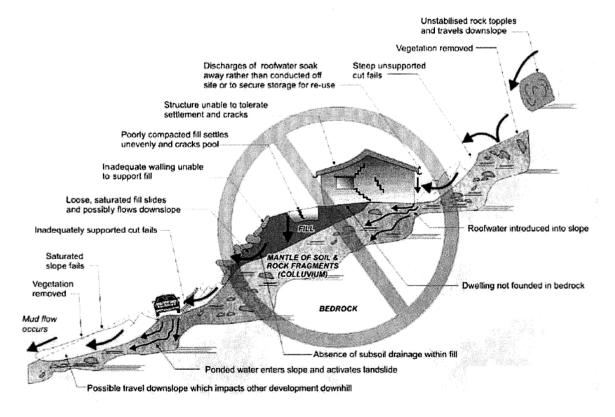
POOR ENGINEERING PRACTICE

ADVICE GEOTECHNICAL ASSESSMENT Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works. PLANNING SITE PLANNING Having obtained geotechnical advice, plan the development with the ris arising from the identified hazards and consequences in mind. DESIGN AND CONSTRUCTION	geotechnical advice.
ASSESSMENT stage of planning and before site works. PLANNING SITE PLANNING SITE PLANNING Having obtained geotechnical advice, plan the development with the ris arising from the identified hazards and consequences in mind.	geotechnical advice.
PLANNING SITE PLANNING Having obtained geotechnical advice, plan the development with the ris arising from the identified hazards and consequences in mind.	
SITE PLANNING Having obtained geotechnical advice, plan the development with the ris arising from the identified hazards and consequences in mind.	k Plan development without regard for the Risk.
arising from the identified hazards and consequences in mind.	k Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION	
HOUSE DESIGN HOUSE DESIGN Use flexible structures which incorporate properly designed brickwork, timbe 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 & Satisfy requirements below for cuts, fills, retaining walls and drainage. DRIVEWAYS 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.
Minimise depth. CUTS 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
Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. FILLS 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 Remove or stabilise boulders which may have unacceptable risk.	Disturb or undercut detached blocks o
& BOULDERS Support rock faces where necessary.	boulders.
RETAINING WALLS WALS WA	Construct a structurally inadequate wall such a sandstone flagging, brick or unreinforce blockwork. Lack of subsurface drains and weepholes.
FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS FOOTINGS Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulder or undercut cliffs.
Engineer designed. Support on piers to rock where practicable. SWIMMING POOLS Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst the may be little or no lateral support on downhill side.	re
DRAINAGE	
Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. SURFACE Provide general falls to prevent blockage by siltation and incorporate silt trap. 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. s.
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 & Usually requires pump-out or mains sewer systems; absorption trenches ma be possible in some areas if risk is acceptable. SULLAGE Storage tanks should be water-tight and adequately founded.	Use absorption trenches without consideration of landslide risk.
EROSION Control erosion as this may lead to instability. CONTROL & Revegetate cleared area. LANDSCAPING Revegetate cleared area.	Failure to observe earthworks and drainag 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	
	ly

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 *geoenviron-mental* 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 conveved 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.



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